Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

VOL. 1 TOTAL SYSTEM & TOPSIDE EQUIPMENT

VOL. 2 SUBSEA EQUIPMENT

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 1, Section 1

TOTAL SYSTEM

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K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

31 MAR 2009	As Built	A. Weilandt	T. Appel	A. Weilandt
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1 Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
A	12OCT06	Initial release Celle	- - -
B	02MAY07	Section 7.5.6.1: Use of Swagelok added for LP lines and added the need for metric size on all LP tubing Section 8.4: cable entry changed from top to bottom Section 9.2: List of Total Tag Numbers added Section 9.1.1.2: Colour for topside equipment changed from RAL5015 to RAL7035 (light grey) 10.8 & 10.9: updated description as per current design of anode and cathode package 10.10: complete section added for Anode Umbilical Assembly	Comments from internal IDC
01	06AUG07	Section 10.8: Anode Package Foundation Base added	Updated to Approved for Construction
02	31MAR09	Minor cosmetic Customer Comments implemented	Update to “As Built”

2 Introduction

This document is written to consolidate the technical requirements for the subsea control system intended to be used on the TOTAL K5F Project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

It will be submitted for approval early on in the project cycle and upon approval will be used for the design of the system.

Referenced client specifications within this document also need to be considered for the design.

3 Scope of this document

The scope of this document is to define the functional requirements for the subsea control system intended to be used on the TOTAL K5F Project.

Technical requirements relate but shall not be limited to:

- Design basis data
- Functional requirements

The Intervention & Workover Control System (IWOCS) shall **NOT** be covered by this document.

4 Abbreviations & Definitions

4.1 Abbreviations

AIV	Annulus Isolation Valve
AMV	Annulus Master Valve
APTA	Annulus Pressure Transmitter A
APTB	Annulus Pressure Transmitter B
BAIV	B Annulus Isolation Valve
CI	Corrosion Inhibitor
CIV	Chemical Injection Valve
CP	Cathodic Protection
CR	Control Room
DCS	Distributed Control System
DHSV	Downhole Safety Valve
DHPT	Downhole Pressure Temperature Transmitter
EPCU	Electrical Power and Communication Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
HPU	Hydraulic Power Unit
ICSS	Integrated Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
KHI	Kinetic Hydrate Inhibitor
LPMV	Lower Production Master Valve
MEOH	Methanol
PCS	Process Control System
PPD	Production Pressure Downstream
PPU	Production Pressure Upstream
PSV	Production Swab Valve
PTD	Production Temperature Downstream
PTU	Production Temperature Upstream
PWV	Production Wing Valve
PRCM	Power Regulation and Communication Module
SCSSV	Surface Controlled Subsurface Safety Valve
SSS	Safety Shutdown System
TUTU	Topside Umbilical Termination Unit
UPMV	Upper Production Master Valve
UPS	Uninterruptible Power Supply
UTA	Umbilical Termination Assembly
WH	Wellhead
XOV	Crossover Valve

4.2 Definitions

COMPANY	Total E&P Nederland B.V. (TEPNL)
CONTRACTOR	Cooper Cameron UK Ltd.

5 References

5.1 Cameron documents

Following documents **MUST** be considered during the design phase.

Description	Number
Subsea Production Control System Interconnection Diagram	SK-066001-88-04
K5F Field Development Project Contract	4600000416
Bill Of Material – Subsea Production Control System	223001-88
Project Quality Specification	SP-003118-15

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Design of cathodic protection of offshore structures	GS GR COR 100
External protection of off-shore and coastal structures and equipment by painting	GS EP COR 350
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Minimum CONTRACTOR document requirements	GS EP ELE 091
Electrical cables	GS EP ELE 161
Cable trays/ladders	GS EP ELE 311
Precommissioning and commissioning specification	GS EP EXP 101
Precommissioning and commissioning technical preparation	GS EP EXP 103
Precommissioning execution	GS EP EXP 105
Commissioning execution	GS EP EXP 107
Operations preparation during project – Maintenance and inspection documentation	GS EP EXP 203
Requirements for contractor quality management	GS EP PJC 501
Requirements for contractor critically rating of a unit	GS EP PJC 502
Requirements for contractor quality control	GS EP PJC 503
Valves	GS EP PVV 142
Welding of duplex and superduplex stainless steel	GS EP PVV 614
Area classification	GS EP SAF 216

Description	Number
Completed wells safety systems and safety rules	GS EP SAF 226
Impacted area, restricted area and fire zones	GS EP SAF 253
Emergency shut-down and emergency de-pressurisation (ESD & EDP)	GS EP SAF 261
Design philosophy and requirements for subsea stations	GS EP SPS 001
Subsea ball valves	GS EP SPS 005
Service valves in subsea stations	GS EP SPS 006
Tie-in systems	GS EP SPS 007
Corrosion protection of subsea stations	GS EP SPS 009
Preservation requirements for subsea package	GS EP SPS 010
Mechanical completion of subsea stations	GS EP SPS 011
Documentation requirements for subsea stations	GS EP SPS 012
Wellhead and guidance systems	GS EP SPS 013
Subsea gate valves and actuators in subsea Xmas-tree systems	GS EP SPS 015
Subsea insert chokes and associated running and retrieval tools	GS EP SPS 016
Subsea production control system	GS EP SPS 019
Subsea control unit functional requirements	GS EP SPS 020
Subsea mateable electrical/optical connectors	GS EP SPS 021
Environmental testing of subsea electronics	GS EP SPS 022
Cleaning and flushing of hydraulic systems	GS EP SPS 023
Subsea mechanical quarter turn actuator (manually operated gearbox)	GS EP SPS 024
Subsea hydraulic spring return quarter turn actuators	GS EP SPS 025
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Static 230Vac power supply units for on- and offshore installations	NL00-U-6S-037
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Typical cable tray details (offshore)	NL00-U-64-044
Elec. Cable colour seq. (onsh. + offsh.)	NL00-U-64-045
Protection and Instrument Earth. Det. (onsh. + offsh.)	NL00-U-64-046
Presentation of engineering and final documentation	NL00-Z-0S-002

Description	Number
Microstation Version 5.0: User Definable Attributes	NL00-Z-0S-005
Codification & Numbering of New Technical Documents for Offshore Installations	NL00-Z-0S-006
Instrumentation/piping interface standards	NL00-Z-4S-042
Actuators and control systems for hydraulically operated control valves	NL00-Z-7S-041
Actuators and control system for hydraulically operated ball valves	NL00-Z-7S-043
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
Codification of instrumentation links & equipment	NL00-Z-7S-077
Electrical/instrument interface diagram typicals for normally unmanned offshore installations	NL00-Z-71-002
Loop diagrams typicals	NL00-Z-71-003
Instrumentation - process hook-up typicals	NL00-Z-74-011
Hydraulic hook-up typicals	NL00-Z-74-021
Mounting typicals	NL00-Z-74-031
Instrument name plate detail	NL00-Z-74-055
Completion dossier guidelines	CS-3-OPE-EC-701 (EDMP-40657)
K5F MCS – K6CC SSS/PCS Interface	EDMP #59401

Any agreed deviations from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

Any clarifications from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

In case of conflict between documents the following order of priority shall be applied:

1) Local and international rules and regulations
2) Company Safety Specifications (GS EP SAF)
3) Project Specifications
4) Company Standards (NL00)
5) Company General Specifications

5.3 Codes, standards and regulations

Following codes, standards and regulations shall be considered during the design phase.

Description	Number
Design and operation of sub sea production systems	ISO 13628
Design & Operation Of Subsea Production Control Systems	ISO 13628-6
Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluids	SAE AS4059

Description	Number
EMC Directive	89/336-EEC
Process measurement control functions and instrumentation Symbolic representation	ISO 3511
Quality management and quality assurance standards - Part 3:Guidelines for the application of ISO 9001 to the development, supply and maintenance of software	ISO 9000-3

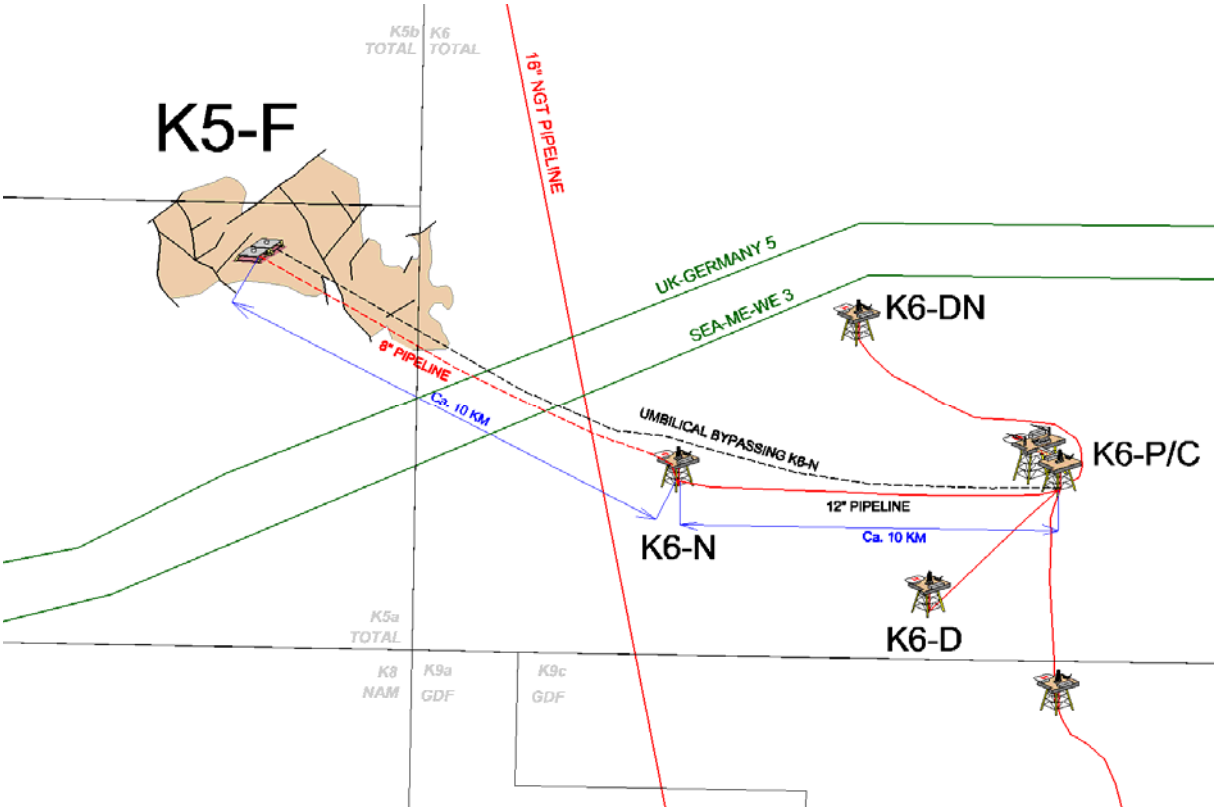
5.4 CE marking

CE marking **will** be required for the K5F project.

6 Project Overview

The K5F is a gas field located 10 km NW of the existing satellite platform K6N and 20km NW of the K6 Central Complex, all operated by TEPNL.

In the first phase, K5F will be developed with two wells. In order to be able to increase the reserves recovery in the future a third well might be connected in the future on the Subsea Protection Structure and it is also possible to connect a fourth future satellite well.



7 Design basis

The following sections are describing the systems information particularly relevant to the design of the Production Control System:

7.1 Field data

Present Number of Production Wells	Two plus two future wells
Design Life	20 years

7.2 Environmental conditions

7.2.1 Climatic data

Parameter		Data
Ambient Temperature (Outdoors)	Minimum Air Temperature	- 16°C
	Maximum Air Temperature	+ 40°C
Ambient Temperature (Indoors)	Minimum Air Temperature	-5°C
	Maximum Air Temperature	+ 40°C

7.2.2 Subsea Design Information

Parameter	Data
Water Depth	37 metres
Temperature	+4°C to +9.5°C
Seawater density	1025 kg/m³
Seawater Electrical Resistivity	0.3 OhmMeter
Wellhead Shut-in Pressure	350 barg

7.2.3 Hazardous Area Classification

The HPU and the TUTU shall be specified for hazardous area Zone 1, Gas Group IIB, Temperature Class T3, on the Platform deck.

7.2.4 Local equipment room

The platform local electrical switch room shall be used to accommodate the MCS and the ECPU cabinets. The maximum temperature during normal conditions within the LER shall be limited to 25 °C, but all of the equipment shall be able to operate as long as the room temperature does not exceed 40°C.

7.2.5 Hydraulic system pressures for the SCSSV line

The subsea production control system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
HP Hydraulics	627 barg	690 barg	1035 barg
Return Lines	< 207 barg	207 barg	N/A
Reservoir Fill Lines	<10 barg	10 barg	15 barg

NOTE: The design pressures shown above shall be used for specification of the HP hydraulic system relief valves and these shall release at the shown design pressures.

The return lines of the HPU are piped directly to the return reservoir and open to atmosphere. Pressure testing of these lines is neither necessary nor possible.

7.2.6 Chemical system pressure requirements

The chemical injection system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
Methanol Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Corrosion Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Kinetic Hydrate Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg

7.2.7 List of chemicals

The following chemicals are considered to be used for chemical injection for the K5F project:

- Methanol (MEOH)
- Corrosion Inhibitor (CI)
- Kinetic Hydrate Inhibitor (KHI)

7.3 Design life

The design life of the Subsea equipment shall be equal to the service life of the field.

The Subsea and related topside facilities shall be designed for a minimum design life of **20 years**.

7.4 Utilities

7.4.1 Platform utilities

The subsea production control system shall be designed to operate from the platform power and utilities as follows:

Electrical Supply (ECPU)	400VAC , 3 phase, 50 Hz ± 2% from UPS (floating), redundant
Electrical Supply (MCS)	230VAC 50 Hz ± 2%,from UPS (floating), redundant
Electrical supply (HPU PLC Cabinet)	230VAC 50 Hz ± 2% from UPS (floating)
Electrical supply (HPU Lighting)	230VAC 50 Hz from MCC
Electrical supply (HPU Motors)	380VAC 3ph 50 Hz, floating (3 wires) from MCC
Electrical supply (Motor heaters)	230VAC 50 Hz from MCC (if applicable)
Electrical supply (ESD solenoids)	24 V DC when healthy, 0V on ESD

7.5 Hydraulic systems

7.5.1 Sealing systems

Hydraulic couplers with primary metal seals are preferred for permanently installed Subsea equipment. Where possible, secondary, non-metallic seals should be considered as back-up for primary metal-to-metal seals. Hydraulic and chemical couplers within removable assemblies like single diver mate able hydraulic/chemical couplings shall have non-metallic primary seals and non-metallic back-up seals.

7.5.2 Hydraulic distribution

The subsea production control system high pressure (HP) hydraulic supplies shall be single from the HPU pumps. The hydraulic system shall be open utilising a water based control fluid.

7.5.3 Hydraulic fluid

The hydraulic system shall use Castrol Transaqua HT water based control fluid.

7.5.4 Fluid cleanliness

The production control system hydraulic control fluid shall be water based. All production control system hydraulic equipment shall be delivered with fluid cleanliness levels of SAE AS4059 class 6 or better. All methanol and chemical lines and equipment shall be delivered with fluid cleanliness level of SAE AS4059 class 12 or better.

Protective caps shall be provisioned for all hydraulic couplings to avoid accidental contamination. Assembly of hydraulic components shall take place in areas where the environment is controlled. The objective shall be to “assemble clean to keep clean” such that subsequent flushing operations are simplified.

Cleaning methods used for sub-assemblies shall include shop air flushing, solvent cleaning, pipe cleaning and ultrasonic bathing as appropriate. Cleaning of major assemblies shall in general be confined to flushing with control fluid of known cleanliness. As far as is practical, designs shall take due note of the subsequent flushing requirements e.g. avoiding blind holes, avoiding welding or grinding on assembled components and ensuring that systems allow turbulent flow for flushing.

All hoses and flying leads intended for chemical service (Methanol, Corrosion Inhibitor and Kinetic Hydrate Inhibitor) should be supplied filled with either control fluid or a suitable fluid compatible with the chemicals to be used.

7.5.5 Tubing

All hydraulic tubing and fittings shall be sized for efficient operation of the system with due regard to design pressures and minimising pressure drops within the system.

- For the topside equipment minimum seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the subsea equipment seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the UTA, the Methanol tubing has to be super duplex.

The tubing of the hydraulic circuits shall be accurately cut and bent using standard tube cutters and tube benders to fitting manufacturer’s recommendation. No burrs shall be allowed and each section of the tubing shall be cleaned and blown dry before assembly to ensure that no contamination is permitted to enter the control components.

All hydraulic tubing together with the associated fittings shall be capable of withstanding the application of a 1.5 times design pressure test for 15 minutes without any deformation or other damage.

7.5.6 Threaded connection systems

All threaded fittings for equipment used subsea shall withstand external ambient pressure at the design depth.

7.5.6.1 Topside equipment

For all circuits Autoclave MP Piping and fittings shall be used, except return lines where Swagelok can be used. All non Autoclave lines need to be in metric size.

7.5.6.2 Permanent subsea equipment

Ferrulok tube end reducers are to be welded to the back of hydraulic couplers, etc., where practical, rather than pipe threaded connections.

High-pressure ports requiring threaded fittings, such as valve actuator ports shall be SAE thread with 37-degree bottom taper conforming to SAE standard J514. Autoclave anti-vibration type fittings shall also be acceptable.

National Pipe Thread (NPT) fittings or any other thread seal type fitting shall **NOT** be used without specific approval from the project.

Fitting assembly torque shall be independently verified and sealed/secured to identify, that fittings have been properly made-up and inspected.

7.5.6.3 Thread sealants

Where taper threads are permitted for use, they shall be sealed using Loctite 572 fluid applied in accordance with the manufacturer's instructions. No other thread sealant shall be used. Teflon tape is **NOT** permitted for use on any equipment used with this system.

7.5.7 Welded connection systems

All couplers, whether in hydraulic or chemical services shall be butt-welded, except were otherwise specified within this document. All couplers shall be fitted with seals from identical compounds. All hydraulic or chemical service valves and fittings shall be butt welded.

- Connections shall be welded to the extent practical
- Autogenously welding shall be acceptable on 316L materials
- Liquid penetrate testing shall be performed on all tubing welds

Note: all welding has to be performed in accordance to approved Cameron welding specification.

8 Electric Systems

8.1 Terminal Type

Screw type terminals shall be used on all topside equipment.

8.2 Instrument Type

For the use in hazardous area EEx-d type instruments shall be used.

8.3 Electrical Motor Type

For the use in hazardous area EEx-d type electrical motors shall be used.

8.4 Cable entry for cabinets located in the Control Room

All cabinets located in the control room shall be designed to allow bottom cable entry only.

9 Functional Requirements

9.1 Coating & protection systems

9.1.1 Coating systems

All equipment manufactured from Carbon steels shall be protected with an approved coating system suitable for the design life of the equipment.

9.1.1.1 Subsea painting

Painting of all subsea components manufactured from Carbon steels shall be done in accordance to the approved paint specification A-020025-01

9.1.1.2 Painting of topside equipment for outside installation

Painting of all topside components located outside shall be done in accordance to the approved paint specification X-065460-04-04

- Top colour for surface equipment shall be light grey (RAL 7035).
- SST framework and parts shall normally NOT be painted, if not separately specified.

9.1.1.3 Painting of topside equipment for inside installation

Paint colour for MCS or EPU cabinet housings shall be light grey (RAL 7035).

9.1.2 Cathodic protection

9.1.2.1 General

The primary corrosion protection system for the control system Subsea equipment shall be via materials selection and suitable paint coatings.

A cathodic protection system using sacrificial anodes shall be utilised to protect the ‘bare steel’ components and to protect uncoated areas of any other control system hardware, i.e. such as those items not protected by the host equipment. Special attention shall be given to SST screws and bolts. All items to be protected shall be electrically connected using stranded, flexible SST 316 earthing braids of a suitable cross sectional area.

9.1.2.2 Calculations

Suitable CP calculations shall be carried out in accordance with the standard applicable for control system hardware i.e. not tree mounted equipment (this shall be part of the Subsea tree CP system). The CP system shall be designed to be capable of protecting the control system for the 20-year design life of the equipment.

9.1.2.3 Construction

The following principles shall be adhered when designing equipment for the subsea control system:

- All equipment metalwork shall be welded (or bolted) onto the equipment main structure to ensure any static potential build up is avoided by continuous drain to earth.
- All metallic items shall have earth continuity by physical connection i.e. metallic fastenings, clamps or earth straps. This shall include all valves, tubing, components, tubing clamps etc.

Electrical connectors may remain isolated from the structure provided suitable materials are chosen for their construction.

- When stainless steel fasteners are used in the construction of subsea structures or equipment, they shall be suitably earth bonded using earth straps. Carbon steel fasteners may alternatively be used.
- Anodes mounted on equipment sub-structures shall be manufactured from material identical and from the same batch as those fitted to the main structure.
- The anodes shall comply with the Cameron material specification MS-011310-01.
- The minimum distance from hydraulic tubing to anodes shall be 80 mm. If unavoidable it is acceptable to have a distance of less than 80 mm for some cases.
- Earthing conductors shall be of corrosion resistant material and shall be securely fastened and protected where necessary against damage and electrolytic corrosion. Where earth-bonding straps are used, conductive paste shall be smeared on contact surfaces (not threads) to ensure a lasting low resistance contact. Where the metallic composition of equipment requiring earth bonding differs from the main structure, care shall be taken in the selection of the bonding strap material to minimise possible ill effects of different contact potentials.
- Connections shall be secured using star-type shake proof washers such that they cannot work loose under vibration.

9.2 Project specific Tag Numbers

This is a list of Tag numbers to be used for K5F equipment. All units and components on this list need to be marked with these numbers as per Total Spec. NL00-Z-74-055.

Instruments	Equipment	Description	Comments
	NN-82201	TUTU	
	NN-82202	HPU	
	NN-82203	HPU PLC	
	NN-81203	MCS	
	NN-81204-1	EPCU 1	
	NN-81204-2	EPCU 2	
	NN-81204-3	EPCU 3	
	NN-81204-4	EPCU 4	
	SA-92100A	Anode Package A	
	SA-92100B	Anode Package B	
	UTA-92100	UTA	
	UTA-92101	IUTA	FUTURE
	UTA-92102	IUTA	FUTURE
	PRCM-92100.1A	PRCM A well 1	
	PRCM-92100.1B	PRCM B well 1	
	SC-92100.1A	Cathode A well 1	
	SC-92100.1B	Cathode B well 1	
	ESCM-92100.1A	ESCM A well 1	
	ESCM-92100.1B	ESCM B well 1	
	DVA-92103.1	Dump valve assembly well 1	
	DHSV-92103.1	Downhole safety valve well 1	

	PRCM-92100.2A	PRCM A well 2	
	PRCM-92100.2B	PRCM B well 2	
	SC-92100.2A	Cathode A well 2	
	SC-92100.2B	Cathode B well 2	
	ESCM-92100.2A	ESCM A well 2	
	ESCM-92100.2B	ESCM B well 2	
	DVA-92103.2	Dump valve assembly well 2	
	DHSV-92103.2	Downhole safety valve well 2	
	PRCM-92100.3A	PRCM A well 3	
	PRCM-92100.3B	PRCM B well 3	
	SC-92100.3A	Cathode A well 3	
	SC-92100.3B	Cathode B well 3	
	ESCM-92100.3A	ESCM A well 3	
	ESCM-92100.3B	ESCM B well 3	
	DVA-92103.3	Dump valve assembly well 3	
	DHSV-92103.3	Downhole safety valve well 3	
	PRCM-92100.4A	PRCM A well 4	
	PRCM-92100.4B	PRCM B well 4	
	SC-92100.4A	Cathode A well 4	
	SC-92100.4B	Cathode B well 4	
	ESCM-92100.4A	ESCM A well 4	
	ESCM-92100.4B	ESCM B well 4	
	DVA-92103.4	Dump valve assembly well 4	
	DHSV-92103.4	Downhole safety valve well 4	
	HP-92100.1	HP Jumper UTA to tree 1	
	MEOH-92100.1	MeOH Jumper UTA to tree 1	
	KHI-92100.1	KHI Jumper UTA to tree 1	
	CI-92100.1	CI Jumper UTA to tree 1	
	COAX-92100.1A	Coax Jumper UTA to PRCM A tree 1	
	COAX-92100.1B	Coax Jumper UTA to PRCM B tree 1	
	PC-92100.1A	P/C Jumper PRCM A to ESCM A tree 1	
	PC-92100.1B	P/C Jumper PRCM B to ESCM B tree 1	
	HP-92100.2	HP Jumper UTA to tree 2	
	MEOH-92100.2	MeOH Jumper UTA to tree 2	
	KHI-92100.2	KHI Jumper UTA to tree 2	
	CI-92100.2	CI Jumper UTA to tree 2	
	COAX-92100.2A	Coax Jumper UTA to PRCM A tree 2	
	COAX-92100.2B	Coax Jumper UTA to PRCM B tree 2	
	PC-92100.2A	P/C Jumper PRCM A to ESCM A tree 2	
	PC-92100.2B	P/C Jumper PRCM B to ESCM B tree 2	
	HP-92100.3	HP Jumper UTA to tree 3	FUTURE
	MEOH-92100.3	MeOH Jumper UTA to tree 3	FUTURE
	KHI-92100.3	KHI Jumper UTA to tree 3	FUTURE

	CI-92100.3	CI Jumper UTA to tree 3	FUTURE
	COAX-92100.3A	Coax Jumper UTA to PRCM A tree 3	FUTURE
	COAX-92100.3B	Coax Jumper UTA to PRCM B tree 3	FUTURE
	PC-92100.3A	P/C Jumper PRCM A to ESCM A tree 3	FUTURE
	PC-92100.3B	P/C Jumper PRCM B to ESCM B tree 3	FUTURE
PCV-92101.1		Production Choke valve well K5F-1	
PWV-92101.1		Production Wing Valve well K5F-1	
UPMV-92102.1		Upper Production Master Valve well K5F-1	
DHSV-92103.1		Down Hole Safety Valve well K5F-1	
AMV-92103.1		Annulus Master Valve well K5F-1	
BAIV-92100.1		B Annulus Isolation Valve well K5F-1	
XOV-92101.1		Crossover Valve well K5F-1	
CIV-92101.1		Chemical Injection Valve well K5F-1	
CIV-92102.1		Chemical Injection Valve well K5F-1	
CIV-92103.1		Chemical Injection Valve well K5F-1	
XEV-92103.1		HP Dump Valve (solenoid) well K5F-1	
PPU-92101.1		Production Pressure Upstream well K5F-1	
PPD-92111.1		Production Pressure Downstream well K5F-1	
APTA-92103.1		Annulus Pressure Transmitter A well K5F-1	
APTB-92105.1		Annulus Pressure transmitter B well K5F-1	
PTD-92101.1		Production Temperature Downstream well K5F-1	
PTU-92104.1		Production Temperature Upstream well K5F-1	
PT-92104.1		Downhole Pressure Transmitter	
TT-92-103.1		Downhole Temperature Transmitter	
PCV-92101.2		Production Choke valve well K5F-2	
PWV-92101.2		Production Wing Valve well K5F-2	
UPMV-92102.2		Upper Production Master Valve well K5F-2	
DHSV-92103.2		Down Hole Safety Valve well K5F-2	
AMV-92103.2		Annulus Master Valve well K5F-2	
BAIV-92100.2		B Annulus Isolation Valve well K5F-2	
XOV-92101.2		Crossover Valve well K5F-2	
CIV-92101.2		Chemical Injection Valve well K5F-2	
CIV-92102.2		Chemical Injection Valve well K5F-2	
CIV-92103.2		Chemical Injection Valve well K5F-2	
XEV-92103.2		HP Dump Valve (solenoid) well K5F-2	
PPU-92101.2		Production Pressure Upstream well K5F-2	
PPD-92111.2		Production Pressure Downstream well K5F-2	
APTA-92103.2		Annulus Pressure Transmitter A well K5F-2	
APTB-92105.2		Annulus Pressure transmitter B well K5F-2	
PTD-92101.2		Production Temperature Downstream well K5F-2	
PTU-92104.2		Production Temperature Upstream well K5F-2	
PT-92104.2		Downhole Pressure Transmitter	
TT-92103.2		Downhole Temperature Transmitter	
PCV-92101.3		Production Choke valve well K5F-3	FUTURE
PWV-92101.3		Production Wing Valve well K5F-3	FUTURE
UPMV-92102.3		Upper Production Master Valve well K5F-3	FUTURE

DHSV-92103.3		Down Hole Safety Valve well K5F-3	FUTURE
AMV-92103.3		Annulus Master Valve well K5F-3	FUTURE
BAIV-92100.3		B Annulus Isolation Valve well K5F-3	FUTURE
XOV-92101.3		Crossover Valve well K5F-3	FUTURE
CIV-92101.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92102.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92103.3		Chemical Injection Valve well K5F-3	FUTURE
XEV-92103.3		HP Dump Valve (solenoid) well K5F-3	FUTURE
PPU-92101.3		Production Pressure Upstream well K5F-3	FUTURE
PPD-92111.3		Production Pressure Downstream well K5F-3	FUTURE
APTA-92103.3		Annulus Pressure Transmitter A well K5F-3	FUTURE
APTB-92105.3		Annulus Pressure transmitter B well K5F-3	FUTURE
PTD-92101.3		Production Temperature Downstream well K5F-3	FUTURE
PTU-92104.3		Production Temperature Upstream well K5F-3	FUTURE
PT-92104.3		Downhole Pressure Transmitter	FUTURE
TT-92103.3		Downhole Temperature Transmitter	FUTURE
PCV-92101.4		Production Choke valve well K5F-4	FUTURE
PWV-92101.4		Production Wing Valve well K5F-4	FUTURE
UPMV-92102.4		Upper Production Master Valve well K5F-4	FUTURE
DHSV-92103.4		Down Hole Safety Valve well K5F-4	FUTURE
AMV-92103.4		Annulus Master Valve well K5F-4	FUTURE
BAIV-92100.4		B Annulus Isolation Valve well K5F-4	FUTURE
XOV-92101.4		Crossover Valve well K5F-4	FUTURE
CIV-92101.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92102.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92103.4		Chemical Injection Valve well K5F-4	FUTURE
XEV-92103.4		HP Dump Valve (solenoid) well K5F-4	FUTURE
PPU-92101.4		Production Pressure Upstream well K5F-4	FUTURE
PPD-92111.4		Production Pressure Downstream well K5F-4	FUTURE
APTA-92103.4		Annulus Pressure Transmitter A well K5F-4	FUTURE
APTB-92105.4		Annulus Pressure transmitter B well K5F-4	FUTURE
PTD-92101.4		Production Temperature Downstream well K5F-4	FUTURE
PTU-92104.4		Production Temperature Upstream well K5F-4	FUTURE
PT-92104.4		Downhole Pressure Transmitter	FUTURE
TT-92103.4		Downhole Temperature Transmitter	FUTURE

9.3 Special Requirements

All warning and emergency signs need to be English **and** Dutch language as per NL00-U-6S-061.

10 Equipment Requirement Specification

10.1 Master Control Station (MCS)

The redundant MCS will be the communication interface between the ICSS and the K5F electrical Subsea Control Modules (ESCM). The MCS will be located in the electrical switch room of the K6P Platform (safe area) and will be powered from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-01 Supplemental Requirements Specification for MCS Hardware

X-076721-87-02 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Control and Management

X-076721-87-03 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Process Interlocks and Shutdowns

X-076721-87-12 Supplemental Requirements Specification for MCS/ICSS Control Interface

10.2 Electrical Power and Control Unit (EPCU)

The EPCU is a redundant electrical power and communication unit for high voltage DC power supply and communication to the subsea installed ESCM's. The EPCU will be located in the electrical switch room of the K6P Platform (safe area) and will receive separate power supply for channel A and B from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-04 Supplemental Requirements Specification for EPCU

10.3 Hydraulic Power Unit (HPU)

A dedicated Hydraulic Power Unit (HPU) will be installed on the K6C platform to provide clean hydraulic HP power for the control of the K5F Downhole Safety Valves (DHSV). The HPU will be controlled from a remote PLC located in a safe area and will be monitored by the MCS/ICSS.

Design Pressure = 690 bar

Hydraulic Fluid = Castrol Transaqua HT

Refer to the following documents for detailed technical requirements:

X-076721-87-05 Supplemental Requirements Specification for HPU

10.4 Topside Umbilical Termination Unit (TUTU)

The Topside Umbilical Termination Unit (TUTU) shall terminate the main electro/hydraulic/chemical umbilical lines and provide the interface to the K6C platform equipment. It will only provide a hardware interface without any block/bleed-valves and/or Pressure gauges for testing or maintenance work. All tubing and couplers need to be supplied by others. The electrical cables shall be terminated in separately mounted explosion proof Junction Boxes or with moulded splice connections.

Refer to the following documents for detailed technical requirements:

X-076721-87-06 Supplemental Requirements Specification for TUTU

10.5 Umbilical Termination Assembly (UTA)

The Umbilical Termination Assembly (UTA) shall be a robust construction to provide interfaces with the umbilical and shall allow to suitably terminating all functions. The UTA shall be setup for the hydraulic connection of the two trees currently in the scope of supply and the two future trees.

Refer to the following documents for detailed technical requirements:

X-076721-87-07 Supplemental Requirements Specification for UTA

10.6 Power Regulation and Control Module (PRCM)

The Power Regulation and Communication Module (PRCM) regulate the power to the ESCM and provide communication to the ESCM. It also provides the connection to the external cathode package.

The PRCM shall be diver recoverable by using a special change out tool and shall be connected to a mounting base.

10.7 Electric Subsea Control Module (eSCM)

The eSCM controls various electric actuators on the tree/wellhead and acquires data from the subsea instrumentation for the transmission to the surface.

The following functions need to be controlled by the eSCM:

No.	Function	Actuator Size	Location	Note
1	CIV 1	¾”	Tree	
2	CIV 2	¾”	Tree	
3	CIV 3	¾”	Tree	
4	BAIV	¾”	Wellhead	
5	AMV	2”	Wellhead	
6	XOV 1	2”	Tree	
7	UPMV	5”	Tree	
8	PWV	5”	Tree	
9	PCV	N/A	Tree	
10	SCSSV Open	N/A	Tree	
11	SCSSV Close	N/A	Tree	

The following tree sensors need to be monitored by the eSCM:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

10.8 Anode Package / Anode Package Foundation Base

There are two separate Anode Packages for the A and the B channel of the system. The Anode Package shall be a robust frame construction for two separate and diver retrievable Anodes. The Anode package requires two separate electrical connectors for each anode for the connection via a flying lead to the anode umbilical assembly. The Anode Packages need to be clearly marked with “A” and “B”. The painted steel frame is protected by FRP grating on all four sides and on top to prevent damages caused by dropped objects. The two anode packages for the channels A and B will be placed on a further support frame to minimize the required installation effort. Both Anode Packages will be located on a Foundation Base.

10.9 Cathode Package

There are four separate Cathode Packages for the A and B channel of each tree. The Cathode Packages will be connected to the respective PRCM on the Subsea Protection Structure via an electrical flying lead. The Cathode Packages are diver installable and will be hooked into the outside plates of the Subsea Protection Structure. The Cathode Package contains the cathode itself and a frame with FRP grating on top to provide mechanical protection.

10.10 Anode Umbilical Assembly

The complete Anode Umbilical Assembly includes the following items:

- an approx. 100m long umbilical with an overall armour and four separate armoured 2,5mm² cores
- a pulling head assembly with 100mm diameter
- a hang-off assembly
- bend restrictor assembly at the Subsea end of the umbilical incl. clamping surface to fix the umbilical
- 4 pigtails, each 6m long, at the end of the umbilical

10.11 Electrical Flying Leads

The electrical flying leads shall comprise a cable moulded to the subsea connectors at both ends. The colour of these cables shall be black with a marking by means of approx. 30cm long heat shrinks at both ends. System A will be marked “blue” and System B “yellow”. These flying leads shall be designed for diver make up only.

10.12 Tree/Wellhead Pressure and Temperature Sensors

The following Pressure and Temperature Sensors are located on the Tree and the Wellhead:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

These sensors shall meet the following requirements:

- Field proven design
- The sensors shall be suitable for the intended subsea service
- Redundant with separate interconnection cables for the A and B channel
- Diver retrievable sensors
- With block-bleed-block assemblies on the pressure sensors
- Minimum accuracy of:
    - +/- 0.03% x full scale accuracy and a drift of 0.2%/year for the pressure sensors
    - +/- 0.3°C accuracy and a drift of 0.2°C/year for the temperature sensors

10.13 SCSSV Dump Valve Assembly

A 3/2 way valve shall be located on the tree for the operation of the SCSSV. The operation of this valve will be direct hydraulic by use of Transaqua HT fluid from a dedicated HPU through a single HP supply line in the main umbilical. The valve shall be designed for the design pressure of the SCSSV system and shall be activated by the ESCM. This assembly will consist of a fixed plate which will be located on the tree and a free plate with the dump valve on which is diver retrievable. Both plates will be connected via quick couplers without the use of poppets. The tree tubing will be connected to the fixed plate by using Autoclave anti-vibration couplers.

11 Quality requirements

A Quality Plan to be used for the project shall be created. For the Project Quality Specification see section 5.1 of this document.

11.1 CE Marking

The topside hardware and software is to be supplied with a CE declaration of conformity, which confirms compliance with all relevant directives.

12 Handling/Installation/Intervention & Shipping

Project shall provide detailed installation and intervention recommendations, and step-by-step project specific procedures, for review as part of the project-engineering phase.

All separately installable and retrievable items shall be provided with suitable lifting points and be generally designed to allow a smooth, simple and quick installation/retrieval process to be performed by divers. This shall include the following items:

- Electric Subsea Control Module (eSCM)
- Power Regulation & Communication Module (PRCM)
- Electrical flying leads between
  - Tree/Wellhead located junction boxes and sensors
  - UTA and PRCM
  - PRCM and ESCM
  - PRCM and Cathode Package

  Tree and Wellhead Pressure and Temperature Sensors
- SCSSV Dump Valve Assembly
- Anode Umbilical Assembly

All subsea assemblies shall be designed to withstand an abandonment period of 6 month sub sea, located where required but not connected to its services (hydraulic, chemical, electrical, ..)

12.1 Use of guidelines

All Subsea equipment (trees, choke inserts, jumpers, control modules, etc.) shall be designed for installation and retrieval by divers with the use of guidelines.

12.2 Lifting / Handling

All equipment shall be designed for safe handling and transportation, both onshore and offshore. All lifting points on all equipment handled offshore shall be:

- Physically load tested to rated weight
- Designed for loads as defined in API 17D and API RP 17G.
- Any welding and associated NDE, which is required for lifting apparatus shall be in compliance with API 17D and API RP 17G.
- All lifting points on all equipment, both purchased and rented; to be handled offshore shall be tested and labelled in accordance with API 17D and API RP 17G.
- All shipped equipment assemblies shall be labelled with their weight.
- Slings and rigging shall be provided for items that require lifting.

12.3 Connection of flying leads

The Subsea hydraulic and electrical flying leads shall be designed to be installed by the use of divers.

Following installation of the Xmas tree, the diver (after removing the LTC from the remote stab or connector) shall pick up the remote end connection and install it to the UTA or Wellhead.

The process shall be similar for the electrical connector.

For recovery the procedure shall be reversed.

12.4 ROV Interfaces

All ROV and diver interfaces shall be designed in accordance with ISO 13628-8.

12.5 ROV Marking of Subsea Stations

Marking of subsea station shall be in accordance with ISO 13628-1 and the following requirements:

- Letter size shall be 50mm

13 Testing

Each item of deliverable equipment shall be tested in accordance with a project approved and CAMERON supplied acceptance test procedure to verify the following as a minimum:

- Functionality
- Internal pressure testing
- External pressure testing
- Control fluid cleanliness to SAE AS4059

CAMERON shall provide written step-by-step procedures for these tests to be provided to COMPANY.

A Control System Integration Test shall be performed in accordance with a COMPANY approved procedure to demonstrate that all of the individual items of equipment function correctly as a system.

The testing programme for the Subsea Production Control System shall be undertaken in the stages detailed as follows:

- Factory Acceptance Test for single units (FAT's)
- System Factory Integration Testing (FIT)
- Tree EFAT
- System Integration Testing (SIT)
- Platform Commissioning
- Offshore Pre-submergence Testing/Deck Testing
- System Commissioning

13.1 Factory Acceptance Test (FAT)

Each deliverable item shall be subjected to a Factory Acceptance Test (FAT). The purpose of this FAT shall be to demonstrate the item is suitable for the intended purpose and functions correctly. FAT tests shall include hydrostatic proof pressure testing to 1.5 times the design pressure of the Subsea control system.

All FAT procedures shall be step-by-step and submitted for review and approval prior to testing commencing.

All critical equipment components shall be subjected to sub-assembly tests during the assembly phase of manufacture and to carry out these tests, the necessary equipment and fittings are specialised in-house equipment and are not project deliverable.

Each item of equipment shall be subject to an in-house FAT in accordance to an approved standard procedure document to demonstrate these meet the specified operational and functional requirements.

The tests shall include interface connections and mechanical alignment tests to verify design and manufacturing limit tolerance effects, component inter-changeability, together with hydraulic fluid system flushing and / or cleanliness checks as necessary to ensure the system meets SAE AS4059. The hydraulic tubing and piping pressure lines shall be hydrostatic pressure tested to 1,5 times the design pressure.

The test equipment shall be determined by the proposed testing programme, however in the event of additional testing or if testing in other locations is required, the quantity of test equipment detailed shall be subject to review.

Testing of fabricated items shall also include continuity testing of bolting.

Testing on subsea assemblies shall include continuity testing and earthing testing.

The maximum value for the resistance measured shall be 0.1 Ohm.

13.1.1 Environmental Stress Screening (ESS)

Modules or subassemblies containing electrical equipment and/or electronic equipment, which are intended for permanent subsea installation shall comply with section 4 of the Total specification GS EP SPS 022 “Environmental testing of Subsea Electronics”.

13.2 Factory Integration Test (FIT)

A System Factory Integration Test (FIT) shall be conducted to verify the correct interfacing and inter-working of all items of the subsea production control system equipment. External interfaces, for example Xmas tree valves & sensors, umbilical cables, DCS, MCC & ESD systems etc. shall be simulated for the purpose of the test. The testing shall be designed to verify the functional and operational integrity of the subsea production control system.

13.3 Xmas Tree/SCM system integration test (Tree eFAT)

A Xmas Tree/SCM System Integration Test shall be conducted for the Xmas tree, following completion of the Xmas tree FAT within the factory.

14 Special packing/shipping procedures/Instructions

For deliverables consisting of a main assembly with additional loose items (Lifting Slings, Test Hoses/Cables, Fill Lance, Pre-Charge Kit, Fluid in Barrels etc.), separate packing/shipping procedures/instructions with included component check-lists shall be provided.

The same shall apply for deliverables that can not be shipped as complete units, as transportation could result in damage of internal components.

These procedures/instructions should be part of the BOM from the related parts.

For all units which include any fluids or substances, COSHH sheets (Control of Substances Hazardous to Health) shall be delivered with the unit. These COSHH sheets shall be available early in the process for supply to the client.

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

07AUG07	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
22MAR07	Issued for Client Comment	A. Weilandt	S. Horne	
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Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirements Specification for HPU**		
PAGE 1 OF 21	**Customer Document Number:**	54NL92-W-0S-510	REV. 1
	Cameron Document No.	X-076721-87-05	REV. 01

1 INTRODUCTION

This document is written to consolidate the technical requirements for the Hydraulic Power Unit (HPU) intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

2 SCOPE OF THIS DOCUMENT

The scope of this document is to define the technical requirements for the Hydraulic Power Unit intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

3 Document revision status / record

Table 3-1 – Amendments

Date	Rev.	Description	Author
01DEC06	A	Initial Release	A. Weilandt
05JAN07	B	Section 7.1: - Operating Environment: “salt spray” changed to “salt laden and corrosive atmosphere” - Outdoors Ambient Air Temperatures added - HP/Circulation Pump: preferred vendor changed to Loher - HP/Circulation Pump: added comment that heater is only required if >10kW and requirement for pulsation dampeners - Pump Filtration: added comment that NPT threads are required on filter block and requirement to use EPE.. - HP Supply ESD Valve: Rotator instead of Bifold. - HPU Remote Interface: deleted EEx-d - HPU Gauges: added requirement for restrictions - Relief Valves: added requirement to use Nupro - Terminal details added - Internal lighting added	A. Weilandt
08FEB07	C	Section 6.1: - PLC deleted from the HPU scope, it will be separately located in a remote PLC Cabinet Section 6.3.1.1: - PLC I/O Schedule and PLC S/W Package deleted - Instrument List added Section 6.3.3.1.3: - S/W Configuration Record and PLC application removed Section 7.1: - Safety/Warning tag requirement in English and Dutch added - Isolation Valve requirement for Level Transmitter added Section 7.2.1: - PLC Power and Comms deleted - Input/Output signals from/to PLC added - Pressure Transmitter signals to safety system added Section 7.5: - EEx-d Box requirement for PLC deleted - requirement for separate junction boxes added	A. Weilandt
07AUG07	01	Updated to “Approved for Construction” Section 6.3.1.1: Equipment and Instrument Data Sheets added Section 7.1: Bypass PLC Enable renamed to Enable Startup Override	A. Weilandt

4 ABBREVIATIONS & DEFINITIONS

For abbreviations and definitions used within the Total K5F Project see related documents referenced within section 5.1 of this document.

Abbreviations and Acronyms that are specific to this document alone, for readability purposes are listed in this section:

Table 4-1 – Abbreviation/Acronym

Abbreviation/Acronym	Description
AVL	Approved Vendor List
DP	Design Pressure
DPDT	Double pole double throw
ESD	Emergency Shutdown
FAT	Factory Acceptance Test
HP	High Pressure
HPU	Hydraulic Power Unit
MCC	Motor Control Center
MCS	Master Control Station
MOP	Maximum Operation Pressure
PLC	Programmable Logic Controller
SCSSV	Surface Controlled Sub-Surface Safety Valve
SST	Stainless Steel
SSS	Saftey Shutdown System
TBD	To be determined

5 References

5.1 Cameron Reference Documents

This section defines the supporting Cameron documents to be used for evaluations against overall project requirements.

Table 5-1 – Cameron Reference Documents

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis
X-065443-70	Hydraulic Accumulator, Pump & Reservoir Calculation

5.2 Customer Reference Documents

This section defines the supporting customer documents to be used for evaluations against overall project requirements.

Table 5-2 – Customer Reference Documents

Description	Number
Total “Design basis for K5F project”	EDMP #32611
K5F Project Specification for Subsea Process Control System (SPCS)	#46643
External protection of offshore and coastal structures/equipment by painting	GS EP COR 350
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Electrical cables	GS EP ELE 161
Cable trays/ladders	GS EP ELE 311
Subsea production control system	GS EP SPS 019
Cleaning and flushing of hydraulic systems	GS EP SPS 023
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Typical cable tray details (offshore)	NL00-U-64-044
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
Instrument Name Plate Detail	NL00-Z-74-055

5.3 Industry Reference Documents

This section defines supporting industry and regulatory documents to be used for evaluations against overall project requirements.

Table 5-3 – Industry Reference Documents

Number	Description
API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platform
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment

Number	Description
ANSI/AWS D1.1	Structural Steel Welding Code
ANSI/AWS D1.6	Structural Welding Code – Stainless Steel
PED/97/23EC	Manufacturing and Certifcation of Accumulators
IEC-60529	Classification of Degrees of Electrical Protection provided by Enclosures
IEC – 92	Section 9.0 “Electrical Installations in Ships”
IEC – 60079 (EN 50014)	Section 9.0 “Electrical Apparatus for Explosive Gas Atmosphere”
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements
SAE AS4059	Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluid

6 Scope of Supply

The scope of supply for the Hydraulic Power Unit (HPU) shall consist of the following:

6.1 Permanently installed HPU Equipment

The scope for the permanently installed HPU equipment shall consist of the following main items:

- HPU Skid and Controls Assembly

The PLC will not be part of the HPU. It will be located in a separate PLC Cabinet located in the safe area.

6.2 HPU Installation and Test Equipment

The scope for the HPU Installation and Test equipment shall consist of the following main items:

- Surface Handling Rigging (Sling and Pad eyes)
- Nitrogen Pre-Charge Kit (including adapters for **all** HPU Accumulators that requires precharge , suitable hoses and Regulator)

6.3 Deliverable Documentation

The deliverable documentation for the Hydraulic Power Unit (HPU) shall consist of the following as a minimum:

NOTE:
Documentation shall be delivered in AutoCAD, Word or Excel format as applicable. All documents shall show metric units of measure as a minimum.

6.3.1 Engineering Documentation Requirements

The scope of supply for engineering documentations for the HPU shall consists of the following as a **minimum** for approval:

6.3.1.1 Engineering Documentation Requirements for Hydraulic Power Unit

- HPU Interface Data Sheet
- Assembly Drawing
- Flow Diagram
- Circuit Diagram
- Instrument List incl. Instrument Data Sheets
- Equipment Data Sheets (from vendor)

- Field Termination Drawing
- Package Structural Fabrication Drawings
- Package Lifting Eye Calculations
- Factory Acceptance Test Procedure
- Special Packing/Shipping Instructions
- Spare Parts List for Installation and Hookup Testing
- Spare Parts List for Commissioning
- Spare Parts List for 1 year of Operation and Maintenance

6.3.1.2 Engineering Documentation Requirements for Nitrogen Pre-Charge Kit

- Assembly Drawing

6.3.2 Installation, Operation and Maintenance Documentation Requirements

The scope of supply for installation, operation and maintenance documentations for the HPU and HPU Auxiliary Equipment shall consists of the following as a **minimum** for approval:

6.3.2.1 Installation, Operation and Maintenance Documentation Requirements for HPU

- Installation Procedure (procedure for physical installation and hookup of all components incl. field power/signal cabling, earthing and hydraulic connections)
- Operation Procedure (procedures start-up activities and for operating the HPU locally and remotely)
- Maintenance Procedure (procedures for operation preparation, replacement of consumable components, replacement of pumps/accumulators/gauges/panel components, and replacement/restoration of HPU controls equipment).
- Field Termination Drawing (drawing indicating all field hookups to the HPU)

6.3.2.2 Installation, Operation and Maintenance Documentation Requirements for Nitrogen Pre-Charge Kit

- Operation & Maintenance Procedure (Pre-charge Procedure)

6.3.3 Quality Documentation Requirements

A Manufacturing Record Book shall be provided for the HPU and HPU Auxiliary Equipment with the following information as a **minimum** for approval:

6.3.3.1 Quality Documentation Requirements for HPU

6.3.3.1.1 HPU Unit QA Records

- Factory acceptance test records/charts
- Hydrostatic pressure test records/charts
- HPU Transmitter calibration certificates
- Relief valve certificates
- Certificate of compliance
- Certification documents for hazardous location electrical component

6.3.3.1.2 HPU Unit Manufacturing Records

- Material test reports
- Welding and NDE procedures, qualification records and reports

6.3.3.1.3 HPU Unit Assembly and Test QA Records

- Assembly traceability record (set-out report)
- Flushing test records
- Certificate of compliance for HPU permanently installed equipment against General Design Basis and HPU Detailed Design Basis requirements.

6.3.3.2 Quality Documentation Requirements for Nitrogen Pre-Charge Kit

- Certificate of compliance

7 Hydraulic Power Unit Design Specifications

7.1 Equipment Design Requirements

Design requirements for the Hydraulic Power Unit (HPU) are defined as follows:

Feature	Static Design Requirement	Performance Requirements	Additional Description
Operating Environment	Offshore, salt laden and corrosive atmosphere, IP56 protection	Exterior and Interior HPU skid components and assemblies shall incorporate protection from environment	
Maximum (not to exceed) Dimensions	2500 mm (Length) 2595 mm (Height) 1800 mm (Width)		
Maximum (Not to exceed) Weights	5500 kg (Empty) 6550 kg (Full)		
Service Access	1500 mm (Front) 0 mm (Rear) 0 mm (Left) 1000 mm (Right) 0 mm (Top)		
Area Classification	Zone 1, Gas Group IIB, Temperature Class T3	N/A	EEx-d type instrumentation shall be used. “Intrinsically Safe” (EEx-i) instrumentation and communications may not be used on HPU skid.
Ambient Air Temperature	Max.: not exceeding +40°C Daily average: not exceeding +35°C Minimum: not less than -16°C		
Service Life	20 years	Filters, pump seals, and components subject to friction shall be identified and characterized by a maintenance life of 2 years	
HP Design Pressure	690 barg	N/A	
HP Control Fluid	Castrol Transaqua HT or HT2	N/A	

Feature	Static Design Requirement	Performance Requirements	Additional Description
Number of HP Pumps	2x 380VAC, 50 Hz, 3 phase, Minimum flow capacity of 3 l/min at 690 barg. Heater only required if >10kW Pulsation Dampeners to be located at the pumps.	Each pump should be sized to completely charge the accumulators within 30 minutes. Shall be self-priming, mounted on anti-vibration pads and fitted with flexible hoses on inlet and outlet. The fluid from the pump shall pass through a check valve and an isolation valve before entering the manifold.	HP pumps operated by off-skid MCC, controlled by remote PLC and hardwired signals to/from MCC. Loher EEx-d motors to be used.
Number of Circulation Pumps	1 x 380VAC, 50 Hz, 3 phase, minimum flow capacity of 35 l/min at 6 barg. Heater required if >10kW	Circulation pump should be able to completely recycle the largest reservoir within 2 hours. Shall be self-priming, mounted on anti-vibration pads and fitted with flexible hoses on inlet and outlet.	Circulation pump operated by off-skid MCC, controlled by remote PLC and hardwired signals to/from MCC. Loher EEx-d motor to be used.
Reservoirs	1x 500 liter (Supply) 1x 550 liter (Return)	Reservoirs to be independent. 3mm 316L to be used To be equipped with: - isolation ball valve on each suction outlet - Air filter - Vent / Breather - fluid sample valve point - 600mm man hole w/ cover - magnetic type sight level gauges on both reservoirs with isolation valves for a replacement of these gauges w/o emptying the tanks.	Given size is incl. spare fluid and air gap.
Cleanliness Requirement	Minimum SAE AS4059, Class 6		Periodic operation at SAE AS4059, Class 10 allowed.
Pump Filtration	Redundant disposable filter cartridge with integral blockage indicator (visual and dry contact N.C. terminals) for hydraulic circuit and a single filter with visual blockage indicator for the circulation circuit. Cartridge filters shall be $\beta_3 \geq 200$, w/SS316 housing construction.	Filter elements shall be removable under service with double block and single bleed/drainage to return reservoir. Filters shall be selected to achieve and maintain cleanliness requirement under continuous service.	Filter block to be equipped with NPT threads. If BSP threads will be used than this need to be clearly stated on the filter block. EPE to be used.
Number of HP Accumulators	2 x 35 l, Bladder type		

Feature	Static Design Requirement	Performance Requirements	Additional Description
HPU Construction	Integral SS316L pickled and passivated enclosed heavy duty type skid in accordance to **IP56** degree of protection.	Provisions shall be made to allow the HPU fastened to the deck (bolted or welded). The base frame shall have an integral drip tray, sloped to a central take-off point.	Applicable (but not limited to) Plinth, Foundation, Frame, Reservoirs, Enclosure, Doors, MCTs, Top and Side Covers
Doors	Applicable for access door and instrument panel.	ESG safety glass to be used for instrument panel. Doors shall be removable using lift-off hinges.	Provided with three point locking mechanism that shall accept one padlock.
Hydraulic Tubing	Autoclave MP 316L cold drawn tubing	To withstand 1,5x DP for 15min w/o damage	
Hydraulic Fitting	Autoclave MP and anti-vibration fitments at the output		Swagelok can be used in return lines.
Pressure Transmitters	0-1000 bar range EEX-d protection 4-20 mA output 2 off for HP Header and 2 off for HP Pump Pressure	One PT will be connected to the remote PLC and the other directly to the Safety System via a separate J-Box. Each PT requires a double block and single bleed valve assembly.	LABOM to be used if combined with a Gauge, otherwise Fisher-Rosemount to be used.
Level Gauge / Transmitters	Both Reservoirs to be provided with combined magnetic sight Level Gauge (LG) / Transmitter (LT) for local control and remote monitoring.	The LT shall indicate 0-100% over maximum design volume of reservoir. The LG shall be provided with isolation valves for replacement w/o emptying the tanks.	KSR-Kuebler EEx-d type to be used.
Relief Valves	Required on the hydraulic side of each accumulator	Setpoint = DP	Nupro or Marshalsea to be used
Burst Disks	Required on the gas side of each accu		To prevent over-pressurization
HP Supply ESD Valve	1 x 3/2-way solenoid w/ manual reset, 2x 3/2-way solenoid valve; AISI 316SS or equivalent; 24VDC solenoid (NC = No Vent/Block)	Deenergizing either valve (series connection) will depressurize the HPU within 5 minutes.	Valve will vent to Return reservoir and block HP Pump to HP Supply Header. Valves are energized and deenergized by circuit off-skid. Rotator to be used.
HPU Control	Remote control with a LPC located in a separate PLC Cabinet located in the safe area.	HPU controls/instrumentation to be powered from protected facility electrical supply (UPS)	
HPU Local Control Panel	EEx-d illuminated momentary pushbuttons, lamps, gauges and annunciator		
HPU Remote Interface	By multicore cables to the external PLC Cabinet		

Feature	Static Design Requirement	Performance Requirements	Additional Description
HPU Gauges	Glycerin filled type with **100-mm diameter** Accuracy: ± 1% F.S 70% = 690 barg. Resolution: 10 bar	To be provided with restriction.	LABOM to be used. Can be combined with pressure transmitters
Local Panel Lamp	**Red Lamp:** HP Pump Pressure HIHI HP Header Pressure HIHI Supply Tank LOLO Supply Tank HI Return Tank LOLO Return Tank HI Filter Blocked **Green Lamp:** HP Pump 1 Running HP Pump 2 Running 230V Power Supply available		BARTEC EEx-d type to be used
Local Panel Illuminated Pushbutton	**Green:** HP Pump 1 AUTO HP Pump 1 DUTY HP Pump 2 AUTO HP Pump 2 DUTY Circulation Pump ON **Red:** HP Pump 1 OFF/ALARM HP Pump 2 OFF/ALARM Circulation Pump OFF Common Alarm/Alarm Accept		BARTEC EEx-d type to be used
Local Panel Pushbutton	Lamp Test Enable Startup Override		BARTEC EEx-d type to be used
Local Panel Annunciator	Alarm Buzzer		BARTEC EEx-d type to be used
Internal Lighting	Minimum 1 off internal illumination lights with internal battery backup.	Minimum 100 Lux at 0,8m above floor required	CEAG to be used
Terminals	Screw-type terminals to be used		Phoenix to be used
Nameplates on “Local Control Panel” and within HPU	To be attached with a min. of two (2) 316 SST screws or SST rivets.		
Painting	All non SST components to be painted in light grey RAL7035.		
Tagging (Drawing/ equipment)	Refer to **General Design Basis**	Main components need to be tagged as per NL00-Z-74-055 with Total tag numbers	
Lifting/ Handling	4-point lifting padeyes and forklift slots	Padeyes to be rated at 2.5 times static weight of empty skid.	

Feature	Static Design Requirement	Performance Requirements	Additional Description
Marking	- HPU Equipment Tag - Company Name - Contract/Purchase Order Number - Weight (Gross / Net) - Cameron PN - Unique Serial Number - Supplier PN	All marking shall be manufactured in such a manner so as to ensure legibility throughout design life.	All shipped items shall be marked with this info as a minimum.
Safety and Warning Signs	All safety and warning signs shall be in English **and** Dutch	White letters on red background	
Misc.	- If dissimilar metals are used on this unit, then isolation material shall be placed between these materials.	- All components on the HPU shall be installed in a manner that permits maintenance without the need to shutdown or depressurize the HPU. Maintenance of items shall **NOT** compromise safety of personal. The HPU shall be designed using a double block and bleed isolation philosophy. - It shall **NOT** be possible to start the HP hydraulic pumps in the “AUTO” operation mode while the ESD signal is energized - all tube clamps need to have a closed clamp surface to prevent water ingress	It shall be not intended that any element of the HPU will come into contact with hydrocarbons (produced fluids) or any chemicals used for well treatment during the normal operation of the system.

7.2 Interface Requirements

7.2.1 Electrical Interface Requirements

Electrical interfaces shall be finally detailed during the detail engineering phase.

Table 7-1 – Electrical Interface Requirements

Interface on HPU	Voltage	Interface to
HPU HP Pump Motors Control	24 VDC	MCC
HPU Circ. Pump Motor Control	24 VDC	MCC
HPU HP Pump Motors (2 off)	380 VAC, 3 ph 50 HZ	MCC
HPU Circ. Pump Motor (1off)	380 VAC, 3 ph 50 HZ	MCC
HPU HP Motor Heaters (2 off); if applicable	230 VAC, 1 ph, 50 Hz	MCC
HPU Circ. Motor Heater if applicable	230 VAC, 1 ph, 50 Hz	MCC
HP Pump Pressure Transmitter	24 VDC	PCS
HP Header Pressure Transmitter	24 VDC	PCS
Inputs/Outputs from/to remote PLC	24 VDC	PLC Cabinet
HPU Internal Lighting	230 VAC, single phase 50 Hz	MCC
HPU ESD Valves (1 off)	24 VDC	SSS

7.2.2 Hydraulic Interface Requirements

Hydraulic interfaces shall be finally detailed during the detail engineering phase.

Table 7-2 – Hydraulic Interface Requirements

Interface on HPU	Quantity	Size	Material	Note
Fill-up Connection	1	1” Female	SST 316	
Common Drain Line	1	1” Female	SST 316	
Frame (Drip Pan) Drain	1	1” ANSI B16.5 Flange	SST 316	
Outlet HP Supply	1	3/8” Size Autoclave	SST 316	

7.3 Specific Hydraulic Accumulators Design Requirements

Accumulators shall be installed downstream the filter units.

An isolation valve and a dump valve shall be fitted to the hydraulic fluid supply connection of each accumulator allowing individually isolation and draining for maintenance purposes.

The HP accumulators shall be fitted with a charging valve together with a metal burst disc to the pre-charge gas end connection of each accumulator. The burst disc shall be installed to protect the individual accumulator for over-pressurization in case the accumulators are subject to excessive heat (fire). The set point of these burst discs shall be the design pressure (DP) of the related accumulators.

The accumulators shall be manufactured and certified (Stamped) to comply with **PED/97/23EC**. The accumulators shall be complete with stainless steel fluid ports and gas valves.

The accumulators shall have the exterior blasted so that the certification is **NOT** invalidated and finish painted in hi-build epoxy, suitable for the environment in accordance to the related painting procedures referenced within section 5.1 of this document and also be subject to manufacturing and test, inspection and certification by an approved certifying authority.

The hydraulic accumulators shall be supplied without pre-charge gas and shall require pre-charging at the pre-commissioning stage with oxygen free nitrogen gas.

7.4 Specific Hydraulic Supply Distribution Design Requirements

The hydraulic distribution section within the HPU shall comprise of one discrete pressure supply headers for the HP supply. The HP supply header shall be fitted with two (2) **35 liter minimum** hydraulic accumulators. The unit shall provide one (**1**) hydraulic output:

- HP Header

This hydraulic supply/outlet header shall have the following components fitted as a minimum:

- Output pressure gauge downstream of pumps and upstream of filters c/w block-bleed-block possibility and incl. test connections.
- Output pressure gauge downstream of filters and upstream of ESD valve c/w block-bleed-block possibility and incl. test connections.
- Hydraulic bleed valve downstream of filters and upstream of ESD valve.
- Hydraulic isolation valve downstream of accumulators and upstream of the ESD solenoid valve (Mounted on "**Local Control Panel**")
- Hydraulic bleed valve downstream of ESD solenoid valve.
- Hydraulic outlet isolation ball valve downstream of ESD Solenoid valve. This valve must have a facility to be pad lockable in open position.
- Solenoid operated ESD valve, 3way 2 positions solenoid operated hydraulic control valve (two in series, one shall be equipped with a latching device, manual reset and manual close button)

- Output pressure gauge/transmitter downstream of the ESD valve c/w block-bleed-block possibility and incl. test connections.

Returns from subsea were necessary; returns from surface accumulators together with bleeds and returns from Safety Valves shall use individual connections within the "**Return Reservoir**".

7.5 Specific Electric Cabling, Junction Boxes and Earthing Requirements

SST or Plastic Type EEx-e electrical junction boxes shall be installed within the HPU for connecting internal and external cables. Each electrical junction box on the HPU shall have a protection rating of **IP 66** as defined in IEC 529 (BS 549).

Cable entries for internal cables into EEx-e electrical junction boxes shall be either from the side or from the bottom through installed plastic flanges via plastic type metric size cable glands. Material of the cable glands shall always be the same as the material of the junction box.

External cables shall be routed through MCT frames (2 off) at a predefined location of the HPU structure (Above the Local Control Panel) via Platform provided MCT inserts. Cable entries for external cables into the electrical junction box within the HPU shall be from the bottom through HPU installed undrilled plastic type flanges via Platform provided plastic type metric size cable glands. In practice the plastic type flanges shall be removed and drilled by the cable installation contractor. The cable installation contractor supplied cable glands (approved for service) shall then be installed into the flange prior the cables being routed into the junction box.

Power and Signal cables shall be run separated from each other on the HPU frame to avoid any interference.

Each electrical junction box together with all associated electrical cables and cable connections shall be clearly labelled in accordance to the requirements raised within the related specifications as referenced within section 5.1 of this document and shall be installed in a manner that permits easy access during maintenance.

The cabling of the instruments and signals shall be wired to separate junction boxes inside the HPU in such way that the different signals shall be wired to their dedicated junction box as per following list:

J-Box "BES 82202" for analogue signals to SSS (Pump and Header Pressure Transmitters)

J-Box "BOS 82202" digital signals from SSS (ESD Solenoid Valve)

J-Box "BA 82202" digital inputs to the PLC (switches)

J-Box "BO 82202" digital outputs from the PLC (Indication lamps)

J-Box "BE 82202" analogue inputs at the PLC (pressure transmitter, level transmitters)

All these boxes need to the tagged accordingly. Tag numbers to be provided by Total.

The HPU shall be provided with three independent and electrically isolated earthing points for the connection to the platform earthing systems. These earth points shall be defined as follows:

- Instrument Earth – Used for connection of instrument circuit screens, etc.
- Protective Earth – Used for connection of power circuit protective earth
- Earth Bonding – Used for earth bonding of structural items

A minimum of two earthing bosses shall be provided at opposite corners of the HPU to allow earth bonding to the platform. In addition earth bonding shall be provided between the HPU frame and all doors, removable panels, cable trays and other metallic components within the HPU.

7.6 HPU Control and Alarm Setpoint Default Settings

Table 7-3 – Default Control Setpoint Settings

Description	HP supply circuit
HP Start Pressure	**580 barg**
HP Stop Pressure	**627 barg**
Emergency Pump Stop	**400 barg**

Table 7-4 – Default Alarm Setpoint Settings

Description	HP supply circuit
Supply Reservoir LoLo Level	**5%**
Supply Reservoir Lo Level	**10%**
Supply Reservoir Hi Level	**95%**
Supply Reservoir HiHi Level	**100%**
Return Reservoir LoLo Level	**5%**
Return Reservoir Lo Level	**10%**
Return Reservoir Hi Level	**95%**
Return Reservoir HiHi Level	**100%**
HP Header LoLo Pressure	**xxx barg**
HP Header Lo Pressure	**xxx barg**
HP Header Hi Pressure	**xxx barg**
HP Header HiHi Pressure	**xxx barg**
HP Pump LoLo Pressure	**xxx barg**
HP Pump Lo Pressure	**xxx barg**
HP Pump Hi Pressure	**xxx barg**
HP PumpHiHi Pressure	**xxx barg**

The above set points shall be confirmed during final acceptance testing.

7.7 Maintainability Requirements

Elevated FRP floor grating shall be provided to cover the internal area of the structure. The grating shall be removable for easy access to tubing during maintenance.

The skid layout shall be such that large items (Pumps, Accumulators, etc.) can be easily removed from the unit for repair and/or replacement trough the entrance door.

The HPU skid shall incorporate a hoist arrangement attached to the structure frame top section assisting and allowing complete change-out of motor/pump assemblies.

The hoist arrangement rail together with the lifting equipment shall allow lift-up of the related pump and transport to the entrance door.

All components shall be installed in a manner that permits maintenance without the need to shutdown or depressurize the HPU.

A hydraulic fluid sample point shall be provided downstream of each hydraulic circulation filter, permitting samples to be taken at this point. Sample points shall be strategically located with caps and warning signs to ensure operator safety.

Each circulation filter unit circuit shall be provided with isolation and bleed facilities, allowing service and replacement of the filter unit without venting pressure throughout the entire circulation system.

If required the pump outlet shall be provided with a relieving device, if pump outlet pressure could exceed the circuit design pressure.

Pressure transmitters shall be equipped with double block valves and single bleed valves together with test connections, allowing online maintenance and calibration checks.

Hydraulic fluid sample points shall be provided downstream of each hydraulic manifold filter unit and on the return manifold, permitting samples to be taken on a regular basis for fluid contamination monitoring purposes. Sample points shall be strategically located with caps and warning signs to ensure operator safety.

Pressure transducers shall be used on the HPU for remote PLC based pressure control of the surface accumulators and header and the connection to the safety system. Each pressure transducer shall be equipped with a block-bleed-block valve to allow maintenance during system operation.

It shall be possible to disconnect each motor pump unit separately from the main electrical power supply from the MCC without interference to **ANY** other HPU equipment.

The HPU shall be provided with two internal illumination lights, to allow maintenance to be safely carried out within the HPU at any time. A switch shall be provided internally adjacent to the access door. The HPU internal lightning shall be derived from the 230 VAC, single phase, 50 Hz electrical supply from the MCC.

7.8 Equipment Manufacturing Requirements

The tubing of the hydraulic circuits shall be accurately cut and bent using standard tube cutters and tube benders. No burrs shall be allowed and each section of the tubing shall be cleaned and blown dry before assembly to ensure that no contamination (dirt) could enter into the control components.

NOTE:
PTFE tape shall not be used on any part of the hydraulic control system. Use of Loctite 572 shall be the preferred sealant compound.

The skid shall, upon completion of fabrication, have all weld scale removed.

7.9 HPU FAT Test Procedure

All transducers and relief valves shall be pre tested and calibrated prior to use in the HPU and installed after hydrostatic testing has been completed.

The HPU shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- HP circuit hydraulic proof pressure test
- Relief Valve setting verification
- Accumulator pre-charge inspection
- Flush/fill verification test
- Electrical tests (Terminals-to-ground insulation resistance)
- PLC logic control verification & transmission to MCS
- PLC instrumentation verification & MCS indication
- Pump start/stop settings from PLC & MCS
- Pump stop due to low fluid level in reservoir and ESD
- ESD vent valve checks & Restart
- Fluid cleanliness inspection
- Final inspection

7.10 Special Packing & Shipping Instructions

For packing and shipping special instructions shall be provided addressing the following as a **minimum**:

- Reservoirs **EMPTY**
- Accumulators **NOT** pre-charged (but with required pressure to avoid damage of bladder)
- Loose Item Check List (Slings, Shackles, Fill Lance, Pre-Charge Kit, etc.)

8 Nitrogen Pre-Charge Kit

An accumulator pre-charge kit shall be provided that consist of the following main items:

- Charging Valves c/w with gauge and bleed valve

- Adapters and Fittings allowing multiple use of above equipment.

9 Hold Points

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

10NOV08	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
08APR08	Issued for Client Comment	A. Weilandt	S. Horne	
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Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirements Specification for HPU PLC Cabinet**		
PAGE 1 OF 15	**Customer Document Number:**	54NL92-W-7S-501	REV. 1
	Cameron Document No.	X-076721-87-18	REV. 01

1 INTRODUCTION

This document is written to consolidate the technical requirements for the Hydraulic Power Unit (HPU) PLC Cabinet intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

2 SCOPE OF THIS DOCUMENT

The scope of this document is to define the technical requirements for the HPU PLC Cabinet intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

3 Document revision status / record

Table 3-1 – Amendments

Date	Rev.	Description	Author
01AUG07	A	Initial Release	A. Weilandt
08APR08	B	Section 7.4 updated to show latest agreed functionality	A. Weilandt
10NOV08	01	Approved for Construction	A. Weilandt

4 ABBREVIATIONS & DEFINITIONS

For abbreviations and definitions used within the Total K5F Project see related documents referenced within section 5.1 of this document.

Abbreviations and Acronyms that are specific to this document alone, for readability purposes are listed in this section:

Table 4-1 – Abbreviation/Acronym

Abbreviation/Acronym	Description
AVL	Approved Vendor List
ESD	Emergency Shutdown
FAT	Factory Acceptance Test
HP	High Pressure
HPU	Hydraulic Power Unit
MCC	Motor Control Center
MCS	Master Control Station
MOP	Maximum Operation Pressure
PLC	Programmable Logic Controller
SCSSV	Surface Controlled Sub-Surface Safety Valve
SST	Stainless Steel
SSS	Saftey Shutdown System
TBD	To be determined

5 References

5.1 Cameron Reference Documents

This section defines the supporting Cameron documents to be used for evaluations against overall project requirements.

Table 5-1 – Cameron Reference Documents

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

5.2 Customer Reference Documents

This section defines the supporting customer documents to be used for evaluations against overall project requirements.

Table 5-2 – Customer Reference Documents

Description	Number
Total “Design basis for K5F project”	EDMP #32611
K5F Project Specification for Subsea Process Control System (SPCS)	#46643
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Electrical cables	GS EP ELE 161
Subsea production control system	GS EP SPS 019
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
Instrument Name Plate Detail	NL00-Z-74-055

5.3 Industry Reference Documents

This section defines supporting industry and regulatory documents to be used for evaluations against overall project requirements.

Table 5-3 – Industry Reference Documents

Number	Description
API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platform
IEC-60529	Classification of Degrees of Electrical Protection provided by Enclosures
IEC – 92	Section 9.0 “Electrical Installations in Ships”
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements

6 Scope of Supply

The scope of supply for the HPU PLC Cabinet shall consist of the following:

6.1 Permanently installed HPU PLC Cabinet Equipment

The scope for the permanently installed HPU PLC Cabinet equipment shall consist of the following main items:

- HPU PLC Cabinet and internal PLC components (CPU, Digital and Analogue Input and Output cards)

6.2 Deliverable Documentation

The deliverable documentation for the HPU PLC Cabinet shall consist of the following as a minimum:

6.2.1 Engineering Documentation Requirements

6.2.1.1 Engineering Documentation Requirements for HPU PLC Cabinet

- Assembly Drawing
- Circuit Diagram
- Field Termination Drawing
- Factory Acceptance Test Procedure
- Spare Parts List for Commissioning
- Spare Parts List for 1 year of Operation and Maintenance

6.2.2 Installation, Operation and Maintenance Documentation Requirements

The scope of supply for installation, operation and maintenance documentations for the HPU PLC Cabinet shall consist of the following as a **minimum**:

- Installation Procedure (procedure for physical installation and hookup of all components incl. field power/signal cabling, earthing and connections)
- Operation Procedure

6.2.3 Quality Documentation Requirements

A Manufacturing Record Book shall be provided for the HPU PLC Cabinet with the following information as a **minimum**:

6.2.3.1 Quality Documentation Requirements for HPU PLC Cabinet

6.2.3.1.1 HPU PLC Cabinet Unit QA Records

- Factory acceptance test records
- Certificate of compliance

7 HPU PLC Cabinet Design Specifications

7.1 Equipment Design Requirements

Design requirements for the HPU PLC Cabinet are defined as follows:

Feature	Static Design Requirement	Performance Requirements	Additional Description
Operating Environment	Indoors, controlled environment		
Maximum (not to exceed) Dimensions	1000 mm (Height) 800 mm (Width) 300 mm (Depth)		
Service Access	800 mm (Front) 0 mm (Rear) 0 mm (Left) 0 mm (Right)		
Area Classification	Safe Area	N/A	N/A
Ambient Air Temperature	Max.: not exceeding +40°C Daily average: not exceeding +35°C Minimum: not less than -5°C		
Service Life	20 years		
Cabinet Construction	Self-contained, totally enclosed cabinet.	Cabinet will be bolted to the wall.	
Cabinet colour	Gray, RAL 7035 or no painting if made out of SST		
Cable Entry	Bottom entry		A suitable number/size of cable trays shall be provided for all external interconnection cables
Earthing	Cabinet to be provided with earthing bars close to cable entry in the bottom of the cabinet	IE and IPE bars to be provided. IE to be marked red and IPE yellow.	
PLC	SIEMENS S7 series		
Terminals	Screw-type terminals to be used		Phoenix to be used
Power Supply	230V/50Hz	See Interface Requirements	

Feature	**Static Design Requirement**	**Performance Requirements**	**Additional Description**
Tagging (Drawing/ equipment)	Refer to Subsea and Topside Functional Requirement Specification	Main components need to be tagged as per NL00-Z-74-055 with Total tag numbers	
Marking	- HPU PLC Cabinet Equipment Tag - Company Name - Contract/Purchase Order Number - Weight (Gross / Net) - Cameron PN - Unique Serial Number	All marking shall be manufactured in such a manner so as to ensure legibility throughout design life.	All shipped items shall be marked with this info as a minimum.
Safety and Warning Signs	All safety and warning signs shall be in English **and** Dutch		
Misc.			

7.2 Interface Requirements

7.2.1 Electrical Interface Requirements

Table 7-1 – Electrical Interface Requirements

Interface on HPU PLC Cabinet	Voltage	Interface to
Power Supply	230V/50Hz	K6C UPS
Communication Channel A	Ethernet via fibre optics	MCS
Communication Channel B	Ethernet via fibre optics	MCS
Motor Start Request (Digital Output at PLC)	24 VDC Signal	K6C MCC
Available/Running Status (Digital Input at PLC)	24 VDC Signal	K6C MCC
Digital Inputs at PLC	24 VDC Signal	HPU
Digital Outputs at PLC	24 VDC Signal	HPU
Analogue Inputs at PLC	24 VDC Signal	HPU

7.3 Specific Electric Cabling, Junction Boxes and Earthing Requirements

Cable entries shall be either from the side or from the bottom with metric size cable glands. Cable glands are not in scope of supply and need to be supplied by others on site.

Power and Signal cables shall be run separated from each other to avoid any interference.

7.4 Functional Requirements

7.4.1 Circulation Pump Logic

		MCC		PLC Output												
				1	2	3	1	2	3	4	5	6	1	2	3	4
X = valid _ = not valid		**INPUTS**	**OUTPUTS**	CP Start			CP STOP						CP ON Indication		CP OFF Indication	CP OFF Indication flashing @ 1Hz
1	CP PUMP ON			**X**									**X**			
2	CP PUMP OFF						**X**								**X**	
3	CP Pump Start request	**X**														
4	LOW LOW Supply Reservoir Level			_				**X**								
5	High Level Supply Reservoir			_					**X**							
6	LOW LOW Return Level									**X**						
7	HIGH HIGH Return Level										**X**					
8	CP available		**X**									_				_
9	CP Pump Running Feedback		**X**										**X**			
10	MCC not available															**X**
11	Lamp Test													**X**	**X**	

Only local operation shall be allowed for the Circulation Pump. It shall not be possible to start or stop the Circulation pump from the MCS. Only a Running Indication will be shown on the MCS HPU screen. Even if a HIHI or LOLO Supply/Return Reservoir Alarms is present the CP can be started by pressing the OVERRIDE Button and the CP ON Button. This function requires permanent operator attendance at the HPU.

A Running counter shall be provided on the MCS HPU screen, suitable data need to be sent to the MCS to have this running counter indication in minutes. It is only possible to reset the counter at the HPU PLC.

7.4.2 Hydraulic Pump Logic

PUMP LOGIC				ESD	MCS		MCC		PLC Output																																			
									1	2	3	4	5	1	2	3	4	5	6	7	8	1	2	1	2	1	1	2	3	4	5	1	2	3	4	5	6	7	8	1	2	1	1	2
> = above setpoint < = below setpoint				**INPUT**	**INPUT DB**	**OUTPUT DB**	**INPUTS**	**OUTPUTS**	**HP 1 Start**					**HP 1 STOP**								**HP1 Running Lamp ON**		**HP 1 OFF/Alarm LMP**		**HP 1 OFF/Alarm 1Hz**	**HP 2 Start**					**HP 2 STOP**								**HP2 Running Lamp ON**		**HP 2 OFF/Alarm LMP**		**HP 2 OFF/Alarm 1Hz**
1	Duty Stop Pressure 627 bar	Analog	PLC							<				>														<				>											
2	Duty Start Pressure 580 bar	Analog	PLC							<					>													<																
3	Standby Stop Pressure 627 bar	Analog	PLC								<				>														<				>											
4	Standby Start Pressure 560 bar	Analog	PLC								<																		<																
5	Low Pressure Stop 400 bar	Analog	PLC							<	<					<												<	<					<											
6	High Pressure Stop 627 bar	Analog	PLC							<	<						>											<	<						>										
7	MCS (Duty Stop Press.)	Analog	MCS			x bar						<						>												<					>										
8	MCS (Duty Start Press.)	Analog	MCS			x bar						<																		<																
9	MCS (Standby Stop Press.)	Analog	MCS			x bar							<						>												<					>										
10	MCS (Standby Start Press.)	Analog	MCS			x bar							<																		<																
11	HP Pump Pressure 13.4	Analog	PT	x bar																																										
12	HP Pump Pressure 13.1	Analog	PT		x bar																																									
13	HP Header Pressure 13.3	Analog	PT	x bar																																										
14	HP Header Pressure 13.2	Analog	PT		x bar																																									
15	Local (Switch)	Bool	SW							×	×			×	×														×	×				×	×											
16	Remote (Switch)	Bool	SW									×	×					×													×	×				×										
17	Startup override (Button)	Bool	PB						×																		×																		
18	HP 1 PUMP OFF/ALARM	Bool	PB																						×																				
19	HP 1 PUMP AUTO	Bool	PB						×	×	×	×	×							×																									
20	HP 1 Start Request	Bool	PLC				×		×	×	×	×	×																																
21	HP 1 Duty	Bool	PB							×		×		×															×	×															
22	HP 1 Available	Bool	MCC					×	×	×	×	×	×																																
23	HP 1 Running Feedback	Bool	MCC					×															×																						
24	HP 2 PUMP OFF/ALARM	Bool	PB																																									×		
25	HP 2 PUMP AUTO	Bool	PB																												×	×	×	×	×									
26	HP 2 Start Request	Bool	PLC				×																								×	×	×	×	×									
27	HP 2 Duty	Bool	PB								×		×																			×		×		×									
28	HP 2 Available	Bool	MCC					×													×										×	×	×	×	×				×					
29	HP 2 Running Feedback	Bool	MCC					×																																		×				
30	LOW LOW Supply Resevoir Level	Analog	PT							>	>	>	>									×										>	>	>	>					×				
31	MCC not available	Bool	MCC																							×																			×
32	Lamp Test	Bool	PB																					×	×																	×	×		

Initial Start-up of the HP pumps is only possible locally at the HPU by using the STARTUP OVERRIDE button to overcome the Low Pressure Interlock. As soon as a pressure level of 400bar is reached the pump will switch to AUTO Mode and will run with its preset stop set points.

HP Pumps can be switched ON and OFF locally at the HPU, but can only be switched OFF at the MCS. It shall not be possible to switch on the HP Pumps remotely from the MCS. If the HPU is in LOCAL mode any changes from the MCS on the pump start/stop set points will be rejected.

DUTY/STANDBY selection can be done locally at the HPU panel and remotely from the MCS.

A Running counter (minutes) shall be provided on the MCS screen, suitable data need to be sent to the MCS.

7.4.3 Alarm Logic

		Horn	PLC Output								
			1	2	3	4	5	6	7		9
	INPUTS		HP Header Press HIHI	HP Pump Press HIHI	Supply Res LOLO	Supply Reservoir HIGH	Return Res LOLO	Return Res HIGH	Filter Blocked Alarm		Common Alarm to MCS
1	Supply Reservoir LOW LOW Level	X			X						
2	Supply Reservoir LOW Level	X									X
3	Supply Reservoir HIGH Level	X				X					
4	Supply Reservoir HIGH HIGH Level	X									X
5	Return Reservoir LOW LOW Level	X					X				
6	Return Reservoir LOW Level	X									X
7	Return Reservoir HIGH Level	X						X			
8	Return Reservoir HIGH HIGH Level	X									X
9	HP Header LOW LOW Pressure	X									X
10	HP Header LOW Pressure	X									X
11	HP Header HIGH Pressure	X									X
12	HP Header HIGH HIGH Pressure	X	X								
13	HP Pump LOW LOW Pressure	X									X
14	HP Pump LOW Pressure	X									X
15	HP Pump HIGH Pressure	X									X
16	HP Pump HIGH HIGH Pressure	X		X							
17	HP 1 Filter Blocked	X							X		
18	HP 2 Filter Blocked	X								X	
19	Alarm Quit										
20	Lamp Test		X	X	X	X	X	X	X	X	

The dedicated Alarm lamp flashes when the corresponding alarm conditions occur. Pressing the ALARM QUIT button switches the horn off and turns the lamp in steady mode. When the alarm condition is gone the alarm lamp turns off.

The current HPU PLC Software version information shall be available at the MCS.

8 HPU PLC Cabinet FAT Test Procedure

The HPU PLC Cabinet shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- Electrical tests (earthing, wiring and insulation checks)
- Input/Output signal check
- Final inspection

9 Hold Points

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

02	16APR08	Reissued as Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
01	07AUG07	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
B	05MAY07	Issued for Client Comment	A. Weilandt	S. Horne	
A	05JAN07	Issued for project IDC	A. Weilandt	S. Horne	
Rev.	**Date**	**Reason for Issue**	**Originator**	**Checked**	**Approved**

CAMERON

Document Title:

Supplemental Requirement Specification
Master Control Station (MCS)

PAGE 1 OF 13	**Customer Document Number:**	54NL92-W-0S-503	REV. 2
	Cameron Document No.	X-076721-87-01	REV. 02

TABLE OF CONTENTS

1 Document Revision Status / Record

Rev.	Date	Description of change	Author
A	05JAN07	Initial release	A. Weilandt
B	05MAY07	Section 5.2: updated list of applicable standards to make sure that it suits an indoor cabinet like the MCS Section 5.3: deleted IEC-60079 for equipment in hazardous area Section 7.1: requirement added that safety and warning signs need to be in English and Dutch language Section 7.2.1: added Profibus connections to the EPCU cabinets	A. Weilandt
01	07AUG07	Updated to Approved for Construction	A. Weilandt
02	16APR08	Updated to include late customer comments	A. Weilandt

2 Introduction

This document is written to consolidate the technical requirements for the Master Control Station (MCS) intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

3 Scope of this document

The scope of this document is to define the technical requirements for the Master Control Station intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

4 Abbreviations & Definitions

4.1 Abbreviations

CCR	Central Control Room
DCS	Distributed Control System
EPCU	Electrical Power and Control Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
HPU	Hydraulic Power Unit
ICSS	Integrated Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
MCS	Master Control Station
PCS	Process Control System
PRCM	Power Regulation and Communication Module
SSS	Safety Shutdown System
UPS	Uninterruptible Power Supply

5 References

5.1 Cameron Documents

Following documents **MUST** be considered during the design phase.

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Subsea production control system	GS EP SPS 019
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
K5F MCS – K6CC SSS/PCS Interface Specification	#59401

Any agreed deviations from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

Any clarifications from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

In case of conflict between documents the following order of priority shall be applied:

1) Local and international rules and regulations
2) Company Safety Specifications (GS EP SAF)
3) Project Specifications
4) Company Standards (NL00)
5) Company General Specifications

5.3 Codes, standards and regulations

Following codes, standards and regulations shall be considered during the design phase.

Number	Description
API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platform
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment
IEC-60529	Classification of Degrees of Electrical Protection provided by Enclosures
IEC – 92	Section 9.0 “Electrical Installations in Ships”
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements

5.4 CE marking

CE marking **will** be required for the K5F project.

6 Scope of Supply

The scope of supply for the MCS shall consist of the following:

6.1 Permanently installed Equipment

The scope for the permanently installed MCS equipment shall consist of the following main items:

- MCS Cabinet
- Set of Industrial PC's with Monitor, Keyboard and Mouse
- PLC's for Signal from/to Safety System and Interface to power supplies in the EPCU

6.2 Installation and Test Equipment

The scope for the MCS Installation and Test equipment shall consist of the following main items:

- N/A

6.3 Deliverable Documentation

The deliverable documentation for the MCS shall consist of the following as a minimum:

6.3.1 Engineering Documentation Requirements

The scope of supply for engineering documentations shall consist of the following as a **minimum**:

- Assembly Drawing
- Circuit Diagram
- Field Termination Drawing
- Hardware Factory Acceptance Test Procedure
- Special Packing/Shipping Instructions
- Spare Parts List for Installation and Commissioning
- Spare Parts List for 1 year of Operation and Maintenance

6.3.2 Installation, Operation and Maintenance Procedure Requirements

The scope of supply for installation, operation and maintenance procedures for the MCS shall consist of the following as a **minimum**:

- Installation Procedure
- Operation Procedure
- Maintenance Procedure

6.3.3 Quality Documentation Requirements

A Manufacturing Record Book shall be provided for the MCS with the following information as a **minimum**:

6.3.3.1 MCS QA Records

- Factory Acceptance Test records
- Certificate of compliance

7 Master Control Station Design Specifications

7.1 Equipment Design Requirements

Design requirements for the MCS are defined as follows:

Feature	Static Design Requirement	Performance Requirements	Additional Description
Operating Environment	Controlled environment in the safe area		
Maximum (not to exceed) Dimensions	800 mm (Width) 1100 mm (Depth) 2100 mm (Height)		
Maximum (Not to exceed) Weights	400 kg		
Service Access	810 mm (Front) 0 mm (Rear) 0 mm (Left) 0 mm (Right) 0 mm (Top)	All equipment to be housed within in one cabinet.	
Area Classification	Located in the safe area	N/A	Located in K6P technical room
Ambient Air Temperature	Max.: not exceeding +40°C Daily average: not exceeding +35°C Minimum: not less than -5°C		
Service Life	20 years		
Cabinet Construction	Self-contained, totally enclosed standard 19” rack.	Window in front door required to facilitate easy reading of display screens. Cabinet will be bolted to the floor.	
Cabinet colour	Gray, RAL 7035	Internal and external	
Cable Entry	Bottom entry	Clamp mechanism for incoming cables need to be part of the cabinet	A suitable number/size of cable trays shall be provided for all external interconnection cables.
Earthing	Cabinet to be provided with earthing bars close to cable entry in the bottom of the cabinet		
PLC	SIEMENS S7 series or compatible	Separate PLC’s required for channel A and B	

Feature	Static Design Requirement	Performance Requirements	Additional Description
Digital Inputs	Safety System requires min. 4 off for each of the 4 wells, , plus 2 off ESD inputs, plus minimum 20% Spare	Inputs from the Safety System are only required on PLC A. PLC B is not directly connected to the Safety System, but it receives the same signal as PLC A.	
Digital Outputs	Safety System requires min. 9 off for each of the 4 well, plus 1 off for the keyswitch, , plus minimum 20% Spare		
PC	4 off Industrial PC's required (2 off for View/Comms A&B 2 off for OPC A&B)		
Operator Interface	Monitor, Keyboard, Mouse and a Video switch to interface to any of the PC's	To be installed in a suitable height to allow the use in standing position.	
Software Package	Linux to be used as PC operating system and Vispro for the HMI Interface		
Terminals	Screw-type terminals to be used		Phoenix to be used
Power Supply	1x Channel A from UPS 1x Channel B from UPS 1x Utility Power Supply (lighting, heater, cooler, …)	See Interface Requirements	
Tagging (Drawing/ equipment)	Refer to General Design Basis		
Safety / Warning Signs	All safety and warning signs shall be in English **and** Dutch language.	White letters on red background to be used.	
Lifting/ Handling	Cabinet has to have suitable lifting eyes		Lifting slings not included in scope of supply
Marking	- Equipment Name - Equipment Tag - Company Name - Contract/Purchase Order Number - Weight (Gross / Net) - Cameron PN - Unique Serial Number	All marking shall be manufactured in such a manner so as to ensure legibility throughout design life.	All shipped items shall be marked with this info as a minimum.

7.2 Interface Requirements

7.2.1 Electrical Interface Requirements

Electrical interfaces shall be finally detailed during the detail engineering phase.

Table 7-1 – Electrical Interface Requirements

Description	Voltage	Interface to
Power Supply A	230V, 50Hz, +/-2%	K6P UPS
Power Supply B	230V, 50Hz, +/-2%	K6P UPS
Utility Power Supply	230V, 50Hz, +/-2%	K6P Utility Power Supply
Communication to HPU	Ethernet via fibre optics	HPU PLC Cabinet
EPCU 1A Control	Profibus	EPCU Cabinet 1A
EPCU 1B Control	Profibus	ECPU Cabinet 1B
EPCU 2A Control	Profibus	ECPU Cabinet 2A
EPCU 1B Control	Profibus	ECPU Cabinet 2B
EPCU 1A Subsea Comms	Ethernet	
EPCU 1B Subsea Comms	Ethernet	
EPCU 2A Subsea Comms	Ethernet	
EPCU 2B Subsea Comms	Ethernet	
Communication A to SSS	Ethernet process communication with OPC 2.0 DA Standard	PCS
Communication B to SSS	Ethernet process communication with OPC 2.0 DA Standard	PCS
Hardwired I/O from to SSS	24 VDC	SSS
Earthing connection (PE)		Platform Earthing system

7.3 Functional Requirements

The MCS will be the redundant communication interface between the K6CC ICSS and the K5F electrical subsea Control Modules (eSCM's). The MCS does not constitute, in whole or in part, a safety related system as defined by IEC61508

7.4 Maintainability Requirements

The cabinet layout shall be such that items can be easily removed from the unit for repair and/or replacement trough the cabinet door.

The MCS shall be provided with internal illumination light, to allow maintenance to be safely carried out within the MCS at any time. The internal lightning shall be derived from the utility power supply.

7.5 FAT Test Procedure

The MCS shall undergo a factory acceptance test (FAT) for hardware following as a **minimum**:

- Insulation Test Channel A & B
- Earthing verification
- Power Supply Check
- Cabinet Lamp Test
- Fan test
- PLC I/O check
- Weighing
- Final inspection

7.6 Special Packing & Shipping Instructions

For packing and shipping special instructions shall be provided addressing the following as a **minimum**:

- Internal components to be removed prior to shipment
- Loose Item Check List

8 Hold Points

As-Built Documentation

Total Exploration and Production Netherlands B.V.

K5F Project

Supplemental Requirements Specification
for MCS/ICSS
Control Interface

1	24. Apr 08	As-Built Documentation	R. Seeck	K. Rufenach	A. Weilandt
E	4. Apr 08	Issued for Approval	R. Seeck	K. Rufenach	A. Weilandt
D	12. Mar 08	Re-issued for Client Comment	R. Seeck	K. Rufenach	A. Weilandt
C	24. Jan 08	Re-issued for Client Comment	R. Seeck	K. Rufenach	A. Weilandt
N/A	20. Dec 07	Issued for Client Comment	R. Seeck	K. Rufenach	A. Weilandt
N/A	4. Sep 07	Issued for Internal IDC	R. Seeck	K. Rufenach	A. Weilandt
Rev.	**Date**	**Reason for Issue**	**Originator**	**Checked**	**Approved**

	Document Title: **Supplemental Requirements Specification for MCS/ICSS Control Interface**		
PAGE 1 OF 63	**Customer Document Number:**	54NL92-W-0S-519	REV. 1
	Cameron Document No.	X-076721-87-12	REV. 01

TABLE OF CONTENTS

1 Document Revision Status / Record

Rev.	Date	Description of change	Author
A	4. Sep. 07	Initial release	R. Seeck
B	20. Dec 07	PCS Heartbeat added	R. Seeck
		Tag Structure and Grouping added	R. Seeck
		Diagnostic parameters EPCU and PRCM added	R. Seeck
		Appendix Tag Lists added	R. Seeck
		PRCM 1A to 4B (instead of 1 to 4), Groups split into PRCMA and PRCMB	R. Seeck
		Status "eSCM not installed" added to well STW	R. Seeck
		General alarm A and B added to valve, choke and instrument stw	R. Seeck
		K5F.TBOK6P tag added	R. Seeck
		Clarification Point 1 removed – Interlocking shall be applied according to TEPNL specification #59401 (*)	R. Seeck
		Clarification Point 2 removed - PRCM High Temperature alarms removed (*)	R. Seeck
		Clarification Point 3 removed – Max valve movement removed (*)	R. Seeck
C	24. Jan. 08	PRCM tag numbers changed 81204 to 92100	R. Seeck
		CIV92101_x will change from Corrosion Inhibitor to Methanol Injection	R. Seeck
		CIV92102_x will change from Methanol Injection to Corrosion Inhibitor	R. Seeck
		Unit V removed from JTI92100R_x_STW	R. Seeck
		Description of High Pressure B changed from A to B	R. Seeck
D	12. Mar. 08	Range of Value added to DHPTT, EPCU and PRCM	R. Seeck
		Chapter "SSS Valve Command Processing" added	R. Seeck
		Short tags for PRCM instruments changed	R. Seeck
		PCSHEARTBEAT_B removed, PCSHEARTBEAT_A renamed to PCSHEARTBEAT	R. Seeck
		Shield and Earth current alarms implemented, no longer optional	R. Seeck
		Interlock “BAIV not closed” added to AMV	R. Seeck
		Interlock “AMV not closed” added to BAIV	R. Seeck
		General Tagging: EPCU numbering changed von “1 to 8” to “1A to 4B”	R. Seeck
		Grouping: Definition of client-site OPC groups	R. Seeck
		Well alarm register: Definition of eSCM and PRCM alarms added	R. Seeck
		Valve status word: Definition of general alarms added	R. Seeck
		Choke status word: Definition of general alarms added	R. Seeck
		Internal instrument status word: Definition of general alarms added	R. Seeck
		External instrument status word: Definition of general alarms added	R. Seeck
		Definition of Status Word DHSV92103_x added	R. Seeck
		Removed clarification points added to version history in revision B, tagged by (*); definitions added in chapters “Interlocks and SSS commands”, “Maximum parallel Operations” and "SSS Valve Command Processing"	R. Seeck
D	17. Mar. 08	Bit assignment of General Alarms A and B changed for PCV92101 (to Bit 8 and 9) and all Subsea Instruments (to Bit 2 and 3)	R. Seeck
		Interlock MCU Cooling Down added for PCV92101	R. Seeck

Rev.	Date	Description of change	Author
		Range of Values for HPU Pressure Transmitters changed: 0 – 690 bar	R. Seeck
		Status word for DVA added to monitor pilot valve state for DHSV Appended tag lists updated	R. Seeck
		Appended tag lists updated using PCSHEARTBEAT only (A and B removed)	R. Seeck
		Well interlocks “PRCM A High Temperature” and “PRCM B High Temperature” removed	R. Seeck
		ITWO for wells introduced carrying the “Max Valve/Choke Movement” Interlock	R. Seeck
		Differential Pressure Alarms added to general alarms for downhole pressure and temperature instruments	R. Seeck
		EPCU status word: Definition of general alarms added	R. Seeck
E	4. Apr. 08	Incorporation of TEPNL/INVENSYS/CAMERON platform building	R. Seeck
		MODE81203 (MCS/PCS Mode) removed because PCS evaluates hardwired interface only	R. Seeck
		Network interfaces alarms marked currently not in use	R. Seeck
		General Alarm, General Alarm A and General Alarm B added to NN81203_ALM	R. Seeck
		Interlock “XOV1 not open” added to AMV and BAIV	R. Seeck
		Tags added for HPU pump running hours and command interface: JZL82840 JZL82840_STW JHSWL82840A JHSWL82840A_STW JZX82840A_ENG JZX82840A_STW JHSW82840A_CTW JRC82840A_CTW JRCL82840A JRCL82840A_STW JHSWL82840B JHSWL82840B_STW JZX82840B_ENG JZX82840B_STW JHSW82840B_CTW JRC82840B_CTW JRCL82840B JRCL82840B_STW JZX82841_ENG JZX82841_STW JRC82841_CTW JRCL82841 JRCL82841_STW	R. Seeck
		General HPU register added: HPU82840	R. Seeck
	15. Apr. 08	Nomenclature adapted to revised implementation at MCS and PCS: analogue override -> Out of Service A+GND/Earth Current -> Sensing Current	R. Seeck
F	24. Aprl. 08	As-Built Documentation:	
		Description of Invalidity for Well, Valve, Choke and Instrument added	R. Seeck
		Clarification well status “eSCM not installed” = “Wellslot not commissioned”	R. Seeck
		Range of values and unit for DHSV92103 corrected (0-690 bar)	R. Seeck
		Assignment of DHSV92103_x interlocks revised	R. Seeck
		Discrepancy alarms added to downhole gauges	R. Seeck

Rev.	Date	Description of change	Author
		Data type of EPCU and Sensing Current changed to integer	R. Seeck
		HPU 82840 added	R. Seeck
		Units of HPU Pump run times corrected to hours	R. Seeck
		Clarification scope of default HPU status words	R. Seeck

2 Introduction

This document shall define the interface of the Master Control Station (MCS) with Process Control System (PCS) and Safety Shutdown System (SSS). Operating principles and tagging rules shall be included covering Integrated Control and Safety System (ICSS) interfaces of the MCS.

Hardwired signals and OPC tags not directly related to MCS/ICSS interfaces are not covered by this document.

3 Scope of this document

The scope of this document is to define

- OPC Tag Names
- Interpretation of OPC Status Information
- Interpretation of OPC Interlock Information
- Application of OPC Control Commands
- Interpretation of Hardwired Status Information
- Application of Hardwired Control Commands
- Runtime Behaviour

4 Abbreviations & Definitions

4.1 Abbreviations

AIV	Annulus Isolation Valve
AMV	Annulus Master Valve
APTA	Annulus Pressure Transmitter A
APTB	Annulus Pressure Transmitter B
APTC	Annulus Pressure Transmitter C
BAIV	B Annulus Isolation Valve
CAIV	C Annulus Isolation Valve
CCR	Central Control Room
CCR	Central Control Room (located in Den Helder)
CI	Corrosion Inhibitor
CICV	Chemical Injection Check Valve
CIV	Chemical Injection Valve
CP	Cathodic Protection
CR	Control Room
DCS	Distributed Control System
DHP	Down hole Pressure
DHT	Down hole Temperature
EDU	Electrical Distribution Unit
EHC	Electro-Hydraulic-Chemical
EPCU	Electrical Power and Control Unit
EPU	Electrical Power Unit
eSCM	Electrical Subsea Control Module
ESD	Emergency Shut Down
HP	Hydraulic High Pressure
HPU	Hydraulic Power Unit
ICSS	Integrated Control and Safety System Information Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
KHI	Kinetic Hydrate Inhibitor
LICS	Light Intervention Control System
LIR	Local Instrument Room
LP	Hydraulic Low Pressure
LPMV	Lower Production Master Valve
LRP	Lower Riser Package
MCS	Master Control Station
MDS	Material Data Sheet
MeOH	Methanol
MIC	Microbiological Influenced Corrosion
MT	Metric Tonnes
MTTR	Mean time to Repair
OS	Operator Station
PCS	Process Control System Production Control System

PCV	Production Choke Valve
PI	Pressure Indicating function code
PPD	Production Pressure Downstream
PPU	Production Pressure Upstream
PRCM	Power Regulation and Communication Module
PSV	Production Swab Valve
PTD	Production Temperature Downstream
PTU	Production Temperature Upstream
PWV	Production Wing Valve
RAM	Reliability, Availability & Maintainability
ROV	Remote Operated Valve or Remote Operated Vehicle
RPC	Remote Power Controller
SAM	Sub sea Accumulator Module
SCSSV	Surface Controlled Subsurface Safety Valve
SCSSVIV	SCSSV Isolation Valve
SDU	Sub sea Distribution Unit
SEM	Sub sea Electronic Module
SIWHP	Shut-In Wellhead Pressure
SPCS	Sub sea Production (Process) Control System
SPCU	Sub sea Power and Communication Unit
SSS	Safety Shutdown System
ST	System Test
TBO	Total Black Out
TCM	Topside Control Module (Control Station of SCM, sometimes referred as MCS - Master Control Station)
TCST	Tree Connection Seal Test
TI	Temperature Indicating function code
TUT	Topside Umbilical Termination
UPMV	Upper Production Master Valve
UPS	Uninterruptible Power Supply
UPS	Uninterruptible Power Supply
UTH	Umbilical Termination Head
WH	Wellhead
WHFP	Wellhead Flowing Pressure
WHFT	Wellhead Flowing Temperature
WHSIP	Wellhead Shut-In Pressure
WOCS	Work-Over Control System
XOV	Crossover Valve

5 Reference Documents

Following documents **MUST** be considered during the design phase.

Description	Revision	Number
Total “Design basis for K5F project”		EDMP #32611
K5F – Project Specification – MCS/PCS – K6CC SSS/PCS Interface	6	#59401
K5F_X-MASTREE_TAGNUMBERS	5	EDMP-#60621

6 General

6.1 Tagging

All OPC tags shall only consist of upper case letters, numbers and underscores and shall not consist of more than 30 characters.

Tagging shall always base on customer tags, followed by a well or unit identifier (well 1 to 4 or EPCU 1A to 4B). The different types of tags are identified by its extension.

OPC tag structure:

customer tag	_	a well or unit identifier	_	type extension

Example:

UPMV92102	_	2	_	CTW
UPMV92102_2_CTW				

Customer tagnames visible at MCS HMI shall also display the well identifier separated by dot (UPMV92102.1, UPMV92102.2, ... UPMV92102.4).

Type Extensions:

engineered value	_ENG
status word	_STW
control word	_CTW
interlock word open and close	_ITW
interlock word open	_ITWO
interlock word close	_ITWC
alarm	_ALM

Example for AMV92103 well 3:

AMV92103_3_STW
AMV92103_3_CTW
AMV92103_3_ITW
AMV92103_3_ITWO
AMV92103_3_ITWC

Boolean or independent status information might be transferred by customer tag plus option well or unit identifier:

Example:

High Voltage Indicator EPCU 4 JZL812043

Tagging lists contain a column named "Short Tag". This name has no direct expression for the interface, but refers to abbreviations and acronyms used in other documents, like drawings or I/O schedules.

6.1.1 Tag Structure

The tag structure shall form a tree to provide best possible access for debugging and maintenance purposes. The maximum number of tags within one branch shall provide best possible overview.

Branch			**Contents**
K5F			Heartbeats, system alarms, system mode
K5F	HPU		HPU instruments and alarms
K5F	W1		Well 1 status, alarms and interlocks
K5F	W1	VLV	Valve's status, command, position and interlocks
K5F	W1	INST	Process instruments (pressure, temperature)
K5F	W1	EPCUA	EPCU A diagnostic instruments and alarms
K5F	W1	EPCUB	EPCU B diagnostic instruments and alarms
K5F	W1	PRCMA	PRCM A diagnostic instruments
K5F	W1	PRCMB	PRCM B diagnostic instruments
K5F	W2		Well 2 status, alarms and interlocks
K5F	W2	VLV	...
K5F	W2	INST	...
K5F	W2	EPCUA	...
K5F	W2	EPCUB	...
K5F	W2	PRCM	...
K5F	W2	PRCMA	...
K5F	W3	PRCMB	...
K5F	W3	VLV	...
K5F	W3	INST	...
K5F	W3	EPCUA	...
K5F	W3	EPCUB	...

K5F	W3	PRCM	...
K5F	W3		
K5F	W4		...
K5F	W4	VLV	...
K5F	W4	INST	...
K5F	W4	EPCUA	...
K5F	W4	EPCUB	...
K5F	W4	PRCMA	...
K5F	W4	PRCMB	...

6.1.2 Grouping

The OPC items can be assigned to different OPC groups in order to optimize system resources covering different requirements regarding update rates. It is mandatory to choose a set-up reflecting the lifetime of particular information.

The minimum update rate supported by the LuX OPC server is 100ms. Update rates exceeding 2 seconds should not be used, especially for status and interlock words as well as heartbeat counters.

In general the PCS supplier is free to set-up OPC groups and related configuration. Definition of OPC groups need to be addressed by the OPC client during connection and are independent from tag structure and name space as defined above. Management of OPC groups shall be responsibility of the OPC client.

It should be taken into consideration that too large update rates for interlock words might result in command mismatches due to interlocks appearing within the update cycle. Update rates of 1 second for interlock and status words provided good results during other projects. Performance issues at OPC server side are not expected.

6.2 Invalidity

The invalidity bit shall indicate the quality of information related to the corresponding object (e.g. valve or instrument)

Invalidity related to the corresponding object is always transferred via the first bit of each status word.

Common algorithm (if applicable) is:

Under Range

or

Over Range

or

(

Feedback unknown MCSA

and

Feedback unknown MCSB

)

6.3 Interlocks

In general MCS interlocks inhibit commands or actions. They are not applied to force a valve into a certain position. Trigger condition for interlock application is always a command.

The MCS uses sequences (trips) to move valves into a certain position. Sequences will be activated, if a configurable sequence condition becomes true (e.g. UPMV becomes open and XOV1 is open -> start sequence to close XOV1).

Interlocks are represented and transferred by interlock words (ITW: 32 bit registers, integer values). Each bit relates to a certain interlock condition which is set to 1, if the interlock condition is true.

The meaning of interlock bits depend on the particular object.

6.3.1 Interlock Hierarchy

Several interlock shall be applied to all actuators of a related well.

E.g. the "Maximum Valve Operation per Well" interlock shall prevent the operator from operating more than one valve or choke per well in parallel (due to power consumption). This interlock bit shall be transferred with a well ITW and shall interlock all valves.

6.3.2 Interlocks in PCS mode

In PCS mode PCS and SSS are in charge of interlock processing. All interlocks shall be defeated in general, i.e. interlocks does not effect OPC commands.

All interlocks preventing actuators from being damaged like "PRCM Max Temperature" or "HP header pressure low" interlock shall be applied by MCS in any case.

Evaluation of interlock conditions by MCS shall not be effected in PCS mode. The MCS shall always provide realtime interlock information, especially to report prevention interlocks to PCS.

Example: "Maximum Valve Operation per Well"

The "Maximum Valve Operation per Well" interlock becomes active (ITW bit set to 1) when valve operation is started. After finalizing valve operation the "Maximum Valve Operation per Well" interlock becomes inactive (ITW bit set to 0). PCS commands of any OPC controlled valve shall be blocked, related commands shall be ignored (it is expected, that the PCS does not operate more than one valve in parallel). Valves controlled by SSS shall be operated according to their order (First In, First Out).

Example: "PRCM High Temperature"

The "PRCM High Temperature" become active (ITW bit set to 1) when HiHi alarms at both PRCMs appear. In this case valve operation is no longer possible. Any further DC valve operation shall be suppressed by MCS independent from PCS and SSS command state.

6.4 MCS and PCS mode

In MCS mode all commands from OPC and/or hardwired interface shall be ignored with exception of ESD signals.

All information (ENG, STW, ITW, ALM, hardwired signals) shall be updated independent from actual mode.

7 OPC Interface

7.1 TBOK6P

The TBOK6P signal indicates shutdown of MCS related power supply within 60s. The TBOK6P signal is arising in parallel with the hardwired TBOK6C shutdown request.

TBOK6P shall be set by the PCS.

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
TBOK6P	TBOK6P		0	1	-	integer

7.2 MCS Heartbeat

The MCS heartbeat indicates access to OPC data through a dedicated server. It is not intended to detect health of a particular MCS (MCS A or B), this information is transferred via summary alarm registers associated with the MCS tag.

The MCS heartbeat is a 32 bit integer value providing a ramp counting from 1 to 9999 every second.

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
	MCSHEARTBEAT		1	9999	-	integer

7.3 PCS Heartbeat

The PCS heartbeat indicates presence of the PCS and shall be used for logging purposes. The intention is to monitor the entire communication chain from PCS to MCS including Cameron OPC servers.

In case of malfunction no MCS activity is derived from DCS heartbeat.

The PCS heartbeat is a 32 bit integer value providing a ramp counting from 1 to 9999 every second exclusively assigned for each OPC client.

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
	PCSHEARTBEAT		1	9999	-	integer

7.4 MCS

7.4.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
MCS	NN81203	Master Control Station (A and B)				
	NN81203_ALM	MCS Alarms	-	-	-	integer
	MODE81203	MCS(0)-/ PCS(1)-Mode Keyswitch	0	1	-	integer

7.4.2 Bit Assignment

7.4.2.1 MCS Alarms: NN81203_ALM

Parameter	Bit	Annotations
MCS A not available	0	
MCS B not available	1	
Network Failure at MCS A Card 1	2	
Network Failure at MCS A Card 2	3	(currently not in use for MCS)
Network Failure at MCS A Card 3	4	(currently not in use for MCS)
Network Failure at MCS B Card 1	5	
Network Failure at MCS B Card 2	6	(currently not in use for MCS)
Network Failure at MCS B Card 3	7	(currently not in use for MCS)
HPU PLC Heartbeat Error A	8	Heartbeat of HPU PLC not detected in time (communication path A).
HPU PLC Heartbeat Error B	9	Heartbeat of HPU PLC not detected in time (communication path B)
MCS PLC A Heartbeat Error	10	Heartbeat of PLC A not detected in time.
MCS PLC B Heartbeat Error	11	Heartbeat of PLC B not detected in time.

Parameter	Bit	Annotations
MCS PLC A I/O Error	12	PLC A Diagnostic modules report errors at interface cards.
MCS PLC B I/O Error	13	PLC B Diagnostic modules report errors at interface cards.
MCS General Alarm A	14	
MCS General Alarm B	15	
MCS General Alarm	16	Cooler or Heater Fault

The general alarms are or-concatenations of single alarms individually appearing at MCS level. The summary alarms are permanently present as long as one the following single alarms is activated at MCS:

MCS A MCS B		• 24V Supply Fault • CB Fault • CB OPC Fault • CB PC Fault • Switch Port 1 Fault • Switch Port 2 Fault • Switch Port 3 Fault • Switch Port 4 Fault • Switch Port 5 Fault • Switch Port 6 Fault • Switch Port 7 Fault • Switch Port 8 Fault • Switch Port 9 Fault • Switch Port 10 Fault • Switch Port 11 Fault • Switch Port 12 Fault • Switch Port 13 Fault • Switch Port 14 Fault • Switch Port 15 Fault • Switch Port 16 Fault

7.5 Wells

Well status information shall be transferred through OPC tags assigned to the following well tags:

7.5.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
K5Fx	K5F_x	K5F Well x				
	K5F_x_STW	" " Status Word	-	-	-	integer
	K5F_x_ITW	" " Interlock Word OC	-	-	-	integer
	K5F_x_ITWO	" " Interlock Word O	-	-	-	integer
	K5F_x_ITWC	" " Interlock Word C	-	-	-	integer
	K5F_x_ALM	" " Alarms	-	-	-	integer

x: placeholder for well 1 to 4

7.5.2 Bit Assignment

7.5.2.1 Status Words

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown from eSCM A and B
Tree power on	1	Power supply activated
Tree start-up finalized	2	Start-up procedure successfully finalized
Well in workover mode	3	
eSCM not installed	4	Wellslot not commissioned

* Invalidity =

eSCM not installed

or

Node State of Subsea Modem A and B not o.k.

7.5.2.2 Well Interlocks

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Sequence condition present	0	
Tree not powered	1	Both eSCMs are not installed, no operation possible.
Tree start-up not finalized	2	(currently not in use)
Well in workover mode	3	Well in control of installation and workover system.
Well in MCS mode	4	Operation from PCS interlocked.
EPCU state unknown	5	Unknown status of both EPCU related to this well, no operation possible.
EPCU failure	6	Summary error at both EPCU related to this well, no operation possible.
Anode current: maximum exceeded	7	
Shield current: maximum exceeded	8	
Sensing current: maximum exceeded	9	
PRCM High Temperature	10	Both PRCMs report high temperature, no DC valve operation possible (interlock not defeatable, PCS and SSS operation concerned)

ITWO: Open Interlocks

Parameter	Bit	Annotations
Max valve/choke operation	0	Only one valve or choke shall be operated at the same time.

7.5.2.3 Well Alarms

Parameter	Bit	Annotations
eSCM A: Feedback unknown	0	eSCM A does not retrieve data
eSCM B: Feedback unknown	1	eSCM B does not retrieve data
eSCM A: Summary Alarm	2	
eSCM B: Summary Alarm	3	
PRCM A: Summary Alarm	4	
PRCM B: Summary Alarm	5	
PRCM A: High Temperature Alarm	6	
PRCM B: High Temperature Alarm	7	
Anode current alarm	8	
Shield current alarm	9	
Sensing current alarm	10	

The summary alarms are or-concatenations of single alarms individually appearing at MCS level. The summary alarms are permanently present as long as one the following single alarms is activated at MCS:

eSCM A eSCM B	Subsea Modem	• 1,26V Power Failure • 3,3V Power Failure • +48V Power Failure • -48V Power Failure • Temperature Sensor Error • High Temperature • Under Voltage • SHT11 Error • Temperature Hi • Temperature HiHi
	Surface Modem	• 1,26V Power Failure • 3,3V Power Failure • +48V Power Failure • -48V Power Failure • Temperature Sensor Error • High Temperature • Under Voltage • SHT11 Error • Temperature Hi (MCS) • Temperature HiHi (MCS)
PRCM A PRCM B		• 20V Power Failure • 4.7V Power Failure • High Temperature -> HVOff • SHT11 Error • Under Voltage • High Temperature Warning

		• Input Current Low • Input Current High • Hi Temperature (MCS) • HiHi Temperature -> HV Off (MCS) • Cathode Potential Alarm [Attention Cathode nearly disintigrated - Tree should be shut in - Cathode should be changed out] (MCS) • Cathode Potential Alarm [Attention Cathode fully disintigrated - Tree should be shut in] (MCS)

7.6 Actuators

7.6.1 SSS controlled valves (SDVs or Shutdown-valves):

7.6.1.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
DHSV	DHSV92103_x	Downhole Safety Valve				
	DHSV92103_x_STW	" " Status Word	-	-	-	integer
	DHSV92103_x_ENG	" " Header Pressure	0	690	bar	float
	DHSV92103_x_ITW	" " Interlock Word OC	-	-	-	integer
	DHSV92103_x_ITWO	" " Interlock Word O	-	-	-	integer
	DHSV92103_x_ITWC	" " Interlock Word C	-	-	-	integer
	DVA92103_x	Dump Valve Assembly (operating DHSV)				
	DVA92103_x_STW	" " Status Word	-	-	-	integer
UPMV	UPMV92102_x	Upper Production Master Valve				
	UPMV92102_x_ENG	" " Actual Position	0	100	%	float
XOV1	XOV92101_x	Crossover Valve				
	XOV92101_x_ENG	" " Actual Position	0	100	%	float
PWV	PWV92101_x	Production Wing Valve				
	PWV92101_x_ENG	" " Actual Position	0	100	%	float

x: placeholder for well 1 to 4

Each SSS controlled valve shall provide the following OPC tags using the same configuration as defined for DHSV92103_x:

status word	STW
actual position	ENG
interlock word open and close	ITW
interlock word open	ITWO
interlock word close	ITWC

Control words enabling valve operation via OPC are explicitly excluded. SSS controlled valves shall only be operated via hardwired interface in PCS mode or locally in MCS mode.

Open and Close status of the valve is part of the status word. The actual position of the valve shall only be included for future use.

7.6.1.2 Bit Assignment

7.6.1.2.1 Status Words DC Valves

The status word bit assignment for SSS and OPC controlled valves shall be identical (refer to chapter 7.6.2 "OPC controlled valves – Bit Assignment – Status Words")

7.6.1.2.2 Status Word DHSV92103_x

The structure of the DHSV92103_x status words shall be identical to DC valves apart from hydraulic instruments and constitution of summary alarms.

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown
Out of Service (Maintenance Inhibition)	1	for hydraulic header pressure instrument
Valve Open	2	
Valve Close	3	
Last Command Open	4	
Last Command Close	5	
Operate	6	Valve operation in progress
Fail to Move	7	Valve operation failed
Fail to Move A	8	operation via eSCM A
Fail to Move B	9	operation via eSCM B
Valve Control Failure A	10	Summary of diagnostics indicating malfunctions at eSCM and PRCM A
Valve Control Failure B	11	Summary of diagnostics indicating malfunctions at eSCM and PRCM B
General alarm A	12	Summary of alarms related to control and fuse board A subdevices
General alarm B	13	Summary of alarms related to control and fuse board B subdevices

* Invalidity:

both SIU 14 Node States not o.k.	or
both SIU 15 Node States not o.k.	or
Feedback Header Pressure unknown	or
DHSV Out of Service	or
Out of Service SIU 14 or SIU 14 Fuseboard (A and B)	or
Out of Service SIU 15 or SIU 15 Fuseboard (A and B)	

The general alarms are or-concatenations of single alarms individually appearing at MCS level. The general alarms are permanently present as long as one the following single alarms is activated at MCS:

Instrument A Instrument B	Board	• Humidity Warning (MCS) • Hi Board Temperature (MCS) • HiHi Board Temperature (MCS) • Node out of Order (MCS)
	Fuse Board	• Link Card Voltage dropped -> Fuse off • Link Card Supply Voltage dropped -> Fuse off • Link Card Time Out -> Fuse off • Link Card Humidity Alarm • Link Card Temperature Error • Link Card High Temperature -> Fuse off • Link Card High Current -> Fuse off • Link Card Heatsink Temperature Hi (MCS) • Link Card Heatsink Temperature HiHi (MCS) • Link Card Current Hi (MCS) • Link Card Current HiHi (MCS) • Link Card Node out of Order (MCS)

Alarms indicated with (MCS) are generated by MCS and not delivered by actuator.

7.6.1.2.3 Status Word DVA92103_x

DVA92103_x operates DHSV92103_x and is only associated with a status word indicating the related status information. Structure and meaning is identical to the DHSV92103_x status word, but states are derived from different thresholds and timing.

7.6.1.2.4 Interlock Words DHSV92103_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
UPMV not closed	0	UPMV is not closed and need to be closed before opening DHSV.

ITWO: Open Interlocks

Parameter	Bit	Annotations
HP header pressure low	0	
HP header pressure unknown	1	
XOV1 not closed	2	XOV1 is not closed and need to be closed before opening DHSV.
TBO K6C active	3	TBO K6C active, TBO K6C need to return to normal condition before opening DHSV.

7.6.1.2.5 Interlock Words UPMV92102_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

ITWO: Open Interlocks

Parameter	Bit	Annotations
PWV not closed	0	PWV is not closed and need to be closed before opening UPMV.
XOV1 not closed	1	XOV1 is not closed and need to be closed before opening UPMV.
ESD2 K5F active	2	ESD2 K5F active, ESD2 K5F need to return to normal condition before opening UPMV.

7.6.1.2.6 Interlock Words XOV92101_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

ITWO: Open Interlocks

Parameter	Bit	Annotations
DHSV not closed	0	DHSV is not closed and need to be closed before opening XOV1.
UPMV not closed	1	UPMV is not closed and need to be closed before opening XOV1.
ESD2 K5F active	2	ESD2 K5F active, ESD2 K5F need to return to normal condition before opening XOV.

7.6.1.2.7 Interlock Words PWV92101_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

7.6.2 OPC controlled valves

7.6.2.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
AMV	AMV92103_x	Annulus Master Valve				
	AMV92103_x_CTW	" " Control Word	-	-	-	integer
	AMV92103_x_STW	" " Status Word	-	-	-	integer
	AMV92103_x_ENG	" " Actual Position	0	100	%	float
	AMV92103_x_ITW	" " Interlock Word OC	-	-	-	integer
	AMV92103_x_ITWO	" " Interlock Word O	-	-	-	integer
	AMV92103_x_ITWC	" " Interlock Word C	-	-	-	integer
CIV1	CIV92101_x	Methanol Injection				
CIV2	CIV92102_x	Corrosion Inhibitor				
CIV3	CIV92103_x	Kinetic Hydrate Inhibitor A				
BAIV	BAIV92100_x	B Annulus Isolation Valve				

x: placeholder for well 1 to 4

Each OPC controlled valve shall provide the following OPC tags using the same configuration as defined for AMV92103_x:

status word	STW
control word	CTW
actual position	ENG
interlock word open and close	ITW
interlock word open	ITWO
interlock word close	ITWC

7.6.2.2 Bit Assignment

7.6.2.2.1 Status Words

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown or actual position out of range.
Out of Service (Maintenance Inhibition)	1	for position indicator
Valve Open	2	
Valve Close	3	
Last Command Open	4	
Last Command Close	5	
Operate	6	Valve operation in progress
Fail to Move	7	Valve operation failed
Fail to Move A	8	operation via eSCM A
Fail to Move B	9	operation via eSCM B
Valve Control Failure A	10	Summary of diagnostics indicating malfunctions at eSCM and PRCM A
Valve Control Failure B	11	Summary of diagnostics indicating malfunctions at eSCM and PRCM B
General alarm A	12	Summary of alarms related to valve A subdevices
General alarm B	13	Summary of alarms related to valve B subdevices

* Invalidity:

(

(

MCU A Node State not o.k. or
MCU A Drive absent or
MCU A Sensor absent or
MCU A Out of Service or
MCU A Fuseboard Out of Service

)

and

(

MCU B Node State not o.k. or
MCU B Drive absent or
MCU B Sensor absent or
MCU B Out of Service or
MCU B Fuseboard Out of Service

)

)

Or

Valve Out of Service

The general alarms are or-concatenations of single alarms individually appearing at MCS level. The general alarms are permanently present as long as one the following single alarms is activated at MCS:

Valve A Valve B	MCU	• Position Indicator Out of Service • MCU 38V Failure • MCU Drive absent • MCU Drive Error • MCU Sensor absent • MCU Sensor Error • MCU Stepper Error • MCU 4.5V Failure • MCU 3.2V Failure • MCU Bus Error • MCU Actuator not moving • MCU Timeout • MCU Parameter mismatch -> check parameter • Humidity Warning (MCS) • MCU Hi Temperature! Valve movement critical (MCS) • MCU HiHi Temperature -> Link Card Switched Off (MCS) • Node out of Order (MCS)

	Fuse Board	• Link Card Voltage dropped -> Fuse off • Link Card Supply Voltage dropped -> Fuse off • Link Card Time Out -> Fuse off • Link Card Humidity Alarm • Link Card Temperature Error • Link Card High Temperature -> Fuse off • Link Card High Current -> Fuse off • Link Card Heatsink Temperature Hi (MCS) • Link Card Heatsink Temperature HiHi (MCS) • Link Card Current Hi (MCS) • Link Card Current HiHi (MCS) • Link Card Node out of Order (MCS)

Alarms indicated with (MCS) are generated by MCS and not delivered by actuator.

7.6.2.2.2 Control Words

Parameter	Bit	Annotations
Close Valve	0	
Open Valve	1	

7.6.2.2.3 Interlock Words AMV92103_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

ITWO: Open Interlocks

Parameter	Bit	Annotations
BAIV not closed	0	BAIV is not closed and need to be closed before opening AMV.
XOV1 not open	1	XOV1 is not open and need to be opened before opening AMV.

7.6.2.2.4 Interlock Words CIV92101_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

7.6.2.2.5 Interlock Words CIV92102_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

7.6.2.2.6 Interlock Words CIV92103_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

7.6.2.2.7 Interlock Words BAIV92100_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

ITWO: Open Interlocks

Parameter	Bit	Annotations
AMV not closed	0	AMV is not closed and need to be closed before opening BAIV.
XOV1 not open	1	XOV1 is not open and need to be opened before opening BAIV.

7.6.3 OPC controlled chokes

7.6.3.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
PCV	PCV92101_x	Production Choke Valve	-	-	-	integer
	PCV92101_x_SPT	" " Setpoint	0	100	%	float
	PCV92101_x_STW	" " Status Word	-	-	-	integer
	PCV92101_x_ENG	" " Actual Position	0	100	%	float
	PCV92101_x_ITW	" " Interlock Word OC	-	-	-	integer
	PCV92101_x_ITWO	" " Interlock Word O	-	-	-	integer
	PCV92101_x_ITWC	" " Interlock Word C	-	-	-	integer

x: placeholder for well 1 to 4

The choke is only controlled by setpoint in PCS mode. The MCS shall immediately proceed to the desired position triggered by value change.

7.6.3.1.1 Status Words PCV92101_x

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown or actual position out of range.
Out of Service (Maintenance Inhibition)	1	for position indicator
Operate	2	Valve operation in progress
Fail to Move	3	Valve operation failed
Fail to Move A	4	operation via eSCM A
Fail to Move B	5	operation via eSCM B
Valve Control Failure A	6	Summary of diagnostics indicating malfunctions at eSCM and PRCM A
Valve Control Failure B	7	Summary of diagnostics indicating malfunctions at eSCM and PRCM B
General alarm A	8	Summary of alarms related to choke A subdevices
General alarm B	9	Summary of alarms related to choke B subdevices

* Invalidity:

(

(

MCU A Node State not o.k. or
MCU A Drive absent or
MCU A Sensor absent or
MCU A Out of Service or
MCU A Fuseboard Out of Service

)

and

(

MCU B Node State not o.k. or
MCU B Drive absent or
MCU B Sensor absent or
MCU B Out of Service or
MCU B Fuseboard Out of Service

)

)

Or

Choke Out of Service

The general alarms are or-concatenations of single alarms individually appearing at MCS level. The general alarms are permanently present as long as one the following single alarms is activated at MCS:

Choke A Choke B	MCU	• Position Indicator Out of Service • MCU 38V Failure • MCU Drive absent • MCU Drive Error • MCU Sensor absent • MCU Sensor Error • MCU Stepper Error • MCU 4.5V Failure • MCU 3.2V Failure • MCU Bus Error • MCU Actuator not moving • MCU Timeout • MCU Parameter mismatch -> check parameter • Humidity Warning (MCS) • MCU Hi Temperature! Choke movement critical (MCS) • MCU HiHi Temperature -> Link Card Switched Off (MCS) • Node out of Order (MCS)

	Fuse Board	• Link Card Voltage dropped -> Fuse off • Link Card Supply Voltage dropped -> Fuse off • Link Card Time Out -> Fuse off • Link Card Humidity Alarm • Link Card Temperature Error • Link Card High Temperature -> Fuse off • Link Card High Current -> Fuse off • Link Card Heatsink Temperature Hi (MCS) • Link Card Heatsink Temperature HiHi (MCS) • Link Card Current Hi (MCS) • Link Card Current HiHi (MCS) • Link Card Node out of Order (MCS)

Alarms indicated with (MCS) are generated by MCS and not delivered by actuator.

7.6.3.1.2 Interlock Words PCV92101_x

ITW: Choke Operation Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.
MCU Cooling Down	2	Cooling down period for motor control unit, operation prohibited

7.7 Instruments

7.7.1 Internal Instruments (CAN devices)

7.7.1.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type	hyd. offs.
PPU	PPU92101_x_ENG	Production Pressure Upstream	0	690	bar	float	yes
	PPU92101_x_STW	" " Status Word	-	-	-	integer	-
PTU	PTU92104_x_ENG	Production Temperature Upstream	-60	100	°C	float	-
	PTU92104_x_STW	" " Status Word	-	-	-	integer	-

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type	hyd. offs.
PPD	PPD92111_x_ENG	Production Pressure Downstream	0	690	bar	float	yes
	PPD92111_x_STW	" " Status Word	-	-	-	integer	-
PTD	PTD92101_x_ENG	Production Temperature Downstream	-60	100	°C	float	-
	PTD92101_x_STW	" " Status Word	-	-	-	integer	-
APTA	APTA92103_x_ENG	Annulus Pressure Transmitter A	0	690	bar	float	yes
	APTA92103_x_STW	" " Status Word	-	-	-	integer	-
APTB	APTB92105_x_ENG	Annulus Pressure Transmitter B	0	690	bar	float	yes
	APTB92105_x_STW	" " Status Word	-	-	-	integer	-

x: placeholder for well 1 to 4

7.7.1.2 Bit Assignment

The status words of all internal instruments shall have the same bit assignment:

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown or out of range or .
Out of Service (Maintenance Inhibition)	1	
General alarm A	2	Summary of alarms related to instrument A
General alarm B	3	Summary of alarms related to instrument B

* Invalidity:

(
Node State A not o.k. or
Instrument A Out of Service
)
and
(
Node State B not o.k. or
Instrument B Out of Service
)

The general alarms are or-concatenations of single alarms individually appearing at MCS level. The general alarms are permanently present as long as one the following single alarms is activated at MCS:

Instrument A Instrument B	Board	• Humidity Warning (MCS) • Hi Board Temperature (MCS) • HiHi Board Temperature (MCS) • Node out of Order (MCS)
	Fuse Board	• Link Card Voltage dropped -> Fuse off • Link Card Supply Voltage dropped -> Fuse off • Link Card Time Out -> Fuse off • Link Card Humidity Alarm • Link Card Temperature Error • Link Card High Temperature -> Fuse off • Link Card High Current -> Fuse off • Link Card Heatsink Temperature Hi (MCS) • Link Card Heatsink Temperature HiHi (MCS) • Link Card Current Hi (MCS) • Link Card Current HiHi (MCS) • Link Card Node out of Order (MCS)

Alarms indicated with (MCS) are generated by MCS and not delivered by actuator.

7.7.2 External Instruments (modbus/CAN devices)

7.7.2.1 Downhole Pressure and Temperature Transmitter (DHPTT)

7.7.2.1.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type	hyd. offs.
DHPT	PT92104_x_ENG	Downhole Pressure Transmitter	0	690	bar	float	no
	PT92104_x_STW	" " Status Word	-	-	-	integer	-
DHTT	TT92103_x_ENG	Downhole Temperature Transmitter	0	150	°C	float	-
	TT92103_x_STW	" " Status Word	-	-	-	integer	-

x: placeholder for well 1 to 4

7.7.3 Bit Assignment

7.7.3.1 PT92104_x_STW, TT92103_x_STW

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	
General alarm A	2	Summary of alarms related to instrument A
General alarm B	3	Summary of alarms related to instrument B
Discrepancy Gauge A	4	Difference larger than 5% of maximum range
Discrepancy Gauge B	5	Difference larger than 5% of maximum range

* Invalidity:

(
SIU A Fuseboard Node State not o.k. or
SIU A Fuseboard Error DHPT not connected or
SIU A Fuseboard Error DHPT error or
SIU A Fuseboard DHPT not powered or
SIU A Fuseboard DHPT not scanning or
Gauge A Out of Service (1 and 2)
)
and
(
SIU B Fuseboard Node State not o.k. or
SIU B Fuseboard Error DHPT not connected or
SIU B Fuseboard Error DHPT error or
SIU B Fuseboard DHPT not powered or
SIU B Fuseboard DHPT not scanning or
Gauge B Out of Service (1 and 2)
)

The general alarms are or-concatenations of single alarms individually appearing at MCS level. The general alarms are permanently present as long as one the following single alarms is activated at MCS:

Instrument1 A Instrument1 B Instrument2 A Instrument2 B	Discrepancy Alarm	• Pressure/Temperature1 Lo or Hi Alarm • Pressure/Temperature2 Lo or Hi Alarm
	Board	• Humidity Warning (MCS) • Hi Board Temperature (MCS) • HiHi Board Temperature (MCS) • Node out of Order (MCS)
	Fuse Board	• Link Card Voltage dropped -> Fuse off • Link Card Supply Voltage dropped -> Fuse off • Link Card Time Out -> Fuse off • Link Card Humidity Alarm • Link Card Temperature Error • Link Card High Temperature -> Fuse off • Link Card High Current -> Fuse off • Link Card Heatsink Temperature Hi (MCS) • Link Card Heatsink Temperature HiHi (MCS) • Link Card Current Hi (MCS) • Link Card Current HiHi (MCS) • Link Card Node out of Order (MCS)

Alarms indicated with (MCS) are generated by MCS and not delivered by actuator.

7.8 EPCU

7.8.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
JSLx	JSL81204_x_STW	Status EPCU x	-	-	-	integer
JUIx	JUI81204_x_ENG	Voltage EPCU x	0	4000	V	float
	JUI81204_x_STW	" " Status Word	-	-	-	integer
JIIx	JII81204_x_ENG	Current EPCU x	0	4000	mA	int
	JII81204_x_STW	" " Status Word	-	-	-	integer
JUIAx	JUI81204A_x_ENG	Anode Voltage x	0	22	V	
	JUI81204A_x_STW	" " Status Word	-	-	-	integer
JIIAx	JII81204A_x_ENG	Anode Current x	0	4500	mA	float
	JII81204A_x_STW	" " Status Word	-	-	-	integer
JIIGx	JII81204G_x_ENG	Sensing Current x	0	4500	mA	int
	JII81204G_x_STW	" " Status Word	-	-	-	integer
JIISx	JII81204S_x_ENG	Shield Current x	0	4500	mA	float
	JII81204S_x_STW	" " Status Word	-	-	-	integer
JZLx	JZL81204_x_ALM	High Voltage Indicator EPCU x	0	1	-	integer/bool
	JZL81204_x_STW	" " Status Word	-	-	-	integer

x: placeholder for EPCU 1A to 4B

7.8.2 Bit Assignment

7.8.2.1 JSL81204_x_STW

Parameter	Bit	Annotations
Invalidity*	0	Heartbeat from EPCU not detected (causes invalidity for all subordinated values).
EPCU_x: open loop	1	Open loop detected at EPCUx
EPCU_x: short circuit	2	Short circuit detected at EPCUx
EPCU_x: General Alarm	3	Summary alarms

* Invalidity:

Feedback unknown (A and B) or

Profibus Error or

The general alarms are or-concatenations of single alarms individually appearing at MCS level. The general alarms are permanently present as long as one the following single alarms is activated at MCS:

		• Sensing Current Hi • Anode Current Hi • Current Hi and HiHi • Summary Fault (from EPCU) • HV Off • HV Profibus Error • Monitor Profibus Error • Anode Potential Alarm • Shield Current Hi • Voltage Lo and Hi -> HV Off

Alarms indicated with (MCS) are generated by MCS and not delivered by actuator.

7.8.2.2 JUI81204_x_STW, JII81204_x_STW, JUI81204A_x_STW, JII81204A_x_STW, JII81204G_x_STW, JII81204S_x_STW, JZL81204_x_STW

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	

* Invalidity:

Feedback unknown (A and B) or

Profibus Error or

Out of Service

7.9 PRCM

7.9.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
JTIx	JTI92100R_x_ENG	Ring Max Temperature	-40	100	°C	float
	JTI92100R_x_STW	" " Status Word			-	integer/bool
JIIPW	JII92100W_x_ENG	Water Current	0	4.6	A	float
	JII92100W_x_STW	" " Status Word			-	integer/bool
JIIPS	JII92100S_x_ENG	Shield Current	0	4.6	A	float
	JII92100S_x_STW	" " Status Word			-	integer/bool

x: placeholder for PRCM 1A to 4B

7.9.2 Bit Assignment

7.9.2.1 JTI92100R_x_STW, JII92100W_x_STW, JII92100S_x_STW

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	

* Invalidity:

Feedback unknown (A and B) or

Out of Service

7.10 HPU

7.10.1 Tag List

7.10.1.1 Global

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
JZL	JZL82840	Local (0) / Remote (1) Control	0	1	-	integer
PT	PT82840_ENG	HP Pump Pressure	0	690	bar	float
	PT82840_STW	" " Status Word	-	-	-	integer
HPT	PT82843_ENG	HP Header Pressure	0	690	bar	float
	PT82843_STW	" " Status Word	-	-	-	integer
LTS	LT82840_ENG	Hydraulic Supply Level vessel	0	100	%	float
	LT82840_STW	" " Status Word	-	-	-	integer
LTR	LT82841_ENG	Hydraulic Return Level vessel	0	100	%	float
	LT82841_STW	" " Status Word	-	-	-	Integer
HPU	HPU82840	HPU Status Word	-	-	-	integer

7.10.1.2 High Pressure A

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
MCCA	JSL82840A	High Pressure Pump A MCC Available	0	1	-	integer
	JSL82840A_STW	" " Status Word	-	-	-	integer
HPA	JZL82840A	High Pressure Pump A Running	0	1	-	integer
	JZL82840A_STW	" " Status Word	-	-	-	integer
PDIA	PDZH82840A	HP Filter A	0	1	-	integer
	PDZH82840A_STW	" " Status Word	-	-	-	integer
JHSWL	JHSWL82840A	HP Pump A Duty (1) / Standby (0) Status	0	1	-	integer
	JHSWL82840A_STW	" " Status Word	-	-	-	integer
JZX	JZX82840A_ENG	HP Pump A Running Hours	0	-	Hours	float
	JZX82840A_STW	" " Status Word	-	-	-	integer
JHSW	JHSW82840A_CTW	Set HP Pump A to Duty *	0	1	-	integer
JRC	JRC82840A_CTW	Stop HP Pump A *	0	1	-	integer
JRCL	JRCL82840A	HP Pump A stopped	0	1	-	integer
	JRCL82840A_STW	" " Status Word	-	-	-	integer

* “Set HP Pump A to Duty” and “Stop HP Pump A” commands shall be applied by a 6 second pulse (0->1->0) to the related control word. Commands shall only be applied in PCS mode and will be ignored in MCS mode.

7.10.1.3 High Pressure B

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
MCCB	JSL82840B	High Pressure Pump B: MCC Available	0	1	-	integer
	JSL82840B_STW	" " Status Word	-	-	-	integer
HPB	JZL82840B	High Pressure Pump B Running	0	1	-	integer
	JZL82840B_STW	" " Status Word	-	-	-	integer
PDIB	PDZH82840B	HP Filter B	0	1	-	integer
	PDZH82840B_STW	" " Status Word	-	-	-	integer
JHSWL	JHSWL82840B	HP Pump B Duty (1) / Standby (0) Status	0	1	-	integer
	JHSWL82840B_STW	" " Status Word	-	-	-	integer
JZX	JZX82840B_ENG	HP Pump B Running Hours	0	-	Hours	float
	JZX82840B_STW	" " Status Word	-	-	-	integer
JHSW	JHSW82840B_CTW	Set HP Pump B to Duty *	0	1	-	integer
JRC	JRC82840B_CTW	Stop HP Pump B *	0	1	-	integer
JRCL	JRCL82840B	HP Pump B stopped	0	1	-	integer
	JRCL82840B_STW	" " Status Word	-	-	-	integer

* “Set HP Pump B to Duty” and “Stop HP Pump B” commands shall be applied by a 6 second pulse (0->1->0) to the related control word. Commands shall only be applied in PCS mode and will be ignored in MCS mode.

7.10.1.4 Circulation Pump

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
MCCC	JSL82841	Circulation Pump: MCC Available	0	1	-	integer
	JSL82841_STW	" " Status Word	-	-	-	integer
CP	JZL82841	Circulation Pump Running	0	1	-	integer
	JZL82841_STW	" " Status Word	-	-	-	integer
JZX	JZX82841_ENG	CP Pump Running Hours	0	-	Hours	float

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
	JZX82841_STW	" " Status Word	-	-	-	integer
JRC	JRC82841_CTW	Stop CP Pump *	0	1	-	integer
JRCL	JRCL82841	CP Pump stopped (1)	0	1	-	integer
	JRCL82841_STW	" " Status Word	-	-	-	integer

* The “Stop CP Pump” commands shall be applied by a 6 second pulse (0->1->0) to the related control word. Commands shall only be applied in PCS mode and will be ignored in MCS mode.

7.10.2 Bit Assignment

7.10.2.1 Default HPU STWs

The status words of all HPU analogue instruments and discrete inputs shall have the same default bit assignment:

Parameter	Bit	Annotations
Invalidity	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	

Besides the following status words provide additional alarm information:

7.10.2.2 HPU82840

Parameter	Bit	Annotations
Invalidity	0	Feedback unknown
HPU General Alarm	1	Fan Fault or HPU Heater Fault

7.10.2.3 PT82840_STW

Parameter	Bit	Annotations
Invalidity	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	
Pump Pressure General Alarm	2	MCS or HPU Pump Pressure HiHi, Hi, Lo, LoLo

7.10.2.4 PT82843_STW

Parameter	Bit	Annotations
Invalidity	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	
Header Pressure General Alarm	2	MCS or HPU Header Pressure HiHi, Hi, Lo, LoLo

7.10.2.5 LT82840_STW

Parameter	Bit	Annotations
Invalidity	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	
Supply Level General Alarm	2	MCS or HPU Supply Level HiHi, Hi, Lo, LoLo

7.10.2.6 LT82841_STW

Parameter	Bit	Annotations
Invalidity	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	
Return Level General Alarm	2	MCS or HPU Return Level HiHi, Hi, Lo, LoLo

8 Hardwired Interface

Hardwired Interface (for each redundant MCS PLC):

1 DO	PCS-/MCS-Mode Keyswitch	
2 DI	SSS	
	TBO K6C status	
	ESD2 K5F status	

Hardwired Interface per well (for each redundant MCS PLC):

8 DO	Open/Close Status Valves	
	DHSV92103_x	opened
	UPMV92102_x	opened
	XOV92101_x	opened
	PWV92101_x	opened
	DHSV92103_x	closed
	UPMV92102_x	closed
	XOV92101_x	closed
	PWV92101_x	closed
1 DO	Close Status Choke	
	PCV92101_x	closed
4 DI	Open/Close Command Valves	
	DHSV92103_x	Open (1), Close (0)
	UPMV92102_x	Open (1), Close (0)
	XOV92101_x	Open (1), Close (0)
	PWV92101_x	Open (1), Close (0)

8.1 Error Detection MCS PLC

The MCS cabinet provides two PLCs each equipped with I/O-Board supplying diagnostic data. Additionally communication between MCS and MCS PLC shall be monitored by PLC heartbeats.

Shutdowns and valve commands shall only be executed, if all related diagnostic data indicate healthy signals.

E.g. a valve shall be opened, if

(
Input MCS PLC A is 1
and
Input MCS PLC A is healthy
and
Heartbeat MCS PLC A is healthy
)
or
(
Input MCS PLC B is 1
and
Input MCS PLC B is healthy
and
Heartbeat MCS PLC B is healthy
)

Shutdowns and valve commands shall NOT be executed, if both PLCs indicate malfunctions.

8.2 Interlocks and SSS commands

In PCS mode the MCS shall ignore interlocks for valves controlled by SSS.

In order to prevent the system from physical damages the related fuse boards, PRCMs and EPCUs will automatically drop supply voltage.

All interlocks are permanently available via OPC interface and should be evaluated for operator HMI to suppress undesired valve or choke operation.

8.3 Maximum parallel Operations

The SSS shall take care that only one valve or choke is operated in parallel. This is caused by power supply restrictions.

8.4 SSS Valve Command Processing

Processing of SSS valve commands will follow the first-in first-out principle (FIFO). Each SSS valve command appearing during SSS valve operation will be delayed by MCS until operation is finalized.

This algorithm should only be applied in an accidental situation because the SSS is losing control about runtime behaviour in this case. Application of parallel setpoint changes would depend on interface timing (SSS output, wiring, etc) or polling cycles (input scan, MCS scan cycles, etc) and is no longer predictable for physical reasons.

Example: Two "parallel" SSS setpoint changes

The SSS system changes two setpoints within one PLC output cycle. The first signal detected at the related MCS server starts valve operation. Operation of the second valve starts immediately after cool down period.

This implementation is only suitable for SSS commands. Commands arising at OPC interface during valve operation will be ignored.

9 Clarification

No.	Date	Objective	Author

10 Appendix A: Tag List K5F-1 and K5F-2

General Items

MCSHEARTBEAT	K5F.MCSHEARTBEAT
PCSHEARTBEAT	K5F.PCSHEARTBEAT
NN81203_ALM	K5F.NN81203_ALM
TBOK6P	K5F.TBOK6P

Wells

K5F_1_STW	K5F.W1.K5F_1_STW
K5F_1_ITW	K5F.W1.K5F_1_ITW
K5F_1_ITWO	K5F.W1.K5F_1_ITWO
K5F_1_ITWC	K5F.W1.K5F_1_ITWC
K5F_1_ALM	K5F.W1.K5F_1_ALM
DVA92103_1_STW	K5F.W1.VLV.DVA92103_1_STW
DHSV92103_1_STW	K5F.W1.VLV.DHSV92103_1_STW
DHSV92103_1_ENG	K5F.W1.VLV.DHSV92103_1_ENG
DHSV92103_1_ITW	K5F.W1.VLV.DHSV92103_1_ITW
DHSV92103_1_ITWO	K5F.W1.VLV.DHSV92103_1_ITWO
DHSV92103_1_ITWC	K5F.W1.VLV.DHSV92103_1_ITWC
UPMV92102_1_STW	K5F.W1.VLV.UPMV92102_1_STW
UPMV92102_1_ENG	K5F.W1.VLV.UPMV92102_1_ENG
UPMV92102_1_ITW	K5F.W1.VLV.UPMV92102_1_ITW
UPMV92102_1_ITWO	K5F.W1.VLV.UPMV92102_1_ITWO
UPMV92102_1_ITWC	K5F.W1.VLV.UPMV92102_1_ITWC
XOV92101_1_STW	K5F.W1.VLV.XOV92101_1_STW
XOV92101_1_ENG	K5F.W1.VLV.XOV92101_1_ENG
XOV92101_1_ITW	K5F.W1.VLV.XOV92101_1_ITW
XOV92101_1_ITWO	K5F.W1.VLV.XOV92101_1_ITWO
XOV92101_1_ITWC	K5F.W1.VLV.XOV92101_1_ITWC
PWV92101_1_STW	K5F.W1.VLV.PWV92101_1_STW
PWV92101_1_ENG	K5F.W1.VLV.PWV92101_1_ENG
PWV92101_1_ITW	K5F.W1.VLV.PWV92101_1_ITW
PWV92101_1_ITWO	K5F.W1.VLV.PWV92101_1_ITWO
PWV92101_1_ITWC	K5F.W1.VLV.PWV92101_1_ITWC
AMV92103_1_CTW	K5F.W1.VLV.AMV92103_1_CTW
AMV92103_1_STW	K5F.W1.VLV.AMV92103_1_STW
AMV92103_1_ENG	K5F.W1.VLV.AMV92103_1_ENG
AMV92103_1_ITW	K5F.W1.VLV.AMV92103_1_ITW
AMV92103_1_ITWO	K5F.W1.VLV.AMV92103_1_ITWO
AMV92103_1_ITWC	K5F.W1.VLV.AMV92103_1_ITWC
CIV92101_1_CTW	K5F.W1.VLV.CIV92101_1_CTW
CIV92101_1_STW	K5F.W1.VLV.CIV92101_1_STW
CIV92101_1_ENG	K5F.W1.VLV.CIV92101_1_ENG
CIV92101_1_ITW	K5F.W1.VLV.CIV92101_1_ITW
CIV92101_1_ITWO	K5F.W1.VLV.CIV92101_1_ITWO
CIV92101_1_ITWC	K5F.W1.VLV.CIV92101_1_ITWC
CIV92102_1_CTW	K5F.W1.VLV.CIV92102_1_CTW
CIV92102_1_STW	K5F.W1.VLV.CIV92102_1_STW
CIV92102_1_ENG	K5F.W1.VLV.CIV92102_1_ENG

CIV92102_1_ITW	K5F.W1.VLV.CIV92102_1_ITW
CIV92102_1_ITWO	K5F.W1.VLV.CIV92102_1_ITWO
CIV92102_1_ITWC	K5F.W1.VLV.CIV92102_1_ITWC
CIV92103_1_CTW	K5F.W1.VLV.CIV92103_1_CTW
CIV92103_1_STW	K5F.W1.VLV.CIV92103_1_STW
CIV92103_1_ENG	K5F.W1.VLV.CIV92103_1_ENG
CIV92103_1_ITW	K5F.W1.VLV.CIV92103_1_ITW
CIV92103_1_ITWO	K5F.W1.VLV.CIV92103_1_ITWO
CIV92103_1_ITWC	K5F.W1.VLV.CIV92103_1_ITWC
BAIV92100_1_CTW	K5F.W1.VLV.BAIV92100_1_CTW
BAIV92100_1_STW	K5F.W1.VLV.BAIV92100_1_STW
BAIV92100_1_ENG	K5F.W1.VLV.BAIV92100_1_ENG
BAIV92100_1_ITW	K5F.W1.VLV.BAIV92100_1_ITW
BAIV92100_1_ITWO	K5F.W1.VLV.BAIV92100_1_ITWO
BAIV92100_1_ITWC	K5F.W1.VLV.BAIV92100_1_ITWC
PCV92101_1_SPT	K5F.W1.VLV.PCV92101_1_SPT
PCV92101_1_STW	K5F.W1.VLV.PCV92101_1_STW
PCV92101_1_ENG	K5F.W1.VLV.PCV92101_1_ENG
PCV92101_1_ITW	K5F.W1.VLV.PCV92101_1_ITW
PCV92101_1_ITWO	K5F.W1.VLV.PCV92101_1_ITWO
PCV92101_1_ITWC	K5F.W1.VLV.PCV92101_1_ITWC
PPU92101_1_ENG	K5F.W1.INST.PPU92101_1_ENG
PPU92101_1_STW	K5F.W1.INST.PPU92101_1_STW
PTU92104_1_ENG	K5F.W1.INST.PTU92104_1_ENG
PTU92104_1_STW	K5F.W1.INST.PTU92104_1_STW
PPD92111_1_ENG	K5F.W1.INST.PPD92111_1_ENG
PPD92111_1_STW	K5F.W1.INST.PPD92111_1_STW
PTD92101_1_ENG	K5F.W1.INST.PTD92101_1_ENG
PTD92101_1_STW	K5F.W1.INST.PTD92101_1_STW
APTA92103_1_ENG	K5F.W1.INST.APTA92103_1_ENG
APTA92103_1_STW	K5F.W1.INST.APTA92103_1_STW
APTB92105_1_ENG	K5F.W1.INST.APTB92105_1_ENG
APTB92105_1_STW	K5F.W1.INST.APTB92105_1_STW
PT92104_1_ENG	K5F.W1.INST.PT92104_1_ENG
PT92104_1_STW	K5F.W1.INST.PT92104_1_STW
TT92103_1_ENG	K5F.W1.INST.TT92103_1_ENG
TT92103_1_STW	K5F.W1.INST.TT92103_1_STW

K5F_2_STW	K5F.W2.K5F_2_STW
K5F_2_ITW	K5F.W2.K5F_2_ITW
K5F_2_ITWO	K5F.W2.K5F_2_ITWO
K5F_2_ITWC	K5F.W2.K5F_2_ITWC
K5F_2_ALM	K5F.W2.K5F_2_ALM
DVA92103_2_STW	K5F.W1.VLV.DVA92103_2_STW
DHSV92103_2_STW	K5F.W2.VLV.DHSV92103_2_STW
DHSV92103_2_ENG	K5F.W2.VLV.DHSV92103_2_ENG
DHSV92103_2_ITW	K5F.W2.VLV.DHSV92103_2_ITW
DHSV92103_2_ITWO	K5F.W2.VLV.DHSV92103_2_ITWO
DHSV92103_2_ITWC	K5F.W2.VLV.DHSV92103_2_ITWC
UPMV92102_2_STW	K5F.W2.VLV.UPMV92102_2_STW
UPMV92102_2_ENG	K5F.W2.VLV.UPMV92102_2_ENG

UPMV92102_2_ITW	K5F.W2.VLV.UPMV92102_2_ITW
UPMV92102_2_ITWO	K5F.W2.VLV.UPMV92102_2_ITWO
UPMV92102_2_ITWC	K5F.W2.VLV.UPMV92102_2_ITWC
XOV92101_2_STW	K5F.W2.VLV.XOV92101_2_STW
XOV92101_2_ENG	K5F.W2.VLV.XOV92101_2_ENG
XOV92101_2_ITW	K5F.W2.VLV.XOV92101_2_ITW
XOV92101_2_ITWO	K5F.W2.VLV.XOV92101_2_ITWO
XOV92101_2_ITWC	K5F.W2.VLV.XOV92101_2_ITWC
PWV92101_2_STW	K5F.W2.VLV.PWV92101_2_STW
PWV92101_2_ENG	K5F.W2.VLV.PWV92101_2_ENG
PWV92101_2_ITW	K5F.W2.VLV.PWV92101_2_ITW
PWV92101_2_ITWO	K5F.W2.VLV.PWV92101_2_ITWO
PWV92101_2_ITWC	K5F.W2.VLV.PWV92101_2_ITWC
AMV92103_2_CTW	K5F.W2.VLV.AMV92103_2_CTW
AMV92103_2_STW	K5F.W2.VLV.AMV92103_2_STW
AMV92103_2_ENG	K5F.W2.VLV.AMV92103_2_ENG
AMV92103_2_ITW	K5F.W2.VLV.AMV92103_2_ITW
AMV92103_2_ITWO	K5F.W2.VLV.AMV92103_2_ITWO
AMV92103_2_ITWC	K5F.W2.VLV.AMV92103_2_ITWC
CIV92101_2_CTW	K5F.W2.VLV.CIV92101_2_CTW
CIV92101_2_STW	K5F.W2.VLV.CIV92101_2_STW
CIV92101_2_ENG	K5F.W2.VLV.CIV92101_2_ENG
CIV92101_2_ITW	K5F.W2.VLV.CIV92101_2_ITW
CIV92101_2_ITWO	K5F.W2.VLV.CIV92101_2_ITWO
CIV92101_2_ITWC	K5F.W2.VLV.CIV92101_2_ITWC
CIV92102_2_CTW	K5F.W2.VLV.CIV92102_2_CTW
CIV92102_2_STW	K5F.W2.VLV.CIV92102_2_STW
CIV92102_2_ENG	K5F.W2.VLV.CIV92102_2_ENG
CIV92102_2_ITW	K5F.W2.VLV.CIV92102_2_ITW
CIV92102_2_ITWO	K5F.W2.VLV.CIV92102_2_ITWO
CIV92102_2_ITWC	K5F.W2.VLV.CIV92102_2_ITWC
CIV92103_2_CTW	K5F.W2.VLV.CIV92103_2_CTW
CIV92103_2_STW	K5F.W2.VLV.CIV92103_2_STW
CIV92103_2_ENG	K5F.W2.VLV.CIV92103_2_ENG
CIV92103_2_ITW	K5F.W2.VLV.CIV92103_2_ITW
CIV92103_2_ITWO	K5F.W2.VLV.CIV92103_2_ITWO
CIV92103_2_ITWC	K5F.W2.VLV.CIV92103_2_ITWC
BAIV92100_2_CTW	K5F.W2.VLV.BAIV92100_2_CTW
BAIV92100_2_STW	K5F.W2.VLV.BAIV92100_2_STW
BAIV92100_2_ENG	K5F.W2.VLV.BAIV92100_2_ENG
BAIV92100_2_ITW	K5F.W2.VLV.BAIV92100_2_ITW
BAIV92100_2_ITWO	K5F.W2.VLV.BAIV92100_2_ITWO
BAIV92100_2_ITWC	K5F.W2.VLV.BAIV92100_2_ITWC
PCV92101_2_SPT	K5F.W2.VLV.PCV92101_2_SPT
PCV92101_2_STW	K5F.W2.VLV.PCV92101_2_STW
PCV92101_2_ENG	K5F.W2.VLV.PCV92101_2_ENG
PCV92101_2_ITW	K5F.W2.VLV.PCV92101_2_ITW
PCV92101_2_ITWO	K5F.W2.VLV.PCV92101_2_ITWO
PCV92101_2_ITWC	K5F.W2.VLV.PCV92101_2_ITWC
PPU92101_2_ENG	K5F.W2.INST.PPU92101_2_ENG
PPU92101_2_STW	K5F.W2.INST.PPU92101_2_STW

PTU92104_2_ENG	K5F.W2.INST.PTU92104_2_ENG
PTU92104_2_STW	K5F.W2.INST.PTU92104_2_STW
PPD92111_2_ENG	K5F.W2.INST.PPD92111_2_ENG
PPD92111_2_STW	K5F.W2.INST.PPD92111_2_STW
PTD92101_2_ENG	K5F.W2.INST.PTD92101_2_ENG
PTD92101_2_STW	K5F.W2.INST.PTD92101_2_STW
APTA92103_2_ENG	K5F.W2.INST.APTA92103_2_ENG
APTA92103_2_STW	K5F.W2.INST.APTA92103_2_STW
APTB92105_2_ENG	K5F.W2.INST.APTB92105_2_ENG
APTB92105_2_STW	K5F.W2.INST.APTB92105_2_STW
PT92104_2_ENG	K5F.W2.INST.PT92104_2_ENG
PT92104_2_STW	K5F.W2.INST.PT92104_2_STW
TT92103_2_ENG	K5F.W2.INST.TT92103_2_ENG
TT92103_2_STW	K5F.W2.INST.TT92103_2_STW

EPCUs

JSL81204_1A_STW	K5F.W1.EPCUA.JSL81204_1A_STW
JUI81204_1A_ENG	K5F.W1.EPCUA.JUI81204_1A_ENG
JUI81204_1A_STW	K5F.W1.EPCUA.JUI81204_1A_STW
JII81204_1A_ENG	K5F.W1.EPCUA.JII81204_1A_ENG
JII81204_1A_STW	K5F.W1.EPCUA.JII81204_1A_STW
JZL81204_1A_ALM	K5F.W1.EPCUA.JZL81204_1A_ALM
JZL81204_1A_STW	K5F.W1.EPCUA.JZL81204_1A_STW
JUI81204A_1A_ENG	K5F.W1.EPCUA.JUI81204A_1A_ENG
JUI81204A_1A_STW	K5F.W1.EPCUA.JUI81204A_1A_STW
JII81204A_1A_ENG	K5F.W1.EPCUA.JII81204A_1A_ENG
JII81204A_1A_STW	K5F.W1.EPCUA.JII81204A_1A_STW
JII81204G_1A_ENG	K5F.W1.EPCUA.JII81204G_1A_ENG
JII81204G_1A_STW	K5F.W1.EPCUA.JII81204G_1A_STW
JII81204S_1A_ENG	K5F.W1.EPCUA.JII81204S_1A_ENG
JII81204S_1A_STW	K5F.W1.EPCUA.JII81204S_1A_STW
JSL81204_1B_STW	K5F.W1.EPCUB.JSL81204_1B_STW
JUI81204_1B_ENG	K5F.W1.EPCUB.JUI81204_1B_ENG
JUI81204_1B_STW	K5F.W1.EPCUB.JUI81204_1B_STW
JII81204_1B_ENG	K5F.W1.EPCUB.JII81204_1B_ENG
JII81204_1B_STW	K5F.W1.EPCUB.JII81204_1B_STW
JZL81204_1B_ALM	K5F.W1.EPCUB.JZL81204_1B_ALM
JZL81204_1B_STW	K5F.W1.EPCUB.JZL81204_1B_STW
JUI81204A_1B_ENG	K5F.W1.EPCUB.JUI81204A_1B_ENG
JUI81204A_1B_STW	K5F.W1.EPCUB.JUI81204A_1B_STW
JII81204A_1B_ENG	K5F.W1.EPCUB.JII81204A_1B_ENG
JII81204A_1B_STW	K5F.W1.EPCUB.JII81204A_1B_STW
JII81204G_1B_ENG	K5F.W1.EPCUB.JII81204G_1B_ENG
JII81204G_1B_STW	K5F.W1.EPCUB.JII81204G_1B_STW
JII81204S_1B_ENG	K5F.W1.EPCUB.JII81204S_1B_ENG
JII81204S_1B_STW	K5F.W1.EPCUB.JII81204S_1B_STW
JSL81204_2A_STW	K5F.W2.EPCUA.JSL81204_2A_STW

JUI81204_2A_ENG	K5F.W2.EPCUA.JUI81204_2A_ENG
JUI81204_2A_STW	K5F.W2.EPCUA.JUI81204_2A_STW
JII81204_2A_ENG	K5F.W2.EPCUA.JII81204_2A_ENG
JII81204_2A_STW	K5F.W2.EPCUA.JII81204_2A_STW
JZL81204_2A_ALM	K5F.W2.EPCUA.JZL81204_2A_ALM
JZL81204_2A_STW	K5F.W2.EPCUA.JZL81204_2A_STW
JUI81204A_2A_ENG	K5F.W2.EPCUA.JUI81204A_2A_ENG
JUI81204A_2A_STW	K5F.W2.EPCUA.JUI81204A_2A_STW
JII81204A_2A_ENG	K5F.W2.EPCUA.JII81204A_2A_ENG
JII81204A_2A_STW	K5F.W2.EPCUA.JII81204A_2A_STW
JII81204G_2A_ENG	K5F.W2.EPCUA.JII81204G_2A_ENG
JII81204G_2A_STW	K5F.W2.EPCUA.JII81204G_2A_STW
JII81204S_2A_ENG	K5F.W2.EPCUA.JII81204S_2A_ENG
JII81204S_2A_STW	K5F.W2.EPCUA.JII81204S_2A_STW
JSL81204_2B_STW	K5F.W2.EPCUB.JSL81204_2B_STW
JUI81204_2B_ENG	K5F.W2.EPCUB.JUI81204_2B_ENG
JUI81204_2B_STW	K5F.W2.EPCUB.JUI81204_2B_STW
JII81204_2B_ENG	K5F.W2.EPCUB.JII81204_2B_ENG
JII81204_2B_STW	K5F.W2.EPCUB.JII81204_2B_STW
JZL81204_2B_ALM	K5F.W2.EPCUB.JZL81204_2B_ALM
JZL81204_2B_STW	K5F.W2.EPCUB.JZL81204_2B_STW
JUI81204A_2B_ENG	K5F.W2.EPCUB.JUI81204A_2B_ENG
JUI81204A_2B_STW	K5F.W2.EPCUB.JUI81204A_2B_STW
JII81204A_2B_ENG	K5F.W2.EPCUB.JII81204A_2B_ENG
JII81204A_2B_STW	K5F.W2.EPCUB.JII81204A_2B_STW
JII81204G_2B_ENG	K5F.W2.EPCUB.JII81204G_2B_ENG
JII81204G_2B_STW	K5F.W2.EPCUB.JII81204G_2B_STW
JII81204S_2B_ENG	K5F.W2.EPCUB.JII81204S_2B_ENG
JII81204S_2B_STW	K5F.W2.EPCUB.JII81204S_2B_STW

PRCM Diagnostic Parameters

JTI92100R_1A_ENG	K5F.W1.PRCMA.JTI92100R_1A_ENG
JTI92100R_1A_STW	K5F.W1.PRCMA.JTI92100R_1A_STW
JII92100W_1A_ENG	K5F.W1.PRCMA.JII92100W_1A_ENG
JII92100W_1A_STW	K5F.W1.PRCMA.JII92100W_1A_STW
JII92100S_1A_ENG	K5F.W1.PRCMA.JII92100S_1A_ENG
JII92100S_1A_STW	K5F.W1.PRCMA.JII92100S_1A_STW
JTI92100R_1B_ENG	K5F.W1.PRCMB.JTI92100R_1B_ENG
JTI92100R_1B_STW	K5F.W1.PRCMB.JTI92100R_1B_STW
JII92100W_1B_ENG	K5F.W1.PRCMB.JII92100W_1B_ENG
JII92100W_1B_STW	K5F.W1.PRCMB.JII92100W_1B_STW
JII92100S_1B_ENG	K5F.W1.PRCMB.JII92100S_1B_ENG
JII92100S_1B_STW	K5F.W1.PRCMB.JII92100S_1B_STW
JTI92100R_2A_ENG	K5F.W2.PRCMA.JTI92100R_2A_ENG
JTI92100R_2A_STW	K5F.W2.PRCMA.JTI92100R_2A_STW
JII92100W_2A_ENG	K5F.W2.PRCMA.JII92100W_2A_ENG

JII92100W_2A_STW	K5F.W2.PRCMA.JII92100W_2A_STW
JII92100S_2A_ENG	K5F.W2.PRCMA.JII92100S_2A_ENG
JII92100S_2A_STW	K5F.W2.PRCMA.JII92100S_2A_STW
JTI92100R_2B_ENG	K5F.W2.PRCMB.JTI92100R_2B_ENG
JTI92100R_2B_STW	K5F.W2.PRCMB.JTI92100R_2B_STW
JII92100W_2B_ENG	K5F.W2.PRCMB.JII92100W_2B_ENG
JII92100W_2B_STW	K5F.W2.PRCMB.JII92100W_2B_STW
JII92100S_2B_ENG	K5F.W2.PRCMB.JII92100S_2B_ENG
JII92100S_2B_STW	K5F.W2.PRCMB.JII92100S_2B_STW

HPU

HPU82840	K5F.HPU.HPU82840
PT82840_ENG	K5F.HPU.PT82840_ENG
PT82840_STW	K5F.HPU.PT82840_STW
PT82843_ENG	K5F.HPU.PT82843_ENG
PT82843_STW	K5F.HPU.PT82843_STW
LT82840_ENG	K5F.HPU.LT82840_ENG
LT82840_STW	K5F.HPU.LT82840_STW
LT82841_ENG	K5F.HPU.LT82841_ENG
LT82841_STW	K5F.HPU.LT82841_STW
JSL82840A	K5F.HPU.JSL82840A
JSL82840A_STW	K5F.HPU.JSL82840A_STW
JZL82840A	K5F.HPU.JZL82840A
JZL82840A_STW	K5F.HPU.JZL82840A_STW
PDZH82840A	K5F.HPU.PDZH82840A
PDZH82840A_STW	K5F.HPU.PDZH82840A_STW
JSL82840B	K5F.HPU.JSL82840B
JSL82840B_STW	K5F.HPU.JSL82840B_STW
JZL82840B	K5F.HPU.JZL82840B
JZL82840B_STW	K5F.HPU.JZL82840B_STW
PDZH82840B	K5F.HPU.PDZH82840B
PDZH82840B_STW	K5F.HPU.PDZH82840B_STW
JSL82841	K5F.HPU.JSL82841
JSL82841_STW	K5F.HPU.JSL82841_STW
JZL82841	K5F.HPU.JZL82841
JZL82841_STW	K5F.HPU.JZL82841_STW
JZL82840	K5F.HPU.JZL82840
JZL82840_STW	K5F.HPU.JZL82840_STW
JHSWL82840A	K5F.HPU.JHSWL82840A
JHSWL82840A_STW	K5F.HPU.JHSWL82840A_STW
JZX82840A_ENG	K5F.HPU.JZX82840A_ENG
JZX82840A_STW	K5F.HPU.JZX82840A_STW
JHSW82840A_CTW	K5F.HPU.JHSW82840A_CTW
JRC82840A_CTW	K5F.HPU.JRC82840A_CTW
JRCL82840A	K5F.HPU.JRCL82840A
JRCL82840A_STW	K5F.HPU.JRCL82840A_STW
JHSWL82840B	K5F.HPU.JHSWL82840B
JHSWL82840B_STW	K5F.HPU.JHSWL82840B_STW

JZX82840B_ENG	K5F.HPU.JZX82840B_ENG
JZX82840B_STW	K5F.HPU.JZX82840B_STW
JHSW82840B_CTW	K5F.HPU.JHSW82840B_CTW
JRC82840B_CTW	K5F.HPU.JRC82840B_CTW
JRCL82840B	K5F.HPU.JRCL82840B
JRCL82840B_STW	K5F.HPU.JRCL82840B_STW
JZX82841_ENG	K5F.HPU.JZX82841_ENG
JZX82841_STW	K5F.HPU.JZX82841_STW
JRC82841_CTW	K5F.HPU.JRC82841_CTW
JRCL82841	K5F.HPU.JRCL82841
JRCL82841_STW	K5F.HPU.JRCL82841_STW

11 Appendix B: Tag List Extension K5F-3 and K5F-4

The following tags are intended to be used for well 3 and 4 extension, but are not accessible until introduced by MCS database.

Wells

K5F_3_STW	K5F.W3.K5F_3_STW
K5F_3_ITW	K5F.W3.K5F_3_ITW
K5F_3_ITWO	K5F.W3.K5F_3_ITWO
K5F_3_ITWC	K5F.W3.K5F_3_ITWC
K5F_3_ALM	K5F.W3.K5F_3_ALM
DVA92103_3_STW	K5F.W3.VLV.DVA92103_3_STW
DHSV92103_3_STW	K5F.W3.VLV.DHSV92103_3_STW
DHSV92103_3_ENG	K5F.W3.VLV.DHSV92103_3_ENG
DHSV92103_3_ITW	K5F.W3.VLV.DHSV92103_3_ITW
DHSV92103_3_ITWO	K5F.W3.VLV.DHSV92103_3_ITWO
DHSV92103_3_ITWC	K5F.W3.VLV.DHSV92103_3_ITWC
UPMV92102_3_STW	K5F.W3.VLV.UPMV92102_3_STW
UPMV92102_3_ENG	K5F.W3.VLV.UPMV92102_3_ENG
UPMV92102_3_ITW	K5F.W3.VLV.UPMV92102_3_ITW
UPMV92102_3_ITWO	K5F.W3.VLV.UPMV92102_3_ITWO
UPMV92102_3_ITWC	K5F.W3.VLV.UPMV92102_3_ITWC
XOV92101_3_STW	K5F.W3.VLV.XOV92101_3_STW
XOV92101_3_ENG	K5F.W3.VLV.XOV92101_3_ENG
XOV92101_3_ITW	K5F.W3.VLV.XOV92101_3_ITW
XOV92101_3_ITWO	K5F.W3.VLV.XOV92101_3_ITWO
XOV92101_3_ITWC	K5F.W3.VLV.XOV92101_3_ITWC
PWV92101_3_STW	K5F.W3.VLV.PWV92101_3_STW
PWV92101_3_ENG	K5F.W3.VLV.PWV92101_3_ENG
PWV92101_3_ITW	K5F.W3.VLV.PWV92101_3_ITW
PWV92101_3_ITWO	K5F.W3.VLV.PWV92101_3_ITWO
PWV92101_3_ITWC	K5F.W3.VLV.PWV92101_3_ITWC
AMV92103_3_CTW	K5F.W3.VLV.AMV92103_3_CTW
AMV92103_3_STW	K5F.W3.VLV.AMV92103_3_STW
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AMV92103_3_ITW	K5F.W3.VLV.AMV92103_3_ITW
AMV92103_3_ITWO	K5F.W3.VLV.AMV92103_3_ITWO
AMV92103_3_ITWC	K5F.W3.VLV.AMV92103_3_ITWC
CIV92101_3_CTW	K5F.W3.VLV.CIV92101_3_CTW
CIV92101_3_STW	K5F.W3.VLV.CIV92101_3_STW
CIV92101_3_ENG	K5F.W3.VLV.CIV92101_3_ENG
CIV92101_3_ITW	K5F.W3.VLV.CIV92101_3_ITW
CIV92101_3_ITWO	K5F.W3.VLV.CIV92101_3_ITWO
CIV92101_3_ITWC	K5F.W3.VLV.CIV92101_3_ITWC
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CIV92102_3_STW	K5F.W3.VLV.CIV92102_3_STW
CIV92102_3_ENG	K5F.W3.VLV.CIV92102_3_ENG
CIV92102_3_ITW	K5F.W3.VLV.CIV92102_3_ITW
CIV92102_3_ITWO	K5F.W3.VLV.CIV92102_3_ITWO

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PPD92111_3_ENG	K5F.W3.INST.PPD92111_3_ENG
PPD92111_3_STW	K5F.W3.INST.PPD92111_3_STW
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APTB92105_3_STW	K5F.W3.INST.APTB92105_3_STW
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XOV92101_4_ITWC	K5F.W4.VLV.XOV92101_4_ITWC
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PPU92101_4_STW	K5F.W4.INST.PPU92101_4_STW
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PTU92104_4_STW	K5F.W4.INST.PTU92104_4_STW

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TT92103_4_STW	K5F.W4.INST.TT92103_4_STW

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JII81204_3A_ENG	K5F.W3.EPCUA.JII81204_3A_ENG
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JZL81204_4A_STW	K5F.W4.EPCUA.JZL81204_4A_STW
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JUI81204A_4A_STW	K5F.W4.EPCUA.JUI81204A_4A_STW
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JII81204A_4A_STW	K5F.W4.EPCUA.JII81204A_4A_STW
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JII81204S_4A_ENG	K5F.W4.EPCUA.JII81204S_4A_ENG
JII81204S_4A_STW	K5F.W4.EPCUA.JII81204S_4A_STW
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JUI81204_4B_STW	K5F.W4.EPCUB.JUI81204_4B_STW
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JZL81204_4B_STW	K5F.W4.EPCUB.JZL81204_4B_STW
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JUI81204A_4B_STW	K5F.W4.EPCUB.JUI81204A_4B_STW
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JII81204G_4B_STW	K5F.W4.EPCUB.JII81204G_4B_STW
JII81204S_4B_ENG	K5F.W4.EPCUB.JII81204S_4B_ENG
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PRCM Diagnostic Parameters

JTI92100R_3A_ENG	K5F.W3.PRCMA.JTI92100R_3A_ENG
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JII92100W_3A_ENG	K5F.W3.PRCMA.JII92100W_3A_ENG
JII92100W_3A_STW	K5F.W3.PRCMA.JII92100W_3A_STW
JII92100S_3A_ENG	K5F.W3.PRCMA.JII92100S_3A_ENG
JII92100S_3A_STW	K5F.W3.PRCMA.JII92100S_3A_STW
JTI92100R_3B_ENG	K5F.W3.PRCMB.JTI92100R_3B_ENG
JTI92100R_3B_STW	K5F.W3.PRCMB.JTI92100R_3B_STW
JII92100W_3B_ENG	K5F.W3.PRCMB.JII92100W_3B_ENG
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JII92100S_4B_ENG	K5F.W4.PRCMB.JII92100S_4B_ENG
JII92100S_4B_STW	K5F.W4.PRCMB.JII92100S_4B_STW

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

1	09NOV07	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
B	26SEP07	Issued for Client Comments	A. Weilandt	S. Horne	
A	20SEP07	Issued for internal IDC	A. Weilandt	S. Horne	
Rev.	**Date**	**Reason for Issue**	**Originator**	**Checked**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirement Specification** **Electrical Power and Communication Unit (EPCU)**		
PAGE 1 OF 13	**Customer Document Number:**	54NL92-W-0S-507	REV. 1
	Cameron Document No.	X-076721-87-04	REV. 01

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1 Document Revision Status / Record

Rev.	Date	Description of change	Author
A	20SEP07	Initial release	A. Weilandt
B	26SEP07	Incorporated comments from Internal IDC	A. Weilandt
01	09NOV07	Front sheet updated to “Approved for Construction”, no further changes	A. Weilandt

2 Introduction

This document is written to consolidate the technical requirements for the Electrical Power and Communication Unit (EPCU) intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

3 Scope of this document

The scope of this document is to define the technical requirements for the EPCU intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

4 Abbreviations & Definitions

4.1 Abbreviations

CCR	Central Control Room
DCS	Distributed Control System
EPCU	Electrical Power and Control Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
ICSS	Integrated Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
MCS	Master Control Station
PCS	Process Control System
PRCM	Power Regulation and Communication Module
SSS	Safety Shutdown System
UPS	Uninterruptible Power Supply

5 References

5.1 Cameron Documents

Following documents **MUST** be considered during the design phase.

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Subsea production control system	GS EP SPS 019
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073

Any agreed deviations from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

Any clarifications from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

In case of conflict between documents the following order of priority shall be applied:

1) Local and international rules and regulations
2) Company Safety Specifications (GS EP SAF)
3) Project Specifications
4) Company Standards (NL00)
5) Company General Specifications

5.3 Codes, standards and regulations

Following codes, standards and regulations shall be considered during the design phase.

Number	Description
API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platform
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment
IEC-60529	Classification of Degrees of Electrical Protection provided by Enclosures
IEC – 92	Section 9.0 “Electrical Installations in Ships”
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements

5.4 CE marking

CE marking **will** be required for the K5F project.

6 Scope of Supply

The scope of supply for the EPCU shall consist of the following:

6.1 Permanently installed Equipment

The scope for the permanently installed EPCU equipment shall consist of the following main items:

- 4 off single Cabinets

6.2 Installation and Test Equipment

The scope for the EPCU Installation and Test equipment shall consist of the following main items:

- N/A

6.3 Deliverable Documentation

The deliverable documentation for the EPCU shall consist of the following as a minimum:

6.3.1 Engineering Documentation Requirements

The scope of supply for engineering documentations shall consist of the following as a **minimum**:

- Assembly Drawing
- Circuit Diagram
- Field Termination Drawing
- PLC Data Input/Output Schedule
- Hardware Factory Acceptance Test Procedure
- Special Packing/Shipping Instructions
- Spare Parts List for Installation and Commissioning
- Spare Parts List for 1 year of Operation and Maintenance

6.3.2 Installation, Operation and Maintenance Procedure Requirements

The scope of supply for installation, operation and maintenance procedures for the EPCU shall consist of the following as a **minimum**:

- Installation Procedure

- Operation Procedure
- Maintenance Procedure

6.3.3 Quality Documentation Requirements

A Manufacturing Record Book shall be provided for the EPCU with the following information as a **minimum**:

6.3.3.1 EPCU QA Records

- Factory Acceptance Test records
- Certificate of compliance

7 EPCU Design Specifications

7.1 Equipment Design Requirements

Design requirements for the MCS are defined as follows:

Feature	Static Design Requirement	Performance Requirements	Additional Description
Operating Environment	Controlled environment in the safe area		
Maximum (not to exceed) Dimensions	606 mm (Width) 805 mm (Depth) 2225 mm (Height)		These values are for a single cabinet. Complete EPCU is therefore 2424 x 805 x 2225mm
Maximum (Not to exceed) Weights	250 kg (single cabinet) 1000 kg (complete EPCU)		
Service Access	500 mm (Front) 0 mm (Rear) 0 mm (Left) 0 mm (Right) 100 mm (Top)		
Area Classification	Located in the safe area	N/A	Located in K6P technical room
Ambient Air Temperature	Max.: not exceeding +40°C Daily average: not exceeding +35°C Minimum: not less than -5°C		
Service Life	20 years		
Cabinet Construction	Self-contained 19” rack.	Cabinet will be bolted to the floor.	
Cabinet colour	Gray, RAL 7035	Internal and external	
Cable Entry	Bottom entry	Clamp mechanism for incoming cables need to be part of the cabinet	A suitable number/size of cable trays shall be provided for all external interconnection cables.
Earthing	Cabinet to be provided with earthing bars close to cable entry in the bottom of the cabinet		
Terminals	Screw-type terminals to be used		Phoenix to be used
Power Supply	1x 3phase 380…440V / 45…65 Hz per cabinet	See Interface Requirements	

Feature	Static Design Requirement	Performance Requirements	Additional Description
Output Voltage	Max. 4kV DC / 4 A		
Tagging (Drawing/ equipment)	Refer to General Design Basis		
Safety / Warning Signs	All safety and warning signs shall be in English **and** Dutch language.	White letters on red background to be used.	
Lifting/ Handling	Each Cabinet has to have suitable lifting eyes		Lifting slings not included in scope of supply
Marking	- Equipment Name - Equipment Tag - Company Name - Contract/Purchase Order Number - Cameron PN - Unique Serial Number	All marking shall be manufactured in such a manner so as to ensure legibility throughout design life.	All shipped items shall be marked with this info as a minimum.

7.2 Interface Requirements

7.2.1 Electrical Interface Requirements

Electrical interfaces shall be finally detailed during the detail engineering phase.

Table 7-1 – Electrical Interface Requirements

Description	Voltage	Interface to
Power Supply A	380…440V / 45…65Hz, 3ph	K6P UPS
Power Supply B	380…440V / 45…65Hz, 3ph	K6P UPS
EPCU 1A Control	Profibus	MCS
EPCU 1B Control	Profibus	MCS
EPCU 2A Control	Profibus	MCS
EPCU 1B Control	Profibus	MCS
EPCU 1A Control	Ethernet connection	MCS
EPCU 1B Control	Ethernet connection	MCS
EPCU 2A Control	Ethernet connection	MCS
EPCU 1B Control	Ethernet connection	MCS
Hardwired I/O from to SSS	24 VDC	SSS
Earthing connection (PE)	N/A	Platform Earthing system

7.3 Maintainability Requirements

The cabinet layout shall be such that items can be easily removed from the unit for repair and/or replacement trough the cabinet door.

7.4 FAT Test Procedure

The EPCU shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- Insulation Test Channel A & B
- Earthing verification
- Power Supply Check
- Fan test

- Heater test
- SSS Interface test
- Weighing
- Final inspection

7.5 Special Packing & Shipping Instructions

If applicable for packing and shipping special instructions shall be provided addressing the following as a **minimum**:

- Internal components to be removed prior to shipment
- Loose Item Check List

8 Hold Points

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

07AUG07	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
10APR07	Issued for Client Comment	A. Weilandt	S. Horne	
01DEC06	Issued for Internal IDC	A. Weilandt	S. Horne	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirements Specification for TUTU**		
PAGE 1 OF 10	**Customer Document Number:**	54NL92-W-0S-512	REV. 1
	Cameron Document No.	X-076721-87-06	REV. 01

1 INTRODUCTION

This document is written to consolidate the technical requirements for the Topside Umbilical Termination Unit (TUTU) intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

2 SCOPE OF THIS DOCUMENT

The scope of this document is to define the technical requirements for the Topside Umbilical Termination Unit intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

3 Document revision status / record

Table 3-1 – Amendments

Date	Rev.	Description	Author
01DEC06	A	Initial Release	Alex Weilandt
10APR07	B	- new front sheet added - updated as per internal IDC comments	Alex Weilandt
07AUG07	01	- Updated to “Approved for Construction”	Alex Weilandt

4 ABBREVIATIONS & DEFINITIONS

For abbreviations and definitions used within the Total K5F Project see related documents referenced within section 5.1 of this document.

Abbreviations and Acronyms that are specific to this document alone, for readability purposes are listed in this section:

Table 4-1 – Abbreviation/Acronym

Abbreviation/Acronym	Description
AVL	Approved Vendor List
CI	Corrosion Inhibitor
CoP	Comms on Power
DP	Design Pressure
FAT	Factory Acceptance Test
HP	High Pressure
HPU	Hydraulic Power Unit
KHI	Kinetic Hydrate Inhibitor
MEOH	Methanol
MOP	Maximum Operation Pressure
SCSSV	Surface Controlled Sub-Surface Safety Valve
SST	Stainless Steel
TBD	To be determined
TUTU	Topside Umbilical Termination Unit

5 References

5.1 Cameron Reference Documents

This section defines the supporting Cameron documents to be used for evaluations against overall project requirements.

Table 5-1 – Cameron Reference Documents

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

5.2 Customer Reference Documents

This section defines the supporting customer documents to be used for evaluations against overall project requirements.

Table 5-2 – Customer Reference Documents

Description	Number
Total “Design basis for K5F project”	EDMP #32611
External protection of offshore and coastal structures/equipment by painting	GS EP COR 350
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Electrical cables	GS EP ELE 161
Cable trays/ladders	GS EP ELE 311
Subsea production control system	GS EP SPS 019
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Typical earthing details	NL00-U-64-042
Typical cable tray details (offshore)	NL00-U-64-044

5.3 Industry Reference Documents

This section defines supporting industry and regulatory documents to be used for evaluations against overall project requirements.

Table 5-3 – Industry Reference Documents

Number	Description
API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platform
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment
ANSI/AWS D1.1	Structural Steel Welding Code
ANSI/AWS D1.6	Structural Welding Code – Stainless Steel
PED/97/23EC	Manufacturing and Certifcation of Accumulators
IEC-60529	Classification of Degrees of Electrical Protection provided by Enclosures
IEC – 92	Section 9.0 “Electrical Installations in Ships”
IEC – 60079 (EN 50014)	Section 9.0 “Electrical Apparatus for Explosive Gas Atmosphere”
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements
SAE AS4059	Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluid

6 Scope of Supply

The scope of supply for the TUTU shall consist of the following:

6.1 Permanently installed TUTU Equipment

The scope for the permanently installed TUTU equipment shall consist of the following main items:

- TUTU Frame
- Cable Mouldings for High Voltage and Return Cables

6.2 Deliverable Documentation

The deliverable documentation for the TUTU shall consist of the following as a minimum:

6.2.1 Engineering Documentation Requirements

The scope of supply for engineering documentations for the TUTU shall consists of the following as a **minimum** for approval:

- TUTU Interface Data Sheet
- TUTU Assembly Drawing
- TUTU Field Termination Drawing
- TUTU Factory Acceptance Test Procedure
- Special Packing/Shipping Instructions

6.2.2 Installation, Operation and Maintenance Documentation Requirements

The scope of supply for installation, operation and maintenance documentations for the TUTU shall consist of the following as a **minimum** for approval:

- TUTU Installation Procedure

7 Topside umbilical Termination Unit Specifications

7.1 Equipment Design Requirements

Feature	Static Design Requirement	Performance Requirements	Additional Description
Operating Environment	Offshore, salt spray, IP56 protection		
Maximum (not to exceed) Dimensions	810 mm (Width) 1400 mm (Height) 150 mm (Depth)		The electrical junction boxes will be mounted on the back of this frame.
Service Access	750 mm (Front) 300 mm (Rear) 150 mm (Left) 150 mm (Right) 1000 mm (Top)		
Area Classification	Zone 1, Gas Group IIB, Temperature Class T3	N/A	
Service Life	20 years		
HP Design Pressure	690 barg	N/A	
Chemical Design Pressure	450 barg	N/A	
HP Control Fluid	Castrol Transaqua HT or HT2	N/A	
Construction	All frame plate material to be SST 316		
Moulded connections	as per manufacturer instructions for umbilical connection	A separate moulded connection for each high voltage tree supply (1A, 1B, 2A, 2B) cable and the four return cables from the Anode Umbilical => 8 connections in total	These connections need to have a mechanical protection
Hydraulic Tubing	N/A		All hydraulic tubing will be supplied by others
Hydraulic Fitting	Autoclave fittings shall be used on all lines		All hydraulic fittings will be supplied by others

Feature	Static Design Requirement	Performance Requirements	Additional Description
Tube clamps	As per DIN 3015 T1/T2	Material: PP and SST316 clamp surface need to be closed to avoid water ingress	Stauff clamps to be used.
Local Control Panel	There is no control panel. The TUTU does not contain any control facilities (gauges, valves, …)		
Nameplates	To be attached with a min. of two (2) 316 SST screws.		
Tagging (Drawing/ equipment)	Refer to General Design Basis		
Lifting/ Handling	2-point lifting pad eyes		
Marking	- TUTU Equipment Tag - Company Name - Contract/Purchase Order Number - Weight (Gross / Net) - Cameron PN - Unique Serial Number - Supplier PN	All marking shall be manufactured in such a manner to ensure legibility throughout design life.	All shipped items shall be marked with this info as a minimum.
Misc.	- If dissimilar metals are used on this unit, then isolation material shall be placed between these materials. - All written instructions, specification and warning notices or plates shall be in English and Dutch.		It shall be not intended that any element of the TUTU will come into contact with hydrocarbons (produced fluids)

7.2 Interface Requirements

7.2.1 Electrical Interface Requirements

Electrical interfaces shall be finally detailed during the detail engineering phase.

Table 7-1 – Electrical Interface Requirements

Description	Voltage	Interface to	Note
CoP Tree 1A	3 kV DC	EPCU 1A	Molded Coax-Cable
CoP Tree 1A	3 kV DC	Umbilical	Molded Coax-Cable
CoP Tree 1B	3 kV DC	EPCU 1B	Molded Coax-Cable
CoP Tree 1B	3 kV DC	Umbilical	Molded Coax-Cable
CoP Tree 2A	3 kV DC	EPCU 2A	Molded Coax-Cable
CoP Tree 2A	3 kV DC	Umbilical	Molded Coax-Cable
CoP Tree 2B	3 kV DC	EPCU 2B	Molded Coax-Cable
CoP Tree 2B	3 kV DC	Umbilical	Molded Coax-Cable
Return Line System 1A	230V DC	EPCU 1A	Molded cable
Return Line System 1A	230V DC	Anode umbilical cable	Molded cable
Return Line System 1B	230V DC	EPCU 1B	Molded cable
Return Line System 1B	230V DC	Anode umbilical cable	Molded cable
Return Line System 2A	230V DC	EPCU 2A	Molded cable
Return Line System 2A	230V DC	Anode umbilical cable	Molded cable
Return Line System 2B	230V DC	EPCU 2B	Molded cable
Return Line System 2B	230V DC	Anode umbilical cable	Molded cable

7.2.2 Hydraulic Interface Requirements

Hydraulic interfaces shall be finally detailed during the detail engineering phase.

Table 7-2 – Hydraulic Interface Requirements

Interface on TUTU	Quantity	Size	Note
MEOH	1	19,05 mm ID	Line 1
KHI A	1	12,7 mm ID	Line 2
KHI B	1	12,7 mm ID	Line 3
CI A	1	12,7 mm ID	Line 4
CI B	1	12,7 mm ID	Line 5

Interface on TUTU	Quantity	Size	Note
HP	1	6,3mm ID	Line 6
Spare	1	12,7 mm ID	Line 7

7.3 Specific Electric Cabling, Junction Boxes and Earthing Requirements

Cables shall also be connected by using an epoxy or compound filled joint if this joint is not subject to mechanical stress. These joints need to be done in accordance to manufacturer's instructions and need to be installed in that way that a suitable mechanical protection is provided.

A minimum of two earthing bosses shall be provided on the TUTU frame to allow earth bonding to the platform.

7.4 TUTU FAT Test Procedure

The TUTU shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- Visual Inspection (incl. check of hose and cable supports to verify that any loose parts can be installed on the TUTU.
- Weight control
- Final inspection

8 Hold Points

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

10NOV08	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
07MAY08	Issued for Client Comment	A. Weilandt	S. Horne	
05MAY08	Issued for Internal IDC	A. Weilandt	S. Horne	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirements Specification for ESCM**		
PAGE 1 OF 9	**Customer Document Number:**	54NL92-W-0S-514	REV. 1
	Cameron Document No.	X-076721-87-08	REV. 01

1 INTRODUCTION

This document is written to consolidate the technical requirements for the Electric Subsea Control Module (ESCM) intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

2 SCOPE OF THIS DOCUMENT

The scope of this document is to define the technical requirements for the ESCM intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

3 Document revision status / record

Table 3-1 – Amendments

Date	Rev.	Description	Author
05MAY08	A	Initial Release	A. Weilandt
07MAY08	B	Issued for client Comment	A. Weilandt
10NOV08	01	Approved for Construction	A. Weilandt

4 ABBREVIATIONS & DEFINITIONS

For abbreviations and definitions used within the Total K5F Project see related documents referenced within section 5.1 of this document.

Abbreviations and Acronyms that are specific to this document alone, for readability purposes are listed in this section:

Table 4-1 – Abbreviation/Acronym

Abbreviation/Acronym	Description
AMV	Annulus Master Valve
APTA	Annulus Pressure Transmitter A
APTB	Annulus Pressure Transmitter B
AVL	Approved Vendor List
BAIV	B Annulus Isolation Valve
DHSV	Downhole Safety Valve
DHPT	Downhole Pressure Temperature Transmitter
DOCOT	Diver operated change out tool
DVA	Dump Valve Assembly
ESCM	Electric Subsea Control Module
FAT	Factory Acceptance Test
MCS	Master Control Station
PCV	Production Choke Valve
PPD	Production Pressure Downstream
PPU	Production Pressure Upstream
PTD	Production Temperature Downstream
PTU	Production Temperature Upstream
PWV	Production Wing Valve
UPMV	Upper Production Master Valve
SCSSV	Surface Controlled Sub-Surface Safety Valve
ESCMMB	ESCM Mounting Base
SST	Stainless Steel
TBD	To be determined
XOV	Crossover Valve

5 References

5.1 Cameron Reference Documents

This section defines the supporting Cameron documents to be used for evaluations against overall project requirements.

Table 5-1 – Cameron Reference Documents

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification

Number	Description
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

5.2 Customer Reference Documents

This section defines the supporting customer documents to be used for evaluations against overall project requirements.

Table 5-2 – Customer Reference Documents

Description	Number
Total “Design basis for K5F project”	EDMP #32611
External protection of offshore and coastal structures/equipment by painting	GS EP COR 350
Subsea production control system	GS EP SPS 019
Environmental Testing of subsea electronics	GS EP SPS 022

5.3 Industry Reference Documents

This section defines supporting industry and regulatory documents to be used for evaluations against overall project requirements.

Table 5-3 – Industry Reference Documents

Number	Description
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 13628-8 (Comparable to API Spec.17H)	Design and Operation of ROV Interfaces on Subsea Production Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements

6 Scope of Supply

The scope of supply for the ESCM shall consist of the following:

6.1 Deliverable Documentation

The deliverable documentation for the ESCM shall consist of the following as a minimum:

NOTE: All documents shall show metric units of measure as a minimum.

6.1.1 Engineering Documentation Requirements for ESCM

- Assembly Drawing
- Block Diagram
- Factory Acceptance Test Procedure
- Installation, Retrievable & Maintenance Procedure

7 ESCM Design Specifications

7.1 Equipment Design Requirements

Design requirements for the ESCM are defined as follows:

Features	Design Requirements	Comments
Maximum Dimensions	760mm x 760mm (Footprint) Height: 920mm (in locked position) Height: 1023mm (in unlocked position)	With open non oil-filled cover design
Maximum Weights	1300 kg (in air) 880 kg (in water)	
Service Life	20 years	
Interface	The SCM is installed and latched onto its associated ESCMMB using a diver operated running/retrieving tool (DOCOT). Interface to the ESCM is via an Lift/Latch mandrel in accordance to API17H / ISO 13628-8 Type “A”.	
Electrical Connections	All electrical connections are made through electrical connectors in the base plate.	
Input Data	300V DC, max. 40A	From the PRCM
Output Data	300V DC, max. 40A	To the Actuators
Marking	- Equipment Tag Number - Weight in air - “Front” - Cameron PN - Unique Serial Number	

7.2 ESCM Functions

7.2.1 Actuators

No.	Function	Actuator Size	Location	Note
1	CIV 1	¾”	Tree	
2	CIV 2	¾”	Tree	
3	CIV 3	¾”	Tree	
4	BAIV	¾”	Wellhead	
5	AMV	2”	Wellhead	
6	XOV 1	2”	Tree	
7	UPMV	5”	Tree	
8	PWV	5”	Tree	
9	PCV	N/A	Tree	
10	SCSSV Open	N/A	Tree	DVA
11	SCSSV Close	N/A	Tree	DVA

7.2.2 Sensors

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

7.3 ESCM FAT Procedure

The ESCM shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- Lockdown Test
- Electrical Continuity and Insulation Resistance checks
- DHPT and Sensor communication check
- Dump Valve Assy Operation Test
- Communication and Operation of Actuators

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

10NOV08	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
07MAY08	Issued for Client Comment	A. Weilandt	S. Horne	
05MAY08	Issued for Internal IDC	A. Weilandt	S. Horne	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirements Specification for PRCM**		
PAGE 1 OF 8	**Customer Document Number:**	54NL92-W-0S-515	REV. 1
	Cameron Document No.	X-076721-87-14	REV. 01

1 INTRODUCTION

This document is written to consolidate the technical requirements for the Power Regulation and Communication Module (PRCM) intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

2 SCOPE OF THIS DOCUMENT

The scope of this document is to define the technical requirements for the PRCM intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

3 Document revision status / record

Table 3-1 – Amendments

Date	Rev.	Description	Author
05MAY08	A	Initial Release	A. Weilandt
07MAY08	B	Issued for Client Comment	A. Weilandt
10NOV08	01	Approved for Construction	A. Weilandt

4 ABBREVIATIONS & DEFINITIONS

For abbreviations and definitions used within the Total K5F Project see related documents referenced within section 5.1 of this document.

Abbreviations and Acronyms that are specific to this document alone, for readability purposes are listed in this section:

Table 4-1 – Abbreviation/Acronym

Abbreviation/Acronym	Description
AVL	Approved Vendor List
SCAP	Subsea Cathode Package Assembly
DOCOT	Diver operated change out tool
ESCM	Electric Subsea Control Module
FAT	Factory Acceptance Test
PRCMMB	PRCM Mounting Base
TBD	To be determined

5 References

5.1 Cameron Reference Documents

This section defines the supporting Cameron documents to be used for evaluations against overall project requirements.

Table 5-1 – Cameron Reference Documents

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

5.2 Customer Reference Documents

This section defines the supporting customer documents to be used for evaluations against overall project requirements.

Table 5-2 – Customer Reference Documents

Description	Number
Total “Design basis for K5F project”	EDMP #32611
External protection of offshore and coastal structures/equipment by painting	GS EP COR 350
Subsea production control system	GS EP SPS 019
Environmental Testing of subsea electronics	GS EP SPS 022

5.3 Industry Reference Documents

This section defines supporting industry and regulatory documents to be used for evaluations against overall project requirements.

Table 5-3 – Industry Reference Documents

Number	Description
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 13628-8 (Comparable to API Spec.17H)	Design and Operation of ROV Interfaces on Subsea Production Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements

6 Scope of Supply

The scope of supply for the PRCM shall consist of the following:

6.1 Deliverable Documentation

The deliverable documentation for the PRCM shall consist of the following as a minimum:

NOTE: All documents shall show metric units of measure as a minimum.

6.1.1 Engineering Documentation Requirements for PRCM

- Assembly Drawing
- Circuit Diagram
- Factory Acceptance Test Procedure
- Installation, Retrievable & Maintenance Procedure

7 PRCM Design Specifications

7.1 Equipment Design Requirements

Design requirements for the PRCM are defined as follows:

Features	Design Requirements	Comments
Maximum Dimensions	760mm x 760mm (Footprint) Height: 920mm (in locked position) Height: 1023mm (in unlocked position)	With open and non oil-filled cover design
Maximum Weights	1000 kg (in air) 765 kg (in water)	
Service Life	20 years	
Interface	The PRCM is installed and latched onto its associated PRCMMB using a diver operated running/retrieving tool (DOCOT). Interface to the PRCM is via an Lift/Latch mandrel in accordance to API17H / ISO 13628-8 Type “A”.	
Electrical Connections	All electrical connections are made through 90° angled electrical connectors at the front. 1x Coax connector for Power/Comms (4KV DC/4A) from UTA 1x 12pin connector for separate Power and Comms to the ESCM (300V DC/40A) 1x 4pin connector for Return path connection to SCPA	
Input Data	4000V DC, max. 4A	From the UTA
Output Data	300V DC, max. 40A	To the ESCM
Marking	- Equipment Tag Number - Weight in air - “Front” - Cameron PN - Unique Serial Number - “COP” for Coax connector - “PC” for connector to ESCM - “RP” for Connector to SCPA	

7.2 PRCM FAT Procedure

The PRCM shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- Lockdown Test
- Electrical Continuity and Insulation Resistance checks
- Communication and Diagnostics checks

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

09NOV07	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
26SEP07	Issued for Client Comment	A. Weilandt	S. Horne	
20SEP07	Issued for Internal IDC	A. Weilandt	S. Horne	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirements Specification for Tree and Wellhead mounted Instrumentation**		
PAGE 1 OF 10	**Customer Document Number:**	54NL92-W-0S-518	REV. 1
	Cameron Document No.	X-076721-87-11	REV. 01

1 Table of Contents

2 INTRODUCTION

This document is written to consolidate the technical requirements for the Tree and Wellhead mounted Instrumentation intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

3 SCOPE OF THIS DOCUMENT

The scope of this document is to define the technical requirements for the Tree and Wellhead mounted Instrumentation intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

4 Document revision status / record

Table 4-1 – Amendments

Date	Rev.	Description	Author
20SEP07	A	Initial Release	A. Weilandt
26SEP07	B	Incorporated comments from internal IDC and updated to "Issued for Client Comment"	A. Weilandt
09NOV07	1	Front sheet updated to "Approved for Construction"	A. Weilandt

5 ABBREVIATIONS & DEFINITIONS

For abbreviations and definitions used within the Total K5F Project see related documents referenced within section 6.1 of this document.

Abbreviations and Acronyms that are specific to this document alone, for readability purposes are listed in this section:

Table 5-1 – Abbreviation/Acronym

Abbreviation/Acronym	Description
FAT	Factory Acceptance Test
SST	Stainless Steel

6 References

6.1 Cameron Reference Documents

This section defines the supporting Cameron documents to be used for evaluations against overall project requirements.

Table 6-1 – Cameron Reference Documents

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

6.2 Customer Reference Documents

This section defines the supporting customer documents to be used for evaluations against overall project requirements.

Table 6-2 – Customer Reference Documents

Description	Number
Total “Design basis for K5F project”	EDMP #32611
K5F Project Specification for Subsea Process Control System (SPCS)	#46643
External protection of offshore and coastal structures/equipment by painting	GS EP COR 350

6.3 Industry Reference Documents

This section defines supporting industry and regulatory documents to be used for evaluations against overall project requirements.

Table 6-3 – Industry Reference Documents

Number	Description
API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platform
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment
ANSI/AWS D1.1	Structural Steel Welding Code
ANSI/AWS D1.6	Structural Welding Code – Stainless Steel
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements
SAE AS4059	Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluid

7 Scope of Supply

The scope of supply for the Tree and Wellhead mounted Instrumentation shall consist of the following:

Item	Location	Acronym	Range
Production **P**ressure Transmitter **U**pstream	Tree	PPU	0 to 400 bar
Production **T**emperature Transmitter **U**pstream	Tree	PTU	-60°C to +100°C
Production **P**ressure Transmitter **D**ownstream	Tree	PPD	0 to 400 bar
Production **T**emperature Transmitter **D**ownstream	Tree	PTD	-60°C to +100°C
Annulus **P**ressure **T**ransmitter 'A'	Wellhead	APT 'A'	0 to 500 bar
Annulus **P**ressure **T**ransmitter 'B'	Wellhead	APT 'B'	0 to 200 bar

7.1 Deliverable Documentation

The deliverable documentation for the Tree and Wellhead mounted Instrumentation shall consist of the following as a minimum:

7.1.1 Engineering Documentation Requirements

The scope of supply for engineering documentations shall consists of the following as a **minimum** for approval:

7.1.1.1 Engineering Documentation Requirements for Hydraulic Power Unit

- Assembly Drawing
- Factory Acceptance Test Procedure

7.1.2 Installation Documentation Requirements

The scope of supply for installation, operation and maintenance documentations for the Tree and Wellhead mounted Instrumentation shall consists of the following as a **minimum** for approval:

- Installation Procedure for Pressure and Temperature Sensor

7.1.3 Quality Documentation Requirements

A Manufacturing Record Book shall be provided for the Tree and Wellhead mounted Instrumentation with the following information as a **minimum** for approval:

7.1.3.1 Quality Documentation Requirements

7.1.3.1.1 QA Records

- Factory acceptance test records/charts

8 Tree and Wellhead Instrumentation Design Specifications

8.1 Equipment Design Requirements

Design requirements are defined as follows:

Feature	Static Design Requirement	Performance Requirements	Additional Description
Ambient Temperature	+4 to +9,5 °C		
Service Life	20 years		
Material Compatibility	All Materials used in the instrument shall be compatible with the following: Seawater. Hydraulic Control Fluid Methanol Xylene Scale Inhibitor Production Fluids Corrosion Inhibitors Low Dosage Hydrate Inhibitor		
Pressure Sensor:		Combined accuracy: +/- 0,02% full scale Calibrated range: +/- 1 bar (-60 to 0°C) +/- 0,14 bar (0 to 100°C) Drift: <0,05 % full scale per year	
Temperature Sensor		Combined accuracy: +/- 0,3% full scale Calibrated range: +/- 0,3°C (-60 to 121°C) +/- 1°C (-60 to 0°C) +/- 0,5°C (0 to 100°C) Drift: <0,05 % full scale per year	If required themal gel to be used for installation in cavity of tree body..
Protocol	CAN Fault tolerant Interface with CANopen Protocol		
Electrical Interface	2off receptacle connectors		
Mechanical Interface	API17D flange with BX152 gasket	Flange material Super Duplex or Duplex with Inconel inlay	
Coating	No coating required		

Feature	Static Design Requirement	Performance Requirements	Additional Description
Qualification requirements	All sensors incl connectors shall be qualified according to ISO13628-6.		
Marking	Manufacturer Name and Model Number Cameron Part Number, Revision Level, and PO Number Unique Manufacturer's Serial Number		
Shipping provisions	The probe and the sealing area need to be protected by an "Acetal" protective cap. The electrical connector need to be protected by a dummy connector		

8.2 FAT Test Procedure

The pressure and temperature sensors shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- Pressure barrier testing according to API17D
- Hyperbaric Test as 1,5 times design water depth
- Helium Leak test
- Pressure and Temperature sensor calibration
- Insulation resistance test
- Function Test (incl. test at minimum voltage supply
- Record label and revision of software
- Dimensional and visual check of sensor assemblies

9 Hold Points

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

10NOV08	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
07MAY08	Issued for Client Comment	A. Weilandt	S. Horne	
07MAY08	Issued for Internal IDC	A. Weilandt	S. Horne	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirements Specification for UTA**		
PAGE 1 OF 8	**Customer Document Number:**	54NL92-W-0S-513	REV. 1
	Cameron Document No.	X-076721-87-07	REV. 01

1 INTRODUCTION

This document is written to consolidate the technical requirements for the Umbilical Termination Assembly (UTA) intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

2 SCOPE OF THIS DOCUMENT

The scope of this document is to define the technical requirements for the UTA intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

3 Document revision status / record

Table 3-1 – Amendments

Date	Rev.	Description	Author
07MAY08	A	Initial Release	A. Weilandt
07MAY08	B	Issued for Client Comment	A. Weilandt
10NOV08	01	Approved for Construction	A. Weilandt

4 ABBREVIATIONS & DEFINITIONS

For abbreviations and definitions used within the Total K5F Project see related documents referenced within section 5.1 of this document.

Abbreviations and Acronyms that are specific to this document alone, for readability purposes are listed in this section:

Table 4-1 – Abbreviation/Acronym

Abbreviation/Acronym	Description
CI	Corrosion Inhibitor
DP	Design Pressure
FAT	Factory Acceptance Test
HP	High Pressure
HPU	Hydraulic Power Unit
KHI	Kynetic Hydrate Inhibitor
MEOH	Methanol
SCSSV	Surface Controlled Sub-Surface Safety Valve
SST	Stainless Steel
TBD	To be determined
MWP	Maximum Working Pressure

5 References

5.1 Cameron Reference Documents

This section defines the supporting Cameron documents to be used for evaluations against overall project requirements.

Table 5-1 – Cameron Reference Documents

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

5.2 Customer Reference Documents

This section defines the supporting customer documents to be used for evaluations against overall project requirements.

Table 5-2 – Customer Reference Documents

Description	Number
Total “Design basis for K5F project”	EDMP #32611
External protection of offshore and coastal structures/equipment by painting	GS EP COR 350
Design of earthing and bonding systems	GS EP ELE 031
Electrical cables	GS EP ELE 161
Subsea production control system	GS EP SPS 019
Cleaning and flushing of hydraulic systems	GS EP SPS 023
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401

5.3 Industry Reference Documents

This section defines supporting industry and regulatory documents to be used for evaluations against overall project requirements.

Table 5-3 – Industry Reference Documents

Number	Description
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment
ANSI/AWS D1.1	Structural Steel Welding Code
ANSI/AWS D1.6	Structural Welding Code – Stainless Steel
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements
SAE AS4059	Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluid

6 Scope of Supply

The scope of supply for the UTA shall consist of the following:

6.1 UTA Equipment

The scope for the UTA equipment shall consist of the following main items:

- UTA frame with internal tubing, electrical and hydraulic couplers, removable protection cover
- Sling set for surface handling (not for subsea installation)
- Pulling shackle

6.2 Deliverable Documentation

The deliverable documentation for the UTA shall consist of the following as a minimum:

6.2.1 Engineering Documentation Requirements

- Assembly Drawing
- Flow Diagram
- Circuit Diagram
- Factory Acceptance Test Procedure

6.2.2 Quality Documentation Requirements

- Factory acceptance test records
- Hydrostatic pressure test records
- Flushing test records

7 UTA Design Specifications

7.1 Equipment Design Requirements

Design requirements for the UTA are defined as follows:

Feature	Design Requirement	Comments
Maximum (not to exceed) Dimensions	Length: approx. 2100mm incl. removable cover Octagonal shape with approx. 1190mm distance across flats	
Maximum (Not to exceed) Weights	2100 kg (in Air) 1800 kg (in Water)	
Service Life	20 years	
Pressures	HP: 690 bar DP / 627 bar MWP CI/KHI/MEOH: 448 bar DP / 403 bar MWP	
Fluid	HP: Castrol Transaqua HT/HT2 CI, KHI and MEOH	
Cleanliness Requirement	Minimum SAE AS4059, Class 6	Periodic operation at SAE AS4059, Class 10 allowed.
Hydraulic Tubing	Super Duplex Tube to be used	
Inlet Connection	HP: JIC 6 male 9/16”-18UNF Spare: JIC 8 male ¾” – 16UNF KHI A: JIC 8 male ¾” – 16UNF KHI B: JIC 8 male ¾” – 16UNF CI A: JIC 8 male ¾” – 16UNF CI B: JIC 8 male ¾” – 16UNF MEOH: welded connection on ¾”ID / 0,122” WT pipe	Umbilical connection
Outlet Connection	HP: 3/8” male diver coupler Spare: 3/8” male diver coupler KHI A: 3/8” male diver coupler KHI B: 3/8” male diver coupler CI A: 3/8” male diver coupler CI B: 3/8” male diver coupler MEOH: 3/4” male diver coupler	Via couplers to the Trees
Painting	RAL1004 (yellow), except the pad eyes and handles which are RAL2004 (orange)	
Marking	Hydraulic Coupler outlets for each tree to be tagged as follows: HP, SP, MEOH, KHI, CI Electrical Coax connectors to be marked as follows: PRC1A, PRC1B, PRC2A, PRC2B	

7.2 Equipment Manufacturing Requirements

The tubing of the hydraulic circuits shall be accurately cut and bent using standard tube cutters and tube benders. No burrs shall be allowed and each section of the tubing shall be cleaned and blown dry before assembly to ensure that no contamination (dirt) could enter into the control components.

NOTE:
PTFE tape shall not be used on any part of the hydraulic system.

The skid shall, upon completion of fabrication, have all weld scale removed.

7.3 FAT Test Procedure

The UTA shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- Flushing and Fluid cleanliness check
- Hydrostatic Pressure Test
- Function Test
- Interface Check
- Cathodic Protection Continuity check
- Weighing
- Final inspection

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

10NOV08	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
31JAN08	Issued for Client Comment	A. Weilandt	S. Horne	
09NOV07	Issued for Internal IDC	A. Weilandt	S. Horne	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Hazardous Area Equipment List**		
PAGE 1 OF 7	**Customer Document Number:**	54NL92-W-09-507	REV. 1
	Cameron Document No.	X-065451-04-05	REV. 01

1 SCOPE OF THIS DOCUMENT

The scope of this document is to list the technical details of equipment used in the hazardous area.

Technical details include but shall not be limited to:

- Tag number
- Function
- Document reference
- Explosion proof class
- Certificate number
- Weight
- Manufacturer
- Model number

2 Document revision status / record

Table 2-1 – Amendments

Date	Rev.	Description	Author
11NOV07	A	Initial Release	A. Weilandt
31JAN08	B	Issued for Client Comments	A. Weilandt
10NOV08	01	Approved for Construction	A. Weilandt

3 Hazardous Area Equipment List

Item	Tag Number	Description	Doc. Reference	Ex-Class	IP-Class	Weight	Manufacturer	Model number	Ex-Certificate
1.	GX-82841	Circulation Pump	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	EEx de, IIB, T4	IP55	70 kg	Marshalsea	MPU 10714-130	SIRA 03 ATEX T348
2.	GX-82840A/B	Hydraulic HP Pump 1/2	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	EEx II 2 Gck T4	IP55	175 kg	Marshalsea	MPU 10728-432	SIRA 03 ATEX T348
3.	EEV-82840A/B	ESD Solenoid Valve	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	ATEX II 2 G EEx em II T4-T6	IP67	7 kg	Rotator	HCV 33.11.51.21-3.2	PTB 02 ATEX 2209 X (Ex 02 IEC 2211 X)

Item	Tag Number	Description	Doc. Reference	Ex-Class	IP-Class	Weight	Manufacturer	Model number	Ex-Certificate
4.	PT-82840 to PT-82844	Pressure Transmitter	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	ATEX II 2 G Eex d IIC T6	IP66	3,2 kg	Emerson	3051TG5A2B21JB4E8P1Q4Q8	KEMA 00ATEX2013X
5.	PDZH-82840A/B	Magnetic Switch on Hydraulic Filter	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	ATEX II 2 GD EEx m II T6	IP67	0,25 kg	Bernstein	MAK 1513 LEX	KEMA 03ATEX1399X
6.	LG-82840 / LG-82941	Level Gauge	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	EEx II 1/2G c T2-T6 ATEX 2106X	IP65	18 kg	KSR Kuebler	BNA-25/16/C-M 1450-V60x2-MRA-ZVSS 200-Ex	KEMA 02ATEX2106X
7.	LT-82840 / LT-82841	Level Transmitter	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	ATEX II 2G EEx d IIC T6-T4	IP65	4 kg	KSR Kuebler	AF-ADF-VK 18/TS-L2090/14	LCIE 03ATEX 6156 X

Item	Tag Number	Description	Doc. Reference	Ex-Class	IP-Class	Weight	Manufacturer	Model number	Ex-Certificate
8.	N/A	Acculampe	Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	ATEX II G EEx edm ib IIC T4	IP66	10 kg	Ceag	eLLK92018/18	PTB 96 ATEX 2144
9.	N/A	Lichtschalter	Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	ATEX II 2G EEx de II C T6	IP66	0,32 kg	Ceag	GHG 273 2000	PTB 98 ATEX 3121
10.	N/A	Alarm Horn	Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	ATEX II 2 G EEx de IIC T6	IP66	4,5 kg	Funke & Huster	dGH21	PTB 01 ATEX 1063
11.	BES82202/ BOS82802/ BA82202/ BO82202/ BE82202	Junction Boxes	Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	II 2G EEx edm IIC	IP66	0,8 – 5 kg	Stahl	8146/1xx	PTB 01 ATEX 1016
12.	N/A	Emergency Pushbutton	Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	ATEX II 2G EEx de II C T6	IP66	0,25 kg	Ceag	GHG411 8100 R0002	PTB 00 ATEX 3117
13.	N/A	Indication Lamps	Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	ATEX II 2G EEx d IIC T6 / ATEX II 2GD EEx e II	IP67	0,3 kg	Bartec	07-3353-21-x3 / 05-0003-0001-x00BN	PTB 97 ATEX 1065X / PTB 00 ATEX 3114U

Item	Tag Number	Description	Doc. Reference	Ex-Class	IP-Class	Weight	Manufacturer	Model number	Ex-Certificate
14.	N/A	Push Buttons	Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	ATEX II 2G EEx d IIC T6 / ATEX II 2GD EEx e II	IP67	0,3 kg	Bartec	07-3323-3x03 / 05-0003-00xxBN	PTB 00 ATEX 1092X / PTB 00 ATEX 3114U
15.	N/A	Illuminated Push Button	Assy 54NL92-W-03-503 Circuit Diagram 54NL92-W-06-503	ATEX II 2G EEx d IIC T6 / ATEX II 2GD EEx e II	IP67	0,3 kg	Bartec	07-3363-3xx-3 / 05-0003-006-x00BN	PTB 97 ATEX 1065X / PTB 00 ATEX 3114U

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

18APR08	Reissued as Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
24NOV07	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
09AUG07	Issued for Client Comment	A. Weilandt	T. Appel	
02JUL07	Issued for Internal IDC	A. Weilandt	T. Appel	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

	Document Title: **Topside Cable List**		
PAGE 1 OF 7	**Customer Document Number:**	54NL92-W-69-001	REV. 2
	Cameron Document No.	X-065451-04-06	REV. 02

Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
A	02JUL07	Initial Release	- - -
B	09AUG07	- CAT 7 requirement added for Ethernet patch cables between MCS and EPCU -	Comments from internal IDC
01	23NOV07	- all Total cable numbers and missing reference drawing numbers added - cables –W3/-W4 deleted and cable –W8 added	As per customer comments
02	18APR08	- cables –W8, -W329 and –W333 added - Total cable numbers and document references added	As per customer comments

Cameron Cable number	TOTAL Cable number	min. required wires	Size	min. required rating	System part connection		Reference drawings		Description
					from	to	from	To	
-W1	EP-4010	4 wires + PE	16mm²	400V AC	K6P UPS (PD-81935)	EPCU Tree 1A (NN-81204-1)	06160228-E-767-002 Sheet 003	SK-066022-31-42 / 54NL92-W-01-501	Power supply, 380-440V, 45-65Hz, 3phase, 20 kVA
-W2	EP-4011	4 wires + PE	16mm²	400V AC	K6P UPS (PD-81935)	EPCU Tree 1B (NN-81204-2)	06160228-E-767-002 Sheet 006	SK-066022-31-42 / 54NL92-W-01-501	Power supply, 380-440V, 45-65Hz, 3phase, 20 kVA
-W3	Tba by Total	4 wires + PE	10mm²	400V AC	EPCU Tree 1A (NN-81204-1)	EPCU Tree 2A (NN-81204-3)	SK-066022-31-42 / 54NL92-W-01-501	SK-066022-31-42 / 54NL92-W-01-501	Power supply, 380-440V, 45-65Hz, 3phase, 20 kVA
-W4	Tba by Total	4 wires + PE	10mm²	400V AC	EPCU Tree 1B (NN-81204-2)	EPCU Tree 2B (NN-81204-4)	SK-066022-31-42 / 54NL92-W-01-501	SK-066022-31-42 / 54NL92-W-01-501	Power supply, 380-440V, 45-65Hz, 3phase, 20 kVA
-W5	EP-4009	2 wires + PE	4mm²	230V AC	K6P UPS (PD-81935)	MCS Channel A (NN-81203)	06160228-E-767-002 Sheet 003	SK-066380-25-42 / 54NL92-W-01-002	Power Supply, 230V/50Hz, 1kVA
-W6	EP-4013	2 wires + PE	4mm²	230V AC	K6P UPS (PD-81935)	MCS Channel B (NN-81203)	06160228-E-767-002 Sheet 006	SK-066380-25-42 / 54NL92-W-01-002	Power Supply, 230V/50Hz, 1kVA
-W7	EP-8028	2 wires + PE	2,5mm²	230V AC	K6C UPS (PD-82945)	HPU PLC Cabinet (NN-82203)	Tba by Total	SK-066022-33-42 / 54NL92-W-71-501	Power Supply, 230V/50Hz, 1kVA
-W8	EP-4014	2 wires + PE	2,5mm²	230V AC	K6P UPS (PD-81935)	MCS (NN-81203)	06160228-E-767-002	SK-066380-25-42 / 54NL92-W-01-002	MCS Utility Supply
-W200	NP-8015	3 wires + PE	4 mm²	380V AC	K6C MCC (PD-82940)	HPU (NN-82202)	NL82-U-61-040 Sheet 114	SK-066011-32-42 / 54NL92-W-31-501	Power Supply HP Pump 1, 380V AC/50Hz, 7,5kW
-W201	NP-8018	3 wires + PE	4 mm²	380V AC	K6C MCC (PD-82941)	HPU (NN-82202)	NL82-U-61-041 Sheet 48	SK-066011-32-42 / 54NL92-W-31-501	Power Supply HP Pump 2, 380V AC/50Hz, 7,5kW
-W202	NP-8021	3 wires + PE	2,5 mm²	380V AC	K6C MCC (PD-82940)	HPU (NN-82202)	NL82-U-61-040 Sheet 116	SK-066011-32-42 / 54NL92-W-31-501	Power Supply Circulation Pump, 380V AC/50Hz, 1,5kW
-W203	NC-8015	4 wires	1,5 mm²	24V DC	K6C MCC (PD-82940)	HPU (NN-82202)	NL82-U-61-040 Sheet 114	NL82-U-61-040 Sheet 113	Maintenance Switch HP Pump 1
-W204	NC-8018	4 wires	1,5 mm²	24V DC	K6C MCC (PD-82941)	HPU (NN-82202)	NL82-U-61-041 Sheet 48	NL82-U-61-040 Sheet 047	Maintenance Switch HP Pump 2

Cameron Cable number	TOTAL Cable number	min. required wires	Size	min. required rating	System part connection		Reference drawings		Description
					from	to	from	To	
-W205	NC-8021	4 wires	1,5 mm²	24V DC	K6C MCC (PD-82940)	HPU (NN-82202)	NL82-U-61-040 Sheet 116	NL82-U-61-040 Sheet 115	Maintenance Switch Circ. Pump
-W215	NP-8025	2 wires + PE	4mm²	230V AC	K6C Switchboard (PD-82942)	HPU (NN-82202)	NL82-U-61-042 Sheet 034	SK-066011-32-42 / 54NL92-W-31-501	Power Supply internal Lighting 230V/50Hz
-W300	Q-81002-1	1x Twisted Screened Pairs (TSP)	1,5mm²	Signal	MCS (NN-81203)	EPCU Tree 1A (NN-81204-1)	SK-066380-25-42 / 54NL92-W-01-002	SK-066022-31-42 / 54NL92-W-01-501	Profibus to EPCU Power Supply
-W301	Q-81002-2	1x TSP	1,5mm²	Signal	MCS (NN-81203)	EPCU Tree 1B (NN-81204-2)	SK-066380-25-42 / 54NL92-W-01-002	SK-066022-31-42 / 54NL92-W-01-501	Profibus to EPCU Power Supply
-W302	Q-81002-3	1x TSP	1,5mm²	Signal	MCS (NN-81203)	EPCU Tree 2A (NN-81204-3)	SK-066380-25-42 / 54NL92-W-01-002	SK-066022-31-42 / 54NL92-W-01-501	Profibus to EPCU Power Supply
-W303	Q-81002-4	1x TSP	1,5mm²	Signal	MCS (NN-81203)	EPCU Tree 2B (NN-81204-4)	SK-066380-25-42 / 54NL92-W-01-002	SK-066022-31-42 / 54NL92-W-01-501	Profibus to EPCU Power Supply
-W304	Q-82001-1	Fibre optics	62,5/125 µm	Signal	MCS (NN-81203)	HPU PLC Cabinet (NN-82203)	SK-066380-25-42 / 54NL92-W-01-002	SK-066022-33-42 / 54NL92-W-71-501	Communication Channel A
-W305	Q-82001-2	Fibre optics	62,5/125 µm	Signal	MCS (NN-81203)	HPU PLC Cabinet (NN-82203)	SK-066380-25-42 / 54NL92-W-01-002	SK-066022-33-42 / 54NL92-W-71-501	Communication Channel B
-W306	NA-82202	16x TSP	0,75mm²	24V DC	HPU (NN-82202) / Junction Box BA-82202	HPU PLC Cabinet (NN-82203)	SK-066011-32-42 / 54NL92-W-31-501	SK-066022-33-42 / 54NL92-W-71-501	Digital Inputs at the HPU PLC
-W307	NO-82202	24x TSP	0,75mm²	24V DC	HPU (NN-82202) / Junction Box BO-82202	HPU PLC Cabinet (NN-82203)	SK-066011-32-42 / 54NL92-W-31-501	SK-066022-33-42 / 54NL92-W-71-501	Digital Outputs at the HPU PLC
-W308	NE-82202	4x TSP	0,75mm²	24V DC	HPU (NN-82202) / Junction Box BE-82202	HPU PLC Cabinet (NN-82203)	SK-066011-32-42 / 54NL92-W-31-501	SK-066022-33-42 / 54NL92-W-71-501	Analogue Inputs at the HPU PLC
-W309	NOS-82202	2x TSP	2,5mm²	24V DC	K6C SSS (ND-8202)	HPU (NN-82202) / Junction Box BOS-82202	SK-066011-32-42 / 54NL92-W-31-501	Tba by Total	ESD Solenoid Valves EEV-82840A / EEV-82840B

Cameron Cable number	TOTAL Cable number	min. required wires	Size	min. required rating	System part connection		Reference drawings		Description
					from	to	from	To	
-W310	NAS-81203-1	9x TSP	0,75mm²	24V DC	MCS (NN-81203)	K6P SSS (NN-8101.3)	SK-066380-25-42 / 54NL92-W-01-002	Tba by Total	Status Signals Tree 1 (Digital outputs at MCS)
-W311	NOS-81203-1	4x TSP	0,75mm²	24V DC	K6P SSS (ND-8103)	MCS (NN-81203)	Tba by Total	SK-066380-25-42 / 54NL92-W-01-002	Open/Close Commands Tree 1 (Digital Inputs at the MCS)
-W312	NAS-81203-2	9x TSP	0,75mm²	24V DC	MCS (NN-81203)	K6P SSS (NN-8101.3)	SK-066380-25-42 / 54NL92-W-01-002	Tba by Total	Status Signals Tree 2 (Digital outputs at MCS)
-W313	NOS-81203-2	4x TSP	0,75mm²	24V DC	K6P SSS (ND-8103)	MCS (NN-81203)	Tba by Total	SK-066380-25-42 / 54NL92-W-01-002	Open/Close Commands Tree 2 (Digital Inputs at the MCS)
-W314	NAS-81203-3	9x TSP	0,75mm²	24V DC	MCS (NN-81203)	K6P SSS (NN-8101.3)	SK-066380-25-42 / 54NL92-W-01-002	Tba by Total	Status Signals Tree 3 (Digital outputs at MCS)
-W315	NOS-81203-3	4x TSP	0,75mm²	24V DC	K6P SSS (ND-8103)	MCS (NN-81203)	Tba by Total	SK-066380-25-42 / 54NL92-W-01-002	Open/Close Commands Tree 3 (Digital Inputs at the MCS)
-W316	NAS-81203-4	9x TSP	0,75mm²	24V DC	MCS (NN-81203)	K6P SSS (NN-8101.3)	SK-066380-25-42 / 54NL92-W-01-002	Tba by Total	Status Signals Tree 4 (Digital outputs at MCS)
-W317	NOS-81203-4	4x TSP	0,75mm²	24V DC	K6P SSS (ND-8103)	MCS (NN-81203)	Tba by Total	SK-066380-25-42 / 54NL92-W-01-002	Open/Close Commands Tree 4 (Digital Inputs at the MCS)
-W318	NAS-81203	1x TSP	0,75mm²	24V DC	MCS (NN-81203)	K6P SSS (NN-8101.3)	SK-066380-25-42 / 54NL92-W-01-002	Tba by Total	Status of PCS/MCS Key switch (Digital output at MCS)
-W319	NOS-81203	2x TSP	0,75mm²	24V DC	K6P SSS (ND-8103)	MCS (NN-81203)	Tba by Total	SK-066380-25-42 / 54NL92-W-01-002	Status TBO/ESD2 (Digital Input at MCS)
-W320	NO-9408	6x TSP	0,75mm²	24 VDC	HPU PLC Cabinet (NN-82203)	K6C MCC (PD-82940)	SK-066022-33-42 / 54NL92-W-71-501	Tba by Total	Available/Running signals for HP Pumps 1&2 and Circulation Pump (Digital Inputs at HPU PLC)
-W321	NO-9418	3x TSP	0,75mm²	24 VDC	HPU PLC Cabinet (NN-82203)	K6C MCC (PD-82941)	SK-066022-33-42 / 54NL92-W-71-501	Tba by Total	Start Request signals for HP Pumps 1&2 and Circulation Pump (Digital Outputs at the HPU PLC)
-W322	Q-81003-1	Cat 7 Ethernet Patch Cable	N/A	N/A	MCS (NN-81203)	K6P Production Network Switch (NN-8101)	SK-066380-25-42 / 54NL92-W-01-002	Tba by Total	OPC Protocol Channel A

Cameron Cable number	TOTAL Cable number	min. required wires	Size	min. required rating	System part connection		Reference drawings		Description
					from	to	from	To	
-W323	Q-81003-2	Cat 7 Ethernet Patch Cable	N/A	N/A	MCS (NN-81203)	K6P Production Network Switch (NN-8101)	SK-066380-25-42 / 54NL92-W-01-002	Tba by Total	OPC Protocol Channel B
-W324	NES-81202	4x TSP	0,75mm²	24V DC	HPU (NN-82202) / Junction Box BES-82202	K6C SSS (ND-8201)	SK-066011-32-42 / 54NL92-W-31-501	Tba by Total	Analogue signals from Header Pressure and Pump Pressure Transmitters
-W325	Q-81001-1	Cat 7 Ethernet Patch Cable	N/A	N/A	MCS (NN-81203)	EPCU Tree 1A (NN-81204-1)	SK-066380-25-42 / 54NL92-W-01-002	SK-066022-31-42 / 54NL92-W-01-501	Ethernet connection to surface modem Tree 1A
-W326	Q-81001-2	Cat 7 Ethernet Patch Cable	N/A	N/A	MCS (NN-81203)	EPCU Tree 1B (NN-81204-2)	SK-066380-25-42 / 54NL92-W-01-002	SK-066022-31-42 / 54NL92-W-01-501	Ethernet connection to surface modem Tree 1B
-W327	Q-81001-3	Cat 7 Ethernet Patch Cable	N/A	N/A	MCS (NN-81203)	EPCU Tree 2A (NN-81204-3)	SK-066380-25-42 / 54NL92-W-01-002	SK-066022-31-42 / 54NL92-W-01-501	Ethernet connection to surface modem Tree 2A
-W328	Q-81001-4	Cat 7 Ethernet Patch Cable	N/A	N/A	MCS (NN-81203)	EPCU Tree 2B (NN-81204-4)	SK-066380-25-42 / 54NL92-W-01-002	SK-066022-31-42 / 54NL92-W-01-501	Ethernet connection to surface modem Tree 2B
-W329	Tba by Total	1x TSP	0,75mm²	24V DC	MCS (NN-81203)	K6P SSS (ND-8103)	SK-066380-25-42 / 54NL92-W-01-002	Tba by Total	Shutdown Signal EPCU Tree 1
-W330	Tba by Total	1x TSP	0,75mm²	24V DC	MCS (NN-81203)	K6P SSS (ND-8103)	SK-066380-25-42 / 54NL92-W-01-002	Tba by Total	Shutdown Signal EPCU Tree 2
-W331	Tba by Total	1x TSP	0,75mm²	24V DC	MCS (NN-81203)	K6P SSS (ND-8103)	SK-066380-25-42 / 54NL92-W-01-002	Tba by Total	Shutdown Signal EPCU Tree 3
-W332	Tba by Total	1x TSP	0,75mm²	24V DC	MCS (NN-81203)	K6P SSS (ND-8103)	SK-066380-25-42 / 54NL92-W-01-002	Tba by Total	Shutdown Signal EPCU Tree 4
-W333	Tba by Total	4x TSP	0,75mm²	24V DC	MCS (NN-81203)	K6P SSS (ND-8103)	SK-066380-25-42 / 54NL92-W-01-002	Tba by Total	DHSV Open Status Trees 1-4
-W334	NAS-HE-840	1x TSP	0,75mm²	24V DC	K6C SSS (ND-8201)	HPU (NN-82202)	Tba by Total	SK-066011-32-42 / 54NL92-W-31-501	HPU Emergency Pushbutton

Cameron Cable number	TOTAL Cable number	min. required wires	Size	min. required rating	System part connection		Reference drawings		Description
					from	to	from	To	
-W400	NP-4001	Coax cable	16mm²	5 kV DC	EPCU Tree 1A (NN-81204-1)	TUTU (NN-82201)	SK-066022-31-42 / 54NL92-W-01-501	SK-066001-88-04 / 54NL92-W-03-530	High Voltage DC Supply Tree 1A
-W401	NP-4002	Coax cable	16mm²	5 kV DC	EPCU Tree 1B (NN-81204-2)	TUTU (NN-82201)	SK-066022-31-42 / 54NL92-W-01-501	SK-066001-88-04 / 54NL92-W-03-530	High Voltage DC Supply Tree 1B
-W402	NP-4003	Coax cable	16mm²	5 kV DC	EPCU Tree 2A (NN-81204-3)	TUTU (NN-82201)	SK-066022-31-42 / 54NL92-W-01-501	SK-066001-88-04 / 54NL92-W-03-530	High Voltage DC Supply Tree 2A
-W403	NP-4004	Coax cable	16mm²	5 kV DC	EPCU Tree 2B (NN-81204-4)	TUTU (NN-82201)	SK-066022-31-42 / 54NL92-W-01-501	SK-066001-88-04 / 54NL92-W-03-530	High Voltage DC Supply Tree 2B
-W410	NP-4005	1 wire (armoured)	2,5mm²	230V DC	EPCU Tree 1A (NN-81204-1)	TUTU (NN-82201)	SK-066022-31-42 / 54NL92-W-01-501	SK-066001-88-04 / 54NL92-W-03-530	Return Path Tree 1A
-W411	NP-4006	1 wire (armoured)	2,5mm²	230V DC	EPCU Tree 1B (NN-81204-2)	TUTU (NN-82201)	SK-066022-31-42 / 54NL92-W-01-501	SK-066001-88-04 / 54NL92-W-03-530	Return Path Tree 1B
-W412	NP-4007	1 wire (armoured)	2,5mm²	230V DC	EPCU Tree 2A (NN-81204-3)	TUTU (NN-82201)	SK-066022-31-42 / 54NL92-W-01-501	SK-066001-88-04 / 54NL92-W-03-530	Return Path Tree 2A
-W413	NP-4008	1 wire (armoured)	2,5mm²	230V DC	EPCU Tree 2B (NN-81204-4)	TUTU (NN-82201)	SK-066022-31-42 / 54NL92-W-01-501	SK-066001-88-04 / 54NL92-W-03-530	Return Path Tree 2B

Notes:

Refer to System Interconnection Diagram SK-066001-88-04/ 54NL92-W-03-530 for topside interconnection details

Interconnection cables for equipment located in hazardous area shall be suitable for the hazardous area.

Intrinsically safe cables are not needed.

Flameproof and/or armoured cables shall be selected by Topsides contractor / Customer according to applicable topside cable requirements

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

16APR08	Reissued for Information	A. Weilandt	S. Horne	A. Weilandt
25SEP07	Issued for Information	A. Weilandt	S. Horne	
15SEP07	Issued for Internal IDC	A. Weilandt	S. Horne	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Instrument List incl. Alarm and Trip Setpoints**		
PAGE 1 OF 7	**Customer Document Number:**	54NL92-W-79-501	REV. 2
	Cameron Document No.	X-065451-04-44	REV. 01

1 SCOPE OF THIS DOCUMENT

The scope of this document is to list the technical details of Instruments used on the K5F Production Controls System.

Technical details include but shall not be limited to:

- Tag number
- Function
- Document reference
- Explosion proof class
- IP Class
- Weight
- Manufacturer
- Model number
- Alarm / Trip / Pump / Default Settings

Note: The Alarm, Trip, Pump and Default Settings given in this document are default values set in the software prior to shipment of the system. Any changes later on will not be covered by this document.

2 Document revision status / record

Table 2-1 – Amendments

Date	Rev.	Description	Author
15SEP07	A	Initial Release	A. Weilandt
25SEP07	B	Issued for Information	A. Weilandt
16APR08	01	Reissued for Information	A. Weilandt

3 Instrument List

Item	Tag Number	Description	Doc. Reference	Ex-Class	IP-Class	Weight	Range	Alarm /Pump Settings				Trip Settings				Default Value	Manufacturer	
								LOLO	LO/ START	HI/ STOP	HIHI	LOLO	LO	HI	HIHI			Model Number
1.	GX-82841	Circulation Pump	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	Eex de, IIB, T4	IP55	70 Kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Marshalsea	MPU 10714-130
2.	GX-82840A	Hydraulic HP Pump 1	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	Ex II 2 Gck T4	IP55	175 Kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Marshalsea	MPU 10728-432
3.	GX-82840B	Hydraulic HP Pump 2	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	Ex II 2 Gck T4	IP55	175 Kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Marshalsea	MPU 10728-432
4.	PG-82840	Pressure Gauge HP Pump Pressure	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	N/A	IP66	0,9 Kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Labom	BA-4250-B3070.46-U3-V3
5.	PG-82842	Pressure Gauge HP Supply Pressure	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	N/A	IP66	0,9 Kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Labom	BA-4250-B3070.46-U3-V3
6.	PG-82843	Pressure Gauge HP Header Pressure	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	N/A	IP66	0,9 Kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Labom	BA-4250-B3070.46-U3-V3
7.	PG-82845	Pressure Gauge Circulation Loop Pressure	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	N/A	IP66	0,9 Kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Labom	BA4240-A3059.5-U3

Item	Tag Number	Description	Doc. Reference	Ex-Class	IP-Class	Weight	Range	Alarm /Pump Settings				Trip Settings				Default Value	Manufacturer	Model Number
								LOLO	LO/ START	HI/ STOP	HIHI	LOLO	LO	HI	HIHI			
8.	PG-82844	Pressure Gauge ESD Pilot Pressure	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	N/A	IP66	0,9 Kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Labom	BA-4540-A3066.15-U33-V3-W4020-W1020
9.	EEV-82840A	ESD Solenoid Valve	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	Ex II 2 G Eex em II T4-T6	IP67	7 Kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Rotator	HCV 33.11.51.21-3.2
10.	EEV-82840B	ESD Solenoid Valve	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	Ex II 2 G Eex em II T4-T6	IP67	7 Kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Rotator	HCV 33.11.51.21-3.2
11.	PT-82840	Pressure Transmitter HP Pump Pressure to MCS	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	EEx II 2 G Eex d IIC T6	IP66	3,2 Kg	0 – 690 bar	400	420	630	635	400	N/A	N/A	N/A	N/A	Emerson	3051TG5A2B21JB4 E8P1Q4Q8
12.	PT-82841	Pressure Transmitter HP Pump Pressure to SSS System	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	EEx II 2 G Eex d IIC T6	IP66	3,2 Kg	0 – 690 bar	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Emerson	3051TG5A2B21JB4 E8P1Q4Q8
13.	PT-82843	Pressure Transmitter HP Header Pressure to MCS	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	EEx II 2 G Eex d IIC T6	IP66	3,2 Kg	0 – 690 bar	400	420	630	635	N/A	N/A	N/A	N/A	N/A	Emerson	3051TG5A2B21JB4 E8P1Q4Q8
14.	PT-82844	Pressure Transmitter HP Header Pressure to SSS System	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	EEx II 2 G Eex d IIC T6	IP66	3,2 Kg	0 – 690 bar	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Emerson	3051TG5A2B21JB4 E8P1Q4Q8
15.	N/A	Pump Control Settings (Duty Pump)	N/A	N/A	N/A	N/A	0 – 627 bar	N/A	580	627	N/A	400	N/A	N/A	N/A	N/A	N/A	N/A
16.	N/A	Pump Control Settings (Standby Pump)	N/A	N/A	N/A	N/A	0 – 627 bar	N/A	560	627	N/A	400	N/A	N/A	N/A	N/A	N/A	N/A

Item	Tag Number	Description	Doc. Reference	Ex-Class	IP-Class	Weight	Range	Alarm /Pump Settings				Trip Settings				Default Value	Manufacturer	Model Number
								LOLO	LO/ START	HI/ STOP	HIHI	LOLO	LO	HI	HIHI			
17.	PDZH-82840A	Magnetic Switch on Hydraulic Filter	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	EEx II 2 GD EEx m II T6 ATEX 1399X	IP67	0,25 Kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Bernstein	MAK 1513 LEX
18.	PDZH-82840B	Magnetic Switch on Hydraulic Filter	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	EEx II 2 GD EEx m II T6 ATEX 1399X	IP67	0,25 Kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Bernstein	MAK 1513 LEX
19.	LG-82840	Level Gauge (Supply Reservoir)	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	EEx II 1/2G c T2-T6 ATEX 2106X	IP65	18 kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	KSR Kübler	BNA-25/16/C-M 1450-V60x2-MRA-ZVSS 200-Ex
20.	LG-82841	Level Gauge (Return Reservoir)	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	EEx II 1/2G c T2-T6 ATEX 2106X	IP65	18 kg	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	KSR Kübler	BNA-25/16/C-M 1450-V60x2-MRA-ZVSS 200-Ex
21.	LT-82840	Level Transmitter (Supply Reservoir)	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	Ex II 2G EEx d IIc T6-T4 ATEX 6156X	IP65	4 kg	0 – 500 l	25	50	475	490	N/A	N/A	N/A	N/A	N/A	KSR Kübler	AF-ADF-VK 18/TS-L2090/14
22.	LT-82841	Level Transmitter (Return Reservoir)	Flow Diagram 54NL92-W-31-501 Assy 54NL92-W-03-503	Ex II 2G EEx d IIc T6-T4 ATEX 6156X	IP65	4 kg	0 – 550 l	28	55	500	530	N/A	N/A	N/A	N/A	N/A	KSR Kübler	AF-ADF-VK 18/TS-L2090/14
23.	PPU-92101.1/.2/.3/.4	Production Pressure Transmitter Upstream	Assy 54NL92-W-03-511	N/A	N/A	31 kg	0 – 690 bar	10	15	350	360	N/A	N/A	N/A	N/A	N/A	Corrocean	22641-20
24.	PPD-92111.1/.2/.3/.4	Production Pressure Transmitter Downstream	Assy 54NL92-W-03-511	N/A	N/A	31 kg	0 – 690 bar	10	15	350	360	N/A	N/A	N/A	N/A	N/A	Corrocean	22642-22
25.	APTA-92103.1/.2/.3/.4	Annulus Pressure Transmitter A	Assy 54NL92-W-03-511	N/A	N/A	31 kg	0 – 690 bar	10	15	350	360	N/A	N/A	N/A	N/A	N/A	Corrocean	22642-24
26.	APTB-92105.1/.2/.3/.4	Annulus Pressure Transmitter B	Assy 54NL92-W-03-511	N/A	N/A	31 kg	0 – 690 bar	10	15	180	190	N/A	N/A	N/A	N/A	N/A	Corrocean	22642-25

Item	Tag Number	Description	Doc. Reference	Ex-Class	IP-Class	Weight	Range	Alarm /Pump Settings				Trip Settings				Default Value	Manufacturer	Model Number
								LOLO	LO/ START	HI/ STOP	HIHI	LOLO	LO	HI	HIHI			
27.	PTU-92104.1/.2/.3/.4	Production Temperature Transmitter Upstream	Assy 54NL92-W-03-331	N/A	N/A	31 kg	-60°C … 100°C	2	4	60	70	N/A	N/A	N/A	N/A	N/A	Corrocean	22641-21
28.	PTD-92101.1/.2/.3/.4	Production Temperature Transmitter Downstream	Assy 54NL92-W-03-332	N/A	N/A	31 kg	-60°C … 100°C	2	4	60	70	N/A	N/A	N/A	N/A	N/A	Corrocean	22264-23
29.	DHPT92104.1/.2/.3/.4	Downhole Pressure Transmitter	N/A	N/A	N/A	N/A	0 – 690 bar	10	15	350	360	N/A	N/A	N/A	N/A	N/A	Baker Hughes	N/A
30.	DHTT92103.1/.2/.3/.4	Downhole Temperature Transmitter	N/A	N/A	N/A	N/A	0 – 150 °C	10	20	135	140	N/A	N/A	N/A	N/A	N/A	Baker Hughes	N/A
31.	N/A	HV Current @EPCU	N/A	N/A	N/A	N/A	0 – 4000 mA	N/A	N/A	3500	3700	N/A	N/A	N/A	N/A	N/A	N/A	N/A
32.	N/A	HV Voltage @ EPCU	N/A	N/A	N/A	N/A	0 – 4000 V	N/A	2900	3400	N/A	N/A	2900	3400	N/A	N/A	N/A	N/A
33.	N/A	Anode Voltage	N/A	N/A	N/A	N/A	0 – 22 V	N/A	N/A	8	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A
34.	N/A	Anode Current	N/A	N/A	N/A	N/A	0 – 4500 mA	N/A	N/A	3600	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
35.	N/A	Sensing Current	N/A	N/A	N/A	N/A	0 – 4500 mA	N/A	N/A	1000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
36.	N/A	Shield Current	N/A	N/A	N/A	N/A	0 – 4500 mA	N/A	N/A	1000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
37.	N/A	Cathode Voltage	N/A	N/A	N/A	N/A	0 – 22 V	N/A	N/A	8	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A
38.	N/A	PRCM Ring Max. Temperature	N/A	N/A	N/A	N/A	0 – 100 °C	N/A	N/A	50	55	N/A	N/A	N/A	55	N/A	N/A	N/A
39.	N/A	HV Preset Current Settings @EPCU	N/A	N/A	N/A	N/A	0 – 1000 mA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	500 mA	N/A	N/A
40.	N/A	HV Preset Voltage Settings @EPCU	N/A	N/A	N/A	N/A	0 – 4000 V	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3200 V	N/A	N/A
41.	N/A	Choke Drive Preset Setting @EPCU	N/A	N/A	N/A	N/A	0 – 500 mA	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	300 mA	N/A	N/A
42.	N/A	MCU Temperature	N/A	N/A	N/A	N/A	0 – 100 °C	N/A	N/A	60	70	N/A	N/A	N/A	N/A	N/A	N/A	N/A
43.	N/A	MCU Humidity	N/A	N/A	N/A	N/A	0 – 100 %rH	N/A	N/A	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
44.	N/A	Link Card Temperature	N/A	N/A	N/A	N/A	0 – 100 °C	N/A	N/A	60	70	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Item	Tag Number	Description	Doc. Reference	Ex-Class	IP-Class	Weight	Range	Alarm /Pump Settings				Trip Settings				Default Value	Manufacturer	
								LOLO	LO/ START	HI/ STOP	HIHI	LOLO	LO	HI	HIHI			Model Number
45.	N/A	Link Card Humidity	N/A	N/A	N/A	N/A	0 – 100 %rH	N/A	N/A	60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
46.	N/A	ESCM Actuator Fuse Current Setting	N/A	N/A	N/A	N/A	0 – 5 A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2 A	N/A	N/A
47.	N/A	ESCM Choke Fuse Current Setting	N/A	N/A	N/A	N/A	0 – 5 A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3,5 A	N/A	N/A
48.	XEV-92103.1/.2/.3/.4	DVA Pulse Time to Open	N/A	N/A	N/A	N/A	0 – 60 s	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3 s	N/A	N/A
49.	XEV-92103.1/.2/.3/.4	DVA Pulse Time to Close	N/A	N/A	N/A	N/A	0 – 60 s	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3 s	N/A	N/A
50.	DHSV-92103.1/.2/.3/.4	SCSSV Open time	N/A	N/A	N/A	N/A	0 – 60 s	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10 s	N/A	N/A
51.	DHSV-92103.1/.2/.3/.4	SCSSV Close time	N/A	N/A	N/A	N/A	0 – 60 s	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10 s	N/A	N/A
52.	N/A	Differential Pressure Well 1 – Well 2	N/A	N/A	N/A	N/A	-100 to +100 bar	N/A	-10	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
53.	N/A	Differential Pressure DHPTT - PPU	N/A	N/A	N/A	N/A	-100 to +100 bar	N/A	-10	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
54.	N/A	Differential Temperature DHPTT - PTU	N/A	N/A	N/A	N/A	-100 to +100 °C	N/A	-10	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
55.	N/A	Differential Pressure PPU - PPD	N/A	N/A	N/A	N/A	-100 to +100 bar	N/A	-10	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
56.	N/A	Differential Temperature PTU - PTD	N/A	N/A	N/A	N/A	-100 to +100 °C	N/A	-10	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
57.																		

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

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1 Summary

The systems as calculated conforms to client specifications as well as to ISO 13628-6 requirements.

Accumulators

N/A	Min. Required			Actual		
	Qty	Size [l]	Total [l]	Qty	Size [l]	Total [l]
Surface Hydraulic LP Accumulators	0,0	0	**0,0**	0	0	**0**
Surface Hydraulic HP Accumulators	0,5	35,2	**17,7**	2	35,2	**70,4**
Subsea Hydraulic LP Accumulators				0	0	**0**
Subsea Hydraulic HP Accumulators				0	0	**0**

Comment: The quantity of accumulators which is required as per client specification and as per ISO 13628-6 specification is more than satisfied with the actual quantity provided.
The size and quantity of subsea accumulators has to be verified in the dynamic response analysis.

Pumps

Pumps	Min. Required	Actual		
	Total [l/min]	Qty	Flow [l/min]	C
LP Pumps	**0,0**	0	0	**0**
HP Pumps	**3,6**	2	3,5	**7**

Comment: The flow rate of the HP pumps which is required as per client specification and as per ISO 13628-6 specification is more than satisfied with the actual flow rate provided.
The final flow rate to satisfy "umbilical charge" requirements has to be verified in the dynamic response analysis.
During normal operation mode only one of both pumps need to run.

Reservoirs

Reservoirs	Min. Required	Actual
	Total [l]	Total [l]
Supply Reservoir	**452**	**500**
Return Reservoir	**512**	**550**

Comment: The volume of the supply and return reservoirs which are required as per client specification and as per ISO 13628-6 specification are more than satisfied with the actual volumes provided.

2 Introduction

This document outlines the accumulator, reservoir & pump calculation for a subsea production control system.
The design basis complies with the following Standards:
- ISO 13628-6 First Edition 2000-04-01,Subsea Production Control Systems
- API 17F First Edition January 2003, Subsea Production Control Systems

The units of the calculation are based on international SI (System International) units. These are:
- Mpa (Mega Pascal) for pressure
- °C (Degree Celsius) for temperature
- l (litre) for volume
- m (Meter) for length

The design also complies with the client specification:
- Client Specification (Name, number and rev)

2.1 General Techncial Data

System Type	Electro / Hydraulic (for SCSSV only)	
Seawater Temperature	+4 DEG C min, + 30 DEG C max	
Control Fluid	Castrol Transaqua HT	
Maximum Operating Pressure, LP		Mpa
Maximum Operating Pressure, HP	62,7	Mpa
Minimum Operating Pressure, LP		Mpa
Minimum Operating Pressure, HP	42,0	Mpa
Pump start pressure, LP		Mpa
Pump start pressure, HP	46,0	Mpa
Water depth (average)	40	m

2.2 Fluid Volume in Accumulators

The usable fluid volume calculation for accumulators will be carried out in accordance to the formula from Boyle / Mariotte for polytropic change. The polytropic exponent n is dependent on the pressure level and the speed of the fluid exchange process. General the following exponents are used:
Cycle time < 1 minute: adiabatic, n = 1.4
1 minute < cycle time < 3 minutes: polytropic, 1< n <1.4
Cycle time > 3 minutes: isothermic, n = 1

Formula $P0*V0^n = P1*V1^n = P2*V2^n$

P0 = Precharge pressure
P1 = Minimum working pressure
P2 = Maximum working pressure (accumulator)
V0 = Total gas volume
V1 = Gas Volume at minimum working pressure
V2 = Gas Volume at maximum working pressure (accumulator)
n = polytropic exponent
dV = Usable fluid volume (V1-V2)

Formula $dV = V0*\{(P0/P1)^{1/n} - (P0/P2)^{1/n}\}$

NOTE: For the subsea accumulators the hydrostatic pressure has to be added to P1 and P2. See calculation for subsea accumulators.

3 Umbilicals, Infield-Umbilicals and Hydraulic Flying Leads

3.1 Umbilical System #1

Umbilical & Infield Umbilical	Qty	Length [m]	Total Lenght [m]	Line size HP [mm]	Line size LP [mm]	Notes
Main Umbilical	1	18000	18000	6,35		
Flying lead UTA/Tree	1	50	50	6,35		to Tree 1
Flying lead UTA/Tree	1	50	50	6,35		to Tree 2
Flying lead UTA/Tree	1	50	50	6,35		to Tree 3
Infield umbilical	1	6000	6000	6,35		to Tree 4
In-field 5	1		0			
In-field 6	1		0			

Hydraulic Flying Lead	Qty	Length [m]	Total Lenght [m]	Line size HP [mm]	Line size LP [mm]	Notes
	0		0			
	0		0			
	0		0			
	0		0			
	0		0			
	0		0			
	0		0			
	0		0			
	0		0			
	0		0			
	0		0			

Summary for HP and LP lines (the sum for LP1 & LP2 and HP1 & HP2 is calculated)

LP and HP Lines in Umbilicals	Qty	Length [m]	Total Lenght [m]	Line size HP [mm]	Line size LP [mm]	Notes
	0	0	0		0	
	0	0	0		0	
HP 1&2, 1st line size	1	24150	24150	6,35		
	0	0	0	6,35		

LP and HP Lines in HFL's	Qty	Length [m]	Total Lenght [m]	Line size HP [mm]	Line size LP [mm]	Notes
			0		0	
			0		0	
			0	0		
			0	0		

3.2 Umbilical System #2- IF APPLICABLE

Umbilical & Infield Umbilical	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
In-field 1	0		0			
In-field 2	0		0			
In-field 3	0		0			
In-field 4	0		0			
In-field 5	0		0			
In-field 6	0		0			

Hydraulic Flying Lead	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
UTA to SDU	0		0			
UTA to Tree	0		0			
SDU to Tree	0		0			
SDU to Manifold	0		0			
Other 1	0		0			
Other 2	0		0			
Other 3	0		0			
Other 4	0		0			
Other 5	0		0			
Other 6	0		0			
Other 7	0		0			

Summary for HP and LP lines (the sum for LP1 & LP2 and HP1 & HP2 is calculated)

LP and HP Lines in Umbilicals	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
LP 1&2, 1st line size	0		0		0	
LP 1&2, 2nd line size	0		0		0	
HP 1&2, 1st line size	0		0	0		
HP 1&2, 2nd line size	0		0	0		

LP and HP Lines in HFL's	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
LP 1&2, 1st line size	0		0		0	
LP 1&2, 2nd line size	0		0		0	
HP 1&2, 1st line size	0		0	0		
HP 1&2, 2nd line size	0		0	0		

3.3 Umbilical System #3 - IF APPLICABLE

Umbilical & Infield Umbilical	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
In-field 1	0		0			
In-field 2	0		0			
In-field 3	0		0			
In-field 4	0		0			
In-field 5	0		0			
In-field 6	0		0			

Hydraulic Flying Lead	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
UTA to SDU	0		0			
UTA to Tree	0		0			
SDU to Tree	0		0			
SDU to Manifold	0		0			
Other 1	0		0			
Other 2	0		0			
Other 3	0		0			
Other 4	0		0			
Other 5	0		0			
Other 6	0		0			
Other 7	0		0			

Summary for LP and LP lines (the sum for LP1 & LP2 and HP1 & HP2 is calculated)

LP and HP Lines in Umbilicals	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
LP 1&2, 1st line size	0		0		0	
LP 1&2, 2nd line size	0		0		0	
HP 1&2, 1st line size	0		0	0		
HP 1&2, 2nd line size	0		0	0		

LP and HP Lines in HFL's	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
LP 1&2, 1st line size	0		0		0	
LP 1&2, 2nd line size	0		0		0	
HP 1&2, 1st line size	0		0	0		
HP 1&2, 2nd line size	0		0	0		

3.4 Umbilical System #4 - IF APPLICABLE

Umbilical & Infield Umbilical	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
In-field 1	0		0			
In-field 2	0		0			
In-field 3	0		0			
In-field 4	0		0			
In-field 5	0		0			
In-field 6	0		0			

Hydraulic Flying Lead	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
UTA to SDU	0		0			
UTA to Tree	0		0			
SDU to Tree	0		0			
SDU to Manifold	0		0			
Other 1	0		0			
Other 2	0		0			
Other 3	0		0			
Other 4	0		0			
Other 5	0		0			
Other 6	0		0			
Other 7	0		0			

Summary for LP and LP lines (the sum for LP1 & LP2 and HP1 & HP2 is calculated)

LP and HP Lines in Umbilicals	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
LP 1&2, 1st line size	0		0		0	
LP 1&2, 2nd line size	0		0		0	
HP 1&2, 1st line size	0		0	0		
HP 1&2, 2nd line size	0		0	0		

LP and HP Lines in HFL's	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
LP 1&2, 1st line size	0		0		0	
LP 1&2, 2nd line size	0		0		0	
HP 1&2, 1st line size	0		0	0		
HP 1&2, 2nd line size	0		0	0		

3.5 Umbilical System #5 - IF APPLICABLE

Umbilical & Infield Umbilical	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
In-field 1	0		0			
In-field 2	0		0			
In-field 3	0		0			
In-field 4	0		0			
In-field 5	0		0			
In-field 6	0		0			

Hydraulic Flying Lead	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
UTA to SDU	0		0			
UTA to Tree	0		0			
SDU to Tree	0		0			
SDU to Manifold	0		0			
Other 1	0		0			
Other 2	0		0			
Other 3	0		0			
Other 4	0		0			
Other 5	0		0			
Other 6	0		0			
Other 7	0		0			

Summary for LP and LP lines (t d for LP1 & LP2 and HP1 & HP2 is calculated)

LP and HP Lines in Umbilicals	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
LP 1&2, 1st line size	0		0		0	
LP 1&2, 2nd line si	0		0		0	
HP 1&2, 1st line si	0		0	0		
HP 1&2, 2nd	0		0	0		

LP and HP Lines in HFL's	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
LP 1&2, 1st line size	0		0		0	
LP 1&2, 2nd line siz	0		0		0	
HP 1&2, 1st line siz	0		0	0		
HP 1&2, 2nd line si	0		0	0		

3.6 Umbilical System #6 - IF APPLICABLE

Umbilical & Infield Umbilical	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
In-field 1	0		0			
In-field 2	0		0			
In-field 3	0		0			
In-field 4	0		0			
In-field 5	0		0			
In-field 6	0		0			

Hydraulic Flying Lead	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
UTA to SDU	0		0			
UTA to Tree	0		0			
SDU to Tree	0		0			
SDU to Manifold	0		0			
Other 1	0		0			
Other 2	0		0			
Other 3	0		0			
Other 4	0		0			
Other 5	0		0			
Other 6	0		0			
Other 7	0		0			

Summary for LP and LP lines (t d for LP1 & LP2 and HP1 & HP2 is calculated)

LP and HP Lines in Umbilicals	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
LP 1&2, 1st line size	0		0		0	
LP 1&2, 2nd line si	0		0		0	
HP 1&2, 1st line si	0		0	0		
HP 1&2, 2nd	0		0	0		

LP and HP Lines in HFL's	Qty	Length [m]	Total Length [m]	Line size HP [mm]	Line size LP [mm]	Notes
LP 1&2, 1st line size	0		0		0	
LP 1&2, 2nd line siz	0		0		0	
HP 1&2, 1st line siz	0		0	0		
HP 1&2, 2nd line si	0		0	0		

3.7 Umbilical System Summary

The volume of fluid held within two LP umbilical cores when in the depressurised state is given by:

V= (PI / 4) * (D^2) * L

Umbilical Core I.D. (Line size) = D Umbilical Length = L

Umbilical & Infield Umbilical	Line	ID [mm]	Length [m]	Volume [l]	Notes
Umbilical System #1	0	0	0	0	
	0	0	0	0	
	HP 1&2, 1st line size	6,35	24150	765	
	0	6,35	0	0	
Umbilical System #2- IF APPLICABLE	LP 1&2, 1st line size	0	0	0	not applicable
	LP 1&2, 2nd line size	0	0	0	
	HP 1&2, 1st line size	0	0	0	
	HP 1&2, 2nd line size	0	0	0	
Umbilical System #3 - IF APPLICABLE	LP 1&2, 1st line size	0	0	0	not applicable
	LP 1&2, 2nd line size	0	0	0	
	HP 1&2, 1st line size	0	0	0	
	HP 1&2, 2nd line size	0	0	0	
Umbilical System #4 - IF APPLICABLE	LP 1&2, 1st line size	0	0	0	not applicable
	LP 1&2, 2nd line size	0	0	0	
	HP 1&2, 1st line size	0	0	0	
	HP 1&2, 2nd line size	0	0	0	
Umbilical System #5 - IF APPLICABLE	LP 1&2, 1st line size	0	0	0	not applicable
	LP 1&2, 2nd line size	0	0	0	
	HP 1&2, 1st line size	0	0	0	
	HP 1&2, 2nd line size	0	0	0	
Umbilical System #6 - IF APPLICABLE	LP 1&2, 1st line size	0	0	0	not applicable
	LP 1&2, 2nd line size	0	0	0	
	HP 1&2, 1st line size	0	0	0	
	HP 1&2, 2nd line size	0	0	0	
Total Umbilical System	**0**	**0**	**0**	**0**	
	0	**0**	**0**	**0**	
	HP 1&2, 1st line size	**6,35**	**24150**	**765**	
	0	**6,35**	**0**	**0**	

Hydraulic Flying Lead	Line	ID [mm]	Length [m]	Volume [l]	Notes
Umbilical System #1	0	0	0	0	not applicable
	0	0	0	0	
	0	0	0	0	
	0	0	0	0	
Umbilical System #2- IF APPLICABLE	LP 1&2, 1st line size	0	0	0	not applicable
	LP 1&2, 2nd line size	0	0	0	
	HP 1&2, 1st line size	0	0	0	
	HP 1&2, 2nd line size	0	0	0	
Umbilical System #3 - IF APPLICABLE	LP 1&2, 1st line size	0	0	0	not applicable
	LP 1&2, 2nd line size	0	0	0	
	HP 1&2, 1st line size	0	0	0	
	HP 1&2, 2nd line size	0	0	0	
Umbilical System #4 - IF APPLICABLE	LP 1&2, 1st line size	0	0	0	not applicable
	LP 1&2, 2nd line size	0	0	0	
	HP 1&2, 1st line size	0	0	0	
	HP 1&2, 2nd line size	0	0	0	
Umbilical System #5 - IF APPLICABLE	LP 1&2, 1st line size	0	0	0	not applicable
	LP 1&2, 2nd line size	0	0	0	
	HP 1&2, 1st line size	0	0	0	
	HP 1&2, 2nd line size	0	0	0	
Umbilical System #6 - IF APPLICABLE	LP 1&2, 1st line size	0	0	0	not applicable
	LP 1&2, 2nd line size	0	0	0	
	HP 1&2, 1st line size	0	0	0	
	HP 1&2, 2nd line size	0	0	0	
Total HFL	**0**	**0**	**0**	**0**	
	0	**0**	**0**	**0**	
	0	**0**	**0**	**0**	
	0	**0**	**0**	**0**	

3.8 Umbilical Expansion - LP System

The change in volume which occurs within two umbilical lines (LP1 + LP2) from topside to the subsea UTA when pressurised to max. WP is given by:

dV= V * Expansion % / 100

System Operating Pressure	0		
Expansion, 1st line size	1,3	%	(Calculated expansion at WP)
Volume of two umbilical lines, LP1 + LP2	0	litre	1st line size
Expansion, 2nd line size	1,3	%	(Calculated expansion at WP)
Volume of two umbilical lines, LP1 + LP2	0	litre	2nd line size

The total expansion volume required to pressurise two LP umbilical lines (LP1 + LP2) is therefore:

$dV_{two\ lines}$= 0,0 litre

3.9 Hydraulic Flying Lead Expansion - LP System

The change in volume which occurs within two HFL lines (LP1 + LP2) withing the subsea distribution system when pressurised to max. WP is given by:

dV= V * Expansion % / 100

System Operating Pressure	0	Mpa	
Expansion, 1st line size	1,3	%	(Calculated expansion at WP)
Volume of two HFL lines, LP1 + LP2	0	litre	1st line size
Expansion, 2nd line size	1,3	%	(Calculated expansion at WP)
Volume of two HFL lines, LP1 + LP2	0	litre	2nd line size

The total expansion volume required to pressurise two LP cores (LP1 & LP2) is therefore:

$dV_{two\ lines}$= 0,0 litre

3.10 Umbilical Expansion - HP System

The change in volume which occurs within two umbilical lines (HP1 + HP2) from topside to the subsea UTA when pressurised to max. WP is given by:

dV= V * Expansion % / 100

System Operating Pressure	62,7		
Expansion, 1st line size	27,0	%	(Calculated expansion at WP)
Volume of two umbilical lines, HP1 + HP	765	litre	1st line size
Expansion, 2nd line size	3,0	%	(Calculated expansion at WP)
Volume of two umbilical lines, HP1 + HP	0	litre	2nd line size

The total expansion volume required to pressurise two HP cores is therefore:

$dV_{two\ lines}$= 206,5 litre

Note: this calculation does not take the spare line volume into consideration.

3.11 Hydraulic Flying Lead Expansion - HP System

The change in volume which occurs within two HFL lines (HP1 + HP2) within the subsea distribution system when pressurised to max. WP is given by:

dV= V * Expansion % / 100

System Operating Pressure	62,7	Mpa	
Expansion, 1st line size	3,0	%	(Calculated expansion at WP)
Volume of two HFL lines, HP1 + HP2	0	litre	1st line size
Expansion, 2nd line size	3,0	%	(Calculated expansion at WP)
Volume of two HFL lines, HP1 + HP2	0	litre	2nd line size

The total expansion volume required to pressurise two HP cores is therefore:

$dV_{two\ lines}$= 0,0 litre

4 Actuator Volumes

4.1 Production Tree

The system is designed to control a max. quantity of SCM's with the functionality as below:

	Quantity SCM	Quantity Trees
Umbilical System #1	4	4
Umbilical System #2- IF APPLICABLE	0	0
Umbilical System #3 - IF APPLICABLE	0	0
Umbilical System #4 - IF APPLICABLE	0	0
Umbilical System #5 - IF APPLICABLE	0	0
Umbilical System #6 - IF APPLICABLE	0	0
TOTAL	**4**	**4**

SCM Functions,	
LP	**HP**
0	1

SCM Functions, actual	
LP	**HP**
0	2

LP Valve	LP Valve Actuator Type	LP Actuator [l]	Quantity Actuators on Tree	LP Actuator Total [l]	Calc. "open tree"	Calc. LP Charge	Calc. ESD vent
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
TOTAL ONE TREE				**0,00**	**0,00**	**0,00**	**0,00**
TOTAL ALL TREES				**0,00**	**0,00**	**0,00**	**0,00**

HP Valve	HP Valve Actuator Type	HP Actuator [l]	Quantity Actuators on Tree	HP Actuator Total [l]	Calc. "open tree"	Calc. HP Charge	Calc. ESD vent
SCSSV 1		0,25	1	0,25	Yes	Yes	Yes
				0,00			
				0,00			
				0,00			
				0,00			
TOTAL ONE TREE				**0,25**	**0,25**	**0,25**	**0,25**
TOTAL ALL TREES				**1,00**	**1,00**	**1,00**	**1,00**

4.2 Injection Tree

The system is designed to control a max. quantity of SCM's with the functionality as below:

	Quantity SCM	Quantity Trees
Umbilical System #1		
Umbilical System #2- IF APPLICABLE		
Umbilical System #3 - IF APPLICABLE		
Umbilical System #4 - IF APPLICABLE		
Umbilical System #5 - IF APPLICABLE		
Umbilical System #6 - IF APPLICABLE		
TOTAL		**0**

SCM Functions,	
LP	HP

SCM Functions, actual	
LP	HP
0	0

LP Valve	LP Valve Actuator Type	LP Actuator [l]	Quantity Actuators on Tree	LP Actuator Total [l]	Calc. "open tree"	Calc. LP Charge	Calc. ESD vent
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
TOTAL ONE TREE				**0,00**	**0,00**	**0,00**	**0,00**
TOTAL ALL TREES				**0,00**	**0,00**	**0,00**	**0,00**

HP Valve	HP Valve Actuator Type	HP Actuator [l]	Quantity Actuators on Tree	HP Actuator Total [l]	Calc. "open tree"	Calc. HP Charge	Calc. ESD vent
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
TOTAL ONE TREE				**0,00**	**0,00**	**0,00**	**0,00**
TOTAL ALL TREES				**0,00**	**0,00**	**0,00**	**0,00**

4.3 Other Tree - IF APPLICABLE

The system is designed to control a max. quantity of SCM's with the functionality as below:

	Quantity SCM	Quantity Trees
Umbilical System #1		
Umbilical System #2- IF APPLICABLE		
Umbilical System #3 - IF APPLICABLE		
Umbilical System #4 - IF APPLICABLE		
Umbilical System #5 - IF APPLICABLE		
Umbilical System #6 - IF APPLICABLE		
TOTAL	**0**	**0**

SCM Functions,	
LP	HP

SCM Functions, actual	
LP	HP
0	0

NOT APPLICABLE FOR THIS PROJECT

LP Valve	LP Valve Actuator Type	LP Actuator [l]	Quantity Actuators on Tree	LP Actuator Total [l]	Calc. "open tree"	Calc. LP Charge	Calc. ESD vent
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
TOTAL ONE TREE				**0,00**	**0,00**	**0,00**	**0,00**
TOTAL ALL TREES				**0,00**	**0,00**	**0,00**	**0,00**

HP Valve	HP Valve Actuator Type	HP Actuator [l]	Quantity Actuators on Tree	HP Actuator Total [l]	Calc. "open tree"	Calc. HP Charge	Calc. ESD vent
			0	0,00	Yes	Yes	Yes
			0	0,00	Yes	Yes	Yes
			0	0,00	No	No	No
			0	0,00	No	No	No
			0	0,00	No	No	No
			0	0,00	No	No	No
TOTAL ONE TREE				**0,00**	**0,00**	**0,00**	**0,00**
TOTAL ALL TREES				**0,00**	**0,00**	**0,00**	**0,00**

NOTE: As ICV volumes are not ESD volumes the total Injection Xmas Tree ESD volume is as indicated.

4.4 Manifold - IF APPLICABLE

The system is designed to control a max. quantity of SCM's with the functionality as below:

	Quantity SCM	Quantity Manifold
Umbilical System #1		
Umbilical System #2- IF APPLICABLE		
Umbilical System #3 - IF APPLICABLE		
Umbilical System #4 - IF APPLICABLE		
Umbilical System #5 - IF APPLICABLE		
Umbilical System #6 - IF APPLICABLE		
TOTAL	**0**	**0**

SCM Functions,	
LP	**HP**
SCM Functions, actual	
LP	**HP**
0	

NOT APPLICABLE FOR THIS PROJECT

LP Valve	LP Valve Actuator Type	LP Actuator [l]	Quantity Actuators on Manif.	Actuator Total [l]	Calc. "open Manif."	Calc. Charge	Calc. ESD vent
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
				0,00			
TOTAL ONE MANIFOLD				**0,00**	**0,00**	**0,00**	**0,00**
TOTAL ALL MANIFOLDS				**0,00**	**0,00**	**0,00**	**0,00**

NOTE: As only one Manifold branch valve can be open at a time closed valve volumes are not ESD volumes. The total Manifold ESD volume is as indicated.

4.5 Other Manifold - IF APPLICABLE

The system is designed to control a max. quantity of SCM's with the functionality as below:

	Quantity SCM	Quantity Manifold
Umbilical System #1	0	0
Umbilical System #2- IF APPLICABLE	0	0
Umbilical System #3 - IF APPLICABLE	0	0
Umbilical System #4 - IF APPLICABLE	0	0
Umbilical System #5 - IF APPLICABLE	0	0
Umbilical System #6 - IF APPLICABLE	0	0
TOTAL		**0**

SCM Functions,	
LP	HP
11	

SCM Functions, actual	
LP	HP
12	

LP Valve	LP Valve Actuator Type	LP Actuator [l]	Quantity Actuators / Manif.	LP Actuator [l]	Calc. "Open Manif."	Calc. LP Charge	Calc. ESD vent
MCV Open	TBA	2,28	0	0,00	Yes	Yes	No
MCV Close	TBA	2,28	0	0,00	No	Yes	No
MHV1-A	5-1/8" 5K	2,79	0	0,00	Yes	Yes	Yes
MHV1-B	5-1/8" 5K	2,79	0	0,00	Yes	Yes	No
MHV1-T	5-1/8" 5K	2,79	0	0,00	Yes	Yes	No
MHV2-A	5-1/8" 5K	2,79	0	0,00	Yes	Yes	Yes
MHV2-B	5-1/8" 5K	2,79	0	0,00	Yes	Yes	Yes
MHV2-T	5-1/8" 5K	2,79	0	0,00	Yes	Yes	Yes
MHV3-A	5-1/8" 5K	2,79	0	0,00	Yes	Yes	Yes
MHV3-B	5-1/8" 5K	2,79	0	0,00	Yes	Yes	Yes
MHV3-T	5-1/8" 5K	2,79	0	0,00	Yes	Yes	Yes
MHCV1 to 3	2-1/16" 5K	0,47	0	0,00	Yes	Yes	Yes
				0,00	---	---	---
				0,00	---	---	---
				0,00	---	---	---
				0,00	---	---	---
				0,00	---	---	---
				0,00	---	---	---
				0,00	---	---	---
				0,00	---	---	---
				0,00	---	---	---
				0,00	---	---	---
				0,00	---	---	---
				0,00	---	---	---
				0,00	---	---	---
				0,00	---	---	---
TOTAL ONE MANIFOLD				**0,00**	**0,00**	**0,00**	**0,00**
TOTAL ALL MANIFOLDS				**0,00**	**0,00**	**0,00**	**0,00**

NOTE: As only one Manifold branch valve can be open at a time closed valve volumes are not ESD volumes. The total Manifold ESD volume is as indicated.

3.6 Actuator Volume Summary

Unit	LP Open Volume [l]	LP Charge Volume [l]	LP ESD Volume [l]	HP Open Volume [l]	HP Charge Volume [l]	HP ESD Volume [l]
Production Tree	0,00	0,00	0,00	1,00	1,00	1,00
Injection Tree	0,00	0,00	0,00	0,00	0,00	0,00
Other Tree - IF APPLIC	0,00	0,00	0,00	0,00	0,00	0,00
Manifold - IF APPLICA	0,00	0,00	0,00			
Other Manifold - IF API	0,00	0,00	0,00			
TOTAL	**0,00**	**0,00**	**0,00**	**1,00**	**1,00**	**1,00**

5 DVA and HPU Valve Leakage

All metal to metal shear seal valves have an allowable leakage.

C

The individual maximum acceptable leakages for the Dump Valve Assembly is:

12,00 ml / h

The individual maximum acceptable leakages for the DCV's in the HPU are:

19,00 ml / h HP Valve,

The following table gives the values for each tree and for the HPU.

SCM Type / HPU	LP Selector Valve	HP Selector Valve	LP Functions	HP Functions	Max LP leakage [l/12h]	Max HP leakage [l/12h]
Production Tree	0	0	0	1	0,00	0,14
Injection Tree	0	0	0	0	0,00	0,00
Other Tree - IF APPLIC	0	0	0	0	0,00	0,00
Manifold - IF APPLICA	0		0		0,00	
Other Manifold - IF API	0		0		0,00	
HPU			0	2	0,00	0,46

The following table gives the values for the complete four well scenario.

SCM Type / HPU	Quantity SCM's	All SCM's + HPU Max LP leakage [l/12 h]	All SCM's + HPU Max HP leakage [l/12 h]
Production Tree	4	0,00	0,58
Injection Tree	0	0,00	0,00
Other Tree - IF APPLIC	0	0,00	0,00
Manifold - IF APPLICA	0	0,00	
Other Manifold - IF API	0	0,00	
HPU		0,00	0,46
TOTAL SYSTEM		**0,00**	**1,03**

6 Accumulators

6.1 Surface Hydraulic LP Accumulators

The LP system is equipped with LP hydraulic accumulators fitted in the HPU. The accumulators are
sized to satisfy the following requirements without the pump as per ISO 13628-6:
- open all of the valves on one tree (including the choke)
- maintain sufficiant pressure to keep process valves open for a period of 12 hours

0,00 litre Actuator volume of one production tree (as per ISO)

	litre	Client requirements above ISO (i.e. one additional prod. Tree)
	litre	Client requirements above ISO (i.e. additional 12 hours leakage)
	litre	Client requirements above ISO (i.e. 10% spare volume)
0,00	**litre**	Total accumulator volume required (A

Formula $Z = dV / \{V0*[(P0/P1)^{1/n}-(P0/P2)^{1/n}]\}$

Z = Required quantity of accumulators
dV = Required fluid volume

P0 =	0,0	Mpa	- Precharge pressure,
P1 =	0,0	Mpa	- Minimum Operating Pressure, LP
P2 =	0,0	Mpa	- Pump start pressure, LP
V0 =	0,0	litre	- Total gas volume per accumulator
n_d =	1,0		- polytropic exponent "discharge"
n_c =	1,2		- polytropic exponent "charge"

$(P0/P1)^{1/n}$ = #DIV/0! $(P0/P2)^{1/n}$ = #DIV/0! Discharge
$(P0/P1)^{1/n}$ = #DIV/0! $(P0/P2)^{1/n}$ = #DIV/0! Charge

Calculation Z = #DIV/0!

#DIV/0! surface accumulator bottles, each with a total gas volume of
0 litres, are needed. Actual installed are 0
accumulator bottles.

The complete fluid volume inside of 0 accumulators between
0 Mpa - Pump start pressure, LP
0 litre - Minimum Operating Pressure, LP

Formula $dV = Z * V0 * [(P0/P1)^{1/n}-(P0/P2)^{1/n}]$

Calculation dV = **#DIV/0! litre (discharge)**

The complete fluid volume inside of 0 accumulators between
0 Mpa - Maximum Operating Pressure, LP
0 Mpa - Precharge pressure, LP

Formula $dV = Z * V0 * [1-(P0/P2)^{1/n}]$

Calculation dV = **#DIV/0! litre (cold fill)**

6.2 Surface Hydraulic HP Accumulators

The HP system is equipped with HP hydraulic accumulators fitted in the HPU. The accumulators are sized to satisfy the following requirements without the pump as per ISO 13628-6:
- maintain sufficiant pressure to keep process valves open for a period of 12 hours
- a minimum of 2 off 10 litre accumulators

1,03	litre	Maximum leak rate all surface & subsea HP valves in 12 hours
		Client requirements above ISO (i.e. One production tree)
	litre	Client requirements above ISO (i.e. additional 12 hours leakage)
	litre	Client requirements above ISO (i.e. 10% spare volume)
1,03	**litre**	Total accumulator volume required (dV)

Formula $Z = dV / \{V0*[(P0/P1)^{1/n}-(P0/P2)^{1/n}]\}$

Z = Required quantity of accumulators
dV = Required fluid volume

P0 =	37,8	Mpa	- Precharge pressure, HP
P1 =	42,0	Mpa	- Minimum Operating Pressure, HP
P2 =	46,0	Mpa	- Pump start pressure, HP
V0 =	35,2	litre	- Total gas volume per accumulator
n_d =	1,4		- polytropic exponent "discharge"
n_c =	1,2		- polytropic exponent "charge"

$(P0/P1)^{1/n}$ = 0,93		$(P0/P2)^{1/n}$ = 0,87	Discharge
$(P0/P1)^{1/n}$ = 0,92		$(P0/P2)^{1/n}$ = 0,85	Charge

Calculation Z = 0,5

1,0 surface accumulator bottles, each with a total gas volume of 35,2 litres, are needed. Actual installed are 2 accumulator bottles.

The complete fluid volume inside of 2 accumulators between
- 46 Mpa - Pump start pressure, HP
- 42 Mpa - Minimum Operating Pressure, HP

Formula $dV = Z * V0 * [(P0/P1)^{1/n}-(P0/P2)^{1/n}]$

Calculation dV = **4,1 litre (discharge)**

The complete fluid volume inside of 2 accumulators between
- 62,7 Mpa - Maximum Operating Pressure, HP
- 37,8 Mpa - Precharge pressure, HP

Formula $dV = Z * V0 * [1-(P0/P2)^{1/n}]$

Calculation dV = **10,6 litre (cold fill)**

6.3 Subsea Hydraulic LP Accumulators

The LP subsea accumulators are sized such that sufficient volume is stored to cushion transient pressure drops, which would occur as tree or manifold valves are operated.
This calculation is done in order to establish the HPU reservoir sizes.

The LP system is fitted with 4 off 20 L accumulator on both LP system (LP1 & LP2) in each SAM.

Formula dV = Z * V0 * [((P0+Phyd)/(P1+Phyd)^1/n - ((P0+Phyd)/(P2+Phyd)^1/n] Approx. coefficient without any comments

Z =	0	-	quantity of accumulator bottles (LP1 + LP2)
dV = fluid volume available			
P0 =	0,0 Mpa	-	Precharge pressure, LP
P1 =	0,0 Mpa	-	Minimum Operating Pressure, LP
P2 =	0,0 Mpa	-	Pump start pressure, LP
V0 =	0,0 litre	-	Total gas volume per accumulator
Phyd =	0,0 Mpa	-	Hydrostatic pressure
n_d =	1,4	-	polytropic exponent "discharge"
n_c =	1,2	-	polytropic exponent "charge"

((P0+Phyd)/(P1+Phyd))^1/n = 1,00 ((P0+Phyd)/(P2+Phyd))^1/n = 1,00 Discharge
((P0+Phyd)/(P1+Phyd))^1/n = 1,00 ((P0+Phyd)/(P2+Phyd))^1/n = 1,00 Charge

The complete fluid volume inside of 0 accumulators between
0 Mpa - Pump start pressure, LP
0 Mpa - Minimum Operating Pressure, LP

Calculation dV = **0,0 litre (discharge)**

The complete fluid volume inside of 0 accumulators between
0 Mpa - Maximum Operating Pressure, LP
0 Mpa - Precharge pressure, LP

Calculation dV = **0,0 litre (cold fill)**

NOTE:
The number of subsea accumulators has to be confirmed through the dynamic analysis (separate document).

6.4 Subsea Hydraulic HP Accumulators

The HP system is equipped with HP hydraulic accumulators fitted in the SCM's or SAM's. The accumulators are not sized to store any specific volume, but are primarily intended to cushion transient pressure drops, which would occur as SCSSV's or Intelligent Well Completion valves are operated.
This calculation is done in order to establish the HPU reservoir sizes.

The HP system is fitted with 2 off 2,3 L accumulator on both HP systems (HP1 + HP2) in each SAM.

Formula dV = Z * V0 * [((P0+Phyd)/(P1+Phyd)) Approved by client without any comments

Z =	0		-	quantity of accumulator bottles (HP1 HP2)
dV = fluid volume available				
P0 =	0,0	Mpa	-	Precharge pressure,
P1 =	42,0	Mpa	-	Minimum Operating Pressure, HP
P2 =	46,0	Mpa	-	Pump start pressure, HP
V0 =	0	l	-	Total gas volume per accumulator
P	0,4	Mpa	-	Hydrostatic pressure
n_d =	1,4		-	polytropic exponent "discharge"
n_c =	1,2		-	polytropic exponent "charge"

((P0+Phyd)/(P1+Phyd))$^{1/n}$ = ((P0+Phyd)/(P2+Phyd))$^{1/n}$ = 0,03 Discharge

((P0+Phyd)/(P1+Phyd))$^{1/n}$ = ((P0+Phyd)/(P2+Phyd))$^{1/n}$ = 0,02 Charge

The complete fluid volume inside of 0 accumulators between
46 Mpa - Pump start pressure, HP
42 Mpa - Minimum Operating Pressure, HP

Calculation dV = **0,0 litre (recharge)**

The complete fluid volume inside of 0 accumulators between
62,7 Mpa - Maximum Operating Pressure, HP
0 Mpa - Precharge pressure, HP

Calculation dV = **0,0 litre (cold fill)**

NOTE:
The number of subsea accumulators has to be confirmed through the dynamic analysis (separate document).

7 Pump Sizing

7.1 LP Pumps

There are no specific requirements as per ISO 13628-6 for sizing the hydraulic pumps.
A typical requirement for pump sizing is:

The combination of all pumps shall be capable of re-charging the entire LP system from precharge pressure to working pressure within a given time (excluding actuators), from a condition following umbilical vent down.
At t=0 the topside accumulators would be fully charged, the umbilical and the subsea accumlators would be vented down.

0	minutes	charging time	
#DIV/0!	litre	complete fluid in	0 off surface accumulator
0,0	litre	complete fluid in	Approved by subsea accumulator
0,0	litre	expansion fluid in	Umbilical Expansion - LP System
0,0	litre	expansion fluid in	Hydraulic Supplying Lead Expansion - LP System
	litre	Client requirement 1	
	litre	Client requirement 2	
	litre	Client requirement 3	
#DIV/0!	**litre**	Total	

Pump capacity required:

#DIV/0! l/minute **pump capacity for all pumps required**

Pump capacity installed:

0 electric driven pump is installed on the HPU.
The pump is able to deliver a volume of 0 l/minute.

0 air driven pump is installed on the HPU.
The pump is able to deliver an average volume of 0 l/minute between the pressure and the maximum working pressure, when the air supply pressure is minimum 5 bar and sufficient air volume is supplied during running of the pump.

The total delivered volume from all pumps is: **0 l/minute**

The calculated time to charge the dedicated accumulator system from precharge pressure to maximum working pressure will be approx.: **#DIV/0! minutes**

NOTE: The calculated time to charge the umbilicals might be longer as the pumps may not run constantly during umbilical fill. A hydraulic response calculation taking the umbilical characteristic into account will give a more accurate value.

7.2 HP Pumps

There are no specific requirements as per ISO 13628-6 for sizing the hydraulic pumps.
A typical requirement for pump sizing is:

The combination of all pumps shall be capable of re-charging the entire HP system from precharge pressure to working pressure within a given time (excluding actuators), from a condition following umbilical vent down.
At t=0 the topside accumulators would be fully charged, the umbilical and the subsea accumlators would be vented down.

60	minutes	charging time	
10,6	litre	complete fluid in	2 off surface accumulator
0,0	litre	complete fluid in	0 off subsea accumulator
206,5	litre	expansion fluid in	Umbilical Expansion - HP System
0,0	litre	expansion fluid in	Hydraulic Flying Lead Expansion - HP System
	litre	Client requirement 1	
	litre	Client requirement 2	
	litre	Client requirement 3	
217	**litre**	Total	

Pump capacity required:

3,6 l/minute **pump capacity for all pumps required**

Pump capacity installed:

2 electric driven pumps are installed on the HPU.
Each pump is able to deliver a volume of 3,5 l/minute.

0 air driven pump is installed on the HPU.
The pump is able to deliver an average volume of 0 l/minute
between the precharge and the maximum working pressure, when the air supply pressure is minimum 5 bar and sufficient air volume is supplied during running of the pumps.

The total delivered volume from all pumps is: **7 l/minute**

The calculated time to charge the dedicated accumulator system from precharge pressure to maximum working pressure will be approx.: **31 minutes**

NOTE: The calculated time to charge the umbilicals might be longer as the pumps may not run constantly during umbilical fill. A hydraulic response calculation taking the umbilical characteristic into account will give a more accurate value.

8 Reservoir Sizing

8.1 Supply Reservoir

The reservoir is sized to satisfy the following requirements as per ISO 13628-6:
1.The main reservoir shall have a minimum capacity of 1,5 times the fluid required to charge the system including surface and subsea accumulators umbilical and all valve operators and one full open and close cycle of chokes.
2. If the reservoir is above 2000 litre a spare capacity of 750 litre is acceptable.

0,0 litre	fluid in surface LP accumulators (cold fill)
0,0 litre	fluid in subsea LP accumu Approved by client without any comments
10,6 litre	fluid in surface HP accumulators (cold fill)
0,0 litre	fluid in subsea HP accumulators (cold fill)
0,0 litre	fluid in umbilical line expansion LP
0,0 litre	fluid in HFL line expansion LP
206,5 litre	fluid in umbilical line expansion HP
0,0 litre	fluid in HFL line expansion HP
0,0 litre	fluid to operate all LP valve actuators.
1,0 litre	fluid to operate all HP valve actuators.
218,1 litre	**total volume to charge the system**

968 litre	Charge volume plus 750 litre (if reservoir selected is above 2000 litre)
327 litre	Charge volume if reservoir selected is below 2000 litre. (min. 250 litre)

The volume of fluid required to satisfy the two criteria is totaled below:

327 litre	The applicable of the two criteria above
0 litre	Additional client requirement
327 litre	**Minimum usable reservoir volume required**

25 litre	5% additional spare volume
50 litre	10% sump volume
50 litre	10% air gap
452 litre	**Minimum total reservoir volume required**

Actual reservoir capacity installed:

The total storage capacity of the installed supply fluid reservoir on the HPU is

500 litre	**selected capacity of supply reservoir**

This calculated volume does not take the 1/2" spare line into consideration.

8.2 Return Reservoir

The reservoir is sized to satisfy the following requirements as per ISO 13628-6:
1. If the reservoir is above 2000 litre a spare capacity of 750 litre is acceptable.
2. The reservoir should be sized to accomodate drainage of all fluid in case of a hydraulic vent ESD

The volume of fluid required to satisfy the first criteria is totalled below.

0,0 litres	fluid in all LP valve actuators. Most of this is usually "vented to sea".
1,0 litres	fluid in all HP valve actuator: Approved by client without any comments
0,0 litres	fluid in subsea LP accumulators (cold fill)
0,0 litres	fluid in subsea HP accumulators (cold fill)
0,0 litres	fluid in umbilical line expansion LP
0,0 litres	fluid in HFL line expansion LP
206,5 litres	fluid in umbilical line expansion HP
0,0 litres	fluid in HFL line expansion HP
207,5 litres	**total volume to drain the system (ESD vent)**

957 litres	Drain volume plus 750 litre (if reservoir selected is above 2000 litre)
457 litres	Drain volume if reservoir selected is below 2000 litre. (min. 250 litre)

The volume of fluid required to satisfy the two criteria is totaled below:

457 litre	The applicable of the two criteria above
0 litre	Additional client requirement
457 litre	**Minimum usable reservoir volume required**

0 litres	0%	additional spare volume
28 litres	5%	sump volume
28 litres	5%	air gap
512 litres		**Minimum total reservoir volume required**

Actual reservoir capacity installed:

The total storage capacity of the installed return fluid reservoir on the HPU is

550 litres	**selected capacity of return reservoir**

This calculated volume does not take the 1/2" spare line into consideration.

8.3 Reservoir Sizing Calculations (if combined reservoir)

The reservoir is sized to satisfy the following requirements as per ISO 13628-6:
1.The main reservoir shall have a minimum capacity of 1,5 times the fluid required to charge the system including surface and subsea accumulators umbilical and all valve operators and one full open and close cycle of chokes.
2. If the reservoir is above 2000 litre a spare capacity of 750 litre is acceptable.
3. The reservoir should be sized to accomodate drainage of all fluid in case of a hydraulic vent ESD.

0,0	litre	fluid in surface LP accumulators (cold fill)
0,0	litre	fluid in subsea LP accumulators (cold fill)
10,6	litre	fluid in surface HP accumulators (cold fill)
0,0	litre	fluid in subsea HP accumulators (cold fill)
0,0	litre	fluid in umbilical line expansion LP
0,0	litre	fluid in HFL line expansion LP
206,5	litre	fluid in umbilical line expansion HP
0,0	litre	fluid in HFL line expansion HP
0,0	litre	fluid to operate all LP valve actuators.
1,0	litre	fluid to operate all HP valve actuators.
218,1	**litre**	**total volume to charge the system**
207,5	**litre**	**total volume to remain the system (ESD vent)**

968	litre	Total volume plus 750 litre (if reservoir selected is above 2000 litre)
327	litre	Total volume if reservoir selected is below 2000 litre. (min. 250 litre)

The volume of fluid required to satisfy the two criteria is totaled below:

327	litre	the applicable of the two criteria above
0	litre	Additional client requirement
327	**litre**	**Minimum usable reservoir volume required**

190	litre	10%	additional spare volume
380	litre	20%	sump volume
190	litre	10%	air gap
1087	**litre**		**Minimum total reservoir volume required**

Actual reservoir capacity installed:

The total storage capacity of the installed supply fluid reservoir on the HPU is

1900	**litre**	**selected capacity of supply reservoir**

9 Revision History

Rev.	Date	Revison Description	Revision Reason
N/A	11-Sep-07	Initial Release	---
B	20-Sep-07	Section 5 updated to include actual leak rates for ESD valves on the HPU and the DVA on the trees	comments from IDC added
C	9-Nov-07	several notes added for clarity.	comments from external IDC
1	19-Feb-08	Updated to "Approved for Constrcution"	Approved by client without any c

NOTE: Template Rev. 02

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

18APR08	Reissued for Information	A. Weilandt	S. Horne	A. Weilandt
25SEP07	Issued for Information	A. Weilandt	S. Horne	
22SEP07	Issued for Internal IDC	A. Weilandt	S. Horne	
Date	**Reason for Issue**	**Originator**	**Checked**	**Approved**

	Document Title: **Electrical Load List**		
PAGE 1 OF 7	**Customer Document Number:**	54NL92-W-69-501	REV. 2
	Cameron Document No.	X-065451-04-07	REV. 01

TABLE OF CONTENTS

1 Document Revision Status / Record

Rev.	Date	Description of change	Author
A	22SEP07	Initial release	A. Weilandt
B	25SEP07	Issued for Information	A. Weilandt
01	18APR08	Reissued for Information	A. Weilandt

2 Introduction

This document shall provide a list of all topsides electrical assemblies and their electrical loads.

3 Scope of this document

The scope of this document is to define

- Topside electrical assemblies
- Electrical Loads

4 Abbreviations & Definitions

4.1 Abbreviations

EPCU	Electrical Power and Control Unit
HPU	Hydraulic Power Unit
MCC	Motor Control Center
MCS	Master Control Station
SSS	Safety Shutdown System
UPS	Uninterruptible Power Supply

5 References

5.1 Cameron Documents

Following documents **MUST** be considered during the design phase.

Number	Description
X-076721-87	Subsea and Topside Functional Design Specification

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Total Project Specification for Subsea Process Control System	#46643
Total “K5F Interfaces on K6CC”	NL92-Z-01-001

6 Electrical Load List

6.1 HPU

The Hydraulic Power Unit (HPU) shall be provided with electrical power from the K6C MCC and the K6C SSS.

- HPU P/N: 223011-32 (NN-82202)

Description	Data	Comments
HP1 Hydraulic Pump (GX-82840A)	**7.5 kW** Motor	The 3 phase **380 Volt / 50 Hz** electrical power supply for these HPU pumps needs to be provided separately to the motors.
HP2 Hydraulic Pump (GX-82840B)	**7.5 kW** Motor	
Circulation Pump (GX-82841)	**1.5 kW** Motor	
HPU Internal Light	One (1) Light Fixture with **36 Watt**	The single phase **230 Volt AC / 60 Hz** electrical power supply for the internal HPU Lights needs to be provided to the internal light switch.
HPU Internal Solenoid Valves	Two **(2**) internal Solenoid Valves each with **10 Watt**	The **24 Volt DC** electrical power supplies for the internal HPU Solenoid Valves need to be supplied from the K6C SSS.

6.2 MCS

The Master Control Station (MCS) shall be provided with electrical power from the K6P UPS.

- MCS P/N: 223380-25 (NN-81203)

Description	Data	Comments
Power Supply A (MCS PC's, PLC, instrumentation)	**1 kW** maximum operation load	The **230Volt / 50 Hz** electrical power supply needs to be provided from the K6P UPS.
Power Supply B (MCS PC's, PLC, instrumentation)	**1 kW** maximum operation load	The **230Volt / 50 Hz** electrical power supply needs to be provided from the K6P UPS.
Utility Supply (internal power outlet)	**1 kW** maximum operation load	The **230Volt / 50 Hz** electrical power supply needs to be provided from the K6P UPS.

6.3 EPCU

The Electrical Power and Communication Unit (EPCU) shall be provided with electrical power from the K6P UPS.

- EPCU P/N: 223022-31 (NN-81204-1/-2/-3/-4)

Description	Data	Comments
Power Supply Tree1 A	**18 kVA** maximum operation load	The 3 phase **380…440Volt / 45…65Hz** electrical power supply needs to be provided from the K6C UPS.
Power Supply Tree1 B	**18 kVA** maximum operation load	The 3 phase **380…440Volt / 45…65Hz** electrical power supply needs to be provided from the K6C UPS.
Power Supply Tree2 A	**18 kVA** maximum operation load	The 3 phase **380…440Volt / 45…65Hz** electrical power supply needs to be provided from the K6C UPS, but through the Tree 1A cabinet
Power Supply Tree2 B	**18 kVA** maximum operation load	The 3 phase **380…440Volt / 45…65Hz** electrical power supply needs to be provided from the K6C UPS, but trough the Tree 1B cabinet.

6.4 HPU PLC Cabinet

The HPU PLC Cabinet shall be provided with electrical power from the K6C UPS.

- HPU PLC Cabinet P/N: 223022-33 (NN-82203)

Description	Data	Comments
Power Supply	**1 kW** maximum operation load	The **230Volt / 50 Hz** electrical power supply needs to be provided from the K6C MCC

GENERAL PRESERVATION & STORAGE PROCEDURE

FOR

CAMERON CONTROLS EQUIPMENT

07	12. March 2008	J. Grochowski	K. Yahosseini	J. Grochowski
06	14. March 2007	J. Grochowski	B. Müller	J. Grochowski
05	12. May 2006	J. Grochowski	F. Duensing	J. Grochowski
04	18. July 2005	J. Grochowski	F. Duensing	J. Gronstedt
03	6. January 2005	J. Grochowski	A. Kamp	T. Loi
02	14. May 2004	H. Mohwinkel	M. Lehmker	A. Voges
01	27. August 2002	J. Grochowski	K. Seidel	K. Yahosseini
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Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
D 07	02. April 02	Document layout revised Document Revision Status sheet added	
01	27. Aug 02	CAMTROL equipment added	Request from project
02	14. May 04	Chapter 3: tarpaulin cover usage for outdoor storage added; Chapter 4.2: Storage fluid (for storage of 1 to 2 years) Castrol Anvol changed to Transaqua HT; Chapter 5.3.1.1 added	Requested by project
03	6. Jan 05	No content change	SAP upload
04	18. July 05	Comments included	Required by D. Coonrod
05	12. May 06	TUTA requirements included	Required by project
06	14. Mar 07	Umbilical poppet requirement included	Required by project
07	12. Mar 08	Comments included	Required by project

Table of contents

1 Introduction

This document outlines the procedure for preservation and storage of a control system before and after use. This includes Production Control Systems, Workover Control Systems and Drilling Control Systems. The purpose of this procedure is to keep the equipment supplied by Cameron Celle in a proper shape during storage. It will be available for further operations without major refurbishment due to insufficient control during storage.

This document provides instructions to ensure preservation and protection of all typical control system equipment in order to prevent deterioration caused by corrosion, damage, influence of weather and foreign materials, during shipment, storage and installation.

2 Reference Procedures

X-065460-( )-( )	Protective Coating Procedure for Cameron Controls Equipment
X-065390-03	General Protection and Coating Procedure for Cameron Celle Controls Equipment
X-065390-03-00-01	Protection and Coating Procedure for Cameron Celle Controls Equipment
X-027055-01	Corrosion Inhibiting Coating of Machined Surfaces

3 General Storage Requirements for Environment

Before starting any activities for preservation & storage all functions need to be verified. It must be checked that maintenance and repair works have been performed by qualified service personnel and that the control system does not have any mechanical damages on framework, umbilicals, hoses and cables.

Clean and dry the equipment prior to storage and place it under cover (if available) in a clean and dry environment.

For outdoor storage use tarpaulin covers. Ensure that covers are correctly attached and check covers for any damage. Replace damaged covers.

Preferred ambient conditions for storage areas[*)]

Temperature range	:	0 to 40°C
Humidity range	:	0 to 50 % (excluding condensation and frost)

[*)] If above values are not available, humidity and temperature must be within project related specified range.

In areas with high ambient temperatures consider protection against UV light / direct sunlight to protect e.g. plastic materials or compensation systems (thermal expansion).

Atmosphere must be free from harmful substances which can effect resilient seals (e.g. high ozone level).

Store equipment and spare parts with sealing surface protection by protective devices and protect after inspection if necessary.

Consider special storage procedures for critical materials like hydraulic fluid, batteries, rubber goods etc.

Handling and transport of equipment must always be in accordance with the conform procedure, shown in the Operation and Maintenance Manual for the control system.

4 Cameron Controls Standard Hydraulic Control Fluids

This section outlines the Cameron Celle Controls standard hydraulic control fluids. If any other fluid is specified the appropriate data sheet must be considered for preparation and storage of the system.

4.1 Hydraulic Oils

The standard oil types for Cameron Celle Controls equipment are:

- SHELL TELLUS (different types)
- CASTROL BRAYCO MICRONIC 864

Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

Note: Further details for treatment of fluid before and during storage for the specific equipment are listed in section 5.

4.2 Water Based Fluid

The typical water based fluid types for Cameron Celle Controls equipment are delivered by **Mac Dermid CANNING (MARSTON BENTLEY) LTD.**:

- Oceanic HW 511
- Oceanic HW 525
- Oceanic HW 540
- Oceanic HW 443
- Oceanic HD 603 Water/Glycol with lubricant

A typical water based fluid supplied by **CASTROL**:

- TRANSAQUA HT or HT2

A typical water based fluid supplied by **CAMERON**:

- CAMERON 590 X Water / Glycol with lubricant

Note: Further details for treatment of water based fluid before and during storage are listed in the following table.

Water Based Fluid	Suitable Storage Fluid (>6 months)	Suitable Storage Fluid (>1 year)	Suitable Storage Fluid (>2 years)
Mac Dermid CANNING OCEANIC HW 525 Cameron PN 619011-36 OCEANIC HW 540 Cameron PN 619011-28 OCEANIC HW 443 Cameron PN 619011-41	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285
Mac Dermid CANNING Water based fluid with ERIFON HD 603 Cameron PN 619011-46 (Lubricant)	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285
	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	Composition Lubricant/Glycol/Water: 5 % Lubricant: PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	
CASTROL TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	TRANSAQUA HT Cameron PN 619011-53
CASTROL TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	TRANSAQUA HT2 Cameron PN 619011-84
CAMERON Fluid Cameron 590 X Cameron PN 619011-24 (Lubricant)	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 40 % Glycol PN 619011-10 55 % Demineralized Water	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285

5 Specific Equipment Preservation and Maintenance Requirements

Note: Preservation during storage shall be performed in accordance with the check lists shown in section 6.
Any damage occurring during the periodical checks must immediately be repaired and reported to the Maintenance Supervisor.

5.1 Instruments for Surface Containers and Frames

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

All moving parts are to be lubricated with Molycote 3402 or equivalent.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

5.2 Hydraulic Power Unit and Local Control Panel

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines, including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen precharge of each hydraulic accumulator down to 10 bar / 145 psi. This is for safety reasons and to keep e.g. bladder in a stable position.

Air accumulators must be vented and drained of water.

Open ends of piping must be sealed off by plugs or caps.

All moving parts including the push rod of the panel valves must be protected by Molycote 3402 or equivalent.

Operation panels must be protected by a protective cover or door.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anti-condensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect ventilation grills / air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof local control panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

All isolation valves (except drain valves) must be closed. 4/3-way panel valves must be moved to "CENTER" position. 3/2-way panel valves must be in "CLOSE" or "VENT" position.

5.2.1 Hydraulic Oil

For long term storage no fluid exchange is required to get conservation against corrosion if equipment is filled with clean hydraulic oil.

After usage or longer storage (>3 months) hydraulic reservoirs must be checked for cleanliness and water content. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

Note: Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

If the water content of the oil is too high, check the hydraulic fluid for bacterial contamination. Clean the system up if necessary by following instructions of supplier.

Hydraulic lines have to be flushed to customer required cleanliness level.

Note: Cleaning of the hydraulic lines of an empty system must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

5.2.2 Water Based Fluid

General

For long term storage (>6 months) a special fluid preparation is required to get conservation against corrosion of equipment.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Reservoirs must be checked for cleanliness.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluid should be within the system during long term storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions. The table in section 4.2 shows different possibilities for long term (>6 months) storage.

5.3 Remote Control Panel

Painting, frame and moving parts must be checked in accordance with section 5.1.

5.3.1 Electric Remote Control Panel

Cable connections are to be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Operation panel must be protected by a protective cover or door if available.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

Rack mounted equipment shipped separately from cabinets should be bagged with desiccant and tagged with shock fuses.

5.3.1.1 Control Panel for climatic controlled environment

Control panel for use in climatic controlled environment e.g. Master Control Station (MCS), Electric Power Unit (EPU), Remote Workstations etc.

Equipment should be stored in a warehouse in undamaged packaging under the following conditions excluding intensive dust and condensation of humidity.

Temperature -18 - +60°C

Humidity 20-90% RHNC

When packaging has to be opened e.g. for site receive tests it is recommended to use corrosion inhibitors (e.g. Cortec®VCI 110) for further preservation.

5.3.2 Pneumatic Remote Control Panel

Pneumatic connections are to be cleaned up and protected by non aggressive protective shield, protection against dust or mating protective cover if available. Check pneumatic jumper cable as well.

Air receivers must be vented and drained of water.

Operation panel front must be protected by a protective cover or door.

Acryl glass window panes on panels located in hazardous areas must be cleaned with wet cloth only due to electrostatic charge.

5.4 Hydraulic Umbilicals, Umbilical Jumpers & Steel Flying Leads

General Instructions

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the applicable hydraulic fluid.

All hydraulic connections must be cleaned from dirt by using cleaning solvents which do not harm the seals (see Operation and Maintenance Procedure).

The connection plate of the junction boxes must be protected by protective covers.

After cleaning mating protective caps or plugs must be mounted to the quick coupling or single connection.

Stainless steel junction boxes and plates must be covered with a thin film of non aggressive oil.

Painting, frame and moving parts must be checked in accordance with section 5.1.

The umbilical can be stored in a box or on a drum. The minimum bending radius for storage indicated by supplier may not be exceeded.

5.4.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The umbilical shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.4.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

All lines with poppets must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids and compositions (see table in section 4.2).

5.5 Electric Cables and Cable Jumpers

Contacts of electrical connectors must be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Check that cable minimum bending radius is kept for storage.

Cable materials have to be protected for storage to avoid mechanical impact and ageing impact caused by sunlight (UV).

5.6 Umbilical Reels

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cleaned piping must be sealed off by using protective plugs, caps or covers.

Parts for power transmission like gear, chain with sprockets etc. must be protected and lubricated.

Open gear drive with gear ring and cog	-	ANTI SEIZE (or equivalent)
Chain drive	-	ESSO CAZAR K2 (or equivalent)
Gear box for direct drive	-	See Operation and Maintenance Manual of gear box for specific oil type.

5.7 Uninterruptable Power Supply (UPS)

WARNING:

Hydrogen may discharge from batteries and cause explosion (depending from battery type). Sufficient ventilation is required.

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cable connections must be protected with non aggressive protective shield.

For storage of the UPS check the allowed temperature range in Operation and Maintenance Manual to avoid damage of sensitive parts like batteries etc.

Recharge batteries to full range. Deep discharge must be avoided.

Follow specific long term storage procedure for installed type of batteries.

Disconnection of batteries may be required.

Ensure that the UPS is tagged with a shock fuse indicator.

5.8 Subsea Valve Packages

Remark: Subsea valve packages are normally mounted to the subsea running tools (e.g. Lower Marine Riser Package), which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.8.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.8.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.9 Subsea Control Modules (direct / pilot hydraulic types)

Remark: This section is **not** to be applied for CAMTROL subsea control modules. Refer to the "CAMTROL Subsea Production Control Equipment" section.
Subsea Control Modules (SCM) are normally mounted to the subsea running tools which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool. Flushing and testing can be done with the appropriate flushing and testing unit.

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Hydraulic pressure from all lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

If applicable, cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

5.9.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.9.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.10 Hydraulic Flushing and Testing Units

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

Air receivers must be vented and drained of water.

Open connection ends must be sealed off by plugs or caps.

All moving parts must be protected by Molycote 3402 or equivalent.

Junction plates must be protected by an overall cover or individual caps and plugs.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anticondensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

5.10.1 Hydraulic Oil

Reservoirs must be checked for cleanliness and water content. Water content of hydraulic oil must be checked to be within the maximum allowed range. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.10.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.11 Running Tools for Subsea Modules

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines must be discharged.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Hydraulic lines are to be flushed to customer required cleanliness level.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.12 Hydraulic Cylinder (e.g. on SCM Test Stand)

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

Hydraulic cylinders are to be flushed to customer required cleanliness level. Ensure that the cavities are completely filled with hydraulic control fluid. Ensure that no air is left in the cylinders as remaining air might cause corrosion.

Painting must be checked in accordance with section 5.1.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Put piston of the cylinder in retract position. This ensures that the rod is protected inside the cylinder against corrosion or damage.

Grease the cylinder rod with silicon grease or equivalent non aggressive grease.

Store the cylinder in a dry indoor environment. Room temperature should not be below 37°F (3°C).

5.13 Float Type Accumulators

Note: Preservation has to be carried out when the float type accumulators are unused and storage will be longer than three (3) months.

<u>Disassembly of Accumulator</u>

Bleed the pressure from hydraulic fluid supply.

Ensure that the ¼" needle valve at the bottom of the accumulator is in the closed position.

Remove the ¼" NPT plug.

Open the ¼" needle valve at the bottom of the accumulator.

Ensure that the accumulator is depressurised.

Open the hammer union at the bottom of the accumulator.

Ensure that the floater is at the lower end of the accumulator.

Remove the plug at the end of the floater pipe.

Inspect the seals (floater pipe plug, hammer union).

Spray non aggressive anticorrosive lubricant into the accumulator to protect the inner surface of the accumulator.

Carefully move the accumulator in vertical position and ensure that the lubricant flows out of the accumulator.

Assembly of Accumulator

Grease the o-ring of the plug and fix the plug at the lower end of the floater pipe.

Grease the thread at the end of the accumulator bottle and connect the hammer union.

Close the ¼" needle valve at the bottom of the accumulator and install the ¼" plug.

Painting must be checked in accordance with section 5.1.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.14 Topside Umbilical Termination Unit / Assembly

Topside Umbilical Termination Units / Assemblies (TUTU / TUTA) will be treated like Hydraulic Power Units (HPU). The workload is reduced as the TUTU / TUTA does not contain motors, pumps and reservoirs.

5.15 Wire Rope

Grease the wire ropes with wire rope grease. Ommex or Kendal or equivalent wire rope grease can be used.

Store the wire ropes in a dry outdoor or indoor environment.

5.16 Load Cell

Protect the load cells by a thin film of non aggressive oil.

Store the load cells in a dry indoor environment. Room temperature should not be below 37°F (3°C).

6 Preservation Maintenance Check Lists

The following checklists must be used to get a controlled storage of the equipment with proper maintenance.

6.1 Hydraulic Power Unit and Local Control Panel (Main Control Unit)

Preservation Maintenance Check List	**Sheet: 1 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-65390-03-00-00 or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film; repair if necessary	Non aggressive oil
8.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Motors, Distribution Boxes, Relay Boxes, Subswitchboards, Junction Boxes**					
1.0			X		Inspect protection on cable connections; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0		X			Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check drain valves to be open	
6.0			X		Inspect fluid according to section 5.2.1 or 5.2.2	

6.2 Umbilical Reel with Umbilical

Preservation Maintenance Check List — **Sheet: 1 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check lines to be pressureless, drain valves to be open	
6.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.3 Electric Remote Control Panels

Preservation Maintenance Check List						**Sheet: 1 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A. General Inspection						
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, Vaseline or equivalent
4.0			X		Check pneumatic circuits to be depressurized (for purged system only)	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil

Preservation Maintenance Check List						**Sheet: 2 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.4 Pneumatic Remote Control Panels

Preservation Maintenance Check List — **Sheet: 1 of 1**

Description of Equipment: **Pneumatic Remote Control Panels**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on pneumatic hose connection, repair if necessary	Non aggressive protective shield with additional cover
4.0			X		Check pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
7.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
8.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
9.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
10.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
11.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.5 Hydraulic and Electrical Jumpers

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Hydraulic and Electrical Jumpers**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0	X				Check junction boxes and couplings for proper protection by covers, caps or plugs	
4.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield; acid free Vaseline or equivalent; protective caps
6.0			X		Check protection of electric cable against mechanical impact and ageing impact by sunlight	
7.0			X		Check that cable minimum bending radius is kept for storage	
8.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.6 Subsea Valve Package

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Valve Package**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
6.0			X		Check lines to be pressureless; drain valves to be open	
7.0			X		Inspect fluid according to section 5.8.1 or 5.8.2	

6.7 Subsea Control Module (direct / pilot hydraulic types)

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Control Module (not for CAMTROL SCM)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
6.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
7.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
8.0			X		Check lines to be pressureless; drain valves to be open	
9.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
10.0			X		Inspect fluid according to section 5.9.1 or 5.9.2	

6.8 Hydraulic Flushing and Testing Unit

Preservation Maintenance Check List						**Sheet: 1 of 3**
Description of Equipment:	**Hydraulic Flushing and Testing Unit**					
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
6.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List	**Sheet: 2 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C. Hydraulic Circuits						
1.0			X		3/2-way valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way valves to be in open centred position; function lines to be pressureless	
3.0			X		Check lines to be pressureless; drain valves to be open	
4.0			X		Inspect fluid according to section 5.10.1 or 5.10.2	

6.9 Running Tool for Subsea Module

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Running Tool for Subsea Module**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
6.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
7.0			X		Inspect fluid according to section 5.11	

7 CAMTROL Subsea Production Control Equipment

Note: Use the instructions in this section as check lists.

7.1 Subsea Control Module / SCM

Check on the bill of material if individual “Shipping, Transportation and Storage Guidelines” are available for the SCM, otherwise follow the instructions below:

Verify: _____

Store the SCM in the crate until it is required for use.

If it is necessary to gain access to the SCM, remove the top and sides of the crate, but leave the SCM on the shipping frame.

Visually inspect the SCM / packing before use and every **3 month** when it is not used.

Verify: _____

The storage environment must be free from harmful substances which can affect resilient seals (i.e. high Ozone level).

Verify: _____

The ambient temperature for storage must be within the range -10°C to 40°C to maintain the integrity of the pressure compensation system and ensure that no dielectric oil bleeds out.

Verify: _____

CAUTION:
If the loss of dielectric oil exceeds 3 Litre the SCM needs to be refilled in accordance to Cameron “Field refill procedure”. The lower reservoir of the shipping frame is seized to 3 Litre. If you are in doubt please contact Cameron Germany Engineering Department (Tel +49 (0)5141 8060).

7.2 Subsea Accumulator Module / SAM

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Any damage occurring during the periodical checks must immediately be reported and repaired by Cameron Controls.

Verify: _____

Drain the hydraulic pressure from the accumulators.

Verify: _____

Bleed nitrogen pre-charge from the accumulators. Leave 10 BAR residual pressure in the accumulator to prevent the bladder from collapsing.

Verify: _____

Close the two (2) Gas Valves on the HP Accumulators.

Verify: _____

Open ends of Accumulators must be sealed by plugs or protective caps off stainless steel on the gas side off the accumulators.

Verify: _____

Lubricate all moving parts, except the Hydraquad hydraulic connectors, by water-resistant grease.

Verify: _____

Painting, frame and moving parts must be checked for damage.

Verify: _____

Stainless Steel parts must be protected by a thin film of non aggressive oil (Pelox Protector or similar).

Verify: _____

7.3 Subsea Distribution Unit / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.3.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Set all valves to CLOSE position.

Verify: _____

Protect the mounting base of the SAM by a protective cover.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes

Verify: _____

7.3.2 Electrical Parts

Check that all ROV connectable fuses are installed.

Verify: _____

Check that all electrical connectors are protected by caps

Verify: _____

7.4 Umbilical Termination Assembly / UTA

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.4.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes.

Verify: _____

7.4.2 Electrical Parts

Check that all electrical connectors are protected by caps.

Verify: _____

7.5 Foundation Base & Mud Mate for UTA / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Foundation Base only: Verify the proper operation of the two (2) pile locks and confirm that they are in the unlocked position.

Verify: _____

Check the SDU locking mechanism by operating.

Verify: _____

Check the guide post locking mechanism by operating.

Verify: _____

Inspect all lift shackles for deformation and other damage.

Verify: _____

Check condition of all protection anodes.

Verify: _____

8 Handling Requirements for Special Materials

8.1 Rubber Goods

GENERAL

There is very little published information on the storage and care of rubber goods as used in the oil field. When we speak of rubber goods we include the synthetic packings of Nitrile Copolymers and Neoprene as well as natural rubber parts. Natural rubber parts have become relatively rare but the same things that are harmful to natural rubber are also harmful to the synthetics in varying degrees.

Generally speaking, light and air are bad for rubber goods. The exact chemical action is not fully understood and what has been written disagrees on the mechanism involved.

Ozone is known to be bad for rubber goods. Ozone (O_3) is a very active form of oxygen. As far as we know two principle sources contribute the ozone that reaches rubber goods. One is atmospheric ozone which is generated in the stratosphere carried downward by convection currents and eventually absorbed by organic matter. The other source is electrical discharges, such as lightning, high voltage corona, but more commonly, electrical machinery. Ozone attack is characterized by fairly deep cracks in the rubber parts.

Rubber is attacked by ordinary oxygen (O_2) much as steel rusts in the presence of oxygen. Oxidation is characterized by a hard skin which eventually crazes in a multitude of small cracks and may turn chalky or assume a bark-like appearance.

A strong direct light, especially sunlight, has deleterious effects on rubber goods. This is attributed to the ultraviolet content of the spectrum which accelerates cracking. Whatever the mechanism however, light, particularly sunlight, is undesirable. In extremely cold climates some rubber goods will become so brittle that upon dropping or rough handling they will shatter.

In very warm humid climates, particularly those found in some parts of the tropics, fungi and bacteria find their way to the rubber goods and attack the organic content. This is especially true on duck reinforced rubber parts. However, parts reinforced with synthetics will not be attacked in the reinforcement.

Heat also has a bad effect on rubber. This could be the result of sunlight or artificial or accidental heating of any type. Heat results in a gradual hardening of the part and if ozone or oxygen are present, will accelerate their action.

Any stretching or bending of rubber in storage will result in very accelerated ageing. By the term ageing, we mean the cumulative effects of all the above mentioned attacking agents over a period of time. Ozone attacks rubber preferentially at points of strain.

Rubber goods, both natural and synthetic, all possess some degree of susceptibility to various solvents including water, but especially the liquid hydro-carbons. These manifest themselves in various ways by either swell or shrinkage of the rubber goods with which they are in contact.

No precise figure can be given as a "storage life" of a part. This is dependent on all of the above conditions and also the size of the part, its material and function. Generally speaking, the greater the relative surface area is to the volume, the more susceptible a part is to being rendered useless by ageing. For example, a relatively bulky part such as a ram front packer might be expected to have a much longer useful shelf life than a thin large diameter o-ring type of seal such as used on the bonnet seals of preventers or the rings in 'X' bushing.

STORAGE

From the preceding section we can draw a few rules governing storage of rubber goods. Briefly put - a cool, dry, dark storage place would be the best. The ideal would be to store the packings in vacuum sealed containers. The following rules, however, should not be difficult to follow under the average storage conditions experienced throughout our operation.

- Keep the rubber storage area as dark as possible. Certainly not out of doors, and, if indoors, away from skylights or windows and with subdued or indirect artificial lighting.
- Select the coolest location possible and be sure that no heaters or stoves are near by and particularly that the direct blast from a space heater does not blow on the rubber parts.
- Be sure that no electrical machinery (motors, switch gear, or any high voltage equipment producing corona) is near the rubber goods and that drafts will not carry the atmosphere from electrical machinery to the area in which the rubber goods are stored.
- The practice of first in - first out is essential with rubber goods. There is a natural tendency to remove parts from the front of a bin and when stock is replenished to leave the parts that are in the back in place, in which case years might pass before these are finally pulled out for use.
- Store rubber goods in a relaxed position. For example, do NOT hang o-rings on nails. Where possible, do not keep assemblies in stock where the rubber goods are stretched in order to assemble them on the part. For example, o-rings on blanking plugs, tubing hangers and 'X' bushing. In some cases this is difficult as it is with the aforementioned 'X' bushings. On these, periodic inspection should be employed to detect any signs of ageing as quickly as possible.

  On parts, such as the 'X' bushing rings, where we know the rubber parts will be stretched in storage, the best age resistant compounds we can buy are used.
- Keep storage as dry as possible and remove any oil, gas, etc. of hydro-carbon nature that may accidentally get on the rubber.
- Do not store the rubber goods on top shelves near galvanized roofs. There are several reasons for this; one is that heat is passed through galvanized roofing and also there is some opinion that ozone may be generated in this area.
- If possible, store rubber goods in buildings of wooden construction and wooden shelves. Wood is believed to scavenger ozone quite effectively.
- If store for extended periods is unavoidable, sealed containers will aid considerably; impervious surface coverings such as "Sea-Peel" or waxing will help.

USABILITY CHECKS

No general rule can be drawn regarding usability. The final measure is whether or not the cumulative effects of ageing have affected the physical properties of the part to such an extent that it will no longer perform the function for which it is designed. Thus, a large heavy part might suffer the same total amount of ageing as a small, light, thin piece, and still be usable whereas the small part is rendered useless. In these cases some judgement must be used in deciding usability.

Prior to shipment or use out of stock, rubber goods should be examined to see that no "chalking" or "barking" (bark-like surface appearance) is present, that there is not a hard skin on the rubber and that there are no cracks. Sometimes cracks will be obvious, but it is wise to stretch or bend the part in question so that any incipient cracks or very thin cracks will reveal themselves. Where a part is suspect, a check of hardness should be run. In the event that the hardness runs 15 points higher than the nominal hardness of the part, it is considered non-usable. Hardness is affected by temperature and readings should be taken with the rubber part at 70°F – 100°F (21°C - 38°C).

8.2 Hydraulic Hoses

STORAGE

- Before placing hose in storage, it should be completely drained.
- Whenever feasible, store the hose in the original wooden shipping crate. This will provide some protection against the deteriorating effects of solvents, corrosive liquids, ozone and sunlight. Hose should be stored so that the coils are in a horizontal plane.
- Certain rodents and insects will damage the hose. Adequate protection from them should be provided.
- The ideal temperature for storing the hose ranges from 50°F (10°C) to 70°F (21°C) with a maximum limit of 100°F (38°C). If stored below 32°F (0°C), the hose will become stiff and would require warming before placed in service. The hose should not be stored near sources of heat, such as radiators, base heaters, etc., nor should the hose be stored under conditions of high or low humidity.
- To avoid the adverse effects of high ozone concentration, the hose should not be stored near electrical equipment that may generate ozone or be stored for any lengthy period in geographical areas of known high ozone concentration. Exposure to direct or reflected sunlight - even through windows - should also be avoided.

HANDLING

CAUTION: Care should be exercised to prevent mishandling. Crushing or kinking of the hose can cause severe damage to the reinforcement. If this occurs, remove hose from service.

- In order to minimize the danger of kinking, the hose preferably should be removed from its crate by hand, laid out in a straight line, then lifted by means of a catline attached near one end of the hose. If a catline is used to remove the hose from its crate, the crate should be rotated as the hose is removed. Recommended practice is to protect the hose in some manner when moving to a new location. It is considered bad practice to handle the hose with a winch, to hand the hose from a truck gin pole, or to place heavy pieces of equipment on the hose.

8.3 Electronic Goods and Tools containing Electronics

8.3.1 General Instructions

Rapid temperature changes must be excluded to avoid condensation of humidity and mechanical stress.

The packing should protect electronic goods against:

- Dust
- Humidity
- Electrostatic Charge
- Shock
- Direct Sunlight

Generally the original transport packing serves the above requirements best.

Normally antistatic bags, desiccant and anti-shock pads are applied to prevent damage.

Electronic goods should be stored in a warehouse secured against theft.

8.3.2 Fiberoptic Terminations

Optic Link Modules (OLM) should be capped. Caps have to be removed before installation.

8.3.3 Handling Procedure for CMOS Devices

Electrical environments such as overvoltages and electrostatic discharges damage CMOS devices and printed circuit cards containing the devices. Most CMOS devices have diode input protection circuits and gate protection structures to protect against such electrical environments.

In addition to the internal protection network, use the following steps to prevent the generation of severe electrical transient voltages during handling of CMOS devices.

- Read the manufacturer's equipment specification and data sheets before performing maintenance. Do not exceed recommended maximum voltage levels.
- Use grounding wrist straps which contact the skin.
- Ground all work surfaces.
- If lead-straightening or hand-soldering is necessary, provide ground straps for the equipment, and ground the soldering ties.
- Connect all unused inputs to an appropriate logic voltage level, either power or ground.
- Inspect test equipment for proper polarity of voltage before conduction parametric or functional testing.
- Inspect all power supplies used for testing to ensure there are no voltage transients present.
- Do not insert or remove devices from test sockets with power applied.
- Do not contact edge connectors which are wired directly to device inputs.
- If external connections to a printed circuit card address only an input of the integrated circuit, use a resistance of 10 K ohms or greater in series with the input. The resistance limits damage to the card if it is removed and contacts static generating materials.
- Connect all low impedance equipment such as pulse generators to inputs only after the device has power applied. Disconnect the equipment before power is removed.
- Do not allow nylon or other static generating materials to contact the devices.
- Store or transport the devices in materials that are antistatic. Do not insert the devices into plastic packing material, styrofoam, or plastic trays.

8.3.4 Lithium Manganese Dioxide Battery

Replacement of the Lithium Manganese Dioxide battery mounted in the subsea transmitter & battery module: The battery supports the AMF-System (Automatic Mode Function / Dead Man System) belonging to multiplex drilling control systems. Under normal operation conditions replacement is required **after each one-year period**. Battery storage conditions should be in a range of 23°F – 59°F (–5°C to 15°C).

9 Attachment

- Data Sheets of Protective Materials (if required)
- Data Sheets of Hydraulic Fluids (if required)

STATUS: Released REVISION : 01
DATE PRINTED : 11/11/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : TOTAL K5F CONTROLS SYSTEM BOM

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
0010	0010	02	223380-25	1.000	EA	MASTER CONTROL STATION / TOTAL K5F		
0020	0020	02	223011-32	1.000	EA	HYDRAULIC POWER UNIT - TOTAL K5-F - Supplied by Koller		
0021	0030	05	223022-33	1.000	EA	PLC CABINET FOR PHPU TOTAL K5F		
0030	0040	01	223022-31	1.000	EA	EPCU, K5-F		
0040	0050	06	223398-98	1.000	EA	TOPSIDE UMBILICAL TERMINATION UNIT TOTAL K5-F		
0100	0060	11	223052-94	4.000	EA	eSCM Total / K5F electric SUBSEA CONTROL MODULE Production Control System Project: K5F Client: Total		
0101	0070	04	223052-98	4.000	EA	PRCM Total / K-5 Power Regulation and Communication Module Production Control System Project: K-5 Client: Total		
0102	0080	03	223445-06	4.000	EA	eSCM MOUNTING BASE (eSCMMB) WITH INTERFACE ISO 13628-8		
0103	0090	03	223415-99	4.000	EA	PRCM MOUNTING BASE (PRCMMB) WITH INTERFACE ISO 13628-8		
0104	0100	02	223170-50	4.000	EA	SUBSEA CATHODE PACKAGE ASSEMBLY SCPA, TOTAL K5-F DC		
0105	0110	05	223170-49	2.000	EA	SAPA, K5-F		
0106	0120	04	223398-99	1.000	EA	K5F UTA		
0107	0130	02	223211-01	1.000	EA	SAPA Anode, K5-F		
0120	0140	01	2197093-01-20	2.000	EA	Dual CANopen Press. TM Upstream (PPU) Process Pressure Range: 0 to 400 bar (Range: 0 to 690bar) Output: CANopen Protocol / Fault tolerant		
0121	0150	02	2197093-01-21	2.000	EA	Dual CANopen Temp. TM Upstream (PTU) Process Temperature Range: -60°C to 100°C Output: CANopen Protocol /		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						Fault tolerant		
0122	0160	01	2197093-01-22	2.000	EA	Dual CANopen Press. TM Downstream (PPD) Process Pressure Range: 0 to 400 bar (Range: 0 to 690bar) Output: CANopen Protocol / Fault tolerant		
0123	0170	02	2197093-01-23	2.000	EA	Dual CANopen Temp. TM Downstream (PTD) Process Temperature Range: -60°C to 100°C Output: CANopen Protocol / Fault tolerant		
0124	0180	04	223350-27	2.000	EA	DC ACTUATOR 3/4"		
0125	0190	03	223350-24	1.000	EA	DC ACTUATOR 2.1/16"		
0126	0200	04	223350-26	2.000	EA	DC ACTUATOR 5.1/8"		
0127	0210	02	223446-01	2.000	EA	Choke Top Level Assy for Prd.-Choke		
0128	0220	01	2197086-08-02	8.000	EA	Subsea Sensor J-Box (with 4 Recept.) Subsea Sensor Junction Box Position 1: 19-way connector, series 10 Position 2,3 and 4: 7-way connector, series 10 Orientations: (Position/Orientation): 1/C,2/C,3/C,4/C		
0129	0230	02	223233-91	2.000	EA	K5F TREE COUPLING SET		
0130	0240	11	223293-20	2.000	EA	3/2 Way SCSSV Dump Valve, K5-F		
0140	0250	01	2197093-01-24	2.000	EA	Dual CANopen Annulus Press. TM 'A' Process Pressure Range: 0 to 500 bar (Pressure Range: 0 to 690bar) Output: CANopen Protocol / Fault tolerant		
0141	0260	01	2197093-01-25	2.000	EA	Dual CANopen Annulus Press. TM 'B' Process Pressure Range: 0 to 500 bar (Pressure Range: 0 to 690bar) Output: CANopen Protocol / Fault tolerant		
0142	0270	04	223350-27	2.000	EA	DC ACTUATOR 3/4"		
0143	0280	03	223350-24	2.000	EA	DC ACTUATOR 2.1/16"		
0144	0290	01	2197086-08-01	4.000	EA	Subsea Sensor J-Box (with 4		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						Recept.) Subsea Sensor Junction Box Position 1: 19-way connector, series 10 Position 2,3 and 4: 7-way connector, series 10 Orientations: (Position/Orientation): 1/A,2/A,3/A,4/A		
0145	0300	03	2197086-09	2.000	EA	Subsea DHPT J-Box (with 3 Receptacles) Subsea DHPT Junction Box Position 1 and 3: 19-way connector, series 10 Position 4: 7-way connector, series 10 (Position/Orientation): 1/B,2/-,3/D,4/A		
0200	0310	01	2197089-18-19	1.000	EA	Jumper UTA to PRCM Type 6, blue, 10,0m		
0201	0320	01	2197089-18-20	1.000	EA	Jumper UTA to PRCM Type 6, blue, 10,5m		
0202	0330	01	2197089-18-65	1.000	EA	Jumper UTA to PRCM Type 6, yell, 8,0m		
0203	0340	01	2197089-18-74	1.000	EA	Jumper UTA to PRCM Type 6, yell, 12,5m		
0205	0350	01	2197089-24-17	2.000	EA	Jumper PRCM to Cath. Type 12, blue, 9,0m		
0206	0360	01	2197089-24-67	2.000	EA	Jumper PRCM to Cath. Type 12, yell, 9,0m		
0210	0370	01	2197089-17-11	1.000	EA	Jmpr. PRCM to Intrm.C. Type 5,blue, 6,0m		
0211	0380	01	2197089-17-23	1.000	EA	Jmpr. PRCM to Intrm.C.Type 5,blue, 12,0m		
0212	0390	01	2197089-17-61	1.000	EA	Jmpr. PRCM to Intrm.C.Type 5,yell, 6,0m		
0213	0400	01	2197089-17-69	1.000	EA	Jmpr. PRCM to Intrm.C.Type 5,yell, 10,0m		
0215	0410	01	2197089-21-12	2.000	EA	Jumper Interm.to eSCM Type 9,blue,3700mm		
0216	0420	01	2197089-21-54	2.000	EA	Jumper Interm.to eSCM Type 9,yell,1600mm		
0220	0430	01	2197089-14-05	2.000	EA	Jumper eSCM to Act. Type 2,blue,2500mm		
0221	0440	01	2197089-14-10	2.000	EA	Jumper eSCM to Act. Type 2,blue,3300mm		
0222	0450	01	2197089-14-12	2.000	EA	Jumper eSCM to Act. Type 2,blue,3600mm		
0223	0460	01	2197089-14-18	2.000	EA	Jumper eSCM to Act. Type 2,blue,4200mm		
0224	0470	01	2197089-14-20	2.000	EA	Jumper eSCM to Act. Type		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						2,blue,4400mm		
0225	0480	01	2197089-14-22	2.000	EA	Jumper eSCM to Act. Type 2,blue,4700mm		
0226	0490	01	2197089-14-30	2.000	EA	Jumper eSCM to Act. Type 2,blue,5600mm		
0227	0500	01	2197089-14-36	4.000	EA	Jumper eSCM to Act. Type 2,blue,6900mm		
0228	0510	01	2197089-14-60	2.000	EA	Jumper eSCM to Act. Type 2,yell,3400mm		
0229	0520	01	2197089-14-61	2.000	EA	Jumper eSCM to Act. Type 2,yell,3500mmCM		
0230	0530	01	2197089-14-65	2.000	EA	Jumper eSCM to Act. Type 2,yell,4100mm		
0231	0540	01	2197089-14-68	2.000	EA	Jumper eSCM to Act. Type 2,yell,4900mm		
0232	0550	01	2197089-14-70	4.000	EA	Jumper eSCM to Act. Type 2,yell,5100mm		
0233	0560	01	2197089-14-71	2.000	EA	Jumper eSCM to Act. Type 2,yell,5200mm		
0234	0570	01	2197089-14-76	2.000	EA	Jumper eSCM to Act. Type 2,yell,6500mm		
0235	0580	01	2197089-14-82	4.000	EA	Jumper eSCM to Act. Type 2,yell,7500mm		
0240	0590	01	2197089-20-03	2.000	EA	SS Jumper J.Box to Sensor Type 8 Lenght: 2000 mm; Colour Marking: Blue		
0241	0600	01	2197089-20-05	2.000	EA	SS Jumper J.Box to Sensor Type 8 Lenght: 3000 mm; Colour Marking: Blue		
0242	0610	01	2197089-20-20	2.000	EA	SS Jumper J.Box to Sensor Type 8 Lenght: 4400 mm; Colour Marking: Blue		
0243	0620	01	2197089-20-21	4.000	EA	SS Jumper J.Box to Sensor Type 8 Lenght: 4500 mm; Colour Marking: Blue		
0244	0630	01	2197089-20-24	4.000	EA	SS Jumper J.Box to Sensor Type 8 Lenght: 4800 mm; Colour Marking: Blue		
0245	0640	01	2197089-20-33	2.000	EA	SS Jumper J.Box to Sensor Type 8 Lenght: 6000 mm; Colour Marking: Blue		
0246	0650	01	2197089-20-36	2.000	EA	SS Jumper J.Box to Sensor Type 8 Lenght: 6300 mm; Colour Marking: Blue		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
0247	0660	01	2197089-20-53	2.000	EA	SS Jumper J.Box to Sensor Type 8 Lenght: 2000 mm; Colour Marking: Yellow		
0248	0670	01	2197089-20-54	2.000	EA	SS Jumper J.Box to Sensor Type 8 Lenght: 2500 mm; Colour Marking: Yellow		
0249	0680	01	2197089-20-68	2.000	EA	SS Jumper J.Box to Sensor Type 8 Lenght: 4200 mm; Colour Marking: Yellow		
0250	0690	01	2197089-20-70	2.000	EA	SS Jumper J.Box to Sensor Type 8 Lenght: 4400 mm; Colour Marking: Yellow		
0251	0700	01	2197089-20-71	2.000	EA	SS Jumper J.Box to Sensor Type 8 Lenght: 4500 mm; Colour Marking: Yellow		
0252	0710	01	2197089-20-75	2.000	EA	SS Jumper J.Box to Sensor Type 8 Lenght: 4900 mm; Colour Marking: Yellow		
0253	0720	01	2197089-20-86	4.000	EA	SS Jumper J.Box to Sensor Type 8 Lenght: 6300 mm; Colour Marking: Yellow		
0255	0730	01	2197089-19-09	2.000	EA	SS Jumper J.-Box to DHPT Sensor Type 7 Gisma BR 10/2/7 90° to Tronic 4-way Connector Lenght: 4500 mm; Colour Marking: -		
0260	0740	01	2197089-23-06	2.000	EA	SS Interm. Jumper to Act. Type 11 Subsea Jumper between Diver Panel (10/4/19 bulkhead) and Valve/Actuator(10/4/19, 90°) Lenght: 3500 mm; Colour Marking: Blue		
0261	0750	01	2197089-23-07	2.000	EA	SS Interm. Jumper to Act. Type 11 Subsea Jumper between Diver Panel (10/4/19 bulkhead) and Valve/Actuator(10/4/19, 90°) Lenght: 4000 mm; Colour Marking: Blue		
0262	0760	01	2197089-23-57	4.000	EA	SS Interm. Jumper to Act.		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						Type 11 Subsea Jumper between Diver Panel (10/4/19 bulkhead) and Valve/Actuator(10/4/19, 90°) Lenght: 4000 mm; Colour Marking: Yellow		
0265	0770	01	2197089-13-04	4.000	EA	Jumper eSCM to J-Box Type 1,blue,2400mm		
0266	0780	01	2197089-13-20	2.000	EA	Jumper eSCM to J-Box Type 1,blue,5700mm		
0267	0790	01	2197089-13-25	2.000	EA	Jumper eSCM to J-Box Type 1,blue,6300mm		
0268	0800	01	2197089-13-70	4.000	EA	Jumper eSCM to J-Box Type 1,yell,4200mm		
0269	0810	01	2197089-13-78	2.000	EA	Jumper eSCM to J-Box Type 1,yell,5100mm		
0270	0820	01	2197089-13-80	2.000	EA	Jumper eSCM to J-Box Type 1,yell,5500mm		
0280	0830	01	2197088-17-07	8.000	EA	SS Long Term Protec. Cover 10/1/1/female		
0281	0840	01	2197088-17-08	4.000	EA	SS Long Term Protec. Cover 10/2/7/male		
0282	0850	01	2197088-17-11	4.000	EA	Gisma Coax LTC, female Pressure watertight Longterm Protective Cap for Receptacle (e.g.2197088-17-10)		
0283	0860	01	2197088-17-20	4.000	EA	Gisma Sealing Cap Size 4 for 10/4/12 Receptacle Longterm Protective Cover		
0284	0870	01	2197088-17-21	4.000	EA	Gisma Sealing Cap Size 4 for 10/4/12 Plug Longterm Protective Cover		
0285	0880	01	2197088-17-22	16.000	EA	SS Long Term Protec. Cover 10/4/19/male		
0286	0890	01	2197088-17-24	4.000	EA	SS Long Term Protec. Cover 10/1/1/male		
0287	0900	01	2197088-17-25	4.000	EA	SS Long Term Protec.Cover 80/3/12/female		
0288	0910	01	2197088-17-26	4.000	EA	SS Long Term Protec. Cover 80/1/1/female		
>>>B/M Category : Engrg Spec/Document item								
0900	0920	10	SK-066001-88	1.000	EA	GENERAL ARRANGEMENT : PRODUCTION CONTROL SYSTEM		
0901	0930	02	SK-066001-88-04	1.000	EA	Total K5F System INTERCONNECTION DIAGRAM		
0902	0940	03	SK-066001-88-38	1.000	EA	BD: Factory Integration Test Block Diagram for Factory		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						Integration Test		
0903	0950	01	X-076721-87	1.000	EA	K5F-Subsea and Topside Funct. Req. Spec.		
0904	0960	02	X-076721-87-01	1.000	EA	K5F-Supplemental Req. Spec. for MCS HW		
0905	0970	01	X-076721-87-04	1.000	EA	K5F-Supplemental Req. Spec. for EPCU		
0906	0980	01	X-076721-87-05	1.000	EA	K5F-Supplemental Req. Spec. for HPU		
0907	0990	01	X-076721-87-06	1.000	EA	K5F-Supplemental Req. Spec. for TUTU		
0908	1000	01	X-076721-87-11	1.000	EA	K5F-Supplemental Req. Spec. for Tree/ Wellhead Instrumentation		
0909	1010	01	X-076721-87-12	1.000	EA	K5F-Supplemental Req. Spec. for MCS/ICSS Control Interface		
0910	1020	01	X-065451-04-05	1.000	EA	Hazardous Area Equipment List, K5-F		
0911	1030	01	X-076702-01-50	1.000	EA	Total K5F - FIT Procedure		
0912	1040	01	X-065451-04-44	1.000	EA	K5F - Instrument List		
0913	1050	01	X-076721-87-18	1.000	EA	FDS HPU PLC Cabinet		
0914	1060	01	X-065443-70	1.000	EA	K5F - Accu, Tank, Pump Calculation		
0915	1070	02	X-065451-04-06	1.000	EA	Topside Cable List, K5-F		
0916	1080	01	X-065451-04-07	1.000	EA	Electrical load list, K5-F		
0917	1120	01	X-065451-04-44	1.000	EA	K5F - Instrument List		
0918	1130	01	X-076721-87-07	1.000	EA	K5F-Supplemental Req. Spec. for UTA		
0919	1140	01	X-076721-87-08	1.000	EA	K5F-Supplemental Req. Spec. for ESCM		
0920	1150	01	X-076721-87-14	1.000	EA	K5F-Supplemental Req. Spec. for PRCM Control and Management		
0921	1160	01	X-065451-04-05	1.000	EA	Hazardous Area Equipment List, K5-F		
>>>B/M Category : Optional item								
1001	1100		619011-53	1.000	LI	OIL CASTROL TRANSAQUA HT 1.07 g/cm3 WATER BASED HYDRAULIC CONTROL FLUID VISKOSITY AT 40°C: 2.2 CST DENSITY: 1.07 g/cm3 POUR POINT: -42°C		
1002	1110	01	223260-99	1.000	EA	SCM/SAM LIFTING EYE ASSY		
1003	1170	02	223001-88-00-98	1.000	EA	Total K5F - Topside Commissioning Spares		
>>>B/M Category : Reference Call Outs								
1000	1090	06	SP-003118-15	1.000	EA	TOTAL K5F Project Quality Plan		

STATUS: Released REVISION : 02
DATE PRINTED : 11/11/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Total K5F - Topside Commissioning Spares

SORT ITEM INDI No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item							
0010 0010		619091-01-50-10	2.000	EA	POWER SUPPLY, 24 V DC, 10 A PRIMARY SWITCHED-MODE, 1-phase TYPE: QUINT-PS-100-240AC/24DC/10 NOM. INPUT VOLT.: 100 - 240 V AC NOM. OUTPUT VOLT.: 24 V DC +/- 1 % OUTPUT CURRENT: 10 A (UP TO 60°C) FREQUENCY: 45 / 65 Hz PROTECTION: IP 20 AMB. TEMP.: -25°C / +70°C W x H x D: 85 x 130 x 130 mm APPROVAL: UL & GL	for MCS and HPU PLC Cabinet	
0020 0020		619091-03-14	2.000	EA	CONVERTER, FIBER OPTIC, 24 V DC TYPE: FL MC 10/100 BASE-T/FO G1300ST NOM. SUPPLY VOLT.: 24 V DC +/- 20%. CURRENT CONSUMPTION: MAX. 95 mA. ELEC. ISOLATION: 10/100Base-T // SUPPLY. PROTECTION: IP 20. TEMP.: 0°C / +55°C. HOUSING: PA V0 , GREEN. L X H X W: 99 X 122 X 22.5 mm. FOR CONVERTING 10/100 BASE-T(X) TO MULTIMODE GLASS FIBER (1300 mm), B-FOC (ST) FO CONNECTION, RAIL-MOUNTABLE. CONFORMANCE WITH EMC DIRECTIVE 89/336/EEC.	for MCS and HPU PLC Cabinet	
0030 0030	01	2711927-02-01	2.000	EA	MODULE, CPU, 315-2 PN/DP, 256 KB RAM, CPU WITH PROFIBUS-DP/MPI AND PROFINET INTERFACES, 24VDC, TYPICAL POWER	for MCS and HPU PLC Cabinet	

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						DISSIPATION: 3.5W, IP20, OPERATING TEMP: 0 TO 60DEGC, MICRO MEMORY CARD REQUIRED, HAZARDOUS AREA AND CE CERTIFICATION REQUIRED		
0040	0040		2761883-02	2.000	EA	SIMATIC S7, MICRO MEMORY CARD, 64KB	for MCS and HPU PLC Cabinet	
0050	0050		619095-05-46	3.000	EA	SIMATIC S7, DIGITAL INPUT SM 326 24 DI ; DC 24 V, 40 PIN, FAILSAFE DIGITAL INPUTS FOR SIMATIC S7F SYSTEMS, WITH DIAGNOST. INTERRUPT.	for MCS and HPU PLC Cabinet	
0060	0060		619095-06-33	3.000	EA	DIGITAL OUTPUT, SM 322, 16 DO, 24 V FOR THE SIMATIC S7-300 OPTICALLY ISOLATED 16 DO DC 24 V, 0.5 A (1 X 16 DO) SHORT-CIRCUIT PROTECTION DIAGNOSTICS 40 PIN	for MCS and HPU PLC Cabinet	
0070	0070		619095-04-20	1.000	EA	S7-300,AI,SM 331,8X(4...20)MA VOLTAGE: DC 24V, MAX.: 20 MA 8 INPUTS	for HPU PLC Cabinet	
0080	0080		619092-01-41-06	1.000	EA	MINIATURE CIRCUIT BREAKER TYPE: S 202 M-C 6 VOLT.: 440 V AC / 125 V DC NO. OF POLES: 2 NO CURRENT: 6 A CHARACTERISTIC: C	for HPU PLC Cabinet	
0090	0090		619092-01-41-10	3.000	EA	MINIATURE CIRCUIT BREAKER TYPE: S 202 M-C 10 VOLT.: 440 V AC / 125 V DC NO. OF POLES: 2 NO CURRENT: 10 A CHARACTERISTIC: C	for MCS and HPU PLC Cabinet	
0100	0100		619092-01-41-16	3.000	EA	MINIATURE CIRCUIT BREAKER TYPE: S 202 M-C 16 VOLT.: 440 V AC / 125 V DC NO. OF POLES: 2 NO CURRENT: 16 A CHARACTERISTIC: C	for MCS and HPU PLC Cabinet	
0110	0110		619092-05-04	4.000	EA	AUX. SWITCH FOR CIRCUIT BREAKER TYPE: S 2C-H11 L CONTACTS: 1 NO AND 1 NC PERMANENT CURRENT: 5 A	for MCS and HPU PLC Cabinet	
0120	0120		619092-14-22-02	10.000	EA	FUSE, GLASS, TUBE 4A MIDDLE	for HPU PLC Cabinet	

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						5 X 20MM, 250 VAC		
0130	0130		619092-14-14-02	80.000	EA	FUSE GLASS-TUBE 5 x 20 mm, MIDDLE 250 V AC 0.63 A	for MCS and HPU PLC Cabinet	
0140	0140		619044-01-08-02	2.000	EA	ENCL. INTERNAL THERMOSTAT, 5 - 55°C SET. RANGE: +5°C / +55°C OPER. VOLT.: 230/115/60/48/24 V (AC), 60/48/24 V (DC). BI-METAL SENSOR AS A TEMPERATURESENSITIVE ELEMENT WITH THERMAL FEEDBACK. CONTACT POPULATION: SINGLE-PIN CHANGE-OVER CONTACT AS A QUICK-BREAK CONTACT. W X H X D: 71 X 71 X 33.5 mm APPROVALS: CE, CUL, UL & VDE	for HPU PLC Cabinet	
0150	0150		619038-01-73	1.000	EA	HEATER, ENCLOSURE, 110 - 240 V, 50 W W. SPECIAL CONN. CABLE: 3000 mm LG. OPER. VOLT.: 110 - 240 V AC/DC CONT. THERMAL OUTPUT AT 20°C: 50 W PRE-FUSE: 4 A ; PROTECTION: IP 40 HOUSING: BLACK ANODISED ALU. TEMP.: MAX. +65°C +/-5°C W X H X D: 64 X 185 X 54 mm APPROVALS: VDE, UL, CUL & CE CONF.	for HPU PLC Cabinet	
0160	0160		619084-13-01	8.000	EA	VCI 105 CORROSION-INHIBITOR PAD 20 x 50,8 mm 140 lt 2 YEARS STEEL,BRASS;CU,Al YELLOW	for HPU PLC Cabinet	
0170	0170		619032-02-24-99	4.000	EA	FILTER ELEMENT FOR 619032-02-23 / -24 MESH DIA.: 3 MICRON DIFF. PRESS.: 30 BAR MATERIAL: MICRO GLASS / AISI 316 TI	for HPU	

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						SEAL: VITON		
0180	0180		619032-02-26-99	8.000	EA	FILTER ELEMENT FOR PN 619032-02-26 MESH DIA.: 3 MICRON DIFF. PRESS.: 30 BAR MATERIAL: MICRO GLASS / AISI 316 Ti SEAL: VITON	for HPU	
0190	0190		619032-01-97-99	5.000	EA	STRAINER ELEMENT 64ES 600 MICRON 1" SST	for HPU	
0200	0200		619089-25-21-01	7.000	EA	EX LENS FOR LAMP MODULE, RED PROTECTION: IP 66/67, Ex II 2GD EEx e II ENCLOSURE: THERMOPLASTIC SEAL: NBR FOR OFFSHORE AREA CERT.: PTB 00 ATEX 3114 U	for HPU	
0210	0210		619089-25-21-02	2.000	EA	EX LENS FOR LAMP MODULE, GREEN PROTECTION: IP 66/67, Ex II 2GD EEx e II ENCLOSURE: THERMOPLASTIC SEAL: NBR FOR OFFSHORE AREA CERT.: PTB 00 ATEX 3114 U	for HPU	
0220	0220		619043-02-02	1.000	EA	REGULATOR, PRESS., 14-700 BAR, SST CONN.: 1/4" NPT INLET PRESS.: MAX. 700 BAR OUTLET PRESS.: 14 - 700 BAR MEDIUM: GAS AND FLUID HOUSING: SST 316 ; SEAL: BUNA-N	for HPU	
0230	0230		619044-01-12-01	1.000	EA	SOCKET FOR POWER SUPPLY THROUGH-WIRING FOR SELF-ASSEMBLY APPROVAL: CE 1 187 110 SUIT. FOR PN 619038-02-02	for MCS	
0240	0240		2762726-01-99	2.000	EA	FLUORESCENT LAMP FOR PN 2762726-01	for MCS	
0250	0250		619089-12-17	1.000	EA	SPEED CONTROL, +20°C / +55°C, 230 V FOR FAN-AND-FILER & HEAT EXCHANGERS SET. RANGE: +20°C / +55°C FAN OUTPUT: MAX. 250 W OR 1.5 A PHASE CROSS-OVER WITH MICROCONTROLLER FOR	for MCS	

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						MOUNTING ON 35 mm SUPPORT RAIL INSTALLED IN A PK ENCLOSURE 9512.100, NTC SENSOR, LENGTH 1.80 m. W x H x D: 94 x 57 x 180 mm APPR.: CE 3 082 710 ; CUL E203342 ; UL E203342		
0260	0260		619097-27	1.000	EA	EX REDUDANCY MODULE, QUINT-DIODE/40 NOM. INPUT VOLT.: 24 V DC INPUT CURRENT: MAX. 30 A OPER. TEMP.: -25°C / +70°C PROT: EX II 3G EEx nA IIC T4, IP 20 TYPE OF CONN.: SCREW CONNECTION L x W x H: 102 x 62 x 84 mm Ex-Cert.: KEMA 03 ATEX 1197X	for MCS	
0270	0270		619095-11-31	2.000	EA	BUS CONNECTOR, 9 WAY, PG CONN. TYPE: EASYCONN PB 90° DATA RATE: 12 MBIT/S END RESISTOR WITH BREAK FUNKTION WITH PG CONNECTION TEMP.: -20°C / +75°C STATUS INDICATION VIA INTGR. LEDS RETARDANT ACC. TO VDE 0472, PART 804, ICE 332,1	for MCS	
0280	0280		619087-12-05	5.000	ME	DISCONTINUED, USE 619087-12-08 or 619087-12-05-01. PROFIBUS CABLE TYPE: 6XV1 830-0CH10 CROSS SECTION: 1 x 2 x 0.64 mm2. NOM. VOLT.: 100 V ISOLATION: FRNC COLOUR: LIGHT VIOLET LICENCE: VDE 0472 PART 804 B	for MCS	
0290	0290		619092-02-02-09	2.000	EA	CONTACTOR, 230 VAC, 6 A, 2 NO, 2 NC TYPE: 3RH11 ; SERIES: S00 VOLTAGE: 230 V AC ; CURRENT: 6 A CONTACTS: 2 NO & 2 NC	for MCS	
0300	0300		619092-02-02-19	10.000	EA	INPUT OPTOCOUPLER TERMINAL	for MCS	

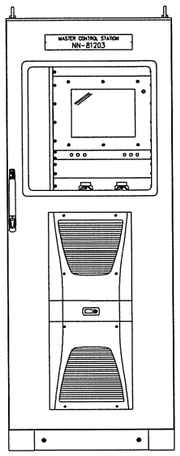
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						BLOCK TYPE: DEK-OE- 24DC/48DC/100. INPUT VOLT.: 24 V DC. OUTPUT VOLT.: 3 - 48 V DC. LIMIT. CONTI. CURRENT: 100 mA. TRANSMISSION FREQUENCY: 300 kHz. LED: YELLOW. TYPE OF CONN.: SCREW CONNECTION		
0310	0310		619097-02-01	4.000	EA	DIODE MODULE, EMG 45-DIO 8E-1N5408 WITH 8 DIODES, INDIVIDUALLY WIRED. DIODE TYPE 1N 5408. OPER. VOLT.: MAX. 250 V AC. CURRENT PER DIODE: 1 (1.5) A. TEMP.: -20°C / +50°C. L X W X H: 75 X 45 X 55 mm.	for MCS	
0320	0320	01	2197095-29-03	1.000	EA	Master Control Station Server PC Kontron PxV206, 19", 2HE Pentium 4, 3,0 GHz; 256 MB DDR; 1 GB RAM Removable HDD 36GB SCSI; ATAPI 5,25" Multinorm DVD	for MCS	
0330	0330		619095-63-11	1.000	EA	MONITOR, 17" TFT, 1280 X 1024 482.6 MM (19") X 8 HE FRONT PLATE IN LIGHT GREY RAL 7035 , OSD WITH PROTECTION GLASS BRIGHTNESS: 230 cd/m2 COLOUR: 16.7 MIO. VIEWING ANGLE (H/V): 170° / 170° CONTRAST RATIO: 400:1 INPUT VOLT.: 100 - 240 V AC VIDEO INPUT ANALOG RGB 15 PIN D-SUB	for MCS	
0340	0340		619095-70-11	1.000	EA	INDUSTRY KEYBOARD, TKS-088a IN 19"-DRAWER WITH TOUCHPAD TYPE: TKS-088a-TOUCH-SCHUBL-PS/2-US NO. OF KEY: 88 INTERFACE: PS/2 ; US-LAYOUT PROTECTION: IP 65 OPER. TEMP.: 0°C / +50°C SIZE: 482.6 x 43.5 x 280 mm	for MCS	

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						(19" , 1 HE) FRONT PLATE: ALUMINIUM		
0350	0350		619095-13-24	4.000	EA	INTEL PRO/100S SERVER ADAPTER IEEE STANDARD/NETWORK TOPOLOGY: 10BASE-T, 100BASE-TX WIRING AND CONNECTORS: CAT-5, 2 PAIR, RJ45 ORDER CODE: PILA8470C3	for MCS	
0360	0360		619095-64-03	1.000	EA	AutoView 1515 KVM SWITCH, 8 PORTS FOR 2 USERS WITH OSD INCL. RACK MOUNT OPER. VOLT.: 100 - 240 VAC, 50/60 Hz POWER INPUT: MAX. 40 W OPER. TEMP.: +10°C / +50°C W X H X D: 431.8 X 44.4 X 279.4 mm	for MCS	
0370	0370		619095-64-03-98	1.000	EA	INTEGRATED ACCESS CABLE, 3 ME TYPE: PS/2 CAT 5-IAC	for MCS	
0380	0380		619095-11-42-01	2.000	EA	MANAGED INDUSTRIAL ETHERNET SWITCH LAYER 2 SWITCH WITH SOFTWARE ENHANCED, ETHERNET (10 MBIT/S) AND FAST ETHERNET (100 MBIT/S). TYPE: RS20-1600T1T1SDAEHH01.0. PORT TYPE & QTY.: 16 X 10/100BASE-TX, TP CABLE, RJ45 SOCKETS, AUTO- CROSSING, AUTO-NEGOTIATION, AUTO-POLARITY. OPER. VOLT.: 24 V DC DIAGNOSTICS: LED MTBF: 23.4 YEARS; MIL-HDBK 217F: GB 25°C MOUNTING: DIN RAIL 35 mm W X H X D: 110 X 131 X 111 mm APPR.: CUL 508, CUL 1604 & GER. LLOYD.	for MCS	
0390	0390		619095-11-43	2.000	EA	ENTRY LEVEL INDUSTRIAL ETHERNET RAIL SWITCH, STORE AND FORWARD SWITCHING MODE, ETHERNET (10 MBIT/S)	for MCS	

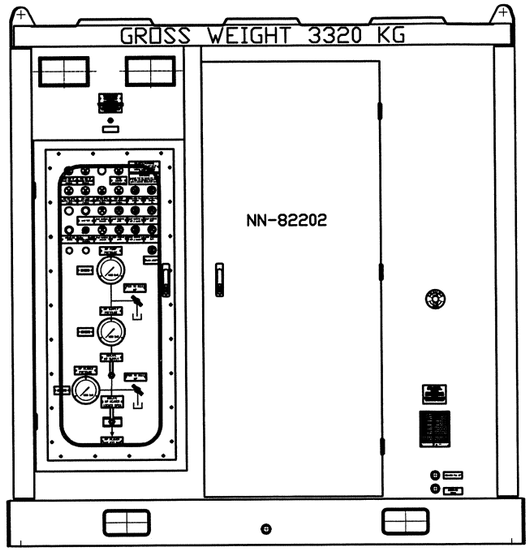
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						AND FAST ETHERNET (100 MBIT/S). TYPE: SPIDER 5TX PORT TYPE & QTY.: 5 X 10/100BASE-TX, TP CABLE, RJ45 SOCKETS, AUTO- CROSSING, AUTO-NEGOTIATION, AUTO-POLARITY. OPER. VOLT.: 9.6 - 32 V DC DIAGNOSTICS: LED MTBF: 123.7 YEARS; MIL-HDBK 217F: GB 25°C MOUNTING: DIN RAIL 35 mm W X H X D: 25 X 114 X 79 mm APPR.: CUL 508 (E175531)		
	0400	0400	619095-68-20	2.000	EA	PATCH CABLE, FTP CROSSOVER, 0.3 ME - CATEGORY 5E, CLASS D+, 10/100/1000 BaseT SUPPORT LENGTH: 0.3 ME GREY WITH RED CONNECTOR ALTERNATIVE: VENDOR: ZAJADACZ MANUFACTURER: ELCOTRONIC LENGTH: 0,5ME COLOR: RED CONNECTOR: BLACK/RED	for MCS	
	0410	0410	619088-02-29	2.000	EA	TERMINAL BOX, FL CAT5 PASSIVE COONECTION FIELD, 4 X SCREW TERMINAL BLOCK ON RJ45 FEMALE CONNECTOR, PIN ASSIGNMENT 1,2,3,6, SHIELD CONTACTING TO MOUNTING RAIL, (MINI PATCH FIELD) AS AN ALTERNATIVE TO ON-SITE ASSEMBLY WITH PRE-ASSEMBLED RJ45 PATCH CABLES.	for MCS	
>>>B/M Category : Engrg Spec/Document item								
	0420	01	QP-000160-01-17	1.000	EA	QP for Controls Part lists		

TOPSIDE EQUIPMENT

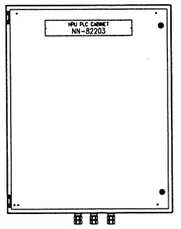
10
MASTER CONTROL STATION (1x)
(MCS)
PN: 223380-25



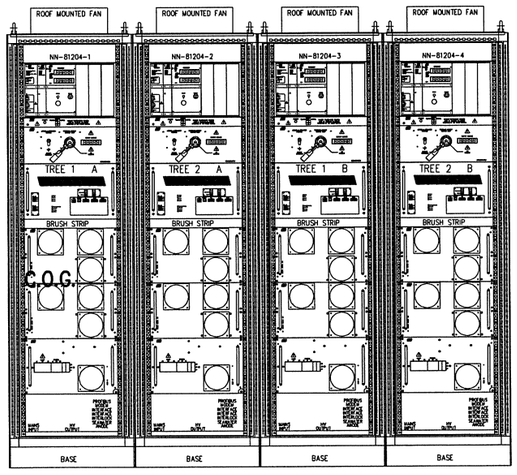
20
HYDRAULIC POWER UNIT (1x)
(HPU)
PN: 223011-32



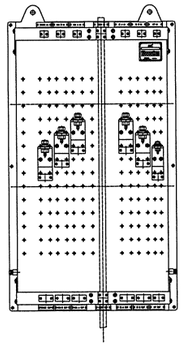
21
PLC CABINET (1x)
PN: 223022-33



30
ELECTRICAL POWER AND COMMUNICATION UNIT (1x)
(EPCU)
PN: 223022-31



40
TOPSIDE UMBILICAL TERMINATION UNIT (1x)
(TUTU)
PN: 223398-98



TOLERANCES ACCORDING TO DIN ISO 8015	SURFACE TREATMENT	DO NOT SCALE	
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	MATERIAL AND HEAT TREATMENT	DRAWN: H.J. Pape	DATE: 19.05.2008
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K		CHECKED: T. Appel	DATE: 19.05.2008
EST. WEIGHT: N/A KG	SUPERSEDES:	APPROVED: A. Weilandt	DATE: 19.05.2008
		SCALE:	

REV. BY:	DATE:	REV.:
H.-J. Pape	19.05.2008	10

CAMERON

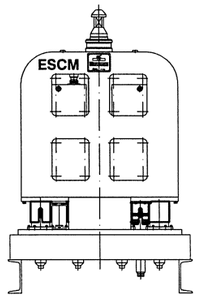
CAMERON GmbH
Lilienweg 1
29227 Celle, Germany

SCOPE OF SUPPLY
PRODUCTION CONTROL SYSTEM
TOTAL K5F

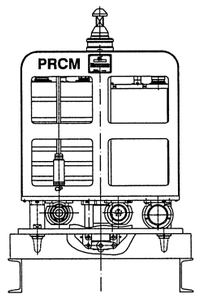
INITIAL USE FROM:	SHEET	DRAWING NUMBER:
223001-88	10F4	SK-066001-88

SUBSEA CONTROL MODULES & MOUNTING BASES & DISTRIBUTION EQUIPMENT

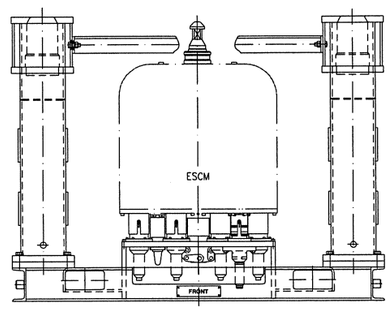
100
ELECTRIC SUBSEA CONTROL MODULE (4x)
(ESCM)
PN: 223052-94



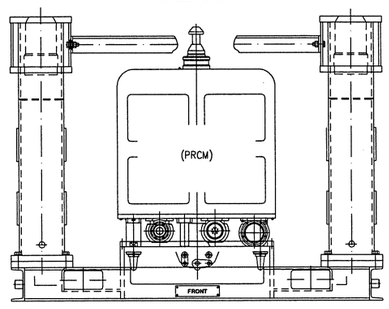
101
POWER REGULATION AND COMMUNICATION MODULE (4x)
(PRCM)
PN: 223052-98



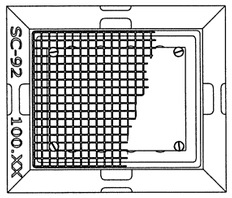
102
ELECTRIC SUBSEA CONTROL MODULE MOUNTING BASE (4x)
(ESCMMB)
PN: 223445-06



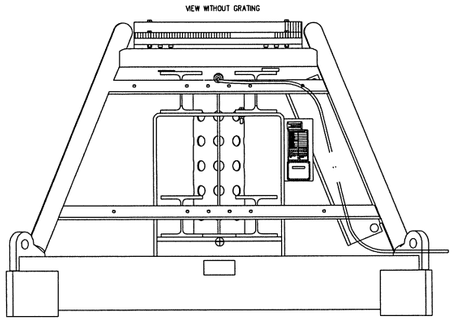
103
POWER REGULATION AND COMMUNICATION MODULE
MOUNTING BASE (4x)
(PRCMMB)
PN: 223415-99



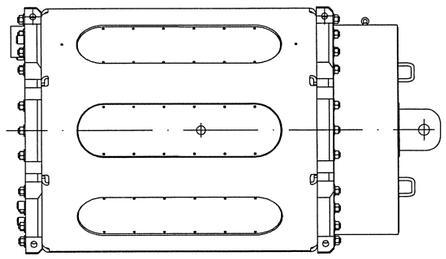
104
SUBSEA CATHODE PACKAGE ASSEMBLY (4x)
(SCPA)
PN: 223170-50



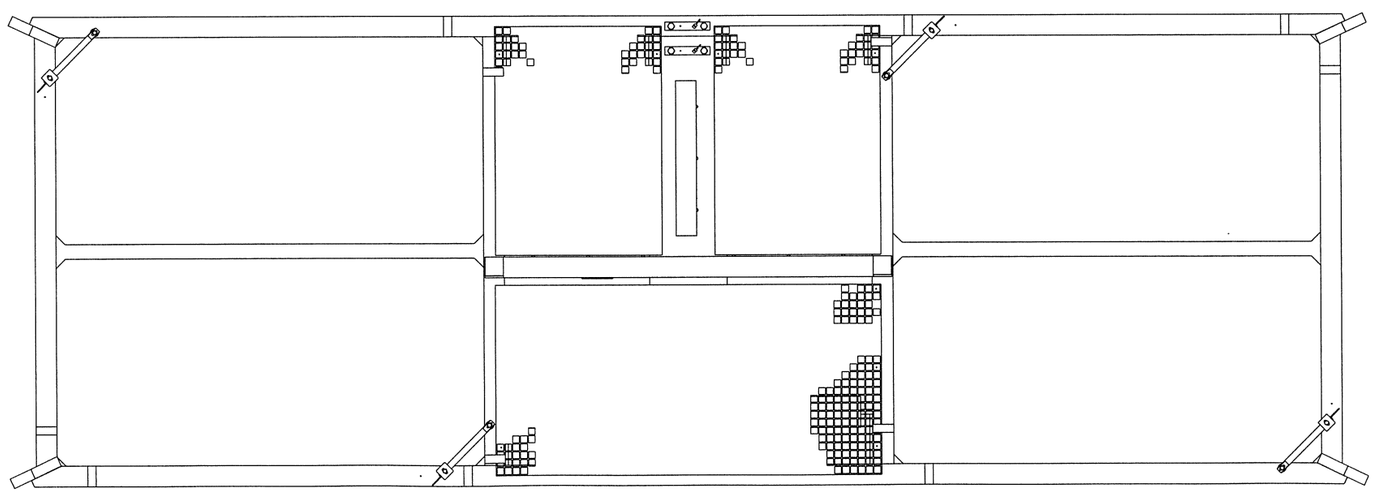
105
SUBSEA ANODE PACKAGE ASSEMBLY (2x)
(SAPA)
PN: 223170-49



106
UMBILICAL TERMINATION ASSEMBLY (1x)
(UTA)
PN: 223398-99



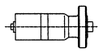
107
SUBSEA ANODE PACKAGE ASSEMBLY (2x)
FOUNDATION BASE (1x)
(SAPAFB)
PN: 223211-01



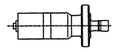
TOLERANCES ACCORDING TO DIN EN 8015	SURFACE TREATMENT:	DO NOT SCALE	REV. BY: H.-J. Pope — DATE: 19.05.2008 — REV.: 10
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	MATERIAL AND HEAT TREATMENT	DRAWN: H.-J. Pope — DATE: 19.05.2008	CAMERON GmbH, Lückenweg 1, 29227 Celle, Germany
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K		CHECKED: T. Appel — DATE: 19.05.2008	SCOPE OF SUPPLY PRODUCTION CONTROL SYSTEM TOTAL K5F
EST. WEIGHT: 000 KG	SUPERSEDES:	APPROVED: A. Weiland — DATE: 19.05.2008	INITIAL USE BOM: 223001-88 — SHEET: 2 OF 4 — DRAWING NUMBER: SK-066001-88
SCALE: /			

TREE MOUNTED CONTROLS EQUIPMENT (FOR 2 TREES)

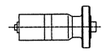
120
PRODUCTION PRESSURE SENSOR UPSTREAM (2x)
(PPU)
PN: 2197093-01-20



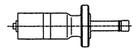
121
PRODUCTION TEMPERATURE SENSOR UPSTREAM (2x)
(PTU)
PN: 2197093-01-21



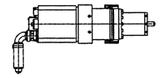
122
PRODUCTION PRESSURE SENSOR DOWNSTREAM (2x)
(PPD)
PN: 2197093-01-22



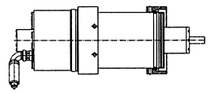
123
PRODUCTION TEMPERATURE SENSOR DOWNSTREAM (2x)
(PTD)
PN: 2197093-01-23



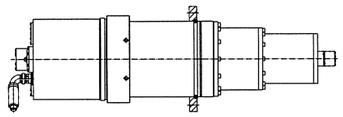
124
3/4" ACTUATOR (6x)
PN: 223350-27



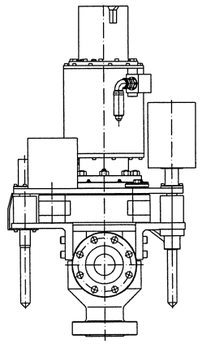
125
2" ACTUATOR (2x)
PN: 223350-24



126
5" ACTUATOR (4x)
PN: 223350-26

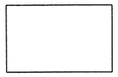


127
CHOKE ASSY IND. ACTUATOR; INSERT CHOKE HOUSING
PN: 223446-01

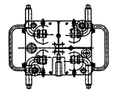


128
TREE MOUNTED JUNCTION BOX (8x)
PN: 2197086-08-02

129
COUPLING SET (2x)
PN: 223233-91

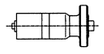


130
SCSSV DUMP VALVE ASSEMBLY (2x)
PN: 223293-20

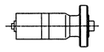


WELLHEAD MOUNTED CONTROLS EQUIPMENT (FOR 2 WELLHEADS)

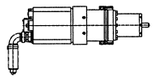
140
ANNULUS "A" PRESSURE SENSOR (2x)
(APT A)
PN: 2197093-01-24



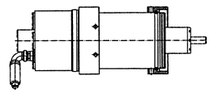
141
ANNULUS "B" PRESSURE SENSOR (2x)
(APT B)
PN: 2197093-01-25



142
3/4" ACTUATOR (2x)
PN: 223350-27



143
2" ACTUATOR (2x)
PN: 223350-24



144
WELLHEAD JUNCTION BOX (4x)
PN: 2197086-08-01

145
DHPT JUNCTION BOX (2x)
PN: 2197086-09

	SURFACE TREATMENT	DO NOT SCALE	
TOLERANCES ACCORDING TO DIN ISO 8015		DRAWN: H.-J. Pape	DATE: 19.05.2008
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	MATERIAL AND HEAT TREATMENT	CHECKED: T. Appel	DATE: 19.05.2008
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN EN 22768 m,K		APPROVED: A. Weilandt	DATE: 19.05.2008
EST. WEIGHT: N/A	NO SUPERSEDES:	SCALE:	

REV. BY:	DATE:	REV.:
H.-J. Pape	19.05.2008	10

CAMERON

CAMERON GmbH
LDickamreg 1
29227 Celle, Germany

SCOPE OF SUPPLY
PRODUCTION CONTROL SYSTEM
TOTAL K5F

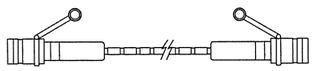
INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223001-88	3 OF 4	SK-066001-88

ELECTRICAL SUBSEA JUMPERS

200 TO 203
ELECTRICAL JUMPER
UTA TO PRCM (TYPE6)

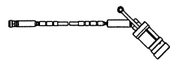
DIFFERENT LENGTH, EACH 10FF ITEM

PN: 2197089-18-19
PN: 2197089-18-20
PN: 2197089-18-65
PN: 2197089-18-74



205 TO 206
ELECTRICAL JUMPER
PRCM TO CATHODE PACKAGE (TYPE12)

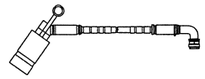
PN: 2197089-24-17 (2x)
PN: 2197089-24-67 (2x)



210 TO 213
ELECTRICAL JUMPER
PRCM TO INTERMEDIATE CONNECTION
AT TREE PANEL (TYPE5)

DIFFERENT LENGTH, EACH 10FF ITEM

PN: 2197089-17-11
PN: 2197089-17-23
PN: 2197089-17-61
PN: 2197089-17-69



215 TO 216
ELECTRICAL JUMPER
INTERMEDIATE CONNECTION
AT TREE PANEL TO ESCM (TYPE9)

PN: 2197089-21-12 (2x)
PN: 2197089-21-54 (2x)

220 TO 235
ELECTRICAL JUMPER
TO ACTUATOR (TYPE2)

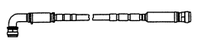
PN: 2197089-14-05 (2x)
PN: 2197089-14-10 (2x)
PN: 2197089-14-12 (2x)
PN: 2197089-14-18 (2x)
PN: 2197089-14-20 (2x)
PN: 2197089-14-22 (2x)
PN: 2197089-14-30 (2x)
PN: 2197089-14-36 (4x)
PN: 2197089-14-60 (2x)
PN: 2197089-14-61 (2x)
PN: 2197089-14-65 (2x)
PN: 2197089-14-68 (2x)
PN: 2197089-14-70 (4x)
PN: 2197089-14-71 (2x)
PN: 2197089-14-76 (2x)
PN: 2197089-14-82 (4x)

240 TO 253
ELECTRICAL JUMPER
JUNCTION BOX TO SENSORS (TYPE8)
AND SCSSV DVA

PN: 2197089-20-03 (2x)
PN: 2197089-20-05 (2x)
PN: 2197089-20-20 (2x)
PN: 2197089-20-21 (4x)
PN: 2197089-20-24 (2x)
PN: 2197089-20-33 (2x)
PN: 2197089-20-36 (2x)
PN: 2197089-20-53 (2x)
PN: 2197089-20-54 (2x)
PN: 2197089-20-68 (2x)
PN: 2197089-20-70 (2x)
PN: 2197089-20-71 (2x)
PN: 2197089-20-75 (2x)
PN: 2197089-20-86 (4x)

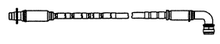
255
ELECTRICAL JUMPER
JUNCTION BOX TO DHPT (TYPE7)

PN: 2197089-19-09 (2x)



260 TO 262
ELECTRICAL JUMPER
WELLHEAD DIVER PANEL
TO WELLHEAD ACTUATOR (TYPE11)

PN: 2197089-23-06 (2x)
PN: 2197089-23-07 (2x)
PN: 2197089-23-57 (4x)



265 TO 270
ELECTRICAL JUMPER
ESCM TO TREE / WELLHEAD
JUNCTION BOXES (TYPE1)

PN: 2197089-13-04 (4x)
PN: 2197089-13-20 (2x)
PN: 2197089-13-25 (2x)
PN: 2197089-13-70 (4x)
PN: 2197089-13-78 (2x)
PN: 2197089-13-80 (2x)

280 TO 288
SET OF ELECTRICAL LONG TERM
PROTECTION COVERS
(SEVERAL TYPES)

PN: 2197088-17-07 (8x)
PN: 2197088-17-08 (4x)
PN: 2197088-17-11 (4x)
PN: 2197088-17-20 (4x)
PN: 2197088-17-21 (4x)
PN: 2197088-17-22 (16x)
PN: 2197088-17-24 (4x)
PN: 2197088-17-25 (4x)
PN: 2197088-17-26 (4x)

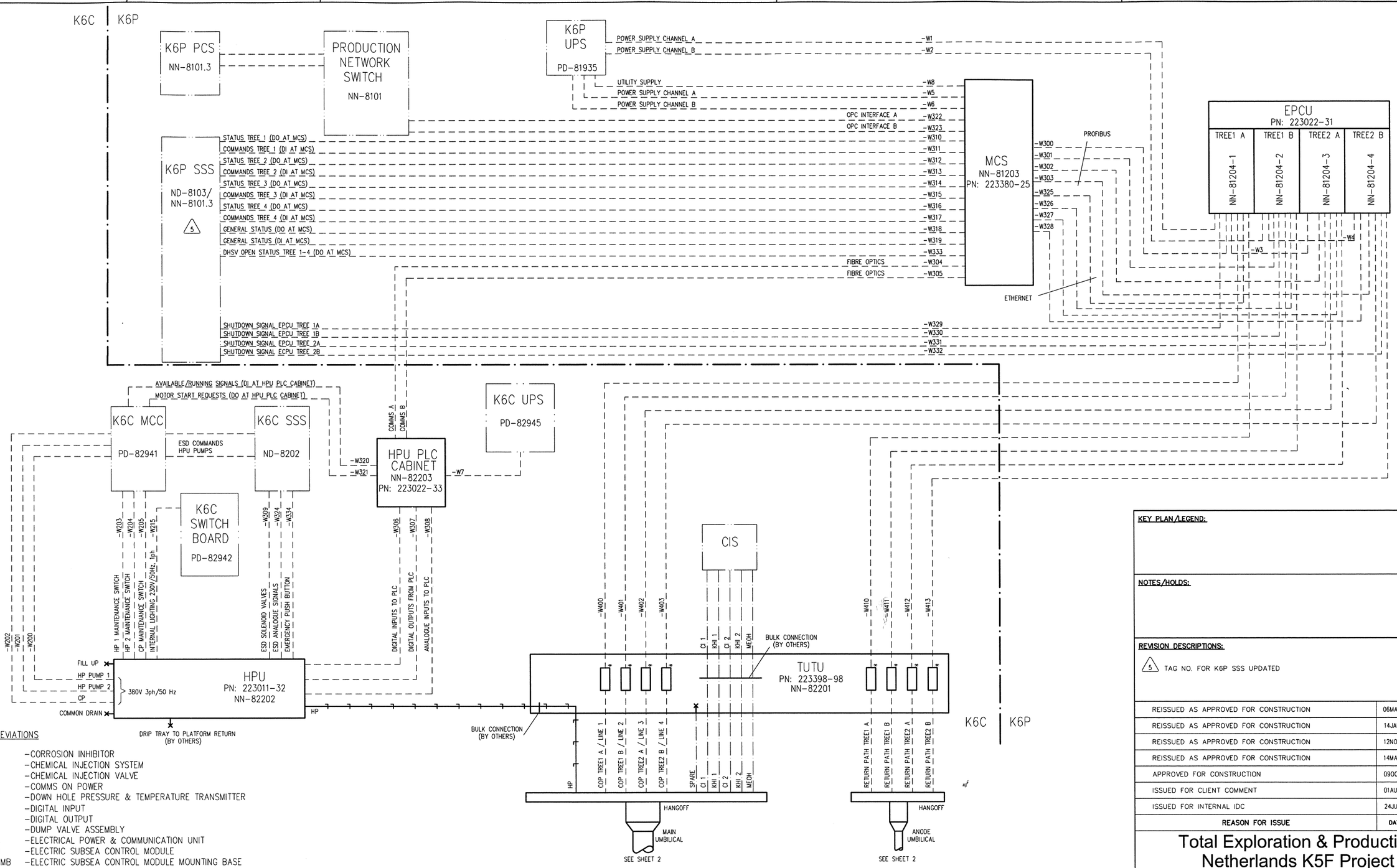
TOLERANCES ACCORDING TO DIN ISO 8015	SURFACE TREATMENT:	DO NOT SCALE	
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	MATERIAL AND HEAT TREATMENT:	DRAWN: H.J. Pope DATE: 19.05.2008	
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K		CHECKED: T. Appel DATE: 19.05.2008	
EST. WEIGHT: N/A KG	SUPERSEDES:	APPROVED: A. Weilandt DATE: 19.05.2008	SCALE:

REV. BY: H.-J. Pope | DATE: 19.05.2008 | REV.: 10

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

SCOPE OF SUPPLY
PRODUCTION CONTROL SYSTEM
TOTAL K5F

INITIAL USE BOM: 223001-88	SHEET: 4 OF 4	DRAWING NUMBER: SK-066001-88



ABBREVIATIONS

CI	-CORROSION INHIBITOR
CIS	-CHEMICAL INJECTION SYSTEM
CIV	-CHEMICAL INJECTION VALVE
COP	-COMMS ON POWER
DHPT	-DOWN HOLE PRESSURE & TEMPERATURE TRANSMITTER
DI	-DIGITAL INPUT
DO	-DIGITAL OUTPUT
DVA	-DUMP VALVE ASSEMBLY
EPCU	-ELECTRICAL POWER & COMMUNICATION UNIT
ESCM	-ELECTRIC SUBSEA CONTROL MODULE
ESCMMB	-ELECTRIC SUBSEA CONTROL MODULE MOUNTING BASE
KHI	-KINTETIC HYDRATE INHIBITOR
MCC	-MOTOR CONTROL CENTER
MCS	-MASTER CONTROL STATION
MCU	-MOTOR CONTROL UNIT
MEOH	-METHANOL
PCS	-PROCESS CONTROL SYSTEM
PRCM	-POWER REGULATION & COMMUNICATION MODULE
PRCMMB	-POWER REGULATION & COMMUNICATION MODULE MOUNTING BASE
PS	-POWER SUPPLY
SAPA	-SUBSEA ANODE PACKAGE ASSEMBLY
SAPAFB	-SUBSEA ANODE PACKAGE ASSEMBLY FOUNDATION BASE
SIU	-SENSOR INTERFACE UNIT
SSS	-SAFETY SHUTDOWN SYSTEM
TJB	-TREE JUNCTION BOX
TUTU	-TOPSIDE UMBILICAL TERMINATION UNIT
UPS	-UNINTERRUPTIBLE POWER SUPPLY
UTA	-UMBILICAL TERMINATION ASSEMBLY
WJB	-WELLHEAD JUNCTION BOX

NOTES:

- HYDRAULIC
- MEOH/CHEMICALS
- ELETRIC
- BY OTHERS
- PLUGGED
- MOULDED CONNECTION
- ELECTRICAL CONNECTOR FEMALE
- ELECTRICAL CONNECTOR MALE
- HYDRAULIC LONG TERM CAP
- ELECTRIC LONG TERM CAP

FOR ELECTRICAL CABLE DETAILS SEE TOPSIDE CABLE LIST X-065451-04-06

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

5 TAG NO. FOR K6P SSS UPDATED

REASON FOR ISSUE	DATE	CLIENT REV.
REISSUED AS APPROVED FOR CONSTRUCTION	06MAY09	5
REISSUED AS APPROVED FOR CONSTRUCTION	14JAN09	4
REISSUED AS APPROVED FOR CONSTRUCTION	12NOV08	3
REISSUED AS APPROVED FOR CONSTRUCTION	14MAY08	2
APPROVED FOR CONSTRUCTION	090CT07	1
ISSUED FOR CLIENT COMMENT	01AUG07	N/A
ISSUED FOR INTERNAL IDC	24JUL07	N/A

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-03-530

CAD

REV. BY: H.-J. Pape | DATE: 06.05.2009 | REV.: 05

SURFACE TREATMENT

TOLERANCES ACCORDING TO DIN ISO 8015

GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219

TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN: A. Weilandt | DATE: 09.02.2006

CHECKED: T. Appel | DATE: 06.05.2009

APPROVED: A. Weilandt | DATE: 06.05.2009

EST. WEIGHT: .000 KG | SUPERSEDES: | SCALE: /

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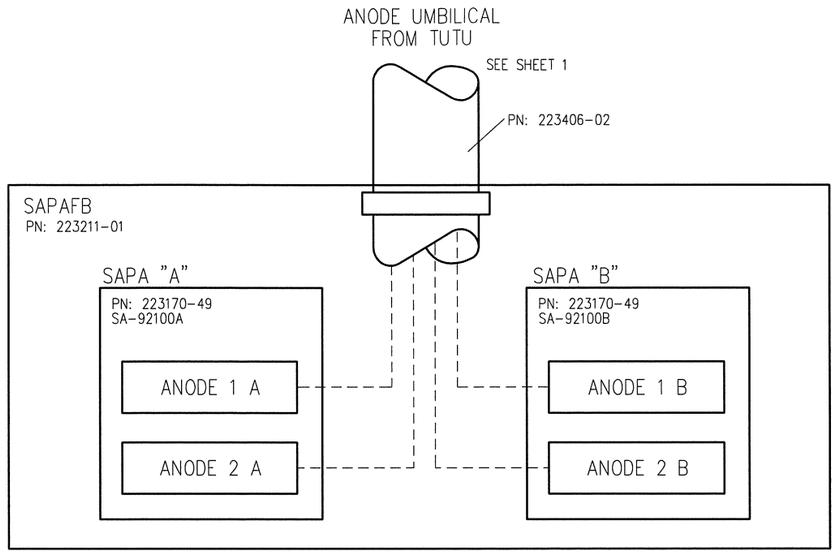
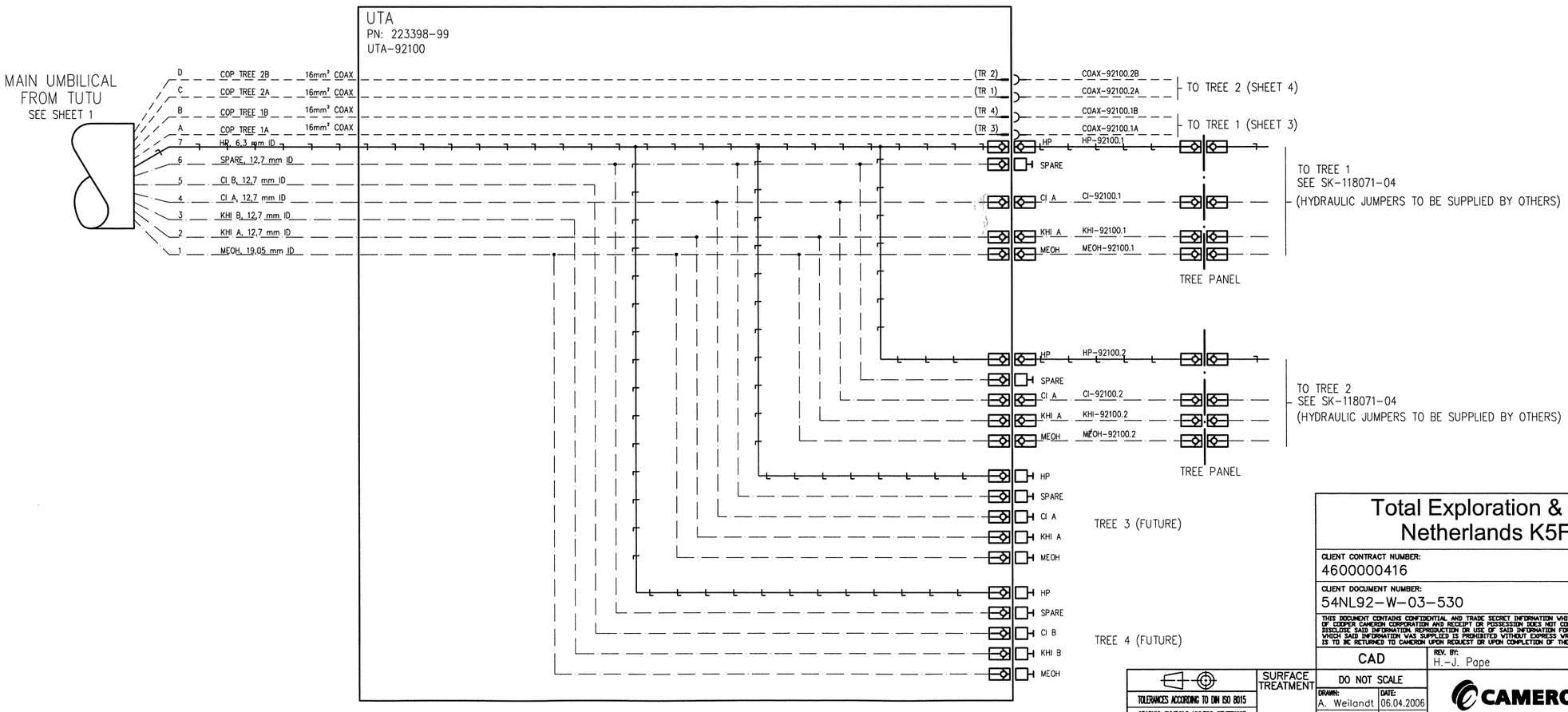
CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

INTERCONNECTION DIAGRAM
PRODUCTION CONTROL SYSTEM

INITIAL USE BOM: 223001-88 | SHEET: 1 OF 4 | DRAWING NUMBER: SK-066001-88-04

STATUS: APPROVED





Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-03-530 | CLIENT REV.: 5

CAD | REV. BY: H.-J. Pape | DATE: 06.05.2009 | REV.: 05

SURFACE TREATMENT: DO NOT SCALE

TOLERANCES ACCORDING TO DIN ISO 8015

GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219

TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

MATERIAL AND HEAT TREATMENT

DRAWN: A. Weilandt	DATE: 06.04.2006	
CHECKED: T. Appel	DATE: 06.05.2009	
APPROVED: A. Weilandt	DATE: 06.05.2009	

EST. WEIGHT: 000 KG | SUPERSEDES: | SCALE: /

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CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

INTERCONNECTION DIAGRAM
PRODUCTION CONTROL SYSTEM

INITIAL USE BOM: 223001-88 | SHEET: 2 OF 4 | DRAWING NUMBER: SK-066001-88-04

STATUS: APPROVED

ESCM
PN: 223052-94
ESCM-92100.1A

ESCM
PN: 223052-94
ESCM-92100.1B

eSCMMB A – TOP VIEW
PN: 223445-06

eSCMMB B – TOP VIEW
PN: 223445-06

CATHODE 1A
PN: 223170-50
SC-92100.1A

PRCM
PN: 223052-98
PRCM-92100.1A
PRCMMB
PN: 223415-99

CATH-92100.1A
PC-92100.1A

SEE SHEET 2

TREE PANEL

FRONT

CATHODE 1B
PN: 223170-50
SC-92100.1B

PRCM
PN: 223052-98
PRCM-92100.1B
PRCMMB
PN: 223415-99

CATH-92100.1B
PC-92100.1B

SEE SHEET 2

TJBB2 — POS.1, POS.2, POS.3, POS.4
DVA-92103.1 (CLOSE / OPEN)
SCSSV DVA
(OPEN: LINK CARD ID 46 / SIU ID 61)
(CLOSE: LINK CARD ID 45 / SIU ID 62)

TJBA2 — POS.1, POS.2, POS.3, POS.4
PPD-92111.1
PRODUCTION PRESSURE TRANSMITTER DOWNSTREAM (PPD)
(LINK CARD ID 46 / SIU ID 82)

PTD-92101.1
PRODUCTION TEMPERATURE TRANSMITTER DOWNSTREAM (PTD)
(LINK CARD ID 46 / SIU ID 83)

TJBB1 — POS.1, POS.2, POS.3, POS.4
PPU-92101.1
PRODUCTION PRESSURE TRANSMITTER UPSTREAM (PPU)
(LINK CARD ID 45 / SIU ID 80)

PTU-92104.1
PRODUCTION TEMPERATURE TRANSMITTER UPSTREAM (PTU)
(LINK CARD ID 45 / SIU ID 81)

TJBA1 — POS.1, POS.2, POS.3, POS.4

3/4" CIV-92101.1
CIV 1 (MEOH)
(LINK CARD ID 42 / MCU ID 58)

3/4" CIV-92102.1
CIV 2 (CI)
(LINK CARD ID 32 / MCU ID 48)

3/4" CIV-92103.1
CIV 3 (KHI)
(LINK CARD ID 33 / MCU ID 49)

2" XOV-92101.1
CROSS OVER VALVE 1 (XOV1)
(LINK CARD ID 34 / MCU ID 50)

5" UPMV-92102.1
UPPER PRODUCTION MASTER VALVE (UPMV)
(LINK CARD ID 37 / MCU ID 54)

5" PWV-92101.1
PRODUCTION WING VALVE (PWV)
(LINK CARD ID 36 / MCU ID 53)

PCV-92101.1
PRODUCTION CHOKE VALVE (PCV)
(LINK CARD ID 39 / MCU ID 52)

TREE 1 / SXT-92100.1

WELLHEAD 1 / SWH-92100.1

WJBDHPT — POS.1, POS.3, POS.4
PT-92104.1
TT-92103.1
DHPT
(LINK CARD ID 44)

WJBB — POS.1, POS.2, POS.3, POS.4
APT 'A' APTA-92103.1
ANNULUS PRESSURE TRANSMITTER "A" (APT "A")
(LINK CARD ID 47 / SIU ID 84)

WJBA — POS.1, POS.2, POS.3, POS.4
APT 'B' APTB-92105.1
ANNULUS PRESSURE TRANSMITTER "B" (APT "B")
(LINK CARD ID 47 / SIU ID 85)

WELLHEAD PANEL

2" AMV-92103.1
ANNULUS MASTER VALVE (AMV)
(LINK CARD ID 40 / MCU ID 56)

3/4" BAIV-92100.1
"B" ANNULUS ISOLATION VALVE (BAIV)
(LINK CARD ID 41 / MCU ID 57)

Total Exploration & Production
Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-03-530 | CLIENT REV.: 5

REV. BY:	DATE:	REV:
H.-J. Pape	06.05.2009	05

CAD

DO NOT SCALE

DRAWN: A. Weilandt	DATE: 06.04.2006	
CHECKED: T. Appel	DATE: 06.05.2009	
APPROVED: A. Weilandt	DATE: 06.05.2009	

SURFACE TREATMENT

MATERIAL AND HEAT TREATMENT

TOLERANCES ACCORDING TO DIN ISO 8015

GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219

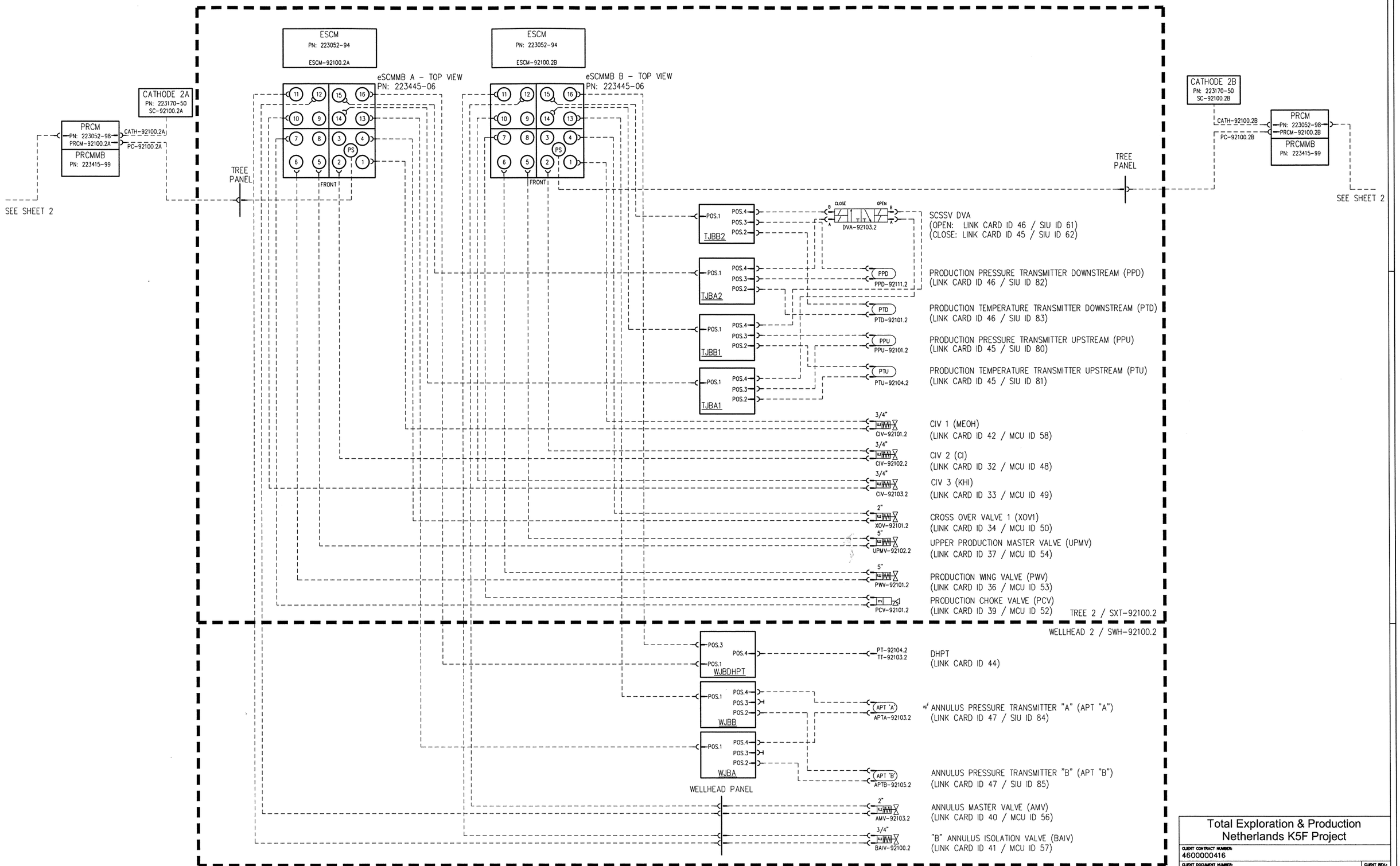
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 mK

EST. WEIGHT: 000 KG | SUPERSEDES: | SCALE: /

CAMERON GmbH
LDickenweg 1
29227 Celle, Germany

INTERCONNECTION DIAGRAM
PRODUCTION CONTROL SYSTEM

INTERNAL USE ITEM:	SHEET	DRAWING NUMBER:
223001-88	3 OF 4	SK-066001-88-04



Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-03-530 | CLIENT REV.: 5

CAD	REV. BY: H.-J. Pape	DATE: 06.05.2009	REV.: 05

SURFACE TREATMENT	DRAWN: A. Weilandt	DATE: 24.07.2007
DO NOT SCALE	CHECKED: T. Appel	DATE: 06.05.2009
TOLERANCES ACCORDING TO DIN ISO 8015	APPROVED: A. Weilandt	DATE: 06.05.2009
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	MATERIAL AND HEAT TREATMENT	
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K		
EST. WEIGHT: 000 KG	SUPERSEDES:	SCALE: /

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

INTERCONNECTION DIAGRAM
PRODUCTION CONTROL SYSTEM

INITIAL USE FROM: 223001-88 | SHEET: 4 OF 4 | DRAWING NUMBER: SK-066001-88-04

DOCUMENT

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 1, Section 2

HYDRAULIC POWER UNIT (HPU) & HPU PLC CABINET

CONTENTS

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 1, Section 2
HYDRAULIC POWER UNIT (HPU) & HPU PLC CABINET

DESCRIPTION, INSTALLATION, OPERATION & MAINTENANCE

CONTENTS

Project No.	Cameron No.	Description
54NL92-W-0S-502	X-076721-87	SPS – Subsea & Topsides Functional Requirement Specif. *See Volume 1, Section 1 Total System*
54NL92-W-0S-510	X-076721-87-05	HPU – Supplemental Requirement Specification *See Volume 1, Section 1 Total System*
54NL92-W-7S-501	X-076721-87-18	HPU PLC Cabinet – Supplemental Requirement Specification *See Volume 1, Section 1 Total System*
54NL92-W-0P-531	X-065467-02-09	HPU – Installation Procedure
54NL92-W-0P-542	X-065438-02-74	HPU – Operation Procedure
54NL92-W-0P-543	X-065438-02-75	HPU – Maintenance Procedure
54NL92-W-7P-506	X-065397-01-02	HPU Control Cabinet – Installation Procedure
54NL92-W-7P-503	X-065457-07	HPU Control Cabinet – Operating Procedure
-	X-065429	General Preservation & Storage Procedure *See Volume 1, Section 1 Total System*

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 1, Section 2
HYDRAULIC POWER UNIT (HPU) & HPU PLC CABINET

PARTS LISTS & DRAWINGS

CONTENTS

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

31 MAR 2009	As Built	A. Weilandt	T. Appel	A. Weilandt
06 AUG 2007	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
02 MAY 2007	Issued for Client Comment	A. Weilandt	S. Horne	
12 OCT 2006	Issued for Internal IDC	A. Weilandt	D.Coonrod	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approver**

CAMERON	**Document Title:** **Subsea and Topsides Functional Requirement Specification**		
PAGE 1 OF 34	**Customer Document Number:**	54NL92-W-0S-502	REV. 2
	Cameron Document No.	X-076721-87	REV. 02

TABLE OF CONTENTS

1 Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
A	12OCT06	Initial release Celle	- - -
B	02MAY07	Section 7.5.6.1: Use of Swagelok added for LP lines and added the need for metric size on all LP tubing Section 8.4: cable entry changed from top to bottom Section 9.2: List of Total Tag Numbers added Section 9.1.1.2: Colour for topside equipment changed from RAL5015 to RAL7035 (light grey) 10.8 & 10.9: updated description as per current design of anode and cathode package 10.10: complete section added for Anode Umbilical Assembly	Comments from internal IDC
01	06AUG07	Section 10.8: Anode Package Foundation Base added	Updated to Approved for Construction
02	31MAR09	Minor cosmetic Customer Comments implemented	Update to “As Built”

2 Introduction

This document is written to consolidate the technical requirements for the subsea control system intended to be used on the TOTAL K5F Project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

It will be submitted for approval early on in the project cycle and upon approval will be used for the design of the system.

Referenced client specifications within this document also need to be considered for the design.

3 Scope of this document

The scope of this document is to define the functional requirements for the subsea control system intended to be used on the TOTAL K5F Project.

Technical requirements relate but shall not be limited to:

- Design basis data
- Functional requirements

The Intervention & Workover Control System (IWOCS) shall **NOT** be covered by this document.

4 Abbreviations & Definitions

4.1 Abbreviations

AIV	Annulus Isolation Valve
AMV	Annulus Master Valve
APTA	Annulus Pressure Transmitter A
APTB	Annulus Pressure Transmitter B
BAIV	B Annulus Isolation Valve
CI	Corrosion Inhibitor
CIV	Chemical Injection Valve
CP	Cathodic Protection
CR	Control Room
DCS	Distributed Control System
DHSV	Downhole Safety Valve
DHPT	Downhole Pressure Temperature Transmitter
EPCU	Electrical Power and Communication Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
HPU	Hydraulic Power Unit
ICSS	Integrated Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
KHI	Kinetic Hydrate Inhibitor
LPMV	Lower Production Master Valve
MEOH	Methanol
PCS	Process Control System
PPD	Production Pressure Downstream
PPU	Production Pressure Upstream
PSV	Production Swab Valve
PTD	Production Temperature Downstream
PTU	Production Temperature Upstream
PWV	Production Wing Valve
PRCM	Power Regulation and Communication Module
SCSSV	Surface Controlled Subsurface Safety Valve
SSS	Safety Shutdown System
TUTU	Topside Umbilical Termination Unit
UPMV	Upper Production Master Valve
UPS	Uninterruptible Power Supply
UTA	Umbilical Termination Assembly
WH	Wellhead
XOV	Crossover Valve

4.2 Definitions

COMPANY	Total E&P Nederland B.V. (TEPNL)
CONTRACTOR	Cooper Cameron UK Ltd.

5 References

5.1 Cameron documents

Following documents **MUST** be considered during the design phase.

Description	Number
Subsea Production Control System Interconnection Diagram	SK-066001-88-04
K5F Field Development Project Contract	4600000416
Bill Of Material – Subsea Production Control System	223001-88
Project Quality Specification	SP-003118-15

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Design of cathodic protection of offshore structures	GS GR COR 100
External protection of off-shore and coastal structures and equipment by painting	GS EP COR 350
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Minimum CONTRACTOR document requirements	GS EP ELE 091
Electrical cables	GS EP ELE 161
Cable trays/ladders	GS EP ELE 311
Precommissioning and commissioning specification	GS EP EXP 101
Precommissioning and commissioning technical preparation	GS EP EXP 103
Precommissioning execution	GS EP EXP 105
Commissioning execution	GS EP EXP 107
Operations preparation during project – Maintenance and inspection documentation	GS EP EXP 203
Requirements for contractor quality management	GS EP PJC 501
Requirements for contractor critically rating of a unit	GS EP PJC 502
Requirements for contractor quality control	GS EP PJC 503
Valves	GS EP PVV 142
Welding of duplex and superduplex stainless steel	GS EP PVV 614
Area classification	GS EP SAF 216

Description	Number
Completed wells safety systems and safety rules	GS EP SAF 226
Impacted area, restricted area and fire zones	GS EP SAF 253
Emergency shut-down and emergency de-pressurisation (ESD & EDP)	GS EP SAF 261
Design philosophy and requirements for subsea stations	GS EP SPS 001
Subsea ball valves	GS EP SPS 005
Service valves in subsea stations	GS EP SPS 006
Tie-in systems	GS EP SPS 007
Corrosion protection of subsea stations	GS EP SPS 009
Preservation requirements for subsea package	GS EP SPS 010
Mechanical completion of subsea stations	GS EP SPS 011
Documentation requirements for subsea stations	GS EP SPS 012
Wellhead and guidance systems	GS EP SPS 013
Subsea gate valves and actuators in subsea Xmas-tree systems	GS EP SPS 015
Subsea insert chokes and associated running and retrieval tools	GS EP SPS 016
Subsea production control system	GS EP SPS 019
Subsea control unit functional requirements	GS EP SPS 020
Subsea mateable electrical/optical connectors	GS EP SPS 021
Environmental testing of subsea electronics	GS EP SPS 022
Cleaning and flushing of hydraulic systems	GS EP SPS 023
Subsea mechanical quarter turn actuator (manually operated gearbox)	GS EP SPS 024
Subsea hydraulic spring return quarter turn actuators	GS EP SPS 025
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Static 230Vac power supply units for on- and offshore installations	NL00-U-6S-037
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Typical cable tray details (offshore)	NL00-U-64-044
Elec. Cable colour seq. (onsh. + offsh.)	NL00-U-64-045
Protection and Instrument Earth. Det. (onsh. + offsh.)	NL00-U-64-046
Presentation of engineering and final documentation	NL00-Z-0S-002

Description	Number
Microstation Version 5.0: User Definable Attributes	NL00-Z-0S-005
Codification & Numbering of New Technical Documents for Offshore Installations	NL00-Z-0S-006
Instrumentation/piping interface standards	NL00-Z-4S-042
Actuators and control systems for hydraulically operated control valves	NL00-Z-7S-041
Actuators and control system for hydraulically operated ball valves	NL00-Z-7S-043
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
Codification of instrumentation links & equipment	NL00-Z-7S-077
Electrical/instrument interface diagram typicals for normally unmanned offshore installations	NL00-Z-71-002
Loop diagrams typicals	NL00-Z-71-003
Instrumentation - process hook-up typicals	NL00-Z-74-011
Hydraulic hook-up typicals	NL00-Z-74-021
Mounting typicals	NL00-Z-74-031
Instrument name plate detail	NL00-Z-74-055
Completion dossier guidelines	CS-3-OPE-EC-701 (EDMP-40657)
K5F MCS – K6CC SSS/PCS Interface	EDMP #59401

Any agreed deviations from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

Any clarifications from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

In case of conflict between documents the following order of priority shall be applied:

1) Local and international rules and regulations
2) Company Safety Specifications (GS EP SAF)
3) Project Specifications
4) Company Standards (NL00)
5) Company General Specifications

5.3 Codes, standards and regulations

Following codes, standards and regulations shall be considered during the design phase.

Description	Number
Design and operation of sub sea production systems	ISO 13628
Design & Operation Of Subsea Production Control Systems	ISO 13628-6
Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluids	SAE AS4059

Description	Number
EMC Directive	89/336-EEC
Process measurement control functions and instrumentation Symbolic representation	ISO 3511
Quality management and quality assurance standards - Part 3:Guidelines for the application of ISO 9001 to the development, supply and maintenance of software	ISO 9000-3

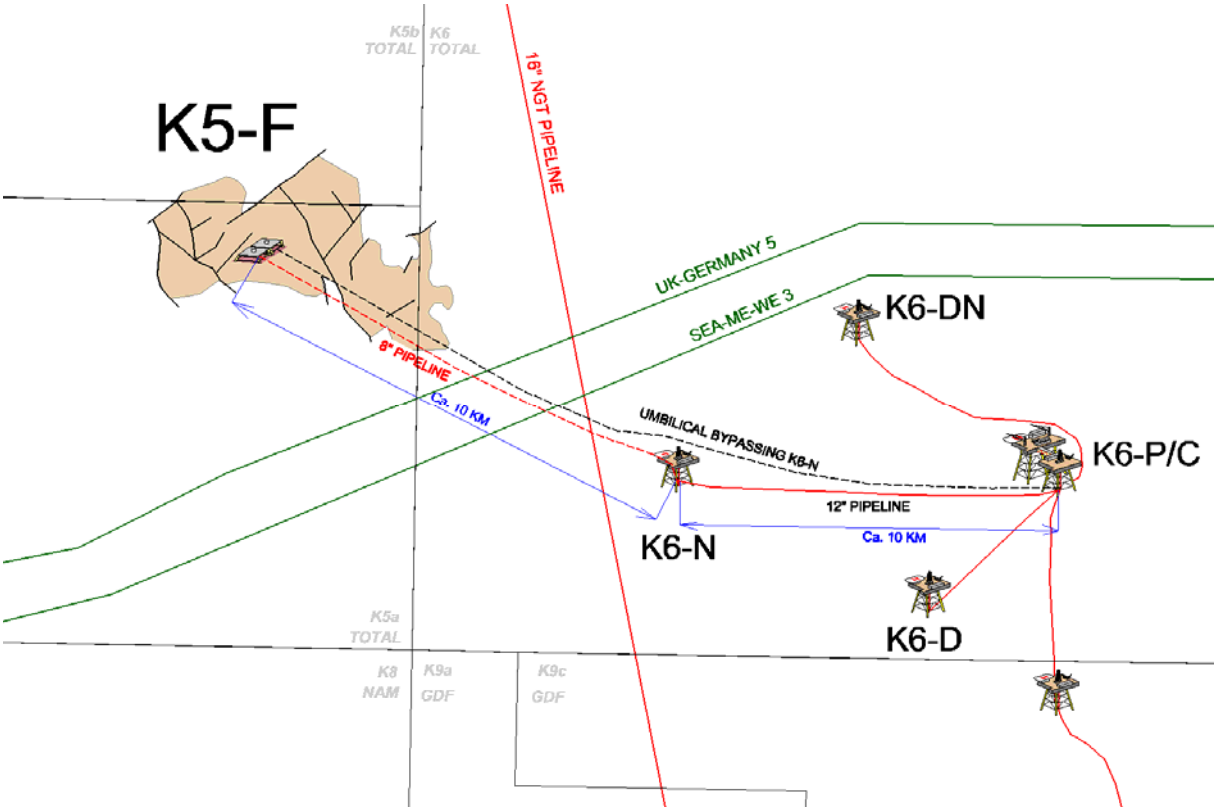
5.4 CE marking

CE marking **will** be required for the K5F project.

6 Project Overview

The K5F is a gas field located 10 km NW of the existing satellite platform K6N and 20km NW of the K6 Central Complex, all operated by TEPNL.

In the first phase, K5F will be developed with two wells. In order to be able to increase the reserves recovery in the future a third well might be connected in the future on the Subsea Protection Structure and it is also possible to connect a fourth future satellite well.



7 Design basis

The following sections are describing the systems information particularly relevant to the design of the Production Control System:

7.1 Field data

Present Number of Production Wells	Two plus two future wells
Design Life	20 years

7.2 Environmental conditions

7.2.1 Climatic data

Parameter		Data
Ambient Temperature (Outdoors)	Minimum Air Temperature	- 16°C
	Maximum Air Temperature	+ 40°C
Ambient Temperature (Indoors)	Minimum Air Temperature	-5°C
	Maximum Air Temperature	+ 40°C

7.2.2 Subsea Design Information

Parameter	Data
Water Depth	37 metres
Temperature	+4°C to +9.5°C
Seawater density	1025 kg/m³
Seawater Electrical Resistivity	0.3 OhmMeter
Wellhead Shut-in Pressure	350 barg

7.2.3 Hazardous Area Classification

The HPU and the TUTU shall be specified for hazardous area Zone 1, Gas Group IIB, Temperature Class T3, on the Platform deck.

7.2.4 Local equipment room

The platform local electrical switch room shall be used to accommodate the MCS and the ECPU cabinets. The maximum temperature during normal conditions within the LER shall be limited to 25 °C, but all of the equipment shall be able to operate as long as the room temperature does not exceed 40°C.

7.2.5 Hydraulic system pressures for the SCSSV line

The subsea production control system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
HP Hydraulics	627 barg	690 barg	1035 barg
Return Lines	< 207 barg	207 barg	N/A
Reservoir Fill Lines	<10 barg	10 barg	15 barg

NOTE: The design pressures shown above shall be used for specification of the HP hydraulic system relief valves and these shall release at the shown design pressures.

The return lines of the HPU are piped directly to the return reservoir and open to atmosphere. Pressure testing of these lines is neither necessary nor possible.

7.2.6 Chemical system pressure requirements

The chemical injection system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
Methanol Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Corrosion Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Kinetic Hydrate Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg

7.2.7 List of chemicals

The following chemicals are considered to be used for chemical injection for the K5F project:

- Methanol (MEOH)
- Corrosion Inhibitor (CI)
- Kinetic Hydrate Inhibitor (KHI)

7.3 Design life

The design life of the Subsea equipment shall be equal to the service life of the field.

The Subsea and related topside facilities shall be designed for a minimum design life of **20 years**.

7.4 Utilities

7.4.1 Platform utilities

The subsea production control system shall be designed to operate from the platform power and utilities as follows:

Electrical Supply (ECPU)	400VAC , 3 phase, 50 Hz ± 2% from UPS (floating), redundant
Electrical Supply (MCS)	230VAC 50 Hz ± 2%,from UPS (floating), redundant
Electrical supply (HPU PLC Cabinet)	230VAC 50 Hz ± 2% from UPS (floating)
Electrical supply (HPU Lighting)	230VAC 50 Hz from MCC
Electrical supply (HPU Motors)	380VAC 3ph 50 Hz, floating (3 wires) from MCC
Electrical supply (Motor heaters)	230VAC 50 Hz from MCC (if applicable)
Electrical supply (ESD solenoids)	24 V DC when healthy, 0V on ESD

7.5 Hydraulic systems

7.5.1 Sealing systems

Hydraulic couplers with primary metal seals are preferred for permanently installed Subsea equipment. Where possible, secondary, non-metallic seals should be considered as back-up for primary metal-to-metal seals. Hydraulic and chemical couplers within removable assemblies like single diver mate able hydraulic/chemical couplings shall have non-metallic primary seals and non-metallic back-up seals.

7.5.2 Hydraulic distribution

The subsea production control system high pressure (HP) hydraulic supplies shall be single from the HPU pumps. The hydraulic system shall be open utilising a water based control fluid.

7.5.3 Hydraulic fluid

The hydraulic system shall use Castrol Transaqua HT water based control fluid.

7.5.4 Fluid cleanliness

The production control system hydraulic control fluid shall be water based. All production control system hydraulic equipment shall be delivered with fluid cleanliness levels of SAE AS4059 class 6 or better. All methanol and chemical lines and equipment shall be delivered with fluid cleanliness level of SAE AS4059 class 12 or better.

Protective caps shall be provisioned for all hydraulic couplings to avoid accidental contamination. Assembly of hydraulic components shall take place in areas where the environment is controlled. The objective shall be to “assemble clean to keep clean” such that subsequent flushing operations are simplified.

Cleaning methods used for sub-assemblies shall include shop air flushing, solvent cleaning, pipe cleaning and ultrasonic bathing as appropriate. Cleaning of major assemblies shall in general be confined to flushing with control fluid of known cleanliness. As far as is practical, designs shall take due note of the subsequent flushing requirements e.g. avoiding blind holes, avoiding welding or grinding on assembled components and ensuring that systems allow turbulent flow for flushing.

All hoses and flying leads intended for chemical service (Methanol, Corrosion Inhibitor and Kinetic Hydrate Inhibitor) should be supplied filled with either control fluid or a suitable fluid compatible with the chemicals to be used.

7.5.5 Tubing

All hydraulic tubing and fittings shall be sized for efficient operation of the system with due regard to design pressures and minimising pressure drops within the system.

- For the topside equipment minimum seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the subsea equipment seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the UTA, the Methanol tubing has to be super duplex.

The tubing of the hydraulic circuits shall be accurately cut and bent using standard tube cutters and tube benders to fitting manufacturer’s recommendation. No burrs shall be allowed and each section of the tubing shall be cleaned and blown dry before assembly to ensure that no contamination is permitted to enter the control components.

All hydraulic tubing together with the associated fittings shall be capable of withstanding the application of a 1.5 times design pressure test for 15 minutes without any deformation or other damage.

7.5.6 Threaded connection systems

All threaded fittings for equipment used subsea shall withstand external ambient pressure at the design depth.

7.5.6.1 Topside equipment

For all circuits Autoclave MP Piping and fittings shall be used, except return lines where Swagelok can be used. All non Autoclave lines need to be in metric size.

7.5.6.2 Permanent subsea equipment

Ferrulok tube end reducers are to be welded to the back of hydraulic couplers, etc., where practical, rather than pipe threaded connections.

High-pressure ports requiring threaded fittings, such as valve actuator ports shall be SAE thread with 37-degree bottom taper conforming to SAE standard J514. Autoclave anti-vibration type fittings shall also be acceptable.

National Pipe Thread (NPT) fittings or any other thread seal type fitting shall **NOT** be used without specific approval from the project.

Fitting assembly torque shall be independently verified and sealed/secured to identify, that fittings have been properly made-up and inspected.

7.5.6.3 Thread sealants

Where taper threads are permitted for use, they shall be sealed using Loctite 572 fluid applied in accordance with the manufacturer's instructions. No other thread sealant shall be used. Teflon tape is **NOT** permitted for use on any equipment used with this system.

7.5.7 Welded connection systems

All couplers, whether in hydraulic or chemical services shall be butt-welded, except were otherwise specified within this document. All couplers shall be fitted with seals from identical compounds. All hydraulic or chemical service valves and fittings shall be butt welded.

- Connections shall be welded to the extent practical
- Autogenously welding shall be acceptable on 316L materials
- Liquid penetrate testing shall be performed on all tubing welds

Note: all welding has to be performed in accordance to approved Cameron welding specification.

8 Electric Systems

8.1 Terminal Type

Screw type terminals shall be used on all topside equipment.

8.2 Instrument Type

For the use in hazardous area EEx-d type instruments shall be used.

8.3 Electrical Motor Type

For the use in hazardous area EEx-d type electrical motors shall be used.

8.4 Cable entry for cabinets located in the Control Room

All cabinets located in the control room shall be designed to allow bottom cable entry only.

9 Functional Requirements

9.1 Coating & protection systems

9.1.1 Coating systems

All equipment manufactured from Carbon steels shall be protected with an approved coating system suitable for the design life of the equipment.

9.1.1.1 Subsea painting

Painting of all subsea components manufactured from Carbon steels shall be done in accordance to the approved paint specification A-020025-01

9.1.1.2 Painting of topside equipment for outside installation

Painting of all topside components located outside shall be done in accordance to the approved paint specification X-065460-04-04

- Top colour for surface equipment shall be light grey (RAL 7035).
- SST framework and parts shall normally NOT be painted, if not separately specified.

9.1.1.3 Painting of topside equipment for inside installation

Paint colour for MCS or EPU cabinet housings shall be light grey (RAL 7035).

9.1.2 Cathodic protection

9.1.2.1 General

The primary corrosion protection system for the control system Subsea equipment shall be via materials selection and suitable paint coatings.

A cathodic protection system using sacrificial anodes shall be utilised to protect the ‘bare steel’ components and to protect uncoated areas of any other control system hardware, i.e. such as those items not protected by the host equipment. Special attention shall be given to SST screws and bolts. All items to be protected shall be electrically connected using stranded, flexible SST 316 earthing braids of a suitable cross sectional area.

9.1.2.2 Calculations

Suitable CP calculations shall be carried out in accordance with the standard applicable for control system hardware i.e. not tree mounted equipment (this shall be part of the Subsea tree CP system). The CP system shall be designed to be capable of protecting the control system for the 20-year design life of the equipment.

9.1.2.3 Construction

The following principles shall be adhered when designing equipment for the subsea control system:

- All equipment metalwork shall be welded (or bolted) onto the equipment main structure to ensure any static potential build up is avoided by continuous drain to earth.
- All metallic items shall have earth continuity by physical connection i.e. metallic fastenings, clamps or earth straps. This shall include all valves, tubing, components, tubing clamps etc.

Electrical connectors may remain isolated from the structure provided suitable materials are chosen for their construction.

- When stainless steel fasteners are used in the construction of subsea structures or equipment, they shall be suitably earth bonded using earth straps. Carbon steel fasteners may alternatively be used.
- Anodes mounted on equipment sub-structures shall be manufactured from material identical and from the same batch as those fitted to the main structure.
- The anodes shall comply with the Cameron material specification MS-011310-01.
- The minimum distance from hydraulic tubing to anodes shall be 80 mm. If unavoidable it is acceptable to have a distance of less than 80 mm for some cases.
- Earthing conductors shall be of corrosion resistant material and shall be securely fastened and protected where necessary against damage and electrolytic corrosion. Where earth-bonding straps are used, conductive paste shall be smeared on contact surfaces (not threads) to ensure a lasting low resistance contact. Where the metallic composition of equipment requiring earth bonding differs from the main structure, care shall be taken in the selection of the bonding strap material to minimise possible ill effects of different contact potentials.
- Connections shall be secured using star-type shake proof washers such that they cannot work loose under vibration.

9.2 Project specific Tag Numbers

This is a list of Tag numbers to be used for K5F equipment. All units and components on this list need to be marked with these numbers as per Total Spec. NL00-Z-74-055.

Instruments	Equipment	Description	Comments
	NN-82201	TUTU	
	NN-82202	HPU	
	NN-82203	HPU PLC	
	NN-81203	MCS	
	NN-81204-1	EPCU 1	
	NN-81204-2	EPCU 2	
	NN-81204-3	EPCU 3	
	NN-81204-4	EPCU 4	
	SA-92100A	Anode Package A	
	SA-92100B	Anode Package B	
	UTA-92100	UTA	
	UTA-92101	IUTA	FUTURE
	UTA-92102	IUTA	FUTURE
	PRCM-92100.1A	PRCM A well 1	
	PRCM-92100.1B	PRCM B well 1	
	SC-92100.1A	Cathode A well 1	
	SC-92100.1B	Cathode B well 1	
	ESCM-92100.1A	ESCM A well 1	
	ESCM-92100.1B	ESCM B well 1	
	DVA-92103.1	Dump valve assembly well 1	
	DHSV-92103.1	Downhole safety valve well 1	

	PRCM-92100.2A	PRCM A well 2	
	PRCM-92100.2B	PRCM B well 2	
	SC-92100.2A	Cathode A well 2	
	SC-92100.2B	Cathode B well 2	
	ESCM-92100.2A	ESCM A well 2	
	ESCM-92100.2B	ESCM B well 2	
	DVA-92103.2	Dump valve assembly well 2	
	DHSV-92103.2	Downhole safety valve well 2	
	PRCM-92100.3A	PRCM A well 3	
	PRCM-92100.3B	PRCM B well 3	
	SC-92100.3A	Cathode A well 3	
	SC-92100.3B	Cathode B well 3	
	ESCM-92100.3A	ESCM A well 3	
	ESCM-92100.3B	ESCM B well 3	
	DVA-92103.3	Dump valve assembly well 3	
	DHSV-92103.3	Downhole safety valve well 3	
	PRCM-92100.4A	PRCM A well 4	
	PRCM-92100.4B	PRCM B well 4	
	SC-92100.4A	Cathode A well 4	
	SC-92100.4B	Cathode B well 4	
	ESCM-92100.4A	ESCM A well 4	
	ESCM-92100.4B	ESCM B well 4	
	DVA-92103.4	Dump valve assembly well 4	
	DHSV-92103.4	Downhole safety valve well 4	
	HP-92100.1	HP Jumper UTA to tree 1	
	MEOH-92100.1	MeOH Jumper UTA to tree 1	
	KHI-92100.1	KHI Jumper UTA to tree 1	
	CI-92100.1	CI Jumper UTA to tree 1	
	COAX-92100.1A	Coax Jumper UTA to PRCM A tree 1	
	COAX-92100.1B	Coax Jumper UTA to PRCM B tree 1	
	PC-92100.1A	P/C Jumper PRCM A to ESCM A tree 1	
	PC-92100.1B	P/C Jumper PRCM B to ESCM B tree 1	
	HP-92100.2	HP Jumper UTA to tree 2	
	MEOH-92100.2	MeOH Jumper UTA to tree 2	
	KHI-92100.2	KHI Jumper UTA to tree 2	
	CI-92100.2	CI Jumper UTA to tree 2	
	COAX-92100.2A	Coax Jumper UTA to PRCM A tree 2	
	COAX-92100.2B	Coax Jumper UTA to PRCM B tree 2	
	PC-92100.2A	P/C Jumper PRCM A to ESCM A tree 2	
	PC-92100.2B	P/C Jumper PRCM B to ESCM B tree 2	
	HP-92100.3	HP Jumper UTA to tree 3	FUTURE
	MEOH-92100.3	MeOH Jumper UTA to tree 3	FUTURE
	KHI-92100.3	KHI Jumper UTA to tree 3	FUTURE

	CI-92100.3	CI Jumper UTA to tree 3	FUTURE
	COAX-92100.3A	Coax Jumper UTA to PRCM A tree 3	FUTURE
	COAX-92100.3B	Coax Jumper UTA to PRCM B tree 3	FUTURE
	PC-92100.3A	P/C Jumper PRCM A to ESCM A tree 3	FUTURE
	PC-92100.3B	P/C Jumper PRCM B to ESCM B tree 3	FUTURE
PCV-92101.1		Production Choke valve well K5F-1	
PWV-92101.1		Production Wing Valve well K5F-1	
UPMV-92102.1		Upper Production Master Valve well K5F-1	
DHSV-92103.1		Down Hole Safety Valve well K5F-1	
AMV-92103.1		Annulus Master Valve well K5F-1	
BAIV-92100.1		B Annulus Isolation Valve well K5F-1	
XOV-92101.1		Crossover Valve well K5F-1	
CIV-92101.1		Chemical Injection Valve well K5F-1	
CIV-92102.1		Chemical Injection Valve well K5F-1	
CIV-92103.1		Chemical Injection Valve well K5F-1	
XEV-92103.1		HP Dump Valve (solenoid) well K5F-1	
PPU-92101.1		Production Pressure Upstream well K5F-1	
PPD-92111.1		Production Pressure Downstream well K5F-1	
APTA-92103.1		Annulus Pressure Transmitter A well K5F-1	
APTB-92105.1		Annulus Pressure transmitter B well K5F-1	
PTD-92101.1		Production Temperature Downstream well K5F-1	
PTU-92104.1		Production Temperature Upstream well K5F-1	
PT-92104.1		Downhole Pressure Transmitter	
TT-92-103.1		Downhole Temperature Transmitter	
PCV-92101.2		Production Choke valve well K5F-2	
PWV-92101.2		Production Wing Valve well K5F-2	
UPMV-92102.2		Upper Production Master Valve well K5F-2	
DHSV-92103.2		Down Hole Safety Valve well K5F-2	
AMV-92103.2		Annulus Master Valve well K5F-2	
BAIV-92100.2		B Annulus Isolation Valve well K5F-2	
XOV-92101.2		Crossover Valve well K5F-2	
CIV-92101.2		Chemical Injection Valve well K5F-2	
CIV-92102.2		Chemical Injection Valve well K5F-2	
CIV-92103.2		Chemical Injection Valve well K5F-2	
XEV-92103.2		HP Dump Valve (solenoid) well K5F-2	
PPU-92101.2		Production Pressure Upstream well K5F-2	
PPD-92111.2		Production Pressure Downstream well K5F-2	
APTA-92103.2		Annulus Pressure Transmitter A well K5F-2	
APTB-92105.2		Annulus Pressure transmitter B well K5F-2	
PTD-92101.2		Production Temperature Downstream well K5F-2	
PTU-92104.2		Production Temperature Upstream well K5F-2	
PT-92104.2		Downhole Pressure Transmitter	
TT-92103.2		Downhole Temperature Transmitter	
PCV-92101.3		Production Choke valve well K5F-3	FUTURE
PWV-92101.3		Production Wing Valve well K5F-3	FUTURE
UPMV-92102.3		Upper Production Master Valve well K5F-3	FUTURE

DHSV-92103.3		Down Hole Safety Valve well K5F-3	FUTURE
AMV-92103.3		Annulus Master Valve well K5F-3	FUTURE
BAIV-92100.3		B Annulus Isolation Valve well K5F-3	FUTURE
XOV-92101.3		Crossover Valve well K5F-3	FUTURE
CIV-92101.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92102.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92103.3		Chemical Injection Valve well K5F-3	FUTURE
XEV-92103.3		HP Dump Valve (solenoid) well K5F-3	FUTURE
PPU-92101.3		Production Pressure Upstream well K5F-3	FUTURE
PPD-92111.3		Production Pressure Downstream well K5F-3	FUTURE
APTA-92103.3		Annulus Pressure Transmitter A well K5F-3	FUTURE
APTB-92105.3		Annulus Pressure transmitter B well K5F-3	FUTURE
PTD-92101.3		Production Temperature Downstream well K5F-3	FUTURE
PTU-92104.3		Production Temperature Upstream well K5F-3	FUTURE
PT-92104.3		Downhole Pressure Transmitter	FUTURE
TT-92103.3		Downhole Temperature Transmitter	FUTURE
PCV-92101.4		Production Choke valve well K5F-4	FUTURE
PWV-92101.4		Production Wing Valve well K5F-4	FUTURE
UPMV-92102.4		Upper Production Master Valve well K5F-4	FUTURE
DHSV-92103.4		Down Hole Safety Valve well K5F-4	FUTURE
AMV-92103.4		Annulus Master Valve well K5F-4	FUTURE
BAIV-92100.4		B Annulus Isolation Valve well K5F-4	FUTURE
XOV-92101.4		Crossover Valve well K5F-4	FUTURE
CIV-92101.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92102.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92103.4		Chemical Injection Valve well K5F-4	FUTURE
XEV-92103.4		HP Dump Valve (solenoid) well K5F-4	FUTURE
PPU-92101.4		Production Pressure Upstream well K5F-4	FUTURE
PPD-92111.4		Production Pressure Downstream well K5F-4	FUTURE
APTA-92103.4		Annulus Pressure Transmitter A well K5F-4	FUTURE
APTB-92105.4		Annulus Pressure transmitter B well K5F-4	FUTURE
PTD-92101.4		Production Temperature Downstream well K5F-4	FUTURE
PTU-92104.4		Production Temperature Upstream well K5F-4	FUTURE
PT-92104.4		Downhole Pressure Transmitter	FUTURE
TT-92103.4		Downhole Temperature Transmitter	FUTURE

9.3 Special Requirements

All warning and emergency signs need to be English **and** Dutch language as per NL00-U-6S-061.

10 Equipment Requirement Specification

10.1 Master Control Station (MCS)

The redundant MCS will be the communication interface between the ICSS and the K5F electrical Subsea Control Modules (ESCM). The MCS will be located in the electrical switch room of the K6P Platform (safe area) and will be powered from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-01 Supplemental Requirements Specification for MCS Hardware

X-076721-87-02 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Control and Management

X-076721-87-03 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Process Interlocks and Shutdowns

X-076721-87-12 Supplemental Requirements Specification for MCS/ICSS Control Interface

10.2 Electrical Power and Control Unit (EPCU)

The EPCU is a redundant electrical power and communication unit for high voltage DC power supply and communication to the subsea installed ESCM's. The EPCU will be located in the electrical switch room of the K6P Platform (safe area) and will receive separate power supply for channel A and B from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-04 Supplemental Requirements Specification for EPCU

10.3 Hydraulic Power Unit (HPU)

A dedicated Hydraulic Power Unit (HPU) will be installed on the K6C platform to provide clean hydraulic HP power for the control of the K5F Downhole Safety Valves (DHSV). The HPU will be controlled from a remote PLC located in a safe area and will be monitored by the MCS/ICSS.

Design Pressure = 690 bar

Hydraulic Fluid = Castrol Transaqua HT

Refer to the following documents for detailed technical requirements:

X-076721-87-05 Supplemental Requirements Specification for HPU

10.4 Topside Umbilical Termination Unit (TUTU)

The Topside Umbilical Termination Unit (TUTU) shall terminate the main electro/hydraulic/chemical umbilical lines and provide the interface to the K6C platform equipment. It will only provide a hardware interface without any block/bleed-valves and/or Pressure gauges for testing or maintenance work. All tubing and couplers need to be supplied by others. The electrical cables shall be terminated in separately mounted explosion proof Junction Boxes or with moulded splice connections.

Refer to the following documents for detailed technical requirements:

X-076721-87-06 Supplemental Requirements Specification for TUTU

10.5 Umbilical Termination Assembly (UTA)

The Umbilical Termination Assembly (UTA) shall be a robust construction to provide interfaces with the umbilical and shall allow to suitably terminating all functions. The UTA shall be setup for the hydraulic connection of the two trees currently in the scope of supply and the two future trees.

Refer to the following documents for detailed technical requirements:

X-076721-87-07 Supplemental Requirements Specification for UTA

10.6 Power Regulation and Control Module (PRCM)

The Power Regulation and Communication Module (PRCM) regulate the power to the ESCM and provide communication to the ESCM. It also provides the connection to the external cathode package.

The PRCM shall be diver recoverable by using a special change out tool and shall be connected to a mounting base.

10.7 Electric Subsea Control Module (eSCM)

The eSCM controls various electric actuators on the tree/wellhead and acquires data from the subsea instrumentation for the transmission to the surface.

The following functions need to be controlled by the eSCM:

No.	Function	Actuator Size	Location	Note
1	CIV 1	¾”	Tree	
2	CIV 2	¾”	Tree	
3	CIV 3	¾”	Tree	
4	BAIV	¾”	Wellhead	
5	AMV	2”	Wellhead	
6	XOV 1	2”	Tree	
7	UPMV	5”	Tree	
8	PWV	5”	Tree	
9	PCV	N/A	Tree	
10	SCSSV Open	N/A	Tree	
11	SCSSV Close	N/A	Tree	

The following tree sensors need to be monitored by the eSCM:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

10.8 Anode Package / Anode Package Foundation Base

There are two separate Anode Packages for the A and the B channel of the system. The Anode Package shall be a robust frame construction for two separate and diver retrievable Anodes. The Anode package requires two separate electrical connectors for each anode for the connection via a flying lead to the anode umbilical assembly. The Anode Packages need to be clearly marked with “A” and “B”. The painted steel frame is protected by FRP grating on all four sides and on top to prevent damages caused by dropped objects. The two anode packages for the channels A and B will be placed on a further support frame to minimize the required installation effort. Both Anode Packages will be located on a Foundation Base.

10.9 Cathode Package

There are four separate Cathode Packages for the A and B channel of each tree. The Cathode Packages will be connected to the respective PRCM on the Subsea Protection Structure via an electrical flying lead. The Cathode Packages are diver installable and will be hooked into the outside plates of the Subsea Protection Structure. The Cathode Package contains the cathode itself and a frame with FRP grating on top to provide mechanical protection.

10.10 Anode Umbilical Assembly

The complete Anode Umbilical Assembly includes the following items:

- an approx. 100m long umbilical with an overall armour and four separate armoured 2,5mm² cores
- a pulling head assembly with 100mm diameter
- a hang-off assembly
- bend restrictor assembly at the Subsea end of the umbilical incl. clamping surface to fix the umbilical
- 4 pigtails, each 6m long, at the end of the umbilical

10.11 Electrical Flying Leads

The electrical flying leads shall comprise a cable moulded to the subsea connectors at both ends. The colour of these cables shall be black with a marking by means of approx. 30cm long heat shrinks at both ends. System A will be marked “blue” and System B “yellow”. These flying leads shall be designed for diver make up only.

10.12 Tree/Wellhead Pressure and Temperature Sensors

The following Pressure and Temperature Sensors are located on the Tree and the Wellhead:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

These sensors shall meet the following requirements:

- Field proven design
- The sensors shall be suitable for the intended subsea service
- Redundant with separate interconnection cables for the A and B channel
- Diver retrievable sensors
- With block-bleed-block assemblies on the pressure sensors
- Minimum accuracy of:
    - +/- 0.03% x full scale accuracy and a drift of 0.2%/year for the pressure sensors
    - +/- 0.3°C accuracy and a drift of 0.2°C/year for the temperature sensors

10.13 SCSSV Dump Valve Assembly

A 3/2 way valve shall be located on the tree for the operation of the SCSSV. The operation of this valve will be direct hydraulic by use of Transaqua HT fluid from a dedicated HPU through a single HP supply line in the main umbilical. The valve shall be designed for the design pressure of the SCSSV system and shall be activated by the ESCM. This assembly will consist of a fixed plate which will be located on the tree and a free plate with the dump valve on which is diver retrievable. Both plates will be connected via quick couplers without the use of poppets. The tree tubing will be connected to the fixed plate by using Autoclave anti-vibration couplers.

11 Quality requirements

A Quality Plan to be used for the project shall be created. For the Project Quality Specification see section 5.1 of this document.

11.1 CE Marking

The topside hardware and software is to be supplied with a CE declaration of conformity, which confirms compliance with all relevant directives.

12 Handling/Installation/Intervention & Shipping

Project shall provide detailed installation and intervention recommendations, and step-by-step project specific procedures, for review as part of the project-engineering phase.

All separately installable and retrievable items shall be provided with suitable lifting points and be generally designed to allow a smooth, simple and quick installation/retrieval process to be performed by divers. This shall include the following items:

- Electric Subsea Control Module (eSCM)
- Power Regulation & Communication Module (PRCM)
- Electrical flying leads between
  - Tree/Wellhead located junction boxes and sensors
  - UTA and PRCM
  - PRCM and ESCM
  - PRCM and Cathode Package

  Tree and Wellhead Pressure and Temperature Sensors
- SCSSV Dump Valve Assembly
- Anode Umbilical Assembly

All subsea assemblies shall be designed to withstand an abandonment period of 6 month sub sea, located where required but not connected to its services (hydraulic, chemical, electrical, ..)

12.1 Use of guidelines

All Subsea equipment (trees, choke inserts, jumpers, control modules, etc.) shall be designed for installation and retrieval by divers with the use of guidelines.

12.2 Lifting / Handling

All equipment shall be designed for safe handling and transportation, both onshore and offshore. All lifting points on all equipment handled offshore shall be:

- Physically load tested to rated weight
- Designed for loads as defined in API 17D and API RP 17G.
- Any welding and associated NDE, which is required for lifting apparatus shall be in compliance with API 17D and API RP 17G.
- All lifting points on all equipment, both purchased and rented; to be handled offshore shall be tested and labelled in accordance with API 17D and API RP 17G.
- All shipped equipment assemblies shall be labelled with their weight.
- Slings and rigging shall be provided for items that require lifting.

12.3 Connection of flying leads

The Subsea hydraulic and electrical flying leads shall be designed to be installed by the use of divers.

Following installation of the Xmas tree, the diver (after removing the LTC from the remote stab or connector) shall pick up the remote end connection and install it to the UTA or Wellhead.

The process shall be similar for the electrical connector.

For recovery the procedure shall be reversed.

12.4 ROV Interfaces

All ROV and diver interfaces shall be designed in accordance with ISO 13628-8.

12.5 ROV Marking of Subsea Stations

Marking of subsea station shall be in accordance with ISO 13628-1 and the following requirements:

- Letter size shall be 50mm

13 Testing

Each item of deliverable equipment shall be tested in accordance with a project approved and CAMERON supplied acceptance test procedure to verify the following as a minimum:

- Functionality
- Internal pressure testing
- External pressure testing
- Control fluid cleanliness to SAE AS4059

CAMERON shall provide written step-by-step procedures for these tests to be provided to COMPANY.

A Control System Integration Test shall be performed in accordance with a COMPANY approved procedure to demonstrate that all of the individual items of equipment function correctly as a system.

The testing programme for the Subsea Production Control System shall be undertaken in the stages detailed as follows:

- Factory Acceptance Test for single units (FAT's)
- System Factory Integration Testing (FIT)
- Tree EFAT
- System Integration Testing (SIT)
- Platform Commissioning
- Offshore Pre-submergence Testing/Deck Testing
- System Commissioning

13.1 Factory Acceptance Test (FAT)

Each deliverable item shall be subjected to a Factory Acceptance Test (FAT). The purpose of this FAT shall be to demonstrate the item is suitable for the intended purpose and functions correctly. FAT tests shall include hydrostatic proof pressure testing to 1.5 times the design pressure of the Subsea control system.

All FAT procedures shall be step-by-step and submitted for review and approval prior to testing commencing.

All critical equipment components shall be subjected to sub-assembly tests during the assembly phase of manufacture and to carry out these tests, the necessary equipment and fittings are specialised in-house equipment and are not project deliverable.

Each item of equipment shall be subject to an in-house FAT in accordance to an approved standard procedure document to demonstrate these meet the specified operational and functional requirements.

The tests shall include interface connections and mechanical alignment tests to verify design and manufacturing limit tolerance effects, component inter-changeability, together with hydraulic fluid system flushing and / or cleanliness checks as necessary to ensure the system meets SAE AS4059. The hydraulic tubing and piping pressure lines shall be hydrostatic pressure tested to 1,5 times the design pressure.

The test equipment shall be determined by the proposed testing programme, however in the event of additional testing or if testing in other locations is required, the quantity of test equipment detailed shall be subject to review.

Testing of fabricated items shall also include continuity testing of bolting.

Testing on subsea assemblies shall include continuity testing and earthing testing.

The maximum value for the resistance measured shall be 0.1 Ohm.

13.1.1 Environmental Stress Screening (ESS)

Modules or subassemblies containing electrical equipment and/or electronic equipment, which are intended for permanent subsea installation shall comply with section 4 of the Total specification GS EP SPS 022 “Environmental testing of Subsea Electronics”.

13.2 Factory Integration Test (FIT)

A System Factory Integration Test (FIT) shall be conducted to verify the correct interfacing and inter-working of all items of the subsea production control system equipment. External interfaces, for example Xmas tree valves & sensors, umbilical cables, DCS, MCC & ESD systems etc. shall be simulated for the purpose of the test. The testing shall be designed to verify the functional and operational integrity of the subsea production control system.

13.3 Xmas Tree/SCM system integration test (Tree eFAT)

A Xmas Tree/SCM System Integration Test shall be conducted for the Xmas tree, following completion of the Xmas tree FAT within the factory.

14 Special packing/shipping procedures/Instructions

For deliverables consisting of a main assembly with additional loose items (Lifting Slings, Test Hoses/Cables, Fill Lance, Pre-Charge Kit, Fluid in Barrels etc.), separate packing/shipping procedures/instructions with included component check-lists shall be provided.

The same shall apply for deliverables that can not be shipped as complete units, as transportation could result in damage of internal components.

These procedures/instructions should be part of the BOM from the related parts.

For all units which include any fluids or substances, COSHH sheets (Control of Substances Hazardous to Health) shall be delivered with the unit. These COSHH sheets shall be available early in the process for supply to the client.

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

07AUG07	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
22MAR07	Issued for Client Comment	A. Weilandt	S. Horne	
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Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirements Specification for HPU**		
PAGE 1 OF 21	**Customer Document Number:**	54NL92-W-0S-510	REV. 1
	Cameron Document No.	X-076721-87-05	REV. 01

1 INTRODUCTION

This document is written to consolidate the technical requirements for the Hydraulic Power Unit (HPU) intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

2 SCOPE OF THIS DOCUMENT

The scope of this document is to define the technical requirements for the Hydraulic Power Unit intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

3 Document revision status / record

Table 3-1 – Amendments

Date	Rev.	Description	Author
01DEC06	A	Initial Release	A. Weilandt
05JAN07	B	Section 7.1: - Operating Environment: “salt spray” changed to “salt laden and corrosive atmosphere” - Outdoors Ambient Air Temperatures added - HP/Circulation Pump: preferred vendor changed to Loher - HP/Circulation Pump: added comment that heater is only required if >10kW and requirement for pulsation dampeners - Pump Filtration: added comment that NPT threads are required on filter block and requirement to use EPE.. - HP Supply ESD Valve: Rotator instead of Bifold. - HPU Remote Interface: deleted EEx-d - HPU Gauges: added requirement for restrictions - Relief Valves: added requirement to use Nupro - Terminal details added - Internal lighting added	A. Weilandt
08FEB07	C	Section 6.1: - PLC deleted from the HPU scope, it will be separately located in a remote PLC Cabinet Section 6.3.1.1: - PLC I/O Schedule and PLC S/W Package deleted - Instrument List added Section 6.3.3.1.3: - S/W Configuration Record and PLC application removed Section 7.1: - Safety/Warning tag requirement in English and Dutch added - Isolation Valve requirement for Level Transmitter added Section 7.2.1: - PLC Power and Comms deleted - Input/Output signals from/to PLC added - Pressure Transmitter signals to safety system added Section 7.5: - EEx-d Box requirement for PLC deleted - requirement for separate junction boxes added	A. Weilandt
07AUG07	01	Updated to “Approved for Construction” Section 6.3.1.1: Equipment and Instrument Data Sheets added Section 7.1: Bypass PLC Enable renamed to Enable Startup Override	A. Weilandt

4 ABBREVIATIONS & DEFINITIONS

For abbreviations and definitions used within the Total K5F Project see related documents referenced within section 5.1 of this document.

Abbreviations and Acronyms that are specific to this document alone, for readability purposes are listed in this section:

Table 4-1 – Abbreviation/Acronym

Abbreviation/Acronym	Description
AVL	Approved Vendor List
DP	Design Pressure
DPDT	Double pole double throw
ESD	Emergency Shutdown
FAT	Factory Acceptance Test
HP	High Pressure
HPU	Hydraulic Power Unit
MCC	Motor Control Center
MCS	Master Control Station
MOP	Maximum Operation Pressure
PLC	Programmable Logic Controller
SCSSV	Surface Controlled Sub-Surface Safety Valve
SST	Stainless Steel
SSS	Saftey Shutdown System
TBD	To be determined

5 References

5.1 Cameron Reference Documents

This section defines the supporting Cameron documents to be used for evaluations against overall project requirements.

Table 5-1 – Cameron Reference Documents

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis
X-065443-70	Hydraulic Accumulator, Pump & Reservoir Calculation

5.2 Customer Reference Documents

This section defines the supporting customer documents to be used for evaluations against overall project requirements.

Table 5-2 – Customer Reference Documents

Description	Number
Total “Design basis for K5F project”	EDMP #32611
K5F Project Specification for Subsea Process Control System (SPCS)	#46643
External protection of offshore and coastal structures/equipment by painting	GS EP COR 350
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Electrical cables	GS EP ELE 161
Cable trays/ladders	GS EP ELE 311
Subsea production control system	GS EP SPS 019
Cleaning and flushing of hydraulic systems	GS EP SPS 023
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Typical cable tray details (offshore)	NL00-U-64-044
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
Instrument Name Plate Detail	NL00-Z-74-055

5.3 Industry Reference Documents

This section defines supporting industry and regulatory documents to be used for evaluations against overall project requirements.

Table 5-3 – Industry Reference Documents

Number	Description
API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platform
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment

Number	Description
ANSI/AWS D1.1	Structural Steel Welding Code
ANSI/AWS D1.6	Structural Welding Code – Stainless Steel
PED/97/23EC	Manufacturing and Certifcation of Accumulators
IEC-60529	Classification of Degrees of Electrical Protection provided by Enclosures
IEC – 92	Section 9.0 “Electrical Installations in Ships”
IEC – 60079 (EN 50014)	Section 9.0 “Electrical Apparatus for Explosive Gas Atmosphere”
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements
SAE AS4059	Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluid

6 Scope of Supply

The scope of supply for the Hydraulic Power Unit (HPU) shall consist of the following:

6.1 Permanently installed HPU Equipment

The scope for the permanently installed HPU equipment shall consist of the following main items:

- HPU Skid and Controls Assembly

The PLC will not be part of the HPU. It will be located in a separate PLC Cabinet located in the safe area.

6.2 HPU Installation and Test Equipment

The scope for the HPU Installation and Test equipment shall consist of the following main items:

- Surface Handling Rigging (Sling and Pad eyes)
- Nitrogen Pre-Charge Kit (including adapters for **all** HPU Accumulators that requires precharge , suitable hoses and Regulator)

6.3 Deliverable Documentation

The deliverable documentation for the Hydraulic Power Unit (HPU) shall consist of the following as a minimum:

NOTE:
Documentation shall be delivered in AutoCAD, Word or Excel format as applicable. All documents shall show metric units of measure as a minimum.

6.3.1 Engineering Documentation Requirements

The scope of supply for engineering documentations for the HPU shall consists of the following as a **minimum** for approval:

6.3.1.1 Engineering Documentation Requirements for Hydraulic Power Unit

- HPU Interface Data Sheet
- Assembly Drawing
- Flow Diagram
- Circuit Diagram
- Instrument List incl. Instrument Data Sheets
- Equipment Data Sheets (from vendor)

- Field Termination Drawing
- Package Structural Fabrication Drawings
- Package Lifting Eye Calculations
- Factory Acceptance Test Procedure
- Special Packing/Shipping Instructions
- Spare Parts List for Installation and Hookup Testing
- Spare Parts List for Commissioning
- Spare Parts List for 1 year of Operation and Maintenance

6.3.1.2 Engineering Documentation Requirements for Nitrogen Pre-Charge Kit

- Assembly Drawing

6.3.2 Installation, Operation and Maintenance Documentation Requirements

The scope of supply for installation, operation and maintenance documentations for the HPU and HPU Auxiliary Equipment shall consists of the following as a **minimum** for approval:

6.3.2.1 Installation, Operation and Maintenance Documentation Requirements for HPU

- Installation Procedure (procedure for physical installation and hookup of all components incl. field power/signal cabling, earthing and hydraulic connections)
- Operation Procedure (procedures start-up activities and for operating the HPU locally and remotely)
- Maintenance Procedure (procedures for operation preparation, replacement of consumable components, replacement of pumps/accumulators/gauges/panel components, and replacement/restoration of HPU controls equipment).
- Field Termination Drawing (drawing indicating all field hookups to the HPU)

6.3.2.2 Installation, Operation and Maintenance Documentation Requirements for Nitrogen Pre-Charge Kit

- Operation & Maintenance Procedure (Pre-charge Procedure)

6.3.3 Quality Documentation Requirements

A Manufacturing Record Book shall be provided for the HPU and HPU Auxiliary Equipment with the following information as a **minimum** for approval:

6.3.3.1 Quality Documentation Requirements for HPU

6.3.3.1.1 HPU Unit QA Records

- Factory acceptance test records/charts
- Hydrostatic pressure test records/charts
- HPU Transmitter calibration certificates
- Relief valve certificates
- Certificate of compliance
- Certification documents for hazardous location electrical component

6.3.3.1.2 HPU Unit Manufacturing Records

- Material test reports
- Welding and NDE procedures, qualification records and reports

6.3.3.1.3 HPU Unit Assembly and Test QA Records

- Assembly traceability record (set-out report)
- Flushing test records
- Certificate of compliance for HPU permanently installed equipment against General Design Basis and HPU Detailed Design Basis requirements.

6.3.3.2 Quality Documentation Requirements for Nitrogen Pre-Charge Kit

- Certificate of compliance

7 Hydraulic Power Unit Design Specifications

7.1 Equipment Design Requirements

Design requirements for the Hydraulic Power Unit (HPU) are defined as follows:

Feature	Static Design Requirement	Performance Requirements	Additional Description
Operating Environment	Offshore, salt laden and corrosive atmosphere, IP56 protection	Exterior and Interior HPU skid components and assemblies shall incorporate protection from environment	
Maximum (not to exceed) Dimensions	2500 mm (Length) 2595 mm (Height) 1800 mm (Width)		
Maximum (Not to exceed) Weights	5500 kg (Empty) 6550 kg (Full)		
Service Access	1500 mm (Front) 0 mm (Rear) 0 mm (Left) 1000 mm (Right) 0 mm (Top)		
Area Classification	Zone 1, Gas Group IIB, Temperature Class T3	N/A	EEx-d type instrumentation shall be used. “Intrinsically Safe” (EEx-i) instrumentation and communications may not be used on HPU skid.
Ambient Air Temperature	Max.: not exceeding +40°C Daily average: not exceeding +35°C Minimum: not less than -16°C		
Service Life	20 years	Filters, pump seals, and components subject to friction shall be identified and characterized by a maintenance life of 2 years	
HP Design Pressure	690 barg	N/A	
HP Control Fluid	Castrol Transaqua HT or HT2	N/A	

Feature	Static Design Requirement	Performance Requirements	Additional Description
Number of HP Pumps	2x 380VAC, 50 Hz, 3 phase, Minimum flow capacity of 3 l/min at 690 barg. Heater only required if >10kW Pulsation Dampeners to be located at the pumps.	Each pump should be sized to completely charge the accumulators within 30 minutes. Shall be self-priming, mounted on anti-vibration pads and fitted with flexible hoses on inlet and outlet. The fluid from the pump shall pass through a check valve and an isolation valve before entering the manifold.	HP pumps operated by off-skid MCC, controlled by remote PLC and hardwired signals to/from MCC. Loher EEx-d motors to be used.
Number of Circulation Pumps	1 x 380VAC, 50 Hz, 3 phase, minimum flow capacity of 35 l/min at 6 barg. Heater required if >10kW	Circulation pump should be able to completely recycle the largest reservoir within 2 hours. Shall be self-priming, mounted on anti-vibration pads and fitted with flexible hoses on inlet and outlet.	Circulation pump operated by off-skid MCC, controlled by remote PLC and hardwired signals to/from MCC. Loher EEx-d motor to be used.
Reservoirs	1x 500 liter (Supply) 1x 550 liter (Return)	Reservoirs to be independent. 3mm 316L to be used To be equipped with: - isolation ball valve on each suction outlet - Air filter - Vent / Breather - fluid sample valve point - 600mm man hole w/ cover - magnetic type sight level gauges on both reservoirs with isolation valves for a replacement of these gauges w/o emptying the tanks.	Given size is incl. spare fluid and air gap.
Cleanliness Requirement	Minimum SAE AS4059, Class 6		Periodic operation at SAE AS4059, Class 10 allowed.
Pump Filtration	Redundant disposable filter cartridge with integral blockage indicator (visual and dry contact N.C. terminals) for hydraulic circuit and a single filter with visual blockage indicator for the circulation circuit. Cartridge filters shall be $\beta_3 \geq 200$, w/SS316 housing construction.	Filter elements shall be removable under service with double block and single bleed/drainage to return reservoir. Filters shall be selected to achieve and maintain cleanliness requirement under continuous service.	Filter block to be equipped with NPT threads. If BSP threads will be used than this need to be clearly stated on the filter block. EPE to be used.
Number of HP Accumulators	2 x 35 l, Bladder type		

Feature	Static Design Requirement	Performance Requirements	Additional Description
HPU Construction	Integral SS316L pickled and passivated enclosed heavy duty type skid in accordance to **IP56** degree of protection.	Provisions shall be made to allow the HPU fastened to the deck (bolted or welded). The base frame shall have an integral drip tray, sloped to a central take-off point.	Applicable (but not limited to) Plinth, Foundation, Frame, Reservoirs, Enclosure, Doors, MCTs, Top and Side Covers
Doors	Applicable for access door and instrument panel.	ESG safety glass to be used for instrument panel. Doors shall be removable using lift-off hinges.	Provided with three point locking mechanism that shall accept one padlock.
Hydraulic Tubing	Autoclave MP 316L cold drawn tubing	To withstand 1,5x DP for 15min w/o damage	
Hydraulic Fitting	Autoclave MP and anti-vibration fitments at the output		Swagelok can be used in return lines.
Pressure Transmitters	0-1000 bar range EEX-d protection 4-20 mA output 2 off for HP Header and 2 off for HP Pump Pressure	One PT will be connected to the remote PLC and the other directly to the Safety System via a separate J-Box. Each PT requires a double block and single bleed valve assembly.	LABOM to be used if combined with a Gauge, otherwise Fisher-Rosemount to be used.
Level Gauge / Transmitters	Both Reservoirs to be provided with combined magnetic sight Level Gauge (LG) / Transmitter (LT) for local control and remote monitoring.	The LT shall indicate 0-100% over maximum design volume of reservoir. The LG shall be provided with isolation valves for replacement w/o emptying the tanks.	KSR-Kuebler EEx-d type to be used.
Relief Valves	Required on the hydraulic side of each accumulator	Setpoint = DP	Nupro or Marshalsea to be used
Burst Disks	Required on the gas side of each accu		To prevent over-pressurization
HP Supply ESD Valve	1 x 3/2-way solenoid w/ manual reset, 2x 3/2-way solenoid valve; AISI 316SS or equivalent; 24VDC solenoid (NC = No Vent/Block)	Deenergizing either valve (series connection) will depressurize the HPU within 5 minutes.	Valve will vent to Return reservoir and block HP Pump to HP Supply Header. Valves are energized and deenergized by circuit off-skid. Rotator to be used.
HPU Control	Remote control with a LPC located in a separate PLC Cabinet located in the safe area.	HPU controls/instrumentation to be powered from protected facility electrical supply (UPS)	
HPU Local Control Panel	EEx-d illuminated momentary pushbuttons, lamps, gauges and annunciator		
HPU Remote Interface	By multicore cables to the external PLC Cabinet		

Feature	Static Design Requirement	Performance Requirements	Additional Description
HPU Gauges	Glycerin filled type with **100-mm diameter** Accuracy: ± 1% F.S 70% = 690 barg. Resolution: 10 bar	To be provided with restriction.	LABOM to be used. Can be combined with pressure transmitters
Local Panel Lamp	**Red Lamp:** HP Pump Pressure HIHI HP Header Pressure HIHI Supply Tank LOLO Supply Tank HI Return Tank LOLO Return Tank HI Filter Blocked **Green Lamp:** HP Pump 1 Running HP Pump 2 Running 230V Power Supply available		BARTEC EEx-d type to be used
Local Panel Illuminated Pushbutton	**Green:** HP Pump 1 AUTO HP Pump 1 DUTY HP Pump 2 AUTO HP Pump 2 DUTY Circulation Pump ON **Red:** HP Pump 1 OFF/ALARM HP Pump 2 OFF/ALARM Circulation Pump OFF Common Alarm/Alarm Accept		BARTEC EEx-d type to be used
Local Panel Pushbutton	Lamp Test Enable Startup Override		BARTEC EEx-d type to be used
Local Panel Annunciator	Alarm Buzzer		BARTEC EEx-d type to be used
Internal Lighting	Minimum 1 off internal illumination lights with internal battery backup.	Minimum 100 Lux at 0,8m above floor required	CEAG to be used
Terminals	Screw-type terminals to be used		Phoenix to be used
Nameplates on “Local Control Panel” and within HPU	To be attached with a min. of two (2) 316 SST screws or SST rivets.		
Painting	All non SST components to be painted in light grey RAL7035.		
Tagging (Drawing/ equipment)	Refer to **General Design Basis**	Main components need to be tagged as per NL00-Z-74-055 with Total tag numbers	
Lifting/ Handling	4-point lifting padeyes and forklift slots	Padeyes to be rated at 2.5 times static weight of empty skid.	

Feature	Static Design Requirement	Performance Requirements	Additional Description
Marking	- HPU Equipment Tag - Company Name - Contract/Purchase Order Number - Weight (Gross / Net) - Cameron PN - Unique Serial Number - Supplier PN	All marking shall be manufactured in such a manner so as to ensure legibility throughout design life.	All shipped items shall be marked with this info as a minimum.
Safety and Warning Signs	All safety and warning signs shall be in English **and** Dutch	White letters on red background	
Misc.	- If dissimilar metals are used on this unit, then isolation material shall be placed between these materials.	- All components on the HPU shall be installed in a manner that permits maintenance without the need to shutdown or depressurize the HPU. Maintenance of items shall **NOT** compromise safety of personal. The HPU shall be designed using a double block and bleed isolation philosophy. - It shall **NOT** be possible to start the HP hydraulic pumps in the “AUTO” operation mode while the ESD signal is energized - all tube clamps need to have a closed clamp surface to prevent water ingress	It shall be not intended that any element of the HPU will come into contact with hydrocarbons (produced fluids) or any chemicals used for well treatment during the normal operation of the system.

7.2 Interface Requirements

7.2.1 Electrical Interface Requirements

Electrical interfaces shall be finally detailed during the detail engineering phase.

Table 7-1 – Electrical Interface Requirements

Interface on HPU	Voltage	Interface to
HPU HP Pump Motors Control	24 VDC	MCC
HPU Circ. Pump Motor Control	24 VDC	MCC
HPU HP Pump Motors (2 off)	380 VAC, 3 ph 50 HZ	MCC
HPU Circ. Pump Motor (1off)	380 VAC, 3 ph 50 HZ	MCC
HPU HP Motor Heaters (2 off); if applicable	230 VAC, 1 ph, 50 Hz	MCC
HPU Circ. Motor Heater if applicable	230 VAC, 1 ph, 50 Hz	MCC
HP Pump Pressure Transmitter	24 VDC	PCS
HP Header Pressure Transmitter	24 VDC	PCS
Inputs/Outputs from/to remote PLC	24 VDC	PLC Cabinet
HPU Internal Lighting	230 VAC, single phase 50 Hz	MCC
HPU ESD Valves (1 off)	24 VDC	SSS

7.2.2 Hydraulic Interface Requirements

Hydraulic interfaces shall be finally detailed during the detail engineering phase.

Table 7-2 – Hydraulic Interface Requirements

Interface on HPU	Quantity	Size	Material	Note
Fill-up Connection	1	1” Female	SST 316	
Common Drain Line	1	1” Female	SST 316	
Frame (Drip Pan) Drain	1	1” ANSI B16.5 Flange	SST 316	
Outlet HP Supply	1	3/8” Size Autoclave	SST 316	

7.3 Specific Hydraulic Accumulators Design Requirements

Accumulators shall be installed downstream the filter units.

An isolation valve and a dump valve shall be fitted to the hydraulic fluid supply connection of each accumulator allowing individually isolation and draining for maintenance purposes.

The HP accumulators shall be fitted with a charging valve together with a metal burst disc to the pre-charge gas end connection of each accumulator. The burst disc shall be installed to protect the individual accumulator for over-pressurization in case the accumulators are subject to excessive heat (fire). The set point of these burst discs shall be the design pressure (DP) of the related accumulators.

The accumulators shall be manufactured and certified (Stamped) to comply with **PED/97/23EC**. The accumulators shall be complete with stainless steel fluid ports and gas valves.

The accumulators shall have the exterior blasted so that the certification is **NOT** invalidated and finish painted in hi-build epoxy, suitable for the environment in accordance to the related painting procedures referenced within section 5.1 of this document and also be subject to manufacturing and test, inspection and certification by an approved certifying authority.

The hydraulic accumulators shall be supplied without pre-charge gas and shall require pre-charging at the pre-commissioning stage with oxygen free nitrogen gas.

7.4 Specific Hydraulic Supply Distribution Design Requirements

The hydraulic distribution section within the HPU shall comprise of one discrete pressure supply headers for the HP supply. The HP supply header shall be fitted with two (2) **35 liter minimum** hydraulic accumulators. The unit shall provide one (**1**) hydraulic output:

- HP Header

This hydraulic supply/outlet header shall have the following components fitted as a minimum:

- Output pressure gauge downstream of pumps and upstream of filters c/w block-bleed-block possibility and incl. test connections.
- Output pressure gauge downstream of filters and upstream of ESD valve c/w block-bleed-block possibility and incl. test connections.
- Hydraulic bleed valve downstream of filters and upstream of ESD valve.
- Hydraulic isolation valve downstream of accumulators and upstream of the ESD solenoid valve (Mounted on "**Local Control Panel**")
- Hydraulic bleed valve downstream of ESD solenoid valve.
- Hydraulic outlet isolation ball valve downstream of ESD Solenoid valve. This valve must have a facility to be pad lockable in open position.
- Solenoid operated ESD valve, 3way 2 positions solenoid operated hydraulic control valve (two in series, one shall be equipped with a latching device, manual reset and manual close button)

- Output pressure gauge/transmitter downstream of the ESD valve c/w block-bleed-block possibility and incl. test connections.

Returns from subsea were necessary; returns from surface accumulators together with bleeds and returns from Safety Valves shall use individual connections within the "**Return Reservoir**".

7.5 Specific Electric Cabling, Junction Boxes and Earthing Requirements

SST or Plastic Type EEx-e electrical junction boxes shall be installed within the HPU for connecting internal and external cables. Each electrical junction box on the HPU shall have a protection rating of **IP 66** as defined in IEC 529 (BS 549).

Cable entries for internal cables into EEx-e electrical junction boxes shall be either from the side or from the bottom through installed plastic flanges via plastic type metric size cable glands. Material of the cable glands shall always be the same as the material of the junction box.

External cables shall be routed through MCT frames (2 off) at a predefined location of the HPU structure (Above the Local Control Panel) via Platform provided MCT inserts. Cable entries for external cables into the electrical junction box within the HPU shall be from the bottom through HPU installed undrilled plastic type flanges via Platform provided plastic type metric size cable glands. In practice the plastic type flanges shall be removed and drilled by the cable installation contractor. The cable installation contractor supplied cable glands (approved for service) shall then be installed into the flange prior the cables being routed into the junction box.

Power and Signal cables shall be run separated from each other on the HPU frame to avoid any interference.

Each electrical junction box together with all associated electrical cables and cable connections shall be clearly labelled in accordance to the requirements raised within the related specifications as referenced within section 5.1 of this document and shall be installed in a manner that permits easy access during maintenance.

The cabling of the instruments and signals shall be wired to separate junction boxes inside the HPU in such way that the different signals shall be wired to their dedicated junction box as per following list:

J-Box "BES 82202" for analogue signals to SSS (Pump and Header Pressure Transmitters)

J-Box "BOS 82202" digital signals from SSS (ESD Solenoid Valve)

J-Box "BA 82202" digital inputs to the PLC (switches)

J-Box "BO 82202" digital outputs from the PLC (Indication lamps)

J-Box "BE 82202" analogue inputs at the PLC (pressure transmitter, level transmitters)

All these boxes need to the tagged accordingly. Tag numbers to be provided by Total.

The HPU shall be provided with three independent and electrically isolated earthing points for the connection to the platform earthing systems. These earth points shall be defined as follows:

- Instrument Earth – Used for connection of instrument circuit screens, etc.
- Protective Earth – Used for connection of power circuit protective earth
- Earth Bonding – Used for earth bonding of structural items

A minimum of two earthing bosses shall be provided at opposite corners of the HPU to allow earth bonding to the platform. In addition earth bonding shall be provided between the HPU frame and all doors, removable panels, cable trays and other metallic components within the HPU.

7.6 HPU Control and Alarm Setpoint Default Settings

Table 7-3 – Default Control Setpoint Settings

Description	HP supply circuit
HP Start Pressure	**580 barg**
HP Stop Pressure	**627 barg**
Emergency Pump Stop	**400 barg**

Table 7-4 – Default Alarm Setpoint Settings

Description	HP supply circuit
Supply Reservoir LoLo Level	**5%**
Supply Reservoir Lo Level	**10%**
Supply Reservoir Hi Level	**95%**
Supply Reservoir HiHi Level	**100%**
Return Reservoir LoLo Level	**5%**
Return Reservoir Lo Level	**10%**
Return Reservoir Hi Level	**95%**
Return Reservoir HiHi Level	**100%**
HP Header LoLo Pressure	**xxx barg**
HP Header Lo Pressure	**xxx barg**
HP Header Hi Pressure	**xxx barg**
HP Header HiHi Pressure	**xxx barg**
HP Pump LoLo Pressure	**xxx barg**
HP Pump Lo Pressure	**xxx barg**
HP Pump Hi Pressure	**xxx barg**
HP PumpHiHi Pressure	**xxx barg**

The above set points shall be confirmed during final acceptance testing.

7.7 Maintainability Requirements

Elevated FRP floor grating shall be provided to cover the internal area of the structure. The grating shall be removable for easy access to tubing during maintenance.

The skid layout shall be such that large items (Pumps, Accumulators, etc.) can be easily removed from the unit for repair and/or replacement trough the entrance door.

The HPU skid shall incorporate a hoist arrangement attached to the structure frame top section assisting and allowing complete change-out of motor/pump assemblies.

The hoist arrangement rail together with the lifting equipment shall allow lift-up of the related pump and transport to the entrance door.

All components shall be installed in a manner that permits maintenance without the need to shutdown or depressurize the HPU.

A hydraulic fluid sample point shall be provided downstream of each hydraulic circulation filter, permitting samples to be taken at this point. Sample points shall be strategically located with caps and warning signs to ensure operator safety.

Each circulation filter unit circuit shall be provided with isolation and bleed facilities, allowing service and replacement of the filter unit without venting pressure throughout the entire circulation system.

If required the pump outlet shall be provided with a relieving device, if pump outlet pressure could exceed the circuit design pressure.

Pressure transmitters shall be equipped with double block valves and single bleed valves together with test connections, allowing online maintenance and calibration checks.

Hydraulic fluid sample points shall be provided downstream of each hydraulic manifold filter unit and on the return manifold, permitting samples to be taken on a regular basis for fluid contamination monitoring purposes. Sample points shall be strategically located with caps and warning signs to ensure operator safety.

Pressure transducers shall be used on the HPU for remote PLC based pressure control of the surface accumulators and header and the connection to the safety system. Each pressure transducer shall be equipped with a block-bleed-block valve to allow maintenance during system operation.

It shall be possible to disconnect each motor pump unit separately from the main electrical power supply from the MCC without interference to **ANY** other HPU equipment.

The HPU shall be provided with two internal illumination lights, to allow maintenance to be safely carried out within the HPU at any time. A switch shall be provided internally adjacent to the access door. The HPU internal lightning shall be derived from the 230 VAC, single phase, 50 Hz electrical supply from the MCC.

7.8 Equipment Manufacturing Requirements

The tubing of the hydraulic circuits shall be accurately cut and bent using standard tube cutters and tube benders. No burrs shall be allowed and each section of the tubing shall be cleaned and blown dry before assembly to ensure that no contamination (dirt) could enter into the control components.

NOTE:
PTFE tape shall not be used on any part of the hydraulic control system. Use of Loctite 572 shall be the preferred sealant compound.

The skid shall, upon completion of fabrication, have all weld scale removed.

7.9 HPU FAT Test Procedure

All transducers and relief valves shall be pre tested and calibrated prior to use in the HPU and installed after hydrostatic testing has been completed.

The HPU shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- HP circuit hydraulic proof pressure test
- Relief Valve setting verification
- Accumulator pre-charge inspection
- Flush/fill verification test
- Electrical tests (Terminals-to-ground insulation resistance)
- PLC logic control verification & transmission to MCS
- PLC instrumentation verification & MCS indication
- Pump start/stop settings from PLC & MCS
- Pump stop due to low fluid level in reservoir and ESD
- ESD vent valve checks & Restart
- Fluid cleanliness inspection
- Final inspection

7.10 Special Packing & Shipping Instructions

For packing and shipping special instructions shall be provided addressing the following as a **minimum**:

- Reservoirs **EMPTY**
- Accumulators **NOT** pre-charged (but with required pressure to avoid damage of bladder)
- Loose Item Check List (Slings, Shackles, Fill Lance, Pre-Charge Kit, etc.)

8 Nitrogen Pre-Charge Kit

An accumulator pre-charge kit shall be provided that consist of the following main items:

- Charging Valves c/w with gauge and bleed valve

- Adapters and Fittings allowing multiple use of above equipment.

9 Hold Points

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

10NOV08	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
08APR08	Issued for Client Comment	A. Weilandt	S. Horne	
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Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirements Specification for HPU PLC Cabinet**		
PAGE 1 OF 15	**Customer Document Number:**	54NL92-W-7S-501	REV. 1
	Cameron Document No.	X-076721-87-18	REV. 01

1 INTRODUCTION

This document is written to consolidate the technical requirements for the Hydraulic Power Unit (HPU) PLC Cabinet intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

2 SCOPE OF THIS DOCUMENT

The scope of this document is to define the technical requirements for the HPU PLC Cabinet intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

3 Document revision status / record

Table 3-1 – Amendments

Date	Rev.	Description	Author
01AUG07	A	Initial Release	A. Weilandt
08APR08	B	Section 7.4 updated to show latest agreed functionality	A. Weilandt
10NOV08	01	Approved for Construction	A. Weilandt

4 ABBREVIATIONS & DEFINITIONS

For abbreviations and definitions used within the Total K5F Project see related documents referenced within section 5.1 of this document.

Abbreviations and Acronyms that are specific to this document alone, for readability purposes are listed in this section:

Table 4-1 – Abbreviation/Acronym

Abbreviation/Acronym	Description
AVL	Approved Vendor List
ESD	Emergency Shutdown
FAT	Factory Acceptance Test
HP	High Pressure
HPU	Hydraulic Power Unit
MCC	Motor Control Center
MCS	Master Control Station
MOP	Maximum Operation Pressure
PLC	Programmable Logic Controller
SCSSV	Surface Controlled Sub-Surface Safety Valve
SST	Stainless Steel
SSS	Saftey Shutdown System
TBD	To be determined

5 References

5.1 Cameron Reference Documents

This section defines the supporting Cameron documents to be used for evaluations against overall project requirements.

Table 5-1 – Cameron Reference Documents

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

5.2 Customer Reference Documents

This section defines the supporting customer documents to be used for evaluations against overall project requirements.

Table 5-2 – Customer Reference Documents

Description	Number
Total “Design basis for K5F project”	EDMP #32611
K5F Project Specification for Subsea Process Control System (SPCS)	#46643
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Electrical cables	GS EP ELE 161
Subsea production control system	GS EP SPS 019
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
Instrument Name Plate Detail	NL00-Z-74-055

5.3 Industry Reference Documents

This section defines supporting industry and regulatory documents to be used for evaluations against overall project requirements.

Table 5-3 – Industry Reference Documents

Number	Description
API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platform
IEC-60529	Classification of Degrees of Electrical Protection provided by Enclosures
IEC – 92	Section 9.0 “Electrical Installations in Ships”
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements

6 Scope of Supply

The scope of supply for the HPU PLC Cabinet shall consist of the following:

6.1 Permanently installed HPU PLC Cabinet Equipment

The scope for the permanently installed HPU PLC Cabinet equipment shall consist of the following main items:

- HPU PLC Cabinet and internal PLC components (CPU, Digital and Analogue Input and Output cards)

6.2 Deliverable Documentation

The deliverable documentation for the HPU PLC Cabinet shall consist of the following as a minimum:

6.2.1 Engineering Documentation Requirements

6.2.1.1 Engineering Documentation Requirements for HPU PLC Cabinet

- Assembly Drawing
- Circuit Diagram
- Field Termination Drawing
- Factory Acceptance Test Procedure
- Spare Parts List for Commissioning
- Spare Parts List for 1 year of Operation and Maintenance

6.2.2 Installation, Operation and Maintenance Documentation Requirements

The scope of supply for installation, operation and maintenance documentations for the HPU PLC Cabinet shall consist of the following as a **minimum**:

- Installation Procedure (procedure for physical installation and hookup of all components incl. field power/signal cabling, earthing and connections)
- Operation Procedure

6.2.3 Quality Documentation Requirements

A Manufacturing Record Book shall be provided for the HPU PLC Cabinet with the following information as a **minimum**:

6.2.3.1 Quality Documentation Requirements for HPU PLC Cabinet

6.2.3.1.1 HPU PLC Cabinet Unit QA Records

- Factory acceptance test records
- Certificate of compliance

7 HPU PLC Cabinet Design Specifications

7.1 Equipment Design Requirements

Design requirements for the HPU PLC Cabinet are defined as follows:

Feature	Static Design Requirement	Performance Requirements	Additional Description
Operating Environment	Indoors, controlled environment		
Maximum (not to exceed) Dimensions	1000 mm (Height) 800 mm (Width) 300 mm (Depth)		
Service Access	800 mm (Front) 0 mm (Rear) 0 mm (Left) 0 mm (Right)		
Area Classification	Safe Area	N/A	N/A
Ambient Air Temperature	Max.: not exceeding +40°C Daily average: not exceeding +35°C Minimum: not less than -5°C		
Service Life	20 years		
Cabinet Construction	Self-contained, totally enclosed cabinet.	Cabinet will be bolted to the wall.	
Cabinet colour	Gray, RAL 7035 or no painting if made out of SST		
Cable Entry	Bottom entry		A suitable number/size of cable trays shall be provided for all external interconnection cables
Earthing	Cabinet to be provided with earthing bars close to cable entry in the bottom of the cabinet	IE and IPE bars to be provided. IE to be marked red and IPE yellow.	
PLC	SIEMENS S7 series		
Terminals	Screw-type terminals to be used		Phoenix to be used
Power Supply	230V/50Hz	See Interface Requirements	

Feature	**Static Design Requirement**	**Performance Requirements**	**Additional Description**
Tagging (Drawing/ equipment)	Refer to Subsea and Topside Functional Requirement Specification	Main components need to be tagged as per NL00-Z-74-055 with Total tag numbers	
Marking	- HPU PLC Cabinet Equipment Tag - Company Name - Contract/Purchase Order Number - Weight (Gross / Net) - Cameron PN - Unique Serial Number	All marking shall be manufactured in such a manner so as to ensure legibility throughout design life.	All shipped items shall be marked with this info as a minimum.
Safety and Warning Signs	All safety and warning signs shall be in English **and** Dutch		
Misc.			

7.2 Interface Requirements

7.2.1 Electrical Interface Requirements

Table 7-1 – Electrical Interface Requirements

Interface on HPU PLC Cabinet	Voltage	Interface to
Power Supply	230V/50Hz	K6C UPS
Communication Channel A	Ethernet via fibre optics	MCS
Communication Channel B	Ethernet via fibre optics	MCS
Motor Start Request (Digital Output at PLC)	24 VDC Signal	K6C MCC
Available/Running Status (Digital Input at PLC)	24 VDC Signal	K6C MCC
Digital Inputs at PLC	24 VDC Signal	HPU
Digital Outputs at PLC	24 VDC Signal	HPU
Analogue Inputs at PLC	24 VDC Signal	HPU

7.3 Specific Electric Cabling, Junction Boxes and Earthing Requirements

Cable entries shall be either from the side or from the bottom with metric size cable glands. Cable glands are not in scope of supply and need to be supplied by others on site.

Power and Signal cables shall be run separated from each other to avoid any interference.

7.4 Functional Requirements

7.4.1 Circulation Pump Logic

		MCC		PLC Output												
				1	2	3	1	2	3	4	5	6	1	2	3	4
X = valid _ = not valid		**INPUTS**	**OUTPUTS**	CP Start			CP STOP						CP ON Indication		CP OFF Indication	CP OFF Indication flashing @ 1Hz
1	CP PUMP ON			**X**									**X**			
2	CP PUMP OFF						**X**								**X**	
3	CP Pump Start request	**X**														
4	LOW LOW Supply Reservoir Level			_				**X**								
5	High Level Supply Reservoir			_					**X**							
6	LOW LOW Return Level									**X**						
7	HIGH HIGH Return Level										**X**					
8	CP available		**X**									_				_
9	CP Pump Running Feedback		**X**										**X**			
10	MCC not available															**X**
11	Lamp Test													**X**	**X**	

Only local operation shall be allowed for the Circulation Pump. It shall not be possible to start or stop the Circulation pump from the MCS. Only a Running Indication will be shown on the MCS HPU screen. Even if a HIHI or LOLO Supply/Return Reservoir Alarms is present the CP can be started by pressing the OVERRIDE Button and the CP ON Button. This function requires permanent operator attendance at the HPU.

A Running counter shall be provided on the MCS HPU screen, suitable data need to be sent to the MCS to have this running counter indication in minutes. It is only possible to reset the counter at the HPU PLC.

7.4.2 Hydraulic Pump Logic

PUMP LOGIC				ESD	MCS		MCC		PLC Output																																			
									1	2	3	4	5	1	2	3	4	5	6	7	8	1	2	1	2	1	1	2	3	4	5	1	2	3	4	5	6	7	8	1	2	1	1	2
> = above setpoint < = below setpoint				**INPUT**	**INPUT DB**	**OUTPUT DB**	**INPUTS**	**OUTPUTS**	**HP 1 Start**					**HP 1 STOP**								**HP1 Running Lamp ON**		**HP 1 OFF/Alarm LMP**		**HP 1 OFF/Alarm 1Hz**	**HP 2 Start**					**HP 2 STOP**								**HP2 Running Lamp ON**		**HP 2 OFF/Alarm LMP**		**HP 2 OFF/Alarm 1Hz**
1	Duty Stop Pressure 627 bar	Analog	PLC							<				>														<				>											
2	Duty Start Pressure 580 bar	Analog	PLC							<					>													<																
3	Standby Stop Pressure 627 bar	Analog	PLC								<				>														<				>											
4	Standby Start Pressure 560 bar	Analog	PLC								<																		<																
5	Low Pressure Stop 400 bar	Analog	PLC							<	<					<												<	<					<											
6	High Pressure Stop 627 bar	Analog	PLC							<	<						>											<	<						>										
7	MCS (Duty Stop Press.)	Analog	MCS			x bar						<						>												<					>										
8	MCS (Duty Start Press.)	Analog	MCS			x bar						<																		<																
9	MCS (Standby Stop Press.)	Analog	MCS			x bar							<						>												<					>										
10	MCS (Standby Start Press.)	Analog	MCS			x bar							<																		<																
11	HP Pump Pressure 13.4	Analog	PT	x bar																																										
12	HP Pump Pressure 13.1	Analog	PT		x bar																																									
13	HP Header Pressure 13.3	Analog	PT	x bar																																										
14	HP Header Pressure 13.2	Analog	PT		x bar																																									
15	Local (Switch)	Bool	SW							×	×			×	×														×	×				×	×											
16	Remote (Switch)	Bool	SW									×	×					×													×	×				×										
17	Startup override (Button)	Bool	PB						×																		×																		
18	HP 1 PUMP OFF/ALARM	Bool	PB																						×																				
19	HP 1 PUMP AUTO	Bool	PB						×	×	×	×	×							×																									
20	HP 1 Start Request	Bool	PLC				×		×	×	×	×	×																																
21	HP 1 Duty	Bool	PB							×		×		×															×	×															
22	HP 1 Available	Bool	MCC					×	×	×	×	×	×																																
23	HP 1 Running Feedback	Bool	MCC					×															×																						
24	HP 2 PUMP OFF/ALARM	Bool	PB																																									×		
25	HP 2 PUMP AUTO	Bool	PB																												×	×	×	×	×									
26	HP 2 Start Request	Bool	PLC				×																								×	×	×	×	×									
27	HP 2 Duty	Bool	PB								×		×																			×		×		×									
28	HP 2 Available	Bool	MCC					×													×										×	×	×	×	×				×					
29	HP 2 Running Feedback	Bool	MCC					×																																		×				
30	LOW LOW Supply Resevoir Level	Analog	PT							>	>	>	>									×										>	>	>	>					×				
31	MCC not available	Bool	MCC																							×																			×
32	Lamp Test	Bool	PB																					×	×																	×	×		

Initial Start-up of the HP pumps is only possible locally at the HPU by using the STARTUP OVERRIDE button to overcome the Low Pressure Interlock. As soon as a pressure level of 400bar is reached the pump will switch to AUTO Mode and will run with its preset stop set points.

HP Pumps can be switched ON and OFF locally at the HPU, but can only be switched OFF at the MCS. It shall not be possible to switch on the HP Pumps remotely from the MCS. If the HPU is in LOCAL mode any changes from the MCS on the pump start/stop set points will be rejected.

DUTY/STANDBY selection can be done locally at the HPU panel and remotely from the MCS.

A Running counter (minutes) shall be provided on the MCS screen, suitable data need to be sent to the MCS.

7.4.3 Alarm Logic

		Horn	PLC Output								
			1	2	3	4	5	6	7		9
	INPUTS		HP Header Press HIHI	HP Pump Press HIHI	Supply Res LOLO	Supply Reservoir HIGH	Return Res LOLO	Return Res HIGH	Filter Blocked Alarm		Common Alarm to MCS
1	Supply Reservoir LOW LOW Level	X			X						
2	Supply Reservoir LOW Level	X									X
3	Supply Reservoir HIGH Level	X				X					
4	Supply Reservoir HIGH HIGH Level	X									X
5	Return Reservoir LOW LOW Level	X					X				
6	Return Reservoir LOW Level	X									X
7	Return Reservoir HIGH Level	X						X			
8	Return Reservoir HIGH HIGH Level	X									X
9	HP Header LOW LOW Pressure	X									X
10	HP Header LOW Pressure	X									X
11	HP Header HIGH Pressure	X									X
12	HP Header HIGH HIGH Pressure	X	X								
13	HP Pump LOW LOW Pressure	X									X
14	HP Pump LOW Pressure	X									X
15	HP Pump HIGH Pressure	X									X
16	HP Pump HIGH HIGH Pressure	X		X							
17	HP 1 Filter Blocked	X							X		
18	HP 2 Filter Blocked	X								X	
19	Alarm Quit										
20	Lamp Test		X	X	X	X	X	X	X	X	

The dedicated Alarm lamp flashes when the corresponding alarm conditions occur. Pressing the ALARM QUIT button switches the horn off and turns the lamp in steady mode. When the alarm condition is gone the alarm lamp turns off.

The current HPU PLC Software version information shall be available at the MCS.

8 HPU PLC Cabinet FAT Test Procedure

The HPU PLC Cabinet shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- Electrical tests (earthing, wiring and insulation checks)
- Input/Output signal check
- Final inspection

9 Hold Points

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

11.01.2008	Reissued for Information	S. Voiges	I. Kiesewetter	A. Weilandt
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CAMERON	**Document Title:** **HPU Installation Procedure**		
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Installation procedure,

site requirements, connection work, operating elements and settings

Table of contents

1. Introduction

1.1 Scope

This document is prepared according to the Requirements Specification for the Hydraulic Power Unit (CAM Doc. No. X-076721-87-05). The HPU is designed to supply on demand the hydraulic pressure for all Downhole Safety Valves (DHSV's) on all four K5F trees. This document covers the HPU installation procedure.

1.2 Abbreviations

Assy, Assembling (drawing)

BetrSichV, "Betriebssicherheitsverordnung" (German Ordinance on Industrial Safety and Health for equipment and installations requiring supervision/monitoring or such equipment and installations in potentially explosive atmospheres), 27.09.2002.
BGV ..., identification with ordinal numbers of ordinances of the professional trade association for accident prevention and DA (implementation order), published by the main association of the BG.
BOM, Bill of Material

CAM, CAMERON
Chapt., chapter
ChemG, "Chemikaliengesetz" (German Chemicals Act),14.03.1990, Act on the Protection Against Hazardous Chemicals.
Conn., connection

dB, decibel
DIN EN, (harmonised European) EN standards published by DIN
DP, Design pressure

EC MRL, Machine Directive 98/37/EC (replacement for the Directives 89/392 EEC as well as 91/368, 93/44 und 93/68 EEC).
ESD, Emergency Shutdown System

FAT, Factory Acceptance Test
Fig., figure

h, hour, here operating hour
HP, high pressure
HPU, Hydraulic Power Unit

KMA, KOLLER Maschinen- und Anlagenbau GmbH, D-29227 Celle, Germany

LP, low pressure

MCC, Motor Control Centre
MCS, Motor Control System
MCT, Multi Cable Transit
MOP, Maximum Operation Pressure
MRB, Manufacturing Record Book
MRL, EC-Machine Directive 98/37/EC
MSDS, Material Safety Data Sheet
MWP, Maximum Working Pressure

NC, normally CLOSED
NO, normally OPEN

PHA, Preliminary Hazard Analysis
PLC, Programmable Logic Controller
PPE, Personal Protective Equipment (German PSA)

Safety Data Sheet, according to Directive 91/155 EEC
Sect., section
SPS, Subsea Production System
SSS, Safety Shutdown System

Tab., table

V AC, voltage AC
V DC, voltage DC
VO, (also V), "Verordnung" (Ordinance)

1.3 Reference Documents and Drawings

Description	TOTAL Doc. No.	CAM Doc. No.	KMA Doc. No.
Bill of Material (BOM)	x	X-076704-01-22	92001086 a
Equipment No.	x	223011-32	NN
Assembly Drawing	x	SK-066011-32	1-92001086 a
Flow Diagram	x	SK-066011-32-01	1-92001083 a
Circuit Diagram	x	SK-066011-32-04	NN
Factory Acceptance Test (FAT)	x	X-065437-01-11	NN
Field Termination Diagram	x	SK-066011-32-42	NN
Installation procedure	54NL92-W-0P-531	X-065467-02-09	NN
Operation procedure	54NL92-W-0P-542	X-065438-02-74	NN
Maintenance procedure	54NL92-W-0P-543	X-065438-02-75	NN

1.4 Intended Use/Equipment limitations

With the aid of two electrically driven HP pumps and an electrically driven circulation pump, the "Total Exploration & Production Netherlands B.V. K5F Project Hydraulic Power Unit"[1)] generates the necessary (system-dependent) pressure for the control of the K5F Downhole Safety Valves (DHSV). The HPU will be controlled by a remote PLC located in a safe area and is designed to supply hydraulic pressure for all DHSV's on all four K5F trees.

The K5F-HPU must not used for the following:
- Pressure testing
- Hot Oil flushing
- Running on other hydraulic fluids than specified in this document
- Running without accumulators in service
- Any service above maximum working pressure 627 bar
- Running of position control valves or servo/proportional directional valve systems with constant leakage.

2. Main Data

Equipment:	Total Netherlands K5F Project Hydraulic Power Unit
TOTAL BOM	NN
CAMERON BOM	X-076704-01-22
KMA Article No.:	KMA P/N 92001086 a
Approval:	Declaration of Conformity according to Machinery Directive 98/37/EC and ATEX Directive 94/9/EC
Area classification	Ex Zone 1, Category II, Gas Group IIB, Temperature Class T3
Ambient air temperature	max. +40 °C min. -16 °C

Electric power supply:
For details please refer to the Circuit Diagram.

- HPU HP Pump Motors Control	24 V DC
- HPU Circ. Pump Motor Control	24 V DC
- HP Pump Motors	3-phase, 380 V AC, 50 Hz
- Circ. Pump Motor	3-phase, 380 V AC, 50 Hz
- Internal light	1-phase, 230 V AC, 50 Hz
- HP Pump Motor Heaters	1-phase, 230 V AC, 50 Hz
- Circ. Pump Motor Heater	1-phase, 230 V AC, 50 Hz
- HP Pump Press. Transmitter	24 V DC
- HP Header Press. Transmitter	24 V DC
- Input/Outputs from/to remote PLC	24 V DC
- HPU ESD Valves	24 V DC

Frame size, weight

Length x width x height	2,500 x 1,800 x 2,595 mm

1) The "Total Exploration & Production Netherlands K5F Project Hydraulic Power Unit" is abbreviated to "K5F-HPU" or referred to as the "Unit" in this installation manual.

Gross weight .....3,320 kg
Tara weight .....3,280 kg
Proof load .....16,350 kg

HP pump and motor .....175 kg
Circulation pump and motor .....70 kg
Accumulator .....150 kg

Process Data
For Set Points/Alarm levels, see Flow Diagram.
MWP HP HEADER .....627 bar
Design Pressure .....690 barg
N2 pre-charge pressure:
- Accumulator item no. 3 .....320 bar
- Accumulator, item no. 4 .....360 bar

Accumulator pre-charge volume:
- Accumulator item no. 3 .....2 x 0.25 ltr.
- Accumulator, item no. 4 .....2 x 32 ltr.

Supply-Reservoir Volume .....500 liters
Return-Reservoir Volume .....550 liters

HP pump flow rate .....3.5 ltr./min.
Circulation pump flow rate .....38 ltr./min.
Circulation pump pressure .....10 bar

Filtration rate .....3 µm
Cleanliness of the hydraulic fluid.....acc. to SAE AS4059, class 6 or better

2.1 Hydraulic Fluid

Hydraulic fluid .....Water/glycol mixture
Type .....CASTROL Transaqua HT
kin. viscosity at 40 °C .....2.3 mm^2/s
kin. viscosity at 20 °C .....4.1 mm^2/s
kin. viscosity at 0 °C .....8.8 mm^2/s
Density at 20 °C .....1.0706 g/dm^3
Degree of purity, min. .....SAE AS4059, Class 6
Properties .....Castrol-MSDS 0000001150,
Safety data sheet according to Directive 91/155/EC

3. Safety information

- Adhere to the official Health and Safety at work and safety regulations (EC-Directives, ordinances, european standards etc.)[2], in particular, for work in explosive atmospheres, only use correct and safe working practices.

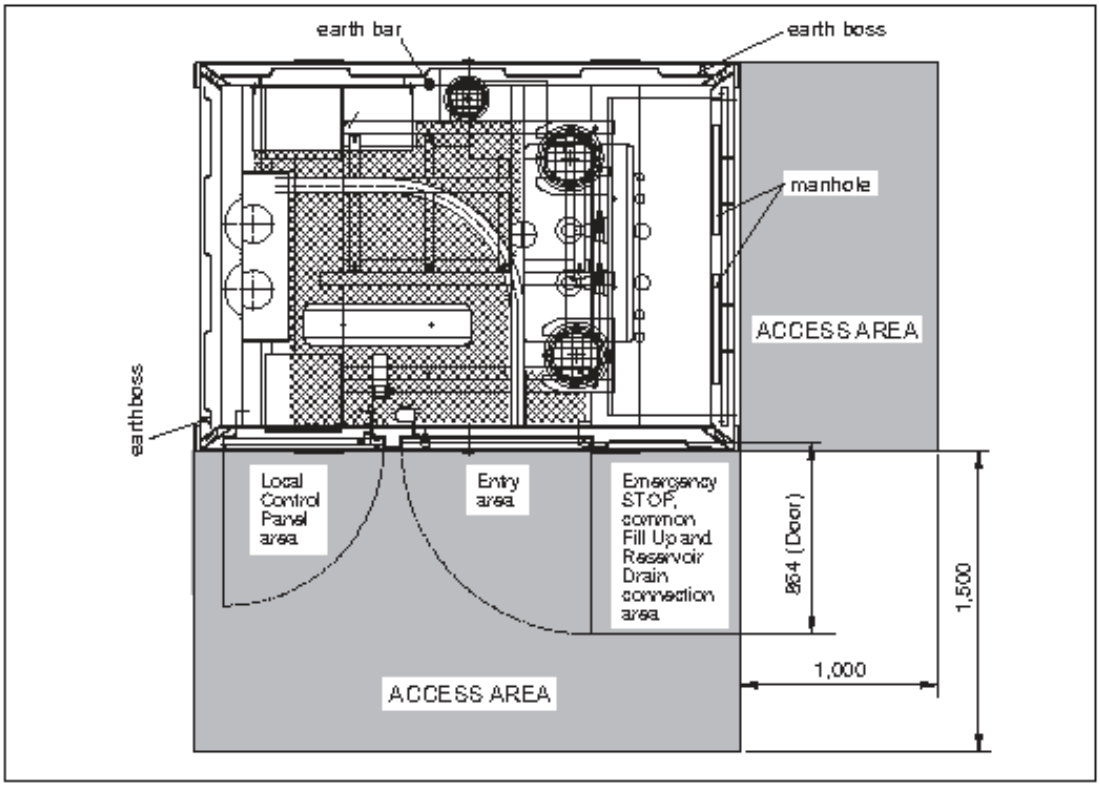
2) Users located outside of the EEC must always follow the safety practices and procedures in accordance with the recommendations of the Occupational Safety and Health Administration (OSHA), the National Safety Council (NSC), the Hand Tools Institute (HTI), the International Association of Drilling Contractors (IADC) etc. All applicable Governmental rules, regulations or restrictions, now in effect or which may be promulgated, take precedence over the suggestions in this publication!

- This document "Installation procedure" is only an extract from the "Operating Manual" abiding by the conformity. The specifications in the "Operating Manual" are exclusively valid for any questions concerning conformity, health and safety at work, warranty etc..
- Observe the safety regulations:
  - Concerning the electrical equipment carrying hazardous voltage (DIN EN 60 204 etc.),
  - Concerning the hydraulic system under hazardous high pressure (DIN EN 982 etc.).
  - Concerning hazards resulting from the "CASTROL Transaqua HT" (Castrol-MSDS or the EC-safety data sheet).
- Danger of fire/explosion at the installation site due to explosive atmosphere.
  Smoking, the use of naked flames or lights are prohibited at the entire installation site.
- Use the prescribed Personal Protection Equipment (hard hat, eye protection, ear protection, protective gloves, safety boots etc.).

Danger

This installation procedure involves high pressure hydraulic, compressed nitrogen and high voltage operations. The operators and all personnel involved in installation shall be fully conversant with the procedures and equipment and ensure that safe working practices are observed at all times.

Fig. 1: Top view of the K5F-HPU with access areas etc.



- Equipment shall be suitably earthed, see chapt. 5.1.

Warning

When topping up with "Transaqua HT", protect your eyes and skin and do not inhale the fumes!

4. Installation site

4.1 Area and floor space requirements

Dimensions and space requirement:

- L x W x H ....= 2,500 x 1,800 x 2,595 mm

Also see Assembly Drawing.

- Allow space for inspection or maintenance of 1.0 and 1.5 m width, acc. to Fig. 1, as the Access Area.

5. Installation

5.1 Mechanical Interface

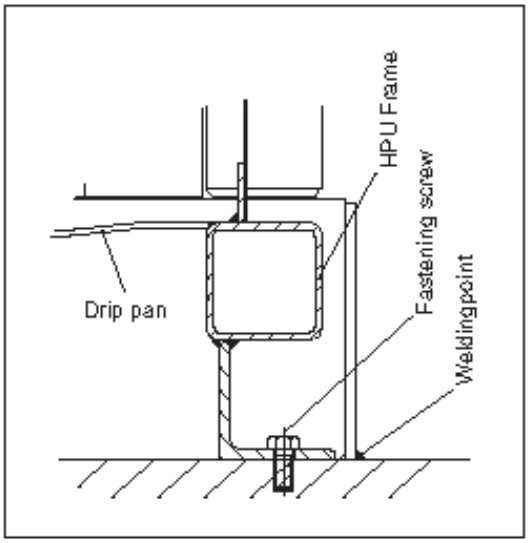
Fastening/securing on deck

- Before fastening/securing the K5F-HPU on deck visually inspect the unit for externally visible transport damage.
- Fasten the K5F-HPU at the predetermined installation site.

Bolting or welding brackets are fitted to the base frame. Please refer to Fig. 2 and the Assembly Drawing.

Drain connection

- Drip pan drain connection:
  - R 1", front and rear of the unit,
  - 1" ANSI B16.5 Flange, centre of drip pan, see Assembly Drawing.



Connection to ground/equipotential bonding

All devices/components of the unit are connected to the conductive components (pipe lines, frame etc.) for equipotential bonding. Earth bar for ground connection/equipotential bonding, see Fig. 5 and "Operation procedure".

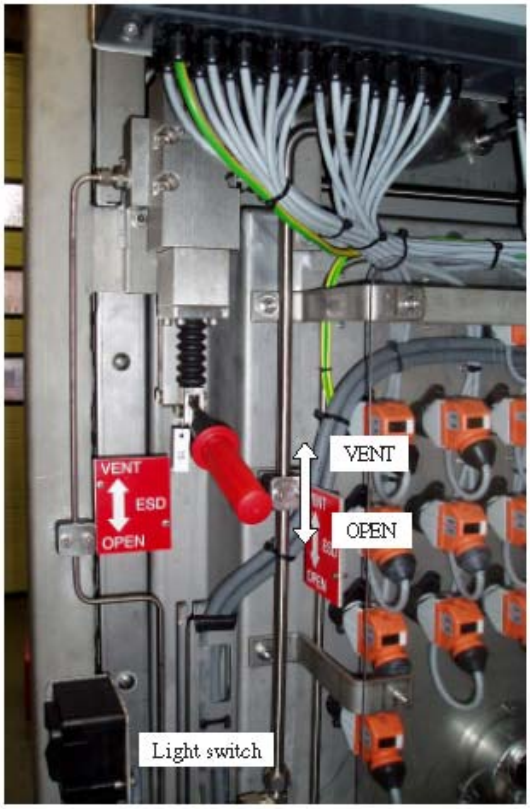
In addition two M12 connections to ground are provided on the front left-hand corner and rear right-hand corner at the base of the frame, see Fig. 1.

- Connect the earth bar to a power conductor or to ground of the platform, connection cable 70 mm², earthing resistance less than 0,5 Ohm.
- Check the insulating resistance, testing voltage

Fig. 2: Fastening screw and/or welding point. See Assembly Drawing.

Fig. 2: Distribution box above the ESD manual valve. Junction boxes see Fig. 4.

Fig. 3: Light switch and ESD manual valve



500 V, insulating resistance must be more than 2 Mega-Ohm.
- When filling the reservoir with hydraulic fluid, include the drums with "Transaqua HT" in the connection to ground and equipotential bonding.
- Check the devices for connection to ground and equipotential bonding prior to first start-up and subsequently at regular intervals (see "Maintenance procedure").

5.2 Electrical Interface

Electric connection to the electric power supply

The completely enclosed junction boxes accommodate the electrical terminals with the connection to the main cable and the HPU Remote Interface by multicore cables to the external PLC Cabinet. Cables are supplied through the MCT frames of the "Electric Connection Area" above the HPU panel (see Assy Drawing) and secured to the pre-installed cable trays. Cable entries for external cables into the electrical junction boxes and the terminal boxes of the motors, within the HPU by cable glands.

Danger

After connection and switching on, certain components of the electrical devices/equipment are inevitably under dangerous voltage!

Light Fixtures

Ensure that the 230 V AC cable is routed through the MCT frames above the local control panel via the MCT inserts provided. The cable will be directly connected to L, L1, N, PE into the switch, see Circuit Diagram.

Motors

Ensure that the 400 V AC cable is routed through the MCT frames above the local control panel via the MCT inserts provided and connected to the terminal strips of the motor terminal boxes, see Circuit Diagram.

Cable	Pump	Terminal box	Connection
W200	HP Pump 1	GX-82840A	U, V, W, PE
W201	HP Pump 2	GX-82840B	U, V, W, PE
W202	Circ. Pump	GX-82841	U, V, W, PE

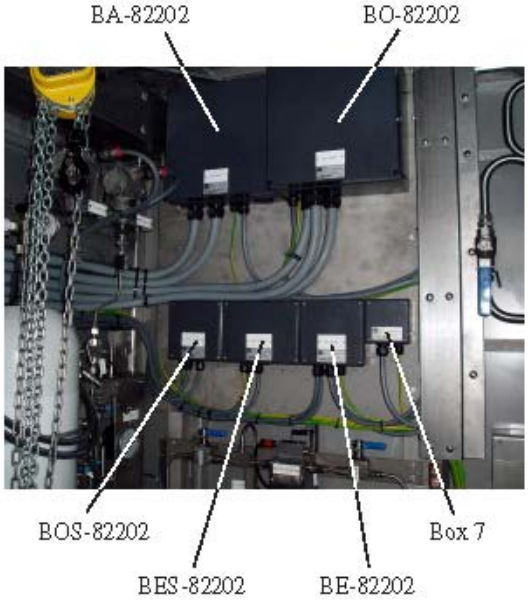


Fig. 4: Junction boxes.

Instrument Cables

Ensure that the instrument cables are routed through the MCT frames above the local control panel via the MCT inserts provided and connected to the terminal strips of the junction boxes BA-82202, BO-82202 etc., see Fig. 4 and the Circuit Diagram.

Cable	Pump	Terminal box	Connection
W306	switches	BA-82202	x22.5/1-36
W307	lighting	BO-82202	x23.6/1-50
W324	pressure-transmitter	BES-82202	x24.1/1-8
W308	level-transm.	BE-82202	x25.1/1-10
W309	ESD-valve	BOS-82202	x26.1/1-8
W310	ESD-Button	Box 7	x27.1/1-4

5.3 Filling the return reservoir with hydraulic fluid

- For information about CASTROL Transaqua HT, refer to the "Castrol-MSDS" or the "EC-Safety data sheet".
- Supply reservoir volume ..... 500 liters
  Return reservoir volume ..... 550 liters

The circulation pump (GX 82841) has to take in the hydraulic fluid and to top up the return reservoir with a dipping lance from a drum/barrel, see Flow Diagram Circulation Loop: The circulation pump take in the hydraulic fluid from the return reservoir and circulate the fluid by passing it through the circulation filter (filter rate 3 µm), item no. 8/9, see Fig. 7.

- Circulate the hydraulic fluid from and to the return reservoir, including filtering is carried out until an analysis of a fluid sample is made (see "Operation procedure") and the purity acc. to SAE AS4059, class 6 is assured.
- Should the analysis reveal that the required degree of purity is adhered to, the hydraulic fluid can be pumped into the supply reservoir by switching over the 3-way valve (item No. 19) with flow direction to supply reservoir.

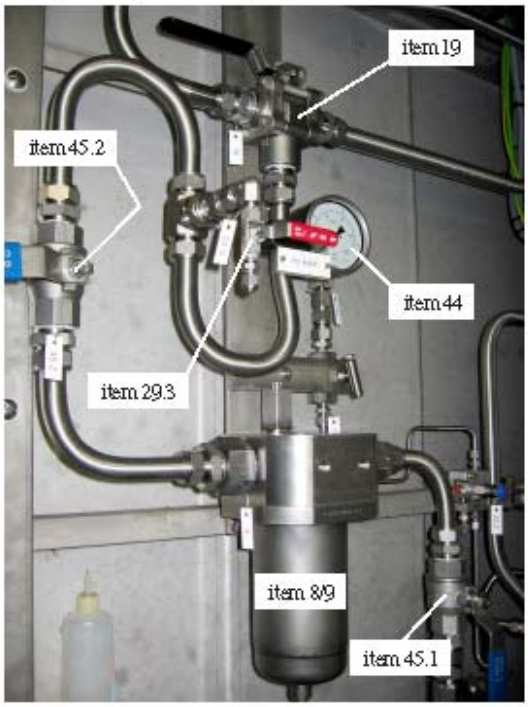
Fig. 5: Earth bar for ground connection and circulation pump.

Attention

Never fill new Transaqua HT into the supply reservoir directly from a drum!
Always fill the return reservoir first, then filter the hydraulic fluid in a circulation loop.

Fig. 6: Level gauge for the return and supply reservoir.

Fig. 7: Circulation loop with filter (item no. 8/9) and 3-way-valve (item no. 19).



- When filling the return reservoir with hydraulic fluid, also earth the drums containing "Transaqua HT" and ensure their earthing resistance.

Warning

When filling the reservoir with "Transaqua HT", protect your eyes and skin and do not inhale the fumes! Wear the prescribed Personal Protective Equipment (PPE)!

Filling the return reservoir

- Insert a clean dipping lance into the drum/barrel.
- Prior to commencing with filling,
  - CLOSE ball valve item no. 27.3 (NC) and 27.4 (NO).
  - Connect the dipping lance to the connection "Common Fill Up" (Fig. 8).
  - OPEN ball valve, item no. 27.5.
- 3-way ball valve, item no. 19, Fig. 7, turned to flow direction to the return reservoir!

Warning

Always open the suction line shut-off valve (item no. 27.5) before starting up the circulation pump! Otherwise the pump will run without fluid (dry), inevitably resulting in damage to pump.

- The circulation pump is started and stopped using the illuminated pushbutton on the HPU Local Control Panel:
  - Press the illuminated pushbutton "Circulation Pump GX 82841 ON" together with
  - the pushbutton "Enable Startup Override".
- Verify that Return Reservoir Level Gauge and the value monitored by the level transmitter are increasing.

When the e.g. LOW LOW level is gone below, the relevant signal light start flashing and an alarm signal is sounded.

- Actuate the ALARM ACCEPT pushbutton.
  The acoustic alarm stops sounding,
  the signal light stops flashing and have a steady light (alarm signal is still pending).
- Slowly fill the return reservoir.
  If the fluid level exceeds: LOW LOW LEVEL,
  the signal light "Reservoir LOW LOW LEVEL" extinguishes, i.e. the standard operating conditions are fulfilled.

If the level reaches: HIGH LEVEL
the signal light "Reservoir HIGH LEVEL" start flashing,
in the event of overfilling, however, an ALARM is triggered.

- Stop circulation pump, press the push button "Circulation pump GX 82 841 OFF", when the barrel/drum is empty, change barrel, and continue filling until the fluid level reach the max. level at the level glass! Do not let the pump run without fluid!
- During filling, check all connections for possible leakages, retighten connections and reseal, if necessary.

5.4 Nitrogen pre-charge of accumulators

- For information on filling the accumulators with nitrogen, the pre-charge equipment, nitrogen cylinders etc. required, please refer to the operating manual of the accumulators and/or the pre-charge equipment manual, to find in the appendix of this Installation procedure.

Warning

Do not use oxygen for pre-charging! Even not gas containing oxygen.
Use pure Nitrogen containing less than 1 % oxygen.

- Pre-charge should only take place when the accumulator hydraulics is vented.

5.5 Hydraulic Interface

Hydraulic connection

- HP HEADER .....3/8" AUTOCLAVE, 627 bar max. working pressure, 690 bar design pressure.
- Common Fill Up Connection .....R 1", to fill the return reservoir with hydraulic fluid,
- Reservoir drain connection ...R 1.1/2"

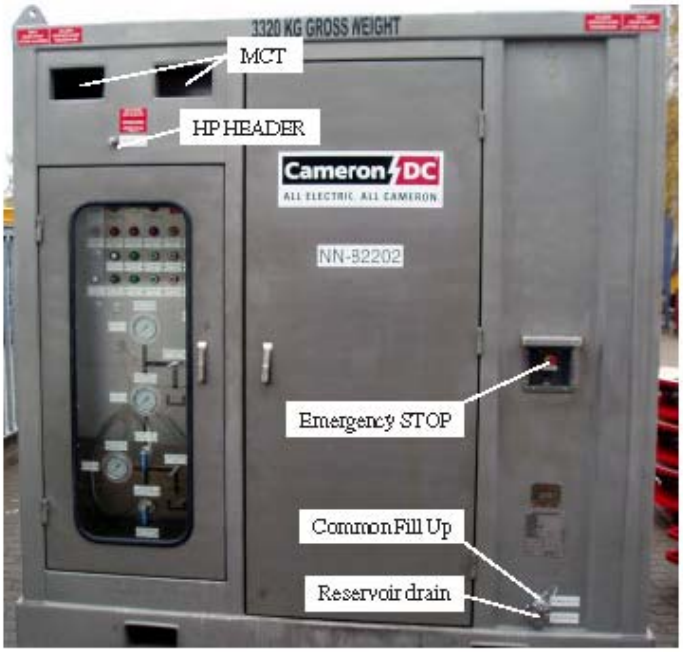


Fig. 8: Front of the K5F-HPU with hydraulic connections.

Connection area/Pipe connection

Danger

Ensure that the entire HP HEADER system and the field line are depressurized before connecting or disconnecting pressure lines! All connections must be made with zero pressure in the system.
Ensure that the isolation valve of the HP HEADER connection (item no. 28.10), is CLOSED for operating preparation and pipe connection.
During operation the valve is locked in OPEN position!

- Once the blind plugs are removed, check the screw connections in the connection area and the external field lines prior to connection.
- Replace damaged screw connections (wear, scoring etc.).

Attention

Never connect damaged or worn pipe connections!

- Never use PTFE/Teflon sealing tape or similar! Parts of the sealing tape could enter the system and cause system malfunctions.
  Use liquid sealant: **Loctite 572** or equivalent.

6. Operating elements and settings

6.1 Pressure transmitters, item no. 13

Pressure transmitter, item no. 13.3 and 13.4

- The measured pressure values transmitted by the pressure transmitter are evaluated by the PLC/ software to control the ESD system (PSH 82841).

Pressure transmitter, item no. 13.1

- The measured values are evaluated by the PLC/software to control the the HP pumps. Supply pressure transmitter Set Points (see Flow Diagram):
  - STOP pump .....627 bar
  - START HP pump .....580 bar
  - EMERGENCY pump STOP .....400 bar

  The setpoints shall be confirmed during FAT.

Pressure transmitter, item no. 13.2

- The measured values are evaluated by the PLC/software to control the HP HEADER pressure.

6.2 Valve settings prior to start-up

- OPEN/CLOSE all valves of the K5F-HPU as described in Table II, page 18 prior to switching ON the power supply.
- Immediately after start-up (pressure should be approx. 10 bar), press the spring loaded RESET knobs of the ESD solenoid valves, see "Operation procedure".

6.3 Deaeration of the HP pumps

- Prior to first start the air locked into the system and/or the HP pump (sound of the pump or pulsation on the pump outlet gauge) must be deaerated.
  Unfasten the air bleed screw located at the bottom of each HP pump. This must be done when the pump is running, do not retighten until the pump is running normal, please refer to the pump manufacturers manual or "Maintenance procedure".

7. Trial run

Warning

Start-up of the K5F-HPU is only permissible when it is in a technically safe and perfect condition with functioning safety devices.

7.1 Pre-operational check (Trial run), prior to first start-up

- Adherence to the following procedures will ensure that the HPU is started up and set in operation safely and correctly.
- For operating preparations, function checks/trial run first (for valve positions/settings see page 18):
  - Unlock/reset the EMERGENCY STOP button,
  - CLOSE the bleed valves (item no. 29.10 and 29.11).
  - Perform a LAMP TEST.
  - Check that all signal lights are extinguished.

  With the REMOTE control active, the control system returns all switches to their home position.
- Perform function checks or trial run in accordance with chapt. 3 "Safety information".
  For information on start-up also see "Operation procedure".
- Ascertain by visual inspection/safety check or according to protocol:
  - Check that the unit has no externally visible damage or defects,
  - check for loose tube connections or component fixings,
  - check that the unit is perfectly connected to ground,
  - check that the fluid reservoirs are filled with "CASTROL-Transaqua HT",
  - check that the electricity applied corresponds to the specifications, see chapt. 2 "Main Data",
  - check that all valves are in the OPEN/CLOSED position as specified in Table II, page 18,
  - check that pressure gauges and transmitters read zero pressure (0 bar),
  - check that the hydraulic fluid in the supply reservoir is clean, degree of purity acc. to SAE AS 4059, class 6 is assured; fluid is filtered with the circulation loop and controlled by fluid samples.
  - Check that the settings of electrical devices correspond to the specifications according to protocol.

7.2 Performing the pre-operational check/trial run

Warning

Only switch ON the pumps if any risk of danger to persons or damage to assets is excluded!

- For information on performing a trial run see "Operation procedure".

7.3 Testing the safety functions

- Check the function of the EMERGENCY STOP system.
  - Actuate the EMERGENCY STOP hit button,
    the circulation pump and/or the HP pumps must stop immediately.
    Reactivate by turning and rearming the mushroom-type push button.
    Further switching measures (restart) as described in "Operation procedure".
  - Safety circuit,
    Ensure that the actuation of one of the pushbuttons has no effect when the EMERGENCY STOP button is pressed.
  - Actuate the ESD manual valve, item no. 14, in accordance with FAT.

7.4 Reference to switching or operating errors

- NEVER switch ON the pumps when unauthorized persons are in the hazard zone/inside of the unit!
- Main power supply with incorrect electrical data.
- Pumps switched ON without the reservoirs having been filled with clean/filtered Transaqua HT.
- Motor maintenance H-0-A-switch, switched to position "0".
- Incorrect valve settings, see Table II, page 18.
- Pumps switched ON with suction valves CLOSE.
- Only use the EMERGENCY STOP button to shut down the unit in hazardous situations, never for standard operating interruptions.

Table I: Installation; line-up and fastening, connection and setting

No.	Sequence of operation - Hazard warning - Remark
001	- Installation and fastening
	- Align the unit horizontally and vertically
	- Check the unit for transport damage
	- Fasten the unit to the installation surface/securing on deck
002	- The power supply corresponds to the specifications:
	- 3-phase, 380 V AC, 50 Hz (Motor 1+2+3)
	- 1-phase, 230 V AC, 50 Hz
	- 1-phase, 24 V DC
003	- Connection to ground/equipotential bonding
	- Connect terminal strip to ground lines
	- Check earthing resistance
004	- Fill the return reservoir with „CASTROL-Transaqua HT"
	- return reservoir volume 550 ltrs.
	Attention: Always wear PPE when refilling, e.g. eye and respiratory protection as well as protective gloves! **Only fill with „Transaqua HT" from originally closed, clean drums, degree of purity according to SAE AS 4059, Class 6!**
	- Connect dipping lance to the Fill Up connection (front of unit)
	- Connect dipping lance to the drum filled with „Transaqua HT"
	- CLOSE valve (27.4) and OPEN valve (27.5)
	- check position of 3-way valve (19), flow direction to return reservoir
005	- Start circulation pump,
	- press illum. pushbutton "Circulation Pump, GX 82841, ON"
	- simultaneously press pushbutton "Enable Startup Override"
006	- Fill return reservoir
	- Level > LOW LOW LEVEL, signal light extinguishes
	- Level > HIGH LEVEL, signal light lit, ALARM
007	- Stop the circulation pump,
	- press the illum. pushbutton "Circulation Pump, GX 82841, OFF"
	- CLOSE valve (27.5) and OPEN valve (27.4)
008	- Filtering of the hydraulic fluid (circulation loop),
	- check the position of 3-way valve (19), flow direction to return reservoir
	- start the circulation pump as described before (No. 005)
	- circulate the fluid from and to the return reservoir
	- stop the pump and take a sample of the fluid from sample valve (25.2)

Remarks:

Table I: Installation; line-up and fastening, connection and setting, contd.

No.	Sequence of operation - Hazard warning - Remark
	Attention: Fill up the supply reservoir with clean/filtered fluid only!
009	Fill up the supply reservoir, - switch the position of 3-way valve (19), flow direction to supply reservoir ..... - OPEN valve (27.4) ..... - start the circulation pump as described before (No. 005) .....
010	- Check the nitrogen filling/pre-charge of the accumulators ..... - accumulator (item no. 3.1) nitrogen pressure 320 bar ..... - accumulator (item no. 3.2) nitrogen pressure 320 bar ..... - accumulator (item no. 4.1) nitrogen pressure 360 bar ..... - accumulator (item no. 4.2) nitrogen pressure 360 bar .....
Remarks:	

Table II: Valve position or setting prior to START-UP

Item No.	Position Setting	Description
26.1, 26.2	CLOSE	Reservoir Drain valve
27.1, 27.2, 27.4	OPEN	Suction Line valve
27.3, 27.5	CLOSE	Reservoir Filling valve
25.1, 25.2, 25.3 25.4	CLOSE	Sample valve
29.1, 29.2, 29.7 29.8	CLOSE	Sample valve
36.1, 36.2, 36.3 36.4	OPEN	Fluid indicator isolation valve
45.1, 45.2	OPEN	Circulation filter isolation valve
28.1	OPEN	HP pump 1, GX 82840 A, isolation valve
28.4	CLOSE	HP pump 2, GX 82840 B, isolation valve
24.1, 24.2, 24.3 24.4, 24.5, 24.6 24.7	see description	Block & Bleed valve - Open block function Block & Bleed valve - Close bleed function
22.1, 22.2	see description	Block & Bleed valve - Open block function Block & Bleed valve - Close bleed function
29.3, 29.12 29.14, 29.9 29.16	OPEN	Gauge isolation valves
29.4, 29.13 29.17, 29.18	OPEN	Transmitter isolation valves
28.2, 28.3	OPEN	Accumulator isolation valves
29.5, 29.6	CLOSE	Accumulator bleed valves
28.5, 28,6	OPEN	HP-Filter 1 isolation valves
28.7, 28.8	CLOSE	HP-Filter 2 isolation valves
28.9	OPEN	ESD isolation valve
28.10	CLOSE	HP HEADER valve
29.10, 29.11	CLOSE	Drain valves
19	see description	3-way valve, in flow direction to return reservoir

Remarks:

Table III: Visual inspection/safety check after installation and prior to START-UP

No.	Sequence of operation - Hazard warning - Remark
001	- No externally visible defects/damage to the unit
002	- No emissions/leakages in the fluid system
003	- Reservoirs filled with "Castrol-Transaqua HT" - Fluid level above LOW LOW LEVEL - Flushing/Filtering of the fluid completed - Fluid in the supply reservoir clean/filtered - fluid sample is made, degree of purity acc. to SAE AS4059, class 6, determined
004	- HP pumps: Pump case oil level sufficient
005	- Pumps, motors and other equipment in the unit fastened
006	- Valve positions/settings acc. to Table II
007	- pressure gauges and transmitters read zero pressure (0 bar)
008	- Pressure gauge display clean, legible
009	- Accumulators pre-charged with Nitrogen
010	- Filters not indicating need for maintenance, no indicator pin disengaged
011	- Guards/protective devices fitted and correctly functioning
012	- Electric cables/hydraulic hoses not kinked or pinched
013	- Electricity applied corresponds to the specifications
014	- Unit is connected to ground
015	- EMERGENCY STOP buttons unlocked/rearmed/reset
016	- Manual ESD valve, hand lever in position OPEN
017	- Unit secured against unauthorized access
018	- Hazard warning signs in place and legible

Remarks:

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Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

04.07.2008	Approved for Construction	Treder	D. Mottaghian	A.Weilandt
18.03.2008	Issued for Client Comment	S.Voiges	D. Mottaghian	A.Weilandt
23.11.2007	Issued for internal IDC	S.Voiges	I.Kiesewetter	A.Weilandt
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**
CAMERON	**Document Title:** **HPU Operation Procedure**			
	Customer Document Number:	54NL92-W-0P-542		REV. 01
	Cameron Document No.	X-065438-02-74		REV. 01

Operation Procedure,
start-up, monitoring, shutting down

Table of contents

1. Introduction

1.1 Scope

This document is prepared according to the Requirements Specification for the Hydraulic Power Unit (CAM Doc. No. X-076721-87-05). The HPU is designed to supply on demand the hydraulic pressure for all Downhole Safety Valves (DHSV's) on all four K5F trees. This document covers the HPU operation procedure.

1.2 Abbreviations

Assy, Assembling (drawing)

BetrSichV, "Betriebssicherheitsverordnung" (German Ordinance on Industrial Safety and Health for equipment and installations requiring supervision/monitoring or such equipment and installations in potentially explosive atmospheres), 27.09.2002.
BGV …, identification with ordinal numbers of ordinances of the professional trade association for accident prevention and DA (implementation order), published by the main association of the BG.
BOM, Bill of Material

CAM, CAMERON
Chapt., chapter
ChemG, "Chemikaliengesetz" (German Chemicals Act),14.03.1990, Act on the Protection Against Hazardous Chemicals.
Conn., connection

dB, decibel
DIN EN, (harmonised European) EN standards published by DIN
DP, Design pressure

EC MRL, Machine Directive 98/37/EC (replacement for the Directives 89/392 EEC as well as 91/368, 93/44 und 93/68 EEC).
ESD, Emergency Shutdown System

FAT, Factory Acceptance Test
Fig., figure

h, hour, here operating hour
HP, high pressure
HPU, Hydraulic Power Unit

KMA, KOLLER Maschinen- und Anlagenbau GmbH, D-29227 Celle, Germany

LP, low pressure

MCC, Motor Control Centre
MCS, Motor Control System
MCT, Multi Cable Transit
MOP, Maximum Operation Pressure
MRB, Manufacturing Record Book
MRL, EC-Machine Directive 98/37/EC
MSDS, Material Safety Data Sheet
MWP, Maximum Working Pressure

NC, normally CLOSED
NO, normally OPEN

PHA, Preliminary Hazard Analysis
PLC, Programmable Logic Controller
PPE, Personal Protective Equipment (German PSA)

Safety Data Sheet, according to Directive 91/155 EEC and 2001/58/EC
Sect., section
SPS, Subsea Production System
SSS, Safety Shutdown System

Tab., table
TBC, to be confirmed

V AC, voltage AC
V DC, voltage DC
VO, (also V), "Verordnung" (Ordinance)

1.3 Reference Documents and Drawings

Description	TOTAL Doc. No.	CAM Doc. No.	KMA Doc. No.
Bill of Material (BOM)	NN	X-076704-01-22	92001086 a
Equipment No.	NN-82202	223011-32	NN
Assembly Drawing	54NL92-W-03-503	SK-066011-32	1-92001086 a
Flow Diagram	54NL92-W-31-504	SK-066011-32-01	1-92001083 a
Circuit Diagram	54NL92-W-06-503	SK-066011-32-04	NN
Factory Acceptance Test (FAT)	54NL92-W-0P-505	X-065437-01-11	NN

Description	TOTAL Doc. No.	CAM Doc. No.	KMA Doc. No.
Field Termination Diagram	54NL92-W-31-501	SK-066011-32-42	NN
Installation procedure	54NL92-W-0P-531	X-065467-02-09	NN
Operation procedure	54NL92-W-0P-542	X-065438-02-74	NN
Maintenance procedure	54NL92-W-0P-543	X-065438-02-75	NN

1.4 Intended Use/Equipment limitations

With the aid of two electrically driven HP pumps and an electrically driven circulation pump, the "Total Exploration & Production Netherlands B.V. K5F Project Hydraulic Power Unit"[1)] generates the necessary (system-dependent) pressure for the control of the K5F Downhole Safety Valves (DHSV). The HPU will be controlled by a remote PLC located in a safe area and is designed to supply hydraulic pressure for all DHSV's on all four K5F trees.

The K5F-HPU must not used for the following:
- Pressure testing
- Hot Oil flushing
- Running on other hydraulic fluids than specified in this document
- Running without accumulators in service
- Any service above maximum working pressure 627 bar
- Running of position control valves or servo/proportional directional valve systems with constant leakage.

2. Main Data

Equipment: ..... Total Netherlands K5F Project Hydraulic Power Unit
TOTAL Equipment No. NN-82202
CAMERON BOM X-076704-01-22
KMA Article No.: ..... P/N 92001086 a
Approval: ..... Declaration of Conformity according to Machinery Directive 98/37/EC and ATEX Directive 94/9/EC

Area classification ..... Ex Zone 1, Category II, Gas Group IIB, Temperature Class T3
Ambient air temperature ..... max. +40 °C
min. -16 °C

Electric power supply:
For details please refer to the Circuit Diagram.
- HPU HP Pump Motors Control ..... 24 V DC
- HPU Circ. Pump Motor Control ..... 24 V DC
- HP Pump Motors ..... 3-phase, 380 V AC, 50 Hz
- Circ. Pump Motor ..... 3-phase, 380 V AC, 50 Hz
- Internal light ..... 1-phase, 230 V AC, 50 Hz

1) The "Total Exploration & Production Netherlands K5F Project Hydraulic Power Unit" is abbreviated as "K5F-HPU" or referred to as the "Unit" in this operation manual.

- HP Pump Motor Heaters ..... 1-phase, 230 V AC, 50 Hz
- Circ. Pump Motor Heater ..... 1-phase, 230 V AC, 50 Hz
- HP Pump Press. Transmitter ..... 24 V DC
- HP Header Press. Transmitter ..... 24 V DC
- Input/Outputs from/to remote PLC ..... 24 V DC
- HPU ESD Valves ..... 24 V DC

Frame size, weight

Length x width x height ..... 2,500 x 1,800 x 2,595 mm
Gross weight ..... 3,320 kg
Tara weight ..... 3,280 kg
Proof load ..... 16,350 kg

HP pump and motor ..... 175 kg
Circulation pump and motor ..... 70 kg
Accumulator ..... 150 kg

Process Data

For Set Points/Alarm levels, see Flow Diagram.
MWP HP HEADER ..... 627 bar
Design Pressure ..... 690 barg
N2 pre-charge pressure:
- Accumulator item no. 3.1 & 3.2 ..... 320 bar
- Accumulator, item no. 4.1 & 4.2 ..... 360 bar

Supply-Reservoir Volume ..... 500 liters
Return-Reservoir Volume ..... 550 liters
Accumulator pre-charge volume:
- Accumulator item no. 3.1 & 3.2 ..... 2 x 0.25 ltr.
- Accumulator, item no. 4.1 & 4.2 ..... 2 x 32 ltr.

HP pump flow rate ..... 3.5 ltr./min.
Circulation pump flow rate ..... 38 ltr./min.
Circulation pump pressure ..... 10 bar

Filtration rate ..... 3 µm
Cleanliness of the hydraulic fluid ..... acc. to SAE AS4059, class 6 or better

2.1 Hydraulic Fluid

Hydraulic fluid ..... Water/glycol mixture
Type ..... CASTROL Transaqua HT
kin. viscosity at 40 °C ..... 2.3 mm^2/s
kin. viscosity at 20 °C ..... 4.1 mm^2/s
kin. viscosity at 0 °C ..... 8.8 mm^2/s
Density at 20 °C ..... 1.0706 g/dm^3
Degree of purity, min. ..... SAE AS4059, Class 6
Properties ..... Castrol-MSDS 0000001150,
Safety data sheet according to Directive 91/155/EC

3. Safety information

Always observe the regulations, warnings and information specified in "Health and Safety at Work Regulations"[2] and the Environmental Protection for each start-up, during operation and shutting down the K5F-HPU.

- This document "Operation procedure" is only an extract from the "Operating Manual/Instruction handbook" abiding by the conformity. The specifications in the "Operating Manual/Instruction handbook" are exclusively valid for any questions concerning conformity, health and safety at work, warranty etc..
- Ensure that no hydraulic pressure is applied to any of the connections before loose hydraulic couplings are tightened.
- Ensure that no electric power is applied to any of the connections before rear panel is opened or loose electric connections are tightened.

Danger

This Operation procedure involves high pressure hydraulic, compressed nitrogen and high voltage operations. The operators and all personnel involved in operation shall be fully conversant with the procedures and equipment and ensure that safe working practices are observed at all times.

3.1 Instruction of the operating personnel

It is the personal responsibility of the operator to read this Operation procedure prior to operate the Unit and apply the measures correctly, according to instruction and in accordance with standard engineering practice[2].

- Refrain from any measure/method of operation that could lead to injury to persons or damage to assets.
- All personnel in contact with the hydraulic fluid or involved with the operation of the K5F-HPU, must wear the prescribed or recommended Personal Protective Equipment (PPE).
- Observe the safety regulations[2]:
  - Regarding the use of the K5F-HPU in potentially explosive areas, e.g. in accordance with EC directives, ordinances and European standards.
  - Concerning the electrical equipment carrying hazardous voltage (DIN EN 60 204),
  - Concerning the HP pressure system under hazardous high pressure (DIN EN 982).

Danger

Lack of specialist knowledge or non-observance of safety regulations and hazard warnings will result in serious injury and damage to the unit/components.

- Ensure that all persons working or commissioning/starting up the unit have the relevant qualifications.
- Prior to switching ON by LOCAL or REMOTE control, check
  - that installation, maintenance or repair work has been fully completed,
  - that hydraulic fluid (CASTROL-Transaqua HT) is available in the reservoirs,
  - that protective/safety devices are fitted and/or fully functioning.

2) Users located outside of the EEC must always follow the safety practices and procedures in accordance with the recommendations of the Occupational Safety and Health Administration (OSHA), the National Safety Council (NSC), the Hand Tools Institute (HTI), the International Association of Drilling Contractors (IADC) etc. All applicable Governmental rules, regulations or restrictions, now in effect or which may be promulgated, take precedence over the suggestions in this publication!

Danger

Prior to connecting/dismantling external field line to the HP HEADER connection ensure that the entire system is depressurized.

- Immediately shut down the K5F-HPU in the event of
  - abnormal operating noises,
  - oscillations or vibrations,
  - electrical and hydraulic faults,
  - leakage of hydraulic fluid.
- After actuation of the EMERGENCY STOP or a shut-down by safety devices:
  - Find the malfunction or cause of the EMERGENCY STOP.
  - Have the malfunction professionally rectified by a hydraulics expert or an electrician.

Warning

Do not switch ON the unit again until the malfunction or cause of the EMERGENCY STOP actuation has been fully rectified!

Note

The motors of circulation pump and HP pumps are equipped with a maintenance switch, designed as a H-0-A-switch, directly located at each pump and used to isolate the pump drive for maintenance purpose only.

3.2 Emergency Stop button

The EMERGENCY STOP button, designed as a mushroom button, switches off the power supply (380 V AC, stopping the circulation pump and the HP pumps), however, not the control voltage (24 V DC). The emergency stop button is located at the front, on the right-hand side beside the door (see Assembly Drawing and Fig. 2) within direct operator's reach. In a dangerous situation, the unit or the pumps can be emergency stopped any time either in the LOCAL or REMOTE operating mode (see H/A switch in Fig. 1).

Attention

Only use the EMERGENCY STOP button to shut down the unit in hazardous situations, never for standard operating interruptions!

3.3 HPU Local Control Panel

3.3.1 Pressure Gauges

Pressure gauges on the Local Control Panel,

- Item no. 12.1, PG 82840 ..... HP pump pressure, press. range 0-1,000 bar
- Item no. 12.2, PG 82842 ..... HP supply pressure, press. range 0-1,000 bar
- Item no. 12.3, PG 82843 ..... HP HEADER pressure, press. range 0-1,000 bar

ESD pilot pressure gauge, located on the right side of the accumulators, see Fig. 3/4.

- Item no. 23, PG 82844 ..... pressure range 0-400 bar

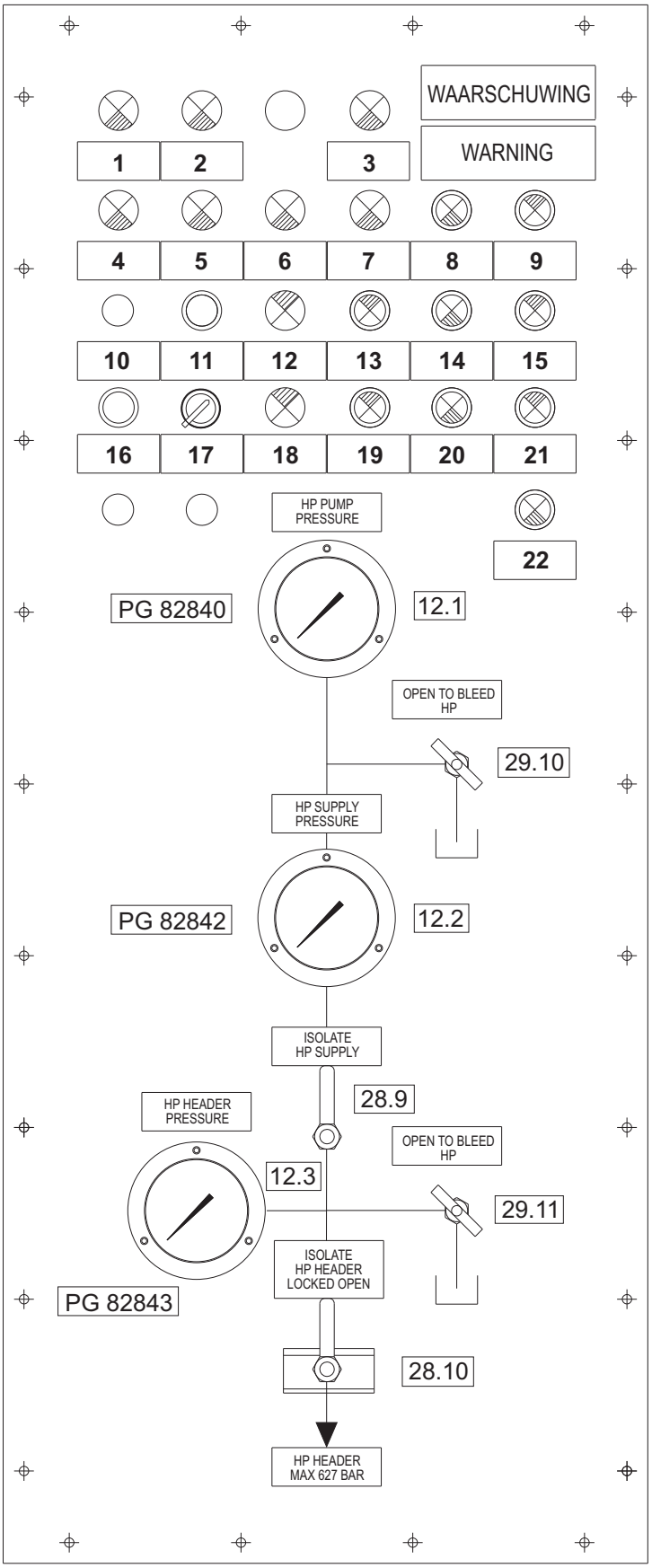


Figure 1: Local Control Panel,
see KMA Doc. No. 2-92001086a

1 - SLR: HP pump pressure, PT 82840, HIGH HIGH pressure

2 - SLR: HP HEADER pressure, PT 82840, HIGH HIGH pressure

3 - SLR: Filter, PDZH 82840 A/B, BLOCKED

4 - SLR: Supply Reservoir, LT 82840, LOW LOW Level

5 - SLR: Supply Reservoir, LT 82840, HIGH Level

6 - SLR: Return Reservoir, LT 82841, LOW LOW Level

7 - SLR: Return Reservoir, LT 82841, HIGH Level

8 - IPR: Circulation Pump, GX 82841, OFF

9 - IPG: Circulation Pump, GX 82841, ON

10 - NN

11 - PB: LAMP TEST

12 - SLG: HP pump, GX 82840 A, RUNNING

13 - IPG: HP pump, GX 82840 A, AUTO

14 - IPR: HP pump, GX 82840 A, OFF/ALARM

15 - IPG: HP pump, GX 82840 A, DUTY

16 - PB: Enable Startup Override

17 - H/A- Switch: Local - Remote Selection

18 - SLG: HP pump, GX 82840 B, RUNNING

19 - IPG: HP pump, GX 82840 B, AUTO

20 - IPR: HP pump, GX 82840 B, OFF/ALARM

21 - IPG: HP pump, GX 82840 B, DUTY

22 - IPR: ALARM ACCEPT

SLR/G - Signal Lamp Red/Green
IPR/G - Illuminated pushbutton Red/Green
PB - Pushbutton
H/A - Switch (Local/Manual - Remote/Auto)
NN - Nomen nescio

Circulation loop pressure gauge, located inside of the unit on the rear, between circulation filter and 3-way ball valve (19), see Fig. 5.

- Item no. 44, PG 82855 ..... pressure range 0-16 bar

3.3.2 Needle valve

- Item no. 29.10 ..... bleed/drain valve, to depressurize the HP supply pressure,
- item no. 29.11 ..... bleed valve, to depressurize the HP HEADER pressure

3.3.3 H/A switch

- H/A switch ..... Place of operation: Local - Remote Selection

3.3.4 Local Control Panel lamps

- Signal lights, red,
  - Supply-Reservoir, LT 82840 ..... HIGH LEVEL
  - Supply-Reservoir, LT 82840 ..... LOW LOW LEVEL
  - Return-Reservoir, LT 82841 ..... HIGH LEVEL
  - Return-Reservoir, LT 82841 ..... LOW LOW LEVEL
  - HP pump pressure, PT 82840 ..... HIGH HIGH pressure
  - HP HEADER pressure, PT 82840 HIGH HIGH pressure
  - Filter, PDZH 82840 A/B, ... HP Filter BLOCKED, maintenance necessary

- Signal lights, green,
  - HP pump, GX 82840 A ..... RUNNING
  - HP pump, GX 82840 B ..... RUNNING
  - 230 V power supply ..... AVAILABLE

Fig. 2: K5F-HPU with Local Control Panel and Emergency STOP button.

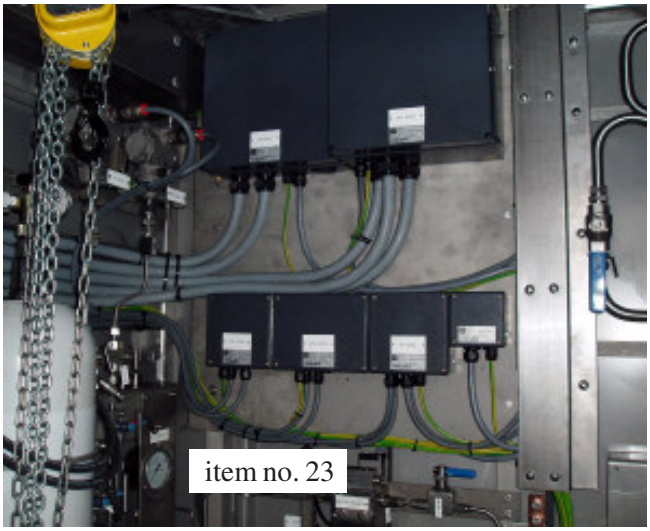


Fig. 3: Junction boxes and ESD pilot pressure gauge, item no. 23, accumulator to the left.

Fig. 4: ESD pilot pressure gauge, item no. 23.

3.3.5 Local Control Panel illuminated pushbuttons

- Illuminated pushbutton, red
  - HP pump, GX 82840 A ..... OFF/ALARM
  - HP pump, GX 82840 B ..... OFF/ALARM
  - Circulation pump, GX 82841 ..... OFF
  - Common Alarm ..... ALARM ACCEPT

- Illuminated pushbutton, green
  - HP pump, GX 82840 A ..... AUTO
  - HP pump, GX 82840 A ..... DUTY
  - HP pump, GX 82840 B ..... AUTO
  - HP pump, GX 82840 B ..... DUTY
  - Circulation pump, GX 82841 ..... ON

3.3.6 Local Control Panel pushbutton

- Lamp Test:
  press for testing all lamps and illuminated pushbuttons.
- Enable Startup Override:
  press together with the ON/DUTY pushbutton of a pump.
  Functioning as a two-hand control to confirm this switching action at the Local Control Panel and to transfer for further monitoring and/or pump control, to the PLC/software.

3.3.7 Local Panel Annunciator

- Alarm Horn, for details please refer to chapt. 4.6.3 of this section "Operation procedure".

3.3.8 Internal Lighting

- Internal illumination lights,
  with 2 nos. fluorescent lamps 18W/25, 230 V AC, 50 Hz, with additional batteries for emergency operation,
- Switch illumination,
  light ON/OFF, inside the unit, left-hand side of the infeed.

4. Prior to operate the K5F-HPU

4.1 Safety inspection

Warning

Wear the prescribed or recommended personal protective equipment (PPE) for all work:
Eye protection, hearing/ear protection, respiratory protection, protective gloves, hard hat, safety boots etc.

- Visually inspect the unit, daily safety check as described in Table I, page 21.

4.2 Valve settings prior to operate the Unit

- All shut-off/isolation valves are in the OPEN/CLOSED position as described in Table II, page 22, also shown in the Flow Diagram.
- HP pump suction valves, item no. 27.1 and 27.2, have to be in the OPEN position!
- Suction valve setting during operation of the circulation pump and feeding from supply or return reservoir:

Priming/ suction from:	valve settings item 27.3	item 27.4
supply reservoir	OPEN	CLOSE
return reservoir	CLOSE	OPEN

- Switch the 3-way ball valve, item no. 19, in the circulation loop, in accordance with the desired target reservoir, i.e. supply or return reservoir.
- The shut-off valve for the HP HEADER line, item no. 28.10, are located on the local control panel. This shut-off/isolation valve is locked in the OPEN position!

4.3 Prior to operate the Unit, start-up and alarm functions

- Make sure that flushing/circulating and filtering the fluid in accordance with table IV, page 24, has been completed and the degree of purity is acc. to SAE AS4059, Class 6 or better.
- Check that junction boxes and panels are free of damages, outside and inside, and that the installed equipment is securely fastened.
- Check all gland and earthing connections.
- Ensure there is enough glycerine in the pressure gauges.
- Never switch ON the K5F-HPU when hydraulic fluid is being topped up or work is still being performed on the unit!
  For information on measures following a prolonged shut-down, maintenance/repair work also see chapter 6.3 of this manual.
- Only allow the unit to be operated by expert personnel appointed by the user/owner.

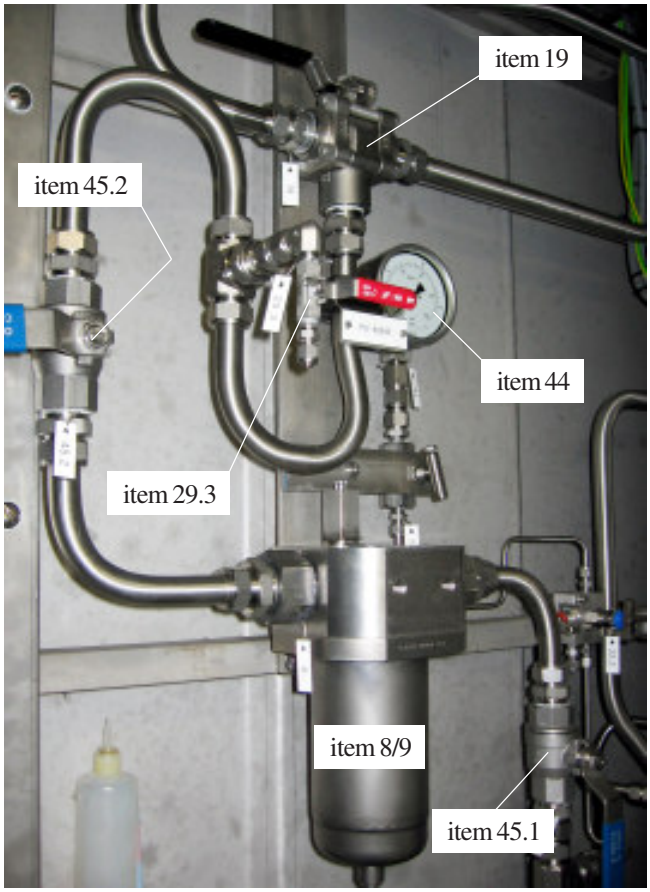


Fig. 5: Circulation loop with filter (item no. 8/9), 3-way-valve, item no. 19, pressure gauge, item no. 44, isolation valves, item no. 45.1/2 and sample valve, item no. 29.3.

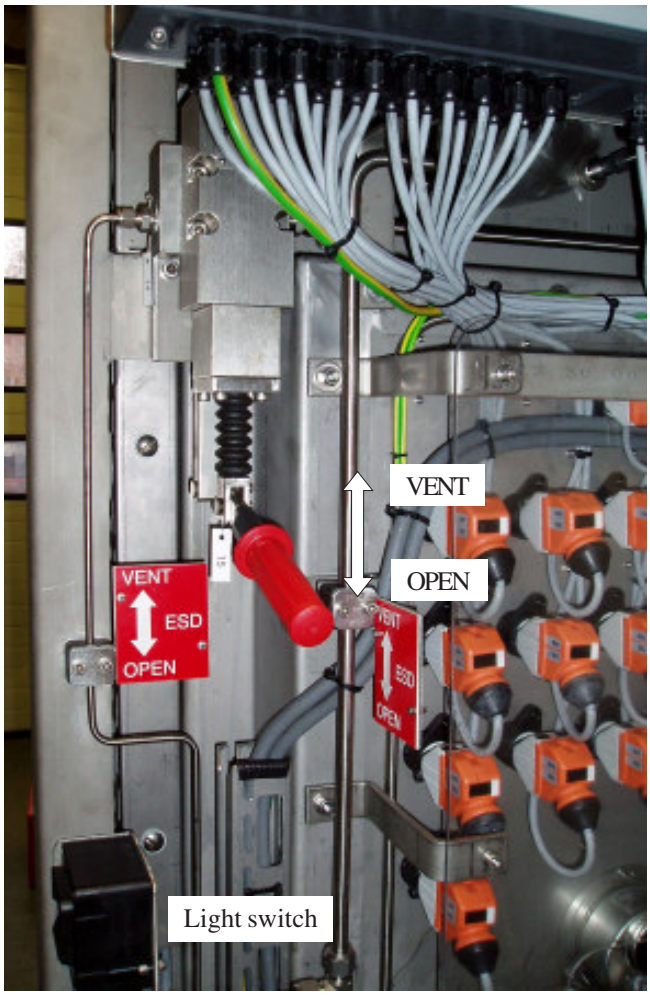
- The K5F-HPU is ready to be started up as soon as the
  - connection work described in the "Installation procedure", and/or
  - operating preparations described in this manual, Table III, page 23, have been completed.

- Set all valves in OPEN/CLOSED position according to Table II, page 22, and to Flow Diagram.
- Ensure that all hydraulic interface points are correctly connected or capped if not in use.
- Verify that all accumulators are pre-charged.
- Inspect the filter in the circulation loop (Fig. 3, item no. 8/9) for clogging as per "Maintenance Procedure". Replace filter element if necessary.
- Observe the reservoir level and do not let the fluid reach the LOW LOW Level limit.

4.3.1 Local Control (Manual mode of operation)

The mode of operation is selected at the Local Control Panel via the H/A selector switch for the Circulation pump and the HP pumps.

- It is necessary to START and STOP all the pumps by the illuminated pushbuttons at the Local Control Panel.
- The Circulation pump will be started and stopped manually only by pressing the illuminated pushbutton "Circulation pump GX 82841 ON/OFF".
- The PLC/software will STOP the HP pumps:
  - at max. working pressure, see Flow Diagram,
  - if the transmitter fails,
  - if the supply reservoir level sensor indicates LOW LOW Level.
  - It ist not possible to start the HP pump when the level in the supply reservoir is LOW LOW, re-filling is necessary.



- H/A switch in position LOCAL.
- Press the pushbutton "LAMP TEST", verify that all signal lamps light up.
- Press the individual illuminated pushbutton ON/DUTY for the required start of the
  - Circulation pump, GX 82841 for re-filling of the return reservoir or circulation/filtering of the fluid,
  - or one of the HP pumps, GX 82840 A/B (duty or stand-by).

4.3.2 Remote Control

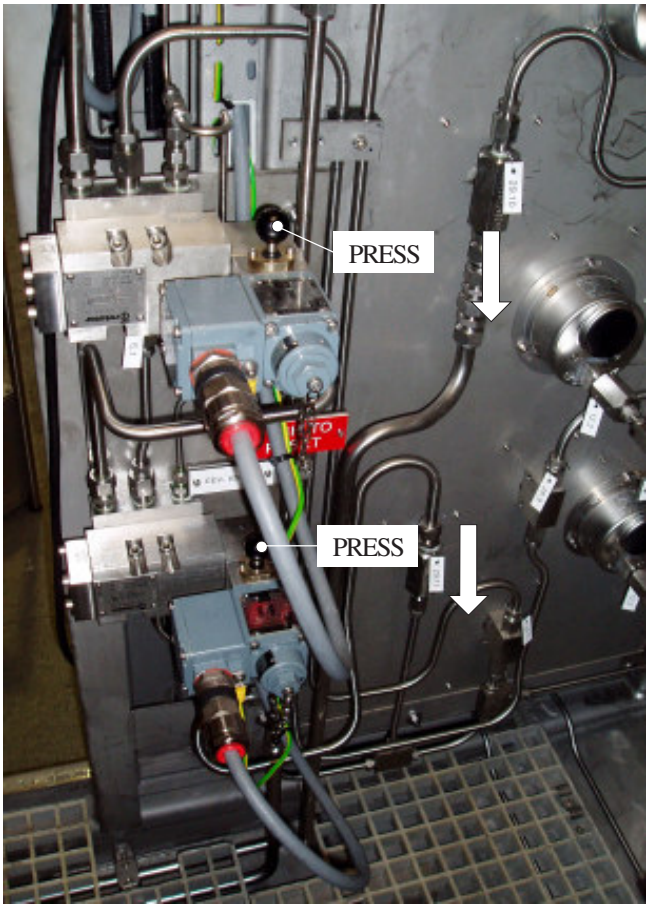
All unit functions are controlled by Remote Control with a PLC accommodated in a separate PLC-cabinet located in the safe area.
The operating mode for the HP pumps is selected at the Local Control Panel via the H/A selector switch and the

Fig. 6: ESD manual valve, item no. 6, with hand lever. Light switch, light ON/OFF, inside the unit, left-hand side of the infeed.

illuminated pushbutton AUTO. Each HP pump is completely controlled by the PLC/software.

- In AUTO mode the duty and stand-by pump will be controlled in accordance with pressure transmitter low and high settings.
- The HP pumps are operated initially by the Local Control Panel in the manual or LOCAL control mode. As soon as the HP pump pressure exceeds 500 bar, switch over to REMOTE control and AUTO mode; the PLC/software controls the pump to reach its 627 bar HP HEADER pressure.
- When changing from manual operation (Local Control Panel) to AUTO operation the pumps will start or continue running if a system demand is present.
- In Remote Control mode (AUTO operation) the PLC/software will STOP the HP pumps:
  - at HP HEADER pressure, see Flow Diagram, before the stand-by pump starts automatically,
  - if the transmitter fails,
  - if the supply reservoir level sensor indicates LOW LOW Level, it is not possible to start the HP pump when the level is LOW LOW, re-filling is necessary.
- It is possible to select the duty or stand-by HP pump (GX 82840 A/B) by pressing the relevant illuminated pushbutton AUTO at the Local Control Panel.

- H/A switch in position LOCAL (!).
- Press the pushbutton "LAMP TEST", verify that all signal lamps light up.
- Press the individual illuminated pushbutton DUTY for the required start of one of the HP pumps, GX 82840 A/B (duty or stand-by),
  as soon as the HP pump pressure exceeds 500 bar,
- H/A switch to REMOTE and press the individual illuminated pushbutton AUTO.
- The PLC/software assume further control and monitoring.



4.3.3 Alarm System

The level sensors monitors the fluid level. In the event of deviations from the set values, the software triggers an acoustic ALARM, at the same time, the respective red signal light is lit.

- Supply reservoir LOWLOW-Level 25 ltr. as a minimum fluid level.
  When Fluid Level is under LOW LOW Level an ALARM is triggered and the HP pumps will stop and cannot be started again without re-filling the supply reservoir, the red signal light, item no. 4 in Fig. 1, start flushing.
- Supply reservoir HIGH-Level 475 ltr. as a maximum fluid level.
  When the HIGH Level is exceeded, an ALARM is triggered, the red signal light, item no. 5 in Fig. 1, start flushing.

Fig. 7: ESD solenoid valves, item no. 14, with manual reset knobs to be pressed prior to start the unit after switch-off by the ESD manual valve.

- Return reservoir LOWLOW-Level .... 27.5 ltr. as a minimum fluid level.
  When Fluid Level is under LOW LOW Level an ALARM is triggered and the red signal light, item no. 6 in Fig. 1, start flushing.
  Re-filling the return reservoir with the circulation pump is necessary in accordance with the "Installation procedure".
- Return reservoir HIGH-Level ..... 522.5 ltr. as a maximum fluid level.
  When the HIGH Level is exceeded, an ALARM is triggered, the red signal light, item no. 7 in Fig. 1, start flushing.

The ALARM is tripped by the PLC/software. Further measures, e.g. shutting down the pumps, according to the user/owner's specifications.

The pressure transmitters monitor the HP pump and HP HEADER pressures. For transmitter set points see Flow Diagram. In the event of deviations from the set values, the software triggers an acoustic ALARM, at the same time, the respective red signal light start flushing.
- HIGH pressure ALARM ..... 650 barg
- LOW pressure ALARM ..... 550 barg
- LOW LOW pressure ALARM ..... 500 barg

- When an ALARM is triggered:
  - The respective signal lights start flashing
  - Press the push button ALARM ACCEPT
  - The signal light is continuously lit as the alarm signal is still pending. The signal extinguishes when normal operating conditions are achieved.
  - Prior to restarting: Remedy the cause of the alarm!

4.4 Start-up after an EMERGENCY shut down

The pumps STOP after actuation of the EMERGENCY STOP button or after switch-off by an electric/ electronic safety device:
- Remedy the cause for actuation of the EMERGENCY STOP button, eliminate the hazardous situation
  or
- have the cause of an automatic switch-off determined by a qualified electrician.
- Have any detected defects or malfunctions rectified immediately in an expert manner!

After an EMERGENCY STOP actuation:
- Rearm by pulling the mushroom-type hit button and allowing it to disengage.
- First shut down the unit and restart:
  - when operated in the REMOTE control mode, the machine is moved to its home position and restarted by control system,
  - when operated in the LOCAL control mode, shut down the unit and restart as described in this section.

4.4.1 Start-up after an emergency shut down with the ESD system

- Rearm the hand lever, see Fig. 6, page 13, pull down the hand lever to OPEN and restart the unit.
- After switch-off by the ESD manual valve, press the RESET knobs, see Fig. 7, page 14, prior to any restart, both in the LOCAL operating mode as well as in the REMOTE operating mode.

5. Operation of the pumps

5.1 Circulation loop, filtering of the hydraulic fluid

Attention

The EMERGENCY STOP button at the front on the right-hand side beside the door, see Assembly Drawing, is only to be used to instantly stop the unit in a hazardous situation!

5.1.1 Circulation Pump, GX 82841, item no. 1

The pump is intended to fill the return reservoir with hydraulic fluid and to filter the hydraulic fluid of the return (and/or supply) reservoir by circulation until the fluid reaches a cleanliness of SAE AS4059, Class 6 or better.
The filtered fluid can either be returned to the return reservoir or supplied to the supply reservoir. Switching over to return the hydraulic fluids to one of the two reservoirs is made by the 3-way ball valve, item no. 19.

Pumping over from the return reservoir to the supply reservoir is carried out when the cleanliness level, SAE AS4059, Class 6 or better, of the fluid is already reached! Analysis of a fluid sample see Table IV, page 24.

- Carry out the filtering/pumping over process at least once per month or acc. to the instructions of the user/owner or as described in Table IV, page 24.
- Check the Common Fill Up and Reservoir Drain Connection for leakage when filling with hydraulic fluid.
- Check that filling and drain sockets are closed with the blind plugs provided when circulate the fluid.
- Check the valve position acc. to Flow Diagram (res. = reservoir):

Valve, item no.	**19**	**27.3**	**27.4**	**27.5**
- filling return reservoir (from drums to return res.)	OPEN to return res.	CLOSE	CLOSE	OPEN
- filtering/circulation loop (from return res. to return res.)	OPEN to return res.	CLOSE	OPEN	CLOSE
- filling supply reservoir (from return re. to supply res.)	OPEN to supply res.	CLOSE	OPEN	CLOSE
- filtering/circulation loop (from supply to supply res.)	OPEN to supply res.	OPEN	CLOSE	CLOSE

Warning

Always OPEN one of the suction valves, item no. 27.4 (return reservoir) or 27.3 (supply reservoir), see Flow Diagram, before starting up the unit. Otherwise the circulation pump will run without fluid (i.e. run dry), inevitably resulting in damage to assets.

5.1.2 Starting up the Circulation pump

LOCAL control

- The fluid will be fed into the return reservoir. Define the target reservoir for the circulation loop and switch the 3-way ball valve accordingly.
  Only fill the return reservoir when topping up with hydraulic fluid "Transaqua HT".
  Filter the hydraulic fluid by circulation first, then pump the fluid into the supply reservoir after having taken a sample (Table IV, page 24) and a degree of purity acc. to SAE AS4059, Class 6 or better is assured.

- The electrically driven Circulation Pump is started and stopped using the illuminated pushbutton on the HPU Local Control Panel:
  - Press the illuminated pushbutton "Circulation Pump ON" together with
  - the pushbutton "Enable Startup Override".
- During start-up two alarm functions will also be activated (TBC):
  - The illuminated pushbutton start flashing.
  - The acoustic ALARM (alarm horn) sounds.
- Actuate the "ALARM ACCEPT" push button. The acoustic alarm signal stops sounding, the signal lights stop flashing and have a steady light.
- The operating status is monitored by the pressure gauge PG 82855, item no. 44 (see Fig. 5, page 12).

5.1.3 Shutting down the Circulation pump

LOCAL control

- Press the illuminated pushbutton "Circulation Pump GX 82841 OFF"

5.2 HP HEADER pressure of max. 627 bar

The HP pumps fill the accumulators that maintain the system pressure at a constant 627 bar pressure. The unit is fitted with two pumps, GX 82840 A and GX 82840 B, used alternatively in their operating and stand-by function.

5.2.1 Starting up the HP Pump, GX 82840 A/B, item no. 2

- During operation check the HP HEADER connection to the external field line for leakage.
- OPEN the suction line valves,
  - item no. 27.1, for pump GX 82840 B or
  - item no. 27.2, for pump GX 82840 A.
- Isolation valve HP HEADER, item no. 28.10, should always be in the OPEN Position.
- CLOSE the bleed/isolation valves in the HPU Local Control Panel, item no. 29.10 and 29.11.
- OPEN the accumulator isolation valve, item no. 28.2 and 28.3,
- CLOSE the accumulator drain/bleed valve, item no. 29.5 and 29.6.

Warning

The accumulator item no. 3.1 and 3.2 absorbs pressure peaks from the system and the accumulator item no. 4.1 and 4.2 maintains a certain pressure in the system even when the pumps are switched off.

LOCAL control

LOCAL or manual operation mode is used for performing particular tasks in accordance with the user/ owner's special operating instructions.

- The electrically driven HP pump is started and stopped using the illuminated pushbutton on the HPU Local Control Panel:
  - Press the illuminated pushbutton "HP pump GX 82840 A, DUTY" or press the pushbutton "HP pump GX 82840 B, DUTY" together with
  - the pushbutton "Enable Startup Override".
- Press the pushbutton "LAMP TEST", verify that all signal lamps light up.
- Allow the accumulators to be charged with fluid pressure, see HP supply pressure gauge, PG 82842, item no. 12.2 on the Local Control Panel.

- Ensure that the pump stops at the correct maximum operating pressure or supply transmitter PT 82840, item no. 13.1, set point 627 barg.
- During start-up two alarm functions will also be activated (TBC):
  - The signal lights start flashing.
  - The acoustic ALARM (alarm horn) sounds.
- Actuate the "ALARM ACCEPT" push button. The acoustic alarm signal stops sounding, the signal lights stop flashing and have a steady light.
- The operating status is monitored by the pressure gauges on the Local Control Panel: PG 82840, PG 82842 and PG 82843, item no. 12.1-12.3, see Fig. 1, page 9.

Attention

If there is air in the system (sound of the pump or pulsation on the pump outlet gauge) unfasten the air bleed screw located at the bottom of each HP pump. This must be done when the pump is running, do not retighten until the pump is running normal.

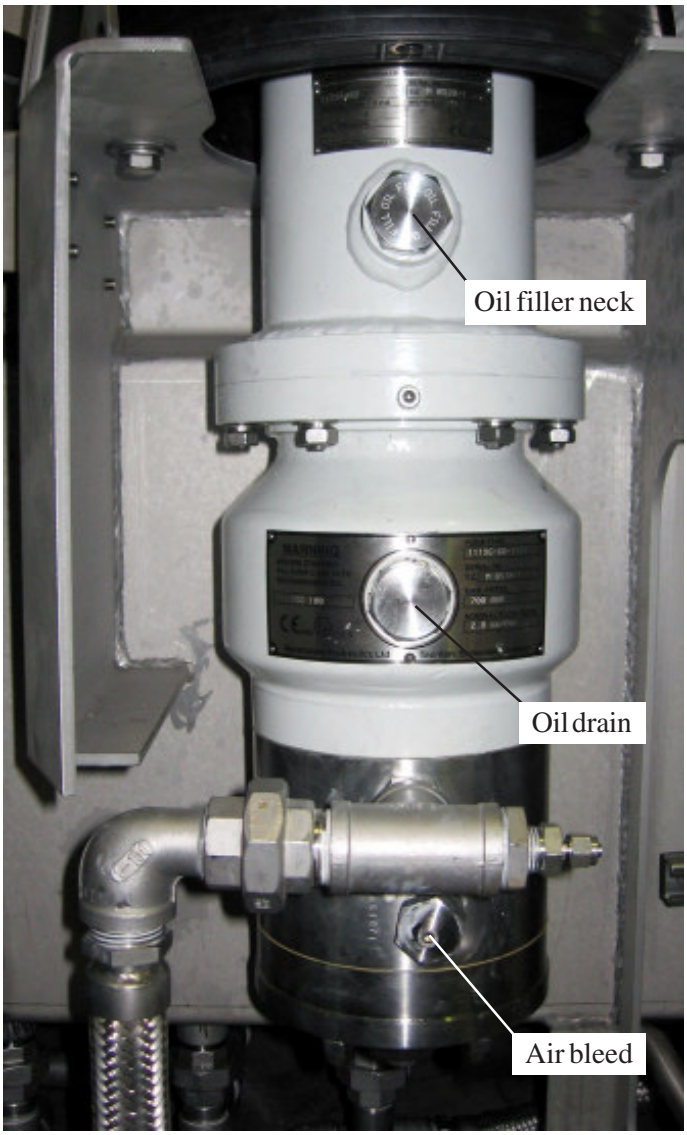


Fig. 8: HP pump with Oil fill, Oil drain and Air bleed connection (Fig. without Oil-level glass).

REMOTE control

In the LOCAL control mode, the HP pump is operated up to a pressure of 500 barg.
In 500 barg up to 627 barg pressure range, switch over to REMOTE control at the Local Control Panel.

- The electrically driven HP pump is started and stopped using the illuminated pushbutton on the HPU Local Control Panel:
  - Press the illuminated pushbutton "HP pump GX 82840 A, DUTY" or press the illuminated pushbutton "HP pump GX 82840 B, DUTY" together with
  - the pushbutton "Enable Startup Override".
- Press the pushbutton "LAMP TEST", verify that all signal lamps light up.
- Switch over manually from LOCAL to REMOTE control mode as soon as the pressure gauges at the Local Control Panel (PG 82840, PG 82842 and PG 82843, item no. 12.1-12.3, see Fig. 1, page 9) show a HP supply pressure of 500 barg:
  - H/A switch in position REMOTE,
  - press the illuminated pushbutton "HP pump GX 82840 A, AUTO" or press the illuminated pushbutton "HP pump GX 82840 B, AUTO" together with
  - the pushbutton "Enable Startup Override".

- The operating status in AUTO mode is remote controlled and monitored by the software. Transmitter PT 82840 and PT 82843, item no. 13.1 and 13.2 (see Flow Diagram), send the necessary measured pressure values to the PLC.
  Should a reset be required, this is also made by the PLC, irrespective of the switching status at the Local Control Panel.
- In the event of low or excess pressure, the HP pumps are automatically switched OFF/ON:
  HP pump ..... STOP ..... at 627 bar
  HP pump ..... START ..... at 580 bar
  HP pump ..... EMERGENCY STOP ..... at 400 bar
- Whenever an alarm situation occurs, e.g.
  - pressure of the HP pump either insufficient or exceeding the set limit values, controlled by transmitters,
  - lack of fluid (< LOW LOW LEVEL) or excessive fluid level (> HIGH LEVEL) in the supply reservoir,

  the acoustic ALARM sounds and the respective signal lights flash!
  To reset, actuate the "ALARM ACCEPT" push button.

Attention

If there is air in the system (sound of the pump or pulsation on the pump outlet gauge) unfasten the air bleed screw located at the bottom of each HP pump (Fig. 8). This must be done when the pump is running, do not retighten until the pump is running normal.

5.2.2 Shutting down the HP Pumps

The following measures apply to brief, temporary shut-down. For a longer term shut-down or even decommissioning, please refer to chapter 6.2 in this manual.

Operating mode: REMOTE control

- The HP pump is switched off by the PLC/software.

Operating mode: LOCAL control

- Press the pushbutton "HP pump GX 82840 A/B, OFF/ALARM"

6. Shutting down the K5F-HPU

6.1 Temporary shut-down.

- Switch off the circulation pump and/or the HP pump as described above (chapt. 5.1.3 and 5.2.2).
- OPEN the drain/bleed valves, item no. 29.5 / 29.6 / 29.10 / 29.11.
  CLOSE the drain/bleed valves again after depressurizing.
- Close all valves on the HPU Control Panel (CLOSE or ISOLATION position).
  - CLOSE item no. 28.9 NO to isolate HP supply
  - CLOSE item no. 28.10 NO to isolate HP HEADER*
  - CLOSE item no. 29.10 NC bleed valve
  - CLOSE item no. 29.11 NC bleed valve

  * locked OPEN

Danger

Ensure that the circulation and HP pressure lines are depressurized and that the accumulator has also been evacuated.

6.2 Decommisioning (mothballing)/preservation

- Perform the measures described in chapt. 6.1.
- Check the hydraulic fluid level, top up with CASTROL Transaqua HT, if necessary.
- Check the oil level in the HP pump case.

Attention

For detailed information on decommissioning also see CAM "General preservation & storage procedure".

6.3 Recommissioning

If the unit is decommissioned for longer than approx. 4 years or for longer than 2 years in unfavorable storage/ambient conditions, have all devices/components inspected by expert personnel and dismantled, if necessary, prior to re-start.

- If in doubt, have all wear parts and small components replaced if there are any signs of wear, corrosion etc..

Table I: Visual inspection or safety check prior to START-UP

No.	Sequence of operation - Hazard warning - Remark
001	- No externally visible defects of/damage to the unit .....
002	- No emissions/leakages in the fluid system .....
003	- Reservoirs filled with "CASTROL Transaqua HT", ...
	- Fluid level above LOW LOW LEVEL .....
	- Flushing/Filtering of the fluid completed .....
	- Fluid in the supply reservoir clean/filtered .....
	- Degree of purity acc. to SAE AS4059, class 6 determined ..... Table IV, page 24
004	- HP pumps: Pump case oil level sufficient .....
005	- Pumps, motors and other equipment in the unit fastened .....
006	- Valve positions/settings acc. to ..... Table II, page 22
007	- Accumulators pre-charged with Nitrogen .....
008	- Filters not indicating need for maintenance, no indicator pin disengaged .....
009	- Guards/protective devices fitted and correctly functioning .....
010	- Electric cables/hydraulic hoses not kinked or pinched .....
011	- EMERGENCY STOP buttons unlocked/rearmed/reset .....
012	- Manual ESD valve, hand lever in position OPEN .....
013	- Pressure gauge display clean, legible .....
014	- Unit secured against unauthorized access .....
015	- Hazard warning signs in place and legible .....

Remarks:

Table II: Valve position or setting prior to START-UP

Item No.	Position Setting	Description
26.1, 26.2	CLOSE	Reservoir Drain valve
27.1, 27.2, 27.4	OPEN	Suction Line valve
27.3, 27.5	CLOSE	Reservoir Filling valve
25.1, 25.2, 25.3 25.4	CLOSE	Sample valve
29.1, 29.2, 29.7 29.8	CLOSE	Sample valve
36.1, 36.2, 36.3 36.4	OPEN	Fluid indicator isolation valve
45.1, 45.2	OPEN	Circulation filter isolation valve
28.1	OPEN	HP pump 1, GX 82840 A, isolation valve
28.4	CLOSE	HP pump 2, GX 82840 B, isolation valve
24.1, 24.2, 24.3 24.4, 24.5, 24.6 24.7	see description	Block & Bleed valve - Open block function Block & Bleed valve - Close bleed function
22.1, 22.2	see description	Block & Bleed valve - Open block function Block & Bleed valve - Close bleed function
29.3, 29.12 29.14, 29.9 29.16	OPEN	Gauge isolation valves
29.4, 29.13 29.17, 29.18	OPEN	Transmitter isolation valves
28.2, 28.3	OPEN	Accumulator isolation valves
29.5, 29.6	CLOSE	Accumulator bleed valves
28.5, 28,6	OPEN	HP-Filter 1 isolation valves
28.7, 28.8	CLOSE	HP-Filter 2 isolation valves
28.9	OPEN	ESD isolation valve
28.10	CLOSE	HP HEADER valve
29.10, 29.11	CLOSE	Drain valves
19	see description	3-way valve, in flow direction to return reservoir

Remarks:

Table III: Prior to START-UP

No.	Sequence of operation - Hazard warning - Remark
001	- Connection to ground/equipotential bonding .....
	- Ground lines connected .....
	- Earthing resistance checked .....
002	- Reservoirs filled with CASTROL Transaqua HT, see "Installation procedure" .....
	- Fluid level above LOW LOW LEVEL .....
003	- Nitrogen filling of the accumulators .....
	- Pressure according to specifications .....
004	- HP pumps: Pump case oil level sufficient, see "Maintenance procedure" .....
005	- All valves in position CLOSED/OPEN ..... Table II, page 22
006	- EMERGENCY buttons unlocked/reset .....
007	- Manual ESD valve, hand lever in position OPEN .....
008	- H/A switch turned to the LOCAL position .....

Remarks:

Table IV: Fluid Sampling Procedure

No.	Sequence of operation - Hazard warning - Remark
001	- Collect hydraulic fluid in a separate waste oil container or ensure emission-free discharge from the unit leakage oil sump (drip pan) (1" discharge connection) .....
	- Only allow fluid sampling to be performed by trained expert personnel, avoid any contamination during sampling!
	- Wear personal protective equipment (PPE)!
002	- Do not take fluid samples until 30 minutes after system mode is activated .....
	- Sample point on the HP pressure line, shut-off valves (29.1 and 29.2), downstream of the HP pumps, see flow diagram .....
	- Sample point on the HP pressure line, shut-off valves (29.7 and 29.8), downstream of the pressure filter, see flow diagram. .....
	- Sample point on the return line, shut-off valve (25.4), downstream of the ESD system, see flow diagram .....
	- Sample point on the reservoirs, shut-off valves (25.1 and 25.2) .....
003	- Selected sample valve OPEN
	- Allow at least 500 ml of the hydraulic fluid to flow into a separate container or the leakage oil sump. .....
	- Do not close the sample valve! .....
004	- Carefully, with clean hands,
	- Unscrew the cap of the specimen flask .....
	- Do not put down the cap ..... but keep it in your hand with the opening facing upward. .....
005	- Hold the specimen flask under the valve with the other hand.
	- Collect at least 200 ml hydraulic fluid. .....
	- Do not close the sample valve! .....
	Do not touch the sample valve/unit components during sampling. Vibrations could cause flushed out particles to enter the sample!
006	- Rinse out the specimen flask with the filled fluid, pour off the fluid. .....
007	- Repeat the filling and flushing procedure (005-006) twice. .....
008	- Collect a specimen of at least 250 ml. .....
009	- Close the specimen flask and carefully wipe the outside. .....
010	- Shut-off valve CLOSED .....
011	- Perform a particle analysis (field fluid sampling set). .....
012	- Empty the waste oil container in an environmentally sound way or clean the leakage oil sump acc. to owners instruction. .....

Remarks:

Table V: Operation of the Circulation pump

No.	Sequence of operation - Hazard warning - Remark
	Fill up the return reservoir with hydraulic fluid
001	- Connect dipping lance to the Fill Up connection (front of unit) .....
002	- Use "LOCTITE 572" sealant .....
003	- Fill the return reservoir with „CASTROL Transaqua HT“ .....
	- return reservoir volume 550 liters .....
	Attention: Always wear PPE when refilling, e.g. eye and respiratory protection as well as protective gloves! **Only fill with „Transaqua HT“ from originally closed, clean drums, degree of purity according to SAE AS 4059, Class 6 or better!**
	- Connect dipping lance to the drum filled with „Transaqua HT“ .....
	- Connect drum/barrel to ground connection .....
	- CLOSE valve (27.4) and OPEN valve (27.5) .....
	- check position of 3-way valve (19), flow direction to return reservoir .....
004	- Start circulation pump,
	- press illum. pushbutton "Circulation Pump, GX 82841, ON" .....
	- simultaneously press pushbutton "Enable Startup Override" .....
005	- Fill return reservoir
	- Level > LOW LOW LEVEL, signal light extinguishes .....
	- Level > HIGH LEVEL, signal light shining, ALARM .....
006	- Stop the circulation pump,
	- press the illum. pushbutton "Circulation Pump, GX 82841, OFF" .....
	- CLOSE valve (27.5) and OPEN valve (27.4) .....
	Circulating the fluid
007	- Filtering of the hydraulic fluid (circulation loop),
	- check the position of 3-way valve (19), flow direction to return reservoir .....
	- start the circulation pump as described before (No. 004) .....
	- circulate the fluid from and to the return reservoir .....
	- stop the pump and take a sample of the fluid from sample valve (25.2), ... see Table IV, page 24
	Attention: Fill up the supply reservoir with clean/filtered fluid only!
008	Fill up the supply reservoir,
	- switch the position of 3-way valve (19), flow direction to supply reservoir .....
	- OPEN valve (27.4) .....
	- start the circulation pump as described before (No. 004) .....

Remarks:

Table VI: Operation of the HP pumps

No.	Sequence of operation - Hazard warning - Remark
001	- Connect external field line to HP HEADER connection
002	- Only use „LOCTITE 572“ as a sealant
003	- CLOSE valve item no. 28.10
004	- OPEN the suction valves, - pump GX 82840 B, valve item no. 27.1 - pump GX 82840 A, valve item no. 27.2
005	- CLOSE bleed valves item no. 29.10 and 29.11
006	- OPEN accumulator isolation valve, item no. 28.2 and 28.3
007	- CLOSE accumulator bleed valves, item no. 29.5 and 29.6
008	- Press the pushbutton LAMP TEST and check signal lamps
009	- Start HP pump (LOCAL control), - H/A switch to LOCAL - press illum. pushbutton "HP pump, GX 82840 A/B, DUTY" - simultaneously press pushbutton "Enable Startup Override"
010	- After start-up and with a pressure of approx. 10 bar, press the reset knobs of the ESD valves
011	- Stop HP pump, - press illum. pushbutton "HP pump, GX 82840 A/B, OFF/ALARM"
012	- Start HP pump (REMOTE control), - H/A switch to LOCAL (!) - press illum. pushbutton "HP pump, GX 82840 A/B, DUTY" - simultaneously press pushbutton "Enable Startup Override"
013	- After start-up and with a pressure of approx. 10 bar, press the reset knobs of the ESD valves
014	- Check pressure gauges, item no. 12.1 - 12.3 for operating pressure, if the pressure is approx. 500 bar: - H/A switch to REMOTE - press illum. pushbutton "HP pump, GX 82840 A/B, AUTO" - simultaneously press pushbutton "Enable Startup Override"
014	- Stop the pump via PLC/software

Remarks:

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

04.07.2008	Approved for Construction	Treder	D. Mottaghian	A.Weilandt
18.03.2008	Issued for Client Comment	S.Voiges	D. Mottaghian	A.Weilandt
16.11.2007	Issued for internal IDC	S.Voiges	I.Kiesewetter	A.Weilandt
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**
CAMERON	**Document Title:** **HPU Maintenance Procedure**			
	Customer Document Number:	54NL92-W-0P-543		REV. 01
	Cameron Document No.	X-065438-02-75		REV. 01

Maintenance procedure,
cleaning/care and repair

Table of contents

1. Introduction

1.1 Scope

This document is prepared according to the Requirements Specification for the Hydraulic Power Unit (CAM Doc. No. X-076721-87-05). The HPU is designed to supply on demand the hydraulic pressure for all Downhole Safety Valves (DHSV's) on all four K5F trees. This document covers the HPU maintenance procedure.

1.2 Abbreviations

Assy, Assembling (drawing)

BetrSichV, "Betriebssicherheitsverordnung" (German Ordinance on Industrial Safety and Health for equipment and installations requiring supervision/monitoring or such equipment and installations in potentially explosive atmospheres), 27.09.2002.

BGV …, identification with ordinal numbers of ordinances of the professional trade association for accident prevention and DA (implementation order), published by the main association of the BG.

BOM, Bill of Material

CAM, CAMERON
Chapt., chapter
ChemG, "Chemikaliengesetz" (German Chemicals Act),14.03.1990, Act on the Protection Against Hazardous Chemicals.
Conn., connection

dB, decibel
DIN EN, (harmonised European) EN standards published by DIN
DP, Design pressure

EC MRL, Machine Directive 98/37/EC (replacement for the Directives 89/392 EEC as well as 91/368, 93/44 und 93/68 EEC).
ESD, Emergency Shutdown System
FAT, Factory Acceptance Test
Fig., figure

h, hour, here operating hour
HP, high pressure
HPU, Hydraulic Power Unit

ISO-VG, ISO viscosity classification, i.e. of lube oil

KMA, KOLLER Maschinen- und Anlagenbau GmbH, D-29227 Celle, Germany

LP, low pressure

MCC, Motor Control Centre
MCS, Motor Control System
MCT, Multi Cable Transit
MOP, Maximum Operation Pressure
MRB, Manufacturing Record Book (with third-party/manufacturers maintenance manual)
MRL, EC-Machine Directive 98/37/EC
MSDS, Material Safety Data Sheet
MWD, Maximum Working Pressure

NC, normally CLOSED
NO, normally OPEN

PHA, Preliminary Hazard Analysis
PLC, Programmable Logic Controller
PPE, Personal Protective Equipment (German PSA)

Safety Data Sheet, according to Directive 91/155 EEC
Sect., section
SPS, Subsea Production System
SSS, Safety Shutdown System

Tab., table

V AC, voltage AC
V DC, voltage DC
VO, (also V), "Verordnung" (Ordinance)

1.3 Reference Documents and Drawings

Description	TOTAL Doc. No.	CAM Doc. No.	KMA Doc. No.
Bill of Material (BOM)	NN	223011-32	92001086 a
Equipment No.	NN-82202	223011-32	NN
Assembly Drawing	54NL92-W-03-503	SK-066011-32	1-92001086 a
Flow Diagram	54NL92-W-31-504	SK-066011-32-01	1-92001083 a
Circuit Diagram	54NL92-W-06-503	SK-066011-32-04	NN
Factory Acceptance Test (FAT)	54NL92-W-0P-505	X-065437-01-11	NN
Field Termination Diagram	54NL92-W-31-501	SK-066011-32-42	NN
Installation procedure	54NL92-W-0P-531	X-065467-02-09	NN
Operation procedure	54NL92-W-0P-542	X-065438-02-74	NN
Maintenance procedure	54NL92-W-0P-543	X-065438-02-75	NN

1.4 Intended Use/Equipment limitations

With the aid of two electrically driven HP pumps and an electrically driven circulation pump, the "Total Exploration & Production Netherlands B.V. K5F Project Hydraulic Power Unit"[1)] generates the necessary (system-dependent) pressure for the control of the K5F Downhole Safety Valves (DHSV). The HPU will be controlled by a remote PLC located in a safe area and is designed to supply hydraulic pressure for all DHSV's on all four K5F trees.

The K5F-HPU must not used for the following:
- Pressure testing
- Hot Oil flushing
- Running on other hydraulic fluids than specified in this document
- Running without accumulators in service
- Any service above maximum working pressure 627 bar
- Running of position control valves or servo/proportional directional valve systems with constant leakage.

2. Main Data

Equipment: ..... Total Netherlands K5F Project Hydraulic Power Unit
TOTAL Equipment No. NN-82202
CAMERON BOM 223011-32
KMA Article No.: ..... P/N 92001086 a
Approval: ..... Declaration of Conformity according to Machinery Directive 98/37/EC and ATEX Directive 94/9/EC

1) The "Total Exploration & Production Netherlands K5F Project Hydraulic Power Unit" is abbreviated to "K5F-HPU" or referred to as the "Unit" in this operating manual.

Area classification ..... Ex Zone 1, Category II, Gas Group IIB, Temperature Class T3
Ambient air temperature ..... max. +40 °C
min. -16 °C

Electric power supply:
For details please refer to the Circuit Diagram, CAM Doc. No. SK-066011-32-04, and the electrical documentation in the MRB.
- HPU HP Pump Motors Control ..... 24 V DC
- HPU Circ. Pump Motor Control ..... 24 V DC
- HP Pump Motors ..... 3-phase, 380 V AC, 50 Hz
- Circ. Pump Motor ..... 3-phase, 380 V AC, 50 Hz
- Internal light ..... 1-phase, 230 V AC, 50 Hz
- HP Pump Motor Heaters ..... 1-phase, 230 V AC, 50 Hz
- Circ. Pump Motor Heater ..... 1-phase, 230 V AC, 50 Hz
- HP Pump Press. Transmitter ..... 24 V DC
- HP Header Press. Transmitter ..... 24 V DC
- Input/Outputs from/to remote PLC ..... 24 V DC
- HPU ESD Valves ..... 24 V DC

Frame size, weight
Length x width x height ..... 2,500 x 1,800 x 2,595 mm
Gross weight ..... 3,320 kg
Tara weight ..... 3,280 kg
Proof load ..... 16,350 kg

HP pump and motor ..... 175 kg
Circulation pump and motor ..... 70 kg
Accumulator ..... 150 kg

Process Data
For Set Points/Alarm levels, see Flow Diagram CAM Doc. No. SK-066011-32-01.
MWP HP HEADER ..... 627 bar
Design Pressure ..... 690 barg
N2 pre-charge pressure:
- Accumulator item no. 3 ..... 320 bar
- Accumulator, item no. 4 ..... 360 bar

Supply-Reservoir Volume ..... 500 liters
Return-Reservoir Volume ..... 550 liters
Accumulator pre-charge volume:
- Accumulator item no. 3 ..... 2 x 0.25 ltr.
- Accumulator, item no. 4 ..... 2 x 32 ltr.

HP pump flow rate ..... 3.5 ltr./min.
Circulation pump flow rate ..... 38 ltr./min.
Circulation pump pressure ..... 10 bar

Filtration rate ..... 3 µm
Cleanliness of the hydraulic fluid ..... acc. to SAE AS4059, class 6 or better

2.1 Hydraulic Fluid

Hydraulic fluid	Water/glycol mixture
Type	CASTROL Transaqua HT
kin. viscosity at 40 °C	2.3 mm^2/s
kin. viscosity at 20 °C	4.1 mm^2/s
kin. viscosity at 0 °C	8.8 mm^2/s
Density at 20 °C	1.0706 g/dm^3
Degree of purity, min.	SAE AS4059, Class 6
Properties	Castrol-MSDS 0000001150, Safety data sheet according to Directive 91/155/EC

3. Safety instructions

Observe the regulations, warnings and instructions contained in the "Health and safety at work, safety regulations and environmental protection"[2)] for all maintenance or repair work on the K5F-HPU.

- Observe the safety regulations, see EC-Directives, ordinances and European standards[2]:
  - Concerning the electrical equipment carrying hazardous voltage (DIN EN 60 204 etc.),
  - Concerning the hydraulic system under hazardous high pressure (DIN EN 982 etc.).
  - Concerning hazards resulting from the "CASTROL Transaqua HT" (Castrol-MSDS or the EC-safety data sheet in the appendix of this manual).
- Danger of fire/explosion at the installation site due to explosive atmosphere.
  Smoking, the use of naked flames or lights are prohibited at the entire installation site.
- Use the prescribed Personal Protection Equipment (hard hat, eye protection, ear protection, protective gloves, safety boots etc.).

⚠ Danger

This maintenance procedure involves high pressure hydraulic, compressed nitrogen and high voltage operations. The operators and all personnel involved in maintenance shall be fully conversant with the procedures and equipment and ensure that safe working practices are observed at all times.

Improper handling of electrical and hydraulic devices or insufficient expert knowledge may lead to serious damage to health and assets!

- Prior to starting any work, secure the standstill of the Unit (chapt. 8.1 of this Maintenance procedure) and have the electrical system disconnected.
  Depressurize the hydraulic group sections to be opened.
- For safety instructions concerning equipment refer to the enclosed third-party operating manuals in the appendix of this manual.

2) Users located outside of the EEC must always follow the safety practices and procedures in accordance with the recommen-dations of The Occupational Safety and Health Administration (OSHA), The National Safety Council (NSC), The Hand Tools Institute (HTI), The International Association of Drilling Contractors (IADC) etc.. All applicable Governmental rules, regulations or restrictions, now in effect or which may be promulgated, take precedence over the suggestions in this publication!

3.1 Instruction for the maintenance personnel

- Read the operation manual prior to starting work, always work properly and in accordance with the safety regulations.
- KOLLER Maschinen- und Anlagenbau GmbH as the Unit manufacturer is not liable if the health and safety at work, safety regulations, hazard information and pertinent information contained in this operating manual are not observed.
- Use the prescribed or recommended personal protective equipment (PPE) for all work: Eye/face protection, respiratory protection, protective gloves, safety helmet, safety boots etc.
- Prior to commencing work,
  - Shut down the specific pump and secure against reactivation (chapt. 8.1 of this manual),
  - Disconnect (isolate) the unit/pump from the power supply,
  - Depressurize the HP supply system sections of the unit to be opened.
- Replace damaged equipment/components immediately. This might otherwise endanger the personal safety of the operator and the operational safety of the K5F-HPU.
- Refrain from using force if the energy involved exceeds the reasonable amount for loosening/ tightening screw connections/threaded joints.
- Comply with the Health and Safety at Work regulations when handling dangerous substances and substances hazardous to ground water, such as e.g. water/glycol fluid (Transaqua HT), cleaning agents or solvents, as well as other chemical substances.
  Read the safety data sheet Castrol-MSDS or the EC-safety data sheet (see appendix).
- Never use aggressive, easily inflammable or harmful solvents or cleaning agents for cleaning your hands, components or tools.
- Safely neutralise and dispose of leakages of consumables immediately and according to the regulations.
- Never allow used oils, water/glycol fluid and chemical substances, e.g. cleaning agents, to seep into the sewage system.
- It is the personal responsibility of the user/owner to ensure that used liquids or solid waste is disposed of in accordance with the pertinent national regulations.

3.2 Required qualifications of the maintenance personnel

Regular simple work:

- Cleaning and care,
- Commissioning/shutting down, visual inspections for externally visible damage, wear or emissions (fluid leakages),
- Hydraulic fluid level check, topping up of "CASTROL-Transaqua HT",
- Connection or disconnection of external flow lines or grounding,
- Determination of the lubricant requirement, refilling with oil, is performed by instructed personnel familiar with the K5F-HPU and the contents of this operation manual.

- Further maintenance or repair work and work on the HP supply system requires technically trained, qualified expert personnel.
- Work on the electrical equipment, devices or operating equipment must only be performed by a qualified electrician.
- Have work requiring trained/qualified persons with special knowledge performed by expert personnel.

3.3 Admissible spare parts

- For reasons of operational safety only use original spare parts.
  Spare parts which have not been tested and approved by KOLLER may affect the active and passive safety of the Unit.
  Inapplicable specification, inadequate quality, incorrect assignment etc. may increase the risk of accidents.
- The user/owner is fully and absolutely responsible for the use of non-approved spare parts.
- When non-approved spare parts/equipment are fitted, the "EC Declaration of Conformity" given by the Unit manufacturer shall become null and void!

4. Required tools, measuring instruments, auxiliary equipment and consumables

Special tools for maintenance work on equipment or components, refer to the third-party operating manuals in the appendix of this manual!

4.1 Maintenance tools

Metric **and** inch dimensions for all tools used!

- 1 set each of fork, ring and socket spanners
- 1 set of pin spanners (DIN 911)
- 1 set of screwdrivers
- Screwdriver for Philips screws and electric screwdriver
- Universal pliers, pipe wrench
- Pull-off device
- Drift punch, centre punch
- Hammer, plastic hammer
- Dipping lance, hose etc., for filling the unit with "Transaqua HT"
- Pre-charge equipment for filling the accumulators with nitrogen, according to the third-party operating manuals for the accumulators in the appendix of this manual.

4.2 Measuring instruments

- Pressure gauges
- Contact thermometer
- Voltage and phase tester, ammeter

4.3 Consumables

- CASTROL-Transaqua HT in sealed/undamaged barrels/drums, see chapt. 2.1/5.1
- Lubricants according to chapt. 5.2.
- Loctite 572
- Cleaning agent approved by the user/owner
- Paint as primer and top coat

4.4 Auxiliary equipment

- Personal protective equipment according to safety regulations: protective helmet, protective gloves, safety goggles, safety boots etc.
- Pre-charge equipment and nitrogen cylinders according to the third-party operating manuals for the accumulators
- Cloths, sponges, pads, tarpaulin, adhesive tape
- Tanks/containers to separately collect used oil, solid waste etc.
- Lifting gear/crane, load bearing capacity min. 3,500 kg
- Attachment equipment (lifting slings, cables etc.), suitable for a weight of min. 3,500 kg.

5. Technical specifications concerning the maintenance work

5.1 Hydraulic fluid CASTROL Transaqua HT

For details on the "CASTROL-Transaqua HT", physical data, possible hazards, PPE, firefighting, ecology, disposal etc., please refer to the Castrol-MSDS 0000001150 or the EC-safety data sheet.

- Water-based Subsea Control Fluid ..... "CASTROL-Transaqua HT"
  Density at 20 °C ..... 1,0706 g/dm^3
  Kin. viscosity at 20 °C ..... 4.1 cSt
  Particle cleanliness ..... SAE AS4059, Class 6
- Supply reservoir, volume ..... 500 liters
  Return reservoir, volume ..... 550 liters

5.2 HP pump case lube oil

For details on the lube oil for the pump case please refer to the information in the respective pump manufacturers operation manual in the appendix of this manual.

- Never mix different lubricant qualities and substances from different manufacturers!

Among others, the oil viscosity (ISO-VG) and/or grease consistency are selected according to average ambient temperatures at the installation site.

The use of a lead-free industrial gear oil on mineral oil basis with additives according to your equivalent national standard is alternatively recommened:
ISO VG 100: amb. temperature below 35 °C,
ISO VG 150: amb. temperature above 35 °C.

5.3 Screw tightening torques

The tightening torques (Nm) listed in Table I, are standard values depending on screw size and property grades.
The tightening torques apply to dry, non-greased friction surfaces.

Table I: Screw tightening torques[4)]

Size	8.8[5)] Nm	10.9[5)] Nm	12.9[5)] Nm	A2/A4[6)] Nm
M 6	10	13	16	8
M 8	23	32	39	20
M 10	46	64	77	42
M 12	80	110	135	70
M 14	125	180	215	112
M 16	195	275	330	170
M 18	270	390	455	240
M 20	385	540	650	340
M 22	510	720	870	
M 24	660	930	1,100	
M 27	980	1,400	1,650	
M 30	1,350	1,850	2,250	

4) Table I: Guideline values for usual tightening torques (dry, non-lubricated) for screws according to:
DIN 912 DIN 931 DIN 933
EN – EN 24 014 EN 24 017
5) Bolt strength class, see list of spare parts list
6) A2/A4 - Screws of stainless steel

6. Visual inspections, safety checks and monitoring

Warning

Always use the prescribed or recommended Personal Protective Equipment (PPE) in the form of eye/face protection, respiratory protection, protective gloves, safety helmet, safety boots etc.

- Visually inspect the machine, perform a daily safety check as described in Table II, page 29.
- Visual inspection or safety checks which exceed the scheduled times (Table III, page 30) are deemed as not in compliance with the intended use.
  The user/owner bears the sole risk!

7. Maintenance intervals

- For the time intervals for maintenance work to be performed regularly refer to Table III, page 30.
- Shorter maintenance intervals may be required depending on operation circumstances.

Attention

The accumulators are pressure vessels as defined by Directive 97/23/EC and are to be inspected/ tested at regular intervals. Please refer to the operation manual of the accumulators in the appendix of this manual.

- Prior to re-start, following completion of maintenance work and after repairs, do not re-start the machine until it has been checked and released by a authorized safety engineer.

7.1 Time intervals of maintenance work to be performed regularly

- For the time intervals for maintenance work to be performed regularly refer to Table III, page 30.

7.1.1 General DAILY maintenance

- Check visually overall cleanliness and moisture.
- Check visually for leakage in the hydraulic system.
- Check for loose or damaged components.
- Check fluid level in the reservoirs.
- Check pump lube oil level.

7.1.2 General WEEKLY maintenance

- All items listed in DAILY maintenance.
- Check that the fluid cleanliness both in reservoirs and in the system is in accordance to required cleanliness of SAE AS4059, class 6, or better.
- If the frame has been exposed to seawater, wash the frame with fresh water.
- Visually inspect for damage to paintwork.
- Visually inspect for corrosion.

7.1.3 General MONTHLY maintenance

- All items listed in DAILY and WEEKLY maintenance.
- Check accumulators pre-charge pressure (see manufacturers manual in the appendix of this manual).

8. General maintenance work

Insufficient, incorrect and untimely maintenance can lead to malfunctions, high repair costs and long downtimes. Perform the maintenance work on time at the intervals specified (Table III, page 30). Insufficient maintenance is also deemed improper handling of the unit. The user/owner bears the sole risk!

8.1 Safeguarding the standstill of the pumps

Warning

Prior to starting maintenance work ensure that the specific pump is at a standstill and safeguarded against reactivation. Ensure that unauthorised/accidental reactivation is impossible.

As a production unit, ensure that the HP HEADER pressure is maintained at all times. One pump at a time is shut down for maintenance purposes. To this effect, a user/owner fitted maintenance switch, designed as a H-0-A switch, is directly located at each pump and used to isolate the pump drive.

Warning

Prior to starting maintenance work, securely switch off and depressurise the pump concerned by means of the maintenance switch.

- Shut down the circulation pump GX 82841 or the HP pump GX 82840 A or the HP pump GX 82840 B at their individual maintenance switch.
  Turn the H-0-A switch to position 0.
- Depressurise the pipes directly connected to the shut down pump, see Flow Diagram. Commence by blocking the pump on the suction and pressure side without impairing the other pump still in operation:
  - HP pump GX 82840 A ..... CLOSE suction valve, item no. 27.2, and isolation valve, item no. 28.1,
  - HP pump GX 82840 B ..... CLOSE suction valve, item no. 27.1, and isolation valve, item no. 28.4.
- Relieve the pump pressure through the sample valves item no. 29.1 or 29.2 (see Flow Diagram).
- Prior to starting work inform the supervisor assigned by the user/owner of the intended maintenance work, and affix a sign to the main switch/control board.
- Report to the supervisor or main switch/control board that the maintenance work has been carried out.

8.2 Maintenance work

Warning

Prior to starting maintenance work ensure that personnel performing maintenance are fully trained.

- Prior to restarting the unit after maintenance refit any guards/safety devices ("Health and safety at work").

8.2.1 Visual inspection

- Visually inspect equipment especially for signs of leaks, loose equipment, hot pumps and equipment

operating when not required to do so.
- Check cleanliness of the K5F-HPU and amount of fluid in the drip pan.
- Look and listen for pressure leaking and identify source.

8.2.2 Fluid Analysis
- From the sample points (see Flow Diagram) extract a sample of hydraulic fluid for particle contamination analysis.
- Change filter elements if necessary.
- Re-flush system if contaminated.

8.2.3 General maintenance
- Ensure all drains on drip pan are unclogged and that no dirt is accumulating on K5F-HPU from overhead/outside. Clean frame, especially any spilt fluid.

8.3 Cleaning and care
- Perform cleaning/care measures at intervals specified in table III, page 30, according to operation.

Attention

Have damage and defects detected during cleaning rectified by specialist personnel, see chapter 6.

Auxiliary cleaning aids:
- Broom, hand brush, scrubbing brush for removing loose dirt,
- Industrial vacuum cleaner[7)] for vacuuming up dust or non-adhesive loose dirt,
- cleaning cloth, sponge.

Remove residual dirt from equipment by hand using a cloth/scrubbing brush only. If necessary use only cleaning agent - authorized by the user/owner - which does not leave residue on the surface.

- Comply with the safety and disposal instructions of the respective manufacturer of solvents or cleaning agents, see the instructions in the EC-safety data sheet (issued by the manufacturer of the substance).

Observe the emission protection regulations.
- Collect and dispose of loose dirt and used materials in accordance with your national regulations.

8.4 Wear or damage of components
In the event of wear it is necessary to evaluate whether or not the part/component will remain fully functional until the next scheduled inspection (Table III, page 30).

- Perform repairs or replacement immediately if the further use of parts/components seems doubtful in any way.

Attention

In the event of damage to individual parts/components, replace (repair) immediately in order to ensure the unlimited operational safety and perfect function of the K5F-HPU.

7) Blowing off with compressed air is prohibited in areas at risk of explosion and in the case of harmful, combustible or explosive dusts! Note your national ordinances and internal regulations!

- Have wear/damage of hydraulic hoses checked and replaced if necessary by qualified specialist personnel.
- Have electric cables checked for damage and secure connection, have cable glands checked for damages/tightness by a qualified electrician.

8.5 Visual inspection of rubber and plastic parts

Attention

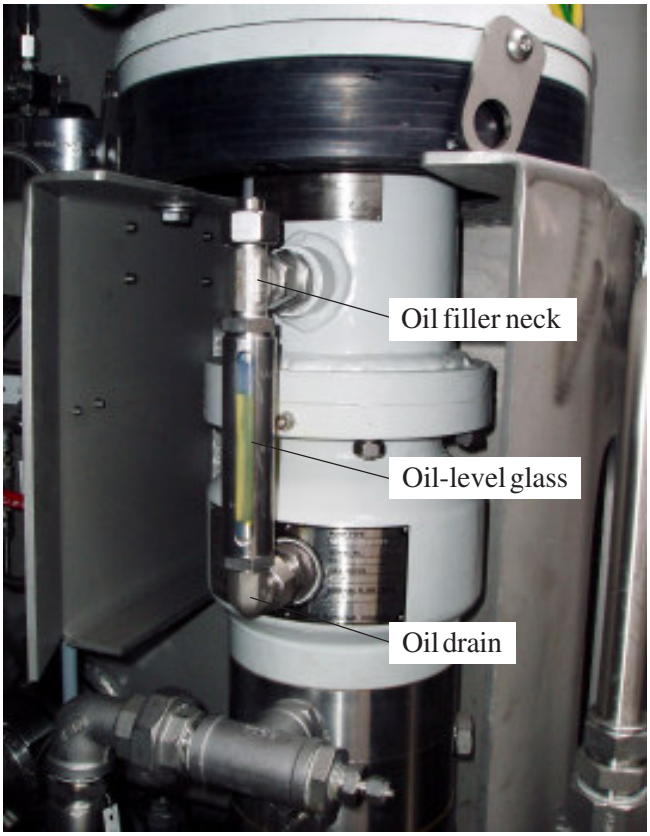
Never apply solvents/cleaning agents or other chemical substances to parts/components made of rubber or plastic, hydraulic hoses, electric cables etc.

Inspect all components made of rubber/plastic and replace if the surface shows any damage or even small cracks or porosity.

- For information on the service life of hydraulic hoses see chapter 9.3.1.

8.6 Screw connections

- Tighten any loose screw connections at once. For screw tightening torques refer to Table I, page 10.
- Replace any damaged screw connections or components with worn thread immediately.
- Fit screw locking elements corresponding to the original to every screw connection.
- Always use new parts for spring-loaded/deforming retaining elements (retaining rings, spring lock washers, self-locking nuts etc.) during maintenance work.



8.7 Hydraulic fluid (Transaqua HT) supply

- Ensure maximum cleanliness during work with a degree of purity in accordance with SAE AS4059, Class 6 for the entire system!
- For details on filling the reservoir with hydraulic fluid "CASTROL-Transaqua HT", please refer to Table I of "Installation procedure"!

Warning

When refilling with "Transaqua HT", take precautions to protect your eyes and skin.
Do not breath in the fumes!
Use the prescribed personal protective equipment!
See Castrol-MSDS / EC-safety data sheet (in the appendix of this manual).

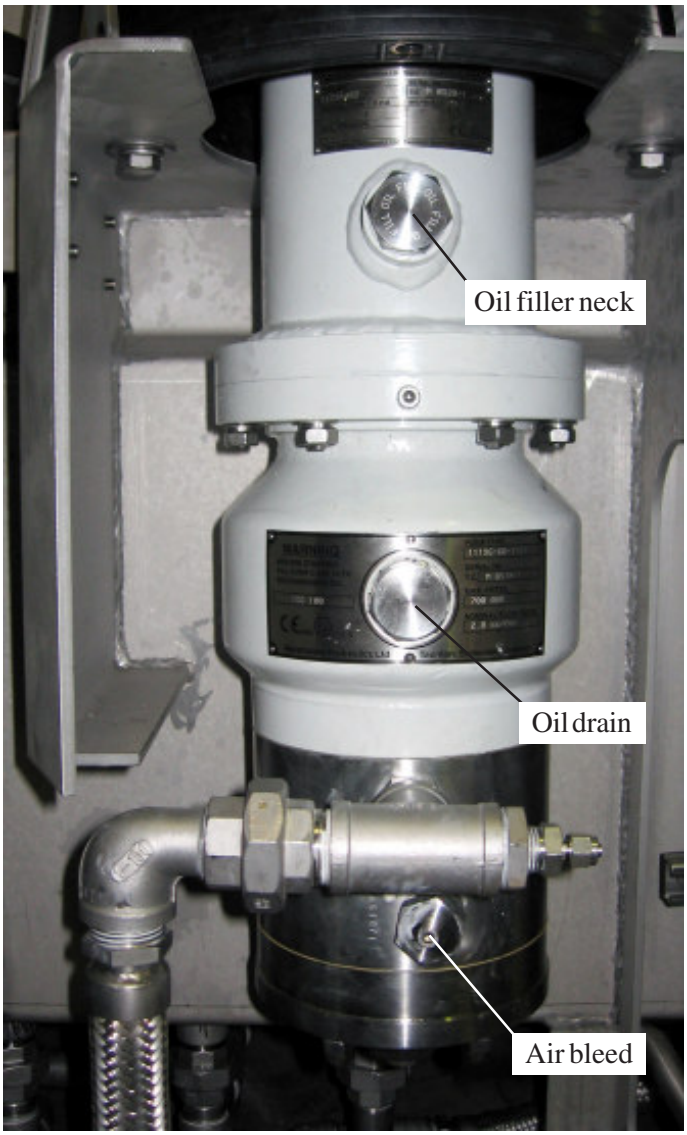
Fig. 1: HP pump with Oil-level glass, Oil filler neck and Oil drain.

8.7.1 Checking the fluid level, refilling with Transaqua HT

- Check the fluid level
  DAILY,
  and refill with "Transaqua HT", if necessary.
- Before refilling, briefly operate the unit in circulation mode (Table V of "Operation procedure") and after shutting down, take a sample from the reservoirs (Table IV of "Operation procedure").
  - Analyze the samples (use field fluid sampling set),
  - Empty the reservoirs and clean, if necessary.
- Refill with "Transaqua HT", also refer to Table I of "Installation procedure".

8.8 HP pump case, refilling of lubrication oil

- Check the oil level of the HP pump case (Fig. 1)
  ONCE A WEEK



and top up the oil, if necessary, for the oil quality, refer to chapt. 5.2.

- For detailed information on pump maintenance / repair please refer to pump manufacturers operation manual (in the appendix of this manual).

9. Maintenance work to be performed regularly on specific equipment/ components

For any hydraulically operated system there is a direct correlation between fluid cleanliness and operational performance, therefore, excellent working practises should be exercised during any planned maintenance activities to ensure that any contamination is controlled to an absolute minimum.

In certain cases it maybe more economical to replace the complete assembly than try to repair and this includes all ball valves, needle valves, pressure gauges etc..

Maintenance frequency, see chapt. 7 and Table III, page 30.

Fig. 2: HP pump with Oil fill, Oil drain and Air bleed connection (without Oil-level glass, see Fig. 1).

9.1 Electrical equipment, connecting to ground and equipotential bonding

Have the electrical drives/devices/equipment checked by a qualified electrician according to the instructions and the test schedules specified by your national standard!

Warning

Prior to any maintenance work ensure:
- Equipment is isolated from power supply,
- electric motor are not liable to start automatically,
- personnel performing maintenance are qualified electricians.

Maintenance of the electrical equipment includes:
- Tightening loose clamping connections immediately.
- Replacing damaged/scorched/chafed through cables immediately.
- Drying moisture in terminal or junction boxes/connections etc. properly, resealing connections.
- Check the electrical equipment, Local Control Panel and Junction boxes for externally visible damage.

9.1.1 Electric motors

- Check all mountings and cables are secure.
- Check for noise and/or vibration of the motor.
- Check casing temperature.
- Cleaning, e.g. the cooling air ducts of electrical motors (cooling fins, ventilator hood, ventilator etc.) **ONCE A YEAR**.

9.1.2 Equipment for connection to ground/equipotential bonding

- Prior to initial commissioning and/or in the event of restarting or after a prolonged standstill and at regular intervals:
  Check the equipment for connection to ground/equipotential bonding and the earthing resistance in accordance with your national standard
  ONCE PER MONTH.

9.2 Circulation pump, GX 82841, item no. 1

Warning

Prior to any maintenance work ensure:
- Pump is isolated from pressure,
- pump does not hold entrapped pressure,
- pump is not liable to start automatically,
- maintenance switch is switched OFF (position 0),
- personnel performing maintenance is fully trained.

Maintenance work:
- Check all mountings are secure,
- check for leaks,
- check fastening of motor and hydraulic connections to the pump.
- For detailed information on maintenance or repair, please refer to the pump manufacturers operation manual (in the appendix of this manual).
- For technical details refer to chapt. 2 "Main Data".

9.3 HP pumps, GX 82840 A & B, item no. 2

Warning

Prior to any maintenance work ensure:
- Pump is isolated from pressure,
- pump does not hold entrapped pressure,
- pump is not liable to start automatically,
- maintenance switch is switched OFF (position 0),
- personnel performing maintenance is fully trained.

Maintenance work:
- Check all mountings are secure,
- check for leaks,
- check fastening of motor and hydraulic connections to the pump.

- Check the oil level in the pump case (see Fig. 1, page 14)
  ONCE A DAY,
  refill with lubrication oil if necessary (see chapt. 5.2), ISO VG 100 or ISO VG 150 in accordance to the ambient temperature.

- Exchange the lube oil in the pump case
  EVERY THREE (3) MONTHS or every 100 RUNNING HOURS.
  Open the oil drain and refill by using the oil fill conn. (see Fig. 2).

- Loss of flow and/or vibration indicates that air is trapped in the cylinder block. To remove this air, open the bleed screws (see Fig. 1, page 14) a number of times.
  If this is not successful, it will be necessary to purge the pump by pressurizing the inlet and forcing fluid through the chambers.
  Connect a flushing or charging pump to the inlet, max. pressure 7.0 bar = 101.5 psi
- For detailed information on maintenance or repair, please refer to the pump manufacturers operation manual in the appendix of this manual.
- For technical details refer to chapt. 2 "Main Data".

9.3.1 Hydraulic system, flexible hose

Warning

Prior to any maintenance work ensure:
- equipment is isolated from pressure,
- equipment does not hold entrapped pressure,
- equipment is not liable to be pressurized automatically,
- personnel performing maintenance is fully trained.

Maintenance work:
- Check condition of the HP supply pressure system and flexible hose around end connection and look for signs of cracks and leaks and general fatigue,
  ONCE A YEAR.

- Eliminate any hazard point at which hoses could be squashed, kinked or chafed through.
- Replace hydraulic hoses, item no.31.1 & 31.2 (see Flow Diagram):
  - in the event of damage (see above),
  - after 4 years of use calculated from the date of assembly.

9.3 HP pumps, GX 82840 A & B, item no. 2, contd.

- Do not use hoses that have been stored for longer than two (2) years!

9.3.2 Replacement of flexible hoses

- Depressurise the section of the hydraulic system to be opened.
- Undo the line connections.
- Collect emerging hydraulic fluid in waste oil containers.
- Fitting a new hose:
  - Only use original spare parts. Adhere to the hose specification (see spare parts list).
  - Adhere to the degree of purity in accordance with SAE AS 4059, Class 6.
  - Do not twist, pinch or kink hoses, and exclude the risk of chafing.
- Always record the date of a flexible hose change.

9.4 Supply and return reservoir

Warning

Prior to any maintenance work ensure:
- Personnel performing maintenance is fully trained,
- consider if special precautions are required for this component.

Maintenance work:
- Check fluid level,
- clean reservoir exterior especially around manhole,
- check manhole is secured,
- check for any leakage from flange nozzles, fix it if necessary.

Warning

Do not remove the manhole cover in dusty atmosphere. Bolts for fasten the manhole cover to be tightened from the centre of the sides towards the corner in a cross pattern.

9.5 Suction strainer, filter and filter element

9.5.1 Suction strainer, item no. 16

Warning

Prior to any maintenance work ensure:
- Equipment is isolated from pressure,
- process is isolated and all pressure is vented,
- equipment does not hold entrapped pressure,
- equipment is not liable to be pressurized automatically,
- personnel performing maintenance is fully trained.

Maintenance work:
- Remove element (see filter manufacturers operation manual in the appendix of this manual) and tap out any entrapped particles,
- rinse and clean, use only cleaner (authorized by the user/owner) which does not leave residue on the surface,
- check seal for damage and replace if necessary.

9.5.2 Circulation filter, item no. 8/9 and HP pressure filter, item no. 10/11

Warning

Prior to any maintenance work:
- Isolate filter on which maintenance is to be performed.
- Bleed of ALL pressure BEFORE filter bowl is removed.
- Filter should not hold entrapped pressure.
- Ensure that personnel performing maintenance is fully trained.

These notes are provided for safety and for the correct operation of the equipment, otherwise injury of personnel and/or damage to equipment could occur.

- Hydraulic pressure filters are small "pressure vessels". Ensure no pressure is entrapped in the bowl before removal.
- Indicating maintenance need:
  Circulation filter: If the red indicating pin protrudes out of the maintenance indicator, the filter element is soiled and requires changing and/or cleaning.
  HP pressure filter: The filters are equipped with optical-electrical maintenance indicators. Maintenance is required when the red indicator pin (optical indicator) has risen to the cap and when required maintenance is indicated above the capacitive solenoid switch by the signal light "Filter BLOCKED 82840 A/B" lighting up.

Maintenance work:
- Remove element (see filter manufacturers operation manual in the appendix of this manual) and replace with new filter element and seals.
- Clean and flush out bowl and housing, use only cleaning agent - authorized by the user/owner - which does not leave residue on the surface, lubricate threads and then fit the bowl.
- Assemble with new element and seals and slowly bring filter up to pressure.
- Check for leaks, fix if leaking.
- For technical details refer to chapt. 2 "Main Data".

9.6 Accumulators, nitrogen pre-charge

Warning

Accumulators are pressure vessels according to Directive 97/23/EC and must be checked/tested at regular intervals!

Prior to any maintenance work ensure:

- Accumulator is isolated from pressure,
- accumulator does not hold entrapped pressure,
- accumulator are not liable to be pressurized automatically,
- personnel performing maintenance is fully trained.

Maintenance work:

- ISOLATE accumulator and vent off pressurised fluid BEFORE checking nitrogen filling pressure,
- firm seating and leak tightness of connections,
- check proper condition of fittings and safety devices,
- check overall condition of bottle, fastening elements and connections,
- check condition of burst disc and replace if necessary.
- Check, pre-charge and record the accumulators (see Flow Diagram),
  - Accumulator, item no. 3.1 ..... Nitrogen pressure 320 bar
    3.2 ..... Nitrogen pressure 320 bar
  - Accumulator, item no. 4.1 ..... Nitrogen pressure 360 bar
    4.2 ..... Nitrogen pressure 360 bar
- For filling/pre-charging the accumulators with nitrogen, please refer to the accumulator manufacturers operation manual and/or the pre-charge equipment manual in the appendix of this manual.
- Also refer to the pre-charge equipment manufacturers operation manual for the required pre-charge equipment, nitrogen cylinders etc..

Attention

When refilling/pre-charging, observe and record the atmospheric temperature,
see Table IV, page 31.

The following test intervals of the gas filling pressure are recommended

- before restarting after a prolonged standstill or following repairs,
- approx. one week after initial commissioning or restarting as described above,
- approx. eight weeks after initial commissioning or restarting as described above.

If no appreciable nitrogen loss has occurred, the tests can be performed
EVERY SIX MONTHS.

9.7 Pressure transmitters

Warning

Prior to any maintenance work ensure:
- Equipment is isolated from pressure,
- process is isolated and all pressure is vented,
- equipment does not hold entrapped pressure,
- equipment is not liable to be pressurized automatically,
- personnel performing maintenance is fully trained.

Maintenance work:
- Check calibration: Refer to the manufacturers maintenance procedures.
- Recalibrate: Refer to the manufacturers maintenance procedures.

9.8 Pressure gauges

Warning

Prior to any maintenance work ensure:
- Equipment is isolated from pressure,
- process is isolated and all pressure is vented,
- equipment does not hold entrapped pressure,
- equipment is not liable to be pressurized automatically,
- personnel performing maintenance is fully trained.

Vent to Zero
- Isolate gauge under test and temporarily mark pointer position.
- Carefully vent off entraped pressure and check pointer returns to zero on the scale.
- Close vent and open supply and check pointer returns to originally marked position.
- Top up glycerine if necessary.

Recalibrate
- Isolate and vent gauge and remove to calibration equipment.
- Recalibrate in accordance with manufacturers maintenance procedures.
- Top up glycerine if necessary.

It may be more economical to replace the pressure gauge than to try to repair or to recalibrate on board of the platform!

9.9 Level sensor and level indicator

Warning

Prior to any maintenance work ensure:

- Equipment is isolated from pressure of the liquid column,
- process is isolated and all pressure is vented,
- equipment does not hold entrapped pressure,
- equipment is not liable to be pressurized automatically,
- personnel performing maintenance is fully trained.

Level sensor

- Check calibration: Refer to the manufacturers maintenance procedures.
- Trouble shooting: Refer to the manufacturers maintenance procedures.

Level indicator - visual inspection

- Check fluid is between operating levels.
- Check colour/clarity of fluid.
- Check no leaks are visible.

9.10 HP supply ESD valves

Warning

Prior to any maintenance work ensure:
- Equipment is isolated from pressure,
- process is isolated and all pressure is vented,
- equipment does not hold entrapped pressure,
- equipment is not liable to be pressurized automatically,
- personnel performing maintenance is fully trained.

Maintenance work:

- Refer to the manufacturer maintenance procedures.

It may be more economical to replace the ESD valve than to try to repair on board of the platform!

9.11 Ball valves and needle valves

Warning

Prior to any maintenance work ensure:
- Equipment is isolated from pressure,
- process is isolated and all pressure is vented,
- equipment does not hold entrapped pressure,
- equipment is not liable to be pressurized automatically,
- personnel performing maintenance is fully trained.

Maintenance work:
- Check overall conditions of all ball valves especially mounting bolts and connections.
- Check for leaks especially around the head units.
- If any connection or head unit leaks are found - depressurise equipment and fix leak.
- Check operation, operate valve several times.
- Leave valve in previous position when inspection is completed - if open than leave it OPEN, if closed than leave it CLOSED.

It may be more economical to replace the ball valve and needle valve than to try to repair on board of the platform!

10. Termination of maintenance operations

- Remove standstill safeguard (chapt. 8.1, page 12).
- Properly fasten or close all guards/safety devices.
- Check the working area inside of the Unit for any items (tools, consumables) that may have been left behind.
- Ensure that EMERGENCY STOP button, the ESD manual valve or the operating elements/Local Control Panel are freely accessible.
- Have the operational safety and readiness for operation checked and confirmed by a safety engineer.

Table II: Visual inspection or safety check

No.	Sequence of Operation - Danger notice - Remark
	Use the prescribed personal protective equipment (PPE) for all work: eye/face protection, respiratory protection, protective gloves, safety helmet (hard hat), safety boots etc.!
001	- No loose or damaged parts/components of the unit .....
002	- No emissions/leakages in the fluid system .....
003	- Reservoirs filled with "Transaqua HT", ...
	- fluid level above LOW LOW LEVEL .....
	- flushing/filtering of the fluid in the return reservoir completed .....
	- fluid in the supply reservoir clean/filtered .....
	- cleanliness of the fluid checked by fluid samples, see "Operation procedure" .....
	- cleanliness level of SAE AS4059, class 6, is determined .....
004	- Drains on drip pan unclogged, no spilt fluid accumulating in the drip pan .....
005	- HP pumps: pump case oil level sufficient .....
006	- Check fastening of pump/motor and hydraulic connections to the pump .....
007	- Accumulators pre-charged with Nitrogen .....
008	- Filters not indicating need for maintenance .....
009	- Protective devices are fitted and functioning correctly .....
010	- No loose objects (tools, auxiliaries etc.) inside of the unit ..... .
011	- Electric cables/hydraulic hoses not kinked or pinched .....
012	- Pressure gauge display clean, legible .....
013	- Hazard signs fitted and legible .....
	Before start-up:
014	- Valve positions/settings acc. to flow positions as per flow diagram .....
015	- EMERGENCY STOP switching device disengaged/reset .....
016	- ESD manual valve, hand lever in OPEN position .....
017	- ESD solenoid valve, reset knob in OPEN position .....

Remark:

Table III: Time intervals for regular maintenance operations

No.	Sequence of Operation - Danger notice - Remark
	DAILY maintenance work
001	- Check overall cleanliness and moisture
002	- Visual inspection/safety check ..... Table II, page 29
003	- Check fluid level, top up "Transaqua HT"
004	- Check HP pumps case oil level, top up oil
	Maintenance ONCE A WEEK
005	- Clean inspection glass of Local Control Panel and pressure gauges
006	- Lamp test: Actuate "LAMP TEST" push button, all signal lights lit
007	- Check circulation pump and HP pumps for leakages
008	- Wash the frame with fresh water, if the frame has been exposed to seawater
	Maintenance ONCE PER MONTH
009	- Check connection to ground/equipotential bonding, earthing resistance
010	- Check ALARM functions
	Maintenance EVERY THREE (3) MONTHS
011	- Check hydraulic connections, flexible hoses etc.
012	- Determine cleaning requirement, clean the unit if necessary
013	- Check screw connections/fastenings, retighten screws
014	- Exchange HP pump case oil
	Maintenance EVERY SIX (6) MONTHS
015	- Check filling pressure of the accumulators, top up nitrogen, see chapt. 9.6, page 22, also see manufacturers maintenance manual in the appendix
	Maintenance EVERY YEAR
016	- Check condition of hydraulic fluid system
017	- Check electric motors
	Maintenance EVERY TWO (2) YEARS
018	- Test electrical safety functions
	Maintenance EVERY FOUR (4) YEARS
019	- Replace hydraulic/flexible hoses

Remark:

Table IV: Nitrogen pre-charge of the accumulators

No.	Sequence of Operation - Danger notice - Remark
	Use the prescribed personal protective equipment (PPE) for all work: eye/face protection, respiratory protection, protective gloves, safety helmet (hard hat), safety boots etc.
001	- Check overall conditions (defects/damage etc.) of bottle, connections and fastening elements .....
002	- Check proper conditions of fittings and safety devices .....
003	- Check firm seating and leak tightness of connections .....
004	- Check condition of burst disc and replace if necessary .....
	When filling the accumulators with nitrogen adhere to the regulations specified by the third-party operating manuals and the instructions for the pre-charge equipment manual in the appendix of this manual!
	Accumulator, item no. 3.1,
005	- Atmospheric temperature, °C: .....
006	- Nitrogen filling pressure 320 bar .....
	Accumulator, item no. 3.2,
005	- Atmospheric temperature, °C: .....
006	- Nitrogen filling pressure 320 bar .....
	Accumulator, item no. 4.1,
005	- Atmospheric temperature, °C: .....
006	- Nitrogen filling pressure 320 bar .....
	Accumulator, item no. 4.2,
007	- Atmospheric temperature, °C: .....
008	- Nitrogen filling pressure 360 bar .....

Remark:

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

06FEB08	Approved for Construction	A. Voges	A. Weilandt	L. Budde
04DEZ07	Issued for Client Comment	A. Voges	A. Weilandt	S. Horne
04SEP07	Issued for Internal IDC	A. Voges	A. Weilandt	S. Horne
Date	**Reason for Issue**	**Originator**	**Checker**	**Approver**
CAMERON	**Document Title:** **Installation Procedure** **Control Cabinet Production HPU**			
	Customer Document Number:	54NL92-W-7P-506		REV. 1
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Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
A	04.09.2007	Initial release	
B	04.12.2007	Correct table under 3.2	IDC comments
01	06.02.2008	Add client cable No.	Client comments

TABLE OF CONTENTS

1 ABBREVIATIONS

BOM	Bill of Material
CAM	CAMERON
FAT	Factory Acceptance Test
HPU	Hydraulic Power Unit
LED	Light Emitting Diode
MCS	Master Control Station
PC	Personal Computer
PE	Protective Earth
PLC	Programmable Logic Controller
RE	Reference Earth
VAT	Variable Table

1.1 CABLE REFERENCE TABLE

Cameron No.	Total No.
-W7	NP-8028
-W304	Q-81001-1
-W305	Q-81001-2
-W306	NA-82202
-W307	NO-82202
-W308	NE-82202
-W320	NO-9408
-W321	NO-9418

2 SAFETY / WARNINGS

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

All personnel must acquaint themselves fully and strictly adhere to all company sites' HEALTH AND SAFETY AT WORK REGULATIONS, together with other specific requirements detailed in this procedure.

All personnel working on the equipment must have the required experience, training and qualifications.

All work is to be carried out within either a dedicated test bay area with authorised personnel entry points, or an area adequately protected from unauthorised access with a visible cordoned zone and adequately displayed warning signs detailing the test type and associated hazards.

The lifting and handling of the equipment must be carried out with extreme caution and with regard to the safety regulations.

For work, which includes the use of pressurised fluid, compressed gas and/or electrical voltage, all necessary suitable and adequate precautions must be taken prior beginning of work.

ENSURE THAT NO ELECTRICAL POWER IS APPLIED TO ANY OF THE CONNECTIONS BEFORE CONNECTIONS ARE MADE – UP OR DISCONNECTED.

Only trained personnel are permitted to perform the test.

Sufficient care must be taken to prevent persons from being injured during this test!

3 INTRODUCTION

3.1 SCOPE

This document outlines the procedure for installation of the HPU Control cabinet.
All test setups and test equipment that is necessary to carry out this test is specified.
The complete HPU installation procedure is issued as document
Cameron No. **X–065467-02-09**.

3.2 REFERENCE DOCUMENTS/DRAWINGS

Item	Description	CAMERON Doc. No.	Client Doc. No.	CAM. Rev.
1	CONTROL CABINET	223022-33	N/A	
2	ASSEMBLY DRAWING	SK-066022-33		
3	CIRCUIT DIAGRAM	SK-066022-33-04		
4	FIELD TERMINATION DIAGRAM	SK-066022-33-42		
5	HPU ASSEMBLY DRAWING	SK-066011-32	54NL92-W-03-503	
6	HPU FLOW DIAGRAM	SK-066011-32-01	54NL92-W-31-504	
7	HPU CIRCUIT DIAGRAM	SK-066011-32-04	54NL92-W-06-503	
8	HPU INSTALLATION PROCEDURE	X-065467-02-09	54NL92-W-0P-531	
9	TOPSIDE CABLE LIST	X-065451-04-06	54NL92-W-69-001	
10	HPU FAT	X–065437-01-11	54NL92-W-0P-505	
11	SPCS (Subsea Process Control System)		#46643 Rev 01	

Record the actual revision level of the documents/drawings.

4 TEST EQUIPMENT

The following test equipment will be required for the installation:

Insulation Test Meter (Megger)
Check for valid calibration label

Type : _____

Serial No. : _____

Multimeter
Check for valid calibration label

Type : _____

Serial No. : _____

5 INSTALLATION

Before electric power is connected to the HPU Control Cabinet perform the following steps:

5.1.1 Installation of cabinet

Securely fix the cabinet to the wall, use wall mounting brackets delivered with the unit.

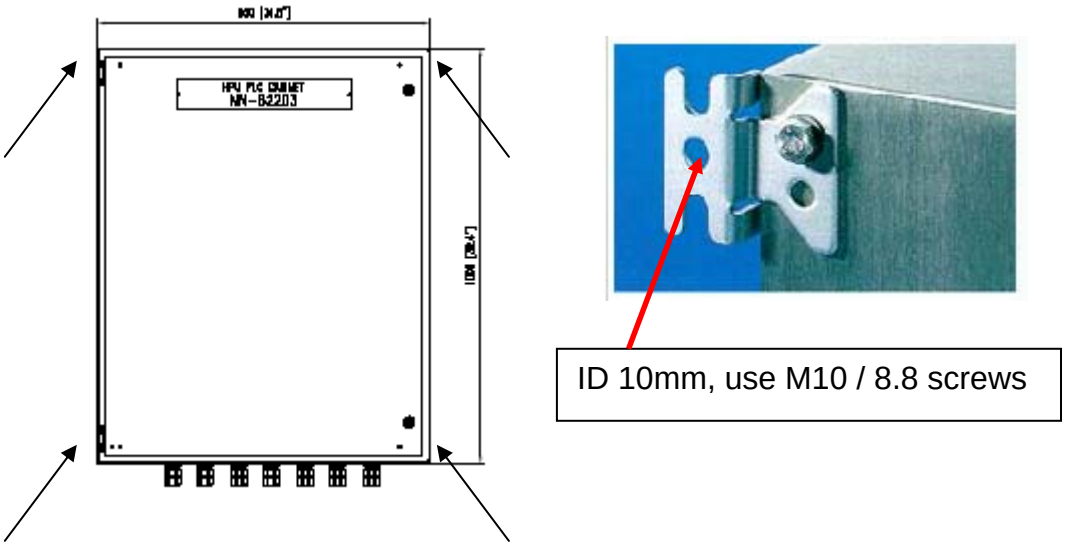
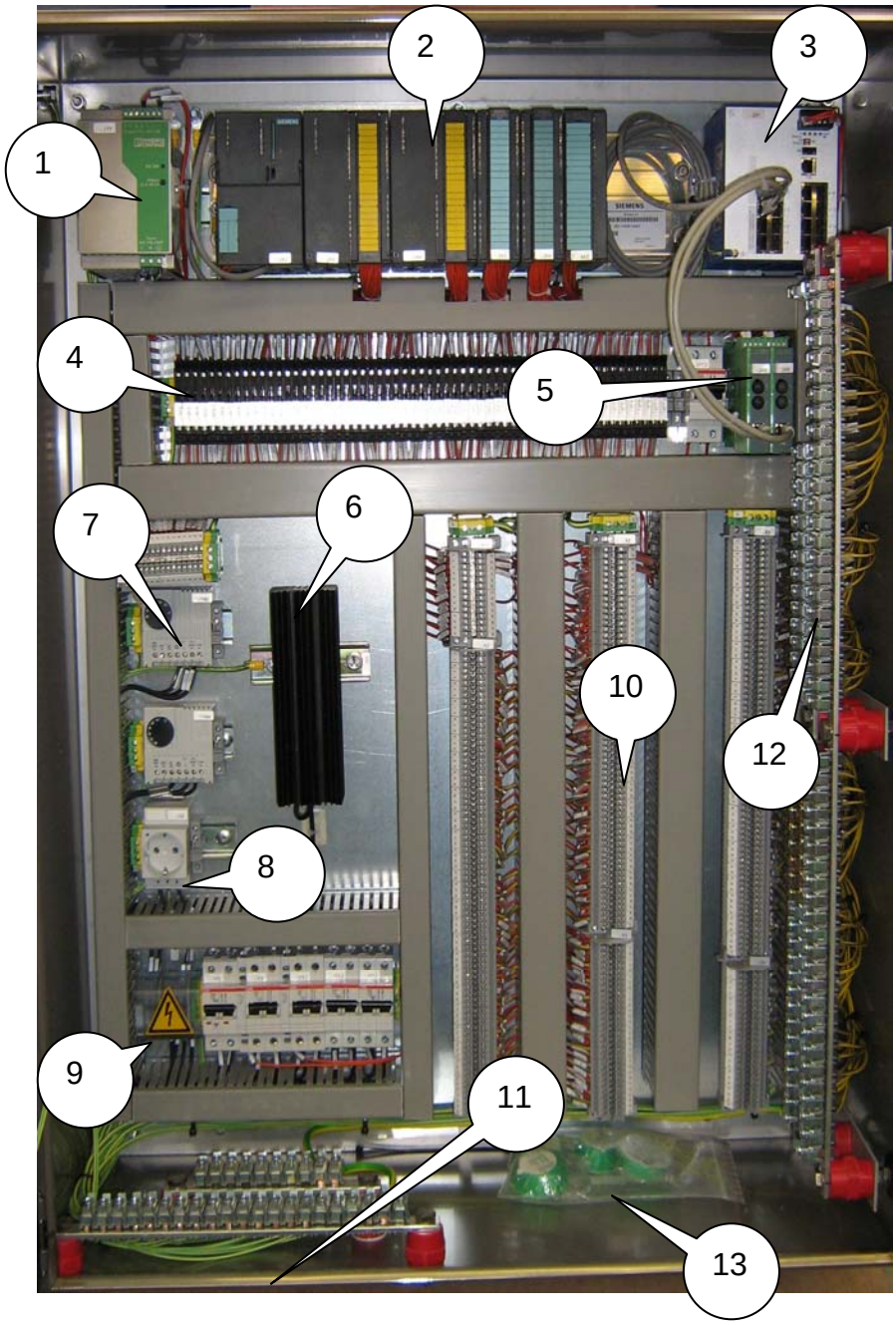


Figure 1 Cabinet mounting details

Use proper lifting equipment cabinet weight **82kg**.

5.1.2 Cabinet layout



1. ***DC power supply 24V***
2. ***PLC system***
3. ***Network switch***
4. ***Fuse terminals***
5. ***Fibre Optic Converter***
6. ***Anti condensation heater***
7. ***Thermostat***
8. ***Service socket***
9. ***Terminals for 230VAC***
10. ***Termination area***
11. ***Protective earth bar***
12. ***Instrument earth bar***
13. ***Corrosion inhibitor***

Figure 2 Cabinet layout

5.1.3 Earthing

Ensure that the cabinet is earthed to the installation earth system (min. 6mm²). use main earth bar as shown below.

Verify: _____

Measure earth resistance and record value.

_____Ω

Verify: _____

Validate the reading with the regulations applies to the associated Offshore Installation.

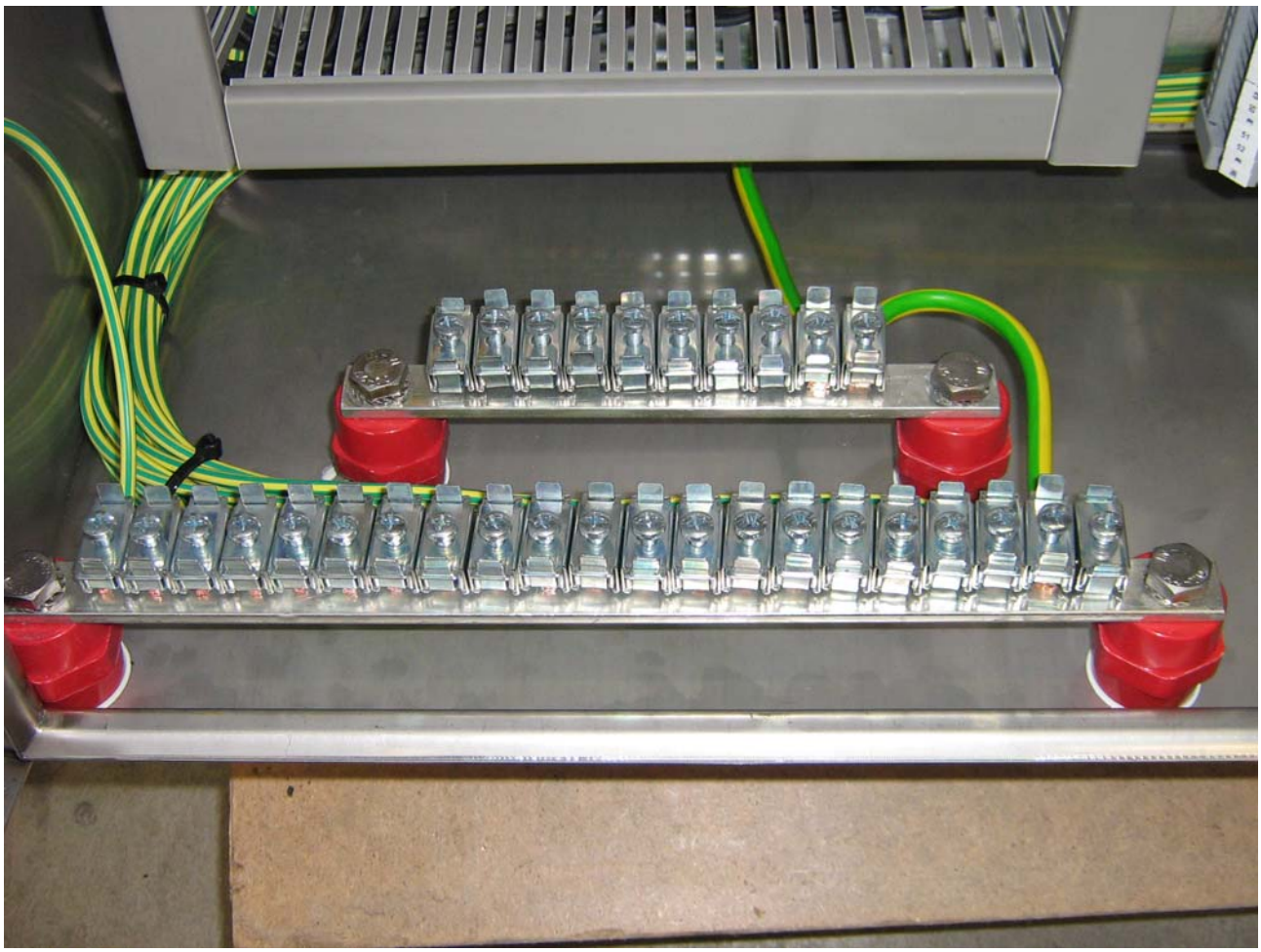


Figure 3 Protective earth bar

6 FIELD CABLE TERMINATION

6.1 CABLE GLANDS

Gabel glands are going to be fitted during installation. All glands are provided by customer and within Cameron scope of supply.

6.2 POWER SUPPLY FROM UPS

- Terminate –W7 / (NP-8028) to terminals -1X1
- Measure insulation resistance

Measure insulation resistance (proof voltage: 500 V) at terminal. **–1X1 (L)** and **–1X1 (N)** against **PE**.

Instrument Reading: _____ MΩ

Reading shall be **> 0,5 MΩ** Verify: _____

- Fasten cable Tag

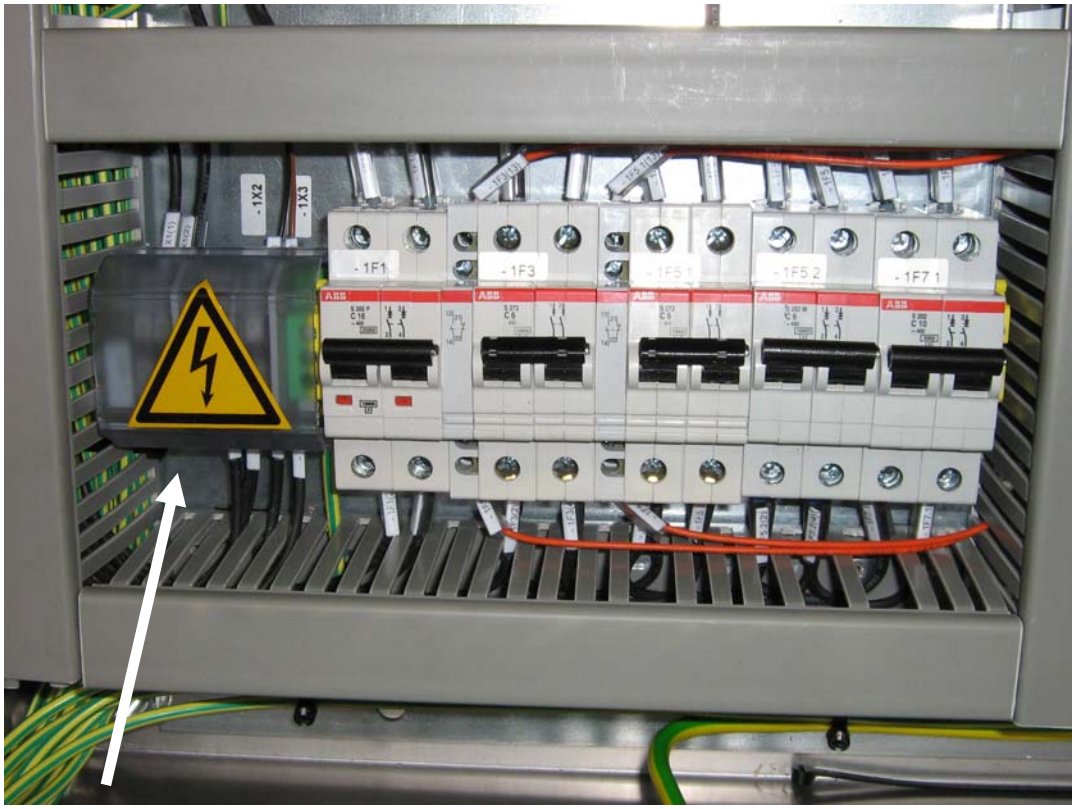


Figure 4 Power supply terminals 230VAC

6.3 FIBRE OPTIC COMMUNICATION LINK TO MCS

- Terminate –W304 / (Q-81001-1), to FO-Converter -2A5
- Fasten cable Tag
- Terminate –W305 / (Q-81001-2), to FO-Converter -2A6
- Fasten cable Tag

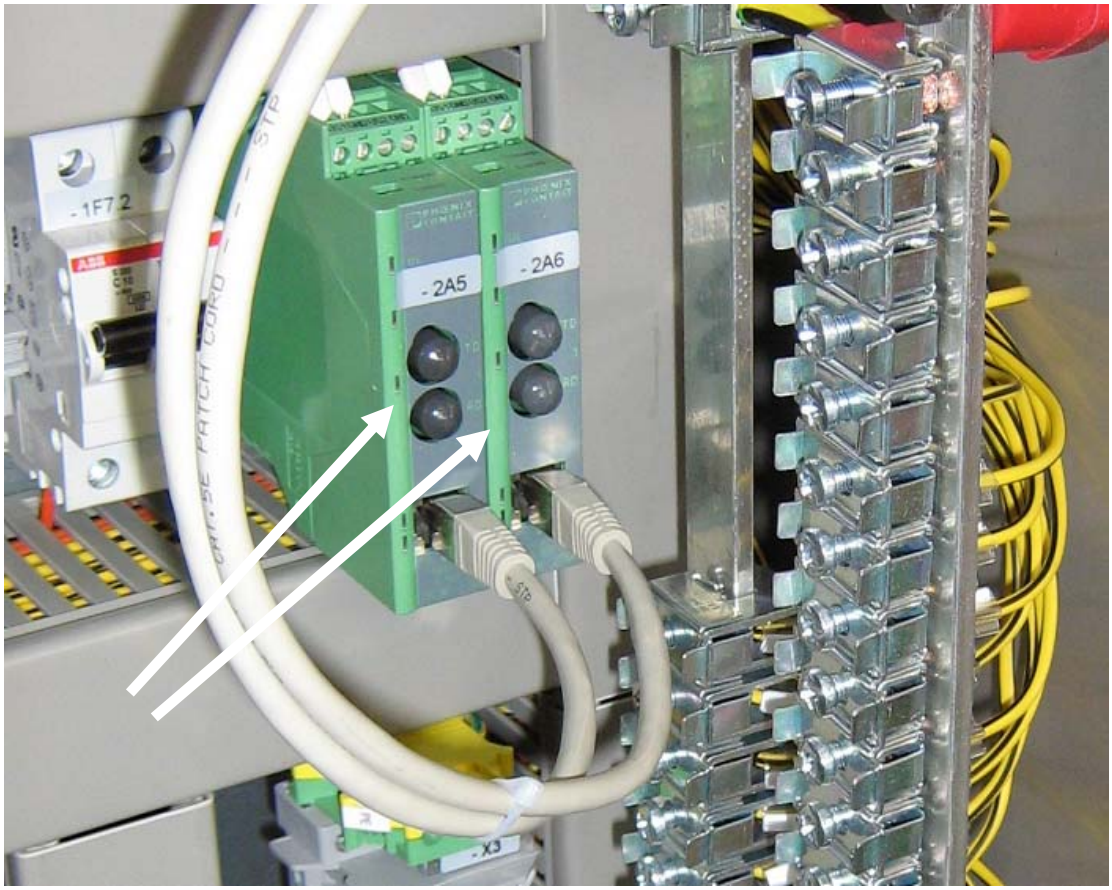


Figure 5 Fibre optic converters

6.4 INTERCONNECTION CABLE TO HPU

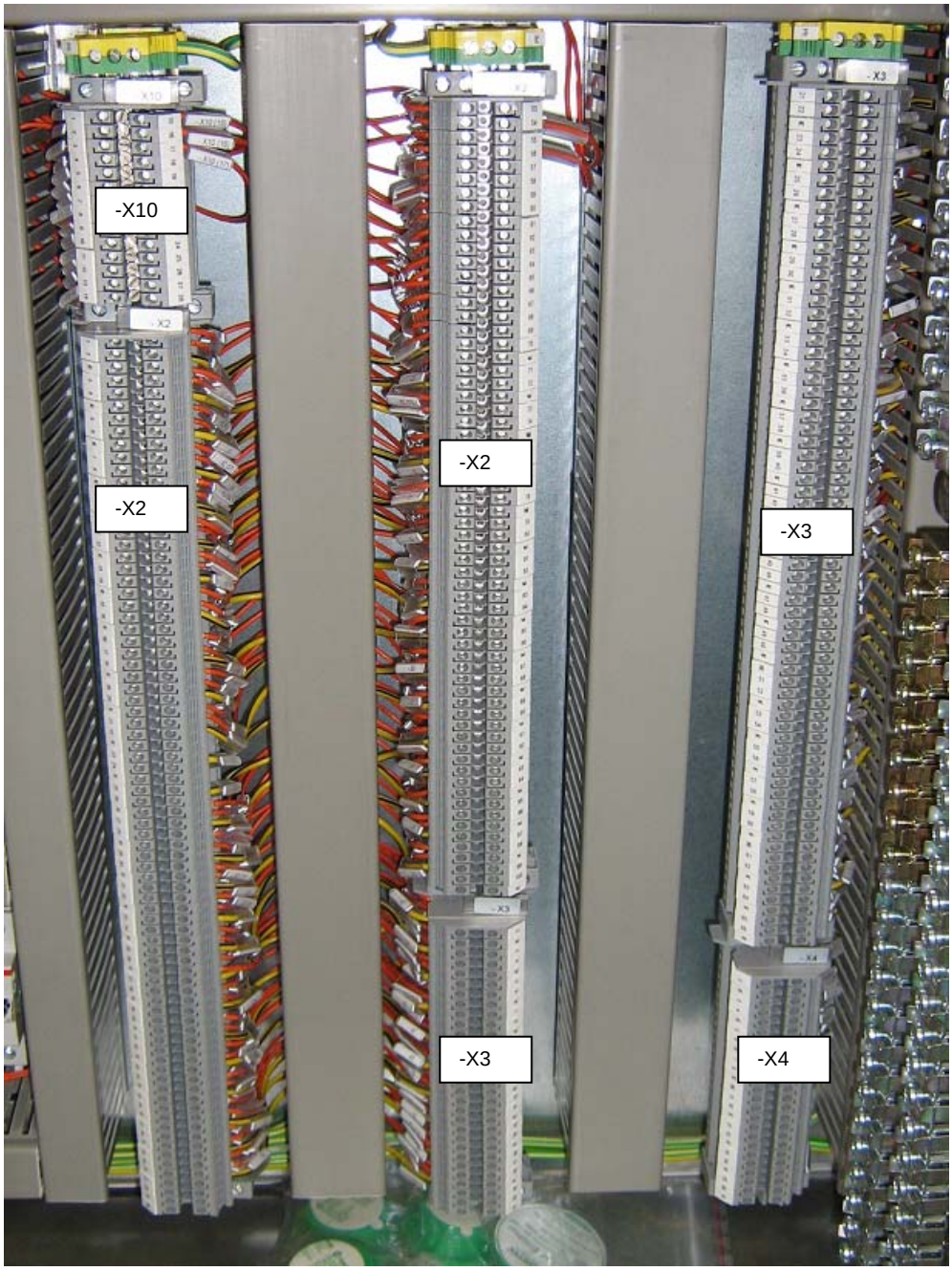


Figure 6 Termination area

6.4.1 Digital Inputs

- Terminate –W306 / (NA-82202),-W320 / (NO-9408) to terminals –X2 (1) ff.
- Remove terminal blocks from PLC card prior test.
- Measure insulation resistance (proof voltage: 500 V)
  at terminal. **–X2 (..)** .. against **PE**.
- Reading shall be **> 0,5 MΩ**

Signal description	**Tag No.**	**Device No. (Terminal)**	**Reading [MΩ]**	**Verify**
HP Pump 1 Duty				
HP Pump 1 Auto				
HP Pump 1 OFF/Alarm				
HP Pump 2 Duty				
HP Pump 2 Auto				
HP Pump 2 OFF/Alarm				
Alarm Accept				
Circulation Pump ON				
Circulation Pump OFF				
Lamp Test				
Enable Start Up Override				
Fan Fault				
Local/Remote				
HP1 Filter Blocked				
HP2 Filter Blocked				
HP Pump 1 Available				
HP Pump 2 Available				
CP Pump Available				
HP Pump 1 Running				
HP Pump 2 Running				
CP Pump Running				

- Fasten cable Tag

6.4.2 Digital Outputs

- Terminate –W307 / (NO-82202),-W321 / (NO-9418) to terminals –X3 (1) ff.
- Remove terminal blocks from PLC card prior test.
- Measure insulation resistance use Multimeter.
  at terminal. **–X3 (..)** .. against **PE**.
- Reading shall be **> 0,5 MΩ.**

Signal description	**Tag No.**	**Device No. (Terminal)**	**Reading [MΩ]**	**Verify**
HP Pump 1 Duty (LAMP)				
HP Pump 1 Auto (LAMP)				
HP Pump 1 OFF/Alarm (LAMP)				
HP Pump 2 Duty (LAMP)				
HP Pump 2 Auto (LAMP)				
HP Pump 2 OFF/Alarm (LAMP)				
Alarm Accept (LAMP)				
Circulation Pump ON (LAMP)				
Circulation Pump OFF (LAMP)				
HP Pump 1 Running (LAMP)				
HP Pump 2 Running (LAMP)				
HIGH Level Return (LAMP)				
LOW LOW Level Return (LAMP)				
HIGH Level Supply (LAMP)				
LOW LOW Level Supply (LAMP)				
Filter Blocked (LAMP)				
HIGH HIGH HP HEADER PRESSURE (LAMP)				
HIGH HIGH HP PUMP PRESSURE (LAMP)				
ALARM HORN				

- Fasten cable Tag

6.4.3 Digital Outputs

- Terminate –W307 / (NO-82202),-W321 / (NO-9418) to terminals –X3 (1) ff.
- Remove terminal blocks from PLC card prior test.
- Measure insulation resistance use Multimeter.
  at terminal. **–X3 (..)** .. against **PE**.
- Reading shall be **> 0,5 MΩ.**

Signal description	**Tag No.**	**Device No. (Terminal)**	**Reading [MΩ]**	**Verify**
HP Pump 1 Duty (LAMP)				
HP Pump 1 Auto (LAMP)				
HP Pump 1 OFF/Alarm (LAMP)				
HP Pump 2 Duty (LAMP)				
HP Pump 2 Auto (LAMP)				
HP Pump 2 OFF/Alarm (LAMP)				
Alarm Accept (LAMP)				
Circulation Pump ON (LAMP)				
Circulation Pump OFF (LAMP)				
POWER ON (LAMP)				
HP Pump 1 Running (LAMP)				
HP Pump 2 Running (LAMP)				
HIGH Level Return (LAMP)				
LOW LOW Level Return (LAMP)				
HIGH Level Supply (LAMP)				
LOW LOW Level Supply (LAMP)				
Filter Blocked (LAMP)				
HIGH HIGH HP HEADER PRESSURE (LAMP)				
HIGH HIGH HP PUMP PRESSURE (LAMP)				
ALARM HORN				

- Fasten cable Tag

6.4.4 Analogue Inputs

- Terminate –W308 / (NE-82202) to terminals –X4 (1) ff.
- Remove terminal blocks from PLC card prior test.
- Measure insulation resistance use Multimeter.
  at terminal. **–X4 (..)** .. against **PE**.
- Reading shall be **> 0,5 MΩ.**

Signal description	**Tag No.**	**Device No. (Terminal)**	**Reading [MΩ]**	**Verify**
Level Transmitter Supply Reservoir				
Level Transmitter Return Reservoir				
HP Pump Pressure Transmitter				
HP Header Pressure Transmitter				

- Fasten cable Tag
- Put the terminal blocks back on the cards.

6.4.5 Corrosion inhibitor

Fit **2** of corrosion inhibitor within the cabinet when installation is completed.

Remove plastic packing and fit inhibitor on rear side of the cabinet door using the adhesive pad.

Do not remove the paper from the canister.

Fit a label with the date close to the inhibitor and change out in cycles of max. 24 month.

7 INSTALLATION CERTIFICATE

Unit: PLC Cabinet for HPU PN. 223011-33

Part Number: 223022-33

The Installation was checked by:

CAMERON representative:

Name: _____

Signature: _____

Date: _____

Customer representative:

Name: _____

Signature: _____

Date: _____

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

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A	04.09.2007	Initial release	
B	17.12.2007	Add IDC comments	IDC complete
01	07.04.2009	Add missing TEPNL No. to table 3.2	As Built

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1 ABBREVIATIONS

BOM	Bill of Material
CAM	CAMERON
CPU	Central Processing Unit
FAT	Factory Acceptance Test
HPU	Hydraulic Power Unit
LED	Light Emitting Diode
MCS	Master Control Station
PC	Personal Computer
PE	Protective Earth
PLC	Programmable Logic Controller
RE	Reference Earth
VAT	Variable Table

2 SAFETY / WARNINGS

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

All personnel must acquaint themselves fully and strictly adhere to all company sites' HEALTH AND SAFETY AT WORK REGULATIONS, together with other specific requirements detailed in this procedure.

All personnel working on the equipment must have the required experience, training and qualifications.

All work is to be carried out within either a dedicated test bay area with authorised personnel entry points, or an area adequately protected from unauthorised access with a visible cordoned zone and adequately displayed warning signs detailing the test type and associated hazards.

The lifting and handling of the equipment must be carried out with extreme caution and with regard to the safety regulations.

For work, which includes the use of pressurised fluid, compressed gas and/or electrical voltage, all necessary suitable and adequate precautions must be taken prior beginning of work.

ENSURE THAT NO ELECTRICAL POWER IS APPLIED TO ANY OF THE CONNECTIONS BEFORE CONNECTIONS ARE MADE – UP OR DISCONNECTED.

Only trained personnel are permitted to perform the test.

Sufficient care must be taken to prevent persons from being injured during this test!

3 INTRODUCTION

3.1 SCOPE

This document outlines the procedure to operate the HPU control cabinet.

The complete HPU Operation Manual is issued as document.

Cameron No. **X–065438-02-74**

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3.2 REFERENCE DOCUMENTS/DRAWINGS

Item	Description	CAMERON Doc. No.	Client Doc. No.	CAM. Rev.
1	CONTROL CABINET	223022-33	N/A	
2	ASSEMBLY DRAWING	SK-066022-33	54NL52-W-73-500	
3	CIRCUIT DIAGRAM	SK-066022-33-04	54NL52-W-71-500	
4	FIELD TERMINATION DIAGRAM	SK-066022-33-42	54NL52-W-71-501	
5	HPU ASSEMBLY DRAWING	SK-066011-32	54NL92-W-03-503	
6	HPU ASSEMBLY DRAWING	SK-066011-32-01	54NL92-W-31-504	
7	HPU CIRCUIT DIAGRAM	SK-066011-32-04	54NL92-W-06-503	
8	HPU FAT	X–065437-01-11	54NL92-W-0P-505	
9	SPCS (Subsea Process Control System)		#46643.	

Record the actual revision level of the documents/drawings.

4 START UP

Prior start up check that all field cable is connected.

- **-W7 230V supply**
- **-W304 Fibre optic communication line A**
- **-W305 Fibre optic communication line B**
- **-W306 Interconnection cable for PLC inputs**
- **-W307 Interconnection cable for PLC outputs**
- **-W308 Interconnection cable for PLC analogue inputs**
- **-W320 Interconnection cable to MCC**
- **-W321 Interconnection cable to MCC**
- **Cabinet earth**

See Topside cable list Cam. X-065451-04-06

4.1 SWITCH ON POWER

Switch ON circuit breaker
-1F1, -1F3, -1F5.1, -1F5.2, -1F7.1, -1F7.2 Verify: _____

Switch ON fuses for PLC Input board.
-5F2 to -10F7 Verify: _____

Switch ON fuses for PLC Output board.
-11F2 to -17F7.2 Verify: _____

Check that Fan Thermostat is set to +25°C Verify: _____

Check that Heater Thermostat is set to +5°C Verify: _____

Check that PLC operating mode switch is set to Run and PLC is operating (Indicated by green Running LED at CPU). Verify: _____

Note: In case of any fault indication on CPU connect laptop and check diagnostic data for trouble shooting.

GENERAL PRESERVATION & STORAGE PROCEDURE

FOR

CAMERON CONTROLS EQUIPMENT

07	12. March 2008	J. Grochowski	K. Yahosseini	J. Grochowski
06	14. March 2007	J. Grochowski	B. Müller	J. Grochowski
05	12. May 2006	J. Grochowski	F. Duensing	J. Grochowski
04	18. July 2005	J. Grochowski	F. Duensing	J. Gronstedt
03	6. January 2005	J. Grochowski	A. Kamp	T. Loi
02	14. May 2004	H. Mohwinkel	M. Lehmker	A. Voges
01	27. August 2002	J. Grochowski	K. Seidel	K. Yahosseini
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D 07	02. April 02	Document layout revised Document Revision Status sheet added	
01	27. Aug 02	CAMTROL equipment added	Request from project
02	14. May 04	Chapter 3: tarpaulin cover usage for outdoor storage added; Chapter 4.2: Storage fluid (for storage of 1 to 2 years) Castrol Anvol changed to Transaqua HT; Chapter 5.3.1.1 added	Requested by project
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05	12. May 06	TUTA requirements included	Required by project
06	14. Mar 07	Umbilical poppet requirement included	Required by project
07	12. Mar 08	Comments included	Required by project

Table of contents

1 Introduction

This document outlines the procedure for preservation and storage of a control system before and after use. This includes Production Control Systems, Workover Control Systems and Drilling Control Systems. The purpose of this procedure is to keep the equipment supplied by Cameron Celle in a proper shape during storage. It will be available for further operations without major refurbishment due to insufficient control during storage.

This document provides instructions to ensure preservation and protection of all typical control system equipment in order to prevent deterioration caused by corrosion, damage, influence of weather and foreign materials, during shipment, storage and installation.

2 Reference Procedures

X-065460-( )-( )	Protective Coating Procedure for Cameron Controls Equipment
X-065390-03	General Protection and Coating Procedure for Cameron Celle Controls Equipment
X-065390-03-00-01	Protection and Coating Procedure for Cameron Celle Controls Equipment
X-027055-01	Corrosion Inhibiting Coating of Machined Surfaces

3 General Storage Requirements for Environment

Before starting any activities for preservation & storage all functions need to be verified. It must be checked that maintenance and repair works have been performed by qualified service personnel and that the control system does not have any mechanical damages on framework, umbilicals, hoses and cables.

Clean and dry the equipment prior to storage and place it under cover (if available) in a clean and dry environment.

For outdoor storage use tarpaulin covers. Ensure that covers are correctly attached and check covers for any damage. Replace damaged covers.

Preferred ambient conditions for storage areas[*)]

Temperature range	:	0 to 40°C
Humidity range	:	0 to 50 % (excluding condensation and frost)

[*)] If above values are not available, humidity and temperature must be within project related specified range.

In areas with high ambient temperatures consider protection against UV light / direct sunlight to protect e.g. plastic materials or compensation systems (thermal expansion).

Atmosphere must be free from harmful substances which can effect resilient seals (e.g. high ozone level).

Store equipment and spare parts with sealing surface protection by protective devices and protect after inspection if necessary.

Consider special storage procedures for critical materials like hydraulic fluid, batteries, rubber goods etc.

Handling and transport of equipment must always be in accordance with the conform procedure, shown in the Operation and Maintenance Manual for the control system.

4 Cameron Controls Standard Hydraulic Control Fluids

This section outlines the Cameron Celle Controls standard hydraulic control fluids. If any other fluid is specified the appropriate data sheet must be considered for preparation and storage of the system.

4.1 Hydraulic Oils

The standard oil types for Cameron Celle Controls equipment are:

- SHELL TELLUS (different types)
- CASTROL BRAYCO MICRONIC 864

Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

Note: Further details for treatment of fluid before and during storage for the specific equipment are listed in section 5.

4.2 Water Based Fluid

The typical water based fluid types for Cameron Celle Controls equipment are delivered by **Mac Dermid CANNING (MARSTON BENTLEY) LTD.**:

- Oceanic HW 511
- Oceanic HW 525
- Oceanic HW 540
- Oceanic HW 443
- Oceanic HD 603 Water/Glycol with lubricant

A typical water based fluid supplied by **CASTROL**:

- TRANSAQUA HT or HT2

A typical water based fluid supplied by **CAMERON**:

- CAMERON 590 X Water / Glycol with lubricant

Note: Further details for treatment of water based fluid before and during storage are listed in the following table.

Water Based Fluid	Suitable Storage Fluid (>6 months)	Suitable Storage Fluid (>1 year)	Suitable Storage Fluid (>2 years)
Mac Dermid CANNING OCEANIC HW 525 Cameron PN 619011-36 OCEANIC HW 540 Cameron PN 619011-28 OCEANIC HW 443 Cameron PN 619011-41	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285
Mac Dermid CANNING Water based fluid with ERIFON HD 603 Cameron PN 619011-46 (Lubricant)	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285
	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	Composition Lubricant/Glycol/Water: 5 % Lubricant: PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	
CASTROL TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	TRANSAQUA HT Cameron PN 619011-53
CASTROL TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	TRANSAQUA HT2 Cameron PN 619011-84
CAMERON Fluid Cameron 590 X Cameron PN 619011-24 (Lubricant)	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 40 % Glycol PN 619011-10 55 % Demineralized Water	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285

5 Specific Equipment Preservation and Maintenance Requirements

Note: Preservation during storage shall be performed in accordance with the check lists shown in section 6.
Any damage occurring during the periodical checks must immediately be repaired and reported to the Maintenance Supervisor.

5.1 Instruments for Surface Containers and Frames

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

All moving parts are to be lubricated with Molycote 3402 or equivalent.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

5.2 Hydraulic Power Unit and Local Control Panel

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines, including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen precharge of each hydraulic accumulator down to 10 bar / 145 psi. This is for safety reasons and to keep e.g. bladder in a stable position.

Air accumulators must be vented and drained of water.

Open ends of piping must be sealed off by plugs or caps.

All moving parts including the push rod of the panel valves must be protected by Molycote 3402 or equivalent.

Operation panels must be protected by a protective cover or door.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anti-condensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect ventilation grills / air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof local control panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

All isolation valves (except drain valves) must be closed. 4/3-way panel valves must be moved to "CENTER" position. 3/2-way panel valves must be in "CLOSE" or "VENT" position.

5.2.1 Hydraulic Oil

For long term storage no fluid exchange is required to get conservation against corrosion if equipment is filled with clean hydraulic oil.

After usage or longer storage (>3 months) hydraulic reservoirs must be checked for cleanliness and water content. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

Note: Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

If the water content of the oil is too high, check the hydraulic fluid for bacterial contamination. Clean the system up if necessary by following instructions of supplier.

Hydraulic lines have to be flushed to customer required cleanliness level.

Note: Cleaning of the hydraulic lines of an empty system must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

5.2.2 Water Based Fluid

General

For long term storage (>6 months) a special fluid preparation is required to get conservation against corrosion of equipment.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Reservoirs must be checked for cleanliness.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluid should be within the system during long term storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions. The table in section 4.2 shows different possibilities for long term (>6 months) storage.

5.3 Remote Control Panel

Painting, frame and moving parts must be checked in accordance with section 5.1.

5.3.1 Electric Remote Control Panel

Cable connections are to be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Operation panel must be protected by a protective cover or door if available.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

Rack mounted equipment shipped separately from cabinets should be bagged with desiccant and tagged with shock fuses.

5.3.1.1 Control Panel for climatic controlled environment

Control panel for use in climatic controlled environment e.g. Master Control Station (MCS), Electric Power Unit (EPU), Remote Workstations etc.

Equipment should be stored in a warehouse in undamaged packaging under the following conditions excluding intensive dust and condensation of humidity.

Temperature -18 - +60°C

Humidity 20-90% RHNC

When packaging has to be opened e.g. for site receive tests it is recommended to use corrosion inhibitors (e.g. Cortec®VCI 110) for further preservation.

5.3.2 Pneumatic Remote Control Panel

Pneumatic connections are to be cleaned up and protected by non aggressive protective shield, protection against dust or mating protective cover if available. Check pneumatic jumper cable as well.

Air receivers must be vented and drained of water.

Operation panel front must be protected by a protective cover or door.

Acryl glass window panes on panels located in hazardous areas must be cleaned with wet cloth only due to electrostatic charge.

5.4 Hydraulic Umbilicals, Umbilical Jumpers & Steel Flying Leads

General Instructions

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the applicable hydraulic fluid.

All hydraulic connections must be cleaned from dirt by using cleaning solvents which do not harm the seals (see Operation and Maintenance Procedure).

The connection plate of the junction boxes must be protected by protective covers.

After cleaning mating protective caps or plugs must be mounted to the quick coupling or single connection.

Stainless steel junction boxes and plates must be covered with a thin film of non aggressive oil.

Painting, frame and moving parts must be checked in accordance with section 5.1.

The umbilical can be stored in a box or on a drum. The minimum bending radius for storage indicated by supplier may not be exceeded.

5.4.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The umbilical shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.4.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

All lines with poppets must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids and compositions (see table in section 4.2).

5.5 Electric Cables and Cable Jumpers

Contacts of electrical connectors must be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Check that cable minimum bending radius is kept for storage.

Cable materials have to be protected for storage to avoid mechanical impact and ageing impact caused by sunlight (UV).

5.6 Umbilical Reels

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cleaned piping must be sealed off by using protective plugs, caps or covers.

Parts for power transmission like gear, chain with sprockets etc. must be protected and lubricated.

Open gear drive with gear ring and cog	-	ANTI SEIZE (or equivalent)
Chain drive	-	ESSO CAZAR K2 (or equivalent)
Gear box for direct drive	-	See Operation and Maintenance Manual of gear box for specific oil type.

5.7 Uninterruptable Power Supply (UPS)

WARNING:

Hydrogen may discharge from batteries and cause explosion (depending from battery type). Sufficient ventilation is required.

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cable connections must be protected with non aggressive protective shield.

For storage of the UPS check the allowed temperature range in Operation and Maintenance Manual to avoid damage of sensitive parts like batteries etc.

Recharge batteries to full range. Deep discharge must be avoided.

Follow specific long term storage procedure for installed type of batteries.

Disconnection of batteries may be required.

Ensure that the UPS is tagged with a shock fuse indicator.

5.8 Subsea Valve Packages

Remark: Subsea valve packages are normally mounted to the subsea running tools (e.g. Lower Marine Riser Package), which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.8.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.8.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.9 Subsea Control Modules (direct / pilot hydraulic types)

Remark: This section is **not** to be applied for CAMTROL subsea control modules. Refer to the "CAMTROL Subsea Production Control Equipment" section.
Subsea Control Modules (SCM) are normally mounted to the subsea running tools which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool. Flushing and testing can be done with the appropriate flushing and testing unit.

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Hydraulic pressure from all lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

If applicable, cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

5.9.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.9.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.10 Hydraulic Flushing and Testing Units

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

Air receivers must be vented and drained of water.

Open connection ends must be sealed off by plugs or caps.

All moving parts must be protected by Molycote 3402 or equivalent.

Junction plates must be protected by an overall cover or individual caps and plugs.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anticondensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

5.10.1 Hydraulic Oil

Reservoirs must be checked for cleanliness and water content. Water content of hydraulic oil must be checked to be within the maximum allowed range. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.10.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.11 Running Tools for Subsea Modules

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines must be discharged.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Hydraulic lines are to be flushed to customer required cleanliness level.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.12 Hydraulic Cylinder (e.g. on SCM Test Stand)

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

Hydraulic cylinders are to be flushed to customer required cleanliness level. Ensure that the cavities are completely filled with hydraulic control fluid. Ensure that no air is left in the cylinders as remaining air might cause corrosion.

Painting must be checked in accordance with section 5.1.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Put piston of the cylinder in retract position. This ensures that the rod is protected inside the cylinder against corrosion or damage.

Grease the cylinder rod with silicon grease or equivalent non aggressive grease.

Store the cylinder in a dry indoor environment. Room temperature should not be below 37°F (3°C).

5.13 Float Type Accumulators

Note: Preservation has to be carried out when the float type accumulators are unused and storage will be longer than three (3) months.

<u>Disassembly of Accumulator</u>

Bleed the pressure from hydraulic fluid supply.

Ensure that the ¼" needle valve at the bottom of the accumulator is in the closed position.

Remove the ¼" NPT plug.

Open the ¼" needle valve at the bottom of the accumulator.

Ensure that the accumulator is depressurised.

Open the hammer union at the bottom of the accumulator.

Ensure that the floater is at the lower end of the accumulator.

Remove the plug at the end of the floater pipe.

Inspect the seals (floater pipe plug, hammer union).

Spray non aggressive anticorrosive lubricant into the accumulator to protect the inner surface of the accumulator.

Carefully move the accumulator in vertical position and ensure that the lubricant flows out of the accumulator.

Assembly of Accumulator

Grease the o-ring of the plug and fix the plug at the lower end of the floater pipe.

Grease the thread at the end of the accumulator bottle and connect the hammer union.

Close the ¼" needle valve at the bottom of the accumulator and install the ¼" plug.

Painting must be checked in accordance with section 5.1.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.14 Topside Umbilical Termination Unit / Assembly

Topside Umbilical Termination Units / Assemblies (TUTU / TUTA) will be treated like Hydraulic Power Units (HPU). The workload is reduced as the TUTU / TUTA does not contain motors, pumps and reservoirs.

5.15 Wire Rope

Grease the wire ropes with wire rope grease. Ommex or Kendal or equivalent wire rope grease can be used.

Store the wire ropes in a dry outdoor or indoor environment.

5.16 Load Cell

Protect the load cells by a thin film of non aggressive oil.

Store the load cells in a dry indoor environment. Room temperature should not be below 37°F (3°C).

6 Preservation Maintenance Check Lists

The following checklists must be used to get a controlled storage of the equipment with proper maintenance.

6.1 Hydraulic Power Unit and Local Control Panel (Main Control Unit)

Preservation Maintenance Check List	**Sheet: 1 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-65390-03-00-00 or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film; repair if necessary	Non aggressive oil
8.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Motors, Distribution Boxes, Relay Boxes, Subswitchboards, Junction Boxes**					
1.0			X		Inspect protection on cable connections; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0		X			Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check drain valves to be open	
6.0			X		Inspect fluid according to section 5.2.1 or 5.2.2	

6.2 Umbilical Reel with Umbilical

Preservation Maintenance Check List — **Sheet: 1 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check lines to be pressureless, drain valves to be open	
6.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.3 Electric Remote Control Panels

Preservation Maintenance Check List						**Sheet: 1 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A. General Inspection						
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, Vaseline or equivalent
4.0			X		Check pneumatic circuits to be depressurized (for purged system only)	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil

Preservation Maintenance Check List						**Sheet: 2 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.4 Pneumatic Remote Control Panels

Preservation Maintenance Check List — **Sheet: 1 of 1**

Description of Equipment: **Pneumatic Remote Control Panels**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on pneumatic hose connection, repair if necessary	Non aggressive protective shield with additional cover
4.0			X		Check pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
7.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
8.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
9.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
10.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
11.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.5 Hydraulic and Electrical Jumpers

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Hydraulic and Electrical Jumpers**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0	X				Check junction boxes and couplings for proper protection by covers, caps or plugs	
4.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield; acid free Vaseline or equivalent; protective caps
6.0			X		Check protection of electric cable against mechanical impact and ageing impact by sunlight	
7.0			X		Check that cable minimum bending radius is kept for storage	
8.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.6 Subsea Valve Package

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Valve Package**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
6.0			X		Check lines to be pressureless; drain valves to be open	
7.0			X		Inspect fluid according to section 5.8.1 or 5.8.2	

6.7 Subsea Control Module (direct / pilot hydraulic types)

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Control Module (not for CAMTROL SCM)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
6.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
7.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
8.0			X		Check lines to be pressureless; drain valves to be open	
9.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
10.0			X		Inspect fluid according to section 5.9.1 or 5.9.2	

6.8 Hydraulic Flushing and Testing Unit

Preservation Maintenance Check List						**Sheet: 1 of 3**
Description of Equipment:	**Hydraulic Flushing and Testing Unit**					
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
6.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List	**Sheet: 2 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C. Hydraulic Circuits						
1.0			X		3/2-way valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way valves to be in open centred position; function lines to be pressureless	
3.0			X		Check lines to be pressureless; drain valves to be open	
4.0			X		Inspect fluid according to section 5.10.1 or 5.10.2	

6.9 Running Tool for Subsea Module

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Running Tool for Subsea Module**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
6.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
7.0			X		Inspect fluid according to section 5.11	

7 CAMTROL Subsea Production Control Equipment

Note: Use the instructions in this section as check lists.

7.1 Subsea Control Module / SCM

Check on the bill of material if individual “Shipping, Transportation and Storage Guidelines” are available for the SCM, otherwise follow the instructions below:

Verify: _____

Store the SCM in the crate until it is required for use.

If it is necessary to gain access to the SCM, remove the top and sides of the crate, but leave the SCM on the shipping frame.

Visually inspect the SCM / packing before use and every **3 month** when it is not used.

Verify: _____

The storage environment must be free from harmful substances which can affect resilient seals (i.e. high Ozone level).

Verify: _____

The ambient temperature for storage must be within the range -10°C to 40°C to maintain the integrity of the pressure compensation system and ensure that no dielectric oil bleeds out.

Verify: _____

CAUTION:
If the loss of dielectric oil exceeds 3 Litre the SCM needs to be refilled in accordance to Cameron “Field refill procedure”. The lower reservoir of the shipping frame is seized to 3 Litre. If you are in doubt please contact Cameron Germany Engineering Department (Tel +49 (0)5141 8060).

7.2 Subsea Accumulator Module / SAM

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Any damage occurring during the periodical checks must immediately be reported and repaired by Cameron Controls.

Verify: _____

Drain the hydraulic pressure from the accumulators.

Verify: _____

Bleed nitrogen pre-charge from the accumulators. Leave 10 BAR residual pressure in the accumulator to prevent the bladder from collapsing.

Verify: _____

Close the two (2) Gas Valves on the HP Accumulators.

Verify: _____

Open ends of Accumulators must be sealed by plugs or protective caps off stainless steel on the gas side off the accumulators.

Verify: _____

Lubricate all moving parts, except the Hydraquad hydraulic connectors, by water-resistant grease.

Verify: _____

Painting, frame and moving parts must be checked for damage.

Verify: _____

Stainless Steel parts must be protected by a thin film of non aggressive oil (Pelox Protector or similar).

Verify: _____

7.3 Subsea Distribution Unit / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.3.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Set all valves to CLOSE position.

Verify: _____

Protect the mounting base of the SAM by a protective cover.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes

Verify: _____

7.3.2 Electrical Parts

Check that all ROV connectable fuses are installed.

Verify: _____

Check that all electrical connectors are protected by caps

Verify: _____

7.4 Umbilical Termination Assembly / UTA

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.4.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes.

Verify: _____

7.4.2 Electrical Parts

Check that all electrical connectors are protected by caps.

Verify: _____

7.5 Foundation Base & Mud Mate for UTA / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Foundation Base only: Verify the proper operation of the two (2) pile locks and confirm that they are in the unlocked position.

Verify: _____

Check the SDU locking mechanism by operating.

Verify: _____

Check the guide post locking mechanism by operating.

Verify: _____

Inspect all lift shackles for deformation and other damage.

Verify: _____

Check condition of all protection anodes.

Verify: _____

8 Handling Requirements for Special Materials

8.1 Rubber Goods

GENERAL

There is very little published information on the storage and care of rubber goods as used in the oil field. When we speak of rubber goods we include the synthetic packings of Nitrile Copolymers and Neoprene as well as natural rubber parts. Natural rubber parts have become relatively rare but the same things that are harmful to natural rubber are also harmful to the synthetics in varying degrees.

Generally speaking, light and air are bad for rubber goods. The exact chemical action is not fully understood and what has been written disagrees on the mechanism involved.

Ozone is known to be bad for rubber goods. Ozone (O_3) is a very active form of oxygen. As far as we know two principle sources contribute the ozone that reaches rubber goods. One is atmospheric ozone which is generated in the stratosphere carried downward by convection currents and eventually absorbed by organic matter. The other source is electrical discharges, such as lightning, high voltage corona, but more commonly, electrical machinery. Ozone attack is characterized by fairly deep cracks in the rubber parts.

Rubber is attacked by ordinary oxygen (O_2) much as steel rusts in the presence of oxygen. Oxidation is characterized by a hard skin which eventually crazes in a multitude of small cracks and may turn chalky or assume a bark-like appearance.

A strong direct light, especially sunlight, has deleterious effects on rubber goods. This is attributed to the ultraviolet content of the spectrum which accelerates cracking. Whatever the mechanism however, light, particularly sunlight, is undesirable. In extremely cold climates some rubber goods will become so brittle that upon dropping or rough handling they will shatter.

In very warm humid climates, particularly those found in some parts of the tropics, fungi and bacteria find their way to the rubber goods and attack the organic content. This is especially true on duck reinforced rubber parts. However, parts reinforced with synthetics will not be attacked in the reinforcement.

Heat also has a bad effect on rubber. This could be the result of sunlight or artificial or accidental heating of any type. Heat results in a gradual hardening of the part and if ozone or oxygen are present, will accelerate their action.

Any stretching or bending of rubber in storage will result in very accelerated ageing. By the term ageing, we mean the cumulative effects of all the above mentioned attacking agents over a period of time. Ozone attacks rubber preferentially at points of strain.

Rubber goods, both natural and synthetic, all possess some degree of susceptibility to various solvents including water, but especially the liquid hydro-carbons. These manifest themselves in various ways by either swell or shrinkage of the rubber goods with which they are in contact.

No precise figure can be given as a "storage life" of a part. This is dependent on all of the above conditions and also the size of the part, its material and function. Generally speaking, the greater the relative surface area is to the volume, the more susceptible a part is to being rendered useless by ageing. For example, a relatively bulky part such as a ram front packer might be expected to have a much longer useful shelf life than a thin large diameter o-ring type of seal such as used on the bonnet seals of preventers or the rings in 'X' bushing.

STORAGE

From the preceding section we can draw a few rules governing storage of rubber goods. Briefly put - a cool, dry, dark storage place would be the best. The ideal would be to store the packings in vacuum sealed containers. The following rules, however, should not be difficult to follow under the average storage conditions experienced throughout our operation.

- Keep the rubber storage area as dark as possible. Certainly not out of doors, and, if indoors, away from skylights or windows and with subdued or indirect artificial lighting.
- Select the coolest location possible and be sure that no heaters or stoves are near by and particularly that the direct blast from a space heater does not blow on the rubber parts.
- Be sure that no electrical machinery (motors, switch gear, or any high voltage equipment producing corona) is near the rubber goods and that drafts will not carry the atmosphere from electrical machinery to the area in which the rubber goods are stored.
- The practice of first in - first out is essential with rubber goods. There is a natural tendency to remove parts from the front of a bin and when stock is replenished to leave the parts that are in the back in place, in which case years might pass before these are finally pulled out for use.
- Store rubber goods in a relaxed position. For example, do NOT hang o-rings on nails. Where possible, do not keep assemblies in stock where the rubber goods are stretched in order to assemble them on the part. For example, o-rings on blanking plugs, tubing hangers and 'X' bushing. In some cases this is difficult as it is with the aforementioned 'X' bushings. On these, periodic inspection should be employed to detect any signs of ageing as quickly as possible.

  On parts, such as the 'X' bushing rings, where we know the rubber parts will be stretched in storage, the best age resistant compounds we can buy are used.
- Keep storage as dry as possible and remove any oil, gas, etc. of hydro-carbon nature that may accidentally get on the rubber.
- Do not store the rubber goods on top shelves near galvanized roofs. There are several reasons for this; one is that heat is passed through galvanized roofing and also there is some opinion that ozone may be generated in this area.
- If possible, store rubber goods in buildings of wooden construction and wooden shelves. Wood is believed to scavenger ozone quite effectively.
- If store for extended periods is unavoidable, sealed containers will aid considerably; impervious surface coverings such as "Sea-Peel" or waxing will help.

USABILITY CHECKS

No general rule can be drawn regarding usability. The final measure is whether or not the cumulative effects of ageing have affected the physical properties of the part to such an extent that it will no longer perform the function for which it is designed. Thus, a large heavy part might suffer the same total amount of ageing as a small, light, thin piece, and still be usable whereas the small part is rendered useless. In these cases some judgement must be used in deciding usability.

Prior to shipment or use out of stock, rubber goods should be examined to see that no "chalking" or "barking" (bark-like surface appearance) is present, that there is not a hard skin on the rubber and that there are no cracks. Sometimes cracks will be obvious, but it is wise to stretch or bend the part in question so that any incipient cracks or very thin cracks will reveal themselves. Where a part is suspect, a check of hardness should be run. In the event that the hardness runs 15 points higher than the nominal hardness of the part, it is considered non-usable. Hardness is affected by temperature and readings should be taken with the rubber part at 70°F – 100°F (21°C - 38°C).

8.2 Hydraulic Hoses

STORAGE

- Before placing hose in storage, it should be completely drained.
- Whenever feasible, store the hose in the original wooden shipping crate. This will provide some protection against the deteriorating effects of solvents, corrosive liquids, ozone and sunlight. Hose should be stored so that the coils are in a horizontal plane.
- Certain rodents and insects will damage the hose. Adequate protection from them should be provided.
- The ideal temperature for storing the hose ranges from 50°F (10°C) to 70°F (21°C) with a maximum limit of 100°F (38°C). If stored below 32°F (0°C), the hose will become stiff and would require warming before placed in service. The hose should not be stored near sources of heat, such as radiators, base heaters, etc., nor should the hose be stored under conditions of high or low humidity.
- To avoid the adverse effects of high ozone concentration, the hose should not be stored near electrical equipment that may generate ozone or be stored for any lengthy period in geographical areas of known high ozone concentration. Exposure to direct or reflected sunlight - even through windows - should also be avoided.

HANDLING

CAUTION: Care should be exercised to prevent mishandling. Crushing or kinking of the hose can cause severe damage to the reinforcement. If this occurs, remove hose from service.

- In order to minimize the danger of kinking, the hose preferably should be removed from its crate by hand, laid out in a straight line, then lifted by means of a catline attached near one end of the hose. If a catline is used to remove the hose from its crate, the crate should be rotated as the hose is removed. Recommended practice is to protect the hose in some manner when moving to a new location. It is considered bad practice to handle the hose with a winch, to hand the hose from a truck gin pole, or to place heavy pieces of equipment on the hose.

8.3 Electronic Goods and Tools containing Electronics

8.3.1 General Instructions

Rapid temperature changes must be excluded to avoid condensation of humidity and mechanical stress.

The packing should protect electronic goods against:

- Dust
- Humidity
- Electrostatic Charge
- Shock
- Direct Sunlight

Generally the original transport packing serves the above requirements best.

Normally antistatic bags, desiccant and anti-shock pads are applied to prevent damage.

Electronic goods should be stored in a warehouse secured against theft.

8.3.2 Fiberoptic Terminations

Optic Link Modules (OLM) should be capped. Caps have to be removed before installation.

8.3.3 Handling Procedure for CMOS Devices

Electrical environments such as overvoltages and electrostatic discharges damage CMOS devices and printed circuit cards containing the devices. Most CMOS devices have diode input protection circuits and gate protection structures to protect against such electrical environments.

In addition to the internal protection network, use the following steps to prevent the generation of severe electrical transient voltages during handling of CMOS devices.

- Read the manufacturer's equipment specification and data sheets before performing maintenance. Do not exceed recommended maximum voltage levels.
- Use grounding wrist straps which contact the skin.
- Ground all work surfaces.
- If lead-straightening or hand-soldering is necessary, provide ground straps for the equipment, and ground the soldering ties.
- Connect all unused inputs to an appropriate logic voltage level, either power or ground.
- Inspect test equipment for proper polarity of voltage before conduction parametric or functional testing.
- Inspect all power supplies used for testing to ensure there are no voltage transients present.
- Do not insert or remove devices from test sockets with power applied.
- Do not contact edge connectors which are wired directly to device inputs.
- If external connections to a printed circuit card address only an input of the integrated circuit, use a resistance of 10 K ohms or greater in series with the input. The resistance limits damage to the card if it is removed and contacts static generating materials.
- Connect all low impedance equipment such as pulse generators to inputs only after the device has power applied. Disconnect the equipment before power is removed.
- Do not allow nylon or other static generating materials to contact the devices.
- Store or transport the devices in materials that are antistatic. Do not insert the devices into plastic packing material, styrofoam, or plastic trays.

8.3.4 Lithium Manganese Dioxide Battery

Replacement of the Lithium Manganese Dioxide battery mounted in the subsea transmitter & battery module: The battery supports the AMF-System (Automatic Mode Function / Dead Man System) belonging to multiplex drilling control systems. Under normal operation conditions replacement is required **after each one-year period**. Battery storage conditions should be in a range of 23°F – 59°F (–5°C to 15°C).

9 Attachment

- Data Sheets of Protective Materials (if required)
- Data Sheets of Hydraulic Fluids (if required)

STATUS: Released REVISION : 03
DATE PRINTED : 04/30/2009 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : HYDRAULIC POWER UNIT - TOTAL K5-F
- Supplied by Koller

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Customer supplied item								
600	0600	A01	222740-00-61	1.000	EA	COMPANY TAG "150 X 300" "CAMERON CONTROLS"		
>>>B/M Category : Engrg Spec/Document item								
	1045	03	SK-066011-32-42	1.000	EA	Field Term. Diagram: HPU, K5-F		
	1070	01	X-065438-02-74	1.000	EA	Operation Procedure: HPU, K5-F		
	1075	01	X-065438-02-75	1.000	EA	Maintenance Procedure: HPU, K5-F		
	1080	01	X-065467-02-09	1.000	EA	IP: HPU, K5F		
1010	1010	A02	WS-000542	1.000	EA	NON-NACE WELD.SPEC. FOR FAB./REPAIR OF ASME SECTION IX, P-1 GR. 1 OR 2 CARBON STEEL, NO PWHT, LOW TEMP. IMPACT REQ'TS. DO NOT APPLY, MEETS ASME SECTION IX, API 6A PRIOR TO 15TH ED., API 6D		
1020	1020	01	SK-066011-32	1.000	EA	AS: HPU, K5-F		
1030	1030	02	SK-066011-32-01	1.000	EA	FD: HPU, K5-F		
1040	1040	01	SK-066011-32-04	1.000	EA	CD: HPU, K5-F		
1050	1050	01	X-076704-01-22	1.000	EA	BILL OF MATERIAL FOR K5F HPU TOTAL K5F PROJECT Supplied by Koller CAM PN 223011-32		
1060	1060	01	X-065437-01-11	1.000	EA	FAT: HPU, K5-F CAM PN 223011-32		
908	0908	01	D-000100-02-04	1.000	EA	PART IDENT: MARK PKG OR ON AFFIXED TAG P/N, "REV" REV, PURCHASE/PRODUCTION ORDER NO.		
909	0909		D-000102-08-45	1.000	EA	MATL SPEC, AUSTENITIC SST WROUGHT 316TI IN ACCORDANCE WITH GERMAN STANDARD 1.4571		
910	0910	A03	WS-000536-01	1.000	EA	NON-NACE WELD.SPEC. FOR FAB./REPAIR OF ASME SECTION IX, P-8 SS, NO PWHT LOW TEMP. IMPACT REQ'TS. DO		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						NOT APPLY, MEETS ASME SECTION IX, API 6A PRIOR TO 15TH ED.		
911	0911	01	X-065460-04-04	1.000	EA	PROT. COATING PROCEDURE, SKY BLUE SYSTEMS WITH EPOXY PRIMER. SYSTEM NO. 4 FOR PLATFORM SERVICE. TOP COAT COLOUR: SKY BLUE, RAL 5015. FOR CAMERON CONTROLS EQUIPMENT. FOR DETAILS REFER TO THE LATEST SAP REVISION OF BASE DOCUMENT X-065460.		
912	0912	07	X-065429	1.000	EA	GENERAL PRESERVATION AND STORAGE PROCEDURE FOR CAMERON CONTROLS EQUIPMENT		
915	0915	18	X-065460	1.000	EA	PROTECTIVE COATING PROCEDURE FOR CAMERON CONTROLS EQUIPMENT NOTE: SEVERAL PART NUMBERS WITH ADDITIONAL DASH NUMBERS (i.e. X-065460-**-**) ARE CHARTED ON THIS DOCUMENT TO SPECIFY APPLICATION SYSTEMS & TOP COAT COLOURS.		
920	0920	02	X-065419-19-02	1.000	EA	PROOF LOAD TEST IS MANDATORY. FOR FURTHER DETAILS OF HOW TO PROCEED SEE THE GENERAL PROCEDURE X-065419-19 FOR PROOF LOAD TESTING, EXAMINATION AND CERTIFICATION OF EQUIPMENT TO BE LIFTED OFFSHORE, NOT CLASSIFIED AS A CONTAINER AND UTILIZED FOR SINGLE OR LIMITED OFFSHORE LIFTING / HANDLING ACTIVITIES.		
926	0926	02	QP-000160-03-12	1.000	EA	QP for Assy procured to Cameron FDS		
>>>B/M Category : Optional item								
	1200	02	223011-32-00-97	1.000	EA	Special Spare Parts for K5F HPU		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Reference Call Outs								
	1210	01	X-076721-87-05	1.000	EA	K5F-Supplemental Req. Spec. for HPU		

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

Cameron P/N 223011-32

18.06.2007	IFI - Issued for Information	Koller	L. Ohlendorf	J. Vagts
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**
CAMERON	Document Title: **Bill of Material**			
	Costumer Doc. No.	**92001083**		**Rev.A**
	Cameron Doc. No.	**X-076704-01-22**		**Rev.01**

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Parts List for K5F HPU

Koller PN: **92001083** **Rev.: A** Status: 18.06.2007

Cameron Doc.No: **X-076704-01-22 (P/N 223011-32)**

Description: **Flow Diagram K5F Production HPU**

No	Quantity	Unit	Koller PN:	Name	Description	Manufacturer
1	1	pc	92001113	CIRCULATION PUMP; 38L; 10BAR	MFG.NR: MPU 10714-114 LOHR EEX-D MOTOR USED 380V/50Hz WITH CERTIFICATE ATEX 99 PTB 3313	Marshalsea
2	2	pcs	92001114	MOTOR PUMP; 6,5L/MIN, 690BAR	MOTOR PUMP UNIT MPU 10728-432 THIS UNIT CONSISTS OF A XW PUMP 11196-60 WICH WILL DELIVER 6,5L/MIN; 1450 RPM; 690BAR INLETCON. 3/4" BSP FEM. OUTLETCON: 1/2" BSP FEM. LOHR MOTOR TO BE USED; 7,5KW; 4 POLE; EEXDE, IIB T4, IP 55;	Marshalsea
3	2	pcs	92001110	Accumulator Bladder, 750bar, 0,25l	MFG.NR. SB0750-0,25A6/342U-750AK* FLUIDCON. G 1/2" (SST) NITROGENCONNECTION 7/8"-14UNF (SST); CERTIFICATE CE DGRL 97/23/EG (PED) ; WORK.TEMP. -15 TO +80°C MATERIAL 1.4313	Hydac-Nord
4	2	pcs	92001109	Accumulator Bladder, 690bar, 32l	MFG.NR. SB690-32A1/312U-690D* FLUIDCONNECTION 1/2" NPT (SST) NITROGENCONNECTION 7/8"-14UNF (SST); CERTIFICATE CE DGRL 97/23/EG (PED) + AD2000; WORK.TEMP. -15 TO +80°C BURSTDISC WITH ADAPTER: SETPOINT 755BAR (SST) PAINT: CAM. X-065460-04-04, RAL 5015:	Hydac-Nord
5	3	pcs	92001149	EX RELIEF VALVE, 3/8", 690 BAR, SST	Type: 14580-03 In: 3/8" MP Butech fem. Out: 3/8 " NPT fem. Press. Range: 345 - 700 bar Setting Press.: 690 bar Mat: Stainless Steel	Marshalsea

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Cameron Doc.No: **X-076704-01-22 (P/N 223011-32)**

Description: **Flow Diagram K5F Production HPU**

No	Quantity	Unit	Koller PN:	Name	Description	Manufacturer
6	2	pcs	92001118	EX VALVE,SOL.3/2-WAY,690 BAR, NC	(MFG.NR: HCV 33.11.51.21-3.29) 3/2 WAY SOLENOID VALVE CONN.: MOUNTING PLATE WORK.PRESS:. MAX. 690 BAR POWERSUPPLY: 24V / 3.3W PROTECT: EX II 2G EEX-D II T3 MEDIUM: WATER GLYCOL FLUID MATERIAL: SST 316 NORMALLY CLOSED CERTIFICATE: PTB 02 ATEX	Oceaneering
7	2	pcs	92001153	MOUNTING PLATE FOR 92001152	Conn.: 3/8" NPT FEM. Mat.: SST 316	Oceaneering
8	1	pc	92000784	FILTER HOUSING, 100 BAR, 140 L/MIN	MFG-NR.: 100EL140-07A2:5-X0V0VS0.(28952-3) N. ATEX 95 WITHOUT FILTER ELEMENT & MAGNET INCL. BYPASS VALVE 3:5 BAR AND MAINTENANCE INDICATOR; SST TYPE: E2.5 A 0000VV SWI.-POINT: 2.5 BAR CONN.: G 1" FEM. WITH REDUCING HOUS: SST; SEAL: VITON;	EPE
9	2	pcs	92000785	FILTER ELEMENT	MFG-NR.: 2.140H3XL-AEV-0-V N: ATEX 95 MESH DIA.: 3 MICRON DIFF: PRESS.: 30 BAR MATERIAL: MICRO GLASS / AISI 316 TI SEAL: VITON	EPE

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Description: **Flow Diagram K5F Production HPU**

No	Quantity	Unit	Koller PN:	Name	Description	Manufacturer
10	2	pcs	92001139	EX FILTER, HYDR.	690 BAR, 32 l/ min. Conn: BSPP 1/4" FEM. Nom. Press: 690 Bar Flow Rate: Max. 32 l/min Prot.: EX II2 GD EEXM IIT6 T85°C Mat.: SST, Seal: Viton Bypass Valve 7 Bar Filter Element: 3 Micron Indic.: Electr., Spec.Cable Length 7 mm Diff.Press.: 5 bar	EPE
11	4	pcs	92001140	FILTER ELEMENT	Mesh Dia.: 3 Micron Diff. Press: 30 bar Mat.: Micro Flass/ AISI 316 Ti Seal: Viton	EPE
12	3	pcs	92001112	GAUGE; 1000BAR	MFG.NR: BA4250-B3070,46-U3-V3-W4 020-W10 20 CONNECTION 1/4" NPT NG 100 WITH GLYCERINFILLING INNER SCALE 0-14500PSI OUTER SCALE 0-1000BAR CERTIFICATION: DIN EN 10204-3.1 MFG.NR: W1020	LABOM
13	4	pcs	92001325	PRESSURE TRANSMITTER 10,000PSI	MFG.NR: 3051TG5A2B21JB4E8P1Q4Q8 N. ATEX 95 PROT. EEX-D IIC T6 OUTPUT 4-20mA SUPPLY 24V DC CASE SST INKL. MONTAGEWINKEL	Emerson

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Koller PN: **92001083** **Rev.: A** Status: 18.06.2007
Cameron Doc.No: **X-076704-01-22 (P/N 223011-32)**
Description: **Flow Diagram K5F Production HPU**

No	Quantity	Unit	Koller PN:	Name	Description	Manufacturer
14	1	pc	92001150	VALVE, MANUAL, 4/2-WAY, 207 BAR	No. Conn: Mounting Plate Work Press.: Max. 207 Bar Medium: Water Glycol Fluid Mat.: SST 316 Actuator: Hand Lever Normally Open	Oceaneering
15	1	pc	92001151	Mounting Plate for 92001150	Conn.: 3/8" NPT FEM Mat: SST 316	Oceaneering
16	5	pcs	92001141	STRAINER G 1" 40 BAR 600 MICRON SST	Conn.: G1" Work.Press: 40 Bar Mesh Diameter: 600 Micron (0.6mm) Temp.: Up to 200°C Mat: 1.4401/1.4408 CR-NI-STEEL Seal: Teflon	END
17	5	pcs	92001142	STRAINER ELEMENT	64 ES 600 Micron 350 my von Norgren 1" Mat.: SST	END
18	2	pcs	92000644	FILTER, 10 Micron, R 1.1/2", 1 BAR	Conn: R 1.1/2" FEM. Work.Press: 1 Bar Mesh Width: 10 Micron Temp: -40°C / +100°C Housing: Sheet Steel Filter: Cellulose MFGNo: 4A-1-10 Cert.: ACC. To EN 10204/2.1	Berendsen

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Description: **Flow Diagram K5F Production HPU**

No	Quantity	Unit	Koller PN:	Name	Description	Manufacturer
19	1	pc	92000807	VALVE, BALL, 3-WAY, 1", 1000 PSI	MFG-NR.: SS-65XTF16 N: ATEX 95 ORFIFICE: 0.781" / 19.8 MM CONN.: 1" NPT FEM. WORK. PRESS.: 1000 PSI / 69 BAR TEMP.: -29°C / +230°C	BEST-Swagelok
20	2	pcs	92001155	Level Sensor for Indicator 1450mm	Typ: AF-ADF- - VK18/TS - L 1600/14 Terminal Box EEx d Measuring Range 1450 Medium Waterglycol With Atex certification	KSR
21	2	pcs	92001143	EX INDICATOR; Fluid; 16 BAR, BYPASS	KSR Bypass SS 316 Ti- Standard (V60 x 2) Type: BNA-25/16/C-M 1450-V60x2-MRA-ZVSS 200-Ex Mat: Stainless steel 316 Ti (DIN 1.4571) Proc.Conn.: Flange DIN DN 25 PN 16 FORM C Float: ZVSS 200, Middle distance. 1450	KSR
22	2	pcs	92000045	VALVE, 2-WAY, 1/4" NPT, 420 BAR, SST	619018-01-01 Nr. HALS2V4N 2-WAY BLOCK AND BLEED NEEDLE VALVE IN / OUTLET & VENT: 1/4" NPT FEM. NOM. PRESS.: 420 BAR / 6000 PSI MATERIAL: SST 316 ; SEALING: PTFE	Delta
23	1	pc	92001335	GAUGE, PRESS., 0-400 BAR, DN 100	MFG-NR.- BA4540-A3066:15-U33-V3-W4020-W1020 N. ATEX 95 INCL: WAZ 3.1B ACC. TO EN 10.204 FOR SPECIAL SAFETY PURPOSES CONN.: G 1/4" MALE BOTTOM. WITH RESTRICTOR 0.6 MM ID. OUTER SCALE: 0-400 BAR; BLACK INNER SCALE: 0-5800 PSI; BLACK	LABOM

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Description: **Flow Diagram K5F Production HPU**

No	Quantity	Unit	Koller PN:	Name	Description	Manufacturer
24	7	pcs	92000002	VALVE, 3-WAY,LEVER OPER 1/4"NPT(F)	SST FOR AIR/HYDR 10000PSI WP BLOCK AND BLEED, BOTTOM VENT, PTFE SEALS CAPABLE OF BEING FLUSHED TO NAS 1638 CLASS 6, SALIFEROUS ENVIRONMENT -20 TO +40 DEG C, CERT OF CONFORMANCE.	TYCO
25	4	pcs	92001146	VALVE, BALL, 2-WAY, DN8, 69 BAR	Conn.: 1/4" NPT FEM. Both Ends Work Press: Max 69 bar Temp: Max 230 °C Seal: PTFE housing & Ball: AISI 316(1.4408) Medium: Waterglycol Lever: Red Plastic Cover Cert: WAZ2.1 ACC. To EN 10.204	Schwer
26	2	pcs	92000660	VALVE, BALL, 2-WAY, DN25, 64 BAR	Series 842; Full Port Design Conn: R 1" FEM. Nom.Press: 64 bar Medium: Water, Oil, Air, Fuel Body: SST (1.4408); Ball: SST (1.4408) STEM: SST (1.4401); Seal: PTFE MFGN: 842 - 1 Cert: EN 10204/2.1	Hydr.-Bauteile
27	5	pcs	92000660	VALVE, BALL, 2-WAY, DN25, 64 BAR	Series 842; Full Port Design Conn: R 1" FEM. Nom.Press: 64 bar Medium: Water, Oil, Air, Fuel Body: SST (1.4408); Ball: SST (1.4408) STEM: SST (1.4401); Seal: PTFE MFGN: 842 - 1 Cert: EN 10204/2.1	Hydr.-Bauteile

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Description: **Flow Diagram K5F Production HPU**

No	Quantity	Unit	Koller PN:	Name	Description	Manufacturer
28	10	pcs	92001145	VALVE, BALL, 2- WAY, 3/8 ", 10000 PSI	Orifice: 0.203"/ 5.2 mm Conn.: MP 3/8" FEM Work. Press.: 10000 PSI/ 690 Bar Temp.: -30 °C/ +200°C Mat.: 316 SST Supplied with Set Screw A-3638-03 for handle Medium: Waterglycol Cert: ATEX95	Butech
29	17	pcs	92000001	VALVE, NEEDLE 1/4 NPT 10000 PSI	Man.FG-Number: V 502SCT-M1 SST 316 FOR HYD/AIR FEM X FEM PANEL MOUNT	PGI-Houston
30	5	pcs	92000051	HOSE, 65 BAR, DN 25 X 0.3 ME, SST	HYDRA ANNULARLY CORRUGATED HOSE TYPE: RS 331L12 WITH SINGLE BRAIDING IN SST CONN.: R 1" MALE NIPPLE BOTH ENDS IN SST ; LENGTH: 300 MM WORK. PRESS.: MAX. 65 BAR HOSE TEMP.: -270°C / +600°C HOSE MATERIAL: AISI 321 (1.4541) Hose Temp: -270/+600 °	Witzenmann
31	2	pcs	92001147	HOSE, HP, 700 BAR ID 5 x 0.4 ME	ID: 5 mm Length: 0.4 ME Conn: HP Nipple 3/8-24 UNF LH in AISI 316 TI (1.4571) Socket: AISI 316 TI (1.4571) Work.Prss.: 700 bar/ 10150 PSI	HANSA

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Cameron Doc.No: **X-076704-01-22 (P/N 223011-32)**

Description: **Flow Diagram K5F Production HPU**

No	Quantity	Unit	Koller PN:	Name	Description	Manufacturer
32	2	pcs	92001148	VALVE, CHECK, 15000 PSI, 1/4", SST	Ball Check Valve Port Dia: 0.187"/ 4.75 mm Conn: 1/4" NPT FEM. In/Out Work.Press: 15000 PSI/ 1030 Bar Medium: Gas/ Fluid Temp: -73 °C/ +315 °C Mat: SST 316 MGF-Nr: FPBC4	Butech
33	1	pc	92001144	DIPPING LANCE		Koller
34	1	pc	92000065	REGULATOR, PRESS., 14-700 BAR, SST	Mfg Number: 54-2061D24 Conn.: 1/4" NPT Inlet Press.: max. 700 bar Outlet Press.: 14 - 700 bar Medium: Gas and Fluid Housing: SST 316 Seal: Buna N	Tescom
35	1	pc	92000821	VALVE, RELIEF, SP 225 BAR	MFG-NR.: 14520-02 N. ATEX 95 TYPE: 14520-02 CONN.: INLET / OUTLET: 3/8" NPT FEMALE SET PRESSURE RANGE: 207-413 BAR SETTING PRESSURE: 225 BAR MATERIAL: SST MEDIUM: WATERBASED FLUID SET PRESSURE CERTIFICATE EN 10204 / 3.1b	Marshalsea
36	4	pcs	92001159	Compact Ball Valve 1" DN25	MFG.Nr: 14-2210225 Ball Valve 1" Connect: DN 25 Flansh PN16 Material: SST 316	Meyer

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Cameron Doc.No: **X-076704-01-22 (P/N 223011-32)**

Description: **Flow Diagram K5F Production HPU**

No	Quantity	Unit	Koller PN:	Name	Description	Manufacturer
37	4	pcs	92001154	Pad-Eyes, Form C, 8t	Pad Eyes Reference MFG.Nr. F 30330NV	Thiele
38	10	pcs	92000864	M-CLIP FOR GRATE, 50 x 20 mm SST 316	MFG: 148005 WITH 4 MM HOLE FOR M6 SCREW	CTS
39	1	pc	92001007	Grille	Grille Standard,CTS M 25 Format 3050mm x 1525mm Mesh size 38x38 Material Standard"O"(Orto)	CTS
40	1	pc	92001156	Lifting Block Typ VS	Mfg.No. 3060.1102 500 Kg	Ditzinger
41	1	pc	92001207	WIRE ROPE SLING, 4 X 2.5 ME, 6 T	WITH 2.2 CERTIFICATE ROPE NUMBER. 4 ROPE DIA.: 16 MM ROPE LENGTH: 2500 MM CARRY. CAPACITY: 6000 KG (0°-45°)	Tecklenborg
42	1	pc	92001157	Prechargekit for Hyd. Accumulators	Typ: FPU-1_400FA3K Material No.: 2114304	Hydac-Nord
43	1	pc	92001158	Hose, Hydr. 1/4"x3me, 400bar	Typ: 2 SN 21-4 Connect.: DKJ JIC 7/16"-20 UNF M14 (Type 6S) Connect Material SST 316 TI length: 3m	Schröder
44	1	pc	92001248	GAUGE, PRESS., 0 - 16 BAR, DN 100	PressureGauge f.high.Safety incl.Throttle Screw, ID = 0,6mm Conn: G1/4" Male, Bottm O-Scale:0-16 bar Bl; I-Scale:0-230 PSI. Protect: IP66; Case:SST304 with Glycerine Filling; MFGN:BA4240-A3059.5-U3 Cert: EN10204/ 3.1B	LABOM

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Description: **Flow Diagram K5F Production HPU**

No	Quantity	Unit	Koller PN:	Name	Description	Manufacturer
45	2	pcs	92000660	VALVE, BALL, 2-WAY, DN25, 64 BAR	Series 842; Full Port Design Conn: R 1" FEM. Nom.Press: 64 bar Medium: Water, Oil, Air, Fuel Body: SST (1.4408); Ball: SST (1.4408); STEM: SST (1.4401); Seal: PTFE MFGN: 842 - 1 Cert: EN 10204/2.1	Hydr.-Bauteile
46	4	pcs	92001005	Sealing Flange Welding Neck	3mm NBR	Schröder
47	8	pcs	92001264	Sealing Flange Welding Neck for Valves	3mm NBR	Schröder
48	1	pc	92001265	Tank Gasket	3 mm NBR	Schröder
49	1	pc	92001327	Hose for Dippinglance	Hose VA/SS DN25 / 1" 1" Male - Connection Bothsides lenght: 3000mm	Meyer
50	1	pc	92001328	Kamlock Coupling	Kamlock Coupling Male Typ F VA/SS DN 25 / 1" MFG.NO.: 34-0006025	Meyer
51	1	pc	92001329	Kamlock Coupling	Kamlock Coupling Female Typ D VA/SS DN 25 / 1" MFG.NO.: 34-0004025	Meyer
52	1	pc	92001330	Dust Plug	Dust Plug Typ: DP VA/SS DN25 / 1" MFG.NO.: 34-0008025	Meyer
53	1	pc	92001331	Dust Cap	Dust Cap Typ: DC VA/SS DN25 / 1" MFG.NO.: 34-0007025	Meyer

STATUS: Released REVISION : 02
DATE PRINTED : 04/28/2009 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Special Spare Parts for K5F HPU

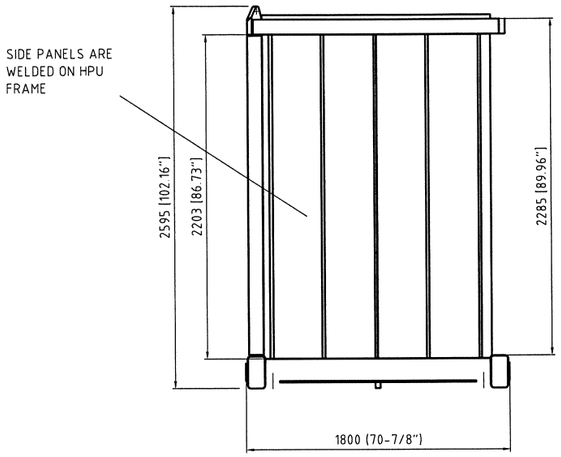
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
	0010	02	X-076704-02-05	1.000	EA	SPECIAL SPARE PARTS K5F HPU supplier: Koller PN 223011-32		

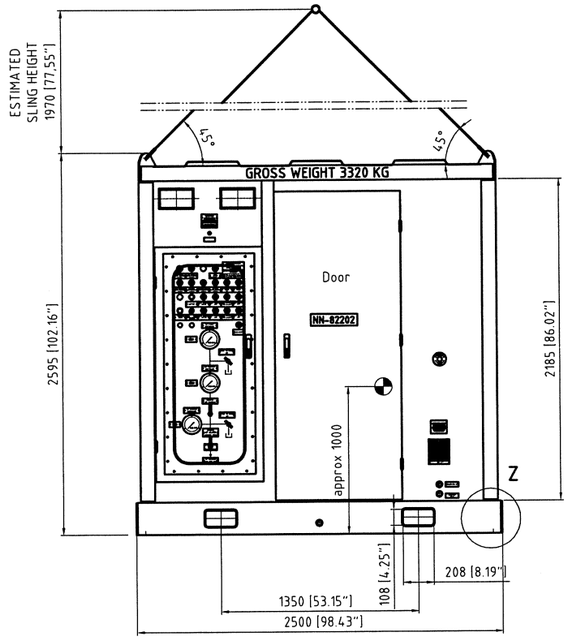
checked A. Muder

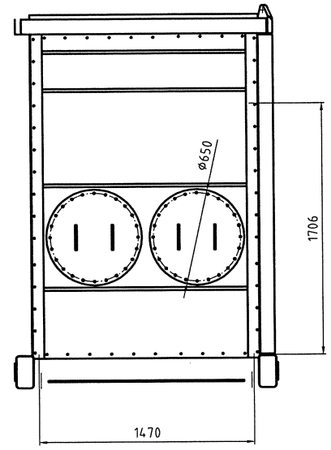
approved D. Mottaghian **SPECIAL SPARE PARTS K5 F HPU** CAM PN 223011-32-00-97 DOC NO X-076704-02-05 Rev.02 15. Aug 08

date 15. Aug 08

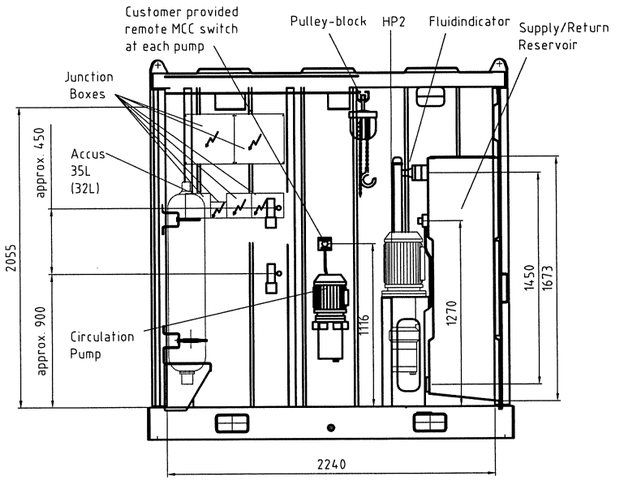
item		description	manufacturer no	qty	price	delivery time
1		**EX Relief VAlve 3/8", 690 bar sst** Type: 14580-03 In: 3/8" MP Butech fem out: 3/8" NPT fem Press range 345-700 bar setting press 690 bar mat: stainless steel	92001149	3		6 weeks
2		**Filter Element** for PN 619032-02-26 Mesh Dia: 3 Micron Diff Pressure 30 bar Mat Micro Flass AISI 316 Ti Seal: Viton	92001140	4		6 weeks
3		Pump Repair KIT for HP pump Marshalsea	11196-60	2		6 weeks
4		**Pump Seal KIT for HP Pump** Marshalsea	11196-60	2		6 weeks
5		**Aviaticon Oil EP, 20 l** ISO VG 100 0,883 g/ml at 15 °C 102 mm²/s at 40°C and 10,7 mm²/s at 100°C pourpoint -21°C flame point 245 °C in accordance to DIN 51517, part3, CLP		3		2 days

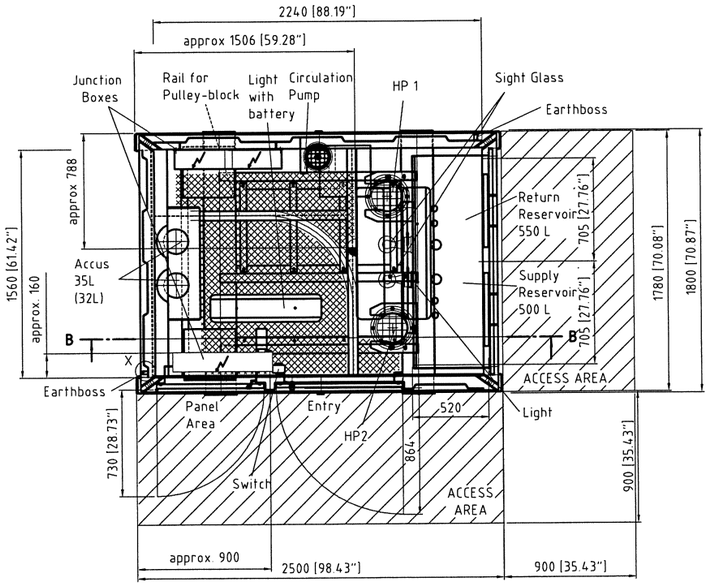


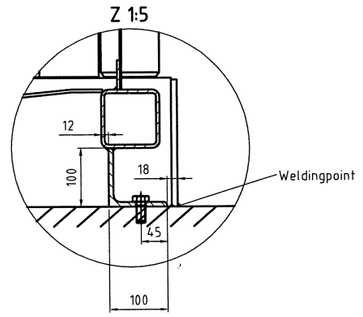




B-B







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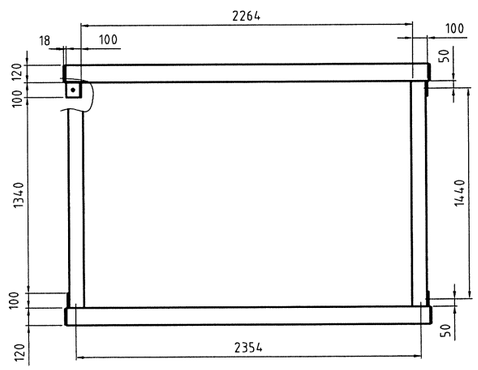

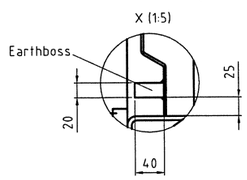

KEY PLAN/LEGEND:

NOTES/HOLDS:

DRY WEIGHT : 3280 Kg
WET WEIGHT : 3320 Kg

REVISION DESCRIPTIONS:

AS BUILT	05NOV07	3
REISSUED AS APPROVED FOR CONSTRUCTION	02JUL07	2
APPROVED FOR CONSTRUCTION	15MAY07	1
ISSUED FOR CONSTRUCTION	30MAR07	N/A
ISSUED FOR INTERNAL IDC	12MAR07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-03-503

CAD

REV. BY: Koller GmbH & Co KG | DATE: 03.04.2007 | REV.: 01

KOLLER Maschinen- und Anlagenbau GmbH
D 29227 Celle, Bruchkampweg 5
Tel.: 05141-98980 Fax.:-989898

Toleranzen DIN ISO 2768-1 m 2768-2 K 13920 B

	Datum	Name
Bearb.	20.02.07	Rempel
Gepr.		

Änderungen werden im Artikelstamm gepflegt, "a" entspricht Orginal

Maßstab 1:20 | Position | Menge

Production HPU
Total K5F

1 - 92001086 a | Blatt 1/2 | BI

TOLERANCES ACCORDING TO DIN ISO 8015
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

SURFACE TREATMENT
MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN: Koller GmbH & Co KG	DATE: 03.04.2007	
CHECKED: A. Weilandt	DATE: 06.11.2007	
APPROVED: L. Ohlendorf	DATE: 07.11.2007	

EST. WEIGHT: 7500.000 KG | SUPERSEDES: | SCALE: 1:20

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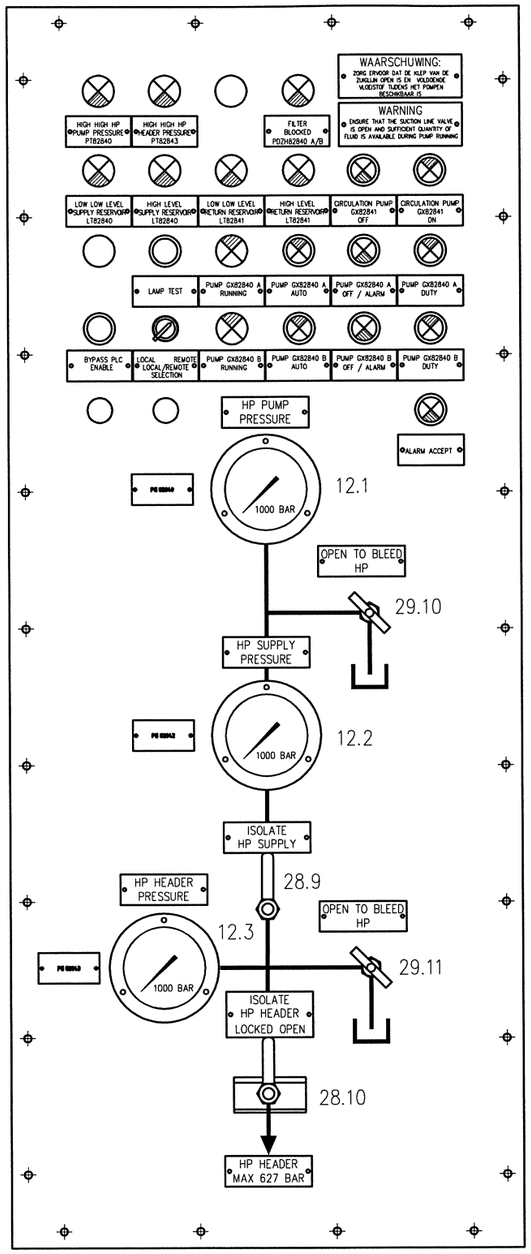
Lückenweg 1
29227 Celle, Germany

ASSEMBLY DRAWING:
HYDRAULIC POWER UNIT
CAM PN 223011-32

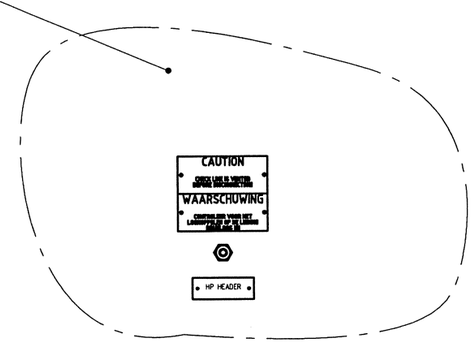
INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223011-32	1OF2	SK-066011-32

STATUS: APPROVED



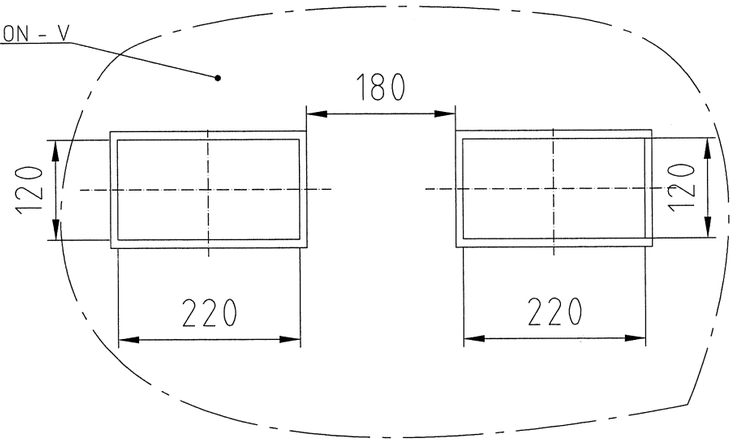
HYDRAULIC CONNECTION AREA

SECTION - U



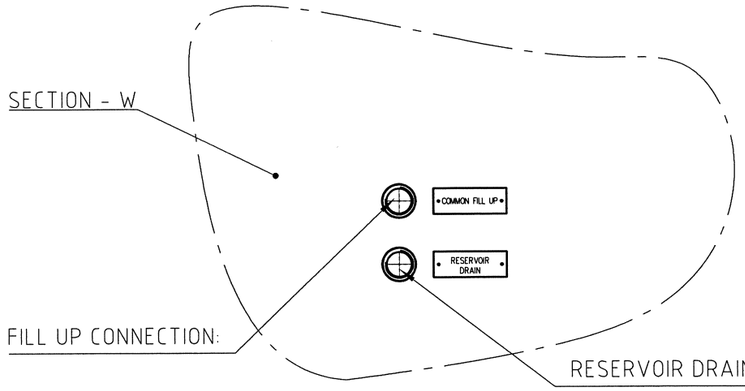
ELECTRIC CONNECTION AREA

SECTION - V



HYDRAULIC CONNECTION AREA

SECTION - W



FILL UP CONNECTION:

RESERVOIR DRAIN CONNECTION:

HYDRAULIC CONNECTIONS:

RESERVOIR DRAIN CONNECTION:	1 1/2" BSPP
FILL UP CONNECTION:	1" BSPP (WITH DIPPING LANCE)
COMMON DRAIN CONNECTION:	ANSI B16.5 FLANGE
HP SUPPLY:	3/8" AUTOCLAVE

(627 BAR MAX. WORKING PRESSURE/690 BAR DESING PRESSURE)

- : H/A SWITCH
- : PUSH BUTTON
- : GREEN
- : RED
- : ILLUMINATED PUSH BUTTON GREEN
- : ILLUMINATED PUSH BUTTON RED

Customer provided remote MCC switch at each pump

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-03-503 | CLIENT REV.: 3

CAD | REV. BY: Koller GmbH & Co KG | DATE: 06.11.2007 | REV.: 01

KOLLER Maschinen- und Anlagenbau GmbH
D 29227 Celle, Bruchkampweg 5
Tel.: 05141-98980 Fax.:-989898

Toleranzen DIN ISO 2768-1 m 2768-2 K 13920 B

Maßstab 1:5 | Position | Menge

	Datum	Name
Bearb.	01.03.07	Rempel
Gepr.		

Änderungen werden im Artikelstamm gepflegt, "a" entspricht Orginal

Production HPU
Total K5F

2 - 92001086 a | Blatt 2/2 | Bl

TOLERANCES ACCORDING TO DIN ISO 8015
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

SURFACE TREATMENT
MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN: Koller GmbH & Co KG	DATE: 06.11.2007	
CHECKED: A. Weilandt	DATE: 06.11.2007	
APPROVED: L. Ohlendorf	DATE: 07.11.2007	

EST. WEIGHT: 7500.000 KG | SUPERSEDES: | SCALE: 1:5

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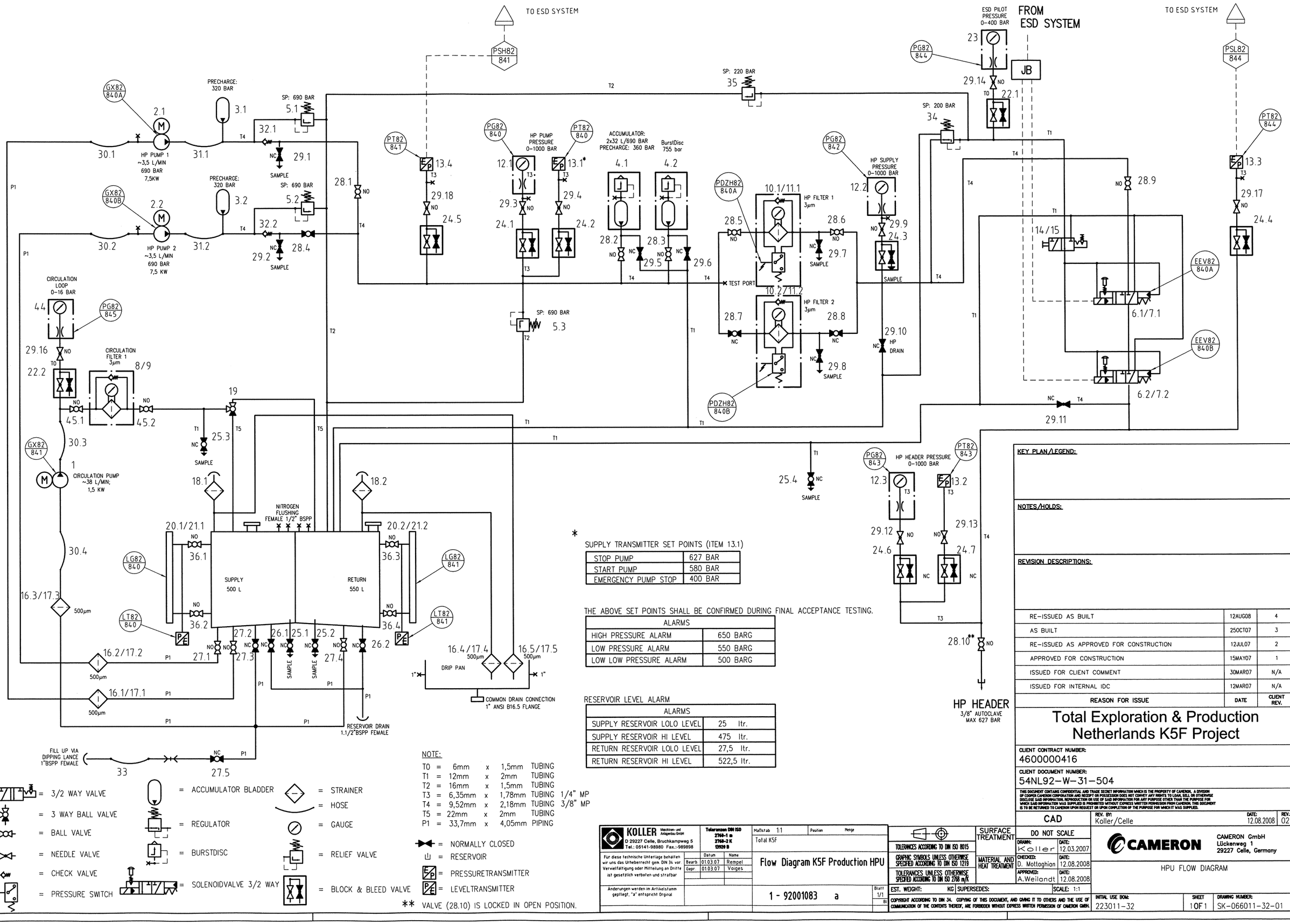
Lückenweg 1
29227 Celle, Germany

ASSEMBLY DRAWING:
HYDRAULIC POWER UNIT
CAM PN 223011-32

INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223011-32	2 OF 2	SK-066011-32

STATUS: APPROVED



* SUPPLY TRANSMITTER SET POINTS (ITEM 13.1)

STOP PUMP	627 BAR
START PUMP	580 BAR
EMERGENCY PUMP STOP	400 BAR

THE ABOVE SET POINTS SHALL BE CONFIRMED DURING FINAL ACCEPTANCE TESTING.

ALARMS	
HIGH PRESSURE ALARM	650 BARG
LOW PRESSURE ALARM	550 BARG
LOW LOW PRESSURE ALARM	500 BARG

RESERVOIR LEVEL ALARM

ALARMS	
SUPPLY RESERVOIR LOLO LEVEL	25 ltr.
SUPPLY RESERVOIR HI LEVEL	475 ltr.
RETURN RESERVOIR LOLO LEVEL	27,5 ltr.
RETURN RESERVOIR HI LEVEL	522,5 ltr.

NOTE:

T0	= 6mm	x	1,5mm	TUBING
T1	= 12mm	x	2mm	TUBING
T2	= 16mm	x	1,5mm	TUBING
T3	= 6,35mm	x	1,78mm	TUBING 1/4" MP
T4	= 9,52mm	x	2,18mm	TUBING 3/8" MP
T5	= 22mm	x	2mm	TUBING
P1	= 33,7mm	x	4,05mm	PIPING

= 3/2 WAY VALVE
= 3 WAY BALL VALVE
= BALL VALVE
= NEEDLE VALVE
= CHECK VALVE
= PRESSURE SWITCH
= ACCUMULATOR BLADDER
= REGULATOR
= BURSTDISC
= SOLENOIDVALVE 3/2 WAY
= STRAINER
= HOSE
= GAUGE
= RELIEF VALVE
= BLOCK & BLEED VALVE
= NORMALLY CLOSED
= RESERVOIR
= PRESSURETRANSMITTER
= LEVELTRANSMITTER

** VALVE (28.10) IS LOCKED IN OPEN POSITION.

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

REASON FOR ISSUE	DATE	CLIENT REV.
RE-ISSUED AS BUILT	12AUG08	4
AS BUILT	25OCT07	3
RE-ISSUED AS APPROVED FOR CONSTRUCTION	12JUL07	2
APPROVED FOR CONSTRUCTION	15MAY07	1
ISSUED FOR CLIENT COMMENT	30MAR07	N/A
ISSUED FOR INTERNAL IDC	12MAR07	N/A

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-31-504

CAD

REV. BY: Koller/Celle — DATE: 12.08.2008 — REV.: 02

KOLLER Maschinen- und Anlagenbau GmbH
D 29227 Celle, Bruchkampweg 5
Tel.: 05141-98980 Fax.: 989898

Toleranzen DIN ISO 2768-1 m 2768-2 K 13920 B

	Datum	Name
Bearb.	01.03.07	Rempel
Gepr.	01.03.07	Voiges

Maßstab 1:1 — Position — Menge

Total K5F

Flow Diagram K5F Production HPU

1 - 92001083 a

Blatt 1/1

TOLERANCES ACCORDING TO DIN ISO 8015

GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219

TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

SURFACE TREATMENT

MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN:	Koller	DATE: 12.03.2007
CHECKED:	D. Mottaghian	DATE: 12.08.2008
APPROVED:	A.Weilandt	DATE: 12.08.2008

EST. WEIGHT: KG — SUPERSEDES: — SCALE: 1:1

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Lückenweg 1
29227 Celle, Germany

HPU FLOW DIAGRAM

INITIAL USE BOM: 223011-32 — SHEET: 1 OF 1 — DRAWING NUMBER: SK-066011-32-01

STATUS:

Plant designation	: Cameron Controls K5F HPU
Drawing number	: 420-2862
Commission	: 420-2862

year of construction	: 09/2007
control voltage	: 24VDC
power supply lights	: 230VAC / 50Hz
power supply motors	: 380VAC / 50Hz
power supply motor heaters	: 230VAC / 50Hz

Changed on: 25 OCT 2007 from: HEY Number of pages : 15

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

REASON FOR ISSUE	DATE	CLIENT REV.
AS BUILT	25OCT07	2
APPROVED FOR CONSTRUCTION	24AUG07	1
REISSUED FOR CLIENT COMMENT	02AUG07	A
ISSUED FOR CLIENT COMMENT	31MAY07	N/A
ISSUED FOR INTERNAL IDC	23APR07	N/A

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-06-503

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	23.05.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

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Lückenweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM HYDRAULIC POWER UNIT

DWG. NO. SK-066011-32-04

= TOTAL / K5F
+ PRODUCTION HPU

B.O.M. NO. 223011-32

SHEET 1 of 15

STATUS: APPROVED

Table of content

NOTE:

- all PE–Terminals to be connected to main IPE Bar

TOTAL TAG NUMBER	Box No.	Purpose
BES 82202	Box 3	for analogue signals to SSS
BOS 82202	Box 1	digital signals from SSS
BA 82202	Box 5	digital inputs to the PLC
BO 82202	Box 6	digital outputs from the PLC
BE 82202	Box 2	analogue inputs at the PLC
N/A	Box 7	Emergency Stop
N/A	Box 4	internal box to separate digital inputs/outputs
N/A	Box 8	digital inputs to the PLC

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	04.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

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29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM HYDRAULIC POWER UNIT

DWG. NO. SK–066011–32–04

B.O.M. NO. 223011–32

CLIENT DOCUMENT NUMBER: 54NL92–W–06–503

CLIENT CONTRACT NUMBER: 4600000416

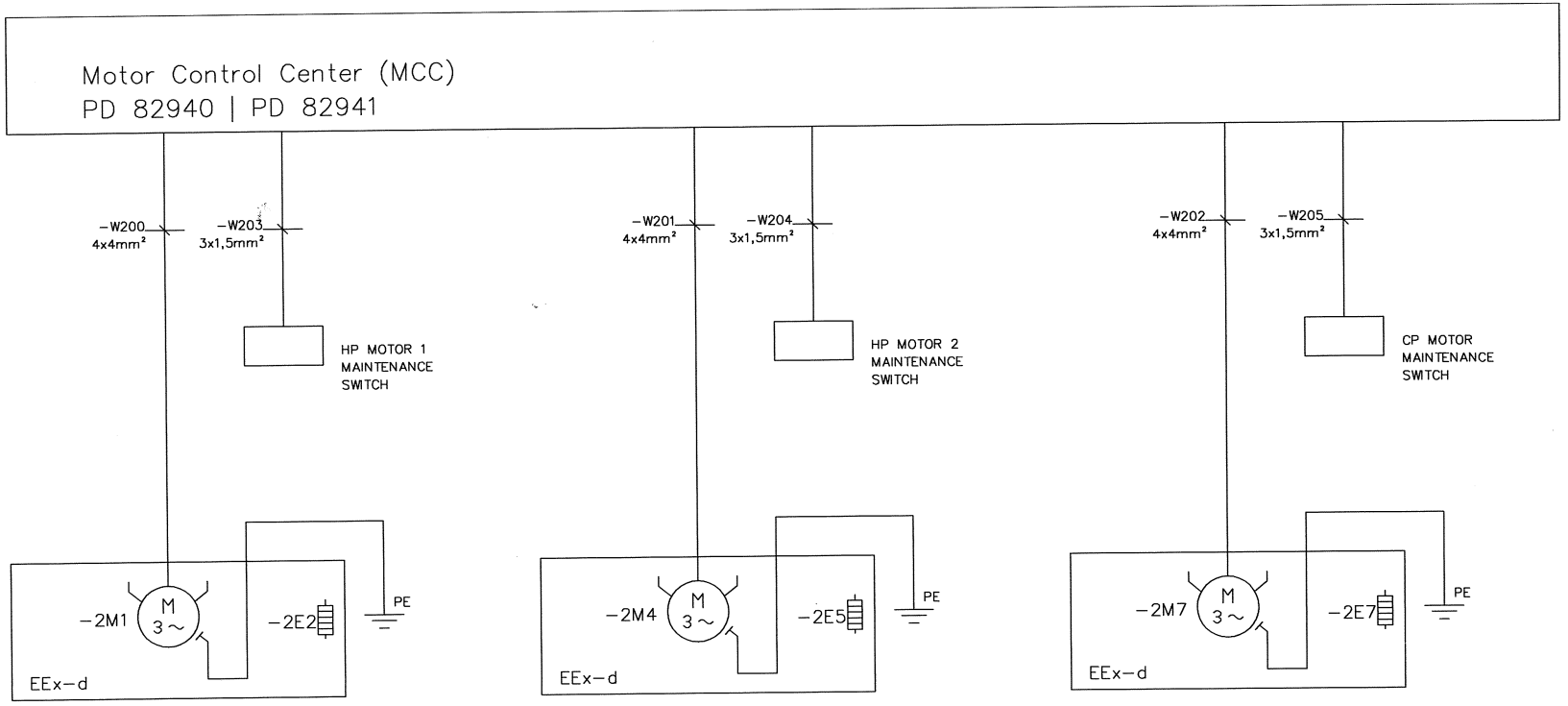
CLIENT REV.: 2

= TOTAL

+ PRODUCTION HPU

SHEET 2 of 15

STATUS: APPROVED



HP Pump 1
GX82840A

P = 7,5kW
U = 380VAC
f = 50Hz
I = 15,5A

HP Pump 2
GX82840B

P = 7,5kW
U = 380VAC
f = 50Hz
I = 15,5A

Circulation Pump
GX82841

P = 1,5kW
U = 380VAC
f = 50Hz
I = 3,95A

CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-06-503	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	04.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

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CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

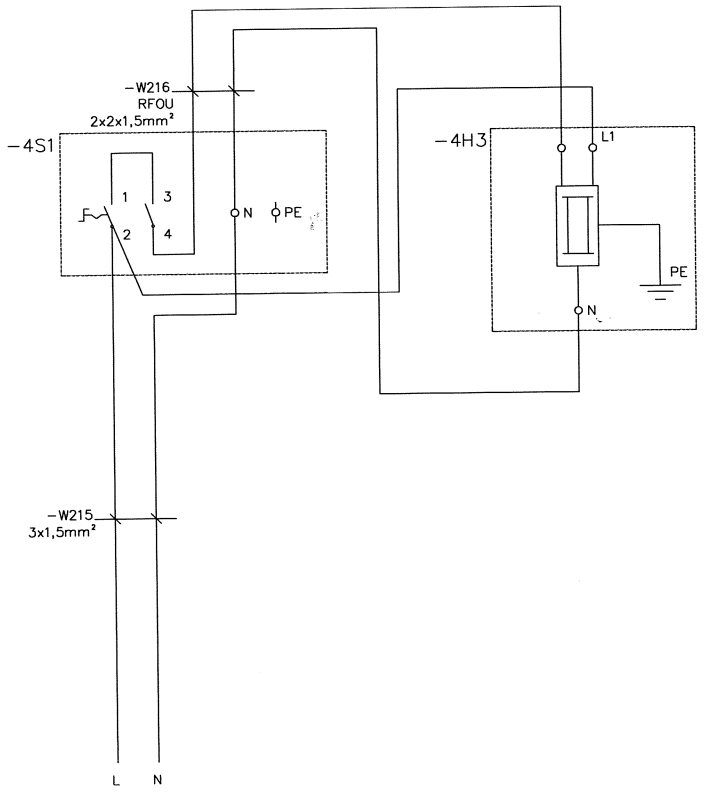
Supersedes

Title: CIRCUIT DIAGRAM HYDRAULIC POWER UNIT

DWG. NO.: SK-066011-32-04
B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU
SHEET: 3 of 15

STATUS: APPROVED



POWER
SUPPLY
LIGHTS 230VAC/50HZ

EMERGENCY
LIGHT WITH
BATTERY BACKUP

CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-06-503	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	04.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM
HYDRAULIC POWER UNIT

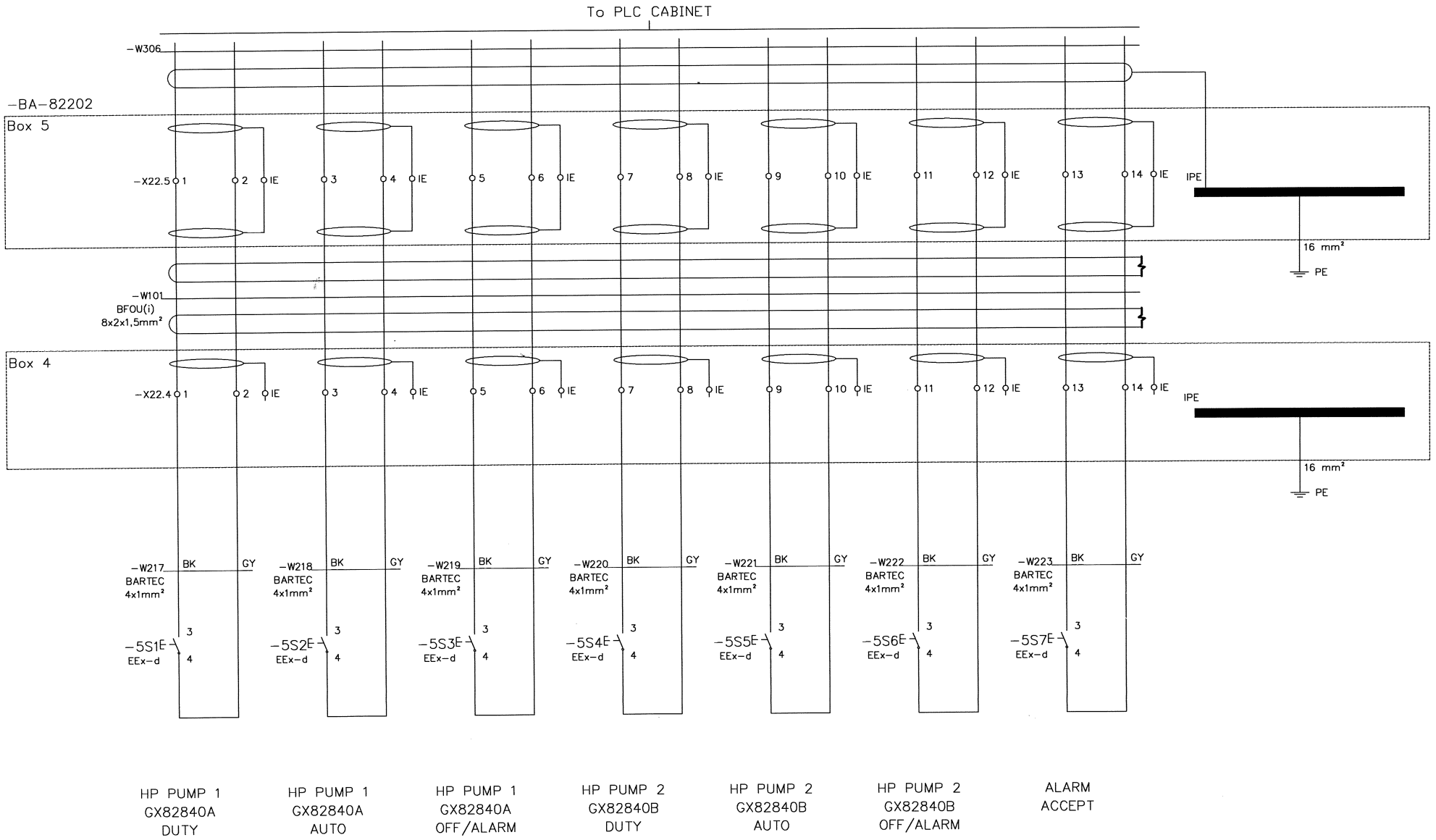
DWG. NO.: SK-066011-32-04

B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU

SHEET: 4 of 15

STATUS: APPROVED



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-06-503	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	04.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM HYDRAULIC POWER UNIT

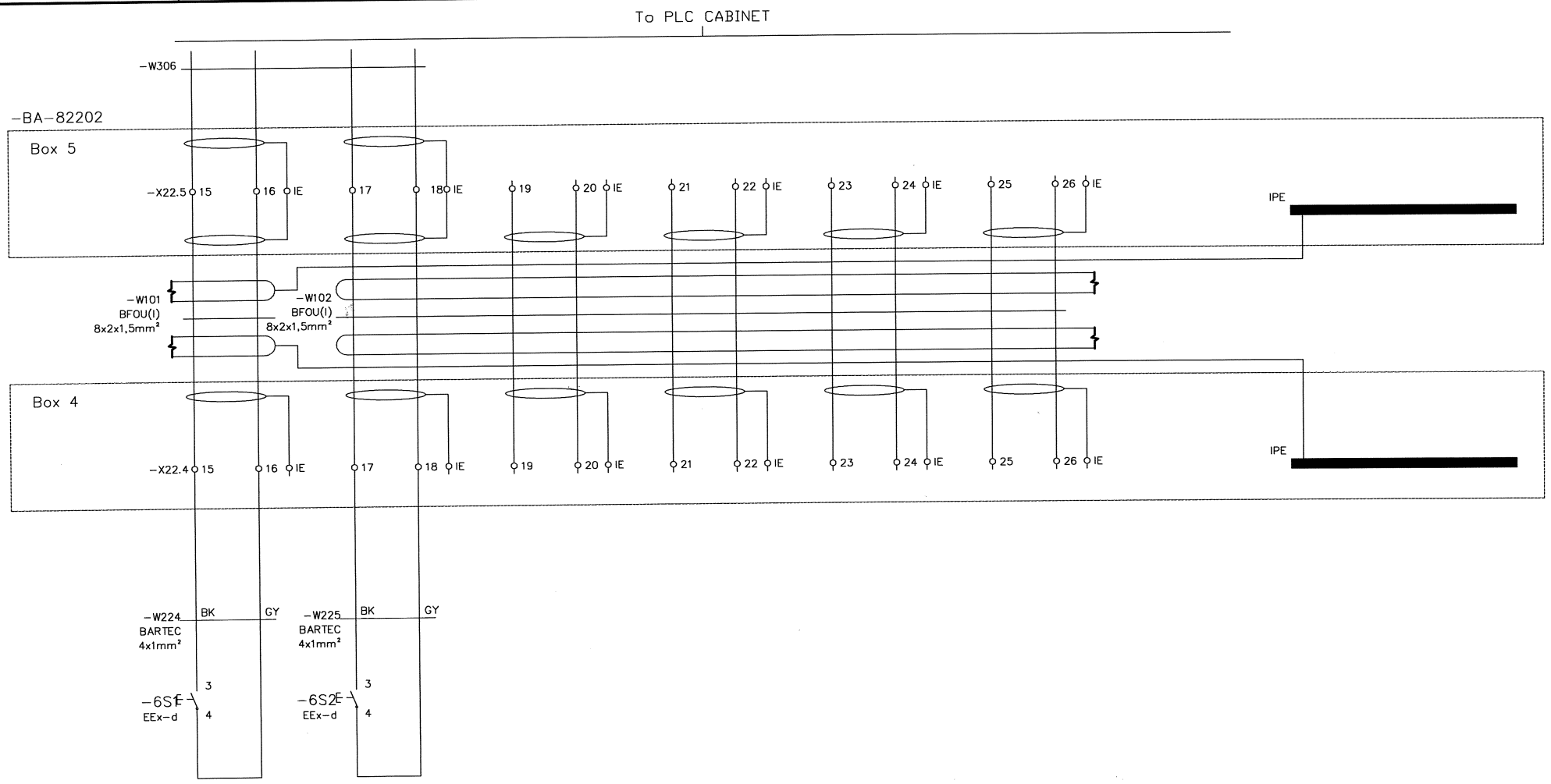
DWG. NO.: SK-066011-32-04

B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU

SHEET: 5 of 15

STATUS: APPROVED



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-06-503	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	04.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM HYDRAULIC POWER UNIT

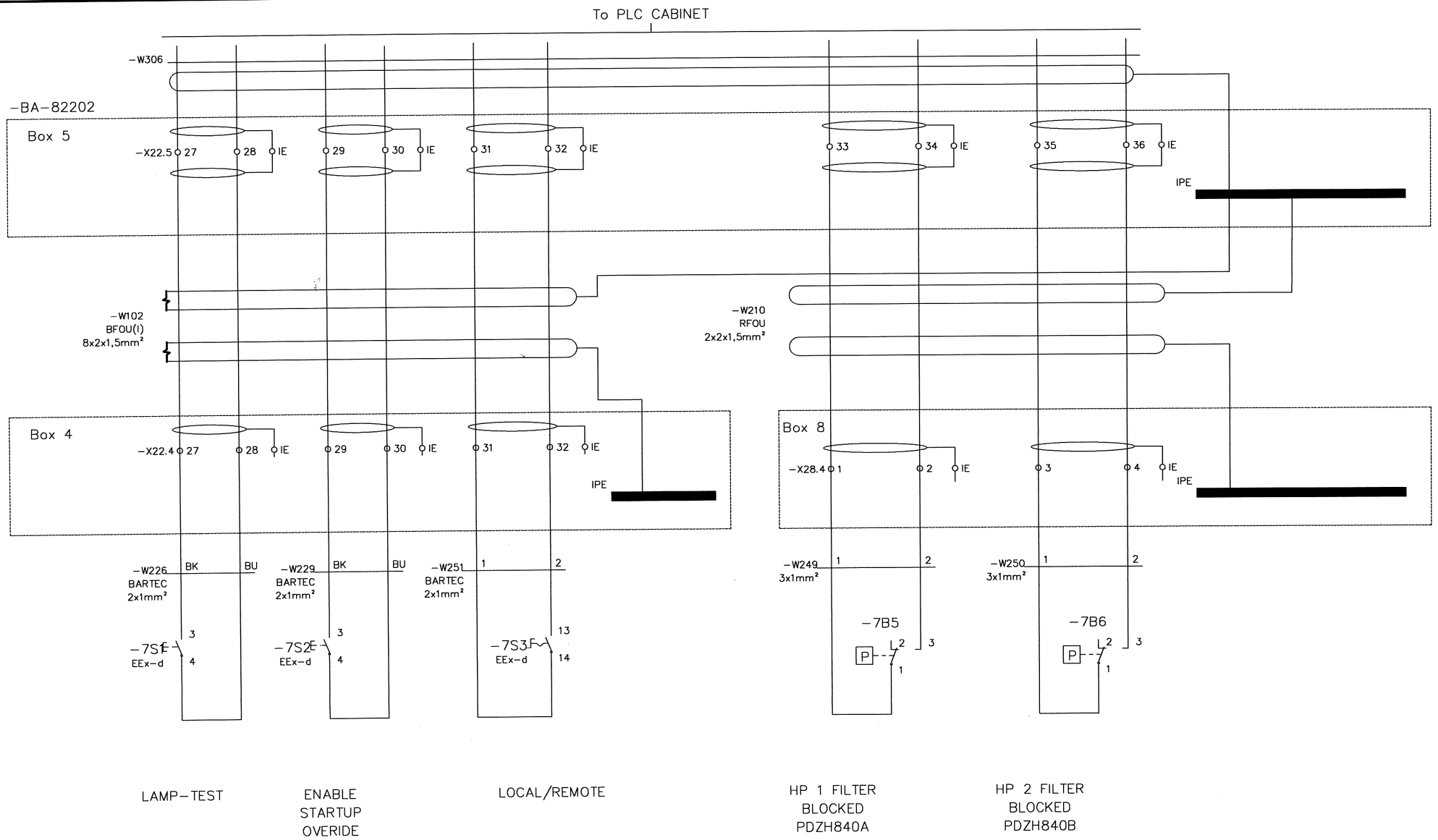
DWG. NO.: SK-066011-32-04

B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU

SHEET: 6 of 15

STATUS: APPROVED



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-06-503	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	04.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lüchenweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM HYDRAULIC POWER UNIT

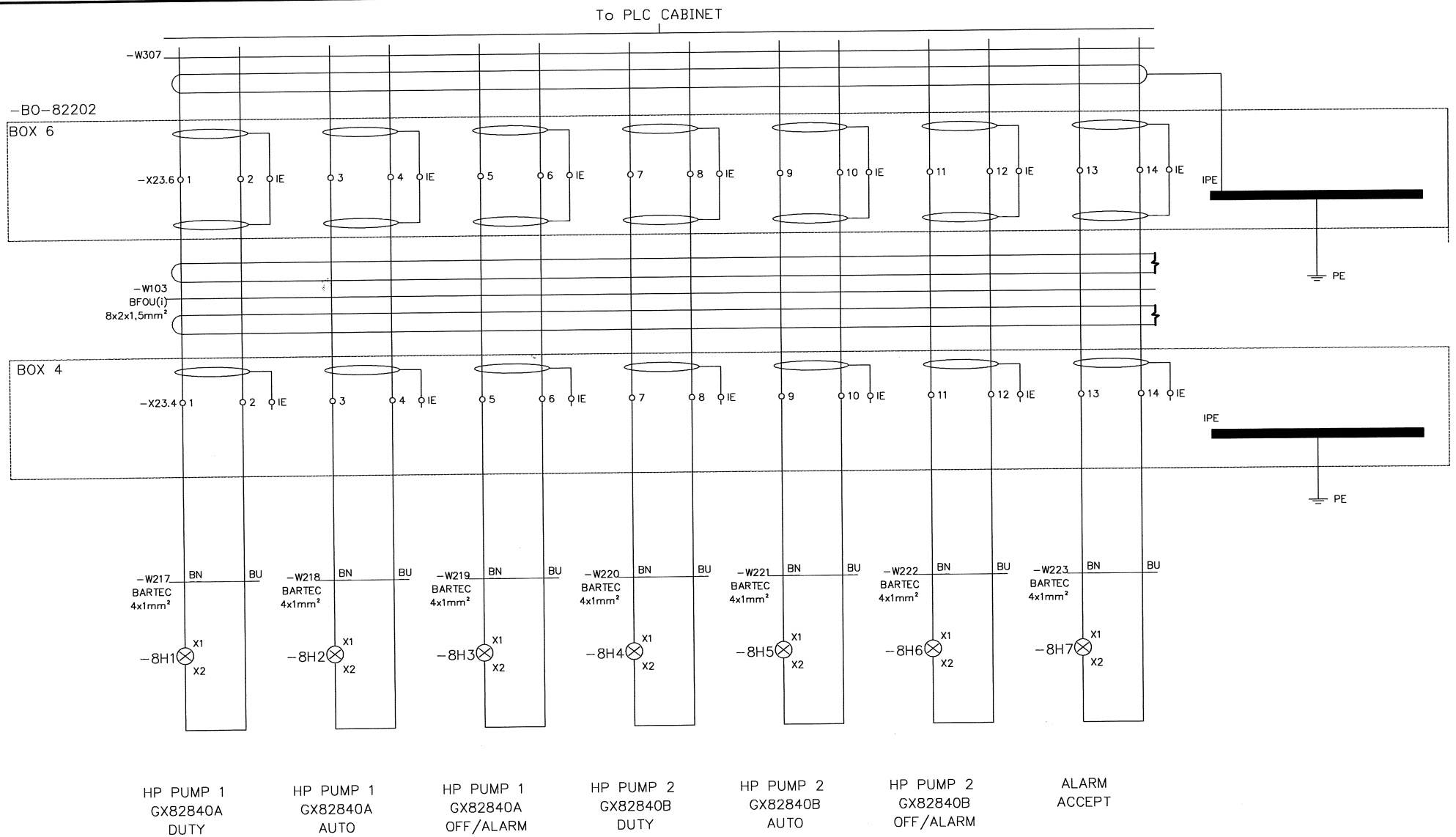
DWG. NO.: SK-066011-32-04

B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU

SHEET: 7 of 15

STATUS: APPROVED



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-06-503	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	04.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lilienweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM HYDRAULIC POWER UNIT

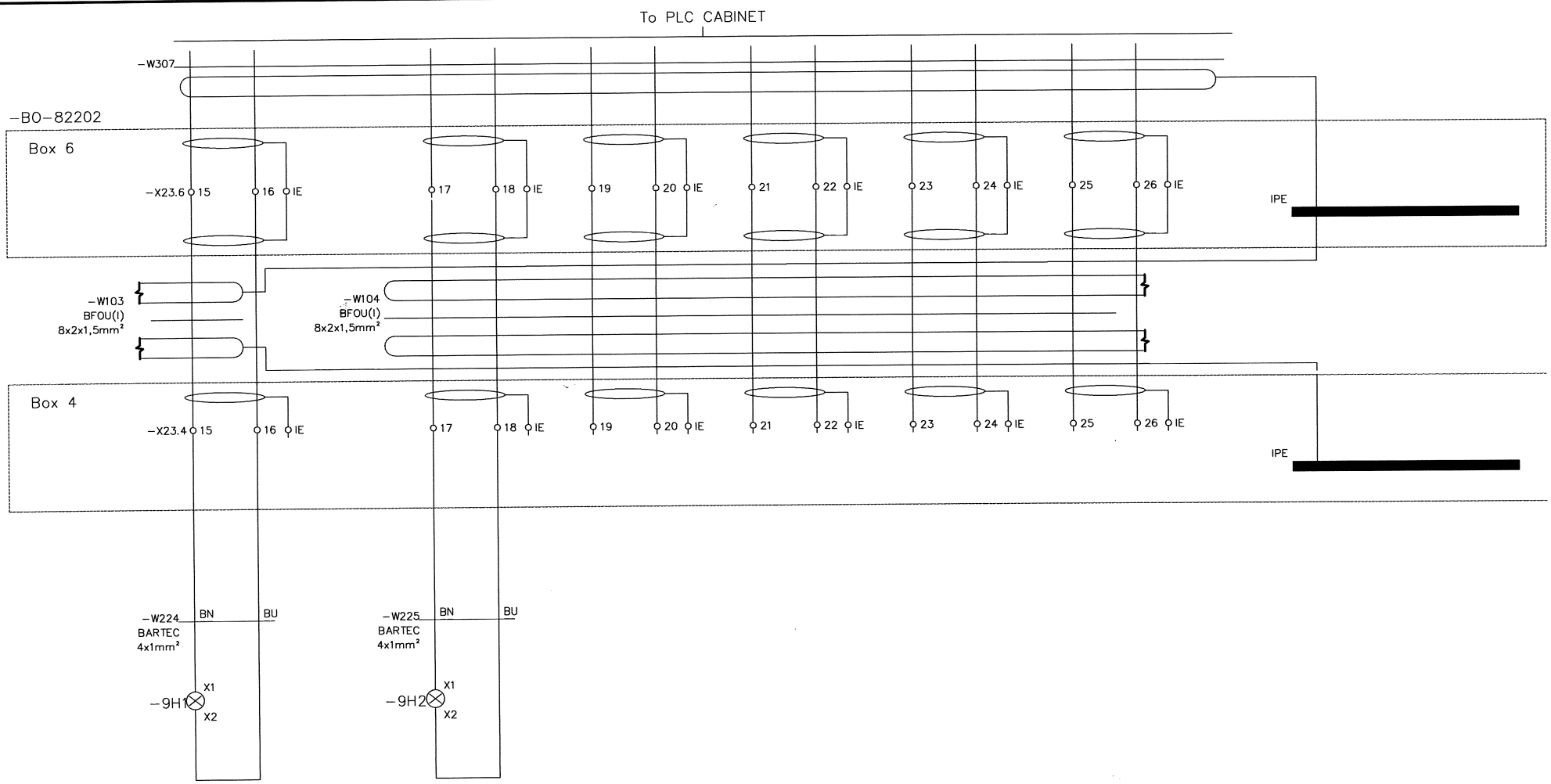
DWG. NO.: SK-066011-32-04

B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU

SHEET: 8 of 15

STATUS: APPROVED



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-06-503	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	04.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lilienweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM HYDRAULIC POWER UNIT

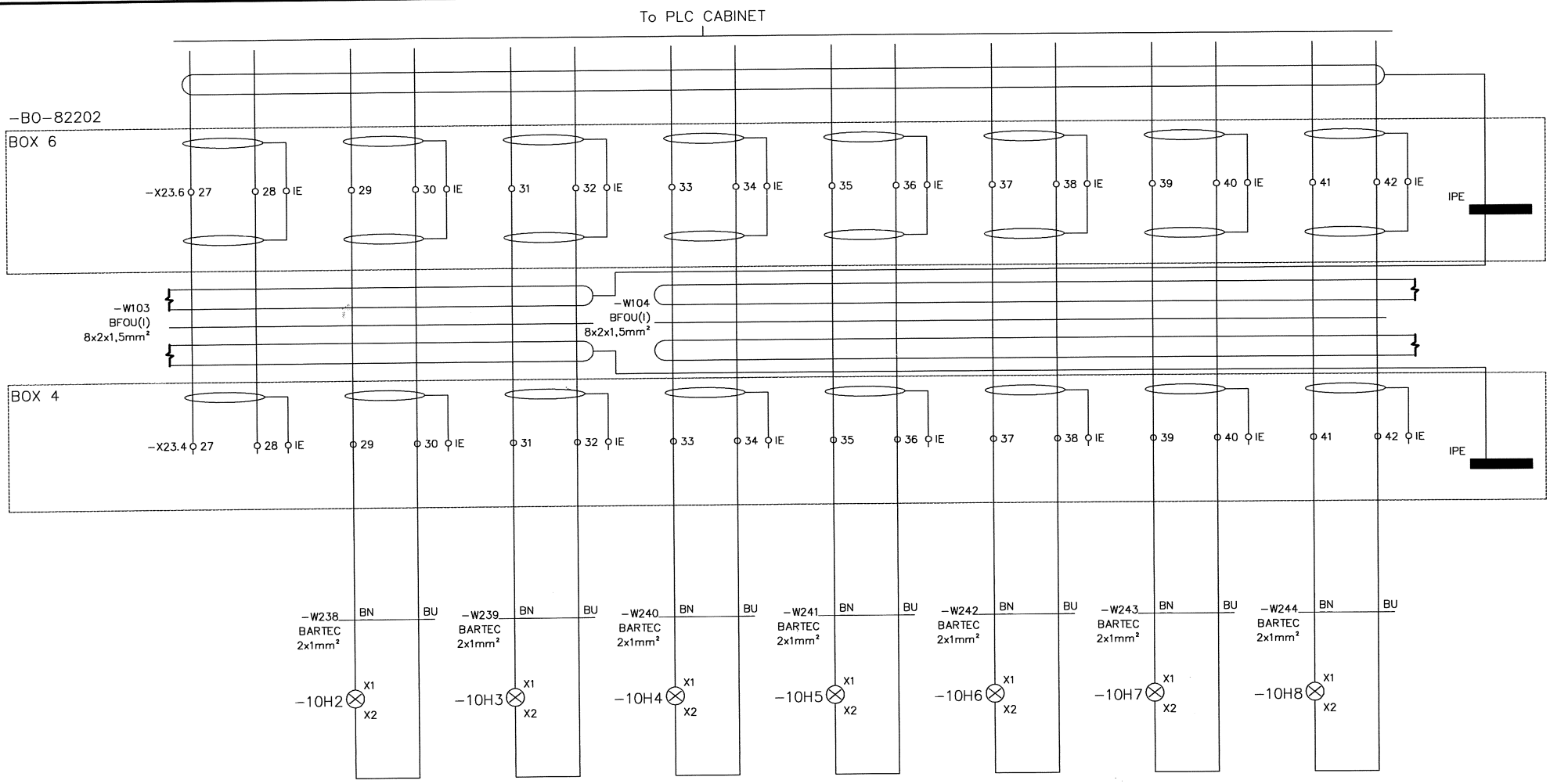
DWG. NO.: SK-066011-32-04

B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU

SHEET: 9 of 15

STATUS: APPROVED



SPARE	HP PUMP 1 RUNNING	HP PUMP 2 RUNNING	HIGH LEVEL RETURN	LOW LOW LEVEL RETURN	HIGH LEVEL SUPPLY	LOW LOW LEVEL SUPPLY	FILTER BLOCKED
	GX 82840 A	GX 82840 B	LT 82841	LT 82841	LT 82840	LT 82840	PDZH 82840 A/B

CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-06-503	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	04.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM HYDRAULIC POWER UNIT

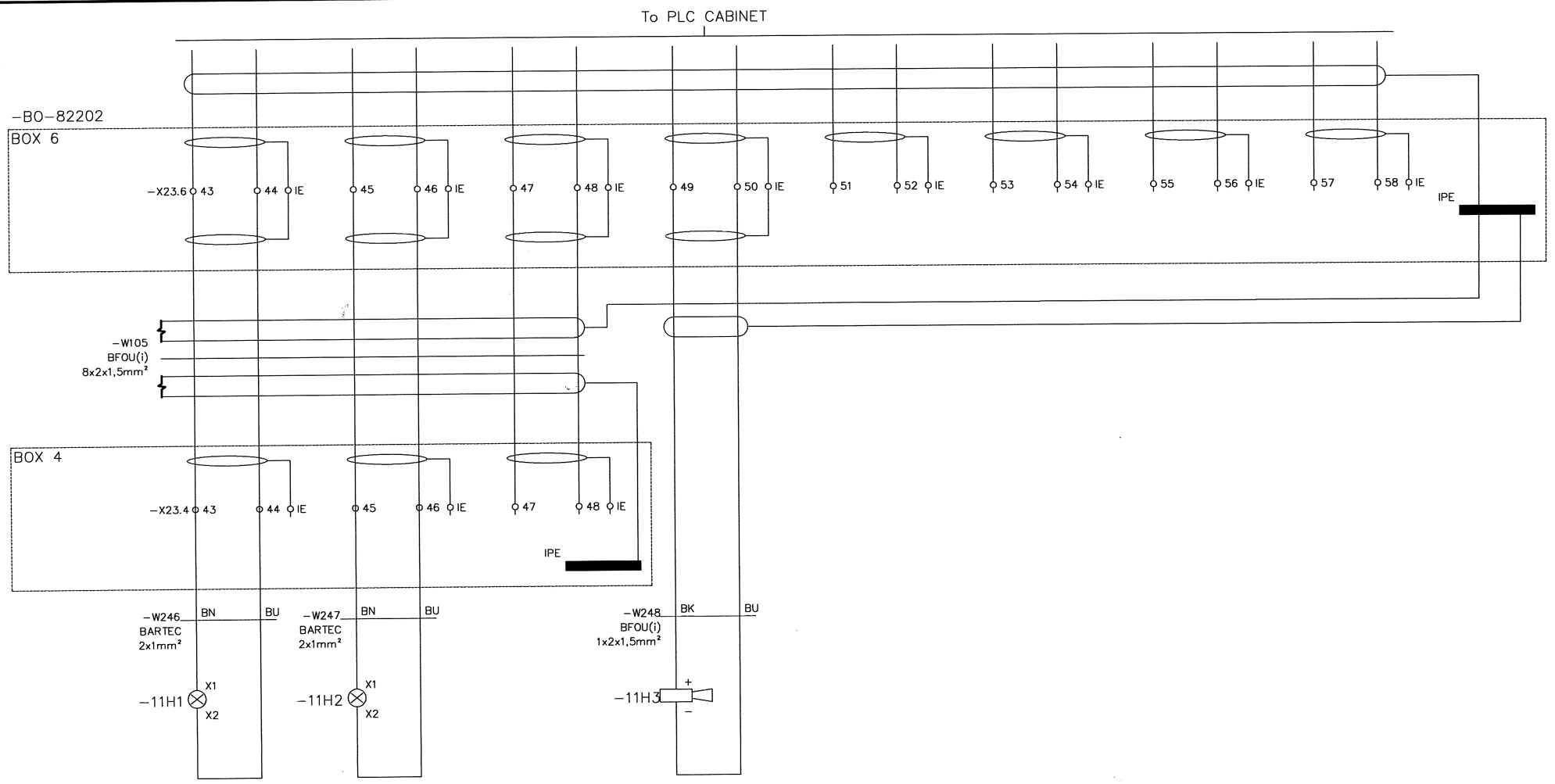
DWG. NO.: SK-066011-32-04

B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU

SHEET: 10 of 15

STATUS: APPROVED



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-06-503	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	04.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lilienweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM HYDRAULIC POWER UNIT

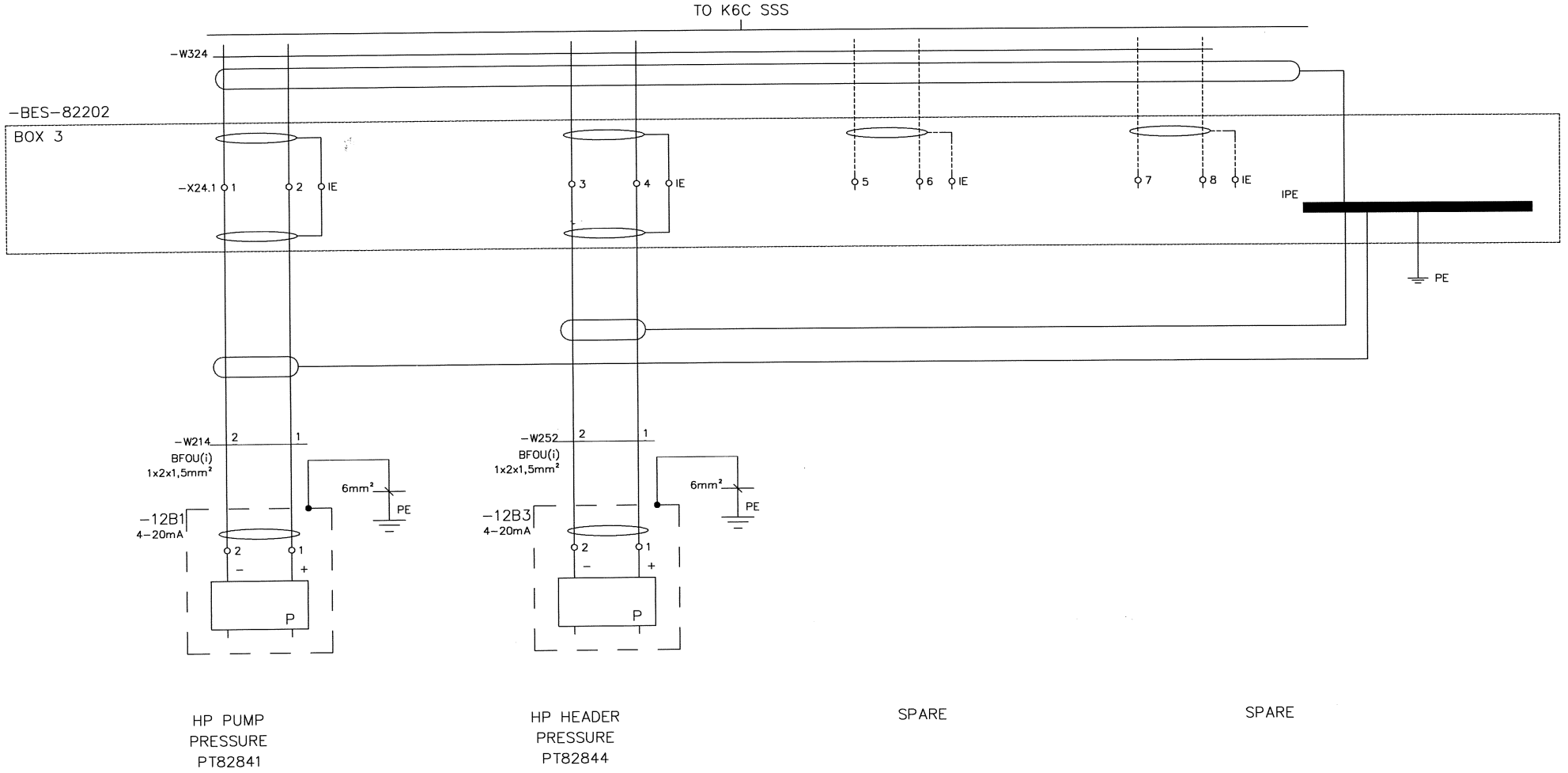
DWG. NO.: SK-066011-32-04

B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU

SHEET: 11 of 15

STATUS: APPROVED



HP PUMP PRESSURE PT82841

HP HEADER PRESSURE PT82844

SPARE

SPARE

CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-06-503	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	04.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM HYDRAULIC POWER UNIT

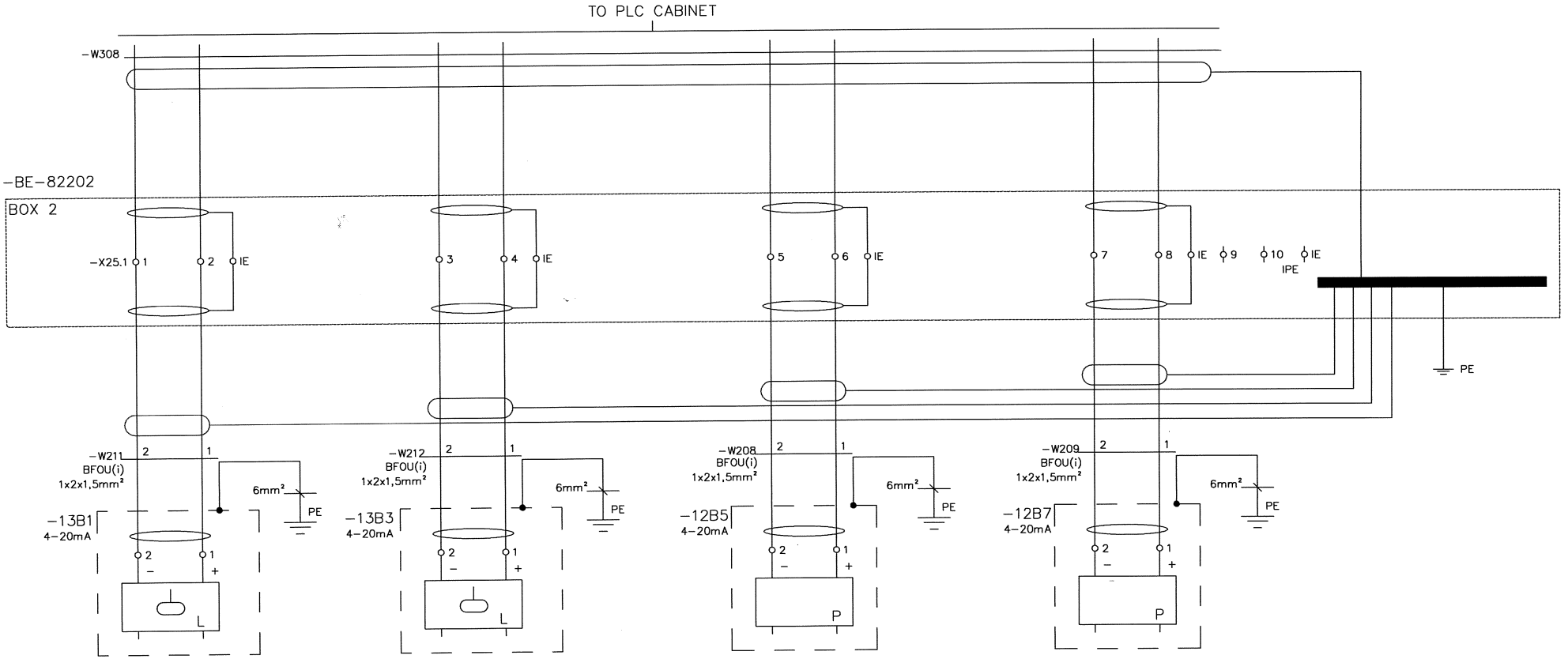
DWG. NO.: SK-066011-32-04

B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU

SHEET: 12 of 15

STATUS: APPROVED



LEVEL TRANSMITTER
SUPPLY RESERVOIR
LT82840

LEVEL TRANSMITTER
RETURN RESERVOIR
LT82841

HP PUMP
PRESSURE
PT82840

HP HEADER
PRESSURE
PT82843

CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-06-503	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	04.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
LDickenweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM HYDRAULIC POWER UNIT

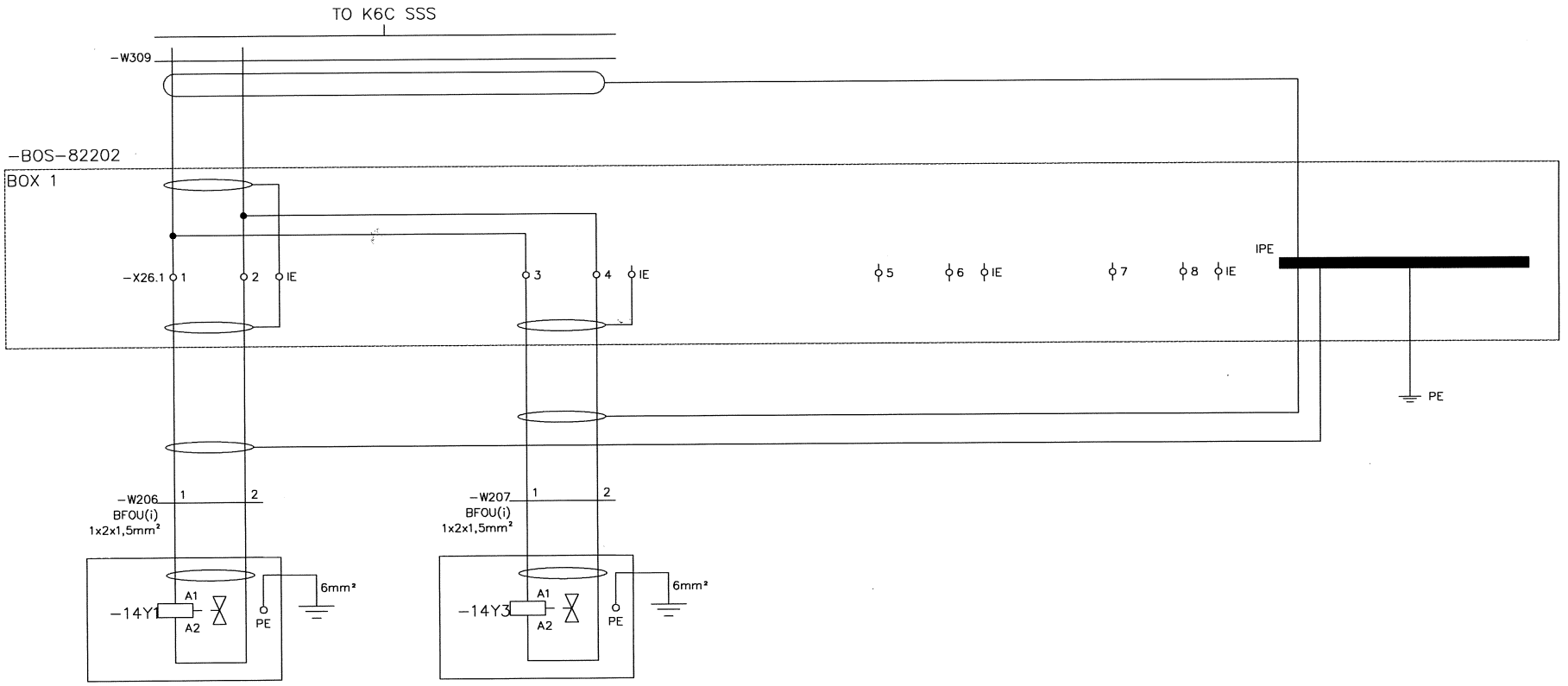
DWG. NO.: SK-066011-32-04

B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU

SHEET: 13 of 15

STATUS: APPROVED



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-06-503	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	04.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

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Lückenweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM HYDRAULIC POWER UNIT

DWG. NO.: SK-066011-32-04

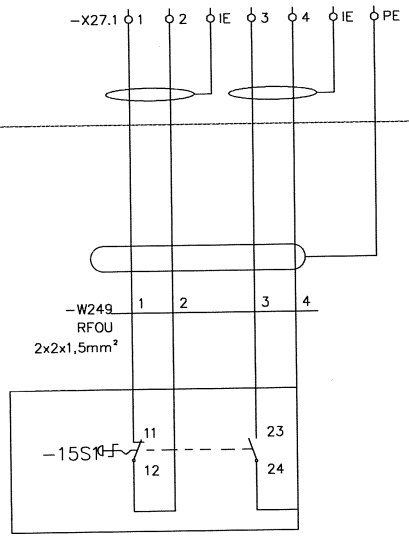
B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU

SHEET: 14 of 15

STATUS: APPROVED

Box 7



EMERGENCY STOP

CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-06-503	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
01	Koller GmbH & Co KG	24.08.2007	L. Ohlendorf	09.11.2007
A	Koller GmbH & Co KG	04.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM HYDRAULIC POWER UNIT

DWG. NO.: SK-066011-32-04

B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU

SHEET: 15 of 15

STATUS: APPROVED

PAGE	TERMINAL	BOX
2	U, V, W + 1/2	MOTORCONTROL + HEATER
3	X22.5	BA-82202 DIGITAL INPUTS TO THE PLC
4	X23.6	BO-82202 DIGITAL OUTPUTS FROM THE PLC
5	X24.1	BES-82202 FOR ANALOGUE SIGNALS TO SSS
6	X25.1	BE-82202 ANALOGUE INPUTS AT THE PLC
7	X26.1	BOS-82202 DIGITAL SIGNALS FROM SSS
8	X27.1	BAS-82202 EMERGENCY PUSH BUTTON
9	L /L1 / N / PE	INTERNAL LIGHTING

ABBREVIATIONS	
BK=	BLACK
BN=	BROWN
BU=	BLUE
GY=	GREY

CABLE	TYPE	TAG NO.
8x2x1,5mm²	BFOU (i)	101 - 105
2x2x1,5mm²	BFOU (i)	106 - 107
1x2x1,5mm²	BFOU (i)	215, 329, 248, 214, 252, 208, 209, 212, 213, 206, 207

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

REASON FOR ISSUE	DATE	CLIENT REV.
AS BUILT	07APR09	3
RE-ISSUED AS APPROVED FOR CONSTRUCTION	05FEB08	2
APPROVED FOR CONSTRUCTION	10JAN08	1
ISSUED FOR CLIENT COMMENT	05NOV07	N/A
ISSUED FOR IDC	24MAY07	N/A

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-31-501

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	K. Kunze	07.04.2009	L. Budde	07.04.2009
A	Koller GmbH & Co KG	23.05.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

Supersedes

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Title
FIELD TERMINATION DIAGRAM
HYDRAULIC POWER UNIT
CAM PN 223011-32

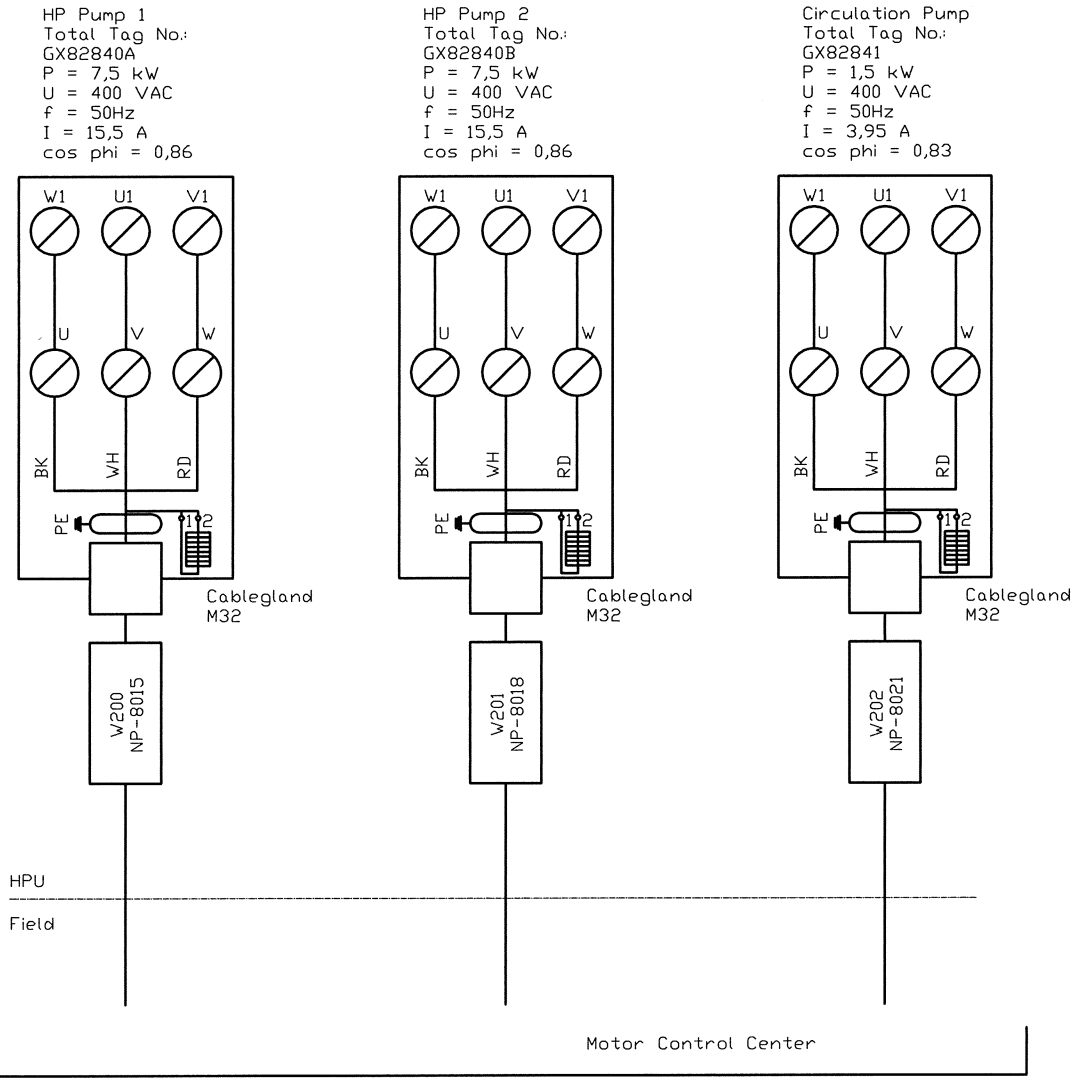
DWG. NO.
SK-066011-32-42

B.O.M. NO.
223011-32

= TOTAL
+ PRODUCTION HPU

SHEET
1 of 9

STATUS: AS BUILT



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-31-501	4600000416	3

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	K. Kunze	07.04.2009	L. Budde	07.04.2009
A	Koller GmbH & Co KG	24.01.2008	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Supersedes

Title: FIELD TERMINATION DIAGRAM
HYDRAULIC POWER UNIT
CAM PN 223011-32

DWG. NO.: SK-066011-32-42

B.O.M. NO.: 223011-32

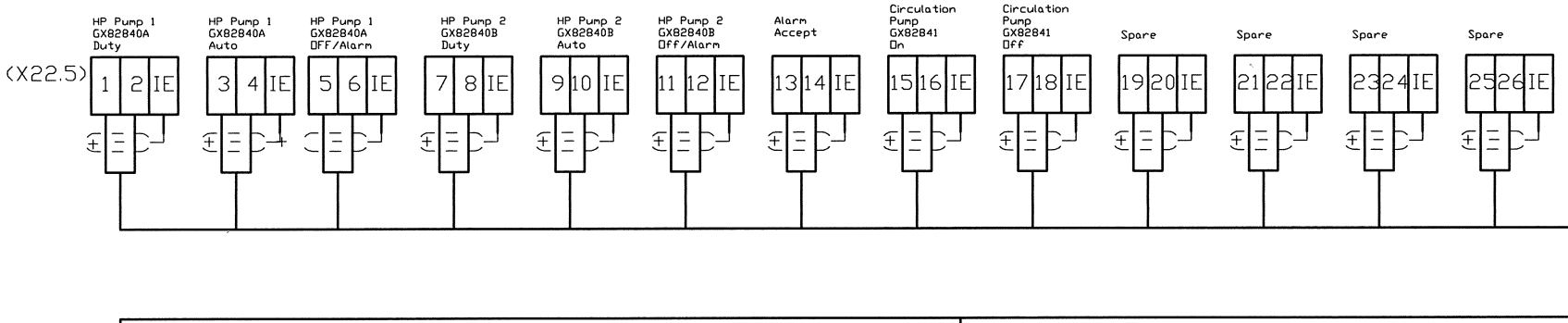
= TOTAL
+ PRODUCTION HPU

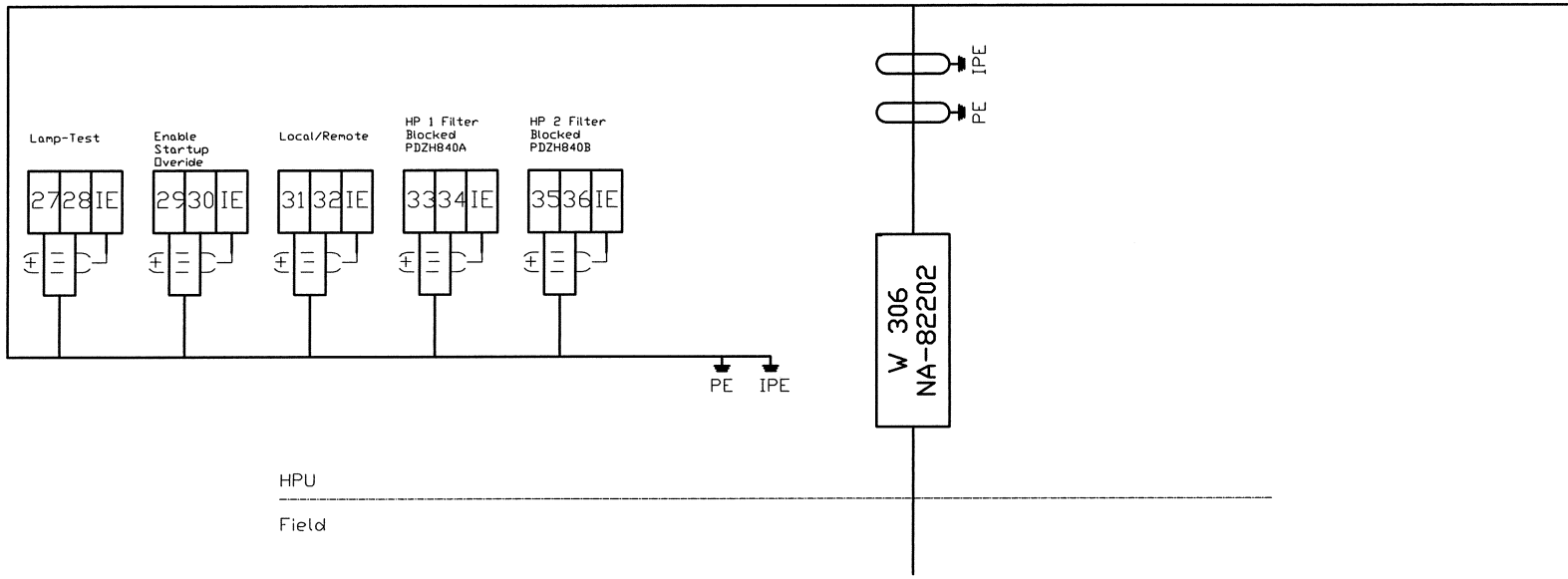
SHEET: 2 of 9

STATUS: AS BUILT

BA82202
BOX 5

DIGITAL INPUTS TO THE PLC





CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-31-501	4600000416	3

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	K. Kunze	07.04.2009	L. Budde	07.04.2009
A	Koller GmbH & Co KG	24.01.2008	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Supersedes

Title: FIELD TERMINATION DIAGRAM
HYDRAULIC POWER UNIT
CAM PN 223011-32

DWG. NO.: SK-066011-32-42

B.O.M. NO.: 223011-32

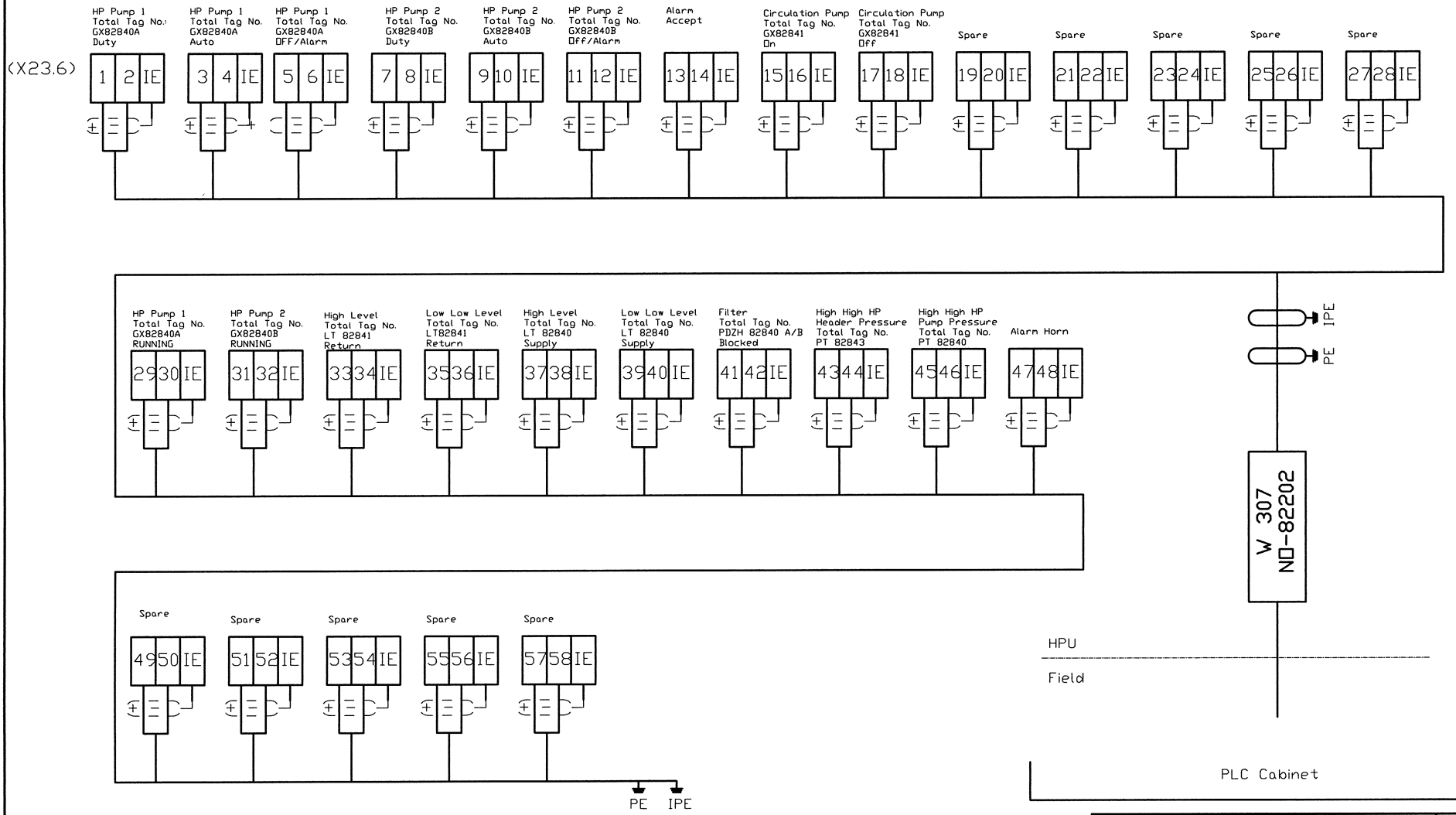
= TOTAL
+ PRODUCTION HPU

SHEET: 3 of 9

STATUS: AS BUILT

BO82202
BOX 6

DIGITAL OUTPUTS FROM THE PLC



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-31-501	4600000416	3

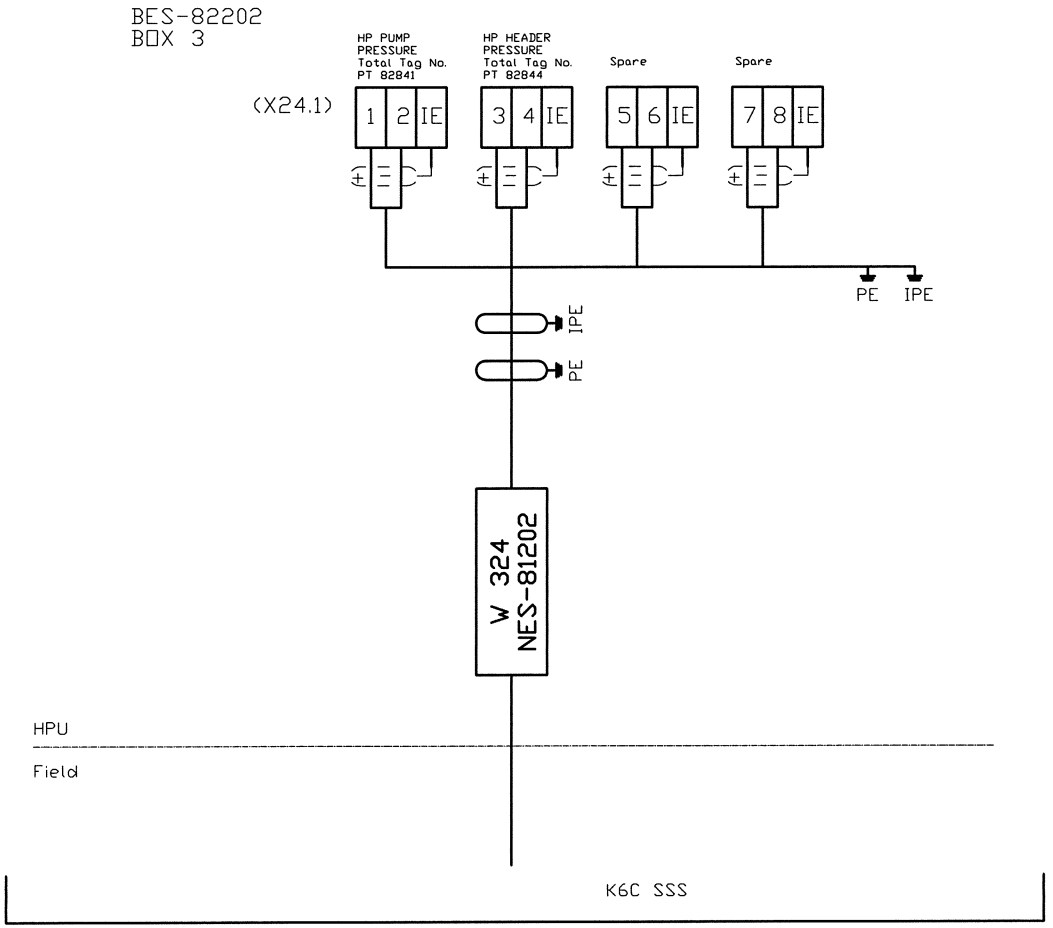
Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	Konstanze Kunze	07.04.2009	L. Budde	07.04.2009
A	Koller GmbH & Co KG	24.01.2008	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON
CAMERON GmbH
Lückenweg 1
29227 Celle, Germany
Supersedes

Title: FIELD TERMINATION DIAGRAM HYDRAULIC POWER UNIT CAM PN 223011-32

DWG. NO.: SK-066011-32-42
B.O.M. NO.: 223011-32
= TOTAL
+ PRODUCTION HPU
SHEET: 4 of 9
STATUS: AS BUILT

FOR ANALOGUE SIGNALS TO SSS



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-31-501	4600000416	3

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	K. Kunze	07.04.2009	L. Budde	07.04.2009
A	Koller GmbH & Co KG	24.01.2008	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Supersedes

Title: FIELD TERMINATION DIAGRAM HYDRAULIC POWER UNIT CAM PN 223011-32

DWG. NO.: SK-066011-32-42

B.O.M. NO.: 223011-32

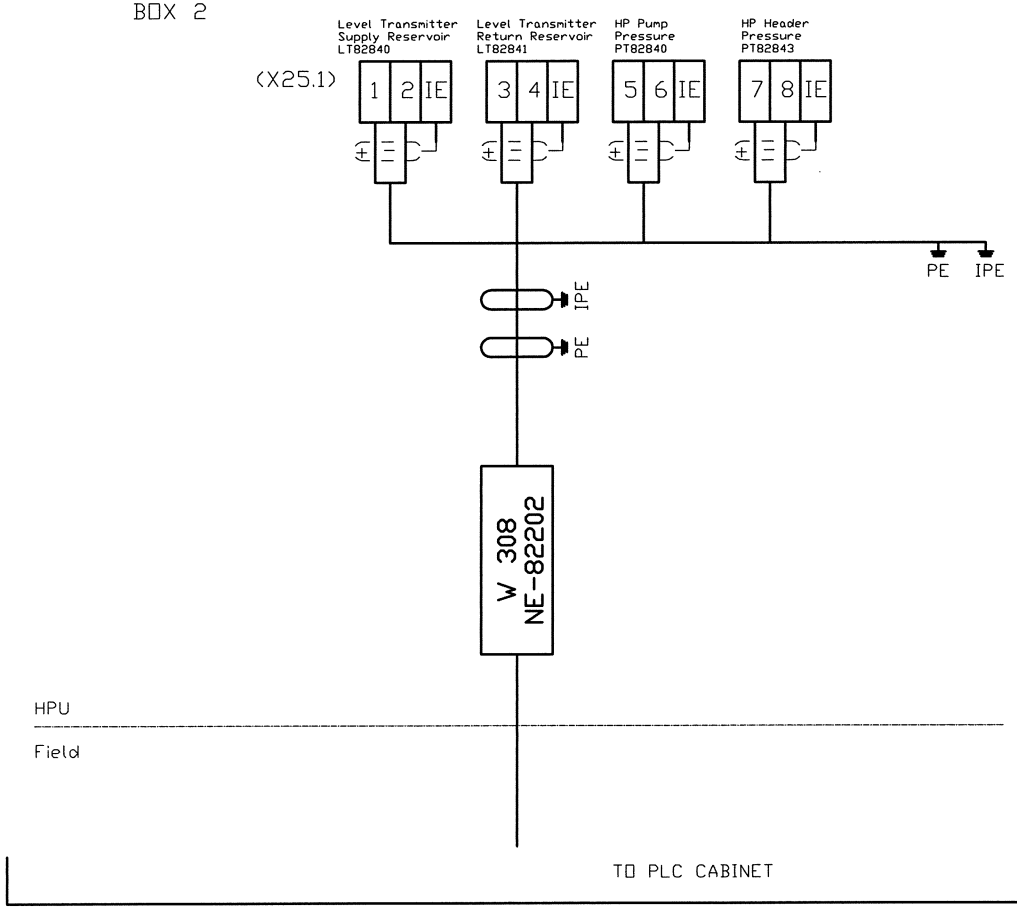
= TOTAL
+ PRODUCTION HPU

SHEET: 5 of 9

STATUS: AS BUILT

ANALOGUE INPUTS AT THE PLC

BE-82202
BOX 2



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-31-501	4600000416	3

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	K. Kunze	07.04.2009	L. Budde	07.04.2009
A	Koller GmbH & Co KG	24.01.2008	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Supersedes

Title: FIELD TERMINATION DIAGRAM
HYDRAULIC POWER UNIT
CAM PN 223011-32

DWG. NO.: SK-066011-32-42

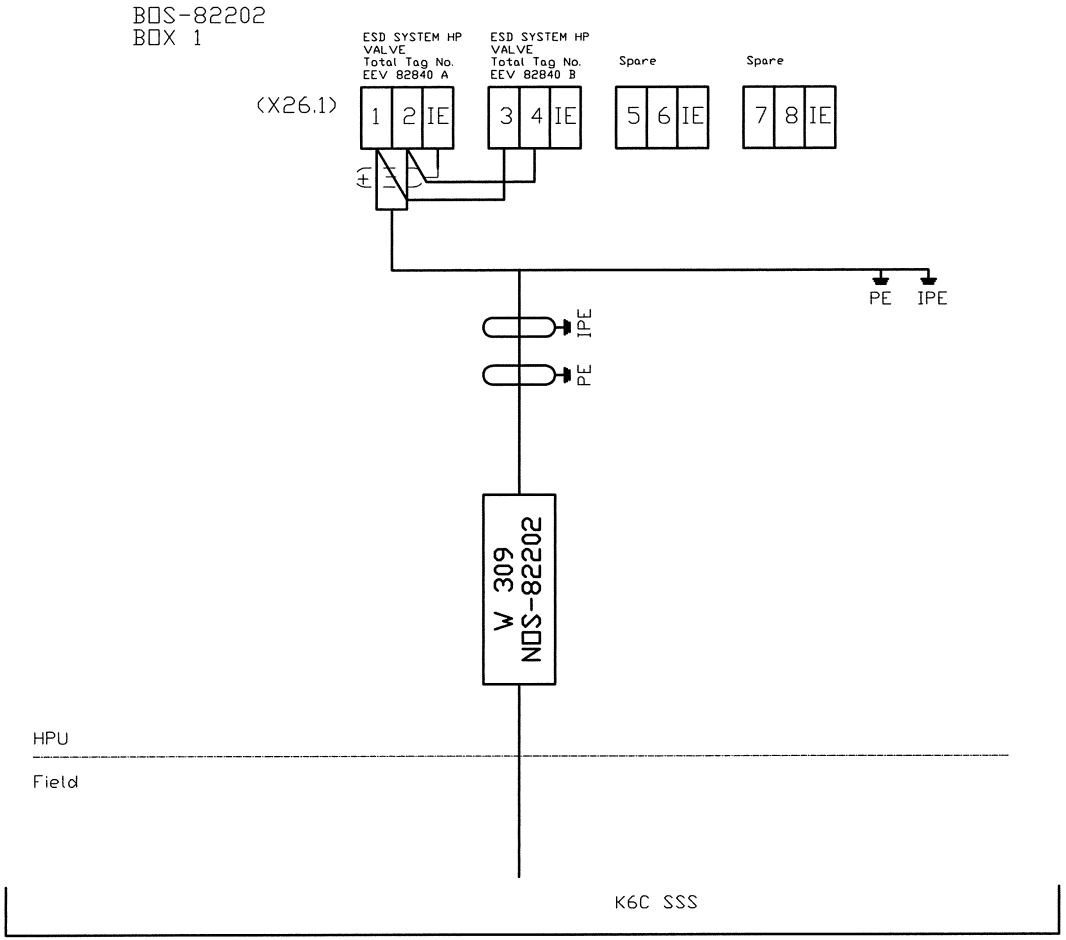
B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU

SHEET: 6 of 9

STATUS: AS BUILT

DIGITAL SIGNALS FROM SSS



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-31-501	4600000416	3

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	K. Kunze	07.04.2009	L. Budde	07.04.2009
A	Koller GmbH & Co KG	24.01.2008	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lilienweg 1
29227 Celle, Germany

Supersedes

Title: FIELD TERMINATION DIAGRAM HYDRAULIC POWER UNIT CAM PN 223011-32

DWG. NO.: SK-066011-32-42

B.O.M. NO.: 223011-32

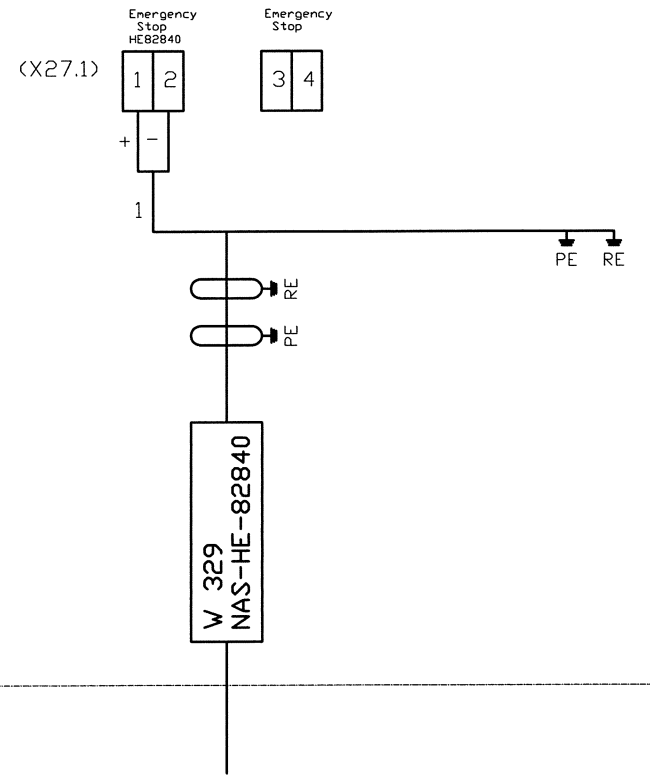
= TOTAL
+ PRODUCTION HPU

SHEET: 7 of 9

STATUS: AS BUILT

BAS-82202
BOX-7

EMERGENCY SHUT DOWN



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-31-501	4600000416	3

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	K. Kunze	07.04.2009	L. Budde	07.04.2009
A	Koller GmbH & Co KG	24.01.2008	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

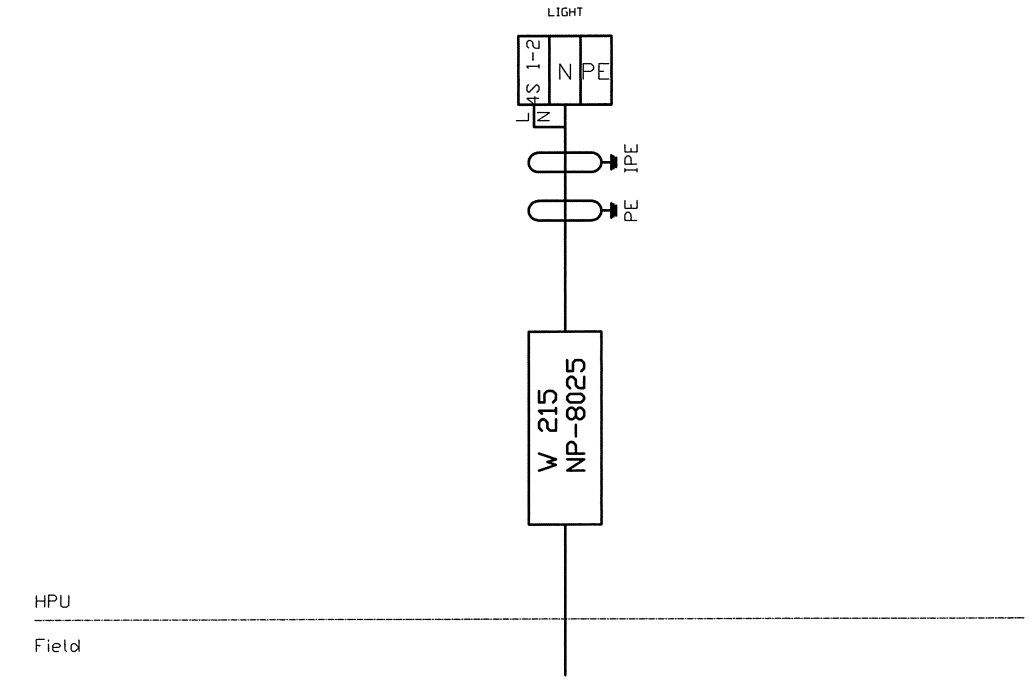
CAMERON
CAMERON GmbH
Lückenweg 1
29227 Celle, Germany
Supersedes

Title: FIELD TERMINATION DIAGRAM
HYDRAULIC POWER UNIT
CAM PN 223011-32

DWG. NO.: SK-066011-32-42
B.O.M. NO.: 223011-32

= TOTAL
+ PRODUCTION HPU
SHEET: 8 of 9

STATUS: AS BUILT



CLIENT DOCUMENT NUMBER: 54NL92-W-31-501						CLIENT CONTRACT NUMBER: 4600000416	CLIENT REV.: 3
03	K. Kunze	07.04.2009	L. Budde	07.04.2009	CAMERON GmbH Lückenweg 1 29227 Celle, Germany	DWG. NO. SK-066011-32-42	= TOTAL
Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date			+ PRODUCTION HPU
A	Koller GmbH & Co KG	24.01.2008	Initial Release		Title: FIELD TERMINATION DIAGRAM HYDRAULIC POWER UNIT CAM PN 223011-32	B.O.M. NO. 223011-32	SHEET 9 of 9
Initial Rev.	Initial Author	Initial Date	Remark		Supersedes		STATUS: AS BUILT

COOPER CAMERON CORPORATION HOUSTON, TEXAS
ENGINEERING BILL OF MATERIAL

STATUS: Released REVISION : 05
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : PLC CABINET FOR PHPU TOTAL K5F

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
010	0010		619044-01-01-21	1.000	EA	ENCLOSURE, 800 X 1000 X 300 mm, SST COMPACT ENCLOSURE WITH 1 DOOR PROTECTION: IP 66. MATERIAL: SST 304 (1.4301). SURFACE FINISH: BRUSHED. DOOR WITH FOAMED-IN SEAL. INCL. MOUNTING PLATE IN SHEET STEEL, ZINC-PLATED AND CAM LOCK IN DIE-CAST ZINC, NICKEL-PLATED. APPR.: BV, CSA, DNV, GL, LR, MRS, TUEV, UL & VDE		
011	0011		619044-61-02	4.000	EA	WALL MOUNTING BRACKET FOR FASTENING KL, EB, BG AE AND EL ENCLOSURES. WALL DISTANCE: 10 mm MATERIAL: SST 304 (1.4301) INCL. ASSEMBLY PARTS.		
050	0050		619091-01-50-10	1.000	EA	POWER SUPPLY, 24 V DC, 10 A PRIMARY SWITCHED-MODE, 1-phase TYPE: QUINT-PS-100-240AC/24DC/10 NOM. INPUT VOLT.: 100 - 240 V AC NOM. OUTPUT VOLT.: 24 V DC +/- 1 % OUTPUT CURRENT: 10 A (UP TO 60°C) FREQUENCY: 45 / 65 Hz PROTECTION: IP 20 AMB. TEMP.: -25°C / +70°C W x H x D: 85 x 130 x 130000 mm APPROVAL: UL & GL		
051	0051		619091-03-14	2.000	EA	CONVERTER, FIBER OPTIC, 24 V DC TYPE: FL MC 10/100 BASE-T/FO G1300ST NOM. SUPPLY VOLT.: 24 V DC +/- 20%.		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						CURRENT CONSUMPTION: MAX. 95 mA. ELEC. ISOLATION: 10/100Base-T // SUPPLY. PROTECTION: IP 20. TEMP.: 0°C / +55°C. HOUSING: PA V0 , GREEN. L X H X W: 99 X 122 X 22.5 mm. FOR CONVERTING 10/100 BASE-T(X) TO MULTIMODE GLASS FIBER (1300 mm), B-FOC (ST) FO CONNECTION, RAIL-MOUNTABLE. CONFORMANCE WITH EMC DIRECTIVE 89/336/EEC.		
300	0300	01	2711927-02-01	1.000	EA	MODULE, CPU, 315-2 PN/DP, 256 KB RAM, CPU WITH PROFIBUS-DP/MPI AND PROFINET INTERFACES, 24VDC, TYPICAL POWER DISSIPATION: 3.5W, IP20, OPERATING TEMP: 0 TO 60DEGC, MICRO MEMORY CARD REQUIRED, HAZARDOUS AREA AND CE CERTIFICATION REQUIRED		
301	0301		2761883-02	1.000	EA	SIMATIC S7, MICRO MEMORY CARD, 64KB		
302	0302		619095-05-46	2.000	EA	SIMATIC S7, DIGITAL INPUT SM 326 24 DI ; DC 24 V, 40 PIN, FAILSAFE DIGITAL INPUTS FOR SIMATIC S7F SYSTEMS, WITH DIAGNOST. INTERRUPT.		
303	0303		619095-06-33	2.000	EA	DIGITAL OUTPUT, SM 322, 16 DO, 24 V FOR THE SIMATIC S7-300 OPTICALLY ISOLATED 16 DO DC 24 V, 0.5 A (1 X 16 DO) SHORT-CIRCUIT PROTECTION DIAGNOSTICS 40 PIN		
304	0304		619095-04-20	1.000	EA	S7-300,AI,SM 331,8X(4...20)MA VOLTAGE: DC 24V, MAX.: 20 MA 8 INPUTS		
306	0306		619095-05-59	2.000	EA	SIMATIC S7-300, FRONT DOOR		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						EXTENDED FOR 32 CHANNELSIGNAL MODULES, ALLOWS CONNECTION OF 1.3 MM2 OR 16 AWG WIRE.		
310	0310		619095-12-46	1.000	EA	S7-300,PROFIL BAR 482MM,IP20 PROTECTION: IP 20 LENGTH: 482 MM		
311	0311		619095-12-49	4.000	EA	S7-300, FRONT CONNECTOR 40 POL. WITH SCREW CONTACTS		
312	0312		619095-12-48	1.000	EA	S7-300, FRONT CONNECTOR 20 POL. WITH SCREW CONTACTS		
400	0400		619088-02-01-04	300.000	EA	EX TERMINAL, GREY, 4 QMM, UK 3 N 4 QMM / 2.5 QMM 726 V 28 A / 23 A PROTECTION: EEX E II CERT.: KEMA 98ATEX1651U INT. APPROBATIONS: CSA ; CUL/UL ; GOST-R (RUSSIA)		
402	0402		619088-02-14-02	10.000	EA	EX TERMINAL, GREY, 6/4 QMM, UK 5 UK 5 N 6 mm / 4 mm 550 V / 726 V 38 A / 30 A PROTECTION: EEX E II CERT.: KEMA EX-94.C.8675U		
403	0403		619044-01-34-03	74.000	EA	CONDUCTOR CONN. CLAMP, 2.5 - 16 mm2 FOR BAR THICKNESS: 5 mm CONN. OF RD CONDUCTOR: 2.5 - 16 mm2 MATERIAL: STEEL SHEET, PASSIVATED APPR.: CE, CSA, CUL, DNV, GL & UL		
404	0404		619044-01-36	10.000	EA	BASE ISOLATOR, HEX., 40 mm, 1 kV HEIGHT: 40 mm ; SW 36 TENSILE STRENGTH: 12 kN TORSIONAL STRENGTH: 75 Nm CONT. OPER. TEMP.: MAX. 135°C MAT.: DUROPLASTIC POLYESTER , RED FOR CONFIGURING BUSBAR SYSTEMS WITH ANY GIVEN BAR		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						CENTRE DISTANCES AND FOR ASSEMBLING PE OR PEN BARS.		
406	0406		619088-12-45	11.000	EA	EX TERMINAL, USLKG 16 N, GN/YE UNIVERSAL GROUND TERMINAL BLOCK RIGID: 2.5 - 25 mm2 FLEXIBLE: 4 - 16 mm2 AWG: 12 - 4 COLOUR: GREEN / YELLOW W x H x D: 12.2 x 61.5 x 42.5 mm Ex Cert.: KEMA 99 ATEX 4487U		
407	0407		619088-03-02	22.000	EA	TERMINAL,END CLAMP,GREY,E/UK TYPE E/UK		
408	0408		619088-47-02-28	10.000	EA	PLUG-IN BRIDGE, FBS 10-5, 10-POS. FOR CROSS-CONNECTIONS IN THE TERMINAL CENTER; CURRENT: MAX. 24 A		
409	0409		619088-03-45	30.000	EA	TERMINAL STRIP MARKER, 25 x 6 mm TYPE: KLM (10 04 30 6) SNAPS ONTO END BRACKET E/UK OR CLIPFIX 35, LETTERING AREA 25 x 6 mm INCL. INSERT STRIP FOR LASER PRINTER TYPE: ESL 26 x 6 (08 08 10 5)		
420	0420		619088-03-33	8.000	EA	LABEL STRIP, ZB 5, WHITE, (1-10) TYP: ZB 5, LGS: 1-10 COLOUR: WHITE LETTERING: 1-10 WIDTH: ZB 5		
421	0421		619088-03-34	2.000	EA	LABEL STRIP, ZB 5, WHITE, (11-20) TYP: ZB 5, LGS: 11-20 COLOUR: WHITE LETTERING: 11-20 WIDTH: ZB 5		
422	0422		619088-03-35	2.000	EA	LABEL STRIP, ZB 5, WHITE, (21-30) TYP: ZB 5, LGS: 21-30 COLOUR: WHITE LETTERING: 21-30 WIDTH: ZB 5		
423	0423		619088-03-36	2.000	EA	LABEL STRIP, ZB 5, WHITE,		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						(31-40) TYP: ZB 5, LGS: 31-40 COLOUR: WHITE LETTERING: 31-40 WIDTH: ZB 5		
424	0424		619088-03-37	2.000	EA	LABEL STRIP, ZB 5, WHITE, (41-50) TYP: ZB 5, LGS: 41-50 COLOUR: WHITE LETTERING: 41-50 WIDTH: ZB 5		
425	0425		619088-03-60	2.000	EA	LABEL STRIP, ZB 5, WHITE (51-60) VERTICALLY LABELED		
426	0426		619088-03-61	2.000	EA	LABEL STRIP, ZB 5, WHITE (61-70) VERTICALLY LABELED		
427	0427		619088-03-62	2.000	EA	LABEL STRIP, ZB 5, WHITE (71-80) VERTICALLY LABELED		
428	0428		619088-03-63	2.000	EA	LABEL STRIP, ZB 5, WHITE (81-90) VERTICALLY LABELED		
429	0429		619088-03-64	2.000	EA	LABEL STRIP, ZB 5, WHITE (91-100) VERTICALLY LABELED		
430	0430		619088-03-65	1.000	EA	LABEL STRIP, ZB 5, WHITE (101-110) VERTICALLY LABELED		
431	0431		619088-03-66	1.000	EA	LABEL STRIP, ZB 5, WHITE (111-120) VERTICALLY LABELED		
433	0433		619088-03-93	2.000	EA	LABEL STRIP, ZB 5, WHITE, (PE) TYP: ZB 5: SO/CMS, LGS: PE COLOUR: WHITE TEXT: PE WIDTH: ZB 5		
434	0434		619088-03-95	3.000	EA	LABEL STRIP, ZB 5, WHITE, BLANK TYP: ZB 5/ WH-100 COLOUR: WHITE TEXT: BLANK WIDTH: ZB 5		
435	0435		619088-01-05	4.000	ME	MOUNTING RAIL, 35 X 7.5 MM, STEEL TYPE: NS 35/7.5 , PERFORATED W X H X T: 35 X 7.5 X 1.0 mm MATERIAL: STEEL , YELLOW CHROMATED TEST STANDARD IN ACC. WITH		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						EN 60715: 2001		
440	0440		619088-10-11-04	1.000	EA	SOCKET, RAIL MOUNTABLE, 250 V AC TYPE: SD-D/SP/GY WITH SPRING-CAGE CONNECTION NOM. VOLT.: 250 V AC NOM. CURRENT: 10 A DC / 16 A AC NATIONAL VERSION: GERMANY TEMP.: -20°C / +60°C INSULATING MATERIAL: PA, GREY MATERIAL CONTACT: CuZn37 STANDARD: STANDARD IEC 83/DIN 49440-1		
609	0609		619092-01-41-06	3.000	EA	CIRCUIT BREAKER, C, 6 A, 2 NO TYPE: S 272-C 6		
610	0610		619092-01-41-10	2.000	EA	CIRCUIT BREAKER, C, 10 A, 2 NO TYPE: S 202 M-C 10 VOLTAGE: 440 V AC / 125 V DC CONTACTS: 2 NO CURRENT: 10 A CHARACTERISTIC: C		
611	0611		619092-01-41-16	2.000	EA	CIRCUIT BREAKER, C, 16 A, 2 NO TYPE: S 272-C 16 VOLTAGE: 440 V AC / 125 V DC CONTACTS: 2 NO CURRENT: 16 A CHARACTERISTIC: C		
612	0612		619092-05-04	2.000	EA	AUX. SWITCH FOR CIRCUIT BREAKER TYPE: S 2C-H11 L CONTACTS: 1 NO AND 1 NC PERMANENT CURRENT: 5 A		
615	0615		619088-02-18-02	60.000	EA	FUSE TERMINAL,GREY,4QMM,UK 5-HESI TYPE: UK 5-HESI 6.3 AMPERE 500 V INTERNATIONAL APPROBATIONS: UL ; CSA ; GL ; GOST-R (RUSSIA)		
616	0616		619092-14-22-02	30.000	EA	FUSE, GLASS, TUBE 4A MIDDLE 5 X 20MM, 250 VAC		
617	0617		619092-14-14-02	50.000	EA	FUSE GLASS-TUBE 5 x 20 mm, MIDDLE 250 V AC 0.63 A		
650	0650		619041-18-02-01	1.000	EA	AC AXIAL FAN, TYPE: 4656 N.		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						NOM. VOLT: 230 V / 50 Hz. POWER INPUT: 19 W. AIR FLOW: 160 m3/h. NOISE LEVEL: 47 dB(A). NOM. SPEED: 2650 RPM. TEMP.: -40°C / +85°C. W X H X D: 119 X 119 X 38 mm.		
651	0651		619041-18-99-02	1.000	EA	VENTILATOR, BARRIER GRID LZ 60, 119 X 119 MM		
652	0653		619044-01-08-02	2.000	EA	ENCL. INTERNAL THERMOSTAT, 5 - 55°C SET. RANGE: +5°C / +55°C OPER. VOLT.: 230/115/60/48/24 V (AC), 60/48/24 V (DC). BI-METAL SENSOR AS A TEMPERATURESENSITIVE ELEMENT WITH THERMAL FEEDBACK. CONTACT POPULATION: SINGLE-PIN CHANGE-OVER CONTACT AS A QUICK-BREAK CONTACT. W X H X D: 71 X 71 X 33.5 mm APPROVALS: CE, CUL, UL & VDE		
654	0654		619038-01-73	1.000	EA	HEATER, ENCLOSURE, 110 - 240 V, 50 W W. SPECIAL CONN. CABLE: 3000 mm LG. OPER. VOLT.: 110 - 240 V AC/DC CONT. THERMAL OUTPUT AT 20°C: 50 W PRE-FUSE: 4 A ; PROTECTION: IP 40 HOUSING: BLACK ANODISED ALU. TEMP.: MAX. +65°C +/-5°C W X H X D: 64 X 185 X 54 mm APPROVALS: VDE, UL, CUL & CE CONF.		
660	0660		619095-11-42-01	1.000	EA	MANAGED INDUSTRIAL ETHERNET SWITCH LAYER 2 SWITCH WITH SOFTWARE ENHANCED, ETHERNET (10 MBIT/S) AND FAST ETHERNET (100 MBIT/S). TYPE: RS20-1600T1T1SDAEHH01.0.		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						PORT TYPE & QTY.: 16 X 10/100BASE-TX, TP CABLE, RJ45 SOCKETS, AUTO- CROSSING, AUTO-NEGOTIATION, AUTO-POLARITY. OPER. VOLT.: 24 V DC DIAGNOSTICS: LED MTBF: 23.4 YEARS; MIL-HDBK 217F: GB 25°C MOUNTING: DIN RAIL 35 mm W X H X D: 110 X 131 X 111 mm APPR.: CUL 508, CUL 1604 & GER. LLOYD.		
661	0661		619095-11-34-01	1.000	EA	AUTO-CONFIGURATION ADAPTER, ACA 21-USB SAVES 2 DIFFERENT VERSIONS OF CONFIGURATION DATAS AND OPERATING SOFTWARE FROM THE CONNECTED SWITCH. IT ENABLES MANAGED SWITCHED TO BE EASILY COMISSIONED & QUICKLY REPLACED. MOUNTING: PLUG-IN MODULE LENGTH: 20 cm. APPR.: CUL 508, CUL 1604, CUL 60950 & GER. LLOYD.		
700	0700		619087-02-02-04	300.000	ME	WIRE, FLEX. H05Z-K, 0.5 mm2, ORANGE HALOGEN-FREE SINGLE CORE , FLEXIBLE NOM. VOLT.: 300 / 500 V TEMP.: -40°C / +110°C ; OD: 1.9 mm FINE WIRE STRANDS, CORE INSULATION OF HALOGEN-FREE SPECIAL COMPOUND, FLAME RETARDANCE IN ACC. TO IEC 60332.1 UP TO IEC 60332.3. APPROBATIONEN: VDE 0282 PART 9 / HD 22.9 S1		
701	0701		619087-02-06-02	30.000	ME	WIRE, FLEX. H07Z-K, 2.5 mm2, BLACK HALOGEN-FREE SINGLE CORE , FLEXIBLE NOM. VOLT.: 450 / 750 V		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						TEMP.: -40°C / +110°C ; OD: 3.8 mm FINE WIRE STRANDS, CORE INSULATION OF HALOGEN-FREE SPECIAL COMPOUND, FLAME RETARDANCE IN ACC. TO IEC 60332.1 UP TO IEC 60332.3. APPROVAL: VDE 0282 PART 9 / HD 22.9 S1		
702	0702		619087-02-06-31	70.000	ME	WIRE, FLEX. H07Z-K, 1.5 mm2, ORANGE HALOGEN-FREE SINGLE CORE , FLEXIBLE NOM. VOLT.: 450 / 750 V TEMP.: -40°C / +110°C ; OD: 3.5 mm FINE WIRE STRANDS, CORE INSULATION OF HALOGEN-FREE SPECIAL COMPOUND, FLAME RETARDANCE IN ACC. TO IEC 60332.1 UP TO IEC 60332.3. APPROVAL: VDE 0282 PART 9 / HD 22.9 S1		
703	0703		619087-02-03-01	100.000	ME	WIRE, FLEX. H07Z-K, 1.5 mm2, GN/YE HALOGEN-FREE SINGLE CORE , FLEXIBLE NOM. VOLT.: 450 / 750 V TEMP.: -40°C / +110°C ; OD: 3.5 mm FINE WIRE STRANDS, CORE INSULATION OF HALOGEN-FREE SPECIAL COMPOUND, FLAME RETARDANCE IN ACC. TO IEC 60332.1 UP TO IEC 60332.3. APPROVAL: VDE 0282 PART 9 / HD 22.9 S1		
704	0704		619087-02-05-01	20.000	ME	WIRE, FLEX. H07Z-K, 6.0 mm2, GN/YE HALOGEN-FREE SINGLE CORE , FLEXIBLE NOM. VOLT.: 450 / 750 V TEMP.: -40°C / +110°C ; OD: 5.4 mm FINE WIRE STRANDS, CORE		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						INSULATION OF HALOGEN-FREE SPECIAL COMPOUND, FLAME RETARDANCE IN ACC. TO IEC 60332.1 UP TO IEC 60332.3. APPROVAL: VDE 0282 PART 9 / HD 22.9 S1		
705	0705		619087-02-07-01	100.000	ME	WIRE, FLEX. X07V-K, 1.5 mm2, YE/BK NOM. VOLT.: 450 / 750 V CROSS SECTION: 1 X 1.5 mm2 TEMP.: -30°C / +80°C ; OD: 3.0 mm COLOUR: YELLOW / BLACK		
706	0706		619087-02-07-02	100.000	ME	WIRE, FLEX. X07V-K, 6.0 mm2, YE/BK NOM. VOLT.: 450 / 750 V CROSS SECTION: 1 X 6.0 mm2 TEMP.: -30°C / +80°C ; OD: 4.9 mm COLOUR: YELLOW / BLACK		
710	0710		619084-10-05-01	100.000	EA	CABLE END-SLEEVE, 2.5 MM2, GREY DESIGN: NORMAL CROSS SECTION: 2.5 MM2 LENGTH: 14.5 MM ; COLOR: GRAY		
711	0711		619084-10-01-01	200.000	EA	CABLE, END-SLEEVE, 1.5 MM2, BLACK PRE-INSULATED CROSS SECTION: 1.5 MM2 LENGTH: 13.5 MM ; COLOUR: BLACK MATERIAL: COPPER , TIN PLATED		
712	0712		619084-10-02-01	200.000	EA	CABLE, END-SLEEVE, 0.5 MM2, WHITE PRE-INSULATED CROSS SECTION: 0.5 MM2 LENGTH: 13 MM ; COLOUR: WHITE MATERIAL: COPPER , TIN PLATED		
713	0713		619084-10-18	100.000	EA	CABLE, END-SLEEVE, 2X1.5 MM2, 16 MM TWIN CABLE END-SLEEVE PRE-INSULATED CROSS SECTION: 2 X 1.5 MM2 LENGTH: 16 MM ; COLOUR: BLACK		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						MATERIAL: COPPER , TIN PLATED		
714	0714		619084-01-04-07	10.000	EA	CABLE EYE, M6, 4 - 6 QMM, YELLOW SOLDERLESS TERMINALS DIN 46237 MATERIAL: E-CU TIN PLATED INSULATION SLEEVE: PA RING TYPE CROSS SECTION: 4 - 6 QMM SCREW DIAMETER: M 6 COLOUR: YELLOW		
720	0720		619084-06-73	1.000	EA	CABLE DUCT, 63 X 19 X 2000 MM, PVC (H X W X L): 63 X 19 X 2000 MM MATERIAL: PVC COLOUR: RAL 7030 GREY		
721	0721		619084-06-75	2.000	EA	CABLE DUCT, 65 X 46 X 2000 MM, PVC (H X W X L): 65 X 46 X 2000 MM MATERIAL: PVC COLOUR: RAL 7030 GREY		
726	0726		619084-04-43	300.000	EA	CABLE TIE,L=186MM, W=4.8MMM NYLON NATURAL, BLACK		
727	0727		619088-36-04-01	1.000	EA	COVER PROFILE, AP 2, PVC, TRANSPARENT W X H X L: 60 X 33 X 1000 MM ; TEMP.: -15°C / +65°C FOR COVERING TERMINAL STRIPS, SNAPS ONTO COVER PROFILE CARRIER AP 2-TU PN 619088-36-04-02, CAN BE MARKED WITH INSERT STRIP AP-ES.		
728	0728		619088-36-04-02	6.000	EA	COVER PROFILE CARRIER, AP 2-TU W X H X L: 60 X 68.5 X 1000 MM MATERIAL: PA , GREY INFLAMMABI. CLASS ACC. TO UL 94: V2 FOR MOUNTING ON MOUNTING RAIL, FOR FIXING THE COVER PROFILE AP, 2 MM THICK		
729	0729		619085-23-07	20.000	EA	HEX SPACER BOLT, M6 X 40, FEM./MALE MATERIAL: STEEL ZINC-PLATED		
750	0750		619088-36-03-01	500.000	EA	TM-I MULTICARD, WHITE		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						TYPE: TM-I 20 NEUTRAL TEMP.: -40°C / +100°C COLOUR: WHITE MATERIAL: POLYAMIDE FIRE PROTECTION CLASS UL 94: V2 MARKING SYSTEM POSSIBLE: PLOTTER, SMARK-LASER, MC-MOBILO		
751	0751		619088-03-00-15	500.000	EA	WIRE HULL, 0.75 - 6.0 MM2 TYPE: PT SLIM 1-20 CROSS SECTION: 0.75 - 6.0 MM2 OD.: 2.5 - 5.0 MM X 21 MM LG. TEMP.: -30°C / +60°C COLOUR: TRANSPARENT MATERIAL: PVC FIRE PROTECTION CLASS UL 94: V2 MARKING SYSTEM POSSIBLE: TAG MOUNTING TIP: TM-I, PF AND X-CARD		
780	0780		619084-13-01	4.000	EA	VCI 105 CORROSION-INHIBITOR PAD 20 x 50,8 mm 140 lt 2 YEARS STEEL,BRASS;CU,Al YELLOW		
800	0820	C03	619046-43-64-01	1.000	EA	TAG, NEW LOGO (52 X 90)		
801	0801	A01	222740-00-62	1.000	EA	COMPANY TAG "50 X 100" (ONLY TO GLUE) "CAMERON CONTROLS"		
>>>B/M Category : Engrg Spec/Document item								
	0910	01	SK-066022-33	1.000	EA	AS: PLC CABINET PHPU TOTAL K5F		
	0911	02	SK-066022-33-04	1.000	EA	CD: PLC CABINET PHPU TOTAL K5F		
	0913	03	X-065404-02-09	1.000	EA	FAT - HPU PLC CABINET / TOTAL K5F		
903	0901	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
904	0902	01	D-000200-27	1.000	EA	PART IDENT: LOW STRESS STAMP, SAP SHORT DESCRIPTION, ASSY P/N, REV, MFG ID, S/N Note: SAP SHORT DESCRIPTION: If test is too long, text should be abbreviated usefully! Refer document X-043764-01		

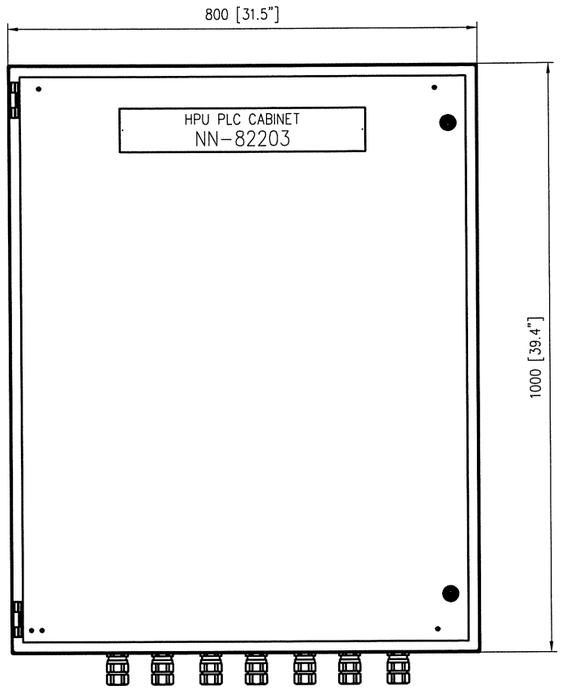
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						for further instructions!		
>>>B/M Category : Optional item								
1000	1000	02	223022-33-00-99	1.000	EA	SPARE PARTS FOR CONTROL CABINET HPU TOTAL K5F		
>>>B/M Category : Reference Call Outs								
	0912	01	X-065397-01-02	1.000	EA	IP: FOR HPU PLC CABINET - TOTAL K5F INSTALLATION PROCEDURE FOR PLC CABINET, PART OF HPU PN.223011-31		

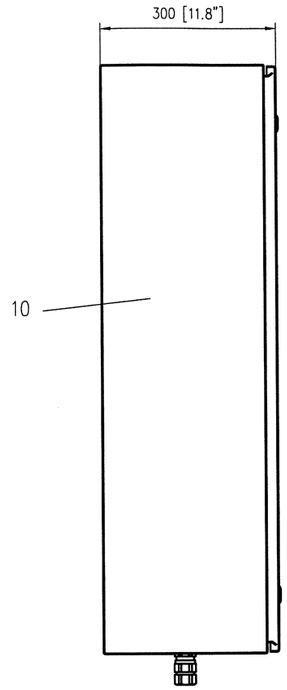
STATUS: Released REVISION : 02
DATE PRINTED : 06/12/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SPARE PARTS FOR CONTROL CABINET HPU
TOTAL K5F

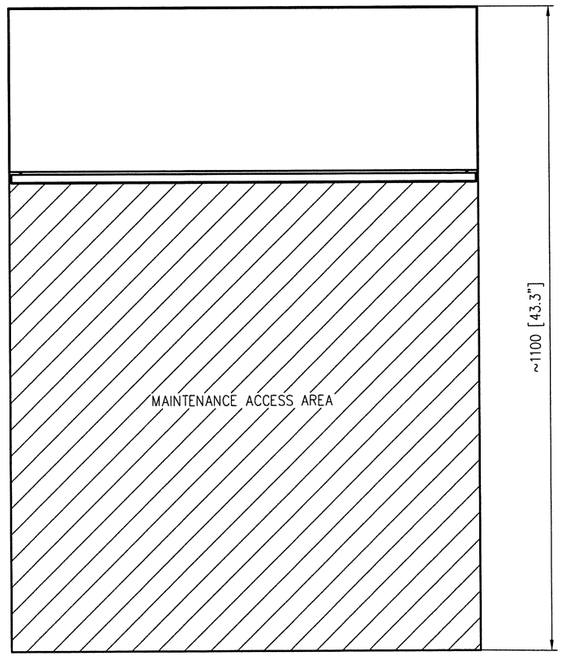
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
050	0050		619091-01-50-10	1.000	EA	POWER SUPPLY, 24 V DC, 10 A PRIMARY SWITCHED-MODE, 1-phase TYPE: QUINT-PS-100-240AC/24DC/10 NOM. INPUT VOLT.: 100 - 240 V AC NOM. OUTPUT VOLT.: 24 V DC +/- 1 % OUTPUT CURRENT: 10 A (UP TO 60°C) FREQUENCY: 45 / 65 Hz PROTECTION: IP 20 AMB. TEMP.: -25°C / +70°C W x H x D: 85 x 130 x 130000 mm APPROVAL: UL & GL		
051	0051		619091-03-14	1.000	EA	CONVERTER, FIBER OPTIC, 24 V DC TYPE: FL MC 10/100 BASE-T/FO G1300ST NOM. SUPPLY VOLT.: 24 V DC +/- 20%. CURRENT CONSUMPTION: MAX. 95 mA. ELEC. ISOLATION: 10/100Base-T // SUPPLY. PROTECTION: IP 20. TEMP.: 0°C / +55°C. HOUSING: PA V0 , GREEN. L X H X W: 99 X 122 X 22.5 mm. FOR CONVERTING 10/100 BASE-T(X) TO MULTIMODE GLASS FIBER (1300 mm), B-FOC (ST) FO CONNECTION, RAIL-MOUNTABLE. CONFORMANCE WITH EMC DIRECTIVE 89/336/EEC.		
300	0300	01	2711927-02-01	1.000	EA	MODULE, CPU, 315-2 PN/DP, 256 KB RAM, CPU WITH PROFIBUS-DP/MPI AND PROFINET		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						INTERFACES, 24VDC, TYPICAL POWER DISSIPATION: 3.5W, IP20, OPERATING TEMP: 0 TO 60DEGC, MICRO MEMORY CARD REQUIRED, HAZARDOUS AREA AND CE CERTIFICATION REQUIRED		
301	0301		2761883-02	1.000	EA	SIMATIC S7, MICRO MEMORY CARD, 64KB		
302	0302		619095-05-46	1.000	EA	SIMATIC S7, DIGITAL INPUT SM 326 24 DI ; DC 24 V, 40 PIN, FAILSAFE DIGITAL INPUTS FOR SIMATIC S7F SYSTEMS, WITH DIAGNOST. INTERRUPT.		
303	0303		619095-06-33	1.000	EA	DIGITAL OUTPUT, SM 322, 16 DO, 24 V FOR THE SIMATIC S7-300 OPTICALLY ISOLATED 16 DO DC 24 V, 0.5 A (1 X 16 DO) SHORT-CIRCUIT PROTECTION DIAGNOSTICS 40 PIN		
304	0304		619095-04-20	1.000	EA	S7-300,AI,SM 331,8X(4...20)MA VOLTAGE: DC 24V, MAX.: 20 MA 8 INPUTS		
609	0609		619092-01-41-06	1.000	EA	CIRCUIT BREAKER, C, 6 A, 2 NO TYPE: S 272-C 6		
610	0610		619092-01-41-10	1.000	EA	CIRCUIT BREAKER, C, 10 A, 2 NO TYPE: S 202 M-C 10 VOLTAGE: 440 V AC / 125 V DC CONTACTS: 2 NO CURRENT: 10 A CHARACTERISTIC: C		
611	0611		619092-01-41-16	1.000	EA	CIRCUIT BREAKER, C, 16 A, 2 NO TYPE: S 272-C 16 VOLTAGE: 440 V AC / 125 V DC CONTACTS: 2 NO CURRENT: 16 A CHARACTERISTIC: C		
612	0612		619092-05-04	2.000	EA	AUX. SWITCH FOR CIRCUIT BREAKER TYPE: S 2C-H11 L CONTACTS: 1 NO AND 1 NC PERMANENT CURRENT: 5 A		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
616	0616		619092-14-22-02	10.000	EA	FUSE, GLASS, TUBE 4A MIDDLE 5 X 20MM, 250 VAC		
617	0617		619092-14-14-02	20.000	EA	FUSE GLASS-TUBE 5 x 20 mm, MIDDLE 250 V AC 0.63 A		
652	0653		619044-01-08-02	2.000	EA	ENCL. INTERNAL THERMOSTAT, 5 - 55°C SET. RANGE: +5°C / +55°C OPER. VOLT.: 230/115/60/48/24 V (AC), 60/48/24 V (DC). BI-METAL SENSOR AS A TEMPERATURESENSITIVE ELEMENT WITH THERMAL FEEDBACK. CONTACT POPULATION: SINGLE-PIN CHANGE-OVER CONTACT AS A QUICK-BREAK CONTACT. W X H X D: 71 X 71 X 33.5 mm APPROVALS: CE, CUL, UL & VDE		
654	0654		619038-01-73	1.000	EA	HEATER, ENCLOSURE, 110 - 240 V, 50 W W. SPECIAL CONN. CABLE: 3000 mm LG. OPER. VOLT.: 110 - 240 V AC/DC CONT. THERMAL OUTPUT AT 20°C: 50 W PRE-FUSE: 4 A ; PROTECTION: IP 40 HOUSING: BLACK ANODISED ALU. TEMP.: MAX. +65°C +/-5°C W X H X D: 64 X 185 X 54 mm APPROVALS: VDE, UL, CUL & CE CONF.		
780	0780		619084-13-01	8.000	EA	VCI 105 CORROSION-INHIBITOR PAD 20 x 50,8 mm 140 lt 2 YEARS STEEL,BRASS;CU,Al YELLOW		







NOTES:

MAX. STORAGE/OPERATION HUMIDITY 95% NOT CONDENSED
MAX. STORAGE TEMPERATURE: -20°C TO 60°C.
MAX. OPERATION TEMPERATURE: -5°C TO 40°C.
TYPE RITTAL COMPACT CABINET AE, MATERIAL SST 1.4301.
CABLE GLANDS NOT IN SCOPE OF SUPPLY. TO BE PROVIDED BY OTHERS.

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

1 SET TO STATUS "APPROVED FOR CONSTRUCTION"

REASON FOR ISSUE	DATE	CLIENT REV.
APPROVED FOR CONSTRUCTION	21SEP07	1
ISSUED FOR CLIENT COMMENT	04SEP07	N/A
ISSUED FOR INTERNAL IDC	25JUL07	N/A

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-73-500

CAD

REV. BY: A. Weilandt | DATE: 23.03.2007 | REV.: 01

TOLERANCES ACCORDING TO DIN ISO 8015
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

SURFACE TREATMENT
MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN:	A. Weilandt	DATE: 23.03.2007
CHECKED:	A. Voges	DATE: 21.09.2007
APPROVED:	M. Longenstrass	DATE: 21.09.2007

EST. WEIGHT: 80.000 KG | SUPERSEDES: | SCALE: 1:5

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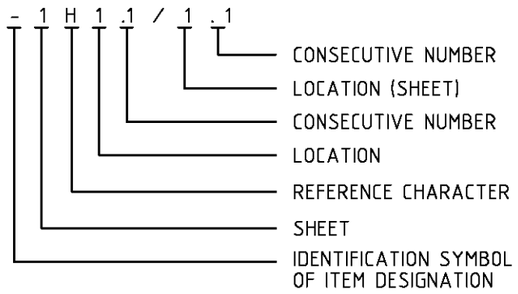
29227 Celle, Germany

GENERAL ARRANGEMENT DRAWING
PLC CABINET

INITIAL USE BOM: 223022-33 | SHEET: 1 OF 1 | DRAWING NUMBER: SK-066022-33

STATUS: APPROVED

SHEET	DESIGNATION	ITEM DESIGNATION
1	POWER SUPPLY, HEATER, VENTILATION 24V DC	
2-4	PLC/COMMUNICATION LINK	
5-10	DIGITAL INPUTS	
11-14	DIGITAL OUTPUTS	
15	ANALOG INPUTS	



STANDARDS:
-ALL INSTALLATION SHALL BE IN ACCORDANCE WITH VDE 0100.
-ALL ELECTRIC SYMBOLS SHALL BE IN ACCORDANCE WITH IEC 617.

NOTES:
-SEPARATE LAYING OF POWER AND SIGNAL CABLES AND WIRING.
-ALL WIRING HAS TO BE MARKED WITH CABLE MARKERS ON EVERY CONNECTION.
-ALL -X10 AND -X20 TERMINALS SHALL BE LOOPED (24V DC).
-ALL -X11 AND -X21 TERMINALS SHALL BE LOOPED (0V DC).
-ALL RE-TERMINALS SHALL BE MADE UP WITH YELLOW/GREEN WIRES TO THE MAIN PROTECTIVE EARTH BAR.
-ALL IE-CONNECTIONS SHALL BE MADE UP WITH YELLOW/BLACK WIRES TO THE MAIN INSTRUMENT EARTH BAR.
-ALL IPE-CONNECTIONS SHALL BE MADE UP WITH YELLOW/GREEN WIRES TO THE MAIN INSTRUMENT PROTECTIVE EARTH BAR.
-CABLE SPLICING SHOULD BE AVOIDED.
-CABLE GLANDS FOR INTERCONNECTION CABLES HAVE TO BE INSTALLED DURING INSTALLATION (NO CUT OUTS PROVIDED).
-CABLE GLANDS NOT IN SCOPE OF SUPPLY.
-ALL METAL COMPONENTS (MOTOR HOUSINGS, CABLE TRAYS, J-BOXES, CABINETS, DOORS ENCLOSURE, ...) WHICH CARRY COMPONENTS WITH VOLTAGES 50V AC /120V DC OR HIGHER MUST BE GROUNDED TO THE CONSTRUCTION (EARTH) WITH A COPPER CONDUCTOR. MINIMUM CROSS SECTION OF THE CONDUCTOR SHALL BE 6mm^2.

NOTES:
PE : YELLOW/GREEN
IPE : YELLOW
IE : RED
ISE : BLUE

CABINET TAG NO.: NN-82203

AS BUILT	07APR09	3
AS BUILT	29OCT07	2
APPROVED FOR CONSTRUCTION	13SEP07	1
ISSUED FOR CLIENT COMMENT	18JUL07	N/A
ISSUED FOR INTERNAL IDC	22MAY05	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production
Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-71-500

Created with ELCAD/AUCOPLAN (R) 7.4.0 SP1

STATUS: APPROVED

Rev	Change	Date	Created by	Checked by	Approved by
03	Minor Revision	07.04.2009	A. Siekmann	A. Voges	L. Budde
02	Minor Revision	29.10.2007	A. Siekmann	A. Voges	M. Langenstraß
01	Initial Release	13.09.2007	A. Siekmann	M. Langenstraß	A. Voges

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HPU PLC CABINET
Table of Contents

BOM NO.: 223022-33

Project/Customer: TOTAL / K5F

Document ID: SK-066022-33-04

Sheets: 1 of 1 Sh.

STATUS: APPROVED

L /2.A1
N /2.A1
PE /2.A1
24V /2.A1
0V /2.A1

-X10 16
-X10 17

-1F1 16A
-1F3 6A
-1F5.1 6A
-1F5.2 6A
-1F7.1 10A
-1F7.2 10A

-X2(54)
/8.D2
-X2(56)
/8.D3

-1X5 L N PE
SOCKET

-1T7 10A
L N
230V AC
PE
24V DC
0V
24V

-1M3
4 5 6

-1A4
6 5 3

-W7
2,5mm²

-1X1 1 2 PE
230V FROM UPS

-1X2 1 2

-1X3 1 2
-1R5
HEATER
230V/50W

Rev	Change	Date	Created by	Checked by	Approved by
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HPU PLC CABINET
Circuit diagram

BOM NO.: 223022-33
Project/Customer: TOTAL / K5F
Document ID: SK-066022-33-04
Sheets: 1 of 15 Sh.

STATUS: APPROVED

/1.A8 L
/1.A8 N
/1.A8 PE
/1.A8 24V
/1.A8 0V
/1.A8

-X10 15
-X11 15 15

-2A1

MCS SWITCH A-ExT
619095-11-42-01

PORT 1 PORT 2 PORT 3 PORT 4 PORT 5 PORT 6 PORT 7 PORT 8 PORT 9 PORT 10 PORT 11 PORT 12 PORT 13 PORT 14 PORT 15 PORT 16

X0.1 X0.2 X0.3 X0.4

PE M L+ M
24 VDC

SIEMENS
CPU 315-2 DP

MPI

1 PE
2 M
3 L+ DC 24V
4 M

MPI

-2A2

1 2 21 22 4 11 24 31
1L+ 1M 2L+ 2M VS1VS2VS3VS4

/5.B2
/5.B3
/5.B3
/5.B4
/5.B5
/5.B6

/5.B7
/5.B7
/6.B1
/6.B2
/6.B3
/6.B4

/6.B5
/6.B6
/6.B7
/6.B8
/7.B2
/7.B3

/7.B4
/7.B4
/7.B5
/7.B6
/7.B7
/7.B8

SM 326 24xDI 24VDC,FS

-2A3

1 2 21 22 4 11 24 31
1L+ 1M 2L+ 2M VS1VS2VS3VS4

/8.B2
/8.B3
/8.B3
/8.B4
/8.B4
/8.B5
/8.B6

/8.B7
/8.B8
/9.B2
/9.B3
/9.B4
/9.B4

/9.B5
/9.B6
/9.B7
/9.B8
/10.B2
/10.B3

/10.B4
/10.B4
/10.B5
/10.B6
/10.B7
/10.B8

24xDI 24VDC,FS

-2A4

-2A5

FO-CONVERTER
10/100MBit

US1+ GND

1 2 3 6
RD TD

-W304

FIBRE OPTIC TO MCS A

-2A6

FO-CONVERTER
10/100MBit

US1+ GND

1 2 3 6
RD TD

-W305

FIBRE OPTIC TO MCS B

CAT5 PATCH CABLE

/3.A1 L
/3.A1 N
/3.A1 PE
/3.A1 24V
/3.A1 0V
/3.A1

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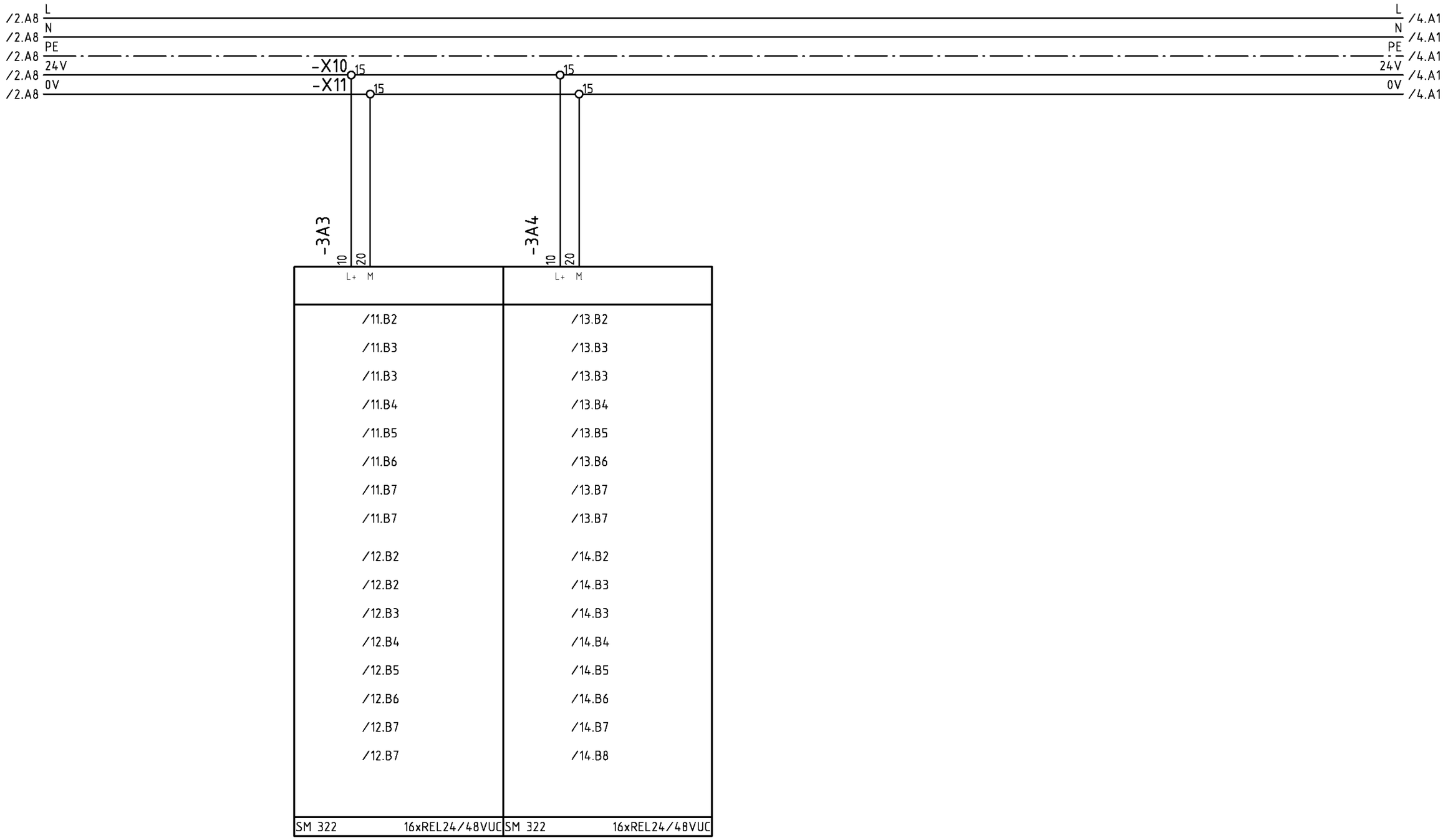
HPU PLC CABINET
Circuit diagram

BOM NO.: 223022-33
Project/Customer: TOTAL / K5F
Document ID: SK-066022-33-04
Sheets: 2 of 15 Sh.



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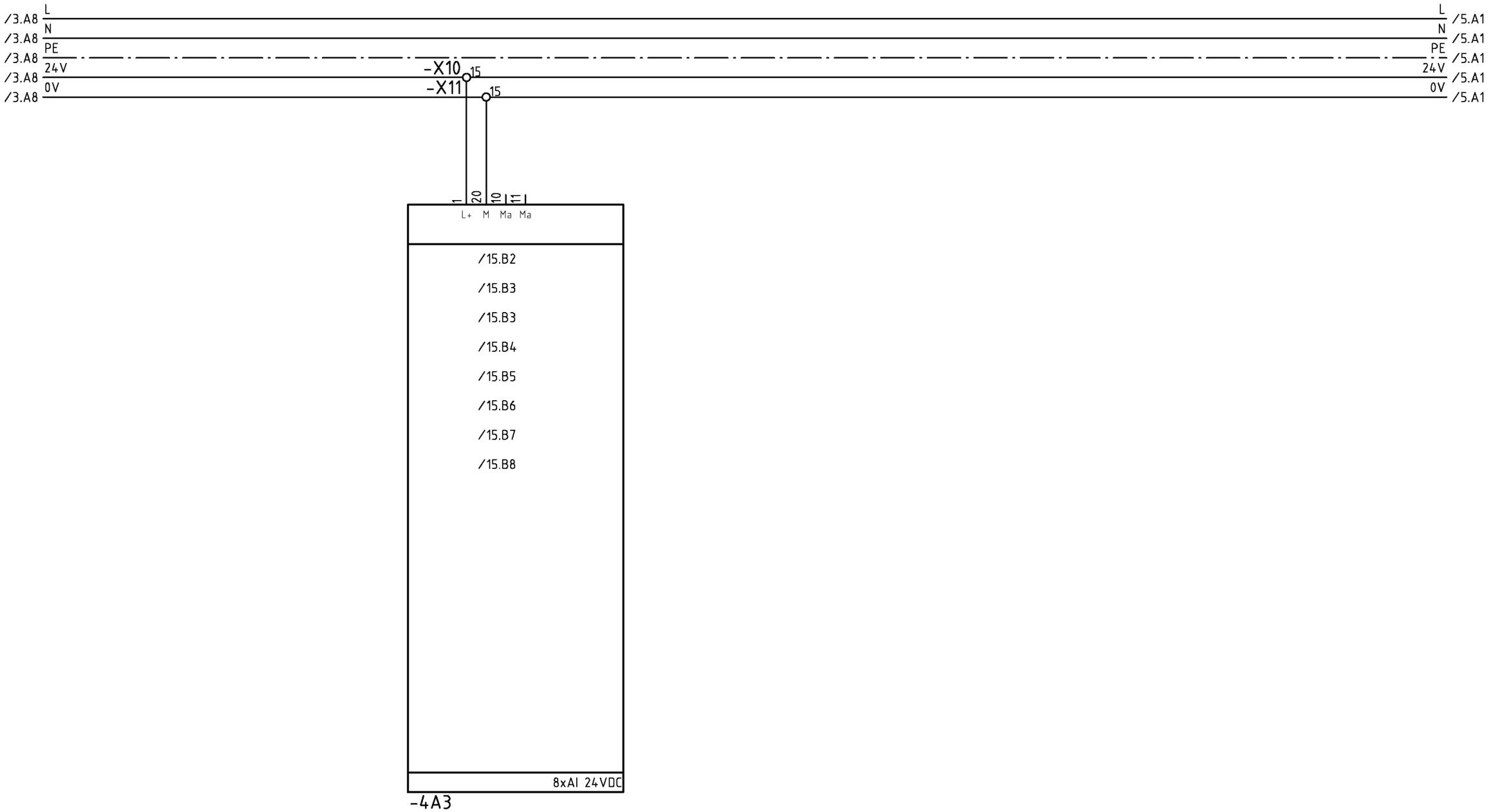
HPU PLC CABINET
Circuit diagram

BOM NO.: 223022-33
Project/Customer: TOTAL / K5F
Document ID: SK-066022-33-04
Sheets: 3 of 15 Sh.



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HPU PLC CABINET
Circuit diagram

BOM NO.: 223022-33
Project/Customer: TOTAL / K5F
Document ID: SK-066022-33-04
Sheets: 4 of 15 Sh.

/4.A8 L — L /6.A1
/4.A8 N — N /6.A1
/4.A8 PE — PE /6.A1
/4.A8 24V — 24V /6.A1
/4.A8 0V — 0V /6.A1

-X10 3

-2A3 /2.B4 SM 326 DI	-2A3 /2.B4 SM 326 DI	-2A3 /2.B4 SM 326 DI	-2A3 /2.B4 SM 326 DI	-2A3 /2.B4 SM 326 DI	-2A3 /2.B4 SM 326 DI	-2A3 /2.B4 SM 326 DI	-2A3 /2.B4 SM 326 DI
5	6	7	8	9	10	12	13
-5F2	-5F3	-5F4	-5F5.1	-5F5.2	-5F6	-5F7	-5F8
630mA	630mA	630mA	630mA	630mA	630mA	630mA	630mA

-X2: 1 2 E 3 4 E 5 6 E 7 8 E 9 10 E 11 12 E 13 14 E 15 16 E PE

PLC CABINET
HPU BOX
-W306

-X22.5: 1 2 E 3 4 E 5 6 E 7 8 E 9 10 E 11 12 E 13 14 E 15 16 E

GX82840A			GX82840B				GX82841
HP PUMP1 DUTY	HP PUMP1 AUTO	HP PUMP1 OFF/ALARM	HP PUMP2 DUTY	HP PUMP2 AUTO	HP PUMP2 OFF/ALARM	ALARM ACCEPT	CIRCULATION PUMP ON

HPU BOX 5 (SK-066011-32-04, PAGE5+6)

Rev	Change	Date	Created by	Checked by	Approved by
03	Minor Revision	07.04.2009	A. Siekmann	A. Voges	L. Budde
02	Minor Revision	29.10.2007	A. Siekmann	A. Voges	M. Langenstraß
01	Initial Release	13.09.2007	A. Siekmann	M. Langenstraß	A. Voges

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HPU PLC CABINET
Circuit diagram

BOM NO.: 223022-33
Project/Customer: TOTAL / K5F
Document ID: SK-066022-33-04
Sheets: 5 of 15 Sh.

STATUS: APPROVED

/5.A8 L — L /7.A1
/5.A8 N — N /7.A1
/5.A8 PE — PE /7.A1
/5.A8 24V — 24V /7.A1
/5.A8 0V — 0V /7.A1

	-2A3 /2.B4	SM 326	DI			
14	-6F2	630mA		GX82841 CIRCULATION PUMP OFF		
15	-6F3	630mA		SPARE		
16	-6F4	630mA		SPARE		
17	-6F5.1	630mA		LAMP TEST		
25	-6F5.2	630mA		STARTUP OVERRIDE		
26	-6F6	630mA		LOCAL REMOTE		
27	-6F7	630mA		PDZH840A HP1 FILTER BLOCKED		
28	-6F8	630mA		PDZH840B HP2 FILTER BLOCKED		

-X2: 17 18 E 19 20 E 21 22 E 23 24 E 25 26 E 27 28 E 29 30 E 31 32 E 33 34 E 35 36 E

PLC CABINET
HPU BOX -W306

-X22.5: 17 18 E 19 20 E 21 22 E 23 24 E 25 26 E 27 28 E 29 30 E 31 32 E 33 34 E 35 36 E

HPU BOX 5 (SK-066011-32-04, PAGE6+7)

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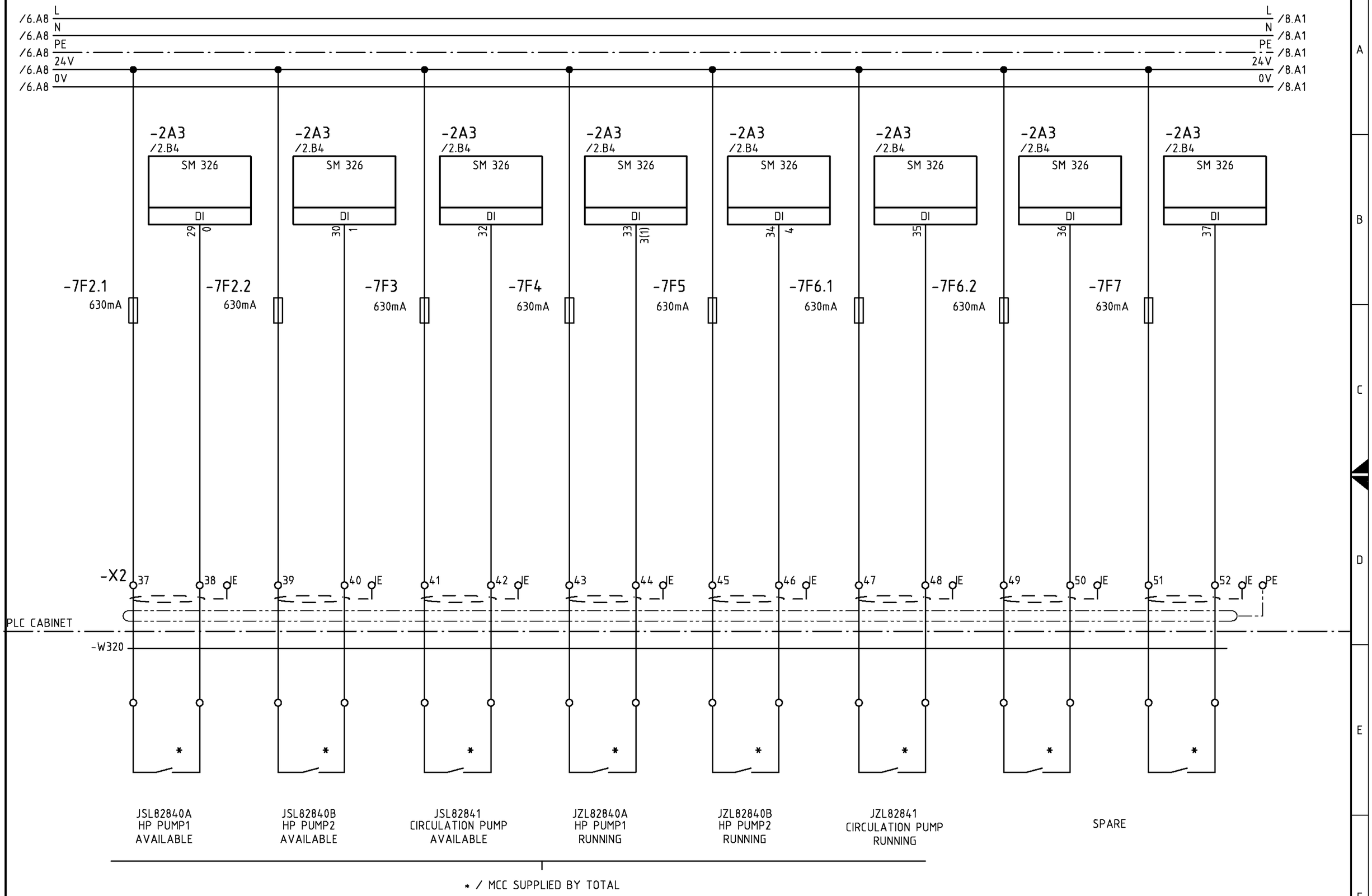
HPU PLC CABINET
Circuit diagram

BOM NO.: 223022-33
Project/Customer: TOTAL / K5F
Document ID: SK-066022-33-04
Sheets: 6 of 15 Sh.



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HPU PLC CABINET
Circuit diagram

BOM NO.: 223022-33
Project/Customer: TOTAL / K5F
Document ID: SK-066022-33-04
Sheets: 7 of 15 Sh.

STATUS: APPROVED

/7.A8 L — L /9.A1
/7.A8 N — N /9.A1
/7.A8 PE — PE /9.A1
/7.A8 24V — 24V /9.A1
/7.A8 0V — 0V /9.A1

	-2A4	-2A4	-2A4	-2A4	-2A4	-2A4	-2A4	-2A4
	/2.B5	/2.B5	/2.B5	/2.B5	/2.B5	/2.B5	/2.B5	/2.B5
	SM 326	SM 326	SM 326	SM 326	SM 326	SM 326	SM 326	SM 326
	DI	DI	DI	DI	DI	DI	DI	DI
	5	6	7	8	9	10	12	13
	-8F2.1 630mA	-8F2.2 630mA	-8F3 630mA	-8F4 630mA	-8F5 630mA	-8F6.1 630mA	-8F6.2 630mA	-8F7 630mA
-X2	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
		-1F3(14) /1.C4		-1F5(14) /1.C5												

PLC CABINET

FAN FAULT

HEATER FAULT

SPARE

Rev	Change	Date	Created by	Checked by	Approved by
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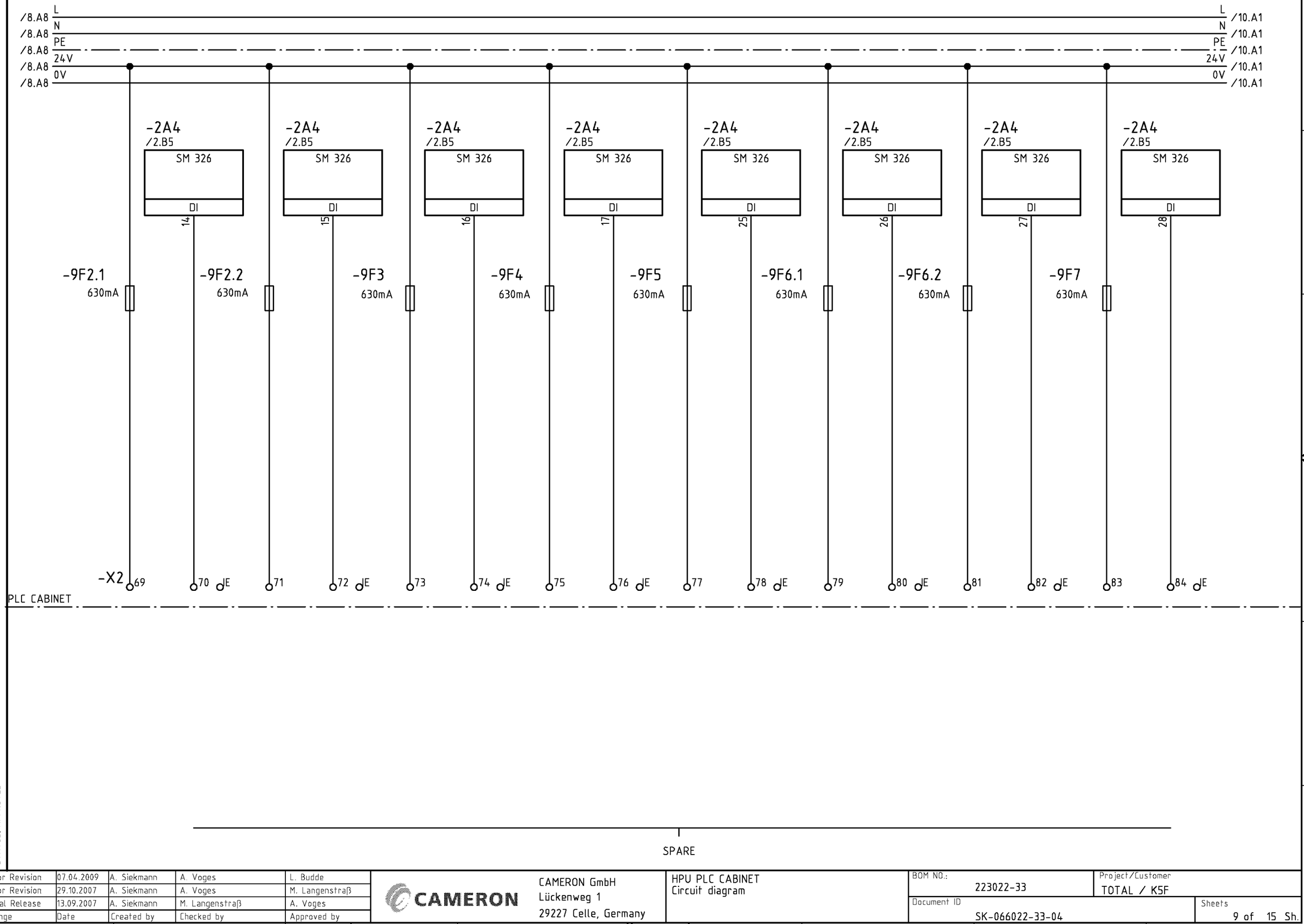
HPU PLC CABINET
Circuit diagram

BOM NO.: 223022-33

Project/Customer: TOTAL / K5F

Document ID: SK-066022-33-04

Sheets: 8 of 15 Sh.



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HPU PLC CABINET
Circuit diagram

BOM NO.: 223022-33
Project/Customer: TOTAL / K5F
Document ID: SK-066022-33-04
Sheets: 9 of 15 Sh.

/9.A8 L — L /11.A1
/9.A8 N — N /11.A1
/9.A8 PE — PE /11.A1
/9.A8 24V — 24V /11.A1
/9.A8 0V — 0V /11.A1

	-2A4 /2.B5	-10F	630mA	DI	
1	-2A4 /2.B5	-10F2.1	630mA	DI	29
2	-2A4 /2.B5	-10F2.2	630mA	DI	30
3	-2A4 /2.B5	-10F3	630mA	DI	32
4	-2A4 /2.B5	-10F4	630mA	DI	33
5	-2A4 /2.B5	-10F5	630mA	DI	34
6	-2A4 /2.B5	-10F6.1	630mA	DI	35
7	-2A4 /2.B5	-10F6.2	630mA	DI	36
8	-2A4 /2.B5	-10F7	630mA	DI	37

SM 326

-X2: 85, 86 E, 87, 88 E, 89, 90 E, 91, 92 E, 93, 94 E, 95, 96 E, 97, 98 E, 99, 100 E

PLC CABINET

SPARE

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HPU PLC CABINET
Circuit diagram

BOM NO.: 223022-33
Project/Customer: TOTAL / K5F
Document ID: SK-066022-33-04
Sheets: 10 of 15 Sh.

/10.A8 L
/10.A8 N
/10.A8 PE
/10.A8 24V
/10.A8 0V

L /12.A1
N /12.A1
PE /12.A1
24V /12.A1
0V /12.A1

-X10 4
-X11 3

-11F2
4A

-3A3 /3.B2 SM 322 DO L 2 3
-3A3 /3.B2 SM 322 DO L 4 5
-3A3 /3.B2 SM 322 DO L 6 7
-3A3 /3.B2 SM 322 DO L 8 9
-3A3 /3.B2 SM 322 DO L 12 13
-3A3 /3.B2 SM 322 DO L 14 15
-3A3 /3.B2 SM 322 DO L 16 17
-3A3 /3.B2 SM 322 DO L 18 19

-X3 1 2 E 3 4 E 5 6 E 7 8 E 9 10 E 11 12 E 13 14 E 15 16 E PE

PLC CABINET
HPU BOX

-W307

-X23.6 1 2 E 3 4 E 5 6 E 7 8 E 9 10 E 11 12 E 13 14 E 15 16 E

GX82840A
HP PUMP1 DUTY LAMP
HP PUMP1 AUTO LAMP
HP PUMP1 OFF/ALARM LAMP

GX82840B
HP PUMP2 DUTY LAMP
HP PUMP2 AUTO LAMP
HP PUMP2 OFF/ALARM LAMP

ALARM ACCEPT LAMP

GX82841
CIRCULATION PUMP ON LAMP

HPU BOX 6 (SK-066011-32-04, PAGE8+9)

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03	Minor Revision	07.04.2009	A. Siekmann	A. Voges	L. Budde
02	Minor Revision	29.10.2007	A. Siekmann	A. Voges	M. Langenstraß
01	Initial Release	13.09.2007	A. Siekmann	M. Langenstraß	A. Voges

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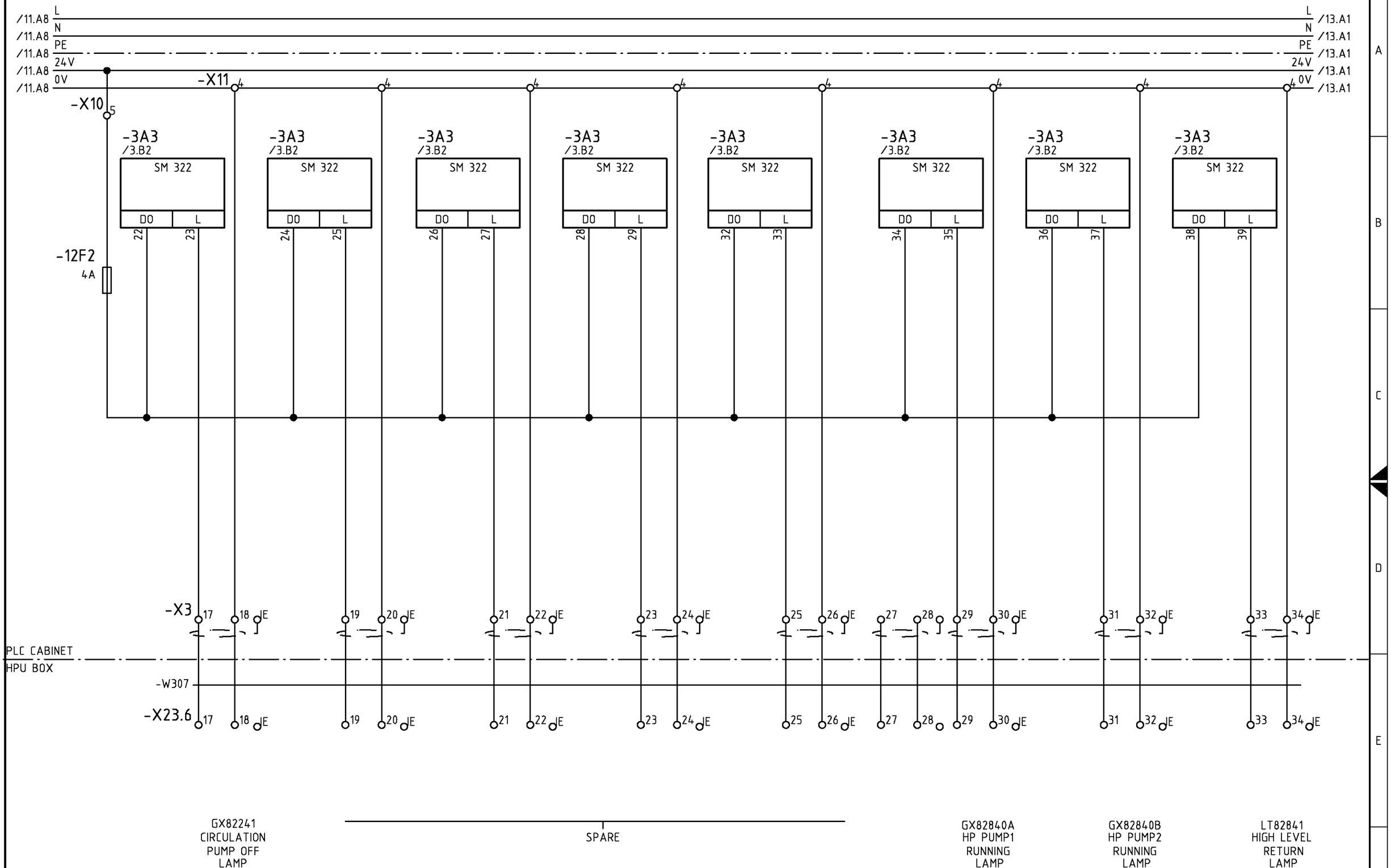
HPU PLC CABINET
Circuit diagram

BOM NO.: 223022-33
Project/Customer: TOTAL / K5F
Document ID: SK-066022-33-04
Sheets: 11 of 15 Sh.



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HPU PLC CABINET
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BOM NO.: 223022-33
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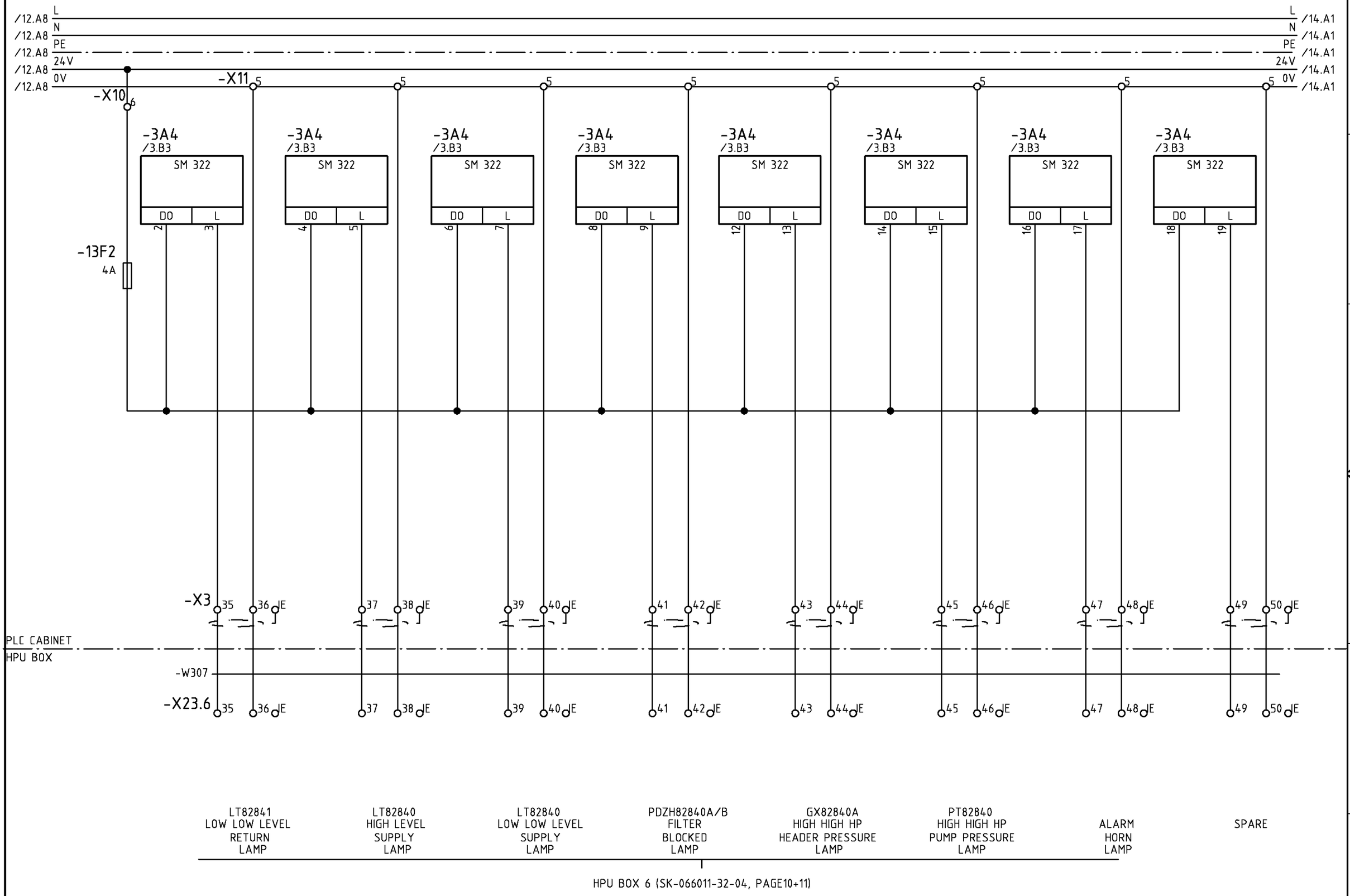
Sheets: 12 of 15 Sh.



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BOM NO.: 223022-33
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Sheets: 13 of 15 Sh.

/13.A8 L
/13.A8 N
/13.A8 PE
/13.A8 24V
/13.A8 0V

L /15.A1
N /15.A1
PE /15.A1
24V /15.A1
0V /15.A1

-X10 7 8 9 10 11 12 13 14

-3A4 /3.B3 SM 322 DO L — 22 23
-14F2 4A
-14F3.1 4A

-3A4 /3.B3 SM 322 DO L — 24 25
-14F3.2 4A

-3A4 /3.B3 SM 322 DO L — 26 27
-14F4 4A

-3A4 /3.B3 SM 322 DO L — 28 29
-14F5 4A

-3A4 /3.B3 SM 322 DO L — 32 33
-14F6 4A

-3A4 /3.B3 SM 322 DO L — 34 35
-14F7.1 4A

-3A4 /3.B3 SM 322 DO L — 36 37
-14F7.2 4A

-3A4 /3.B3 SM 322 DO L — 38 39

-X11 6 7 8 9 10 11 12 13

-X3 51 52 E | 53 54 E | 55 56 E | 57 58 E | 59 60 E RE | 61 62 E | 63 64 E | 65 66 E RE

PLC CABINET

-W307

-W321

-X23.6 51 52 E | 53 54 E | 55 56 E | 57 58 E | 59 60 E | 61 62 E | 63 64 E | 65 66 E

JRC82840A HP PUMP1 START REQUEST
JRC82840B HP PUMP2 START REQUEST
JRC82841 CIRCULATION PUMP START REQUEST

SPARE

MCC SUPPLIED BY TOTAL

Rev	Change	Date	Created by	Checked by	Approved by
03	Minor Revision	07.04.2009	A. Siekmann	A. Voges	L. Budde
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Project/Customer: TOTAL / K5F
Document ID: SK-066022-33-04
Sheets: 14 of 15 Sh.

STATUS: APPROVED

/14.A8 L — L
/14.A8 N — N
/14.A8 PE — PE
/14.A8 24V — 24V
/14.A8 0V — 0V

-4A3 /4.B3	M0+	M0-	M1+	M1-	M2+	M2-	M3+	M3-	M4+	M4-	M5+	M5-	M6+	M6-	M7+	M7-
SM 331	2	3	4	5	6	7	8	9	12	13	14	15	16	17	18	19

-X4: 1 2 E | 3 4 E | 5 6 E | 7 8 E RE | 9 10 E | 11 12 E | 13 14 E | 15 16 E

PLC CABINET
HPU BOX

-W308

-X25.1: 1 2 E | 3 4 E | 5 6 E | 7 8 E | 9 10 E | 11 12 E | 13 14 E | 15 16 E

LT82840 LEVEL TRANSMITTER SUPPLY RESERVOIR	LT82841 LEVEL TRANSMITTER RETURN RESERVOIR	PT82840 HP PUMP PRESSURE TRANSMITTER	PT82843 HP HEADER PRESSURE TRANSMITTER	SPARE

HPU BOX 2 (SK-066011-32-04, PAGE13)

Rev	Change	Date	Created by	Checked by	Approved by
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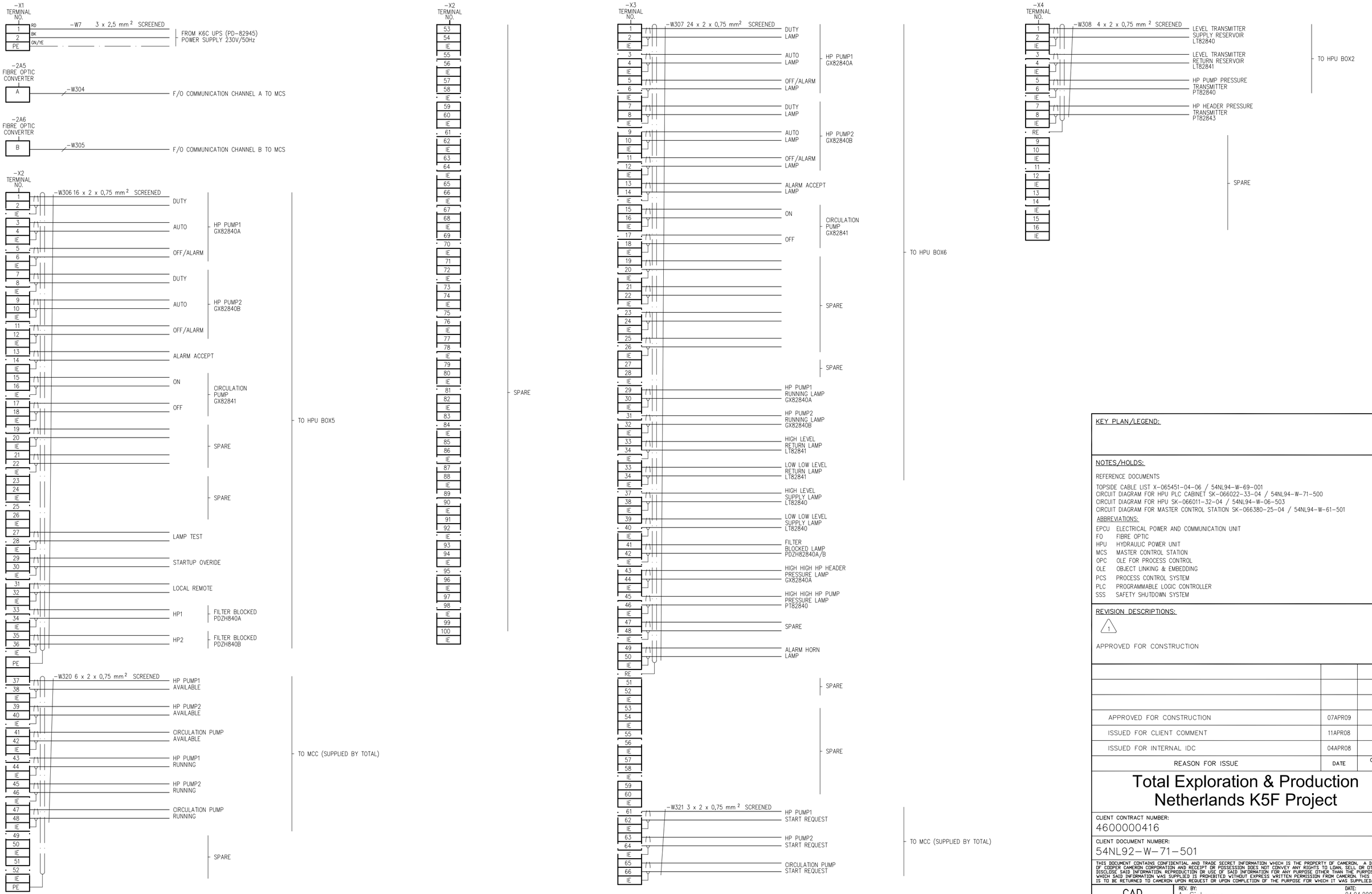

KEY PLAN/LEGEND:

NOTES/HOLDS:

REFERENCE DOCUMENTS

TOPSIDE CABLE LIST X-065451-04-06 / 54NL94-W-69-001
CIRCUIT DIAGRAM FOR HPU PLC CABINET SK-066022-33-04 / 54NL94-W-71-500
CIRCUIT DIAGRAM FOR HPU SK-066011-32-04 / 54NL94-W-06-503
CIRCUIT DIAGRAM FOR MASTER CONTROL STATION SK-066380-25-04 / 54NL94-W-61-501

ABBREVIATIONS:

EPCU	ELECTRICAL POWER AND COMMUNICATION UNIT
FO	FIBRE OPTIC
HPU	HYDRAULIC POWER UNIT
MCS	MASTER CONTROL STATION
OPC	OLE FOR PROCESS CONTROL
OLE	OBJECT LINKING & EMBEDDING
PCS	PROCESS CONTROL SYSTEM
PLC	PROGRAMMABLE LOGIC CONTROLLER
SSS	SAFETY SHUTDOWN SYSTEM

REVISION DESCRIPTIONS:

1 APPROVED FOR CONSTRUCTION

REASON FOR ISSUE	DATE	CLIENT REV.
APPROVED FOR CONSTRUCTION	07APR09	1
ISSUED FOR CLIENT COMMENT	11APR08	N/A
ISSUED FOR INTERNAL IDC	04APR08	N/A

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-71-501

CAD

REV. BY: A. Siekmann | DATE: 04.04.2008 | REV.: 01

TOLERANCES ACCORDING TO DIN ISO 8015

GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219

TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

SURFACE TREATMENT

MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN:	A. Siekmann	DATE: 04.04.2008
CHECKED:	A. Voges	DATE: 08.04.2009
APPROVED:	L. Budde	DATE: 08.04.2009

EST. WEIGHT: N/A KG | SUPERSEDES: | SCALE: /

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FIELD TERMINATION DRAWING FOR HPU PLC CABINET

INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223022-33	1 OF 1	SK-066022-33-42

STATUS: APPROVED

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 1, Section 3

MASTER CONTROL STATION (MCS)

CONTENTS

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 1, Section 3
MASTER CONTROL STATION (MCS)

DESCRIPTION, INSTALLATION, OPERATION & MAINTENANCE

CONTENTS

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 1, Section 3
MASTER CONTROL STATION (MCS)

PARTS LISTS & DRAWINGS

CONTENTS

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

31 MAR 2009	As Built	A. Weilandt	T. Appel	A. Weilandt
06 AUG 2007	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
02 MAY 2007	Issued for Client Comment	A. Weilandt	S. Horne	
12 OCT 2006	Issued for Internal IDC	A. Weilandt	D.Coonrod	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approver**

CAMERON	**Document Title:** **Subsea and Topsides Functional Requirement Specification**		
PAGE 1 OF 34	**Customer Document Number:**	54NL92-W-0S-502	REV. 2
	Cameron Document No.	X-076721-87	REV. 02

TABLE OF CONTENTS

1 Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
A	12OCT06	Initial release Celle	- - -
B	02MAY07	Section 7.5.6.1: Use of Swagelok added for LP lines and added the need for metric size on all LP tubing Section 8.4: cable entry changed from top to bottom Section 9.2: List of Total Tag Numbers added Section 9.1.1.2: Colour for topside equipment changed from RAL5015 to RAL7035 (light grey) 10.8 & 10.9: updated description as per current design of anode and cathode package 10.10: complete section added for Anode Umbilical Assembly	Comments from internal IDC
01	06AUG07	Section 10.8: Anode Package Foundation Base added	Updated to Approved for Construction
02	31MAR09	Minor cosmetic Customer Comments implemented	Update to “As Built”

2 Introduction

This document is written to consolidate the technical requirements for the subsea control system intended to be used on the TOTAL K5F Project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

It will be submitted for approval early on in the project cycle and upon approval will be used for the design of the system.

Referenced client specifications within this document also need to be considered for the design.

3 Scope of this document

The scope of this document is to define the functional requirements for the subsea control system intended to be used on the TOTAL K5F Project.

Technical requirements relate but shall not be limited to:

- Design basis data
- Functional requirements

The Intervention & Workover Control System (IWOCS) shall **NOT** be covered by this document.

4 Abbreviations & Definitions

4.1 Abbreviations

AIV	Annulus Isolation Valve
AMV	Annulus Master Valve
APTA	Annulus Pressure Transmitter A
APTB	Annulus Pressure Transmitter B
BAIV	B Annulus Isolation Valve
CI	Corrosion Inhibitor
CIV	Chemical Injection Valve
CP	Cathodic Protection
CR	Control Room
DCS	Distributed Control System
DHSV	Downhole Safety Valve
DHPT	Downhole Pressure Temperature Transmitter
EPCU	Electrical Power and Communication Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
HPU	Hydraulic Power Unit
ICSS	Integrated Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
KHI	Kinetic Hydrate Inhibitor
LPMV	Lower Production Master Valve
MEOH	Methanol
PCS	Process Control System
PPD	Production Pressure Downstream
PPU	Production Pressure Upstream
PSV	Production Swab Valve
PTD	Production Temperature Downstream
PTU	Production Temperature Upstream
PWV	Production Wing Valve
PRCM	Power Regulation and Communication Module
SCSSV	Surface Controlled Subsurface Safety Valve
SSS	Safety Shutdown System
TUTU	Topside Umbilical Termination Unit
UPMV	Upper Production Master Valve
UPS	Uninterruptible Power Supply
UTA	Umbilical Termination Assembly
WH	Wellhead
XOV	Crossover Valve

4.2 Definitions

COMPANY	Total E&P Nederland B.V. (TEPNL)
CONTRACTOR	Cooper Cameron UK Ltd.

5 References

5.1 Cameron documents

Following documents **MUST** be considered during the design phase.

Description	Number
Subsea Production Control System Interconnection Diagram	SK-066001-88-04
K5F Field Development Project Contract	4600000416
Bill Of Material – Subsea Production Control System	223001-88
Project Quality Specification	SP-003118-15

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Design of cathodic protection of offshore structures	GS GR COR 100
External protection of off-shore and coastal structures and equipment by painting	GS EP COR 350
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Minimum CONTRACTOR document requirements	GS EP ELE 091
Electrical cables	GS EP ELE 161
Cable trays/ladders	GS EP ELE 311
Precommissioning and commissioning specification	GS EP EXP 101
Precommissioning and commissioning technical preparation	GS EP EXP 103
Precommissioning execution	GS EP EXP 105
Commissioning execution	GS EP EXP 107
Operations preparation during project – Maintenance and inspection documentation	GS EP EXP 203
Requirements for contractor quality management	GS EP PJC 501
Requirements for contractor critically rating of a unit	GS EP PJC 502
Requirements for contractor quality control	GS EP PJC 503
Valves	GS EP PVV 142
Welding of duplex and superduplex stainless steel	GS EP PVV 614
Area classification	GS EP SAF 216

Description	Number
Completed wells safety systems and safety rules	GS EP SAF 226
Impacted area, restricted area and fire zones	GS EP SAF 253
Emergency shut-down and emergency de-pressurisation (ESD & EDP)	GS EP SAF 261
Design philosophy and requirements for subsea stations	GS EP SPS 001
Subsea ball valves	GS EP SPS 005
Service valves in subsea stations	GS EP SPS 006
Tie-in systems	GS EP SPS 007
Corrosion protection of subsea stations	GS EP SPS 009
Preservation requirements for subsea package	GS EP SPS 010
Mechanical completion of subsea stations	GS EP SPS 011
Documentation requirements for subsea stations	GS EP SPS 012
Wellhead and guidance systems	GS EP SPS 013
Subsea gate valves and actuators in subsea Xmas-tree systems	GS EP SPS 015
Subsea insert chokes and associated running and retrieval tools	GS EP SPS 016
Subsea production control system	GS EP SPS 019
Subsea control unit functional requirements	GS EP SPS 020
Subsea mateable electrical/optical connectors	GS EP SPS 021
Environmental testing of subsea electronics	GS EP SPS 022
Cleaning and flushing of hydraulic systems	GS EP SPS 023
Subsea mechanical quarter turn actuator (manually operated gearbox)	GS EP SPS 024
Subsea hydraulic spring return quarter turn actuators	GS EP SPS 025
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Static 230Vac power supply units for on- and offshore installations	NL00-U-6S-037
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Typical cable tray details (offshore)	NL00-U-64-044
Elec. Cable colour seq. (onsh. + offsh.)	NL00-U-64-045
Protection and Instrument Earth. Det. (onsh. + offsh.)	NL00-U-64-046
Presentation of engineering and final documentation	NL00-Z-0S-002

Description	Number
Microstation Version 5.0: User Definable Attributes	NL00-Z-0S-005
Codification & Numbering of New Technical Documents for Offshore Installations	NL00-Z-0S-006
Instrumentation/piping interface standards	NL00-Z-4S-042
Actuators and control systems for hydraulically operated control valves	NL00-Z-7S-041
Actuators and control system for hydraulically operated ball valves	NL00-Z-7S-043
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
Codification of instrumentation links & equipment	NL00-Z-7S-077
Electrical/instrument interface diagram typicals for normally unmanned offshore installations	NL00-Z-71-002
Loop diagrams typicals	NL00-Z-71-003
Instrumentation - process hook-up typicals	NL00-Z-74-011
Hydraulic hook-up typicals	NL00-Z-74-021
Mounting typicals	NL00-Z-74-031
Instrument name plate detail	NL00-Z-74-055
Completion dossier guidelines	CS-3-OPE-EC-701 (EDMP-40657)
K5F MCS – K6CC SSS/PCS Interface	EDMP #59401

Any agreed deviations from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

Any clarifications from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

In case of conflict between documents the following order of priority shall be applied:

1) Local and international rules and regulations
2) Company Safety Specifications (GS EP SAF)
3) Project Specifications
4) Company Standards (NL00)
5) Company General Specifications

5.3 Codes, standards and regulations

Following codes, standards and regulations shall be considered during the design phase.

Description	Number
Design and operation of sub sea production systems	ISO 13628
Design & Operation Of Subsea Production Control Systems	ISO 13628-6
Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluids	SAE AS4059

Description	Number
EMC Directive	89/336-EEC
Process measurement control functions and instrumentation Symbolic representation	ISO 3511
Quality management and quality assurance standards - Part 3:Guidelines for the application of ISO 9001 to the development, supply and maintenance of software	ISO 9000-3

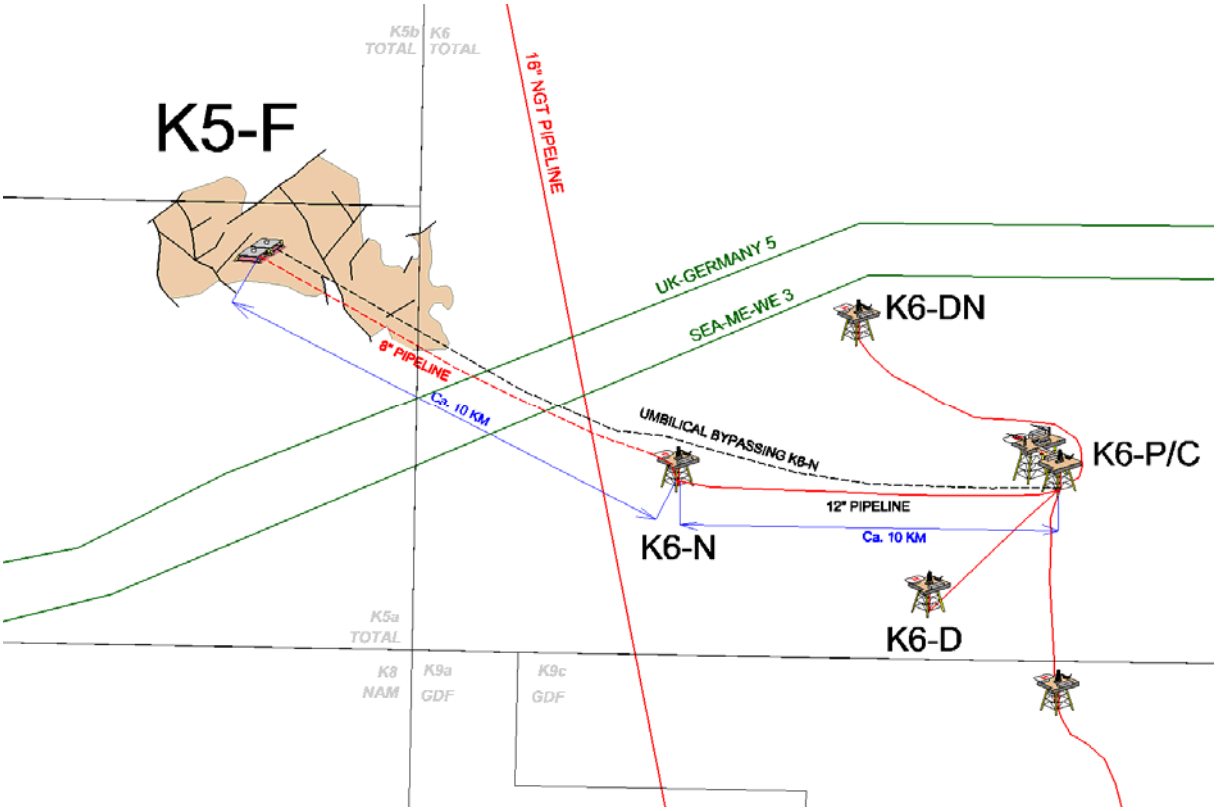
5.4 CE marking

CE marking **will** be required for the K5F project.

6 Project Overview

The K5F is a gas field located 10 km NW of the existing satellite platform K6N and 20km NW of the K6 Central Complex, all operated by TEPNL.

In the first phase, K5F will be developed with two wells. In order to be able to increase the reserves recovery in the future a third well might be connected in the future on the Subsea Protection Structure and it is also possible to connect a fourth future satellite well.



7 Design basis

The following sections are describing the systems information particularly relevant to the design of the Production Control System:

7.1 Field data

Present Number of Production Wells	Two plus two future wells
Design Life	20 years

7.2 Environmental conditions

7.2.1 Climatic data

Parameter		Data
Ambient Temperature (Outdoors)	Minimum Air Temperature	- 16°C
	Maximum Air Temperature	+ 40°C
Ambient Temperature (Indoors)	Minimum Air Temperature	-5°C
	Maximum Air Temperature	+ 40°C

7.2.2 Subsea Design Information

Parameter	Data
Water Depth	37 metres
Temperature	+4°C to +9.5°C
Seawater density	1025 kg/m³
Seawater Electrical Resistivity	0.3 OhmMeter
Wellhead Shut-in Pressure	350 barg

7.2.3 Hazardous Area Classification

The HPU and the TUTU shall be specified for hazardous area Zone 1, Gas Group IIB, Temperature Class T3, on the Platform deck.

7.2.4 Local equipment room

The platform local electrical switch room shall be used to accommodate the MCS and the ECPU cabinets. The maximum temperature during normal conditions within the LER shall be limited to 25 °C, but all of the equipment shall be able to operate as long as the room temperature does not exceed 40°C.

7.2.5 Hydraulic system pressures for the SCSSV line

The subsea production control system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
HP Hydraulics	627 barg	690 barg	1035 barg
Return Lines	< 207 barg	207 barg	N/A
Reservoir Fill Lines	<10 barg	10 barg	15 barg

NOTE: The design pressures shown above shall be used for specification of the HP hydraulic system relief valves and these shall release at the shown design pressures.

The return lines of the HPU are piped directly to the return reservoir and open to atmosphere. Pressure testing of these lines is neither necessary nor possible.

7.2.6 Chemical system pressure requirements

The chemical injection system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
Methanol Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Corrosion Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Kinetic Hydrate Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg

7.2.7 List of chemicals

The following chemicals are considered to be used for chemical injection for the K5F project:

- Methanol (MEOH)
- Corrosion Inhibitor (CI)
- Kinetic Hydrate Inhibitor (KHI)

7.3 Design life

The design life of the Subsea equipment shall be equal to the service life of the field.

The Subsea and related topside facilities shall be designed for a minimum design life of **20 years**.

7.4 Utilities

7.4.1 Platform utilities

The subsea production control system shall be designed to operate from the platform power and utilities as follows:

Electrical Supply (ECPU)	400VAC , 3 phase, 50 Hz ± 2% from UPS (floating), redundant
Electrical Supply (MCS)	230VAC 50 Hz ± 2%,from UPS (floating), redundant
Electrical supply (HPU PLC Cabinet)	230VAC 50 Hz ± 2% from UPS (floating)
Electrical supply (HPU Lighting)	230VAC 50 Hz from MCC
Electrical supply (HPU Motors)	380VAC 3ph 50 Hz, floating (3 wires) from MCC
Electrical supply (Motor heaters)	230VAC 50 Hz from MCC (if applicable)
Electrical supply (ESD solenoids)	24 V DC when healthy, 0V on ESD

7.5 Hydraulic systems

7.5.1 Sealing systems

Hydraulic couplers with primary metal seals are preferred for permanently installed Subsea equipment. Where possible, secondary, non-metallic seals should be considered as back-up for primary metal-to-metal seals. Hydraulic and chemical couplers within removable assemblies like single diver mate able hydraulic/chemical couplings shall have non-metallic primary seals and non-metallic back-up seals.

7.5.2 Hydraulic distribution

The subsea production control system high pressure (HP) hydraulic supplies shall be single from the HPU pumps. The hydraulic system shall be open utilising a water based control fluid.

7.5.3 Hydraulic fluid

The hydraulic system shall use Castrol Transaqua HT water based control fluid.

7.5.4 Fluid cleanliness

The production control system hydraulic control fluid shall be water based. All production control system hydraulic equipment shall be delivered with fluid cleanliness levels of SAE AS4059 class 6 or better. All methanol and chemical lines and equipment shall be delivered with fluid cleanliness level of SAE AS4059 class 12 or better.

Protective caps shall be provisioned for all hydraulic couplings to avoid accidental contamination. Assembly of hydraulic components shall take place in areas where the environment is controlled. The objective shall be to “assemble clean to keep clean” such that subsequent flushing operations are simplified.

Cleaning methods used for sub-assemblies shall include shop air flushing, solvent cleaning, pipe cleaning and ultrasonic bathing as appropriate. Cleaning of major assemblies shall in general be confined to flushing with control fluid of known cleanliness. As far as is practical, designs shall take due note of the subsequent flushing requirements e.g. avoiding blind holes, avoiding welding or grinding on assembled components and ensuring that systems allow turbulent flow for flushing.

All hoses and flying leads intended for chemical service (Methanol, Corrosion Inhibitor and Kinetic Hydrate Inhibitor) should be supplied filled with either control fluid or a suitable fluid compatible with the chemicals to be used.

7.5.5 Tubing

All hydraulic tubing and fittings shall be sized for efficient operation of the system with due regard to design pressures and minimising pressure drops within the system.

- For the topside equipment minimum seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the subsea equipment seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the UTA, the Methanol tubing has to be super duplex.

The tubing of the hydraulic circuits shall be accurately cut and bent using standard tube cutters and tube benders to fitting manufacturer’s recommendation. No burrs shall be allowed and each section of the tubing shall be cleaned and blown dry before assembly to ensure that no contamination is permitted to enter the control components.

All hydraulic tubing together with the associated fittings shall be capable of withstanding the application of a 1.5 times design pressure test for 15 minutes without any deformation or other damage.

7.5.6 Threaded connection systems

All threaded fittings for equipment used subsea shall withstand external ambient pressure at the design depth.

7.5.6.1 Topside equipment

For all circuits Autoclave MP Piping and fittings shall be used, except return lines where Swagelok can be used. All non Autoclave lines need to be in metric size.

7.5.6.2 Permanent subsea equipment

Ferrulok tube end reducers are to be welded to the back of hydraulic couplers, etc., where practical, rather than pipe threaded connections.

High-pressure ports requiring threaded fittings, such as valve actuator ports shall be SAE thread with 37-degree bottom taper conforming to SAE standard J514. Autoclave anti-vibration type fittings shall also be acceptable.

National Pipe Thread (NPT) fittings or any other thread seal type fitting shall **NOT** be used without specific approval from the project.

Fitting assembly torque shall be independently verified and sealed/secured to identify, that fittings have been properly made-up and inspected.

7.5.6.3 Thread sealants

Where taper threads are permitted for use, they shall be sealed using Loctite 572 fluid applied in accordance with the manufacturer's instructions. No other thread sealant shall be used. Teflon tape is **NOT** permitted for use on any equipment used with this system.

7.5.7 Welded connection systems

All couplers, whether in hydraulic or chemical services shall be butt-welded, except were otherwise specified within this document. All couplers shall be fitted with seals from identical compounds. All hydraulic or chemical service valves and fittings shall be butt welded.

- Connections shall be welded to the extent practical
- Autogenously welding shall be acceptable on 316L materials
- Liquid penetrate testing shall be performed on all tubing welds

Note: all welding has to be performed in accordance to approved Cameron welding specification.

8 Electric Systems

8.1 Terminal Type

Screw type terminals shall be used on all topside equipment.

8.2 Instrument Type

For the use in hazardous area EEx-d type instruments shall be used.

8.3 Electrical Motor Type

For the use in hazardous area EEx-d type electrical motors shall be used.

8.4 Cable entry for cabinets located in the Control Room

All cabinets located in the control room shall be designed to allow bottom cable entry only.

9 Functional Requirements

9.1 Coating & protection systems

9.1.1 Coating systems

All equipment manufactured from Carbon steels shall be protected with an approved coating system suitable for the design life of the equipment.

9.1.1.1 Subsea painting

Painting of all subsea components manufactured from Carbon steels shall be done in accordance to the approved paint specification A-020025-01

9.1.1.2 Painting of topside equipment for outside installation

Painting of all topside components located outside shall be done in accordance to the approved paint specification X-065460-04-04

- Top colour for surface equipment shall be light grey (RAL 7035).
- SST framework and parts shall normally NOT be painted, if not separately specified.

9.1.1.3 Painting of topside equipment for inside installation

Paint colour for MCS or EPU cabinet housings shall be light grey (RAL 7035).

9.1.2 Cathodic protection

9.1.2.1 General

The primary corrosion protection system for the control system Subsea equipment shall be via materials selection and suitable paint coatings.

A cathodic protection system using sacrificial anodes shall be utilised to protect the ‘bare steel’ components and to protect uncoated areas of any other control system hardware, i.e. such as those items not protected by the host equipment. Special attention shall be given to SST screws and bolts. All items to be protected shall be electrically connected using stranded, flexible SST 316 earthing braids of a suitable cross sectional area.

9.1.2.2 Calculations

Suitable CP calculations shall be carried out in accordance with the standard applicable for control system hardware i.e. not tree mounted equipment (this shall be part of the Subsea tree CP system). The CP system shall be designed to be capable of protecting the control system for the 20-year design life of the equipment.

9.1.2.3 Construction

The following principles shall be adhered when designing equipment for the subsea control system:

- All equipment metalwork shall be welded (or bolted) onto the equipment main structure to ensure any static potential build up is avoided by continuous drain to earth.
- All metallic items shall have earth continuity by physical connection i.e. metallic fastenings, clamps or earth straps. This shall include all valves, tubing, components, tubing clamps etc.

Electrical connectors may remain isolated from the structure provided suitable materials are chosen for their construction.

- When stainless steel fasteners are used in the construction of subsea structures or equipment, they shall be suitably earth bonded using earth straps. Carbon steel fasteners may alternatively be used.
- Anodes mounted on equipment sub-structures shall be manufactured from material identical and from the same batch as those fitted to the main structure.
- The anodes shall comply with the Cameron material specification MS-011310-01.
- The minimum distance from hydraulic tubing to anodes shall be 80 mm. If unavoidable it is acceptable to have a distance of less than 80 mm for some cases.
- Earthing conductors shall be of corrosion resistant material and shall be securely fastened and protected where necessary against damage and electrolytic corrosion. Where earth-bonding straps are used, conductive paste shall be smeared on contact surfaces (not threads) to ensure a lasting low resistance contact. Where the metallic composition of equipment requiring earth bonding differs from the main structure, care shall be taken in the selection of the bonding strap material to minimise possible ill effects of different contact potentials.
- Connections shall be secured using star-type shake proof washers such that they cannot work loose under vibration.

9.2 Project specific Tag Numbers

This is a list of Tag numbers to be used for K5F equipment. All units and components on this list need to be marked with these numbers as per Total Spec. NL00-Z-74-055.

Instruments	Equipment	Description	Comments
	NN-82201	TUTU	
	NN-82202	HPU	
	NN-82203	HPU PLC	
	NN-81203	MCS	
	NN-81204-1	EPCU 1	
	NN-81204-2	EPCU 2	
	NN-81204-3	EPCU 3	
	NN-81204-4	EPCU 4	
	SA-92100A	Anode Package A	
	SA-92100B	Anode Package B	
	UTA-92100	UTA	
	UTA-92101	IUTA	FUTURE
	UTA-92102	IUTA	FUTURE
	PRCM-92100.1A	PRCM A well 1	
	PRCM-92100.1B	PRCM B well 1	
	SC-92100.1A	Cathode A well 1	
	SC-92100.1B	Cathode B well 1	
	ESCM-92100.1A	ESCM A well 1	
	ESCM-92100.1B	ESCM B well 1	
	DVA-92103.1	Dump valve assembly well 1	
	DHSV-92103.1	Downhole safety valve well 1	

	PRCM-92100.2A	PRCM A well 2	
	PRCM-92100.2B	PRCM B well 2	
	SC-92100.2A	Cathode A well 2	
	SC-92100.2B	Cathode B well 2	
	ESCM-92100.2A	ESCM A well 2	
	ESCM-92100.2B	ESCM B well 2	
	DVA-92103.2	Dump valve assembly well 2	
	DHSV-92103.2	Downhole safety valve well 2	
	PRCM-92100.3A	PRCM A well 3	
	PRCM-92100.3B	PRCM B well 3	
	SC-92100.3A	Cathode A well 3	
	SC-92100.3B	Cathode B well 3	
	ESCM-92100.3A	ESCM A well 3	
	ESCM-92100.3B	ESCM B well 3	
	DVA-92103.3	Dump valve assembly well 3	
	DHSV-92103.3	Downhole safety valve well 3	
	PRCM-92100.4A	PRCM A well 4	
	PRCM-92100.4B	PRCM B well 4	
	SC-92100.4A	Cathode A well 4	
	SC-92100.4B	Cathode B well 4	
	ESCM-92100.4A	ESCM A well 4	
	ESCM-92100.4B	ESCM B well 4	
	DVA-92103.4	Dump valve assembly well 4	
	DHSV-92103.4	Downhole safety valve well 4	
	HP-92100.1	HP Jumper UTA to tree 1	
	MEOH-92100.1	MeOH Jumper UTA to tree 1	
	KHI-92100.1	KHI Jumper UTA to tree 1	
	CI-92100.1	CI Jumper UTA to tree 1	
	COAX-92100.1A	Coax Jumper UTA to PRCM A tree 1	
	COAX-92100.1B	Coax Jumper UTA to PRCM B tree 1	
	PC-92100.1A	P/C Jumper PRCM A to ESCM A tree 1	
	PC-92100.1B	P/C Jumper PRCM B to ESCM B tree 1	
	HP-92100.2	HP Jumper UTA to tree 2	
	MEOH-92100.2	MeOH Jumper UTA to tree 2	
	KHI-92100.2	KHI Jumper UTA to tree 2	
	CI-92100.2	CI Jumper UTA to tree 2	
	COAX-92100.2A	Coax Jumper UTA to PRCM A tree 2	
	COAX-92100.2B	Coax Jumper UTA to PRCM B tree 2	
	PC-92100.2A	P/C Jumper PRCM A to ESCM A tree 2	
	PC-92100.2B	P/C Jumper PRCM B to ESCM B tree 2	
	HP-92100.3	HP Jumper UTA to tree 3	FUTURE
	MEOH-92100.3	MeOH Jumper UTA to tree 3	FUTURE
	KHI-92100.3	KHI Jumper UTA to tree 3	FUTURE

	CI-92100.3	CI Jumper UTA to tree 3	FUTURE
	COAX-92100.3A	Coax Jumper UTA to PRCM A tree 3	FUTURE
	COAX-92100.3B	Coax Jumper UTA to PRCM B tree 3	FUTURE
	PC-92100.3A	P/C Jumper PRCM A to ESCM A tree 3	FUTURE
	PC-92100.3B	P/C Jumper PRCM B to ESCM B tree 3	FUTURE
PCV-92101.1		Production Choke valve well K5F-1	
PWV-92101.1		Production Wing Valve well K5F-1	
UPMV-92102.1		Upper Production Master Valve well K5F-1	
DHSV-92103.1		Down Hole Safety Valve well K5F-1	
AMV-92103.1		Annulus Master Valve well K5F-1	
BAIV-92100.1		B Annulus Isolation Valve well K5F-1	
XOV-92101.1		Crossover Valve well K5F-1	
CIV-92101.1		Chemical Injection Valve well K5F-1	
CIV-92102.1		Chemical Injection Valve well K5F-1	
CIV-92103.1		Chemical Injection Valve well K5F-1	
XEV-92103.1		HP Dump Valve (solenoid) well K5F-1	
PPU-92101.1		Production Pressure Upstream well K5F-1	
PPD-92111.1		Production Pressure Downstream well K5F-1	
APTA-92103.1		Annulus Pressure Transmitter A well K5F-1	
APTB-92105.1		Annulus Pressure transmitter B well K5F-1	
PTD-92101.1		Production Temperature Downstream well K5F-1	
PTU-92104.1		Production Temperature Upstream well K5F-1	
PT-92104.1		Downhole Pressure Transmitter	
TT-92-103.1		Downhole Temperature Transmitter	
PCV-92101.2		Production Choke valve well K5F-2	
PWV-92101.2		Production Wing Valve well K5F-2	
UPMV-92102.2		Upper Production Master Valve well K5F-2	
DHSV-92103.2		Down Hole Safety Valve well K5F-2	
AMV-92103.2		Annulus Master Valve well K5F-2	
BAIV-92100.2		B Annulus Isolation Valve well K5F-2	
XOV-92101.2		Crossover Valve well K5F-2	
CIV-92101.2		Chemical Injection Valve well K5F-2	
CIV-92102.2		Chemical Injection Valve well K5F-2	
CIV-92103.2		Chemical Injection Valve well K5F-2	
XEV-92103.2		HP Dump Valve (solenoid) well K5F-2	
PPU-92101.2		Production Pressure Upstream well K5F-2	
PPD-92111.2		Production Pressure Downstream well K5F-2	
APTA-92103.2		Annulus Pressure Transmitter A well K5F-2	
APTB-92105.2		Annulus Pressure transmitter B well K5F-2	
PTD-92101.2		Production Temperature Downstream well K5F-2	
PTU-92104.2		Production Temperature Upstream well K5F-2	
PT-92104.2		Downhole Pressure Transmitter	
TT-92103.2		Downhole Temperature Transmitter	
PCV-92101.3		Production Choke valve well K5F-3	FUTURE
PWV-92101.3		Production Wing Valve well K5F-3	FUTURE
UPMV-92102.3		Upper Production Master Valve well K5F-3	FUTURE

DHSV-92103.3		Down Hole Safety Valve well K5F-3	FUTURE
AMV-92103.3		Annulus Master Valve well K5F-3	FUTURE
BAIV-92100.3		B Annulus Isolation Valve well K5F-3	FUTURE
XOV-92101.3		Crossover Valve well K5F-3	FUTURE
CIV-92101.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92102.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92103.3		Chemical Injection Valve well K5F-3	FUTURE
XEV-92103.3		HP Dump Valve (solenoid) well K5F-3	FUTURE
PPU-92101.3		Production Pressure Upstream well K5F-3	FUTURE
PPD-92111.3		Production Pressure Downstream well K5F-3	FUTURE
APTA-92103.3		Annulus Pressure Transmitter A well K5F-3	FUTURE
APTB-92105.3		Annulus Pressure transmitter B well K5F-3	FUTURE
PTD-92101.3		Production Temperature Downstream well K5F-3	FUTURE
PTU-92104.3		Production Temperature Upstream well K5F-3	FUTURE
PT-92104.3		Downhole Pressure Transmitter	FUTURE
TT-92103.3		Downhole Temperature Transmitter	FUTURE
PCV-92101.4		Production Choke valve well K5F-4	FUTURE
PWV-92101.4		Production Wing Valve well K5F-4	FUTURE
UPMV-92102.4		Upper Production Master Valve well K5F-4	FUTURE
DHSV-92103.4		Down Hole Safety Valve well K5F-4	FUTURE
AMV-92103.4		Annulus Master Valve well K5F-4	FUTURE
BAIV-92100.4		B Annulus Isolation Valve well K5F-4	FUTURE
XOV-92101.4		Crossover Valve well K5F-4	FUTURE
CIV-92101.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92102.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92103.4		Chemical Injection Valve well K5F-4	FUTURE
XEV-92103.4		HP Dump Valve (solenoid) well K5F-4	FUTURE
PPU-92101.4		Production Pressure Upstream well K5F-4	FUTURE
PPD-92111.4		Production Pressure Downstream well K5F-4	FUTURE
APTA-92103.4		Annulus Pressure Transmitter A well K5F-4	FUTURE
APTB-92105.4		Annulus Pressure transmitter B well K5F-4	FUTURE
PTD-92101.4		Production Temperature Downstream well K5F-4	FUTURE
PTU-92104.4		Production Temperature Upstream well K5F-4	FUTURE
PT-92104.4		Downhole Pressure Transmitter	FUTURE
TT-92103.4		Downhole Temperature Transmitter	FUTURE

9.3 Special Requirements

All warning and emergency signs need to be English **and** Dutch language as per NL00-U-6S-061.

10 Equipment Requirement Specification

10.1 Master Control Station (MCS)

The redundant MCS will be the communication interface between the ICSS and the K5F electrical Subsea Control Modules (ESCM). The MCS will be located in the electrical switch room of the K6P Platform (safe area) and will be powered from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-01 Supplemental Requirements Specification for MCS Hardware

X-076721-87-02 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Control and Management

X-076721-87-03 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Process Interlocks and Shutdowns

X-076721-87-12 Supplemental Requirements Specification for MCS/ICSS Control Interface

10.2 Electrical Power and Control Unit (EPCU)

The EPCU is a redundant electrical power and communication unit for high voltage DC power supply and communication to the subsea installed ESCM's. The EPCU will be located in the electrical switch room of the K6P Platform (safe area) and will receive separate power supply for channel A and B from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-04 Supplemental Requirements Specification for EPCU

10.3 Hydraulic Power Unit (HPU)

A dedicated Hydraulic Power Unit (HPU) will be installed on the K6C platform to provide clean hydraulic HP power for the control of the K5F Downhole Safety Valves (DHSV). The HPU will be controlled from a remote PLC located in a safe area and will be monitored by the MCS/ICSS.

Design Pressure = 690 bar

Hydraulic Fluid = Castrol Transaqua HT

Refer to the following documents for detailed technical requirements:

X-076721-87-05 Supplemental Requirements Specification for HPU

10.4 Topside Umbilical Termination Unit (TUTU)

The Topside Umbilical Termination Unit (TUTU) shall terminate the main electro/hydraulic/chemical umbilical lines and provide the interface to the K6C platform equipment. It will only provide a hardware interface without any block/bleed-valves and/or Pressure gauges for testing or maintenance work. All tubing and couplers need to be supplied by others. The electrical cables shall be terminated in separately mounted explosion proof Junction Boxes or with moulded splice connections.

Refer to the following documents for detailed technical requirements:

X-076721-87-06 Supplemental Requirements Specification for TUTU

10.5 Umbilical Termination Assembly (UTA)

The Umbilical Termination Assembly (UTA) shall be a robust construction to provide interfaces with the umbilical and shall allow to suitably terminating all functions. The UTA shall be setup for the hydraulic connection of the two trees currently in the scope of supply and the two future trees.

Refer to the following documents for detailed technical requirements:

X-076721-87-07 Supplemental Requirements Specification for UTA

10.6 Power Regulation and Control Module (PRCM)

The Power Regulation and Communication Module (PRCM) regulate the power to the ESCM and provide communication to the ESCM. It also provides the connection to the external cathode package.

The PRCM shall be diver recoverable by using a special change out tool and shall be connected to a mounting base.

10.7 Electric Subsea Control Module (eSCM)

The eSCM controls various electric actuators on the tree/wellhead and acquires data from the subsea instrumentation for the transmission to the surface.

The following functions need to be controlled by the eSCM:

No.	Function	Actuator Size	Location	Note
1	CIV 1	¾”	Tree	
2	CIV 2	¾”	Tree	
3	CIV 3	¾”	Tree	
4	BAIV	¾”	Wellhead	
5	AMV	2”	Wellhead	
6	XOV 1	2”	Tree	
7	UPMV	5”	Tree	
8	PWV	5”	Tree	
9	PCV	N/A	Tree	
10	SCSSV Open	N/A	Tree	
11	SCSSV Close	N/A	Tree	

The following tree sensors need to be monitored by the eSCM:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

10.8 Anode Package / Anode Package Foundation Base

There are two separate Anode Packages for the A and the B channel of the system. The Anode Package shall be a robust frame construction for two separate and diver retrievable Anodes. The Anode package requires two separate electrical connectors for each anode for the connection via a flying lead to the anode umbilical assembly. The Anode Packages need to be clearly marked with “A” and “B”. The painted steel frame is protected by FRP grating on all four sides and on top to prevent damages caused by dropped objects. The two anode packages for the channels A and B will be placed on a further support frame to minimize the required installation effort. Both Anode Packages will be located on a Foundation Base.

10.9 Cathode Package

There are four separate Cathode Packages for the A and B channel of each tree. The Cathode Packages will be connected to the respective PRCM on the Subsea Protection Structure via an electrical flying lead. The Cathode Packages are diver installable and will be hooked into the outside plates of the Subsea Protection Structure. The Cathode Package contains the cathode itself and a frame with FRP grating on top to provide mechanical protection.

10.10 Anode Umbilical Assembly

The complete Anode Umbilical Assembly includes the following items:

- an approx. 100m long umbilical with an overall armour and four separate armoured 2,5mm² cores
- a pulling head assembly with 100mm diameter
- a hang-off assembly
- bend restrictor assembly at the Subsea end of the umbilical incl. clamping surface to fix the umbilical
- 4 pigtails, each 6m long, at the end of the umbilical

10.11 Electrical Flying Leads

The electrical flying leads shall comprise a cable moulded to the subsea connectors at both ends. The colour of these cables shall be black with a marking by means of approx. 30cm long heat shrinks at both ends. System A will be marked “blue” and System B “yellow”. These flying leads shall be designed for diver make up only.

10.12 Tree/Wellhead Pressure and Temperature Sensors

The following Pressure and Temperature Sensors are located on the Tree and the Wellhead:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

These sensors shall meet the following requirements:

- Field proven design
- The sensors shall be suitable for the intended subsea service
- Redundant with separate interconnection cables for the A and B channel
- Diver retrievable sensors
- With block-bleed-block assemblies on the pressure sensors
- Minimum accuracy of:
    - +/- 0.03% x full scale accuracy and a drift of 0.2%/year for the pressure sensors
    - +/- 0.3°C accuracy and a drift of 0.2°C/year for the temperature sensors

10.13 SCSSV Dump Valve Assembly

A 3/2 way valve shall be located on the tree for the operation of the SCSSV. The operation of this valve will be direct hydraulic by use of Transaqua HT fluid from a dedicated HPU through a single HP supply line in the main umbilical. The valve shall be designed for the design pressure of the SCSSV system and shall be activated by the ESCM. This assembly will consist of a fixed plate which will be located on the tree and a free plate with the dump valve on which is diver retrievable. Both plates will be connected via quick couplers without the use of poppets. The tree tubing will be connected to the fixed plate by using Autoclave anti-vibration couplers.

11 Quality requirements

A Quality Plan to be used for the project shall be created. For the Project Quality Specification see section 5.1 of this document.

11.1 CE Marking

The topside hardware and software is to be supplied with a CE declaration of conformity, which confirms compliance with all relevant directives.

12 Handling/Installation/Intervention & Shipping

Project shall provide detailed installation and intervention recommendations, and step-by-step project specific procedures, for review as part of the project-engineering phase.

All separately installable and retrievable items shall be provided with suitable lifting points and be generally designed to allow a smooth, simple and quick installation/retrieval process to be performed by divers. This shall include the following items:

- Electric Subsea Control Module (eSCM)
- Power Regulation & Communication Module (PRCM)
- Electrical flying leads between
  - Tree/Wellhead located junction boxes and sensors
  - UTA and PRCM
  - PRCM and ESCM
  - PRCM and Cathode Package

  Tree and Wellhead Pressure and Temperature Sensors
- SCSSV Dump Valve Assembly
- Anode Umbilical Assembly

All subsea assemblies shall be designed to withstand an abandonment period of 6 month sub sea, located where required but not connected to its services (hydraulic, chemical, electrical, ..)

12.1 Use of guidelines

All Subsea equipment (trees, choke inserts, jumpers, control modules, etc.) shall be designed for installation and retrieval by divers with the use of guidelines.

12.2 Lifting / Handling

All equipment shall be designed for safe handling and transportation, both onshore and offshore. All lifting points on all equipment handled offshore shall be:

- Physically load tested to rated weight
- Designed for loads as defined in API 17D and API RP 17G.
- Any welding and associated NDE, which is required for lifting apparatus shall be in compliance with API 17D and API RP 17G.
- All lifting points on all equipment, both purchased and rented; to be handled offshore shall be tested and labelled in accordance with API 17D and API RP 17G.
- All shipped equipment assemblies shall be labelled with their weight.
- Slings and rigging shall be provided for items that require lifting.

12.3 Connection of flying leads

The Subsea hydraulic and electrical flying leads shall be designed to be installed by the use of divers.

Following installation of the Xmas tree, the diver (after removing the LTC from the remote stab or connector) shall pick up the remote end connection and install it to the UTA or Wellhead.

The process shall be similar for the electrical connector.

For recovery the procedure shall be reversed.

12.4 ROV Interfaces

All ROV and diver interfaces shall be designed in accordance with ISO 13628-8.

12.5 ROV Marking of Subsea Stations

Marking of subsea station shall be in accordance with ISO 13628-1 and the following requirements:

- Letter size shall be 50mm

13 Testing

Each item of deliverable equipment shall be tested in accordance with a project approved and CAMERON supplied acceptance test procedure to verify the following as a minimum:

- Functionality
- Internal pressure testing
- External pressure testing
- Control fluid cleanliness to SAE AS4059

CAMERON shall provide written step-by-step procedures for these tests to be provided to COMPANY.

A Control System Integration Test shall be performed in accordance with a COMPANY approved procedure to demonstrate that all of the individual items of equipment function correctly as a system.

The testing programme for the Subsea Production Control System shall be undertaken in the stages detailed as follows:

- Factory Acceptance Test for single units (FAT's)
- System Factory Integration Testing (FIT)
- Tree EFAT
- System Integration Testing (SIT)
- Platform Commissioning
- Offshore Pre-submergence Testing/Deck Testing
- System Commissioning

13.1 Factory Acceptance Test (FAT)

Each deliverable item shall be subjected to a Factory Acceptance Test (FAT). The purpose of this FAT shall be to demonstrate the item is suitable for the intended purpose and functions correctly. FAT tests shall include hydrostatic proof pressure testing to 1.5 times the design pressure of the Subsea control system.

All FAT procedures shall be step-by-step and submitted for review and approval prior to testing commencing.

All critical equipment components shall be subjected to sub-assembly tests during the assembly phase of manufacture and to carry out these tests, the necessary equipment and fittings are specialised in-house equipment and are not project deliverable.

Each item of equipment shall be subject to an in-house FAT in accordance to an approved standard procedure document to demonstrate these meet the specified operational and functional requirements.

The tests shall include interface connections and mechanical alignment tests to verify design and manufacturing limit tolerance effects, component inter-changeability, together with hydraulic fluid system flushing and / or cleanliness checks as necessary to ensure the system meets SAE AS4059. The hydraulic tubing and piping pressure lines shall be hydrostatic pressure tested to 1,5 times the design pressure.

The test equipment shall be determined by the proposed testing programme, however in the event of additional testing or if testing in other locations is required, the quantity of test equipment detailed shall be subject to review.

Testing of fabricated items shall also include continuity testing of bolting.

Testing on subsea assemblies shall include continuity testing and earthing testing.

The maximum value for the resistance measured shall be 0.1 Ohm.

13.1.1 Environmental Stress Screening (ESS)

Modules or subassemblies containing electrical equipment and/or electronic equipment, which are intended for permanent subsea installation shall comply with section 4 of the Total specification GS EP SPS 022 “Environmental testing of Subsea Electronics”.

13.2 Factory Integration Test (FIT)

A System Factory Integration Test (FIT) shall be conducted to verify the correct interfacing and inter-working of all items of the subsea production control system equipment. External interfaces, for example Xmas tree valves & sensors, umbilical cables, DCS, MCC & ESD systems etc. shall be simulated for the purpose of the test. The testing shall be designed to verify the functional and operational integrity of the subsea production control system.

13.3 Xmas Tree/SCM system integration test (Tree eFAT)

A Xmas Tree/SCM System Integration Test shall be conducted for the Xmas tree, following completion of the Xmas tree FAT within the factory.

14 Special packing/shipping procedures/Instructions

For deliverables consisting of a main assembly with additional loose items (Lifting Slings, Test Hoses/Cables, Fill Lance, Pre-Charge Kit, Fluid in Barrels etc.), separate packing/shipping procedures/instructions with included component check-lists shall be provided.

The same shall apply for deliverables that can not be shipped as complete units, as transportation could result in damage of internal components.

These procedures/instructions should be part of the BOM from the related parts.

For all units which include any fluids or substances, COSHH sheets (Control of Substances Hazardous to Health) shall be delivered with the unit. These COSHH sheets shall be available early in the process for supply to the client.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

02	16APR08	Reissued as Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
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Rev.	**Date**	**Reason for Issue**	**Originator**	**Checked**	**Approved**

CAMERON

Document Title:

Supplemental Requirement Specification
Master Control Station (MCS)

PAGE 1 OF 13	**Customer Document Number:**	54NL92-W-0S-503	REV. 2
	Cameron Document No.	X-076721-87-01	REV. 02

TABLE OF CONTENTS

1 Document Revision Status / Record

Rev.	Date	Description of change	Author
A	05JAN07	Initial release	A. Weilandt
B	05MAY07	Section 5.2: updated list of applicable standards to make sure that it suits an indoor cabinet like the MCS Section 5.3: deleted IEC-60079 for equipment in hazardous area Section 7.1: requirement added that safety and warning signs need to be in English and Dutch language Section 7.2.1: added Profibus connections to the EPCU cabinets	A. Weilandt
01	07AUG07	Updated to Approved for Construction	A. Weilandt
02	16APR08	Updated to include late customer comments	A. Weilandt

2 Introduction

This document is written to consolidate the technical requirements for the Master Control Station (MCS) intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

3 Scope of this document

The scope of this document is to define the technical requirements for the Master Control Station intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

4 Abbreviations & Definitions

4.1 Abbreviations

CCR	Central Control Room
DCS	Distributed Control System
EPCU	Electrical Power and Control Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
HPU	Hydraulic Power Unit
ICSS	Integrated Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
MCS	Master Control Station
PCS	Process Control System
PRCM	Power Regulation and Communication Module
SSS	Safety Shutdown System
UPS	Uninterruptible Power Supply

5 References

5.1 Cameron Documents

Following documents **MUST** be considered during the design phase.

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Subsea production control system	GS EP SPS 019
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
K5F MCS – K6CC SSS/PCS Interface Specification	#59401

Any agreed deviations from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

Any clarifications from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

In case of conflict between documents the following order of priority shall be applied:

1) Local and international rules and regulations
2) Company Safety Specifications (GS EP SAF)
3) Project Specifications
4) Company Standards (NL00)
5) Company General Specifications

5.3 Codes, standards and regulations

Following codes, standards and regulations shall be considered during the design phase.

Number	Description
API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platform
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment
IEC-60529	Classification of Degrees of Electrical Protection provided by Enclosures
IEC – 92	Section 9.0 “Electrical Installations in Ships”
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements

5.4 CE marking

CE marking **will** be required for the K5F project.

6 Scope of Supply

The scope of supply for the MCS shall consist of the following:

6.1 Permanently installed Equipment

The scope for the permanently installed MCS equipment shall consist of the following main items:

- MCS Cabinet
- Set of Industrial PC's with Monitor, Keyboard and Mouse
- PLC's for Signal from/to Safety System and Interface to power supplies in the EPCU

6.2 Installation and Test Equipment

The scope for the MCS Installation and Test equipment shall consist of the following main items:

- N/A

6.3 Deliverable Documentation

The deliverable documentation for the MCS shall consist of the following as a minimum:

6.3.1 Engineering Documentation Requirements

The scope of supply for engineering documentations shall consist of the following as a **minimum**:

- Assembly Drawing
- Circuit Diagram
- Field Termination Drawing
- Hardware Factory Acceptance Test Procedure
- Special Packing/Shipping Instructions
- Spare Parts List for Installation and Commissioning
- Spare Parts List for 1 year of Operation and Maintenance

6.3.2 Installation, Operation and Maintenance Procedure Requirements

The scope of supply for installation, operation and maintenance procedures for the MCS shall consist of the following as a **minimum**:

- Installation Procedure
- Operation Procedure
- Maintenance Procedure

6.3.3 Quality Documentation Requirements

A Manufacturing Record Book shall be provided for the MCS with the following information as a **minimum**:

6.3.3.1 MCS QA Records

- Factory Acceptance Test records
- Certificate of compliance

7 Master Control Station Design Specifications

7.1 Equipment Design Requirements

Design requirements for the MCS are defined as follows:

Feature	Static Design Requirement	Performance Requirements	Additional Description
Operating Environment	Controlled environment in the safe area		
Maximum (not to exceed) Dimensions	800 mm (Width) 1100 mm (Depth) 2100 mm (Height)		
Maximum (Not to exceed) Weights	400 kg		
Service Access	810 mm (Front) 0 mm (Rear) 0 mm (Left) 0 mm (Right) 0 mm (Top)	All equipment to be housed within in one cabinet.	
Area Classification	Located in the safe area	N/A	Located in K6P technical room
Ambient Air Temperature	Max.: not exceeding +40°C Daily average: not exceeding +35°C Minimum: not less than -5°C		
Service Life	20 years		
Cabinet Construction	Self-contained, totally enclosed standard 19” rack.	Window in front door required to facilitate easy reading of display screens. Cabinet will be bolted to the floor.	
Cabinet colour	Gray, RAL 7035	Internal and external	
Cable Entry	Bottom entry	Clamp mechanism for incoming cables need to be part of the cabinet	A suitable number/size of cable trays shall be provided for all external interconnection cables.
Earthing	Cabinet to be provided with earthing bars close to cable entry in the bottom of the cabinet		
PLC	SIEMENS S7 series or compatible	Separate PLC’s required for channel A and B	

Feature	Static Design Requirement	Performance Requirements	Additional Description
Digital Inputs	Safety System requires min. 4 off for each of the 4 wells, , plus 2 off ESD inputs, plus minimum 20% Spare	Inputs from the Safety System are only required on PLC A. PLC B is not directly connected to the Safety System, but it receives the same signal as PLC A.	
Digital Outputs	Safety System requires min. 9 off for each of the 4 well, plus 1 off for the keyswitch, , plus minimum 20% Spare		
PC	4 off Industrial PC's required (2 off for View/Comms A&B 2 off for OPC A&B)		
Operator Interface	Monitor, Keyboard, Mouse and a Video switch to interface to any of the PC's	To be installed in a suitable height to allow the use in standing position.	
Software Package	Linux to be used as PC operating system and Vispro for the HMI Interface		
Terminals	Screw-type terminals to be used		Phoenix to be used
Power Supply	1x Channel A from UPS 1x Channel B from UPS 1x Utility Power Supply (lighting, heater, cooler, …)	See Interface Requirements	
Tagging (Drawing/ equipment)	Refer to General Design Basis		
Safety / Warning Signs	All safety and warning signs shall be in English **and** Dutch language.	White letters on red background to be used.	
Lifting/ Handling	Cabinet has to have suitable lifting eyes		Lifting slings not included in scope of supply
Marking	- Equipment Name - Equipment Tag - Company Name - Contract/Purchase Order Number - Weight (Gross / Net) - Cameron PN - Unique Serial Number	All marking shall be manufactured in such a manner so as to ensure legibility throughout design life.	All shipped items shall be marked with this info as a minimum.

7.2 Interface Requirements

7.2.1 Electrical Interface Requirements

Electrical interfaces shall be finally detailed during the detail engineering phase.

Table 7-1 – Electrical Interface Requirements

Description	Voltage	Interface to
Power Supply A	230V, 50Hz, +/-2%	K6P UPS
Power Supply B	230V, 50Hz, +/-2%	K6P UPS
Utility Power Supply	230V, 50Hz, +/-2%	K6P Utility Power Supply
Communication to HPU	Ethernet via fibre optics	HPU PLC Cabinet
EPCU 1A Control	Profibus	EPCU Cabinet 1A
EPCU 1B Control	Profibus	ECPU Cabinet 1B
EPCU 2A Control	Profibus	ECPU Cabinet 2A
EPCU 1B Control	Profibus	ECPU Cabinet 2B
EPCU 1A Subsea Comms	Ethernet	
EPCU 1B Subsea Comms	Ethernet	
EPCU 2A Subsea Comms	Ethernet	
EPCU 2B Subsea Comms	Ethernet	
Communication A to SSS	Ethernet process communication with OPC 2.0 DA Standard	PCS
Communication B to SSS	Ethernet process communication with OPC 2.0 DA Standard	PCS
Hardwired I/O from to SSS	24 VDC	SSS
Earthing connection (PE)		Platform Earthing system

7.3 Functional Requirements

The MCS will be the redundant communication interface between the K6CC ICSS and the K5F electrical subsea Control Modules (eSCM's). The MCS does not constitute, in whole or in part, a safety related system as defined by IEC61508

7.4 Maintainability Requirements

The cabinet layout shall be such that items can be easily removed from the unit for repair and/or replacement trough the cabinet door.

The MCS shall be provided with internal illumination light, to allow maintenance to be safely carried out within the MCS at any time. The internal lightning shall be derived from the utility power supply.

7.5 FAT Test Procedure

The MCS shall undergo a factory acceptance test (FAT) for hardware following as a **minimum**:

- Insulation Test Channel A & B
- Earthing verification
- Power Supply Check
- Cabinet Lamp Test
- Fan test
- PLC I/O check
- Weighing
- Final inspection

7.6 Special Packing & Shipping Instructions

For packing and shipping special instructions shall be provided addressing the following as a **minimum**:

- Internal components to be removed prior to shipment
- Loose Item Check List

8 Hold Points

As-Built Documentation

Total Exploration and Production Netherlands B.V.

K5F Project

Supplemental Requirements Specification
for MCS/ICSS
Control Interface

1	24. Apr 08	As-Built Documentation	R. Seeck	K. Rufenach	A. Weilandt
E	4. Apr 08	Issued for Approval	R. Seeck	K. Rufenach	A. Weilandt
D	12. Mar 08	Re-issued for Client Comment	R. Seeck	K. Rufenach	A. Weilandt
C	24. Jan 08	Re-issued for Client Comment	R. Seeck	K. Rufenach	A. Weilandt
N/A	20. Dec 07	Issued for Client Comment	R. Seeck	K. Rufenach	A. Weilandt
N/A	4. Sep 07	Issued for Internal IDC	R. Seeck	K. Rufenach	A. Weilandt
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PAGE 1 OF 63	**Customer Document Number:**	54NL92-W-0S-519	REV. 1
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1 Document Revision Status / Record

Rev.	Date	Description of change	Author
A	4. Sep. 07	Initial release	R. Seeck
B	20. Dec 07	PCS Heartbeat added	R. Seeck
		Tag Structure and Grouping added	R. Seeck
		Diagnostic parameters EPCU and PRCM added	R. Seeck
		Appendix Tag Lists added	R. Seeck
		PRCM 1A to 4B (instead of 1 to 4), Groups split into PRCMA and PRCMB	R. Seeck
		Status "eSCM not installed" added to well STW	R. Seeck
		General alarm A and B added to valve, choke and instrument stw	R. Seeck
		K5F.TBOK6P tag added	R. Seeck
		Clarification Point 1 removed – Interlocking shall be applied according to TEPNL specification #59401 (*)	R. Seeck
		Clarification Point 2 removed - PRCM High Temperature alarms removed (*)	R. Seeck
		Clarification Point 3 removed – Max valve movement removed (*)	R. Seeck
C	24. Jan. 08	PRCM tag numbers changed 81204 to 92100	R. Seeck
		CIV92101_x will change from Corrosion Inhibitor to Methanol Injection	R. Seeck
		CIV92102_x will change from Methanol Injection to Corrosion Inhibitor	R. Seeck
		Unit V removed from JTI92100R_x_STW	R. Seeck
		Description of High Pressure B changed from A to B	R. Seeck
D	12. Mar. 08	Range of Value added to DHPTT, EPCU and PRCM	R. Seeck
		Chapter "SSS Valve Command Processing" added	R. Seeck
		Short tags for PRCM instruments changed	R. Seeck
		PCSHEARTBEAT_B removed, PCSHEARTBEAT_A renamed to PCSHEARTBEAT	R. Seeck
		Shield and Earth current alarms implemented, no longer optional	R. Seeck
		Interlock “BAIV not closed” added to AMV	R. Seeck
		Interlock “AMV not closed” added to BAIV	R. Seeck
		General Tagging: EPCU numbering changed von “1 to 8” to “1A to 4B”	R. Seeck
		Grouping: Definition of client-site OPC groups	R. Seeck
		Well alarm register: Definition of eSCM and PRCM alarms added	R. Seeck
		Valve status word: Definition of general alarms added	R. Seeck
		Choke status word: Definition of general alarms added	R. Seeck
		Internal instrument status word: Definition of general alarms added	R. Seeck
		External instrument status word: Definition of general alarms added	R. Seeck
		Definition of Status Word DHSV92103_x added	R. Seeck
		Removed clarification points added to version history in revision B, tagged by (*); definitions added in chapters “Interlocks and SSS commands”, “Maximum parallel Operations” and "SSS Valve Command Processing"	R. Seeck
D	17. Mar. 08	Bit assignment of General Alarms A and B changed for PCV92101 (to Bit 8 and 9) and all Subsea Instruments (to Bit 2 and 3)	R. Seeck
		Interlock MCU Cooling Down added for PCV92101	R. Seeck

Rev.	Date	Description of change	Author
		Range of Values for HPU Pressure Transmitters changed: 0 – 690 bar	R. Seeck
		Status word for DVA added to monitor pilot valve state for DHSV Appended tag lists updated	R. Seeck
		Appended tag lists updated using PCSHEARTBEAT only (A and B removed)	R. Seeck
		Well interlocks “PRCM A High Temperature” and “PRCM B High Temperature” removed	R. Seeck
		ITWO for wells introduced carrying the “Max Valve/Choke Movement” Interlock	R. Seeck
		Differential Pressure Alarms added to general alarms for downhole pressure and temperature instruments	R. Seeck
		EPCU status word: Definition of general alarms added	R. Seeck
E	4. Apr. 08	Incorporation of TEPNL/INVENSYS/CAMERON platform building	R. Seeck
		MODE81203 (MCS/PCS Mode) removed because PCS evaluates hardwired interface only	R. Seeck
		Network interfaces alarms marked currently not in use	R. Seeck
		General Alarm, General Alarm A and General Alarm B added to NN81203_ALM	R. Seeck
		Interlock “XOV1 not open” added to AMV and BAIV	R. Seeck
		Tags added for HPU pump running hours and command interface: JZL82840 JZL82840_STW JHSWL82840A JHSWL82840A_STW JZX82840A_ENG JZX82840A_STW JHSW82840A_CTW JRC82840A_CTW JRCL82840A JRCL82840A_STW JHSWL82840B JHSWL82840B_STW JZX82840B_ENG JZX82840B_STW JHSW82840B_CTW JRC82840B_CTW JRCL82840B JRCL82840B_STW JZX82841_ENG JZX82841_STW JRC82841_CTW JRCL82841 JRCL82841_STW	R. Seeck
		General HPU register added: HPU82840	R. Seeck
	15. Apr. 08	Nomenclature adapted to revised implementation at MCS and PCS: analogue override -> Out of Service A+GND/Earth Current -> Sensing Current	R. Seeck
F	24. Aprl. 08	As-Built Documentation:	
		Description of Invalidity for Well, Valve, Choke and Instrument added	R. Seeck
		Clarification well status “eSCM not installed” = “Wellslot not commissioned”	R. Seeck
		Range of values and unit for DHSV92103 corrected (0-690 bar)	R. Seeck
		Assignment of DHSV92103_x interlocks revised	R. Seeck
		Discrepancy alarms added to downhole gauges	R. Seeck

Rev.	Date	Description of change	Author
		Data type of EPCU and Sensing Current changed to integer	R. Seeck
		HPU 82840 added	R. Seeck
		Units of HPU Pump run times corrected to hours	R. Seeck
		Clarification scope of default HPU status words	R. Seeck

2 Introduction

This document shall define the interface of the Master Control Station (MCS) with Process Control System (PCS) and Safety Shutdown System (SSS). Operating principles and tagging rules shall be included covering Integrated Control and Safety System (ICSS) interfaces of the MCS.

Hardwired signals and OPC tags not directly related to MCS/ICSS interfaces are not covered by this document.

3 Scope of this document

The scope of this document is to define

- OPC Tag Names
- Interpretation of OPC Status Information
- Interpretation of OPC Interlock Information
- Application of OPC Control Commands
- Interpretation of Hardwired Status Information
- Application of Hardwired Control Commands
- Runtime Behaviour

4 Abbreviations & Definitions

4.1 Abbreviations

AIV	Annulus Isolation Valve
AMV	Annulus Master Valve
APTA	Annulus Pressure Transmitter A
APTB	Annulus Pressure Transmitter B
APTC	Annulus Pressure Transmitter C
BAIV	B Annulus Isolation Valve
CAIV	C Annulus Isolation Valve
CCR	Central Control Room
CCR	Central Control Room (located in Den Helder)
CI	Corrosion Inhibitor
CICV	Chemical Injection Check Valve
CIV	Chemical Injection Valve
CP	Cathodic Protection
CR	Control Room
DCS	Distributed Control System
DHP	Down hole Pressure
DHT	Down hole Temperature
EDU	Electrical Distribution Unit
EHC	Electro-Hydraulic-Chemical
EPCU	Electrical Power and Control Unit
EPU	Electrical Power Unit
eSCM	Electrical Subsea Control Module
ESD	Emergency Shut Down
HP	Hydraulic High Pressure
HPU	Hydraulic Power Unit
ICSS	Integrated Control and Safety System Information Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
KHI	Kinetic Hydrate Inhibitor
LICS	Light Intervention Control System
LIR	Local Instrument Room
LP	Hydraulic Low Pressure
LPMV	Lower Production Master Valve
LRP	Lower Riser Package
MCS	Master Control Station
MDS	Material Data Sheet
MeOH	Methanol
MIC	Microbiological Influenced Corrosion
MT	Metric Tonnes
MTTR	Mean time to Repair
OS	Operator Station
PCS	Process Control System Production Control System

PCV	Production Choke Valve
PI	Pressure Indicating function code
PPD	Production Pressure Downstream
PPU	Production Pressure Upstream
PRCM	Power Regulation and Communication Module
PSV	Production Swab Valve
PTD	Production Temperature Downstream
PTU	Production Temperature Upstream
PWV	Production Wing Valve
RAM	Reliability, Availability & Maintainability
ROV	Remote Operated Valve or Remote Operated Vehicle
RPC	Remote Power Controller
SAM	Sub sea Accumulator Module
SCSSV	Surface Controlled Subsurface Safety Valve
SCSSVIV	SCSSV Isolation Valve
SDU	Sub sea Distribution Unit
SEM	Sub sea Electronic Module
SIWHP	Shut-In Wellhead Pressure
SPCS	Sub sea Production (Process) Control System
SPCU	Sub sea Power and Communication Unit
SSS	Safety Shutdown System
ST	System Test
TBO	Total Black Out
TCM	Topside Control Module (Control Station of SCM, sometimes referred as MCS - Master Control Station)
TCST	Tree Connection Seal Test
TI	Temperature Indicating function code
TUT	Topside Umbilical Termination
UPMV	Upper Production Master Valve
UPS	Uninterruptible Power Supply
UPS	Uninterruptible Power Supply
UTH	Umbilical Termination Head
WH	Wellhead
WHFP	Wellhead Flowing Pressure
WHFT	Wellhead Flowing Temperature
WHSIP	Wellhead Shut-In Pressure
WOCS	Work-Over Control System
XOV	Crossover Valve

5 Reference Documents

Following documents **MUST** be considered during the design phase.

Description	Revision	Number
Total “Design basis for K5F project”		EDMP #32611
K5F – Project Specification – MCS/PCS – K6CC SSS/PCS Interface	6	#59401
K5F_X-MASTREE_TAGNUMBERS	5	EDMP-#60621

6 General

6.1 Tagging

All OPC tags shall only consist of upper case letters, numbers and underscores and shall not consist of more than 30 characters.

Tagging shall always base on customer tags, followed by a well or unit identifier (well 1 to 4 or EPCU 1A to 4B). The different types of tags are identified by its extension.

OPC tag structure:

customer tag	_	a well or unit identifier	_	type extension

Example:

UPMV92102	_	2	_	CTW
UPMV92102_2_CTW				

Customer tagnames visible at MCS HMI shall also display the well identifier separated by dot (UPMV92102.1, UPMV92102.2, ... UPMV92102.4).

Type Extensions:

engineered value	_ENG
status word	_STW
control word	_CTW
interlock word open and close	_ITW
interlock word open	_ITWO
interlock word close	_ITWC
alarm	_ALM

Example for AMV92103 well 3:

AMV92103_3_STW
AMV92103_3_CTW
AMV92103_3_ITW
AMV92103_3_ITWO
AMV92103_3_ITWC

Boolean or independent status information might be transferred by customer tag plus option well or unit identifier:

Example:

High Voltage Indicator EPCU 4 JZL812043

Tagging lists contain a column named "Short Tag". This name has no direct expression for the interface, but refers to abbreviations and acronyms used in other documents, like drawings or I/O schedules.

6.1.1 Tag Structure

The tag structure shall form a tree to provide best possible access for debugging and maintenance purposes. The maximum number of tags within one branch shall provide best possible overview.

Branch			**Contents**
K5F			Heartbeats, system alarms, system mode
K5F	HPU		HPU instruments and alarms
K5F	W1		Well 1 status, alarms and interlocks
K5F	W1	VLV	Valve's status, command, position and interlocks
K5F	W1	INST	Process instruments (pressure, temperature)
K5F	W1	EPCUA	EPCU A diagnostic instruments and alarms
K5F	W1	EPCUB	EPCU B diagnostic instruments and alarms
K5F	W1	PRCMA	PRCM A diagnostic instruments
K5F	W1	PRCMB	PRCM B diagnostic instruments
K5F	W2		Well 2 status, alarms and interlocks
K5F	W2	VLV	...
K5F	W2	INST	...
K5F	W2	EPCUA	...
K5F	W2	EPCUB	...
K5F	W2	PRCM	...
K5F	W2	PRCMA	...
K5F	W3	PRCMB	...
K5F	W3	VLV	...
K5F	W3	INST	...
K5F	W3	EPCUA	...
K5F	W3	EPCUB	...

K5F	W3	PRCM	...
K5F	W3		
K5F	W4		...
K5F	W4	VLV	...
K5F	W4	INST	...
K5F	W4	EPCUA	...
K5F	W4	EPCUB	...
K5F	W4	PRCMA	...
K5F	W4	PRCMB	...

6.1.2 Grouping

The OPC items can be assigned to different OPC groups in order to optimize system resources covering different requirements regarding update rates. It is mandatory to choose a set-up reflecting the lifetime of particular information.

The minimum update rate supported by the LuX OPC server is 100ms. Update rates exceeding 2 seconds should not be used, especially for status and interlock words as well as heartbeat counters.

In general the PCS supplier is free to set-up OPC groups and related configuration. Definition of OPC groups need to be addressed by the OPC client during connection and are independent from tag structure and name space as defined above. Management of OPC groups shall be responsibility of the OPC client.

It should be taken into consideration that too large update rates for interlock words might result in command mismatches due to interlocks appearing within the update cycle. Update rates of 1 second for interlock and status words provided good results during other projects. Performance issues at OPC server side are not expected.

6.2 Invalidity

The invalidity bit shall indicate the quality of information related to the corresponding object (e.g. valve or instrument)

Invalidity related to the corresponding object is always transferred via the first bit of each status word.

Common algorithm (if applicable) is:

Under Range

or

Over Range

or

(

Feedback unknown MCSA

and

Feedback unknown MCSB

)

6.3 Interlocks

In general MCS interlocks inhibit commands or actions. They are not applied to force a valve into a certain position. Trigger condition for interlock application is always a command.

The MCS uses sequences (trips) to move valves into a certain position. Sequences will be activated, if a configurable sequence condition becomes true (e.g. UPMV becomes open and XOV1 is open -> start sequence to close XOV1).

Interlocks are represented and transferred by interlock words (ITW: 32 bit registers, integer values). Each bit relates to a certain interlock condition which is set to 1, if the interlock condition is true.

The meaning of interlock bits depend on the particular object.

6.3.1 Interlock Hierarchy

Several interlock shall be applied to all actuators of a related well.

E.g. the "Maximum Valve Operation per Well" interlock shall prevent the operator from operating more than one valve or choke per well in parallel (due to power consumption). This interlock bit shall be transferred with a well ITW and shall interlock all valves.

6.3.2 Interlocks in PCS mode

In PCS mode PCS and SSS are in charge of interlock processing. All interlocks shall be defeated in general, i.e. interlocks does not effect OPC commands.

All interlocks preventing actuators from being damaged like "PRCM Max Temperature" or "HP header pressure low" interlock shall be applied by MCS in any case.

Evaluation of interlock conditions by MCS shall not be effected in PCS mode. The MCS shall always provide realtime interlock information, especially to report prevention interlocks to PCS.

Example: "Maximum Valve Operation per Well"

The "Maximum Valve Operation per Well" interlock becomes active (ITW bit set to 1) when valve operation is started. After finalizing valve operation the "Maximum Valve Operation per Well" interlock becomes inactive (ITW bit set to 0). PCS commands of any OPC controlled valve shall be blocked, related commands shall be ignored (it is expected, that the PCS does not operate more than one valve in parallel). Valves controlled by SSS shall be operated according to their order (First In, First Out).

Example: "PRCM High Temperature"

The "PRCM High Temperature" become active (ITW bit set to 1) when HiHi alarms at both PRCMs appear. In this case valve operation is no longer possible. Any further DC valve operation shall be suppressed by MCS independent from PCS and SSS command state.

6.4 MCS and PCS mode

In MCS mode all commands from OPC and/or hardwired interface shall be ignored with exception of ESD signals.

All information (ENG, STW, ITW, ALM, hardwired signals) shall be updated independent from actual mode.

7 OPC Interface

7.1 TBOK6P

The TBOK6P signal indicates shutdown of MCS related power supply within 60s. The TBOK6P signal is arising in parallel with the hardwired TBOK6C shutdown request.

TBOK6P shall be set by the PCS.

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
TBOK6P	TBOK6P		0	1	-	integer

7.2 MCS Heartbeat

The MCS heartbeat indicates access to OPC data through a dedicated server. It is not intended to detect health of a particular MCS (MCS A or B), this information is transferred via summary alarm registers associated with the MCS tag.

The MCS heartbeat is a 32 bit integer value providing a ramp counting from 1 to 9999 every second.

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
	MCSHEARTBEAT		1	9999	-	integer

7.3 PCS Heartbeat

The PCS heartbeat indicates presence of the PCS and shall be used for logging purposes. The intention is to monitor the entire communication chain from PCS to MCS including Cameron OPC servers.

In case of malfunction no MCS activity is derived from DCS heartbeat.

The PCS heartbeat is a 32 bit integer value providing a ramp counting from 1 to 9999 every second exclusively assigned for each OPC client.

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
	PCSHEARTBEAT		1	9999	-	integer

7.4 MCS

7.4.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
MCS	NN81203	Master Control Station (A and B)				
	NN81203_ALM	MCS Alarms	-	-	-	integer
	MODE81203	MCS(0)-/ PCS(1)-Mode Keyswitch	0	1	-	integer

7.4.2 Bit Assignment

7.4.2.1 MCS Alarms: NN81203_ALM

Parameter	Bit	Annotations
MCS A not available	0	
MCS B not available	1	
Network Failure at MCS A Card 1	2	
Network Failure at MCS A Card 2	3	(currently not in use for MCS)
Network Failure at MCS A Card 3	4	(currently not in use for MCS)
Network Failure at MCS B Card 1	5	
Network Failure at MCS B Card 2	6	(currently not in use for MCS)
Network Failure at MCS B Card 3	7	(currently not in use for MCS)
HPU PLC Heartbeat Error A	8	Heartbeat of HPU PLC not detected in time (communication path A).
HPU PLC Heartbeat Error B	9	Heartbeat of HPU PLC not detected in time (communication path B)
MCS PLC A Heartbeat Error	10	Heartbeat of PLC A not detected in time.
MCS PLC B Heartbeat Error	11	Heartbeat of PLC B not detected in time.

Parameter	Bit	Annotations
MCS PLC A I/O Error	12	PLC A Diagnostic modules report errors at interface cards.
MCS PLC B I/O Error	13	PLC B Diagnostic modules report errors at interface cards.
MCS General Alarm A	14	
MCS General Alarm B	15	
MCS General Alarm	16	Cooler or Heater Fault

The general alarms are or-concatenations of single alarms individually appearing at MCS level. The summary alarms are permanently present as long as one the following single alarms is activated at MCS:

MCS A MCS B		• 24V Supply Fault • CB Fault • CB OPC Fault • CB PC Fault • Switch Port 1 Fault • Switch Port 2 Fault • Switch Port 3 Fault • Switch Port 4 Fault • Switch Port 5 Fault • Switch Port 6 Fault • Switch Port 7 Fault • Switch Port 8 Fault • Switch Port 9 Fault • Switch Port 10 Fault • Switch Port 11 Fault • Switch Port 12 Fault • Switch Port 13 Fault • Switch Port 14 Fault • Switch Port 15 Fault • Switch Port 16 Fault

7.5 Wells

Well status information shall be transferred through OPC tags assigned to the following well tags:

7.5.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
K5Fx	K5F_x	K5F Well x				
	K5F_x_STW	" " Status Word	-	-	-	integer
	K5F_x_ITW	" " Interlock Word OC	-	-	-	integer
	K5F_x_ITWO	" " Interlock Word O	-	-	-	integer
	K5F_x_ITWC	" " Interlock Word C	-	-	-	integer
	K5F_x_ALM	" " Alarms	-	-	-	integer

x: placeholder for well 1 to 4

7.5.2 Bit Assignment

7.5.2.1 Status Words

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown from eSCM A and B
Tree power on	1	Power supply activated
Tree start-up finalized	2	Start-up procedure successfully finalized
Well in workover mode	3	
eSCM not installed	4	Wellslot not commissioned

* Invalidity =

eSCM not installed

or

Node State of Subsea Modem A and B not o.k.

7.5.2.2 Well Interlocks

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Sequence condition present	0	
Tree not powered	1	Both eSCMs are not installed, no operation possible.
Tree start-up not finalized	2	(currently not in use)
Well in workover mode	3	Well in control of installation and workover system.
Well in MCS mode	4	Operation from PCS interlocked.
EPCU state unknown	5	Unknown status of both EPCU related to this well, no operation possible.
EPCU failure	6	Summary error at both EPCU related to this well, no operation possible.
Anode current: maximum exceeded	7	
Shield current: maximum exceeded	8	
Sensing current: maximum exceeded	9	
PRCM High Temperature	10	Both PRCMs report high temperature, no DC valve operation possible (interlock not defeatable, PCS and SSS operation concerned)

ITWO: Open Interlocks

Parameter	Bit	Annotations
Max valve/choke operation	0	Only one valve or choke shall be operated at the same time.

7.5.2.3 Well Alarms

Parameter	Bit	Annotations
eSCM A: Feedback unknown	0	eSCM A does not retrieve data
eSCM B: Feedback unknown	1	eSCM B does not retrieve data
eSCM A: Summary Alarm	2	
eSCM B: Summary Alarm	3	
PRCM A: Summary Alarm	4	
PRCM B: Summary Alarm	5	
PRCM A: High Temperature Alarm	6	
PRCM B: High Temperature Alarm	7	
Anode current alarm	8	
Shield current alarm	9	
Sensing current alarm	10	

The summary alarms are or-concatenations of single alarms individually appearing at MCS level. The summary alarms are permanently present as long as one the following single alarms is activated at MCS:

eSCM A eSCM B	Subsea Modem	• 1,26V Power Failure • 3,3V Power Failure • +48V Power Failure • -48V Power Failure • Temperature Sensor Error • High Temperature • Under Voltage • SHT11 Error • Temperature Hi • Temperature HiHi
	Surface Modem	• 1,26V Power Failure • 3,3V Power Failure • +48V Power Failure • -48V Power Failure • Temperature Sensor Error • High Temperature • Under Voltage • SHT11 Error • Temperature Hi (MCS) • Temperature HiHi (MCS)
PRCM A PRCM B		• 20V Power Failure • 4.7V Power Failure • High Temperature -> HVOff • SHT11 Error • Under Voltage • High Temperature Warning

		• Input Current Low • Input Current High • Hi Temperature (MCS) • HiHi Temperature -> HV Off (MCS) • Cathode Potential Alarm [Attention Cathode nearly disintigrated - Tree should be shut in - Cathode should be changed out] (MCS) • Cathode Potential Alarm [Attention Cathode fully disintigrated - Tree should be shut in] (MCS)

7.6 Actuators

7.6.1 SSS controlled valves (SDVs or Shutdown-valves):

7.6.1.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
DHSV	DHSV92103_x	Downhole Safety Valve				
	DHSV92103_x_STW	" " Status Word	-	-	-	integer
	DHSV92103_x_ENG	" " Header Pressure	0	690	bar	float
	DHSV92103_x_ITW	" " Interlock Word OC	-	-	-	integer
	DHSV92103_x_ITWO	" " Interlock Word O	-	-	-	integer
	DHSV92103_x_ITWC	" " Interlock Word C	-	-	-	integer
	DVA92103_x	Dump Valve Assembly (operating DHSV)				
	DVA92103_x_STW	" " Status Word	-	-	-	integer
UPMV	UPMV92102_x	Upper Production Master Valve				
	UPMV92102_x_ENG	" " Actual Position	0	100	%	float
XOV1	XOV92101_x	Crossover Valve				
	XOV92101_x_ENG	" " Actual Position	0	100	%	float
PWV	PWV92101_x	Production Wing Valve				
	PWV92101_x_ENG	" " Actual Position	0	100	%	float

x: placeholder for well 1 to 4

Each SSS controlled valve shall provide the following OPC tags using the same configuration as defined for DHSV92103_x:

status word	STW
actual position	ENG
interlock word open and close	ITW
interlock word open	ITWO
interlock word close	ITWC

Control words enabling valve operation via OPC are explicitly excluded. SSS controlled valves shall only be operated via hardwired interface in PCS mode or locally in MCS mode.

Open and Close status of the valve is part of the status word. The actual position of the valve shall only be included for future use.

7.6.1.2 Bit Assignment

7.6.1.2.1 Status Words DC Valves

The status word bit assignment for SSS and OPC controlled valves shall be identical (refer to chapter 7.6.2 "OPC controlled valves – Bit Assignment – Status Words")

7.6.1.2.2 Status Word DHSV92103_x

The structure of the DHSV92103_x status words shall be identical to DC valves apart from hydraulic instruments and constitution of summary alarms.

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown
Out of Service (Maintenance Inhibition)	1	for hydraulic header pressure instrument
Valve Open	2	
Valve Close	3	
Last Command Open	4	
Last Command Close	5	
Operate	6	Valve operation in progress
Fail to Move	7	Valve operation failed
Fail to Move A	8	operation via eSCM A
Fail to Move B	9	operation via eSCM B
Valve Control Failure A	10	Summary of diagnostics indicating malfunctions at eSCM and PRCM A
Valve Control Failure B	11	Summary of diagnostics indicating malfunctions at eSCM and PRCM B
General alarm A	12	Summary of alarms related to control and fuse board A subdevices
General alarm B	13	Summary of alarms related to control and fuse board B subdevices

* Invalidity:

both SIU 14 Node States not o.k.	or
both SIU 15 Node States not o.k.	or
Feedback Header Pressure unknown	or
DHSV Out of Service	or
Out of Service SIU 14 or SIU 14 Fuseboard (A and B)	or
Out of Service SIU 15 or SIU 15 Fuseboard (A and B)	

The general alarms are or-concatenations of single alarms individually appearing at MCS level. The general alarms are permanently present as long as one the following single alarms is activated at MCS:

Instrument A Instrument B	Board	• Humidity Warning (MCS) • Hi Board Temperature (MCS) • HiHi Board Temperature (MCS) • Node out of Order (MCS)
	Fuse Board	• Link Card Voltage dropped -> Fuse off • Link Card Supply Voltage dropped -> Fuse off • Link Card Time Out -> Fuse off • Link Card Humidity Alarm • Link Card Temperature Error • Link Card High Temperature -> Fuse off • Link Card High Current -> Fuse off • Link Card Heatsink Temperature Hi (MCS) • Link Card Heatsink Temperature HiHi (MCS) • Link Card Current Hi (MCS) • Link Card Current HiHi (MCS) • Link Card Node out of Order (MCS)

Alarms indicated with (MCS) are generated by MCS and not delivered by actuator.

7.6.1.2.3 Status Word DVA92103_x

DVA92103_x operates DHSV92103_x and is only associated with a status word indicating the related status information. Structure and meaning is identical to the DHSV92103_x status word, but states are derived from different thresholds and timing.

7.6.1.2.4 Interlock Words DHSV92103_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
UPMV not closed	0	UPMV is not closed and need to be closed before opening DHSV.

ITWO: Open Interlocks

Parameter	Bit	Annotations
HP header pressure low	0	
HP header pressure unknown	1	
XOV1 not closed	2	XOV1 is not closed and need to be closed before opening DHSV.
TBO K6C active	3	TBO K6C active, TBO K6C need to return to normal condition before opening DHSV.

7.6.1.2.5 Interlock Words UPMV92102_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

ITWO: Open Interlocks

Parameter	Bit	Annotations
PWV not closed	0	PWV is not closed and need to be closed before opening UPMV.
XOV1 not closed	1	XOV1 is not closed and need to be closed before opening UPMV.
ESD2 K5F active	2	ESD2 K5F active, ESD2 K5F need to return to normal condition before opening UPMV.

7.6.1.2.6 Interlock Words XOV92101_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

ITWO: Open Interlocks

Parameter	Bit	Annotations
DHSV not closed	0	DHSV is not closed and need to be closed before opening XOV1.
UPMV not closed	1	UPMV is not closed and need to be closed before opening XOV1.
ESD2 K5F active	2	ESD2 K5F active, ESD2 K5F need to return to normal condition before opening XOV.

7.6.1.2.7 Interlock Words PWV92101_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

7.6.2 OPC controlled valves

7.6.2.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
AMV	AMV92103_x	Annulus Master Valve				
	AMV92103_x_CTW	" " Control Word	-	-	-	integer
	AMV92103_x_STW	" " Status Word	-	-	-	integer
	AMV92103_x_ENG	" " Actual Position	0	100	%	float
	AMV92103_x_ITW	" " Interlock Word OC	-	-	-	integer
	AMV92103_x_ITWO	" " Interlock Word O	-	-	-	integer
	AMV92103_x_ITWC	" " Interlock Word C	-	-	-	integer
CIV1	CIV92101_x	Methanol Injection				
CIV2	CIV92102_x	Corrosion Inhibitor				
CIV3	CIV92103_x	Kinetic Hydrate Inhibitor A				
BAIV	BAIV92100_x	B Annulus Isolation Valve				

x: placeholder for well 1 to 4

Each OPC controlled valve shall provide the following OPC tags using the same configuration as defined for AMV92103_x:

status word	STW
control word	CTW
actual position	ENG
interlock word open and close	ITW
interlock word open	ITWO
interlock word close	ITWC

7.6.2.2 Bit Assignment

7.6.2.2.1 Status Words

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown or actual position out of range.
Out of Service (Maintenance Inhibition)	1	for position indicator
Valve Open	2	
Valve Close	3	
Last Command Open	4	
Last Command Close	5	
Operate	6	Valve operation in progress
Fail to Move	7	Valve operation failed
Fail to Move A	8	operation via eSCM A
Fail to Move B	9	operation via eSCM B
Valve Control Failure A	10	Summary of diagnostics indicating malfunctions at eSCM and PRCM A
Valve Control Failure B	11	Summary of diagnostics indicating malfunctions at eSCM and PRCM B
General alarm A	12	Summary of alarms related to valve A subdevices
General alarm B	13	Summary of alarms related to valve B subdevices

* Invalidity:

(

(

MCU A Node State not o.k. or
MCU A Drive absent or
MCU A Sensor absent or
MCU A Out of Service or
MCU A Fuseboard Out of Service

)

and

(

MCU B Node State not o.k. or
MCU B Drive absent or
MCU B Sensor absent or
MCU B Out of Service or
MCU B Fuseboard Out of Service

)

)

Or

Valve Out of Service

The general alarms are or-concatenations of single alarms individually appearing at MCS level. The general alarms are permanently present as long as one the following single alarms is activated at MCS:

Valve A Valve B	MCU	• Position Indicator Out of Service • MCU 38V Failure • MCU Drive absent • MCU Drive Error • MCU Sensor absent • MCU Sensor Error • MCU Stepper Error • MCU 4.5V Failure • MCU 3.2V Failure • MCU Bus Error • MCU Actuator not moving • MCU Timeout • MCU Parameter mismatch -> check parameter • Humidity Warning (MCS) • MCU Hi Temperature! Valve movement critical (MCS) • MCU HiHi Temperature -> Link Card Switched Off (MCS) • Node out of Order (MCS)

	Fuse Board	• Link Card Voltage dropped -> Fuse off • Link Card Supply Voltage dropped -> Fuse off • Link Card Time Out -> Fuse off • Link Card Humidity Alarm • Link Card Temperature Error • Link Card High Temperature -> Fuse off • Link Card High Current -> Fuse off • Link Card Heatsink Temperature Hi (MCS) • Link Card Heatsink Temperature HiHi (MCS) • Link Card Current Hi (MCS) • Link Card Current HiHi (MCS) • Link Card Node out of Order (MCS)

Alarms indicated with (MCS) are generated by MCS and not delivered by actuator.

7.6.2.2.2 Control Words

Parameter	Bit	Annotations
Close Valve	0	
Open Valve	1	

7.6.2.2.3 Interlock Words AMV92103_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

ITWO: Open Interlocks

Parameter	Bit	Annotations
BAIV not closed	0	BAIV is not closed and need to be closed before opening AMV.
XOV1 not open	1	XOV1 is not open and need to be opened before opening AMV.

7.6.2.2.4 Interlock Words CIV92101_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

7.6.2.2.5 Interlock Words CIV92102_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

7.6.2.2.6 Interlock Words CIV92103_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

7.6.2.2.7 Interlock Words BAIV92100_x

ITW: Open and Close Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.

ITWO: Open Interlocks

Parameter	Bit	Annotations
AMV not closed	0	AMV is not closed and need to be closed before opening BAIV.
XOV1 not open	1	XOV1 is not open and need to be opened before opening BAIV.

7.6.3 OPC controlled chokes

7.6.3.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
PCV	PCV92101_x	Production Choke Valve	-	-	-	integer
	PCV92101_x_SPT	" " Setpoint	0	100	%	float
	PCV92101_x_STW	" " Status Word	-	-	-	integer
	PCV92101_x_ENG	" " Actual Position	0	100	%	float
	PCV92101_x_ITW	" " Interlock Word OC	-	-	-	integer
	PCV92101_x_ITWO	" " Interlock Word O	-	-	-	integer
	PCV92101_x_ITWC	" " Interlock Word C	-	-	-	integer

x: placeholder for well 1 to 4

The choke is only controlled by setpoint in PCS mode. The MCS shall immediately proceed to the desired position triggered by value change.

7.6.3.1.1 Status Words PCV92101_x

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown or actual position out of range.
Out of Service (Maintenance Inhibition)	1	for position indicator
Operate	2	Valve operation in progress
Fail to Move	3	Valve operation failed
Fail to Move A	4	operation via eSCM A
Fail to Move B	5	operation via eSCM B
Valve Control Failure A	6	Summary of diagnostics indicating malfunctions at eSCM and PRCM A
Valve Control Failure B	7	Summary of diagnostics indicating malfunctions at eSCM and PRCM B
General alarm A	8	Summary of alarms related to choke A subdevices
General alarm B	9	Summary of alarms related to choke B subdevices

* Invalidity:

(

(

MCU A Node State not o.k. or
MCU A Drive absent or
MCU A Sensor absent or
MCU A Out of Service or
MCU A Fuseboard Out of Service

)

and

(

MCU B Node State not o.k. or
MCU B Drive absent or
MCU B Sensor absent or
MCU B Out of Service or
MCU B Fuseboard Out of Service

)

)

Or

Choke Out of Service

The general alarms are or-concatenations of single alarms individually appearing at MCS level. The general alarms are permanently present as long as one the following single alarms is activated at MCS:

Choke A Choke B	MCU	• Position Indicator Out of Service • MCU 38V Failure • MCU Drive absent • MCU Drive Error • MCU Sensor absent • MCU Sensor Error • MCU Stepper Error • MCU 4.5V Failure • MCU 3.2V Failure • MCU Bus Error • MCU Actuator not moving • MCU Timeout • MCU Parameter mismatch -> check parameter • Humidity Warning (MCS) • MCU Hi Temperature! Choke movement critical (MCS) • MCU HiHi Temperature -> Link Card Switched Off (MCS) • Node out of Order (MCS)

	Fuse Board	• Link Card Voltage dropped -> Fuse off • Link Card Supply Voltage dropped -> Fuse off • Link Card Time Out -> Fuse off • Link Card Humidity Alarm • Link Card Temperature Error • Link Card High Temperature -> Fuse off • Link Card High Current -> Fuse off • Link Card Heatsink Temperature Hi (MCS) • Link Card Heatsink Temperature HiHi (MCS) • Link Card Current Hi (MCS) • Link Card Current HiHi (MCS) • Link Card Node out of Order (MCS)

Alarms indicated with (MCS) are generated by MCS and not delivered by actuator.

7.6.3.1.2 Interlock Words PCV92101_x

ITW: Choke Operation Interlocks

Parameter	Bit	Annotations
Fuse board not available	0	Both fuse boards cannot be accessed.
Valve Control Failure	1	Valve Control Failure at A and B, operation not possible.
MCU Cooling Down	2	Cooling down period for motor control unit, operation prohibited

7.7 Instruments

7.7.1 Internal Instruments (CAN devices)

7.7.1.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type	hyd. offs.
PPU	PPU92101_x_ENG	Production Pressure Upstream	0	690	bar	float	yes
	PPU92101_x_STW	" " Status Word	-	-	-	integer	-
PTU	PTU92104_x_ENG	Production Temperature Upstream	-60	100	°C	float	-
	PTU92104_x_STW	" " Status Word	-	-	-	integer	-

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type	hyd. offs.
PPD	PPD92111_x_ENG	Production Pressure Downstream	0	690	bar	float	yes
	PPD92111_x_STW	" " Status Word	-	-	-	integer	-
PTD	PTD92101_x_ENG	Production Temperature Downstream	-60	100	°C	float	-
	PTD92101_x_STW	" " Status Word	-	-	-	integer	-
APTA	APTA92103_x_ENG	Annulus Pressure Transmitter A	0	690	bar	float	yes
	APTA92103_x_STW	" " Status Word	-	-	-	integer	-
APTB	APTB92105_x_ENG	Annulus Pressure Transmitter B	0	690	bar	float	yes
	APTB92105_x_STW	" " Status Word	-	-	-	integer	-

x: placeholder for well 1 to 4

7.7.1.2 Bit Assignment

The status words of all internal instruments shall have the same bit assignment:

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown or out of range or .
Out of Service (Maintenance Inhibition)	1	
General alarm A	2	Summary of alarms related to instrument A
General alarm B	3	Summary of alarms related to instrument B

* Invalidity:

(
Node State A not o.k. or
Instrument A Out of Service
)
and
(
Node State B not o.k. or
Instrument B Out of Service
)

The general alarms are or-concatenations of single alarms individually appearing at MCS level. The general alarms are permanently present as long as one the following single alarms is activated at MCS:

Instrument A Instrument B	Board	• Humidity Warning (MCS) • Hi Board Temperature (MCS) • HiHi Board Temperature (MCS) • Node out of Order (MCS)
	Fuse Board	• Link Card Voltage dropped -> Fuse off • Link Card Supply Voltage dropped -> Fuse off • Link Card Time Out -> Fuse off • Link Card Humidity Alarm • Link Card Temperature Error • Link Card High Temperature -> Fuse off • Link Card High Current -> Fuse off • Link Card Heatsink Temperature Hi (MCS) • Link Card Heatsink Temperature HiHi (MCS) • Link Card Current Hi (MCS) • Link Card Current HiHi (MCS) • Link Card Node out of Order (MCS)

Alarms indicated with (MCS) are generated by MCS and not delivered by actuator.

7.7.2 External Instruments (modbus/CAN devices)

7.7.2.1 Downhole Pressure and Temperature Transmitter (DHPTT)

7.7.2.1.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type	hyd. offs.
DHPT	PT92104_x_ENG	Downhole Pressure Transmitter	0	690	bar	float	no
	PT92104_x_STW	" " Status Word	-	-	-	integer	-
DHTT	TT92103_x_ENG	Downhole Temperature Transmitter	0	150	°C	float	-
	TT92103_x_STW	" " Status Word	-	-	-	integer	-

x: placeholder for well 1 to 4

7.7.3 Bit Assignment

7.7.3.1 PT92104_x_STW, TT92103_x_STW

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	
General alarm A	2	Summary of alarms related to instrument A
General alarm B	3	Summary of alarms related to instrument B
Discrepancy Gauge A	4	Difference larger than 5% of maximum range
Discrepancy Gauge B	5	Difference larger than 5% of maximum range

* Invalidity:

(
SIU A Fuseboard Node State not o.k. or
SIU A Fuseboard Error DHPT not connected or
SIU A Fuseboard Error DHPT error or
SIU A Fuseboard DHPT not powered or
SIU A Fuseboard DHPT not scanning or
Gauge A Out of Service (1 and 2)
)
and
(
SIU B Fuseboard Node State not o.k. or
SIU B Fuseboard Error DHPT not connected or
SIU B Fuseboard Error DHPT error or
SIU B Fuseboard DHPT not powered or
SIU B Fuseboard DHPT not scanning or
Gauge B Out of Service (1 and 2)
)

The general alarms are or-concatenations of single alarms individually appearing at MCS level. The general alarms are permanently present as long as one the following single alarms is activated at MCS:

Instrument1 A Instrument1 B Instrument2 A Instrument2 B	Discrepancy Alarm	• Pressure/Temperature1 Lo or Hi Alarm • Pressure/Temperature2 Lo or Hi Alarm
	Board	• Humidity Warning (MCS) • Hi Board Temperature (MCS) • HiHi Board Temperature (MCS) • Node out of Order (MCS)
	Fuse Board	• Link Card Voltage dropped -> Fuse off • Link Card Supply Voltage dropped -> Fuse off • Link Card Time Out -> Fuse off • Link Card Humidity Alarm • Link Card Temperature Error • Link Card High Temperature -> Fuse off • Link Card High Current -> Fuse off • Link Card Heatsink Temperature Hi (MCS) • Link Card Heatsink Temperature HiHi (MCS) • Link Card Current Hi (MCS) • Link Card Current HiHi (MCS) • Link Card Node out of Order (MCS)

Alarms indicated with (MCS) are generated by MCS and not delivered by actuator.

7.8 EPCU

7.8.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
JSLx	JSL81204_x_STW	Status EPCU x	-	-	-	integer
JUIx	JUI81204_x_ENG	Voltage EPCU x	0	4000	V	float
	JUI81204_x_STW	" " Status Word	-	-	-	integer
JIIx	JII81204_x_ENG	Current EPCU x	0	4000	mA	int
	JII81204_x_STW	" " Status Word	-	-	-	integer
JUIAx	JUI81204A_x_ENG	Anode Voltage x	0	22	V	
	JUI81204A_x_STW	" " Status Word	-	-	-	integer
JIIAx	JII81204A_x_ENG	Anode Current x	0	4500	mA	float
	JII81204A_x_STW	" " Status Word	-	-	-	integer
JIIGx	JII81204G_x_ENG	Sensing Current x	0	4500	mA	int
	JII81204G_x_STW	" " Status Word	-	-	-	integer
JIISx	JII81204S_x_ENG	Shield Current x	0	4500	mA	float
	JII81204S_x_STW	" " Status Word	-	-	-	integer
JZLx	JZL81204_x_ALM	High Voltage Indicator EPCU x	0	1	-	integer/bool
	JZL81204_x_STW	" " Status Word	-	-	-	integer

x: placeholder for EPCU 1A to 4B

7.8.2 Bit Assignment

7.8.2.1 JSL81204_x_STW

Parameter	Bit	Annotations
Invalidity*	0	Heartbeat from EPCU not detected (causes invalidity for all subordinated values).
EPCU_x: open loop	1	Open loop detected at EPCUx
EPCU_x: short circuit	2	Short circuit detected at EPCUx
EPCU_x: General Alarm	3	Summary alarms

* Invalidity:

Feedback unknown (A and B) or

Profibus Error or

The general alarms are or-concatenations of single alarms individually appearing at MCS level. The general alarms are permanently present as long as one the following single alarms is activated at MCS:

		• Sensing Current Hi • Anode Current Hi • Current Hi and HiHi • Summary Fault (from EPCU) • HV Off • HV Profibus Error • Monitor Profibus Error • Anode Potential Alarm • Shield Current Hi • Voltage Lo and Hi -> HV Off

Alarms indicated with (MCS) are generated by MCS and not delivered by actuator.

7.8.2.2 JUI81204_x_STW, JII81204_x_STW, JUI81204A_x_STW, JII81204A_x_STW, JII81204G_x_STW, JII81204S_x_STW, JZL81204_x_STW

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	

* Invalidity:

Feedback unknown (A and B) or

Profibus Error or

Out of Service

7.9 PRCM

7.9.1 Tag List

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
JTIx	JTI92100R_x_ENG	Ring Max Temperature	-40	100	°C	float
	JTI92100R_x_STW	" " Status Word			-	integer/bool
JIIPW	JII92100W_x_ENG	Water Current	0	4.6	A	float
	JII92100W_x_STW	" " Status Word			-	integer/bool
JIIPS	JII92100S_x_ENG	Shield Current	0	4.6	A	float
	JII92100S_x_STW	" " Status Word			-	integer/bool

x: placeholder for PRCM 1A to 4B

7.9.2 Bit Assignment

7.9.2.1 JTI92100R_x_STW, JII92100W_x_STW, JII92100S_x_STW

Parameter	Bit	Annotations
Invalidity*	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	

* Invalidity:

Feedback unknown (A and B) or

Out of Service

7.10 HPU

7.10.1 Tag List

7.10.1.1 Global

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
JZL	JZL82840	Local (0) / Remote (1) Control	0	1	-	integer
PT	PT82840_ENG	HP Pump Pressure	0	690	bar	float
	PT82840_STW	" " Status Word	-	-	-	integer
HPT	PT82843_ENG	HP Header Pressure	0	690	bar	float
	PT82843_STW	" " Status Word	-	-	-	integer
LTS	LT82840_ENG	Hydraulic Supply Level vessel	0	100	%	float
	LT82840_STW	" " Status Word	-	-	-	integer
LTR	LT82841_ENG	Hydraulic Return Level vessel	0	100	%	float
	LT82841_STW	" " Status Word	-	-	-	Integer
HPU	HPU82840	HPU Status Word	-	-	-	integer

7.10.1.2 High Pressure A

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
MCCA	JSL82840A	High Pressure Pump A MCC Available	0	1	-	integer
	JSL82840A_STW	" " Status Word	-	-	-	integer
HPA	JZL82840A	High Pressure Pump A Running	0	1	-	integer
	JZL82840A_STW	" " Status Word	-	-	-	integer
PDIA	PDZH82840A	HP Filter A	0	1	-	integer
	PDZH82840A_STW	" " Status Word	-	-	-	integer
JHSWL	JHSWL82840A	HP Pump A Duty (1) / Standby (0) Status	0	1	-	integer
	JHSWL82840A_STW	" " Status Word	-	-	-	integer
JZX	JZX82840A_ENG	HP Pump A Running Hours	0	-	Hours	float
	JZX82840A_STW	" " Status Word	-	-	-	integer
JHSW	JHSW82840A_CTW	Set HP Pump A to Duty *	0	1	-	integer
JRC	JRC82840A_CTW	Stop HP Pump A *	0	1	-	integer
JRCL	JRCL82840A	HP Pump A stopped	0	1	-	integer
	JRCL82840A_STW	" " Status Word	-	-	-	integer

* “Set HP Pump A to Duty” and “Stop HP Pump A” commands shall be applied by a 6 second pulse (0->1->0) to the related control word. Commands shall only be applied in PCS mode and will be ignored in MCS mode.

7.10.1.3 High Pressure B

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
MCCB	JSL82840B	High Pressure Pump B: MCC Available	0	1	-	integer
	JSL82840B_STW	" " Status Word	-	-	-	integer
HPB	JZL82840B	High Pressure Pump B Running	0	1	-	integer
	JZL82840B_STW	" " Status Word	-	-	-	integer
PDIB	PDZH82840B	HP Filter B	0	1	-	integer
	PDZH82840B_STW	" " Status Word	-	-	-	integer
JHSWL	JHSWL82840B	HP Pump B Duty (1) / Standby (0) Status	0	1	-	integer
	JHSWL82840B_STW	" " Status Word	-	-	-	integer
JZX	JZX82840B_ENG	HP Pump B Running Hours	0	-	Hours	float
	JZX82840B_STW	" " Status Word	-	-	-	integer
JHSW	JHSW82840B_CTW	Set HP Pump B to Duty *	0	1	-	integer
JRC	JRC82840B_CTW	Stop HP Pump B *	0	1	-	integer
JRCL	JRCL82840B	HP Pump B stopped	0	1	-	integer
	JRCL82840B_STW	" " Status Word	-	-	-	integer

* “Set HP Pump B to Duty” and “Stop HP Pump B” commands shall be applied by a 6 second pulse (0->1->0) to the related control word. Commands shall only be applied in PCS mode and will be ignored in MCS mode.

7.10.1.4 Circulation Pump

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
MCCC	JSL82841	Circulation Pump: MCC Available	0	1	-	integer
	JSL82841_STW	" " Status Word	-	-	-	integer
CP	JZL82841	Circulation Pump Running	0	1	-	integer
	JZL82841_STW	" " Status Word	-	-	-	integer
JZX	JZX82841_ENG	CP Pump Running Hours	0	-	Hours	float

Short Tag	OPC Tag	Parameter	Min	Max	Unit	Data Type
	JZX82841_STW	" " Status Word	-	-	-	integer
JRC	JRC82841_CTW	Stop CP Pump *	0	1	-	integer
JRCL	JRCL82841	CP Pump stopped (1)	0	1	-	integer
	JRCL82841_STW	" " Status Word	-	-	-	integer

* The “Stop CP Pump” commands shall be applied by a 6 second pulse (0->1->0) to the related control word. Commands shall only be applied in PCS mode and will be ignored in MCS mode.

7.10.2 Bit Assignment

7.10.2.1 Default HPU STWs

The status words of all HPU analogue instruments and discrete inputs shall have the same default bit assignment:

Parameter	Bit	Annotations
Invalidity	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	

Besides the following status words provide additional alarm information:

7.10.2.2 HPU82840

Parameter	Bit	Annotations
Invalidity	0	Feedback unknown
HPU General Alarm	1	Fan Fault or HPU Heater Fault

7.10.2.3 PT82840_STW

Parameter	Bit	Annotations
Invalidity	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	
Pump Pressure General Alarm	2	MCS or HPU Pump Pressure HiHi, Hi, Lo, LoLo

7.10.2.4 PT82843_STW

Parameter	Bit	Annotations
Invalidity	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	
Header Pressure General Alarm	2	MCS or HPU Header Pressure HiHi, Hi, Lo, LoLo

7.10.2.5 LT82840_STW

Parameter	Bit	Annotations
Invalidity	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	
Supply Level General Alarm	2	MCS or HPU Supply Level HiHi, Hi, Lo, LoLo

7.10.2.6 LT82841_STW

Parameter	Bit	Annotations
Invalidity	0	Feedback unknown or out of range.
Out of Service (Maintenance Inhibition)	1	
Return Level General Alarm	2	MCS or HPU Return Level HiHi, Hi, Lo, LoLo

8 Hardwired Interface

Hardwired Interface (for each redundant MCS PLC):

1 DO	PCS-/MCS-Mode Keyswitch	
2 DI	SSS	
	TBO K6C status	
	ESD2 K5F status	

Hardwired Interface per well (for each redundant MCS PLC):

8 DO	Open/Close Status Valves	
	DHSV92103_x	opened
	UPMV92102_x	opened
	XOV92101_x	opened
	PWV92101_x	opened
	DHSV92103_x	closed
	UPMV92102_x	closed
	XOV92101_x	closed
	PWV92101_x	closed
1 DO	Close Status Choke	
	PCV92101_x	closed
4 DI	Open/Close Command Valves	
	DHSV92103_x	Open (1), Close (0)
	UPMV92102_x	Open (1), Close (0)
	XOV92101_x	Open (1), Close (0)
	PWV92101_x	Open (1), Close (0)

8.1 Error Detection MCS PLC

The MCS cabinet provides two PLCs each equipped with I/O-Board supplying diagnostic data. Additionally communication between MCS and MCS PLC shall be monitored by PLC heartbeats.

Shutdowns and valve commands shall only be executed, if all related diagnostic data indicate healthy signals.

E.g. a valve shall be opened, if

(
Input MCS PLC A is 1
and
Input MCS PLC A is healthy
and
Heartbeat MCS PLC A is healthy
)
or
(
Input MCS PLC B is 1
and
Input MCS PLC B is healthy
and
Heartbeat MCS PLC B is healthy
)

Shutdowns and valve commands shall NOT be executed, if both PLCs indicate malfunctions.

8.2 Interlocks and SSS commands

In PCS mode the MCS shall ignore interlocks for valves controlled by SSS.

In order to prevent the system from physical damages the related fuse boards, PRCMs and EPCUs will automatically drop supply voltage.

All interlocks are permanently available via OPC interface and should be evaluated for operator HMI to suppress undesired valve or choke operation.

8.3 Maximum parallel Operations

The SSS shall take care that only one valve or choke is operated in parallel. This is caused by power supply restrictions.

8.4 SSS Valve Command Processing

Processing of SSS valve commands will follow the first-in first-out principle (FIFO). Each SSS valve command appearing during SSS valve operation will be delayed by MCS until operation is finalized.

This algorithm should only be applied in an accidental situation because the SSS is losing control about runtime behaviour in this case. Application of parallel setpoint changes would depend on interface timing (SSS output, wiring, etc) or polling cycles (input scan, MCS scan cycles, etc) and is no longer predictable for physical reasons.

Example: Two "parallel" SSS setpoint changes

The SSS system changes two setpoints within one PLC output cycle. The first signal detected at the related MCS server starts valve operation. Operation of the second valve starts immediately after cool down period.

This implementation is only suitable for SSS commands. Commands arising at OPC interface during valve operation will be ignored.

9 Clarification

No.	Date	Objective	Author

10 Appendix A: Tag List K5F-1 and K5F-2

General Items

MCSHEARTBEAT	K5F.MCSHEARTBEAT
PCSHEARTBEAT	K5F.PCSHEARTBEAT
NN81203_ALM	K5F.NN81203_ALM
TBOK6P	K5F.TBOK6P

Wells

K5F_1_STW	K5F.W1.K5F_1_STW
K5F_1_ITW	K5F.W1.K5F_1_ITW
K5F_1_ITWO	K5F.W1.K5F_1_ITWO
K5F_1_ITWC	K5F.W1.K5F_1_ITWC
K5F_1_ALM	K5F.W1.K5F_1_ALM
DVA92103_1_STW	K5F.W1.VLV.DVA92103_1_STW
DHSV92103_1_STW	K5F.W1.VLV.DHSV92103_1_STW
DHSV92103_1_ENG	K5F.W1.VLV.DHSV92103_1_ENG
DHSV92103_1_ITW	K5F.W1.VLV.DHSV92103_1_ITW
DHSV92103_1_ITWO	K5F.W1.VLV.DHSV92103_1_ITWO
DHSV92103_1_ITWC	K5F.W1.VLV.DHSV92103_1_ITWC
UPMV92102_1_STW	K5F.W1.VLV.UPMV92102_1_STW
UPMV92102_1_ENG	K5F.W1.VLV.UPMV92102_1_ENG
UPMV92102_1_ITW	K5F.W1.VLV.UPMV92102_1_ITW
UPMV92102_1_ITWO	K5F.W1.VLV.UPMV92102_1_ITWO
UPMV92102_1_ITWC	K5F.W1.VLV.UPMV92102_1_ITWC
XOV92101_1_STW	K5F.W1.VLV.XOV92101_1_STW
XOV92101_1_ENG	K5F.W1.VLV.XOV92101_1_ENG
XOV92101_1_ITW	K5F.W1.VLV.XOV92101_1_ITW
XOV92101_1_ITWO	K5F.W1.VLV.XOV92101_1_ITWO
XOV92101_1_ITWC	K5F.W1.VLV.XOV92101_1_ITWC
PWV92101_1_STW	K5F.W1.VLV.PWV92101_1_STW
PWV92101_1_ENG	K5F.W1.VLV.PWV92101_1_ENG
PWV92101_1_ITW	K5F.W1.VLV.PWV92101_1_ITW
PWV92101_1_ITWO	K5F.W1.VLV.PWV92101_1_ITWO
PWV92101_1_ITWC	K5F.W1.VLV.PWV92101_1_ITWC
AMV92103_1_CTW	K5F.W1.VLV.AMV92103_1_CTW
AMV92103_1_STW	K5F.W1.VLV.AMV92103_1_STW
AMV92103_1_ENG	K5F.W1.VLV.AMV92103_1_ENG
AMV92103_1_ITW	K5F.W1.VLV.AMV92103_1_ITW
AMV92103_1_ITWO	K5F.W1.VLV.AMV92103_1_ITWO
AMV92103_1_ITWC	K5F.W1.VLV.AMV92103_1_ITWC
CIV92101_1_CTW	K5F.W1.VLV.CIV92101_1_CTW
CIV92101_1_STW	K5F.W1.VLV.CIV92101_1_STW
CIV92101_1_ENG	K5F.W1.VLV.CIV92101_1_ENG
CIV92101_1_ITW	K5F.W1.VLV.CIV92101_1_ITW
CIV92101_1_ITWO	K5F.W1.VLV.CIV92101_1_ITWO
CIV92101_1_ITWC	K5F.W1.VLV.CIV92101_1_ITWC
CIV92102_1_CTW	K5F.W1.VLV.CIV92102_1_CTW
CIV92102_1_STW	K5F.W1.VLV.CIV92102_1_STW
CIV92102_1_ENG	K5F.W1.VLV.CIV92102_1_ENG

CIV92102_1_ITW	K5F.W1.VLV.CIV92102_1_ITW
CIV92102_1_ITWO	K5F.W1.VLV.CIV92102_1_ITWO
CIV92102_1_ITWC	K5F.W1.VLV.CIV92102_1_ITWC
CIV92103_1_CTW	K5F.W1.VLV.CIV92103_1_CTW
CIV92103_1_STW	K5F.W1.VLV.CIV92103_1_STW
CIV92103_1_ENG	K5F.W1.VLV.CIV92103_1_ENG
CIV92103_1_ITW	K5F.W1.VLV.CIV92103_1_ITW
CIV92103_1_ITWO	K5F.W1.VLV.CIV92103_1_ITWO
CIV92103_1_ITWC	K5F.W1.VLV.CIV92103_1_ITWC
BAIV92100_1_CTW	K5F.W1.VLV.BAIV92100_1_CTW
BAIV92100_1_STW	K5F.W1.VLV.BAIV92100_1_STW
BAIV92100_1_ENG	K5F.W1.VLV.BAIV92100_1_ENG
BAIV92100_1_ITW	K5F.W1.VLV.BAIV92100_1_ITW
BAIV92100_1_ITWO	K5F.W1.VLV.BAIV92100_1_ITWO
BAIV92100_1_ITWC	K5F.W1.VLV.BAIV92100_1_ITWC
PCV92101_1_SPT	K5F.W1.VLV.PCV92101_1_SPT
PCV92101_1_STW	K5F.W1.VLV.PCV92101_1_STW
PCV92101_1_ENG	K5F.W1.VLV.PCV92101_1_ENG
PCV92101_1_ITW	K5F.W1.VLV.PCV92101_1_ITW
PCV92101_1_ITWO	K5F.W1.VLV.PCV92101_1_ITWO
PCV92101_1_ITWC	K5F.W1.VLV.PCV92101_1_ITWC
PPU92101_1_ENG	K5F.W1.INST.PPU92101_1_ENG
PPU92101_1_STW	K5F.W1.INST.PPU92101_1_STW
PTU92104_1_ENG	K5F.W1.INST.PTU92104_1_ENG
PTU92104_1_STW	K5F.W1.INST.PTU92104_1_STW
PPD92111_1_ENG	K5F.W1.INST.PPD92111_1_ENG
PPD92111_1_STW	K5F.W1.INST.PPD92111_1_STW
PTD92101_1_ENG	K5F.W1.INST.PTD92101_1_ENG
PTD92101_1_STW	K5F.W1.INST.PTD92101_1_STW
APTA92103_1_ENG	K5F.W1.INST.APTA92103_1_ENG
APTA92103_1_STW	K5F.W1.INST.APTA92103_1_STW
APTB92105_1_ENG	K5F.W1.INST.APTB92105_1_ENG
APTB92105_1_STW	K5F.W1.INST.APTB92105_1_STW
PT92104_1_ENG	K5F.W1.INST.PT92104_1_ENG
PT92104_1_STW	K5F.W1.INST.PT92104_1_STW
TT92103_1_ENG	K5F.W1.INST.TT92103_1_ENG
TT92103_1_STW	K5F.W1.INST.TT92103_1_STW

K5F_2_STW	K5F.W2.K5F_2_STW
K5F_2_ITW	K5F.W2.K5F_2_ITW
K5F_2_ITWO	K5F.W2.K5F_2_ITWO
K5F_2_ITWC	K5F.W2.K5F_2_ITWC
K5F_2_ALM	K5F.W2.K5F_2_ALM
DVA92103_2_STW	K5F.W1.VLV.DVA92103_2_STW
DHSV92103_2_STW	K5F.W2.VLV.DHSV92103_2_STW
DHSV92103_2_ENG	K5F.W2.VLV.DHSV92103_2_ENG
DHSV92103_2_ITW	K5F.W2.VLV.DHSV92103_2_ITW
DHSV92103_2_ITWO	K5F.W2.VLV.DHSV92103_2_ITWO
DHSV92103_2_ITWC	K5F.W2.VLV.DHSV92103_2_ITWC
UPMV92102_2_STW	K5F.W2.VLV.UPMV92102_2_STW
UPMV92102_2_ENG	K5F.W2.VLV.UPMV92102_2_ENG

UPMV92102_2_ITW	K5F.W2.VLV.UPMV92102_2_ITW
UPMV92102_2_ITWO	K5F.W2.VLV.UPMV92102_2_ITWO
UPMV92102_2_ITWC	K5F.W2.VLV.UPMV92102_2_ITWC
XOV92101_2_STW	K5F.W2.VLV.XOV92101_2_STW
XOV92101_2_ENG	K5F.W2.VLV.XOV92101_2_ENG
XOV92101_2_ITW	K5F.W2.VLV.XOV92101_2_ITW
XOV92101_2_ITWO	K5F.W2.VLV.XOV92101_2_ITWO
XOV92101_2_ITWC	K5F.W2.VLV.XOV92101_2_ITWC
PWV92101_2_STW	K5F.W2.VLV.PWV92101_2_STW
PWV92101_2_ENG	K5F.W2.VLV.PWV92101_2_ENG
PWV92101_2_ITW	K5F.W2.VLV.PWV92101_2_ITW
PWV92101_2_ITWO	K5F.W2.VLV.PWV92101_2_ITWO
PWV92101_2_ITWC	K5F.W2.VLV.PWV92101_2_ITWC
AMV92103_2_CTW	K5F.W2.VLV.AMV92103_2_CTW
AMV92103_2_STW	K5F.W2.VLV.AMV92103_2_STW
AMV92103_2_ENG	K5F.W2.VLV.AMV92103_2_ENG
AMV92103_2_ITW	K5F.W2.VLV.AMV92103_2_ITW
AMV92103_2_ITWO	K5F.W2.VLV.AMV92103_2_ITWO
AMV92103_2_ITWC	K5F.W2.VLV.AMV92103_2_ITWC
CIV92101_2_CTW	K5F.W2.VLV.CIV92101_2_CTW
CIV92101_2_STW	K5F.W2.VLV.CIV92101_2_STW
CIV92101_2_ENG	K5F.W2.VLV.CIV92101_2_ENG
CIV92101_2_ITW	K5F.W2.VLV.CIV92101_2_ITW
CIV92101_2_ITWO	K5F.W2.VLV.CIV92101_2_ITWO
CIV92101_2_ITWC	K5F.W2.VLV.CIV92101_2_ITWC
CIV92102_2_CTW	K5F.W2.VLV.CIV92102_2_CTW
CIV92102_2_STW	K5F.W2.VLV.CIV92102_2_STW
CIV92102_2_ENG	K5F.W2.VLV.CIV92102_2_ENG
CIV92102_2_ITW	K5F.W2.VLV.CIV92102_2_ITW
CIV92102_2_ITWO	K5F.W2.VLV.CIV92102_2_ITWO
CIV92102_2_ITWC	K5F.W2.VLV.CIV92102_2_ITWC
CIV92103_2_CTW	K5F.W2.VLV.CIV92103_2_CTW
CIV92103_2_STW	K5F.W2.VLV.CIV92103_2_STW
CIV92103_2_ENG	K5F.W2.VLV.CIV92103_2_ENG
CIV92103_2_ITW	K5F.W2.VLV.CIV92103_2_ITW
CIV92103_2_ITWO	K5F.W2.VLV.CIV92103_2_ITWO
CIV92103_2_ITWC	K5F.W2.VLV.CIV92103_2_ITWC
BAIV92100_2_CTW	K5F.W2.VLV.BAIV92100_2_CTW
BAIV92100_2_STW	K5F.W2.VLV.BAIV92100_2_STW
BAIV92100_2_ENG	K5F.W2.VLV.BAIV92100_2_ENG
BAIV92100_2_ITW	K5F.W2.VLV.BAIV92100_2_ITW
BAIV92100_2_ITWO	K5F.W2.VLV.BAIV92100_2_ITWO
BAIV92100_2_ITWC	K5F.W2.VLV.BAIV92100_2_ITWC
PCV92101_2_SPT	K5F.W2.VLV.PCV92101_2_SPT
PCV92101_2_STW	K5F.W2.VLV.PCV92101_2_STW
PCV92101_2_ENG	K5F.W2.VLV.PCV92101_2_ENG
PCV92101_2_ITW	K5F.W2.VLV.PCV92101_2_ITW
PCV92101_2_ITWO	K5F.W2.VLV.PCV92101_2_ITWO
PCV92101_2_ITWC	K5F.W2.VLV.PCV92101_2_ITWC
PPU92101_2_ENG	K5F.W2.INST.PPU92101_2_ENG
PPU92101_2_STW	K5F.W2.INST.PPU92101_2_STW

PTU92104_2_ENG	K5F.W2.INST.PTU92104_2_ENG
PTU92104_2_STW	K5F.W2.INST.PTU92104_2_STW
PPD92111_2_ENG	K5F.W2.INST.PPD92111_2_ENG
PPD92111_2_STW	K5F.W2.INST.PPD92111_2_STW
PTD92101_2_ENG	K5F.W2.INST.PTD92101_2_ENG
PTD92101_2_STW	K5F.W2.INST.PTD92101_2_STW
APTA92103_2_ENG	K5F.W2.INST.APTA92103_2_ENG
APTA92103_2_STW	K5F.W2.INST.APTA92103_2_STW
APTB92105_2_ENG	K5F.W2.INST.APTB92105_2_ENG
APTB92105_2_STW	K5F.W2.INST.APTB92105_2_STW
PT92104_2_ENG	K5F.W2.INST.PT92104_2_ENG
PT92104_2_STW	K5F.W2.INST.PT92104_2_STW
TT92103_2_ENG	K5F.W2.INST.TT92103_2_ENG
TT92103_2_STW	K5F.W2.INST.TT92103_2_STW

EPCUs

JSL81204_1A_STW	K5F.W1.EPCUA.JSL81204_1A_STW
JUI81204_1A_ENG	K5F.W1.EPCUA.JUI81204_1A_ENG
JUI81204_1A_STW	K5F.W1.EPCUA.JUI81204_1A_STW
JII81204_1A_ENG	K5F.W1.EPCUA.JII81204_1A_ENG
JII81204_1A_STW	K5F.W1.EPCUA.JII81204_1A_STW
JZL81204_1A_ALM	K5F.W1.EPCUA.JZL81204_1A_ALM
JZL81204_1A_STW	K5F.W1.EPCUA.JZL81204_1A_STW
JUI81204A_1A_ENG	K5F.W1.EPCUA.JUI81204A_1A_ENG
JUI81204A_1A_STW	K5F.W1.EPCUA.JUI81204A_1A_STW
JII81204A_1A_ENG	K5F.W1.EPCUA.JII81204A_1A_ENG
JII81204A_1A_STW	K5F.W1.EPCUA.JII81204A_1A_STW
JII81204G_1A_ENG	K5F.W1.EPCUA.JII81204G_1A_ENG
JII81204G_1A_STW	K5F.W1.EPCUA.JII81204G_1A_STW
JII81204S_1A_ENG	K5F.W1.EPCUA.JII81204S_1A_ENG
JII81204S_1A_STW	K5F.W1.EPCUA.JII81204S_1A_STW
JSL81204_1B_STW	K5F.W1.EPCUB.JSL81204_1B_STW
JUI81204_1B_ENG	K5F.W1.EPCUB.JUI81204_1B_ENG
JUI81204_1B_STW	K5F.W1.EPCUB.JUI81204_1B_STW
JII81204_1B_ENG	K5F.W1.EPCUB.JII81204_1B_ENG
JII81204_1B_STW	K5F.W1.EPCUB.JII81204_1B_STW
JZL81204_1B_ALM	K5F.W1.EPCUB.JZL81204_1B_ALM
JZL81204_1B_STW	K5F.W1.EPCUB.JZL81204_1B_STW
JUI81204A_1B_ENG	K5F.W1.EPCUB.JUI81204A_1B_ENG
JUI81204A_1B_STW	K5F.W1.EPCUB.JUI81204A_1B_STW
JII81204A_1B_ENG	K5F.W1.EPCUB.JII81204A_1B_ENG
JII81204A_1B_STW	K5F.W1.EPCUB.JII81204A_1B_STW
JII81204G_1B_ENG	K5F.W1.EPCUB.JII81204G_1B_ENG
JII81204G_1B_STW	K5F.W1.EPCUB.JII81204G_1B_STW
JII81204S_1B_ENG	K5F.W1.EPCUB.JII81204S_1B_ENG
JII81204S_1B_STW	K5F.W1.EPCUB.JII81204S_1B_STW
JSL81204_2A_STW	K5F.W2.EPCUA.JSL81204_2A_STW

JUI81204_2A_ENG	K5F.W2.EPCUA.JUI81204_2A_ENG
JUI81204_2A_STW	K5F.W2.EPCUA.JUI81204_2A_STW
JII81204_2A_ENG	K5F.W2.EPCUA.JII81204_2A_ENG
JII81204_2A_STW	K5F.W2.EPCUA.JII81204_2A_STW
JZL81204_2A_ALM	K5F.W2.EPCUA.JZL81204_2A_ALM
JZL81204_2A_STW	K5F.W2.EPCUA.JZL81204_2A_STW
JUI81204A_2A_ENG	K5F.W2.EPCUA.JUI81204A_2A_ENG
JUI81204A_2A_STW	K5F.W2.EPCUA.JUI81204A_2A_STW
JII81204A_2A_ENG	K5F.W2.EPCUA.JII81204A_2A_ENG
JII81204A_2A_STW	K5F.W2.EPCUA.JII81204A_2A_STW
JII81204G_2A_ENG	K5F.W2.EPCUA.JII81204G_2A_ENG
JII81204G_2A_STW	K5F.W2.EPCUA.JII81204G_2A_STW
JII81204S_2A_ENG	K5F.W2.EPCUA.JII81204S_2A_ENG
JII81204S_2A_STW	K5F.W2.EPCUA.JII81204S_2A_STW
JSL81204_2B_STW	K5F.W2.EPCUB.JSL81204_2B_STW
JUI81204_2B_ENG	K5F.W2.EPCUB.JUI81204_2B_ENG
JUI81204_2B_STW	K5F.W2.EPCUB.JUI81204_2B_STW
JII81204_2B_ENG	K5F.W2.EPCUB.JII81204_2B_ENG
JII81204_2B_STW	K5F.W2.EPCUB.JII81204_2B_STW
JZL81204_2B_ALM	K5F.W2.EPCUB.JZL81204_2B_ALM
JZL81204_2B_STW	K5F.W2.EPCUB.JZL81204_2B_STW
JUI81204A_2B_ENG	K5F.W2.EPCUB.JUI81204A_2B_ENG
JUI81204A_2B_STW	K5F.W2.EPCUB.JUI81204A_2B_STW
JII81204A_2B_ENG	K5F.W2.EPCUB.JII81204A_2B_ENG
JII81204A_2B_STW	K5F.W2.EPCUB.JII81204A_2B_STW
JII81204G_2B_ENG	K5F.W2.EPCUB.JII81204G_2B_ENG
JII81204G_2B_STW	K5F.W2.EPCUB.JII81204G_2B_STW
JII81204S_2B_ENG	K5F.W2.EPCUB.JII81204S_2B_ENG
JII81204S_2B_STW	K5F.W2.EPCUB.JII81204S_2B_STW

PRCM Diagnostic Parameters

JTI92100R_1A_ENG	K5F.W1.PRCMA.JTI92100R_1A_ENG
JTI92100R_1A_STW	K5F.W1.PRCMA.JTI92100R_1A_STW
JII92100W_1A_ENG	K5F.W1.PRCMA.JII92100W_1A_ENG
JII92100W_1A_STW	K5F.W1.PRCMA.JII92100W_1A_STW
JII92100S_1A_ENG	K5F.W1.PRCMA.JII92100S_1A_ENG
JII92100S_1A_STW	K5F.W1.PRCMA.JII92100S_1A_STW
JTI92100R_1B_ENG	K5F.W1.PRCMB.JTI92100R_1B_ENG
JTI92100R_1B_STW	K5F.W1.PRCMB.JTI92100R_1B_STW
JII92100W_1B_ENG	K5F.W1.PRCMB.JII92100W_1B_ENG
JII92100W_1B_STW	K5F.W1.PRCMB.JII92100W_1B_STW
JII92100S_1B_ENG	K5F.W1.PRCMB.JII92100S_1B_ENG
JII92100S_1B_STW	K5F.W1.PRCMB.JII92100S_1B_STW
JTI92100R_2A_ENG	K5F.W2.PRCMA.JTI92100R_2A_ENG
JTI92100R_2A_STW	K5F.W2.PRCMA.JTI92100R_2A_STW
JII92100W_2A_ENG	K5F.W2.PRCMA.JII92100W_2A_ENG

JII92100W_2A_STW	K5F.W2.PRCMA.JII92100W_2A_STW
JII92100S_2A_ENG	K5F.W2.PRCMA.JII92100S_2A_ENG
JII92100S_2A_STW	K5F.W2.PRCMA.JII92100S_2A_STW
JTI92100R_2B_ENG	K5F.W2.PRCMB.JTI92100R_2B_ENG
JTI92100R_2B_STW	K5F.W2.PRCMB.JTI92100R_2B_STW
JII92100W_2B_ENG	K5F.W2.PRCMB.JII92100W_2B_ENG
JII92100W_2B_STW	K5F.W2.PRCMB.JII92100W_2B_STW
JII92100S_2B_ENG	K5F.W2.PRCMB.JII92100S_2B_ENG
JII92100S_2B_STW	K5F.W2.PRCMB.JII92100S_2B_STW

HPU

HPU82840	K5F.HPU.HPU82840
PT82840_ENG	K5F.HPU.PT82840_ENG
PT82840_STW	K5F.HPU.PT82840_STW
PT82843_ENG	K5F.HPU.PT82843_ENG
PT82843_STW	K5F.HPU.PT82843_STW
LT82840_ENG	K5F.HPU.LT82840_ENG
LT82840_STW	K5F.HPU.LT82840_STW
LT82841_ENG	K5F.HPU.LT82841_ENG
LT82841_STW	K5F.HPU.LT82841_STW
JSL82840A	K5F.HPU.JSL82840A
JSL82840A_STW	K5F.HPU.JSL82840A_STW
JZL82840A	K5F.HPU.JZL82840A
JZL82840A_STW	K5F.HPU.JZL82840A_STW
PDZH82840A	K5F.HPU.PDZH82840A
PDZH82840A_STW	K5F.HPU.PDZH82840A_STW
JSL82840B	K5F.HPU.JSL82840B
JSL82840B_STW	K5F.HPU.JSL82840B_STW
JZL82840B	K5F.HPU.JZL82840B
JZL82840B_STW	K5F.HPU.JZL82840B_STW
PDZH82840B	K5F.HPU.PDZH82840B
PDZH82840B_STW	K5F.HPU.PDZH82840B_STW
JSL82841	K5F.HPU.JSL82841
JSL82841_STW	K5F.HPU.JSL82841_STW
JZL82841	K5F.HPU.JZL82841
JZL82841_STW	K5F.HPU.JZL82841_STW
JZL82840	K5F.HPU.JZL82840
JZL82840_STW	K5F.HPU.JZL82840_STW
JHSWL82840A	K5F.HPU.JHSWL82840A
JHSWL82840A_STW	K5F.HPU.JHSWL82840A_STW
JZX82840A_ENG	K5F.HPU.JZX82840A_ENG
JZX82840A_STW	K5F.HPU.JZX82840A_STW
JHSW82840A_CTW	K5F.HPU.JHSW82840A_CTW
JRC82840A_CTW	K5F.HPU.JRC82840A_CTW
JRCL82840A	K5F.HPU.JRCL82840A
JRCL82840A_STW	K5F.HPU.JRCL82840A_STW
JHSWL82840B	K5F.HPU.JHSWL82840B
JHSWL82840B_STW	K5F.HPU.JHSWL82840B_STW

JZX82840B_ENG	K5F.HPU.JZX82840B_ENG
JZX82840B_STW	K5F.HPU.JZX82840B_STW
JHSW82840B_CTW	K5F.HPU.JHSW82840B_CTW
JRC82840B_CTW	K5F.HPU.JRC82840B_CTW
JRCL82840B	K5F.HPU.JRCL82840B
JRCL82840B_STW	K5F.HPU.JRCL82840B_STW
JZX82841_ENG	K5F.HPU.JZX82841_ENG
JZX82841_STW	K5F.HPU.JZX82841_STW
JRC82841_CTW	K5F.HPU.JRC82841_CTW
JRCL82841	K5F.HPU.JRCL82841
JRCL82841_STW	K5F.HPU.JRCL82841_STW

11 Appendix B: Tag List Extension K5F-3 and K5F-4

The following tags are intended to be used for well 3 and 4 extension, but are not accessible until introduced by MCS database.

Wells

K5F_3_STW	K5F.W3.K5F_3_STW
K5F_3_ITW	K5F.W3.K5F_3_ITW
K5F_3_ITWO	K5F.W3.K5F_3_ITWO
K5F_3_ITWC	K5F.W3.K5F_3_ITWC
K5F_3_ALM	K5F.W3.K5F_3_ALM
DVA92103_3_STW	K5F.W3.VLV.DVA92103_3_STW
DHSV92103_3_STW	K5F.W3.VLV.DHSV92103_3_STW
DHSV92103_3_ENG	K5F.W3.VLV.DHSV92103_3_ENG
DHSV92103_3_ITW	K5F.W3.VLV.DHSV92103_3_ITW
DHSV92103_3_ITWO	K5F.W3.VLV.DHSV92103_3_ITWO
DHSV92103_3_ITWC	K5F.W3.VLV.DHSV92103_3_ITWC
UPMV92102_3_STW	K5F.W3.VLV.UPMV92102_3_STW
UPMV92102_3_ENG	K5F.W3.VLV.UPMV92102_3_ENG
UPMV92102_3_ITW	K5F.W3.VLV.UPMV92102_3_ITW
UPMV92102_3_ITWO	K5F.W3.VLV.UPMV92102_3_ITWO
UPMV92102_3_ITWC	K5F.W3.VLV.UPMV92102_3_ITWC
XOV92101_3_STW	K5F.W3.VLV.XOV92101_3_STW
XOV92101_3_ENG	K5F.W3.VLV.XOV92101_3_ENG
XOV92101_3_ITW	K5F.W3.VLV.XOV92101_3_ITW
XOV92101_3_ITWO	K5F.W3.VLV.XOV92101_3_ITWO
XOV92101_3_ITWC	K5F.W3.VLV.XOV92101_3_ITWC
PWV92101_3_STW	K5F.W3.VLV.PWV92101_3_STW
PWV92101_3_ENG	K5F.W3.VLV.PWV92101_3_ENG
PWV92101_3_ITW	K5F.W3.VLV.PWV92101_3_ITW
PWV92101_3_ITWO	K5F.W3.VLV.PWV92101_3_ITWO
PWV92101_3_ITWC	K5F.W3.VLV.PWV92101_3_ITWC
AMV92103_3_CTW	K5F.W3.VLV.AMV92103_3_CTW
AMV92103_3_STW	K5F.W3.VLV.AMV92103_3_STW
AMV92103_3_ENG	K5F.W3.VLV.AMV92103_3_ENG
AMV92103_3_ITW	K5F.W3.VLV.AMV92103_3_ITW
AMV92103_3_ITWO	K5F.W3.VLV.AMV92103_3_ITWO
AMV92103_3_ITWC	K5F.W3.VLV.AMV92103_3_ITWC
CIV92101_3_CTW	K5F.W3.VLV.CIV92101_3_CTW
CIV92101_3_STW	K5F.W3.VLV.CIV92101_3_STW
CIV92101_3_ENG	K5F.W3.VLV.CIV92101_3_ENG
CIV92101_3_ITW	K5F.W3.VLV.CIV92101_3_ITW
CIV92101_3_ITWO	K5F.W3.VLV.CIV92101_3_ITWO
CIV92101_3_ITWC	K5F.W3.VLV.CIV92101_3_ITWC
CIV92102_3_CTW	K5F.W3.VLV.CIV92102_3_CTW
CIV92102_3_STW	K5F.W3.VLV.CIV92102_3_STW
CIV92102_3_ENG	K5F.W3.VLV.CIV92102_3_ENG
CIV92102_3_ITW	K5F.W3.VLV.CIV92102_3_ITW
CIV92102_3_ITWO	K5F.W3.VLV.CIV92102_3_ITWO

CIV92102_3_ITWC	K5F.W3.VLV.CIV92102_3_ITWC
CIV92103_3_CTW	K5F.W3.VLV.CIV92103_3_CTW
CIV92103_3_STW	K5F.W3.VLV.CIV92103_3_STW
CIV92103_3_ENG	K5F.W3.VLV.CIV92103_3_ENG
CIV92103_3_ITW	K5F.W3.VLV.CIV92103_3_ITW
CIV92103_3_ITWO	K5F.W3.VLV.CIV92103_3_ITWO
CIV92103_3_ITWC	K5F.W3.VLV.CIV92103_3_ITWC
BAIV92100_3_CTW	K5F.W3.VLV.BAIV92100_3_CTW
BAIV92100_3_STW	K5F.W3.VLV.BAIV92100_3_STW
BAIV92100_3_ENG	K5F.W3.VLV.BAIV92100_3_ENG
BAIV92100_3_ITW	K5F.W3.VLV.BAIV92100_3_ITW
BAIV92100_3_ITWO	K5F.W3.VLV.BAIV92100_3_ITWO
BAIV92100_3_ITWC	K5F.W3.VLV.BAIV92100_3_ITWC
PCV92101_3_SPT	K5F.W3.VLV.PCV92101_3_SPT
PCV92101_3_STW	K5F.W3.VLV.PCV92101_3_STW
PCV92101_3_ENG	K5F.W3.VLV.PCV92101_3_ENG
PCV92101_3_ITW	K5F.W3.VLV.PCV92101_3_ITW
PCV92101_3_ITWO	K5F.W3.VLV.PCV92101_3_ITWO
PCV92101_3_ITWC	K5F.W3.VLV.PCV92101_3_ITWC
PPU92101_3_ENG	K5F.W3.INST.PPU92101_3_ENG
PPU92101_3_STW	K5F.W3.INST.PPU92101_3_STW
PTU92104_3_ENG	K5F.W3.INST.PTU92104_3_ENG
PTU92104_3_STW	K5F.W3.INST.PTU92104_3_STW
PPD92111_3_ENG	K5F.W3.INST.PPD92111_3_ENG
PPD92111_3_STW	K5F.W3.INST.PPD92111_3_STW
PTD92101_3_ENG	K5F.W3.INST.PTD92101_3_ENG
PTD92101_3_STW	K5F.W3.INST.PTD92101_3_STW
APTA92103_3_ENG	K5F.W3.INST.APTA92103_3_ENG
APTA92103_3_STW	K5F.W3.INST.APTA92103_3_STW
APTB92105_3_ENG	K5F.W3.INST.APTB92105_3_ENG
APTB92105_3_STW	K5F.W3.INST.APTB92105_3_STW
PT92104_3_ENG	K5F.W3.INST.PT92104_3_ENG
PT92104_3_STW	K5F.W3.INST.PT92104_3_STW
TT92103_3_ENG	K5F.W3.INST.TT92103_3_ENG
TT92103_3_STW	K5F.W3.INST.TT92103_3_STW
K5F_4_STW	K5F.W4.K5F_4_STW
K5F_4_ITW	K5F.W4.K5F_4_ITW
K5F_4_ITWO	K5F.W4.K5F_4_ITWO
K5F_4_ITWC	K5F.W4.K5F_4_ITWC
K5F_4_ALM	K5F.W4.K5F_4_ALM
DVA92103_4_STW	K5F.W3.VLV.DVA92103_4_STW
DHSV92103_4_STW	K5F.W4.VLV.DHSV92103_4_STW
DHSV92103_4_ENG	K5F.W4.VLV.DHSV92103_4_ENG
DHSV92103_4_ITW	K5F.W4.VLV.DHSV92103_4_ITW
DHSV92103_4_ITWO	K5F.W4.VLV.DHSV92103_4_ITWO
DHSV92103_4_ITWC	K5F.W4.VLV.DHSV92103_4_ITWC
UPMV92102_4_STW	K5F.W4.VLV.UPMV92102_4_STW
UPMV92102_4_ENG	K5F.W4.VLV.UPMV92102_4_ENG
UPMV92102_4_ITW	K5F.W4.VLV.UPMV92102_4_ITW
UPMV92102_4_ITWO	K5F.W4.VLV.UPMV92102_4_ITWO

UPMV92102_4_ITWC	K5F.W4.VLV.UPMV92102_4_ITWC
XOV92101_4_STW	K5F.W4.VLV.XOV92101_4_STW
XOV92101_4_ENG	K5F.W4.VLV.XOV92101_4_ENG
XOV92101_4_ITW	K5F.W4.VLV.XOV92101_4_ITW
XOV92101_4_ITWO	K5F.W4.VLV.XOV92101_4_ITWO
XOV92101_4_ITWC	K5F.W4.VLV.XOV92101_4_ITWC
PWV92101_4_STW	K5F.W4.VLV.PWV92101_4_STW
PWV92101_4_ENG	K5F.W4.VLV.PWV92101_4_ENG
PWV92101_4_ITW	K5F.W4.VLV.PWV92101_4_ITW
PWV92101_4_ITWO	K5F.W4.VLV.PWV92101_4_ITWO
PWV92101_4_ITWC	K5F.W4.VLV.PWV92101_4_ITWC
AMV92103_4_CTW	K5F.W4.VLV.AMV92103_4_CTW
AMV92103_4_STW	K5F.W4.VLV.AMV92103_4_STW
AMV92103_4_ENG	K5F.W4.VLV.AMV92103_4_ENG
AMV92103_4_ITW	K5F.W4.VLV.AMV92103_4_ITW
AMV92103_4_ITWO	K5F.W4.VLV.AMV92103_4_ITWO
AMV92103_4_ITWC	K5F.W4.VLV.AMV92103_4_ITWC
CIV92101_4_CTW	K5F.W4.VLV.CIV92101_4_CTW
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CIV92102_4_ENG	K5F.W4.VLV.CIV92102_4_ENG
CIV92102_4_ITW	K5F.W4.VLV.CIV92102_4_ITW
CIV92102_4_ITWO	K5F.W4.VLV.CIV92102_4_ITWO
CIV92102_4_ITWC	K5F.W4.VLV.CIV92102_4_ITWC
CIV92103_4_CTW	K5F.W4.VLV.CIV92103_4_CTW
CIV92103_4_STW	K5F.W4.VLV.CIV92103_4_STW
CIV92103_4_ENG	K5F.W4.VLV.CIV92103_4_ENG
CIV92103_4_ITW	K5F.W4.VLV.CIV92103_4_ITW
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BAIV92100_4_STW	K5F.W4.VLV.BAIV92100_4_STW
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BAIV92100_4_ITWO	K5F.W4.VLV.BAIV92100_4_ITWO
BAIV92100_4_ITWC	K5F.W4.VLV.BAIV92100_4_ITWC
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PCV92101_4_ITWO	K5F.W4.VLV.PCV92101_4_ITWO
PCV92101_4_ITWC	K5F.W4.VLV.PCV92101_4_ITWC
PPU92101_4_ENG	K5F.W4.INST.PPU92101_4_ENG
PPU92101_4_STW	K5F.W4.INST.PPU92101_4_STW
PTU92104_4_ENG	K5F.W4.INST.PTU92104_4_ENG
PTU92104_4_STW	K5F.W4.INST.PTU92104_4_STW

PPD92111_4_ENG	K5F.W4.INST.PPD92111_4_ENG
PPD92111_4_STW	K5F.W4.INST.PPD92111_4_STW
PTD92101_4_ENG	K5F.W4.INST.PTD92101_4_ENG
PTD92101_4_STW	K5F.W4.INST.PTD92101_4_STW
APTA92103_4_ENG	K5F.W4.INST.APTA92103_4_ENG
APTA92103_4_STW	K5F.W4.INST.APTA92103_4_STW
APTB92105_4_ENG	K5F.W4.INST.APTB92105_4_ENG
APTB92105_4_STW	K5F.W4.INST.APTB92105_4_STW
PT92104_4_ENG	K5F.W4.INST.PT92104_4_ENG
PT92104_4_STW	K5F.W4.INST.PT92104_4_STW
TT92103_4_ENG	K5F.W4.INST.TT92103_4_ENG
TT92103_4_STW	K5F.W4.INST.TT92103_4_STW

EPCUs

JSL81204_3A_STW	K5F.W3.EPCUA.JSL81204_3A_STW
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JUI81204_3A_STW	K5F.W3.EPCUA.JUI81204_3A_STW
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JZL81204_3A_STW	K5F.W3.EPCUA.JZL81204_3A_STW
JUI81204A_3A_ENG	K5F.W3.EPCUA.JUI81204A_3A_ENG
JUI81204A_3A_STW	K5F.W3.EPCUA.JUI81204A_3A_STW
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JII81204A_3A_STW	K5F.W3.EPCUA.JII81204A_3A_STW
JII81204G_3A_ENG	K5F.W3.EPCUA.JII81204G_3A_ENG
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JII81204S_3A_STW	K5F.W3.EPCUA.JII81204S_3A_STW
JSL81204_3B_STW	K5F.W3.EPCUB.JSL81204_3B_STW
JUI81204_3B_ENG	K5F.W3.EPCUB.JUI81204_3B_ENG
JUI81204_3B_STW	K5F.W3.EPCUB.JUI81204_3B_STW
JII81204_3B_ENG	K5F.W3.EPCUB.JII81204_3B_ENG
JII81204_3B_STW	K5F.W3.EPCUB.JII81204_3B_STW
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JII81204A_3B_ENG	K5F.W3.EPCUB.JII81204A_3B_ENG
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JII81204S_3B_ENG	K5F.W3.EPCUB.JII81204S_3B_ENG
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JUI81204_4A_STW	K5F.W4.EPCUA.JUI81204_4A_STW

JII81204_4A_ENG	K5F.W4.EPCUA.JII81204_4A_ENG
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JZL81204_4A_STW	K5F.W4.EPCUA.JZL81204_4A_STW
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JII81204S_4A_STW	K5F.W4.EPCUA.JII81204S_4A_STW
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JUI81204_4B_ENG	K5F.W4.EPCUB.JUI81204_4B_ENG
JUI81204_4B_STW	K5F.W4.EPCUB.JUI81204_4B_STW
JII81204_4B_ENG	K5F.W4.EPCUB.JII81204_4B_ENG
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JII81204A_4B_ENG	K5F.W4.EPCUB.JII81204A_4B_ENG
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JII81204G_4B_STW	K5F.W4.EPCUB.JII81204G_4B_STW
JII81204S_4B_ENG	K5F.W4.EPCUB.JII81204S_4B_ENG
JII81204S_4B_STW	K5F.W4.EPCUB.JII81204S_4B_STW

PRCM Diagnostic Parameters

JTI92100R_3A_ENG	K5F.W3.PRCMA.JTI92100R_3A_ENG
JTI92100R_3A_STW	K5F.W3.PRCMA.JTI92100R_3A_STW
JII92100W_3A_ENG	K5F.W3.PRCMA.JII92100W_3A_ENG
JII92100W_3A_STW	K5F.W3.PRCMA.JII92100W_3A_STW
JII92100S_3A_ENG	K5F.W3.PRCMA.JII92100S_3A_ENG
JII92100S_3A_STW	K5F.W3.PRCMA.JII92100S_3A_STW
JTI92100R_3B_ENG	K5F.W3.PRCMB.JTI92100R_3B_ENG
JTI92100R_3B_STW	K5F.W3.PRCMB.JTI92100R_3B_STW
JII92100W_3B_ENG	K5F.W3.PRCMB.JII92100W_3B_ENG
JII92100W_3B_STW	K5F.W3.PRCMB.JII92100W_3B_STW
JII92100S_3B_ENG	K5F.W3.PRCMB.JII92100S_3B_ENG
JII92100S_3B_STW	K5F.W3.PRCMB.JII92100S_3B_STW
JTI92100R_4A_ENG	K5F.W4.PRCMA.JTI92100R_4A_ENG
JTI92100R_4A_STW	K5F.W4.PRCMA.JTI92100R_4A_STW
JII92100W_4A_ENG	K5F.W4.PRCMA.JII92100W_4A_ENG
JII92100W_4A_STW	K5F.W4.PRCMA.JII92100W_4A_STW
JII92100S_4A_ENG	K5F.W4.PRCMA.JII92100S_4A_ENG

JII92100S_4A_STW	K5F.W4.PRCMA.JII92100S_4A_STW
JTI92100R_4B_ENG	K5F.W4.PRCMB.JTI92100R_4B_ENG
JTI92100R_4B_STW	K5F.W4.PRCMB.JTI92100R_4B_STW
JII92100W_4B_ENG	K5F.W4.PRCMB.JII92100W_4B_ENG
JII92100W_4B_STW	K5F.W4.PRCMB.JII92100W_4B_STW
JII92100S_4B_ENG	K5F.W4.PRCMB.JII92100S_4B_ENG
JII92100S_4B_STW	K5F.W4.PRCMB.JII92100S_4B_STW

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

01.08.2007	Approved for Construction	A. Haase	A. Voges	A. Weilandt
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Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Installation Manual** **Master Control Station / Hardware**		
PAGE 1 OF 14	**Customer Document Number:**	54NL92-W-0P-503	REV. 1
	Cameron Document No.	X-065467-02-07	REV. 01

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TABLE OF FIGURES

1 INTRODUCTION

1.1 SCOPE

This document outlines the procedure for installation of the Master Control Station Hardware.

1.2 TERMS AND ABBREVIATIONS

AVC	Auto View Commander
BOM	Bill of Materials
CAM	CAMERON
EPCU	Electrical Power & Communication Unit
ESCM	Electrical Subsea Control Module
FAT	Factory Acceptance Test
HMI	Human Machine Interface
Hz	Hertz
LTC	Long Term Cover
MCS	Master Control Station
N/A	Not applicable
PCS	Production Control System
PLC	Programmable Logic Controller
PN	Part Number
UPS	Uninterruptible Power Supply
VAC	Voltage Alternate Current
VDC	Voltage Direct Current

1.3 CAMERON CONTACT DETAILS FOR FURTHER ASSISTANCE

The contact for quotation, service and maintenance is:

Cameron GmbH
Lueckenweg 1
D - 29227 Celle
Germany

Tel: +49 5141 8060
Fax: +49 5141 806 333

2 REFERENCE DOCUMENTS

Description	CAMERON Doc. No.	Total Doc. No.
BOM MCS	223380-25	N/A
Commissioning Spares	223380-25-00-98	N/A
2 Year Operational Spares	223380-25-00-99	N/A
ASSEMBLY DRAWING MCS	SK-066380-25	54NL92-W-03-501
CIRCUIT DIAGRAM MCS	SK-066380-25-04	54NL92-W-61-501
FIELD TERMINATION DIAGRAM MCS	SK-066380-25-42	54NL92-W-01-002
HARDWARE DESIGN SPECIFICATION MCS	X-076734-03	
HARDWARE FAT MCS	X-076736-09	54NL92-W-0P-502
SOFTWARE FAT MCS	X-076736-10	54NL92-W-0P-535
MAINTENANCE PROCECURE MCS	X-065438-02-70	54NL92-W-0P-538
OPERATION PROCEDURE MCS	X-065438-02-71	54NL92-W-0P-539

3 SAFETY / WARNINGS

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

- All personnel must acquaint themselves fully and strictly adhere to all company sites' HEALTH AND SAFETY AT WORK REGULATIONS, together with other specific requirements detailed in this procedure.
- All personnel working on the equipment must have the required experience, training and qualifications.
- The lifting and handling of the equipment must be carried out with extreme caution and with regard to the safety regulations.

3.1 MEDIUM VOLTAGE POWER

CAUTION
Risk of electric shock

This equipment contains Medium Voltage Electrical Equipment: (230VAC/60Hz input).

Isolate this equipment prior to starting work.

This can be done at the UPS or locally at the MCS.

3.2 WEIGHT OF MODULES

CAUTION
Risk injuries and damages

The PCs are heavy (approximately 20 kg)

There is no stop at the exit of the panel and the full weight has to be supported.

The PCs must be removed by two persons supporting underneath the module, one person at each side

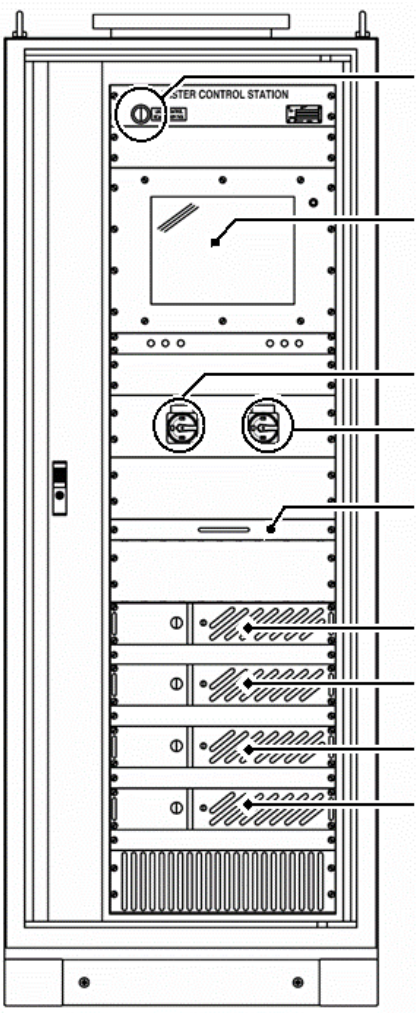
3.3 COMPANY PROCEDURES

Follow company procedures

All work carried out on this equipment shall follow company procedures and health and safety requirements. All work carried out on this equipment shall follow the permit to work system for the K5F project and health and safety requirements.

4 EQUIPMENT DESCRIPTION

4.1 OVERVIEW



1	Local / Remote Switch
2	17'' TFT screen
3	Main Switch A
4	Main Switch B
5	Keyboard
6	MCS A
7	MCS B
8	OPC Gateway A
9	OPC Gateway B

Figure 4-1 MASTER CONTROL STATION

4.2 ENVIRONMENTAL CONDITIONS

The MCS is designed for following environmental conditions:

Parameter		**Data**
Ambient Temperature	Operating Temperature	-5°C to +40°C
	Storage Temperature	-20°C to +60°C
Relative Humidity	Operating Humidity	< 95% not condensed
	Storage Humidity	20 – 80%

5 INSTALLATION PROCEDURES

5.1 LIFTING

	• The cabinet should be lifted in accordance to RITTAL TS8 Lifting Procedure see Appendix A. • Adequate lifting equipment should be used (Cameron PN. 619010-11-20) on the four lifting eyes mounted on top of each cabinet.

For internal movement a wire rope string, with a capacity of 1000kg (0° - 45°) and a length of 1000mm can be used.

5.2 BOLTING TO DECK

The cabinet plinth provides holes for bolting for fixing the cabinet, details and dimensions are shown on assembly drawing SK-066380-25.

5.3 CONNECTING FIELD TERMINATION

5.3.1 Connecting Incoming power supply to cabinet

	**CAUTION** **Risk of electric shock** This equipment contains Medium Voltage Electrical Equipment: (230VAC/60Hz input). **Isolate this equipment prior to starting work.** This can be done at the MCS Output Module on the EPU or local at the MCS.

Device	Cable No.	MCS Terminal	Verify
UPS A (230VAC/60Hz)		terminal -1X1 (L1, N, PE)	
UPS B (230VAC/60Hz)		terminal -1X2 (L1, N, PE)	

5.3.2 Connecting HPU PLC to MCS

CAUTION
Communication malfunctions

Fiber optic connections must be clean!

- Clean Fiber optic connectors with Fiber optic cleaning equipment prior to connecting!

Fiber optic cables must be healthy!

- Check Fiber optic cables prior to connecting!

Device	Cable No.	MCS Terminal	Verify
HPU PLC A		terminal –6A2.2	
HPU PLC B		terminal –6A6.2	

5.3.3 Connecting SSS to MCS

Connect Cables according to Circuit diagram SK-066380-25-04

Device	Cable No.	MCS Terminal	Verify
PCS/MCS Key		–X2 (1-2)	
TBO K6C Status		–X3 (1-2)	
ESD K5F Status		–X3 (3-4)	
Tree 1 A/B inputs		–X2 (3-18)	
Tree 1 A/B outputs		–X3 (5-12)	
Tree 2 A/B inputs		–X2 (19-34)	
Tree 2 A/B outputs		–X3 (13-20)	
Tree 3 A/B inputs		–X2 (35-50)	
Tree 3 A/B outputs		–X3 (21-28)	
Tree 4 A/B inputs		–X2 (51-66)	
Tree 4 A/B outputs		–X3 (29-36)	
Spare inputs		–X2 (67-88)	
		–X2 (107-121)	
Spare outputs		–X3 (37-64)	

Connect Earth straps to PE and RE-Terminals

5.4 INSULATION MEASUREMENT

After having connected the Field termination carry out an insulation measurement as described in the Factory Acceptance Test (X-076736-09)

5.4.1 Test Equipment

The following test equipment will be required for the Insulation Measurement:

230 VAC/50Hz Power Supply for testing

Insulation Test Meter (Megger)
(see Appendix for Calibration Certificate)

Type : _____

Serial No. : _____

Multimeter
(see Appendix for Calibration Certificate)

Type : _____

Serial No. : _____

NOTE: The Insulation Measurement shall be carried out in the following order!

5.4.2 Earthing

Ensure that the MCS is earthed to the platform earth system (min. 6mm²).

Verify: _____

Ensure that all metal parts (doors, etc) are earthed and check continuity to Main earth. Resistance shall be <1 Ω.

Verify: _____

5.4.3 Insulation Test Power Supply A

Electric supply is **not** connected. Ensure that all circuit breakers and main switches are switched ON.

Verify: _____

Measure insulation resistance (proof voltage: 500 V) at terminal. **–1X1 (L)** and **–1X1 (N)** against **PE**.

Instrument Reading: _____ MΩ

Reading shall be **> 0,5 MΩ**

Verify: _____

5.4.4 Insulation Test Power Supply B

Ensure that all circuit breakers and main switches are switched ON.

Verify: _____

Measure insulation resistance (proof voltage: 500 V) at terminal. **–1X2 (L)** and **–1X2 (N)** against **PE**.

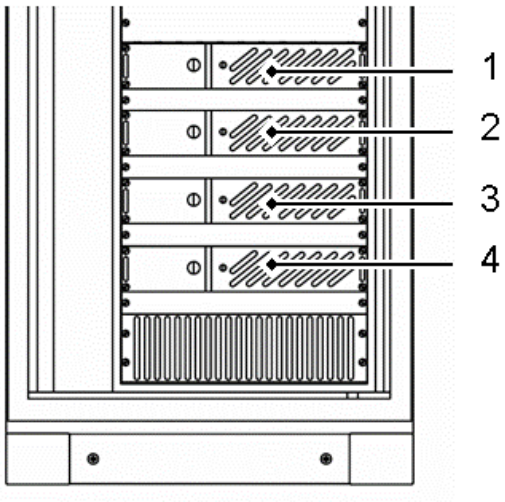
Instrument Reading: _____ MΩ

Reading shall be **> 0,5 MΩ**

Verify: _____

5.5 INSTALLATION OF SEPARATE SHIPPED ITEMS

Place the separate shipped system Components as follows:



1	MCS A
2	MCS B
3	OPC Gateway A
4	OPC Gateway B

Figure 5-1 SEPARATE SHIPPED ITEMS

Internal connections have to be made in accordance to the MCS circuit diagram (SK-066380-25-04).

CAUTION
Communication malfunctions

- **Make sure that Ethernet connections are not interchanged!**

Each cable/wire is marked with terminal No. and connection point.

Connection	**Verify**
MCS A Video to Auto View Commander	
MCS A Keyboard to Auto View Commander	
MCS A Mouse to Auto View Commander	
MCS A Ethernet 1 to Switch 1	
MCS A Ethernet 2 to Switch 2	
MCS A Ethernet 1 to Switch 3	
MCS A Power	

MCS B Video to Auto View Commander	
MCS B Keyboard to Auto View Commander	
MCS B Mouse to Auto View Commander	
MCS B Ethernet 1 to Switch 1	
MCS B Ethernet 2 to Switch 2	
MCS B Ethernet 1 to Switch 3	
MCS B Power	
OPC GATEWAY A Video to Auto View Commander	
OPC GATEWAY A Keyboard to Auto View Commander	
OPC GATEWAY A Mouse to Auto View Commander	
OPC GATEWAY A Ethernet 2 to Switch 1	
OPC GATEWAY A Ethernet 3 to Switch 2	
OPC GATEWAY A Power	
OPC GATEWAY A Video to Auto View Commander	
OPC GATEWAY A Keyboard to Auto View Commander	
OPC GATEWAY A Mouse to Auto View Commander	
OPC GATEWAY A Ethernet 2 to Switch 1	
OPC GATEWAY A Ethernet 3 to Switch 2	
OPC GATEWAY A Power	

6 INSTALLATION CERTIFICATE

Unit: Master Control Station

Part Number: 223380-25

The Installation was checked by:

CAMERON representative:

Name: _____

Signature: _____

Date: _____

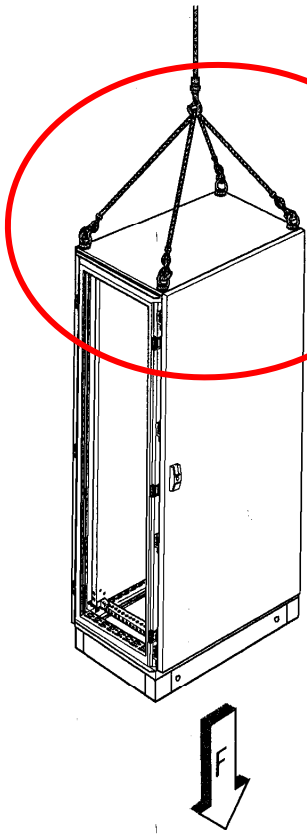
Customer representative:

Name: _____

Signature: _____

Date: _____

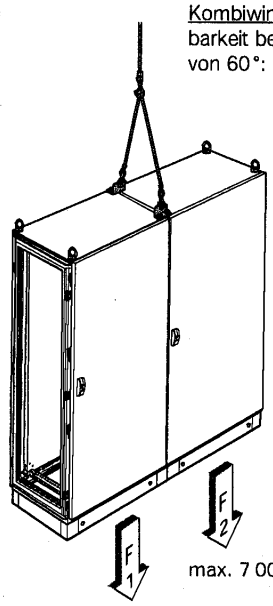
7 APPENDIX A (LIFTING PROCEDURE)



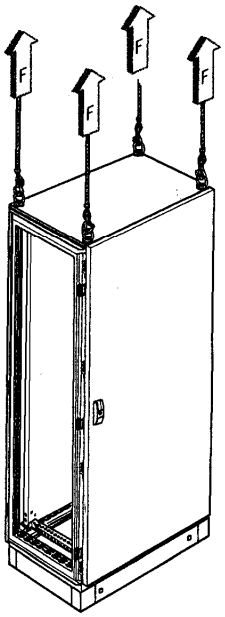
Einzelschränke werden sicher mit den zum Lieferumfang gehörenden Transportösen transportiert. Bei systematischer Belastung gelten folgende zulässige Gesamtbelastungen:
bei 45° Seilzugwinkel 4 800 N,
bei 60° Seilzugwinkel 6 400 N,
bei 90° Seilzugwinkel 13 600 N.

Individual enclosures can be transported safely using the eyebolts supplied. With systematic distribution of the load, the following overall loads are permissible:
with cable angle 45° 4 800 N,
with cable angle 60° 6 400 N,
with cable angle 90° 13 600 N.

Bei der hier gezeigten Schrankkombination mit Anreihwinkeln, Anreihschnellverbindern sowie Kombiwinkeln beträgt die Belastbarkeit bei einem Seilzugwinkel von 60°: F1 = 7 000 N, F2 = 7 000 N.

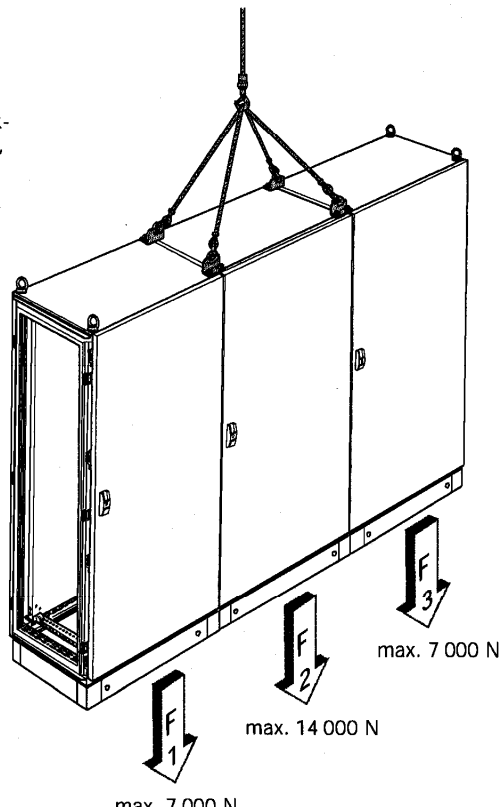


For the enclosure combination shown here, with baying brackets, baying clamps and combination angles, the permissible load is specified for a cable angle of 60°: F1 = 7 000 N, F2 = 7 000 N.



Bei der hier gezeigten Schrankkombination mit Anreihwinkeln, Anreihschnellverbindern sowie Kombiwinkeln beträgt die Belastbarkeit bei einem Seilzugwinkel von 60°: F1 = 7 000 N, F2 = 14 000 N, F3 = 7 000 N.

For the enclosure combination shown here, with baying brackets, baying clamps and combination angles, the permissible load capacity is again specified for a cable angle of 60°: F1 = 7 000 N, F2 = 14 000 N, F3 = 7 000 N.



Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

07.04.2009	As Built	A. Voges	L. Budde	O. Heinze
03.03.2008	Approved for Construction	A. Haase	A. Voges	A. Weilandt
03.07.2007	Issued for Client Comments	A. Haase	A. Voges	A. Weilandt
07.05.2007	Issued for internal IDC	A. Haase	A. Voges	A. Weilandt
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Operation Procedure** **Master Control Station / Hardware**		
PAGE 1 OF 9	**Customer Document Number:**	54NL92-W-0P-539	REV. 2
	Cameron Document No.	X-065438-02-71	REV. 02

TABLE OF CONTENTS

1 INTRODUCTION

1.1 SCOPE

This document outlines the procedure for installation, operation and maintenance of the Master Control Station Hardware. The purpose of the document is to allow installing, operating and maintaining of control equipment supplied by Cameron Controls Celle.

1.2 TERMS AND ABBREVIATIONS

AVC	Auto View Commander
BOM	Bill of Materials
CAM	CAMERON
EPCU	Electrical Power & Communication Unit
ESCM	Electrical Subsea Control Module
FAT	Factory Acceptance Test
HMI	Human Machine Interface
Hz	Hertz
LTC	Long Term Cover
MCS	Master Control Station
N/A	Not applicable
PCS	Production Control System
PLC	Programmable Logic Controller
PN	Part Number
UPS	Uninterruptible Power Supply
VAC	Voltage Alternate Current
VDC	Voltage Direct Current

1.3 CAMERON CONTACT DETAILS FOR FURTHER ASSISTANCE

The contact for quotation, service and maintenance is:

Cameron GmbH
Lueckenweg 1
D - 29227 Celle
Germany

Tel: +49 5141 8060
Fax: +49 5141 806 333

2 REFERENCE DOCUMENTS

Description	CAMERON Doc. No.	Total Doc. No.
BOM MCS	223380-25	N/A
Commissioning Spares	223380-25-00-98	N/A
2 Year Operational Spares	223380-25-00-99	N/A
ASSEMBLY DRAWING MCS	SK-066380-25	54NL92-W-03-501
CIRCUIT DIAGRAM MCS	SK-066380-25-04	54NL92-W-61-501
FIELD TERMINATION DIAGRAM MCS	SK-066380-25-42	54NL92-W-01-002
HARDWARE DESIGN SPECIFICATION MCS	X-076734-03	
HARDWARE FAT MCS	X-076736-09	54NL92-W-0P-502
SOFTWARE FAT MCS	X-076736-10	54NL92-W-0P-535
MAINTENANCE PROCECURE MCS	X-065438-02-70	54NL92-W-0P-538
INSTALLATION PROCEDURE MCS	X-065467-02-07	54NL92-W-0P-503

3 SAFETY / WARNINGS

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

- All personnel must acquaint themselves fully and strictly adhere to all company sites' HEALTH AND SAFETY AT WORK REGULATIONS, together with other specific requirements detailed in this procedure.
- All personnel working on the equipment must have the required experience, training and qualifications.
- The lifting and handling of the equipment must be carried out with extreme caution and with regard to the safety regulations.

3.1 MEDIUM VOLTAGE POWER

CAUTION
Risk of electric shock

This equipment contains Medium Voltage Electrical Equipment: (230VAC/50Hz input). For maintenance purposes.

Isolate this equipment prior to starting work.

This can be done at the UPS or locally at the MCS.

3.2 WEIGHT OF MODULES

CAUTION
Risk injuries and damages

The PCs are heavy (approximately 20 kg)

There is no stop at the exit of the panel and the full weight has to be supported.

The PCs must be removed by two persons supporting underneath the module, one person at each side

3.3 COMPANY PROCEDURES

Follow company procedures

All work carried out on this equipment shall follow company procedures and health and safety requirements. All work carried out on this equipment shall follow the permit to work system for the K5F project and health and safety requirements.

4 OPERATING PROCEDURES (HARDWARE)

The MCS is designed for following environmental conditions:

Parameter		Data
Ambient Temperature	Operating Temperature	-5°C to +40°C
	Storage Temperature	-20°C to +60°C
Relative Humidity	Operating Humidity	< 95% not condensed
	Storage Humidity	20 – 80%, no rain

Warning:
The system has to be operated by a trained operator only.

Before you switch on the Master Control Station open up the cabinet, open swing frame to get access to the interior.

CAUTION
Risk of electric shock and/or damages

This equipment contains Medium Voltage Electrical Equipment: (230VAC/50Hz input).

Make sure that all circuit breakers inside the MCS are in OFF position.

Switch on 230VAC from EPCU.

Now switch on MCS:

- Switch on Circuit Breaker Cooler/Light **(-1F3)**
- Switch on Circuit Breaker Heater Supply **(-1F4)**
- Switch on Circuit breaker for 24V Supply A **(-1F6.1)** and **(-1F6.2)**
- Switch on Circuit breaker for 24V Supply B **(-1F7.1)** and **(-1F7.2)**
- Switch on Circuit Breaker 230VAC Supply MCS A **(-2F3)**
- Switch on Circuit Breaker 230VAC Supply MCS B **(-3F3)**
- Switch on Circuit Breaker 230VAC Supply OPC Gateway A **(-4F3)**
- Switch on Circuit Breaker 230VAC Supply OPC Gateway B **(-5F3)**
- ***Switch on main switch A&B*** **(-1S1) and (-1S2)**

5 OPERATING PROCEDURE (SOFTWARE)

The MCS is delivered with all required software installed and tested.

The actual Operating Procedure for the software application will be available "ONLINE" (Online Help).

5.1 START UP OF MCS

Start-up Channel A

- Press the '**Power On**' button for about 3 seconds.
  The operating system will be loaded.
  A dialog window asks you if the machine should act as Master.

CAUTION
Loss of historical data!

The Master should be the PC with the most recent historical data because the redundant data is copied from Master to Slave.

- Type **YES** if the most recent historical data is on **this** MCS.
- Type **NO** if the most recent historical data is on **the other** MCS.

If you do nothing for about 30 seconds, this PC will be automatically set to act as Master.

The project data will be loaded and the main screen 'Subsea Overview' appears. The logon level is 'monitor'.

- Login [Monitor (View only), Operator, Supervisor, Engineer (Administrator)].

Start-up Channel B.

- Press the '**Power On**' button for about 3 seconds.
  The operating system will be loaded.
  Depending on the 1st MCS being Master or Slave, this MCS automatically starts as Slave or Master and the redundant data will be copied from Master to Slave.

5.2 START UP OF OPC GATEWAY

- Press the **power** on button for about 3 seconds.
  The OPC gateway starts up automatically.

6 FAULT FINDING

The following table lists potential problems and their possible causes and the action to remedy the problem.

Problem	Possible Cause	Action
Main Supply is not active.	No power supply.	Check that the main switch at the UPS is on. Check LED indications of units.
	Faulty power cable connector.	Check that the cable connector pins have not been damaged.
Cabinet cooler is not working.	Circuit breaker has tripped.	Check circuit breaker, reset if tripped.
	Faulty cable connector.	Check that the cable connector pins have not been damaged.
Cabinet heater is not working.	Circuit breaker has tripped.	Check circuit breaker, reset if tripped.
	Faulty cable connector.	Check that the cable connector pins have not been damaged.
Cabinet lights do not illuminate.	Circuit breaker has tripped.	Check circuit breaker, reset if tripped.
	Fluorescent lamp is faulty.	Change fluorescent lamp.
	Door switch is sticking.	Check door switch.
	Faulty cable connector.	Check that the cable connector pins have not been damaged.
Monitor does not work.	No power supply at the monitor.	Check that the power cable is connected to the socket.
	Circuit breaker of Auto View Commander has tripped.	Check circuit breaker, reset if tripped.
	No 24 VDC supply at the Auto View Commander.	Check 24 VDC supply at the back of the Auto View Commander.
	Faulty cable connector.	Check that the cable connector pins have not been damaged.
Monitor does not get data.	One or more PCs are not switched on or are defective.	Check that the PCs are switched on.
	Circuit breaker has tripped.	Check circuit breaker, reset if tripped.
	No connection between PCs and Ethernet Switch.	Check that the patch cables have not been damaged.

Problem	Possible Cause	Action
	Faulty cable connector.	Check that the cable connector pins have not been damaged.
MCS does not get data from remote.	Data communications fault.	Check digital and analog Inputs.
	Faulty cable connector.	Check that the cable connector pins have not been damaged.

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

01.08.2007	Approved for Construction	A. Haase	A. Voges	A. Weilandt
03.07.2007	Issued for Client Comment	A. Haase	A. Voges	A. Weilandt
07.05.2007	Issued for internal IDC	A. Haase	A. Voges	A. Weilandt
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Maintenance Procedure** **Master Control Station / Hardware**		
PAGE 1 OF 8	**Customer Document Number:**	54NL92-W-0P-538	REV. 1
	Cameron Document No.	X-065438-02-70	REV. 01

TABLE OF CONTENTS

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AVC	Auto View Commander
BOM	Bill of Materials
CAM	CAMERON
EPCU	Electrical Power & Communication Unit
ESCM	Electrical Subsea Control Module
FAT	Factory Acceptance Test
HMI	Human Machine Interface
Hz	Hertz
LTC	Long Term Cover
MCS	Master Control Station
N/A	Not applicable
PCS	Production Control System
PLC	Programmable Logic Controller
PN	Part Number
UPS	Uninterruptible Power Supply
VAC	Voltage Alternate Current
VDC	Voltage Direct Current

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Cameron GmbH
Lueckenweg 1
D - 29227 Celle
Germany

Tel: +49 5141 8060
Fax: +49 5141 806 333

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HARDWARE FAT MCS	X-076736-09	54NL92-W-0P-502
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- All personnel working on the equipment must have the required experience, training and qualifications.
- The lifting and handling of the equipment must be carried out with extreme caution and with regard to the safety regulations.

3.1 MEDIUM VOLTAGE POWER

CAUTION
Risk of electric shock

This equipment contains Medium Voltage Electrical Equipment: (230VAC/60Hz input). For maintenance purposes.

Isolate this equipment prior to starting work.

This can be done at the UPS or locally at the MCS.

3.2 WEIGHT OF MODULES

CAUTION
Risk injuries and damages

The PCs are heavy (approximately 20 kg)

There is no stop at the exit of the panel and the full weight has to be supported.

The PCs must be removed by two persons supporting underneath the module, one person at each side

3.3 COMPANY PROCEDURES

Follow company procedures

All work carried out on this equipment shall follow company procedures and health and safety requirements. All work carried out on this equipment shall follow the permit to work system for the K5F project and health and safety requirements.

4 MAINTENANCE PROCEDURES

4.1 REPLACEMENT OF CONSUMABLES

The MCS is designed for long term maintenance free operation. However, from time to time, relays and consumables such as switches, etc., may fail and require replacement.

4.2 REMOVAL OF PCS, MONITOR, AVC OR MODEM RACK FOR REPAIR

CAUTION
Risk injuries and damages

The PCs are heavy (approximately 20 kg)

There is no stop at the exit of the panel and the full weight has to be supported.

The PCs must be removed by two persons supporting underneath the module, one person at each side

1. Switch off the relevant circuit breaker/s see circuit diagram SK-066380-25-04
2. Use a Voltmeter to verify the power off condition in the cabinet.
3. Open the swing frame.
   When following steps 4 and 5, ensure that when the connectors are unmated they do not come into contact with the housings and are secured to the frame.
4. Disconnect the power cable.
5. Disconnect the data cables.
6. Unscrew the fixing screws on the front panel of the module.
7. Carefully pull out the module drawer. There are no slide retainers, the PC modules are heavy (approximately 20 kg) and will need support from underneath when they are pulled clear of the frame.

4.3 REPLACING FILTER PADS

Check inlet filter at door for contamination in cycles of 6 month.

Change out if necessary.

Use Cameron PN. 619044-01-08-03 or equivalent material.

5 FAULT FINDING

The following table lists potential problems and their possible causes and the action to remedy the problem.

Problem	Possible Cause	Action
Main Supply is not active.	No power supply.	Check that the main switch at the UPS is on. Check LED indications of units.
	Faulty power cable connector.	Check that the cable connector pins have not been damaged.
Cabinet fan is not working.	Circuit breaker has tripped.	Check circuit breaker, reset if tripped.
	Faulty cable connector.	Check that the cable connector pins have not been damaged.
Cabinet heater is not working.	Circuit breaker has tripped.	Check circuit breaker, reset if tripped.
	Faulty cable connector.	Check that the cable connector pins have not been damaged.
Cabinet lights do not illuminate.	Circuit breaker has tripped.	Check circuit breaker, reset if tripped.
	Fluorescent lamp is faulty.	Change fluorescent lamp.
	Door switch is sticking.	Check door switch.
	Faulty cable connector.	Check that the cable connector pins have not been damaged.
Monitor does not work.	No power supply at the monitor.	Check that the power cable is connected to the socket.
	Circuit breaker of Auto View Commander has tripped.	Check circuit breaker, reset if tripped.
	No 24 VDC supply at the Auto View Commander.	Check 24 VDC supply at the back of the Auto View Commander.
	Faulty cable connector.	Check that the cable connector pins have not been damaged.
Monitor does not get data.	One or more PCs are not switched on or are defective.	Check that the PCs are switched on.
	Circuit breaker has tripped.	Check circuit breaker, reset if tripped.
	No connection between PCs and Ethernet Switch.	Check that the patch cables have not been damaged.

Problem	Possible Cause	Action
	Faulty cable connector.	Check that the cable connector pins have not been damaged.
MCS does not get data from remote.	Data communications fault.	Check digital and analog Inputs.
	Faulty cable connector.	Check that the cable connector pins have not been damaged.

Total Exploration and Production Netherlands B.V.

K5-F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

01	N/A	10.11.2008	Initial Release	L.Budde	A.Weilandt
Rev.	**Client Rev.**	**Date**	**Reason for Issue**	**Originated by**	**Checked by**

Document Title:	**Operation & Maintenance Manual for Master Control Station Software**	
Cameron DC™	**Document Number:**	X-076738-17
	Client Document Number:	N/A

Document Revision History

Rev	Date	Description of change	Reason for change
01	10.11.2008	Initial Release	

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Table of Figures

1 REFERENCES

Document Title	Document Number
MAINTENANCE PROCEDURE MCS HW	X-065438-02-70
DATA I/O SCHEDULE ESCM	X-076705-37
DATA I/O SCHEDULE PRCM	X-076705-47
DATA I/O SCHEDULE IWOCS UTA	X-076705-48
SPS MCS/ICSS CONTROL INTERFACE	X-076721-87-12
HPU PLC CABINET REQUIREMENT SPEC	X-076721-87-18

2 INTRODUCTION

The Master Control Station (MCS) Operation and Maintenance Manual for the TOTAL K5 Project is intended to provide the user with a detailed reference document for all aspects of the MCS software which may be used by the operator.

It is intended to allow the user to logon to the system, navigate to the available screens and understand the information available on these screens as well as to obtain historical data from the system. It details the installation, start-up and backup routines of the PC based system.

The manual is not intended as an operators guide to the overall operating system. Information relating to the operation of the system as a whole, valve operation, shutdown sequences, fault finding etc. should be referred to the System Operation & Maintenance Manual.

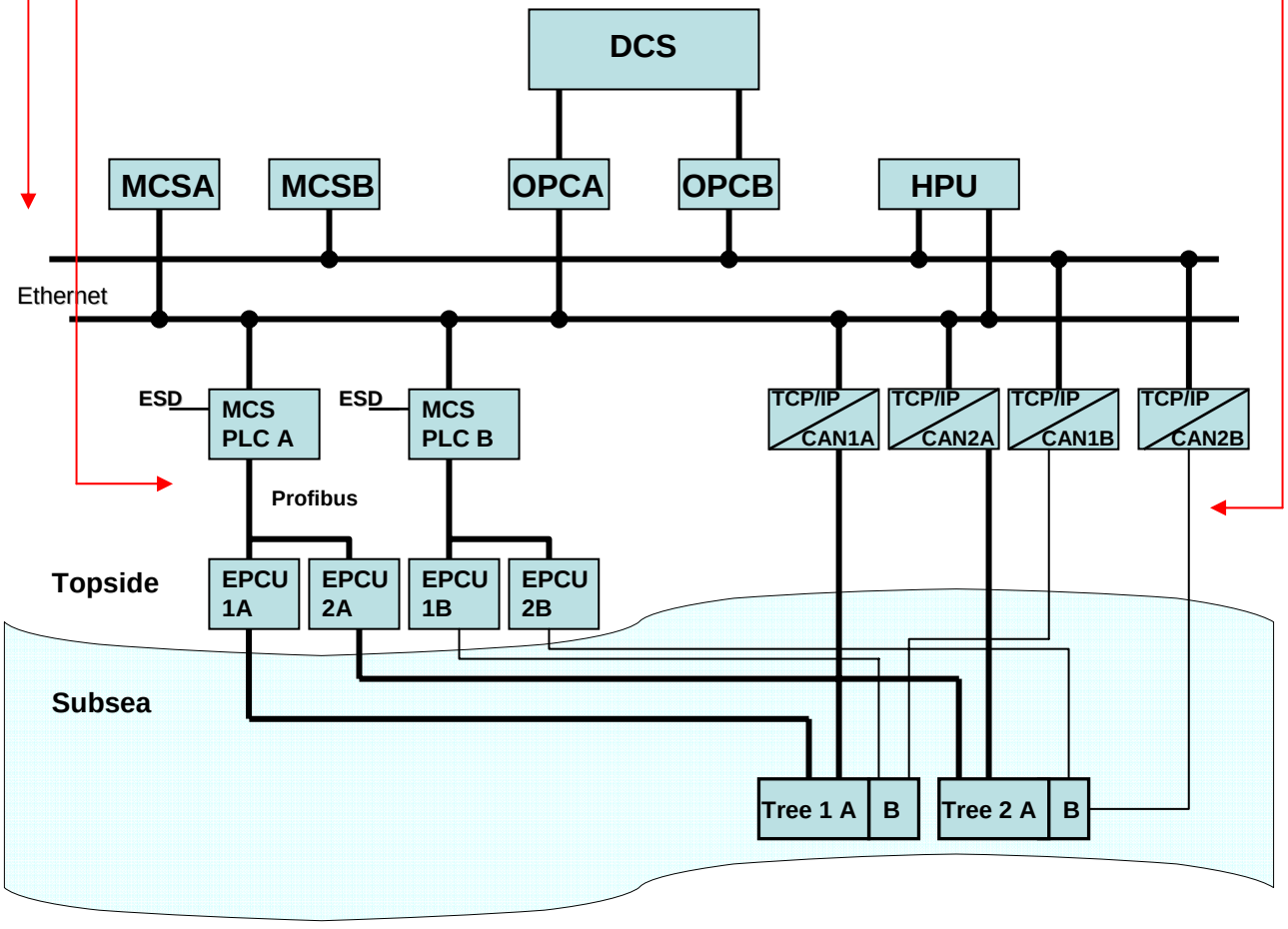
The MCS is dual redundant to ensure bump-less continuous system operation. The system contains two PCs, MCS A and MCS B.

3 SYSTEM OVERVIEW

Communication between MCS PLC's, HPU PLC, MCS PCs and OPC PCs is via Ethernet links. The interface between DCS/PCS and MCS is via an OPC Gateway.

The subsea communication protocol is CanOpen – The Ethernet to CAN bridges are located in the topside modems. The modems are part of the EPCU.

The High Voltage and Monitoring devices of the EPCUs are connected via a serial profibus connection to the MCS PLCs.



3.1 3.1 IP Address Table

Device		IP Address A	IP Address B	Comment
MCS		192.168.0.1	192.168.0.101	Bonding: 2 Network-Cards
SWITCH		192.168.0.5	192.168.0.105	
OPC PC Network		192.16.0.50	192.16.0.150	OPC Gateway
OPC PC Gateway		172.16.0.51	172.16.0.151	
MCS PLC		192.168.0.41	192.168.0.141	
HPU PLC		192.168.0.21	--	
HPU Switch		192.168.0.45	--	
EPCU's	**Tree 1**	192.168.0.201	192.168.0.202	CAN bridge
	Tree 2	192.168.0.203	192.168.0.204	CAN bridge

3.2 MCS Structure

The operating system of the MCS PC's is Linux®; the distribution is SuSE® 9.0.
Internet Link: http://www.SuSE.com

The SCADA system used on this project is ViSpro®. http://www.vsys.de. The system has got client server architecture.

Different services are running on the MCS to operate and handle all devices connected to it. All necessary programs will be started automatically during start up of the MCS PCs. In case of a failure of the used programs, the program will automatically be restarted. A program not running generates an alarm. This alarm is displayed in the alarm header display.

The following programs are the main applications utilized to build the MCS software:

ViSpro® Servers
All services which are related to the Graphical User Interface (GUI) of the system, like io-base, like trend server, alarm server, print server, historical data server, and view server.

Redundancy Server
This server transfers continuous redundant data between MCS A and B, during operation and also on start up to synchronise the nodes.

Subsea Control Server
This server interprets the interface to the Subsea equipment. It handles choke and valve commands.

Canmap
This driver interprets the interface to the Subsea equipment. It handles the communication to the subsea CAN devices. The configuration of this driver is via an ASCII file. The driver connects to the related partner (ethernet/can bridge) on received broadcast message of the bridge match the own configuration.

Calculation Engine
This service calculates the engineering values of 3rd party devices, like DHPTT data. The configuration is read during start of the server and if a coefficient file has been changed using the coeff. file popup.

Interlock Server
The Interlock Server calculates the interlocks to block operations. The configuration of this server is via an ASCII file. The configuration is read during start of the server only.

Sequence Server
The Sequence server is responsible for serialized shutdown sequences like production shutdowns or emergency shutdowns. The sequence configuration is read during start of the sequence server only. An active sequence is executed by one MCS only. The active server has a connection to the remote sequence server to inform about its state and the current step. The remote server takes over the sequence job at any active server break and executes the outstanding steps of the sequence.

4 INSTALLATION, START-UP, AND SHUT DOWN

4.1 4.1 MCS Installation

4.1.1 Installing from a Bootable CD

This method describes how to install a newer software version on the MCS.

The installation of the system, including the operating system will be done with a bootable CD/DVD.

Installing newer software version on 1st computer

CAUTION
Loss of historical data! Not for Level 0 changes!

Installing system from CD will overwrite log files, retentive and historical data.

- **Backup historical data before installation!**
  See: 4.2.2 Historical data Backup

- Disconnect or turn off 2nd computer.
- Insert the CD and start the computer.
- Type **'yes'** to install the system from CD.
  The system installation starts.

NOTE
Overwriting new installation on reboot!

After installation the system will be rebooted.

If the 2nd computer is not disconnected on reboot, the new installed PC gets old data back, related on the synchronisation on start-up!

- **Disconnect 2nd computer before reboot starts!**
- **Take out CD before reboot starts!**

The system reboots.

Installing newer software version on 2nd computer

- Connect 2nd computer and reboot.
  The computer will be automatically updated to the new software version.

4.1.2 Re-Installing from a Bootable CD

This method describes how to re-install a software version on an MCS, e.g. after a disk crash.

The installation of the system, including the operating system, will be done with a bootable CD/DVD.

Re-installing software version on 1st computer

- Insert the CD and start the computer.
- Type **'yes'** to install the system from CD.
  The system installation starts.
  The system reboots.
  The new installed PC gets all relevant process data back, related to the synchronisation on start-up!

4.1.3 Software Update

On 'software' logon, you can update the system on one click.

- Insert the update CD/DVD.
- Start in KDE-Mode (see ***4.3.4 MCS start with KDE*** on p. 17)
- Execute Setup on Update-CD.

4.1.4 Blackstart

On new version installation (Level 0 related stuff changes) **both PCs should be off** and should be installed one after the other! A Level 0 installation will be highlighted in the release notes from software department.

CAUTION
Loss of historical data!

Installing system from CD will overwrite log files, retentive and historical data.

- **Backup historical data before installation!**
  See: 4.2.2 Historical data Backup

Blackstart 1st computer.

- Insert the CD and start the computer.
- Type **'yes'** to install the system from CD.
  The system installation starts.

- Take out CD before reboot starts!

The system reboots.

Blackstart 2nd computer.

- Insert the CD and start the computer.
- Type **'yes'** to install the system from CD.
  The system installation starts.

- Take out CD before reboot starts!

The system reboots.

4.2 Backup

4.2.1 System Backup

The operation system and the project related files will be saved.

The log files, historical data and profiles will **NOT** be saved.

- Insert a blank CD-R.
- Press the '**System Backup**' button and follow the routine.

4.2.2 Historical data Backup

This feature archives all historical data (trend, alarm) and log files

- Insert a CD/DVD
- Click on the Button in the Main Menu.
  The Historical Data Backup PopUp opens.

- Select, whether you want to create a CD or DVD
- In the fields 'from' and 'to' enter the desired time range.
- Press 'Check' to check if file size is not too large.
- Press 'Create CD'.
  All files matching the time range criteria are burned to CD/DVD
  These are:

  - Historical Trend data
  - Historical Alarm data
  - MCS log files (events)

4.3 MCS Start-Up and Shut Down

4.3.1 Start-Up MCS

Start-up 1st MCS.

- Press the '**Power On**' button for about 3 seconds.

  The operating system will be loaded.

  A dialog window asks you if the machine should act as Master.

CAUTION
Loss of historical data!

The Master should be the PC with the most recent historical data because the redundant data are copied from Master to Slave.

- Type **'yes'** if the most recent historical data is on **this** MCS.
- Type **'no'** if the most recent historical data is on **the other** MCS.

If you do nothing for about 30 seconds, this PC will be automatically set to act as Master.

The project data will be loaded and the main screen 'Subsea Overview' appears. The logon level is 'monitor'.

- Login (**'operator'**, **'supervisor'**, **'engineer'**, **'administrator'**).

Start-up 2nd MCS.

- Press the '**Power On**' button for about 3 seconds.

  The operating system will be loaded.

  Depending on the 1st MCS being Master or Slave, this MCS automatically starts as Slave or Master and the redundant data will be updated from Master to Slave.

4.3.2 Start-Up MCS on File System Failure

It is possible, that the MCS was shut in on 'hard' power off. In this case, the file system can be corrupted and needs file system check. The following message appears on start-up:

'Fsck for root file system (/) failed
Please repair it manually and reboot…
Give root a password to login:'

- You have to log in as user **'superuser' [su]**.

- Type '**fsck –y**' and press Enter.
  The file check starts.
- After file check reboot the system; type '**reboot**' and press **Enter**.

4.3.3 Shutdown the MCS

This will initiate a soft power down. All applications will be closed and the PC will be power down.

- You need to be logged in as user **'engineer'** or higher!

- Click on the **'Shutdown PC'** button.

  The PC will switch off.

4.3.4 MCS start with KDE

This mode to start the MCS with KDE is for service or software engineers only. This can be done for deeper investigation or operating system settings. KDE is a windows environment on a Linux® system.

4.3.4.1 Switch to KDE Mode

CAUTION
You may not notice Alarms, Trips and ESDs.

Vispro services will remain running while switching to the KDE mode.

- **Keep monitoring the system while working in KDE!**

You need to be logged in as user 'software'.
Otherwise the 'KDE next LogOn' Button is not available.

- Click this button.
  Now on the next logon the windows manager KDE will be loaded.

- Click the 'GO!' button to open Vispro Menu.

- In the Vispro Menu select 'New user / exit'
  The 'New user on server' window appears.

- Press this button to exit the Vispro Browser.
  The Linux login dialog appears
- In the Linux login dialog click the button '
  The KDE mode is started automatically.

You need to switch back to MCS runtime environment after you have finished working in KDE! (p. 18)

4.3.4.2 Working in KDE Mode

Start Vispro® Development environment

- Press **Alt + F2** to open a terminal window.
- Type **'visbrs'** and press **Enter**.
  The Vispro® Development environment opens.

Start Vispro® Viewer

- Press **Alt + F2** to open a terminal window.
- Type '**visrun –alaheight 0 –kde'** and press ENTER
  The Vispro® Viewer opens

You are logged in by default as user '**Monitor'**.

- Log in at desired user level (p. 108).

To move the window press, click into the header of the window move the window.

Start KSnapshot

- Select **'Utilities'** ▶ **'Desktop'** ▶ **'KSnapshot'** from the linux Start Menu (green bubble in the linux taskbar).

4.3.4.3 Switch back to MCS runtime environment

- Select 'Logout Vispro' from the Linux Start Menu (green bubble in the Linux taskbar)
  The Logout dialog appears.
- Select 'Login as different user' and press the '**OK**' button.
  The Linux login dialog appears.
- Login as desired User Level and click the button **'GO!**'
  The Vispro run mode is started automatically.

4.4 Screendump

To generate a screen dump, the related function can be accessed via the Main Menu.

Figure 1 Screendump PopUp

- In the Main Menu, click the '**Screendump**' button.

The '**Screendump**' PopUp opens.

- Click on the '**Screen Dump**' button to generate the screen dump.

A click on the '**Cancel**' button will close the PopUp without generating a screen dump.

4.5 Serial Monitor

For testing purpose, the user can connect via telnet to several tasks. The user can choose between five different debug levels.

Level	Description
0	off
1	warnings
2	notification
3	info
4	debug
5	verbose debug

For connection Hostname and Port Number are needed.

Task Name	Runs on		Hostname	Port Number
Calc	MCS A		CamtrolA	65025
	MCS B		CamtrolB	65025
Canmap1 Tree 1A	MCS A		CamtrolA	65401
	MCS B		CamtrolB	65401
Canmap2 Tree 1B	MCS A		CamtrolA	65402
	MCS B		CamtrolB	65402
Canmap3 Tree 2A	MCS A		CamtrolA	65403
	MCS A		CamtrolB	65403
Canmap4 Tree 2B	MCS A		CamtrolA	65404
	MCS B		CamtrolB	65404

- Open an '**X-Terminal**' Window.
- To connect to the subsea or serial task via telnet, type the '**telnet *Hostname Port number***' and press '**Enter**'.

Example1: *'telnet camtrola 65401'.*
This connects to canmap task can-1 (Tree1A) on MCS A.

- Type **'0'** and press Enter to set the level to show all.
  Level 111111111 appears.
- Set the debug level '**t *No.***' and press Enter (Level Number 0..5).

- Type '**?**' and press Enter for help.
- Type '**q**' and press Enter to quit.

5 OVERVIEW

5.1 Screen Layout

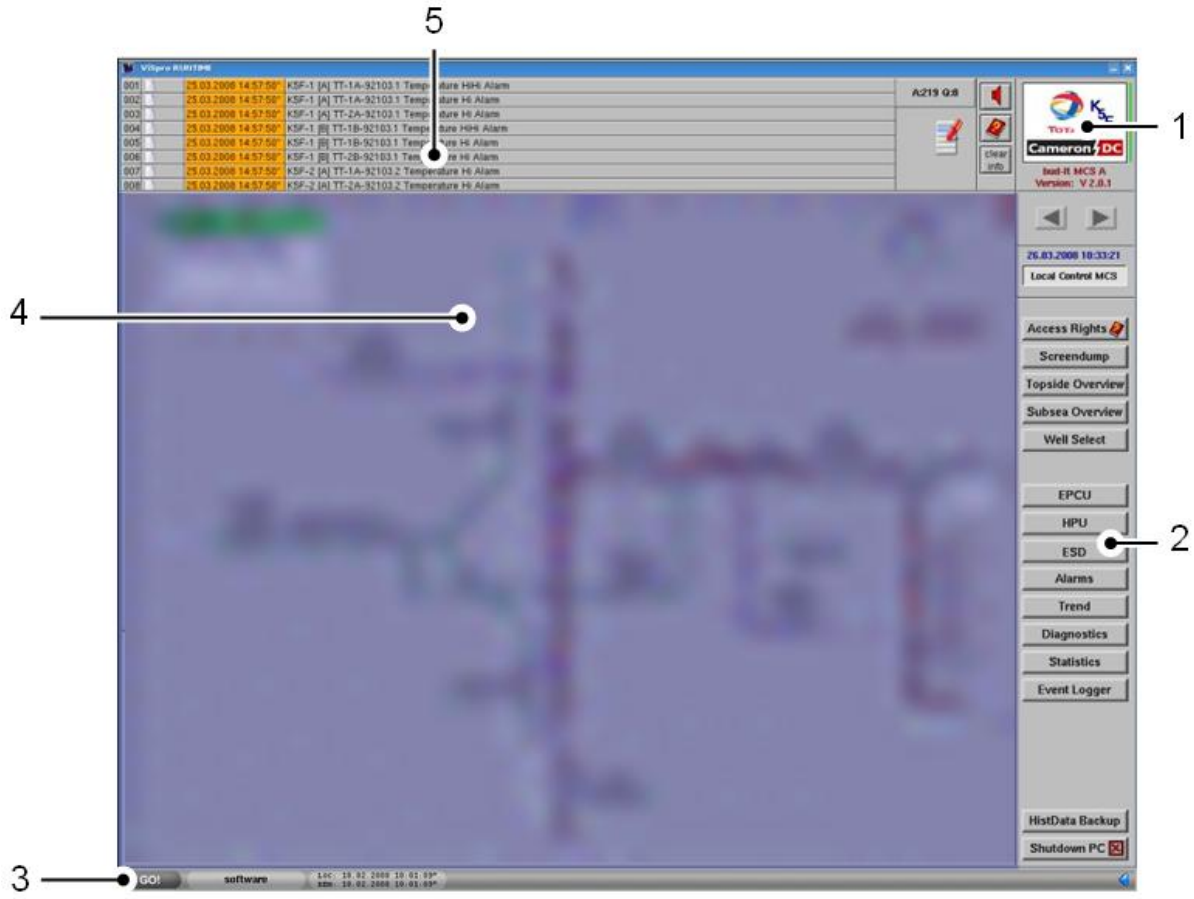


Figure 2 Screen Layout

	Name	Description
1	**Logo + Node Name + MCS Version**	A click on the version string shows the revision history. The mouse over the version string shows a version tooltip. (all topside software versions will be displayed)
2	**Main Menu**	The buttons and drop down menus which are accessible from this panel navigate to different pages (p. 22). Display varies dependent on the logged in user
3	**Footer**	Displays the logged in user and warning/info messages. The '**GO!**' button opens the ViSpro® Main Menu (p. 23).
4	**Screen Area**	Display depends on the selection chosen from the Main Menu.
5	**Online Alarm Display**	The Alarm Display shows the name, status and time stamp of an alarm. (p. 87)

5.2 Main Menu

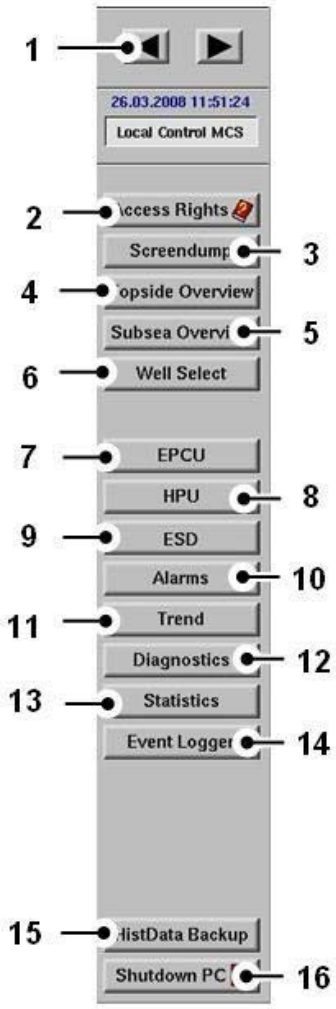


Figure 3 Main Menu

	Description
1	The two arrows are for previous and forward page selection, like on an internet browser.
2	Opens a PopUp which describes all access rights setup for this project (p. 109).
3	Opens the 'Screendump' PopUp (p. 19).
4	Opens the Topside System Overview (p. 24). This page shows a topside system overview.
5	Opens the Subsea Overview (p. 25). This page shows a subsea system overview.
6	Opens a list menu, where you can choose between the different Well Pages (p. 30). The Well Page opens on a click on the specific line item. This page displays analogue data of the well slot and provides the interface to operate chokes and valves.
7	Opens the Electrical Power and Communication Unit Page (p. 75).
8	Opens the Hydraulic Power Unit Page (p. 65).
9	Opens the Emergency Shutdown Page (p. 79).
10	Opens the Alarm and Historical Alarm Page (p. 89). All system related alarms are shown on this page.
11	Opens the Trend page (p. 99). The page can displays up to 8 analogue trends at the same time. The curves can be added or deleted at the related Instrument PopUp.
12	Opens a list menu, where you can choose between different Tree Diagnostic Pages (p. 95). The page opens on a click on the specific line item. This page displays all diagnostic values of the Tree equipment.
13	Opens the Subsea Communication Statistics Page (p. 98).
14	Opens a list menu, where you can choose the logging data. The Event Logging Page (p. 93) will open on a click on the specific line item. This page displays all logging entries of the system.
15	Opens the 'Historical Data Backup' PopUp (p. 14).
16	Initiates a soft power down. (Supervisor or higher login.)

5.3 ViSpro® Main Menu

To open the ViSpro® Main Menu, click on the '**GO!**' button in the left corner at the footer.

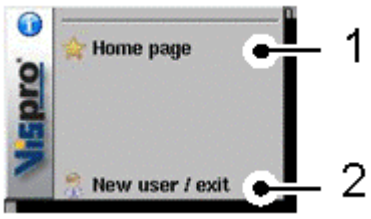


Figure 4 ViSpro® Main Menu

	Name	Description
1	**Login** 	To login or change the user click on '**New user**' to open the login window. Type in the user name, use **Enter** or the mouse to select the password field. Type in the related password and press **Enter** or use the mouse and click on the OK button (**green tick**) to login. If the user name or password is incorrect, the system will login as 'monitor'. The shutdown/exit button (**red arrow**) in the user menu will end the GUI. In normal operation mode, the GUI will be automatically restarted. In service mode, the window manager KDE is running, the GUI will end.
2	**Homepage**	Click on '**Homepage**', this will reload the GUI and open the Overview Page (p. 24).

6 SYSTEM

6.1 Hotspots on the Topside System Overview Page

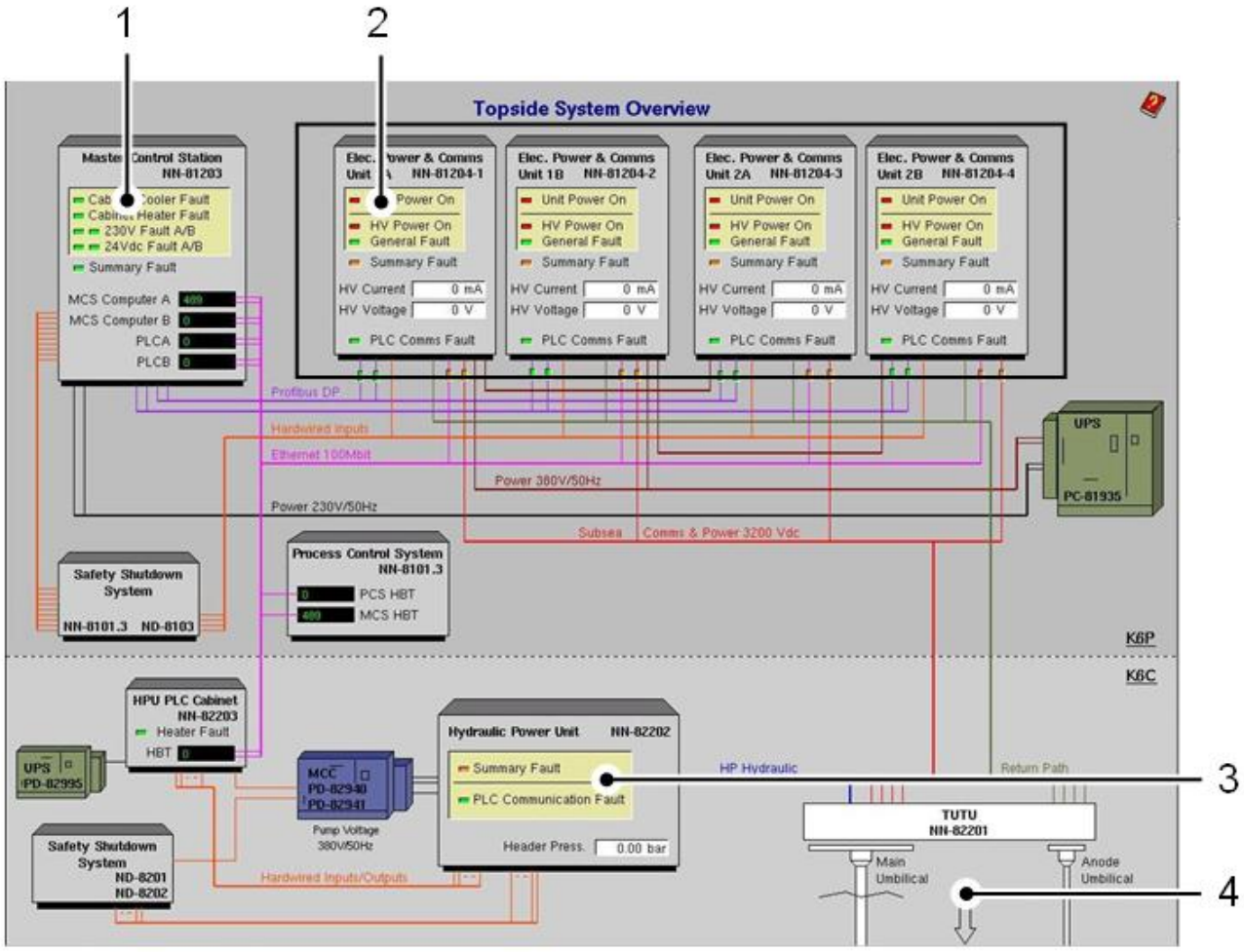


Figure 5 System Overview Page

	Name	Description
1	**Master Control Station**	Click here to open the **Master Control Station** PopUp (p. 27). for maintenance.
2	**Electrical Power & Comms Unit Symbol**	Click here to open the **Electrical Power & Communication Unit** Page (p. 75).
3	**Hydraulic Power Unit Symbol**	Click here to open the **Hydraulic Power Unit Page** (p. 65).
4	**Subsea Overview**	Click here to open the **Subsea Overview** Page (p. 25).

6.2 Hotspots on the Subsea Overview Page

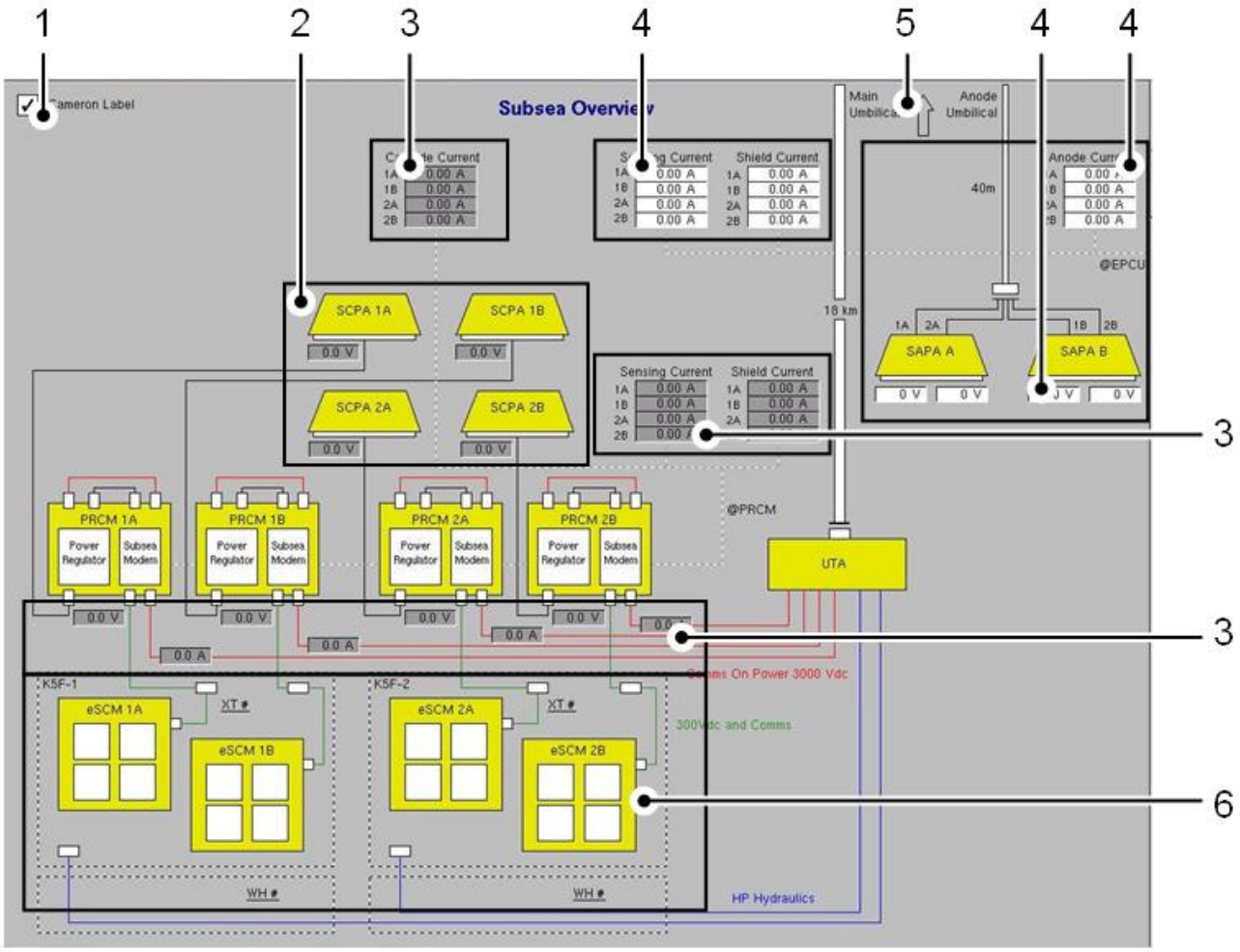


Figure 6 Subsea Overview Page

	Name	Description
1	**Cameron Label**	Displays the Cameron Labels.
2	**Subsea Instrument**	Click here to open the **Subsea Instrument** PopUp (p. 63)
3	**Historical Data**	Click here to open the **Historical Data** (Assign/De-Assign)PopUp (p. 64)
4	**EPU Instrument**	Click here to open the **EPU Instrument** PopUp (p. 77)
5	**Topside Overview**	Click here to open the **Topside Overview Page** (p. 24)
6	**Well Page**	Click here to open the **Well Pages** (p. 30)

6.3 Master Control Station

6.3.1 Master Control Station Depiction

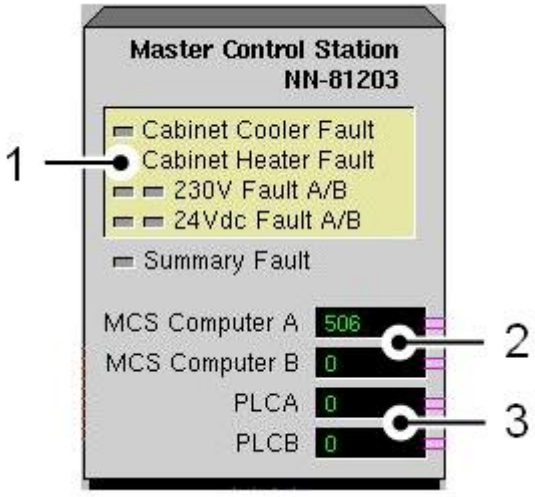


Figure 7 Master Control Station Depiction

	Description		
1	**Alarm LEDs**	**dark grey**	Feedback unknown
		green	No Alarm
		orange	Alarm
2	**Heartbeat signal of MCS**		
3	**Heartbeat signal of PLC**		

6.3.2 Master Control Station PopUp

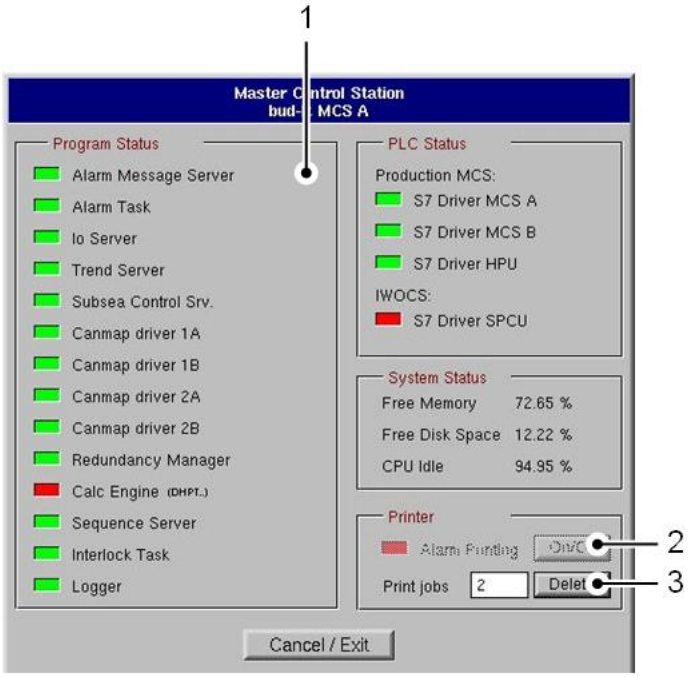


Figure 8 Master Control Station PopUp

How to open this PopUp:

- In the Topside System Overview Window ▶ click on the Master Control Station Symbol.

	Description	Colour	State
1	**Status LEDs**	**dark grey**	Feedback unknown
		red	Off
		green	On
2	**Alarm Printing On/Off**	If Alarm Printing is set to on, all incoming alarms are automatically printed out.	
		If alarm printing is available, a needle printer for continuous paper is required.	
3	**Delete**	Deletes print jobs from queue.	

6.4 Electrical Power and Comms Unit

6.4.1 Electrical Power and Comms Unit Depiction

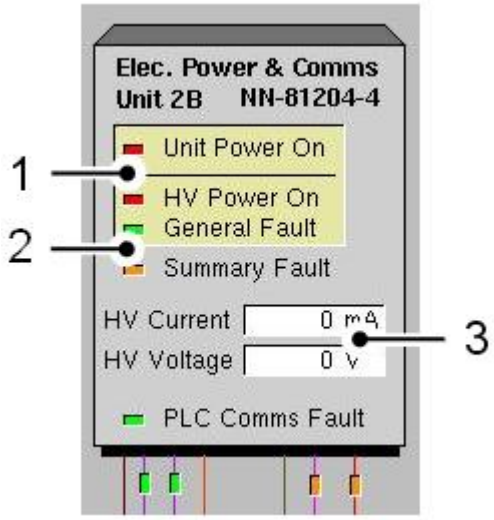


Figure 9 Electrical Power and Comms Unit Depiction

	Description	Colour	State
1	**Status LEDs**	**dark grey**	Feedback unknown
		green	On
		red	Off
2	**Alarm LEDs**	**dark grey**	Feedback unknown
		green	No Alarm
		orange	Alarm
3	**HV Current + HV Voltage**	Displays the HV Current and Voltage. Click here to open the **Electrical Power and Communication Unit** page. (p. 75)	

6.5 Hydraulic Power Unit

6.5.1 Hydraulic Power Unit Depiction

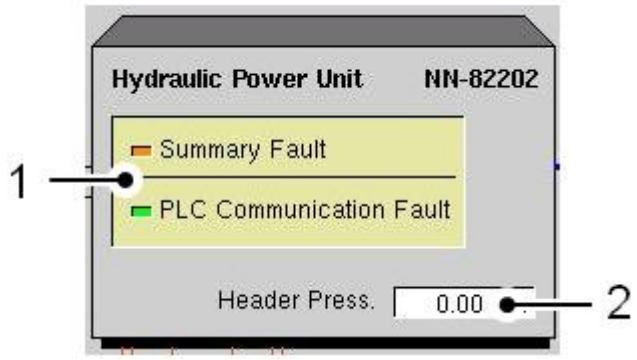
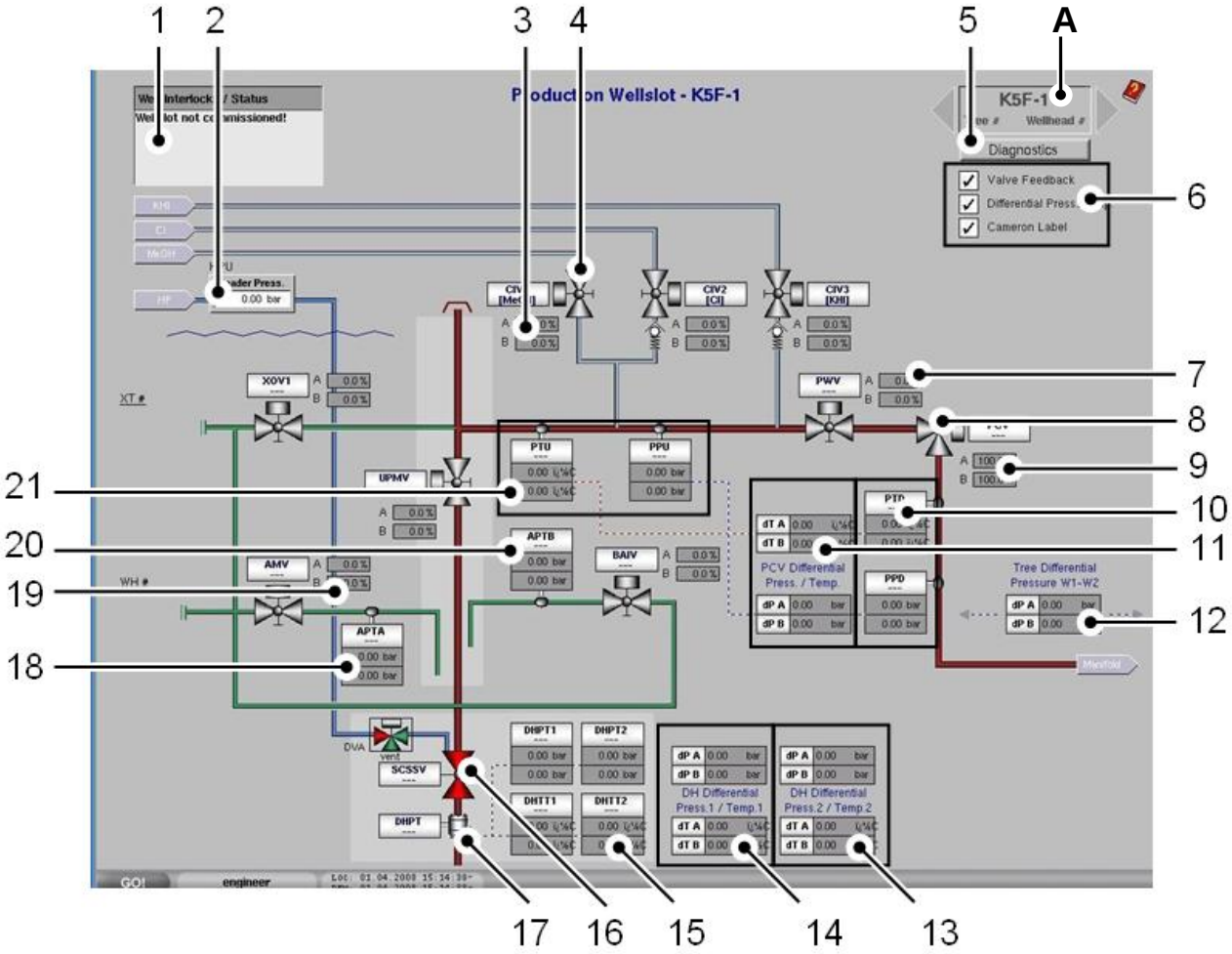


Figure 10 Hydraulic Power Unit Depiction

	Description	Colour	State
2	**Alarm LEDs**	**dark grey**	Feedback unknown
		green	No Alarm
		orange	Alarm
2	**Header Pressure**	Displays HPU Header Pressure. Click here to open **Hydraulic Power Unit** page (p. 65)	

7 PRODUCTION WELL

7.1 Hotspots on the Production Well Page



	Name	Description
A	**Well label**	Displays the well label, the tree number and wellhead number. The tree/wellhead number relates to serial number comparison of UPMV and AMV. Click here to open the **Well Configuration** Popup (p.33) for starting or shut-in in the Tree.
1	**Status display**	Shows the **status** of the well: - Subsea System up (all nodes powered up) - Well flowing - Well reverse flowing

- Well shut-in
- Any Valve Open

And **interlocks**:

- No power subsea
- Workover mode
- DCS in control
- Well not commissioned
- Seq. condition present
- Max Valve movement

2	**Transducer display (Header Press.)**	Click here to open the **Topside Instrument** Popup (p. 63)
3	**Transducer display (CIV1, CIV2, CIV3)**	Click here to open the **Valve Control** Popup (p. 36)
4	**Valve**	Click here to open the **Valve and Choke Instrument** PopUp (p. 60)
5	**Diagnostics**	Click here to open the **SCM-Diagnostics Page** (p. 95)
6	**Valve Feedback**	Shows / hides Valve Feedback
	Differential Pressure	Shows / hides Differential Pressure
	Cameron Label	Shows / hides Cameron Label
7	**Transducer display (PMV)**	Click here to open the **Valve and Choke Instrument** PopUp (p. 60)
8	**Choke**	Click here to open the **Choke Control** Popup (p. 49)
9	**Transducer display (PCV)**	Click here to open the **Valve and Choke Instrument** PopUp (p. 60)
10	**Transducer display (PTD, PPD)**	Click here to open the **Valve and Choke Instrument** PopUp (p. 60)
11	**Transducer display (PCV Differential Press. / Temp.)**	Click here to open the **Subsea Instrument** Popup (p. 63)
12	**Transducer display (Tree Differential Pressure W1-W2)**	Click here to open the **Subsea Instrument** Popup (p. 63)
13	**Transducer display (DH Differential Press. 2 / Temp. 2)**	Click here to open the **Subsea Instrument** Popup (p. 63)
14	**Transducer display (DH Differential Press. 1 / Temp. 1)**	Click here to open the **Subsea Instrument** Popup (p. 63)

15	**Transducer display (DHPT1-2, DHPTT 1-2)**	Click here to open the **Subsea Instrument** Popup (p. 63)
16	**Valve**	Click here to open the **Valve Control** Popup (p. 36)
17	**Down Hole Pressure and Temperature (DHPT)**	Click here to open the **DHPTT Control** Popup (p. 56)
18	**Transducer display (APTA)**	Click here to open the **Subsea Instrument** Popup (p. 63)
19	**Valve Instrument (AMV)**	Click here to open the **Valve and Choke Instrument** PopUp (p. 60)
20	**Transducer display (APTB)**	Click here to open the **Subsea Instrument** Popup (p. 63)
21	**Transducer display (PTU, PPU)**	Click here to open the **Subsea Instrument** Popup (p. 63)

Well Configuration

7.1.1 Well Configuration PopUp

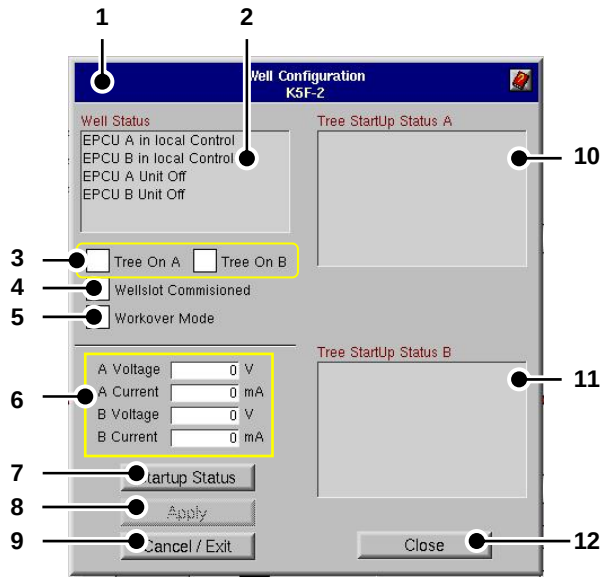


Figure 11 Well Configuration PopUp

		Description
1	**Header**	The 'Help' symbol opens the valve control help page. The name of the valve is displayed in the header of the PopUp.
2	**Well Status**	Displays the Well operating related status messages: - EPCU A/B local controlled - EPCU A/B Unit off (No Tree On seq. possible if EPCU is local controlled or the Unit is off)
3	**Tree On/Off (A/B)**	Starts the Tree up or shuts the tree in: **ON:** A sequence runs - switches HV power ON and enables all subsea fuses within the eSCM. The start up sequence checks the node states of the topside modem, Ethernet-To-CAN bridge and the subsea modem – if any node is not available the sequence ends. Info: The HV Voltage and Current Pre-Settings can be changed within the related EPCU Control PopUp.

		OFF: Turns the HV power off to the tree.
4	**Well commissioned**	Sets the commissioning state of the well. Requires Supervisor log in level. After commissioning phase the well is ready for production and can be operated by the Operator.
5	**SCM Workover Mode**	 **CAUTION:** **Temporal loss of control!** As the MCS/SCM has no control of the well during Workover, no ESD of that well is possible, but the IWOCS controls this from the workover vessel. ■ Before placing a well into Workover Mode, close all valves. ■ Give a formal notification to the workover vessel. This option is set in order to display that a well is on workover. Workover is a maintenance function on a well in which a workover vessel uses special equipment to operate the subsea tree. An interlock will be set to inhibit valve or choke operation on this well. Tree Valves is **no longer physically possible** from the SCM, although pressure and temperature can still be observed.
6	**HV Values (A/B)**	Displays the “High Voltage” analogue values as are Current (mA) and Voltage (V). These values can be changed online in service/software login level.
7	**Start-up status**	Expands the popup to display the start-up status windows. On “Tree On” the popup will be automatically expanded.
8	**Apply**	Applies the changes.
9	**Cancel/Exit**	Closes PopUp without applying changes.
10	**Channel A start-up status**	Displays the steps of the start-up sequence and or the error messages.
11	**Channel B start-up status**	Displays the steps of the start-up sequence and or the error messages.
12	**Close**	Closes the sequence status view.

Valve

7.1.2 Valve Depiction

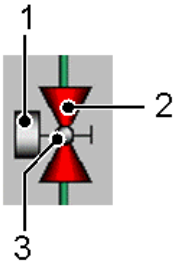


Figure 12 Valve Depiction

	Description	Colour	State
1-3	Click here to open the **Valve Control** PopUp (p. 36).		
1	**Valve Actuator**	■ **magenta**	OOS (Out of Service)
		■ **grey**	Unknown.
		■ **green**	Last command open.
		■ **red**	Last command close.
2	**Valve Body**	■ **magenta**	OOS (Out of Service)
		■ **grey**	Feedback unknown.
		■ **green**	Valve open.
		■ **red**	Valve closed.
		■ **orange**	Valve in alarm.
3	**Valve Ball**	□■ **Flashing**	Valve moving.

7.1.3 Valve Control PopUp

How to open this PopUp:

- In the **Well** window ▶ click on a **Valve** symbol

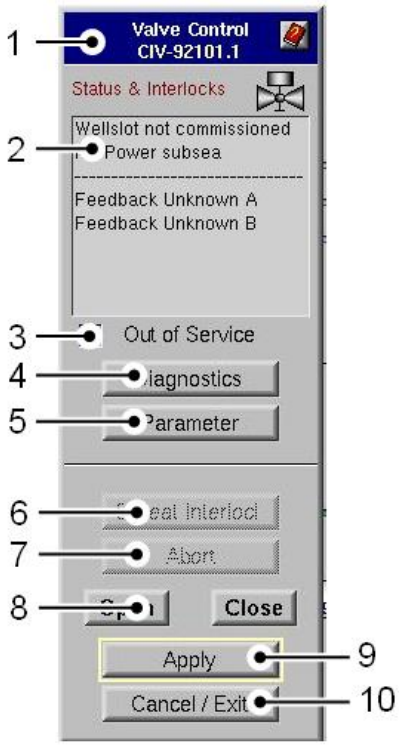


Figure 13 Valve Control PopUp

		Description	
1	**Header**	The 'Help' symbol opens the valve control help page. The name of the valve is displayed in the header of the PopUp.	
2	**Valve State and Interlocks**	*Valve Interlocks*	All interlocks are shown which blocks a valve open or close operation
		Valve Command operate	The subsea task gets the command request and processes it.
		Valve moving (open/close)	The time a valve is moving
		Failed to move	The command is not acknowledged or interrupted
3	**Out of Service**	Sets the valve out of service The '**Apply**' button becomes accessible.	
		Only on sufficient login level.	

4	**Diagnostics**	Opens the **Valve Diagnostics** PopUp (p. 39).
5	**Parameter**	Opens the **Parameter** PopUp of the Motor Control Unit (p. 41). Only on sufficient login level.
6	**Defeat Interlock**	Overrides Interlocks. The '**Apply**' button becomes accessible. Only on sufficient login level and if interlock is defeatable.
7	**Abort**	Aborts the valve movement. This button is accessible when the valve is moving. See 7.1.4 Aborting Valve Movement (p. 37)
8	**Open**	Opens the valve. See 7.1.5 Opening a Valve (p. 38)
	Close	Closes the valve. See 7.1.6 Closing a Valve (p. 38)
9	**Apply**	Applies the changes.
10	**Cancel/Exit**	Closes PopUp without applying changes.

7.1.4 Aborting Valve Movement

The valve moving can be aborted. The '**Abort**' button is accessible while the valve is moving.

- Click on the valve body to open the **Choke Control** PopUp.
- Click the '**Abort**' button.

- Click the '**Apply**' button.
  The valve abort command will be sent subsea.

7.1.5 Opening a Valve

- Click on the valve body to open the Valve Control PopUp.
- Press '**Open**'.
  If interlocks are activated, the '**Apply**' button is not available and the current interlocks are displayed in the status window.

CAUTION
Overriding interlocks may lead to serious damages.

- Check carefully before overriding interlocks and opening the valve.

- To override interlocks press '**Defeat Interlock**'.
  The '**Apply**' button becomes accessible.

- Press '**Apply**'.
  The valve actuator box becomes green (last command) and the valve command will be sent subsea.

7.1.6 Closing a Valve

- Click on the valve body to open the Valve Control PopUp.

- Press '**Close**'.
  If interlocks are activated, the '**Apply**' button is not available and the current interlocks are displayed in the status window.

CAUTION
Overriding interlocks may lead to serious damages.

- Check carefully before overriding interlocks and closing the valve.

- To override interlocks press '**Defeat Interlock**'.
  The '**Apply**' button becomes accessible.

- Press '**Apply**'.
  The valve actuator box becomes red (last command) and the valve command will be sent subsea.

7.1.7 Valve Diagnostics

How to open this PopUp:

- In the **Well** Window ▶ click on a **Valve** Symbol.
- The **Valve Control** PopUp appears ▶ click on the '**Diagnostics**' button.

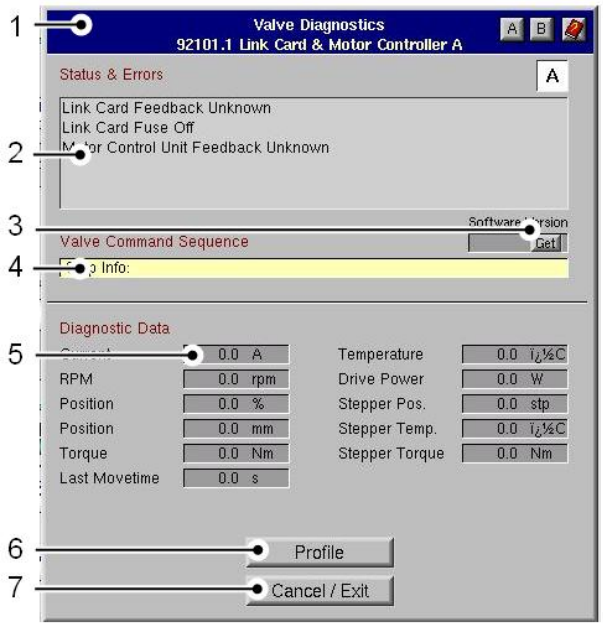


Figure 14 Valve Diagnostics PopUp

	Description	
1	**Header**	The '**Help**' Symbol opens the valve control help page. The name, label or address of the valve is displayed in the header of the PopUp. A mouse click on the header will change between the different modes. Click A or B to switch between Channel A and B
2	**Status Window**	Displays all states and interlocks
3	**Software Version**	Click here to get software version
4	**Valve Command Sequence**	Displays the Valve command Sequence
5	**Diagnostic Data**	Displays the Diagnostic Data. Click in a Transducer display to open **Historical Data** PopUp (p. 64).
6	**Profile**	Click here to open the '**Valve Profile**'.
7	**Cancel / Exit**	Closes PopUp without applying changes.

7.1.8 Valve Profile PopUp

How to open this PopUp:

- In the **Well** Window ▶ click on a **Valve** Symbol.
- The **Valve Control** PopUp appears ▶ click on the '**Diagnostics**' button.
- The **Valve Diagnostics** PopUp appears ▶ click on the '**Profile**' button.

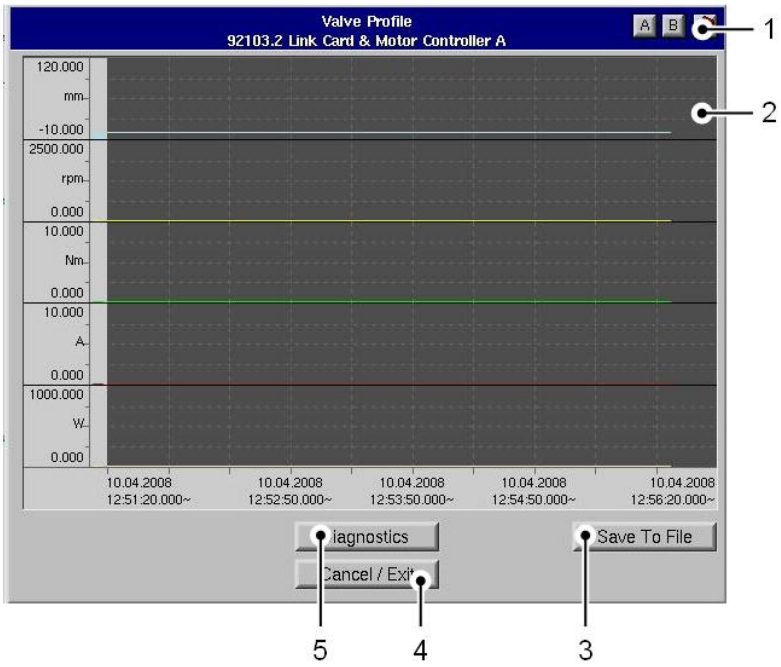


Figure 15 Valve Profile PopUp

	Description	
1	**Header**	The '**Help**' Symbol opens the valve control help page. The name, label or address of the valve is displayed in the header of the PopUp. Click A or B to switch between Channel A and B
2	**Display**	Displays Valve Profiles
3	**Save To File**	Saves file to hard disk.
4	**Cancel/Exit**	Closes the window.
5	**Diagnostics**	Opens the **Valve Diagnostics** PopUp (p. 39).

7.1.9 Valve Parameters

How to open this PopUp:

- In the **Well** Window ▶ click on a **Valve** Symbol.
- The **Valve Control** PopUp appears ▶ click on the '**Parameter**' button.

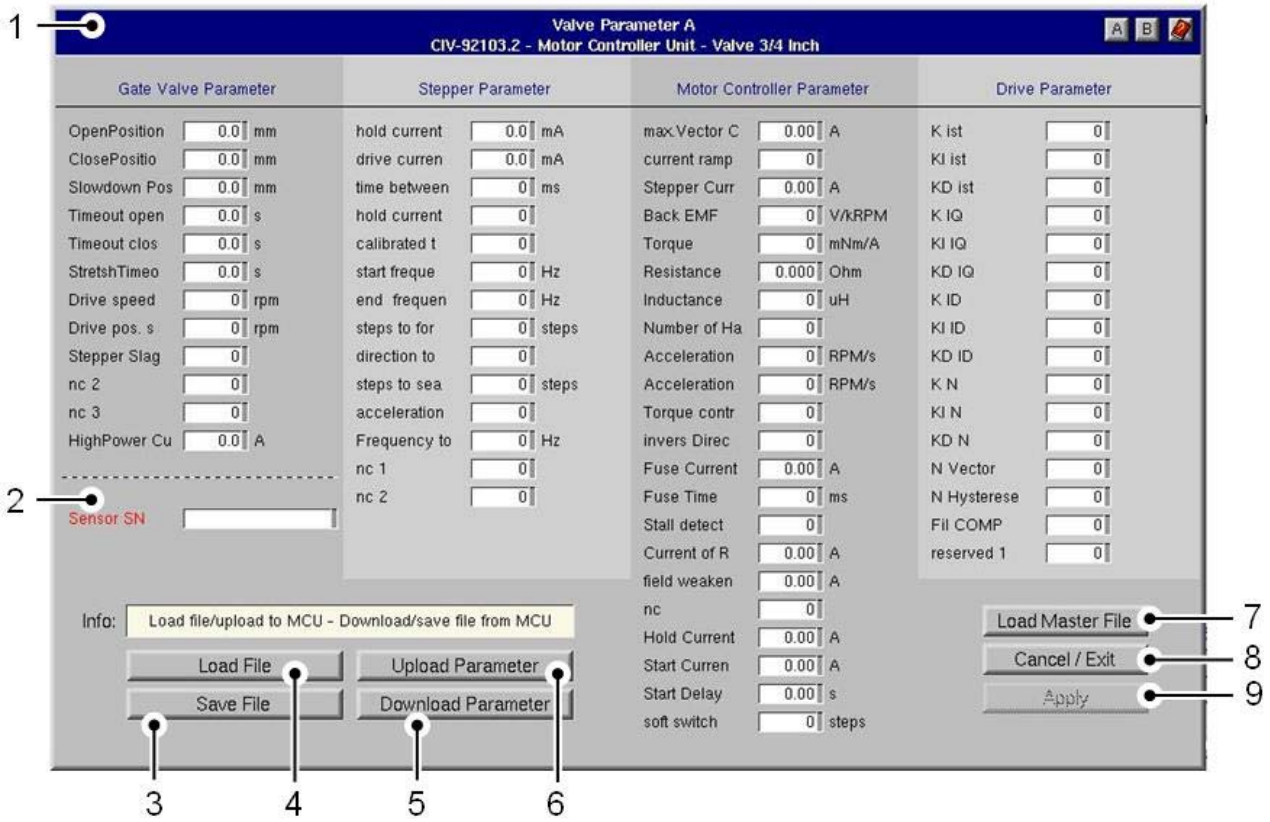


Figure 16 Valve Parameter PopUp

	Description	
1	**Header**	The '**Help**' Symbol opens the Valve control help page. The name, label or address of the Valve is displayed in the header of the PopUp. Click A or B to switch between **Valve Parameter** PopUp A and B
2	**Sensor SN**	Enter Sensor SN.
3	**Save Files**	Safes Parameter Files. Click here to open the Save **Parameter Files** PopUp (p. 55)
3	**Load Files**	Loads Parameter Files. Click here to open the Load **Parameter Files** PopUp (p. 55)

5	**Download Parameter**	Click here to download the Parameter Files from the MCU.
6	**Upload Parameter**	Click here to upload the Parameter Files to the MCU.
7	**Load Master File**	Loads Master Files. Click here to open the Load **Parameter Files** PopUp (p. 55) – **Only as Initial Start-up!!**
8	**Apply**	Applies the changes.
9	**Cancel / Exit**	Closes PopUp without applying changes.

7.1.10 Valve Parameter Files

How to open this PopUp:

- In the **Well** Window ▶ click on a **Valve** Symbol.
- The **Valve Control** PopUp appears ▶ click on the '**Parameter**' button.
- The **Valve Parameter** PopUp appears ▶ click on the '**Load/Save (Master) File**' button.

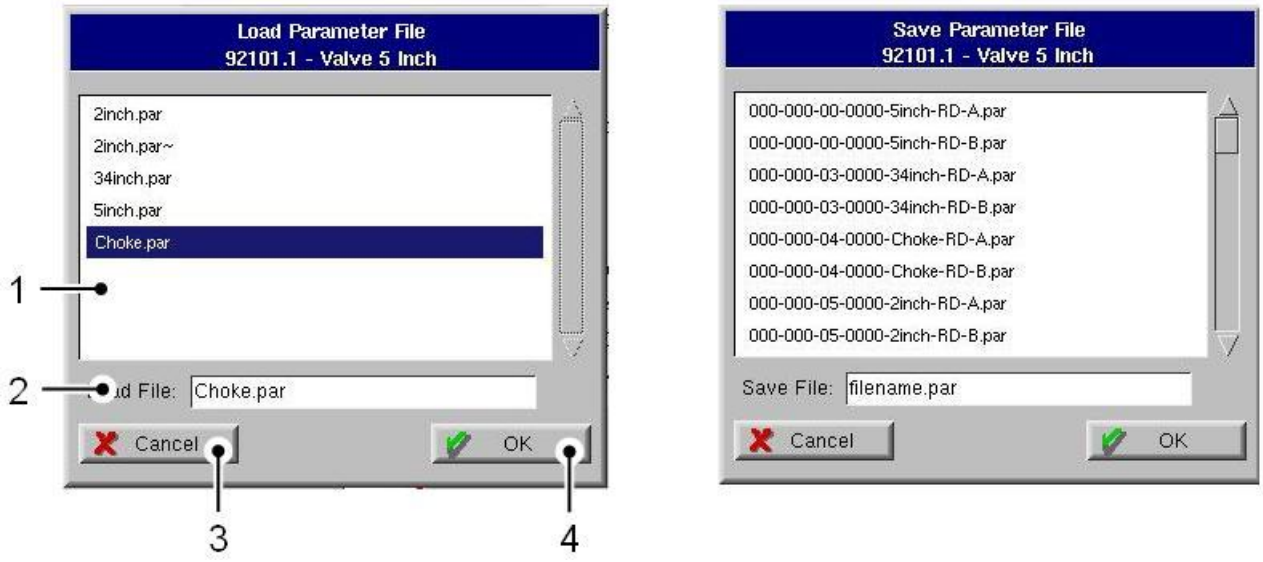


Figure 17 Valve Parameter Files PopUp

	Description	
1	**Display**	Displays all files you can choose to load or save.
2	**Display**	Displays actual file you have chosen to load or save.
3	**Cancel**	Click on this button to close PopUp without loading/saving files.
4	**OK**	Click on this button to load or save chosen file.

7.2 SCSSV / DHSV

7.2.1 Valve Depiction

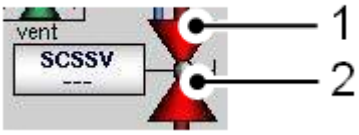


Figure 18 Valve Depiction

	Description	Colour	State
1-2	Click here to open the **Valve Control** PopUp (p. 36).		
1	**Valve Body**	**magenta**	OOS (Out of Service)
		grey	Feedback unknown.
		green	Valve open.
		red	Valve closed.
		orange	Valve in alarm.
2	**Valve Ball**	**Flashing**	Valve moving.

7.2.2 Valve Control PopUp

How to open this PopUp:

- In the **Well** window ▶ click on the **Valve (DHSV, SCSSV)** symbol

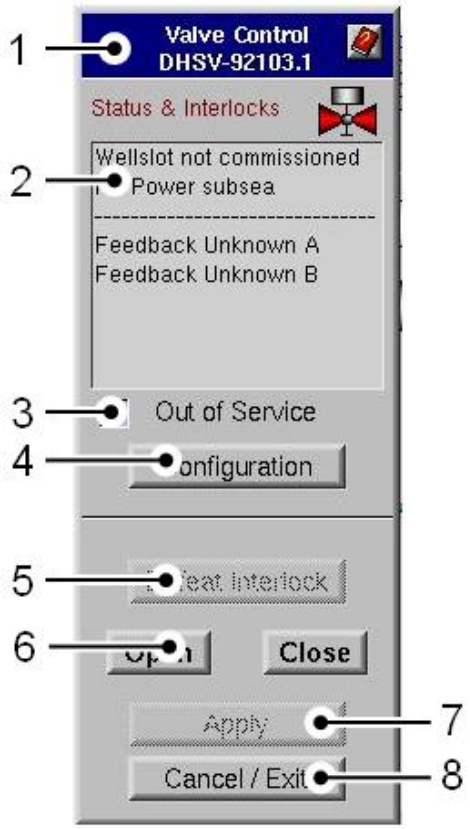


Figure 19 Valve Control PopUp

		Description	
1	**Header**	The 'Help' symbol opens the valve control help page. The name of the valve is displayed in the header of the PopUp.	
2	**Valve State and Interlocks**	*Valve Interlocks*	All interlocks are shown which blocks a valve open or close operation
		Valve Command operate	The subsea task gets the command request and processes it.
		Valve moving	The time a valve is moving.
		Failed to move	The command is not acknowledged
3	**Out of Service**	Sets the valve out of service. The '**Apply**' button becomes accessible.	

		Only on sufficient login level.
4	**Configuration**	Click here to open the **Valve Configuration** PopUp (p. 37).
5	**Defeat Interlock**	Overrides Interlocks. The '**Apply**' button becomes accessible.
		Only on sufficient login level and if interlock is defeatable.
6	**Open**	Opens the valve. See 7.1.5 Opening a Valve (p. 38)
	Close	Closes the valve. See 7.1.6 Closing a Valve (p. 38)
7	**Apply**	Applies the changes.
8	**Cancel/Exit**	Closes PopUp without applying changes.

7.2.3 Valve Configuration PopUp

How to open this PopUp:

- In the **Well** window ▶ click on the **Valve (DHSV, SCSSV)** symbol.
- The **Valve Control** PopUp appears ▶ click on the '**Configuration'** button

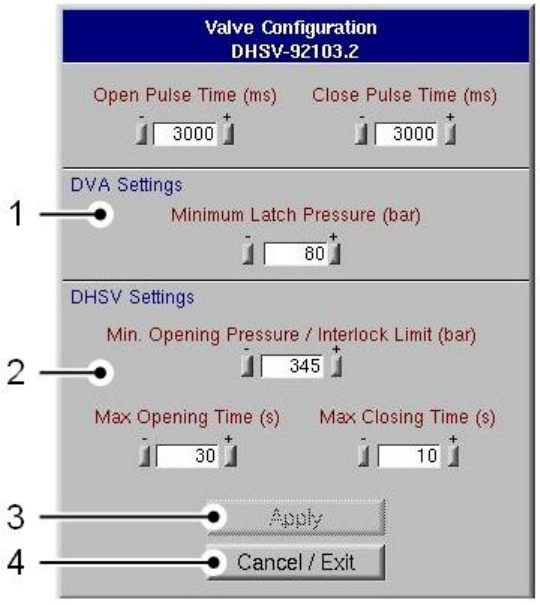


Figure 20 Valve Configuration PopUp

		Description
1	**DVA Settings**	Click in the input field to enter **DVA** Settings.
2	**DHVS Settings**	Click in the input field to enter **DHVS / SCSSV** Settings.
3	**Apply**	Applies the changes.
4	**Cancel/Exit**	Closes PopUp without applying changes.

7.3 Choke

7.3.1 Choke Depiction

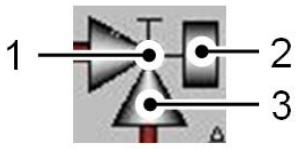


Figure 21 Choke Layout

	Description	Colour	State
1-3	Click here to open **Choke Control** PopUp (p. 49)		
1	**Choke Ball**	**Flashing**	Choke moving.
2	**Choke Actuator**	**magenta**	OOS (Out of Service)
		grey	Feedback unknown.
		green	Last command open.
		red	Last command close.
		blue (Flashing)	Cooling down.
3	**Choke Body**	**magenta**	OOS (Out of Service)
		grey	Feedback unknown.
		green	Choke open.
		red	Choke closed.
		orange	Choke in alarm.

7.3.2 Choke Control PopUp

How to open this PopUp:

- In the **Well** Window ▶ click on a **Choke** Symbol.

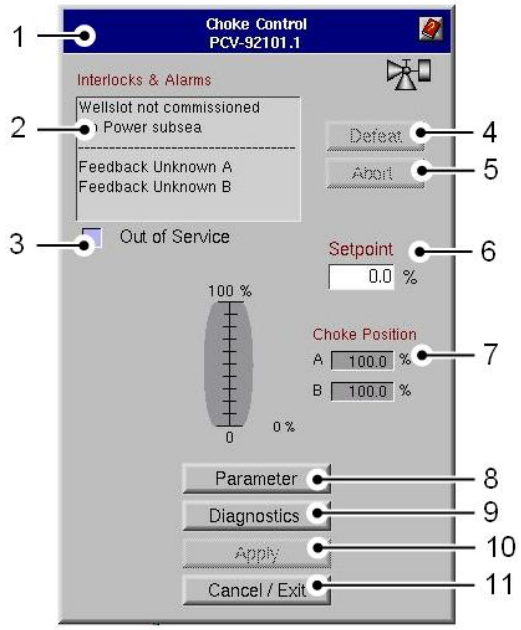


Figure 22 Choke Control PopUp

1	**Header**	The '**Help**' Symbol opens the choke control help page. The name, label or address of the choke is displayed in the header of the PopUp.	
2	**Choke State and Interlocks**	*Choke Interlocks*	All interlocks are shown which blocks a choke movement.
		Last Command Open	Last incoming command in SCM to open the choke.
		Last Command Close	Last incoming command in SCM to close the choke.
		Choke Command operate	The subsea task gets the command request and processes it.
		Choke moving	The time a choke is moving, the readback is between the thresholds.
		Failed to move	The command is not acknowledged by the Subsea Control Module.
		Cooling down	After moving the Motor Control Unit needs time to cool down.
		Discrepancy Alarm	The position of the choke and the related

			transmitter feedback are different (difference > 5 %). The discrepancy alarm of the choke will not be calculated if the associated transmitter is overridden.
		Feedback ignored	Feedback from valve instrument is ignored to determine Open/Close position, travel time is used instead.
3	**Out of Service**	Sets the choke out of service. The '**Apply**' button becomes accessible. Only on sufficient login level.	
4	**Defeat**	Overrides Interlocks. The '**Apply**' button becomes accessible. Only on sufficient login level and if interlock is defeatable.	
5	**Abort**	Aborts the choke movement. This button is accessible when the choke is moving. See also 7.3.4 Aborting Choke Movement (p. 51).	
6	**Setpoint**	Sets of the set point where the choke shall move to.	
7	**Choke Position**	Feedback from choke A and B position transmitter. See also 7.3.3 Changing Choke Position (p. 51).	
8	**Parameter**	Opens the **Parameter** PopUp of the Motor Control Unit (p. 53). Only on sufficient login level.	
9	**Diagnostics**	Opens the **Choke Diagnostics** PopUp (p. 52).	
10	**Apply**	Applies the changes.	
11	**Cancel/Exit**	Closes PopUp without applying changes.	

7.3.3 Changing Choke Position

- Click on the choke body to open the **Choke Control** PopUp.
- Type in the Setpoint, the choke shall move to.
  If interlocks are activated, the '**Apply**' button is not available and the current interlocks are displayed in the status window.

CAUTION
Overriding interlocks may lead to serious damages.

- Check carefully before overriding interlocks and opening the choke.

- To override Interlocks press '**Defeat Interlock**'.
  The '**Apply**' button becomes accessible.

- Press '**Apply**'.
  The choke command will be sent subsea.

7.3.4 Aborting Choke Movement

The choke moving can be aborted. The '**Abort**' button is accessible while the choke is moving.

- Click on the choke body to open the **Choke Control** PopUp.
- Click the '**Abort**' button.

- Click the '**Apply**' button.
  The choke abort command will be sent subsea. On abort, the choke will move one step further in its actual direction.

7.3.5 Choke Diagnostics

How to open this PopUp:

- In the **Well** Window ▶ click on a **Choke** Symbol.
- The **Choke Control** PopUp appears ▶ click on the '**Diagnostics**' button.

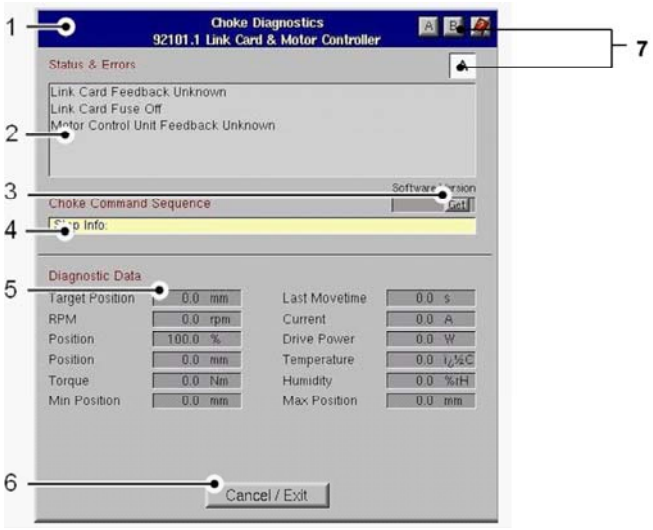


Figure 23 Choke Diagnostics PopUp

	Description	
1	**Header**	The '**Help**' Symbol opens the choke control help page. The name, label or address of the choke is displayed in the header of the PopUp. A mouse click on the header will change between the different modes. Click A or B to switch between Channel A and B
2	**Status Window**	Displays all states and interlocks
3	**Software Version**	Push button to get software version
4	**Choke Command Sequence**	Displays the Choke command Sequence
5	**Diagnostic Data**	Displays the Diagnostic Data. Click in a Transducer display to open **Historical Data** PopUp (p. 64).
6	**Cancel / Exit**	Closes PopUp without applying changes.
7	**A/B**	Switches between A and B. Selected is shown on display.

7.3.6 Choke Parameters

How to open this PopUp:

- In the **Well** Window ▶ click on a **Choke** Symbol.
- The **Choke Control** PopUp appears ▶ click on the '**Parameter**' button.

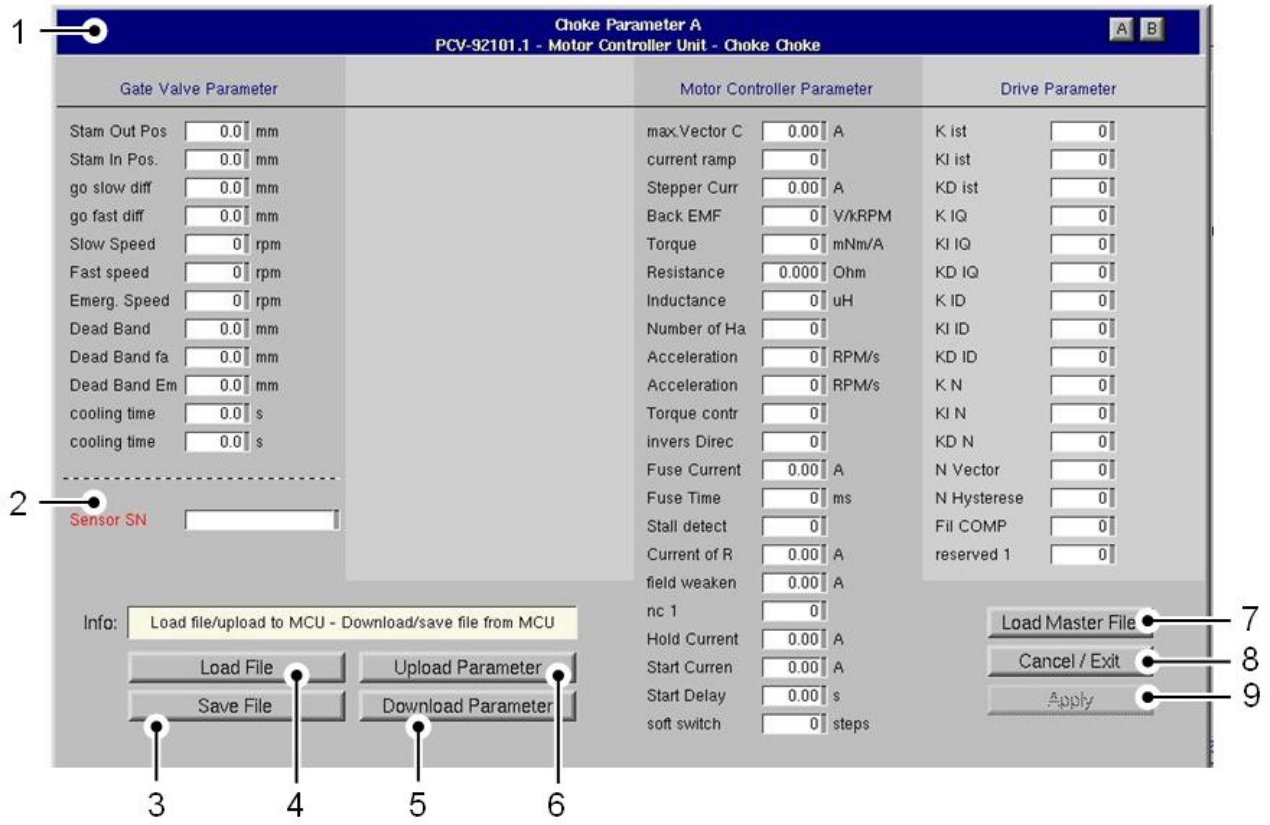


Figure 24 Choke Parameters PopUp

	Description	
1	**Header**	The '**Help**' Symbol opens the choke control help page. The name, label or address of the choke is displayed in the header of the PopUp. A mouse click on the header will change between the different modes. Click A or B to switch between **Choke Parameter** PopUp A and B
2	**Sensor SN**	Enter Sensor SN
3	**Save Files**	Safes Parameter Files. Click here to open the Save **Parameter Files** PopUp (p. 55)
3	**Load Files**	Loads Parameter Files. Click here to open the Load **Parameter Files** PopUp (p. 55)

5	**Download Parameter**	Click here to download the Parameter Files from the MCU.
6	**Upload Parameter**	Click here to upload the Parameter Files to the MCU.
7	**Load Master File**	Loads Master Files. Click here to open the Load **Parameter Files** PopUp (p. 55) – **Only as initial start-up!!!**
8	**Apply**	Applies the changes.
9	**Cancel / Exit**	Closes PopUp without applying changes.

7.3.7 Parameter Files

How to open this PopUp:

- In the **Well** Window ▶ click on a **Choke** Symbol.
- The **Choke Control** PopUp appears ▶ click on the '**Parameter**' button.
- The **Choke Parameter** PopUp appears ▶ click on the '**Load/Save (Master) File**' button.

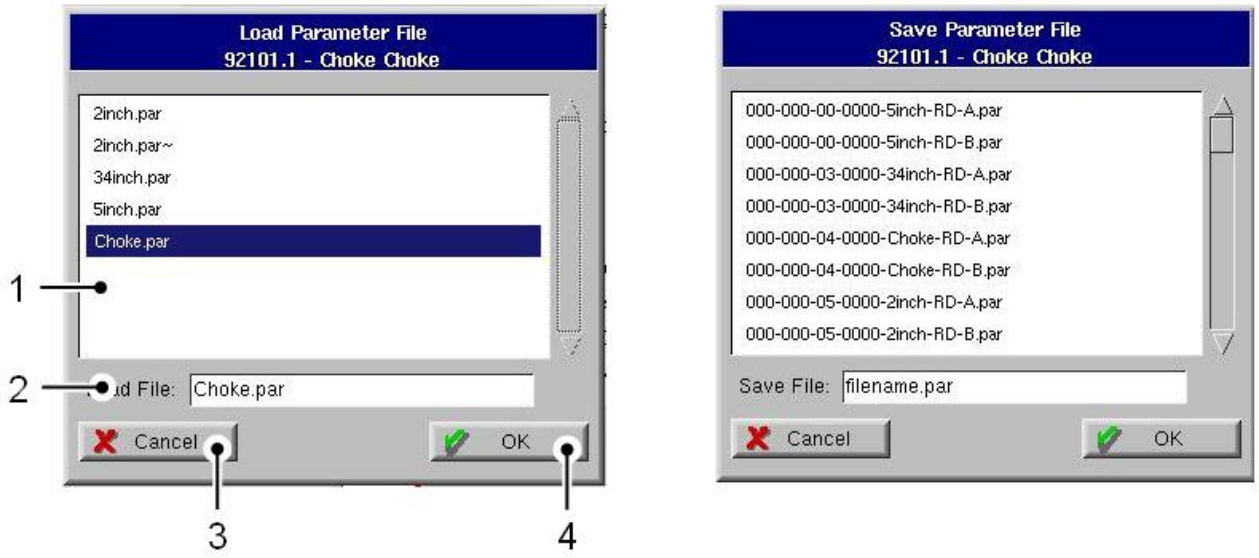


Figure 25 Choke Parameters PopUp

	Description	
1	**Display**	Displays all files you can choose to load or save.
2	**Display**	Displays actual file you have chosen to load or save.
3	**Cancel**	Click on this button to close PopUp without loading/saving files.
4	**OK**	Click on this button to load or save chosen file.

7.4 DHPTT

7.4.1 DHPTT Depiction

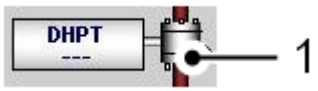


Figure 26 DHPTT Depiction

	Description	
1	**DHPTT**	Click on Symbol to open the **DHPTT Control** PopUp. (p. 56)

7.4.2 DHPTT Control PopUp

How to open this PopUp:

- In the **Well** window ▶ click on the **DHPT** symbol.

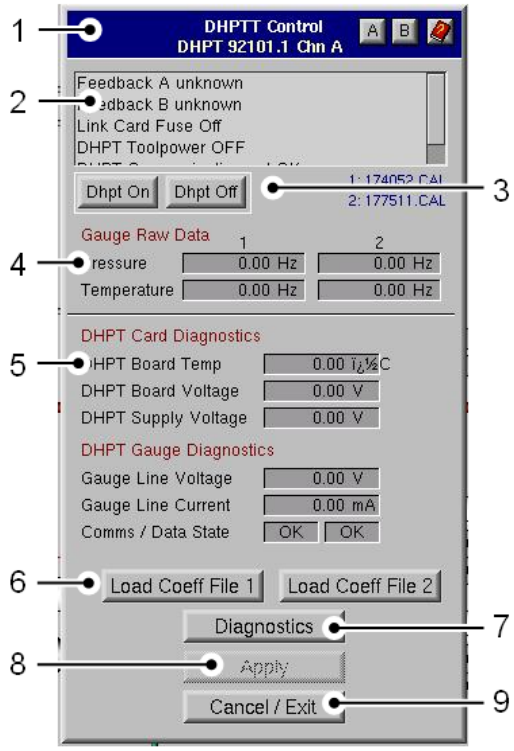


Figure 27 DHPTT Control PopUp

	Description	
1	**Header**	The '**Help**' Symbol opens the choke control help page. The name, label or address of the choke is displayed in the header of the PopUp. Click A or B to switch between Channel A and B.

2	**Status Window**	*Unknown*	No feedback from Card A or B
		Toolpower on	Power to Gauge
		Toolpower off	No Power to Gauge
		Toolpower on/off Sequence running	To activate power to the gauge a sequence is running. This can take up to 2 minutes.
		Dhpt not connected	No interface card within the eSCM or card is defect
		Dhpt error	Communication problem to the interface card
3	**DHPT On/Off**	Sets the gauge power to on/off. On Toolpower "on" the DHPT interface card within the eSCM will be set to power the gauges.	
		Set only one card to power the gauge!	
4	**Gauge Readings from DHPT**	**Pressure**	RAW values of the DHPTT. Click in the transducer display to open **Historical Data** PopUp (p. 64).
		Temperature	RAW values of the DHPTT. Click in the transducer display to open **Historical Data** PopUp (p. 64).
4	**DHPT Card Diagnostics**	**Board Temp**	Actual temperature of the board. Click in the transducer display to open **Historical Data** PopUp (p. 64).
		Board Voltage	Actual voltage of the board. Click in the transducer display to open **Historical Data** PopUp (p. 64).
		Supply Voltage	Supply voltage of the board. Click in the transducer display to open **Historical Data** PopUp (p. 64).
5	**DHPT Gauge Diagnostics**	**Line Voltage**	Readback values. Click in the transducer display to open **Historical Data** PopUp (p. 64).
		Line Current	Readback values. Click in the transducer display to open **Historical Data** PopUp (p. 64).
		Comms/Data State	Readback values. Click in the transducer display to open **Historical Data** PopUp (p. 64).
6	**Load Coeff File 1-2**	Click button 1-2 to open **Load Coefficient File** PopUp (p. 59).	
7	**Diagnostics**	Click Button to open **DHPT Diagnostic** PopUp (p. 58).	
8	**Apply**	Applies the changes.	
9	**Cancel/Exit**	Closes PopUp without applying changes.	

7.4.3 DHPT Diagnostics

How to open this PopUp:

- In the **Well** Window ▶ click on a **DHPT** Symbol.
- The **DHPT Control** PopUp appears ▶ click on the '**Diagnostics**' button.

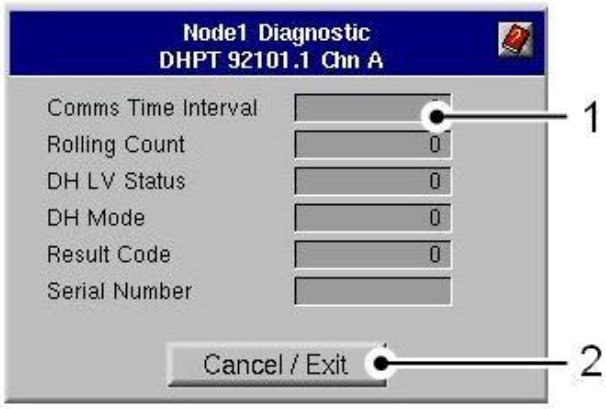


Figure 28 DHPT Diagnostics PopUp

	Description	
1	**Transducer Display**	Displays the Diagnostic Data. Click in a Transducer display to open **Historical Data** PopUp (p. 64).
2	**Cancel / Exit**	Closes PopUp without applying changes.

7.4.4 DHPT Coefficient File PopUp

How to open this PopUp:

- In the **Well** Window ▶ click on a **Choke** Symbol.
- The **DHPT Control** PopUp appears ▶ click on the '**Load Coefficient File**' button.

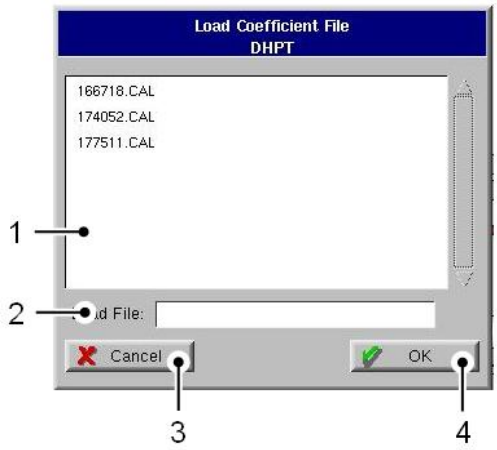


Figure 29 DHPT Coefficient File PopUp

	Description	
1	**Display**	Displays all files you can choose to load.
2	**Display**	Displays actual file you have chosen to load.
3	**Cancel**	Click on this button to close PopUp without loading files.
4	**OK**	Click on this button to load or save chosen file.

7.5 Instruments

7.5.1 Valve and Choke Instrument Depiction

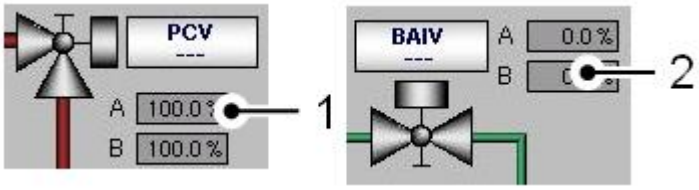


Figure 30 Valve and Choke Instrument

	Description	
1	**Choke Transducer Display**	Click here to open the Choke instrument PopUp (p. 60)
2	**Valve Transducer Display**	Click here to open the Valve instrument PopUp (p. 60)

7.5.2 Valve and Choke Instrument PopUp

How to open this PopUp:

- In the **Well** Window ▶ click on a choke or valve **Transducer Display** Symbol.

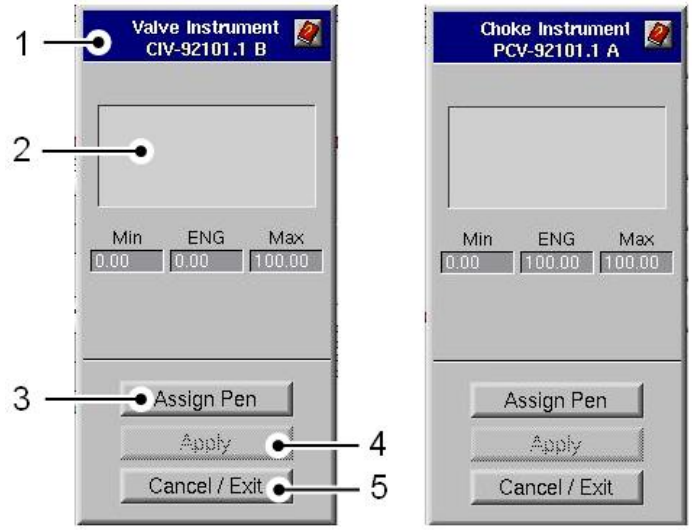


Figure 31 Valve and Choke Inst. PopUp

		Description
1	**Header**	The name, label of the instrument is displayed in the header of the PopUp.
2	**Instrument State**	The status window displays the different transducer status. • Under Range,

		• Over Range, • Feedback Unknown, • Analogue Override, • Alarms (LoLo, Lo, Hi, HiHi), or • Trips (Lo, Hi).
3	**Assign Pen**	Assigns the Instrument to the graphical display of the **Trending** page. See *15.4* ***Editing Trend Page*** on p. 103
4	**Apply**	Applies the changes.
5	**Cancel / Exit**	Closes PopUp without applying changes.

7.5.3 Subsea Instrument Depiction

Figure 32 Subsea Instrument Depiction

Description	Colour	State
Subsea Instruments	**grey**	Feedback unknown.
	magenta	Analogue Override (OOS)
	orange	Over or under range.
	red	Alarm
	white	Normal.

7.5.4 Subsea Instrument PopUp

How to open this PopUp:

- In the **Well** window ▶ click on a Subsea Instrument Transducer display.

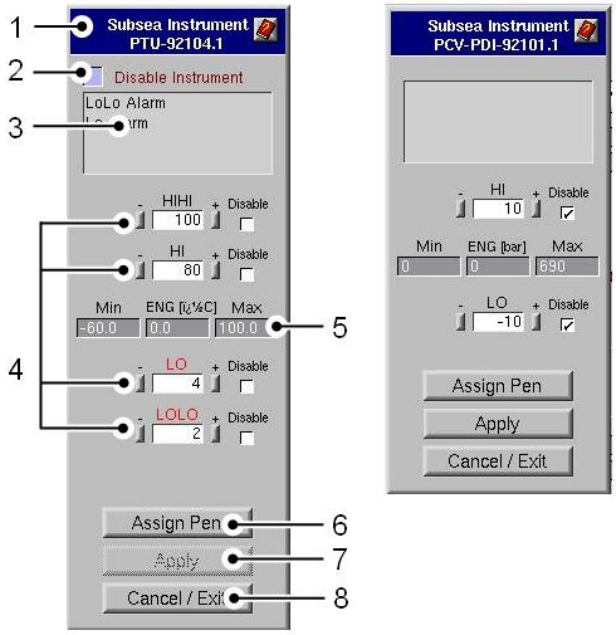


Figure 33 Subsea Instrument PopUp

	Description		
1	**Header**	The name, label of the instrument is displayed in the header of the PopUp.	
2	**Disable Instrument**	This will disable the transmitter, including all alarms. The transmitter is now in “out of service” mode.	
		Even with Enable Instrument selected, the alarms are still disabled and have to be reset separately if required.	
3	**Status Window**	Displays the status of the instrument.	
		OOS	Instrument has been set out of service
		LoLo Alarm	The LoLo value is undershoot.
		Lo Alarm	The Lo value is undershoot.
		Hi Alarm	The Hi value is exceeded.
		HiHi Alarm	The HiHi value is exceeded.
4	**HiHi / Hi / Lo / LoLo Alarm Settings**	If the Hi, HiHi value is exceeded or if the Lo, LoLo value is undershoot the corresponding alarm appears. The following conditions will not be allowed: HiHi > EngMax Hi > HiHi	

		Lo < LoLo LoLo < EngMin.
	Disable Alarm	This will enable / disable the related alarm or trip of the transmitter. The alarm will not appear in the alarm banner if the alarm condition is present. Related trips will not be started.
5	**Readout Values**	
6	**Assign Pen**	Assigns the Instrument to the graphical display of the **Trending** page. See *15.4 Editing Trend Page* on p. 103
7	**Apply**	Applies the changes.
8	**Cancel/Exit**	Closes PopUp without applying changes.

7.6 Historical Data

How to open this PopUp:

- Click '**Transducer Display**' in the **Diagnostic, Choke, DHPT Control** PopUp or **Diagnostic Page** ▶ The '**Historical Data**' PopUp appears.

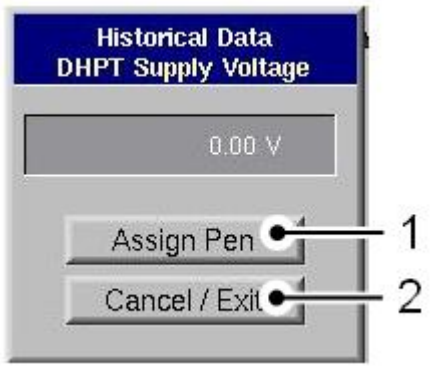


Figure 34 Historical Data PopUp

	Description	
1	**Assign Pen**	Assigns the Instrument to the graphical display of the **Trending** page. See 15.4 Editing Trend Page (p. 103)
2	**Cancel / Exit**	Closes PopUp without applying changes.

8 HYDRAULIC POWER UNIT

8.1 Hotspots on the Hydraulic Power Unit Page

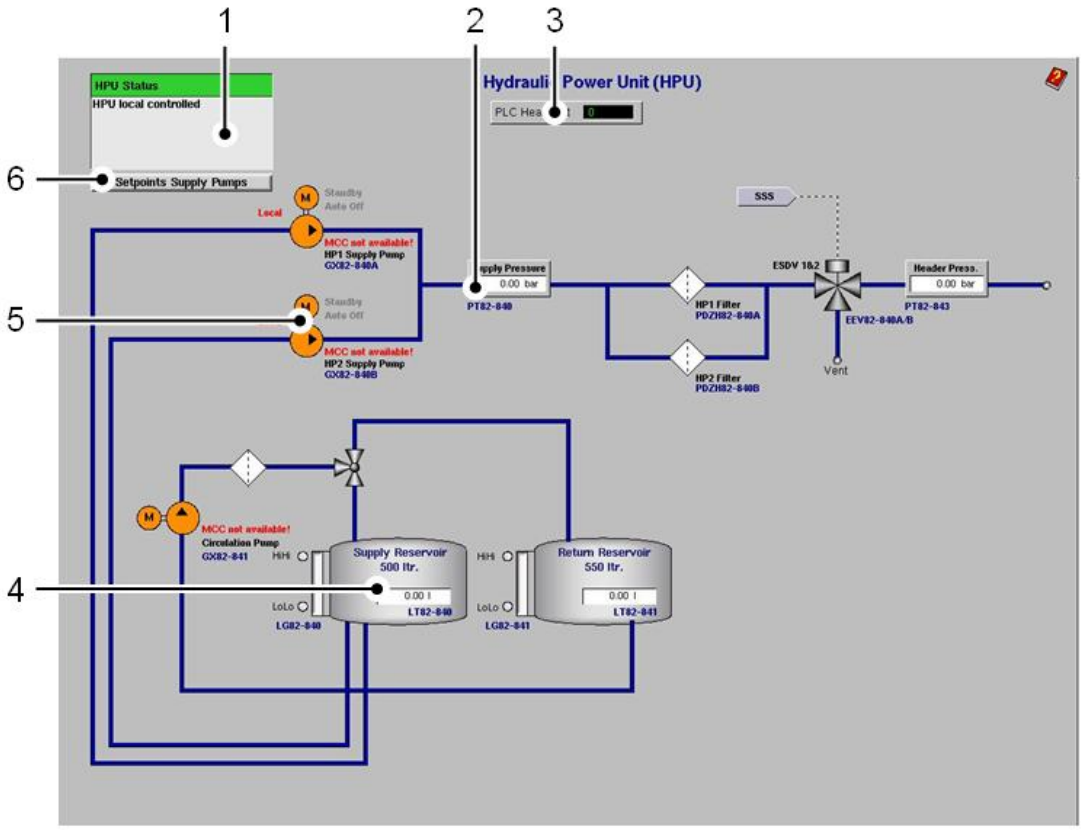


Figure 35 Hydraulic Power Unit Page

	Name	Description	
1	**Status Window**	Driver disabled	The Driver is disabled in the MCS Configuration
		Communication fails	The heartbeat of the HPU stopped
		HPU emergency stopped	One of the emergency buttons is pressed
		■ **dark grey**	Unknown / Comms fault
		■ **green**	On scan
2	**Transducer display**	Click here to open the **HPU Instrument – Supply / Header Pressure** Popup (p. 73)	
3	**PLC Heartbeat**	Displays the PLC Heartbeat	
4	**Reservoir Level Instrument**	Click here to open the **HPU Instrument – Supply Level / Return Level** Popup (p. 71)	

5	**Pump**	Click here to open the **HPU Pump Control** Popup (p. 68)
6	**Setpoints Supply Pumps**	Click here to open the **HPU Pump Setup – Setpoints HP Pumps** Popup (p. 69)

8.2 Pump

The HPU system provides two high pressure (HP) and one recirculation pump. The pumps can be operated local at the HPU or remote via the MCS. The user can set setpoints, change modes and can stop the related pumps. The supply pumps generate the pressure for the subsea system. The pumps stop if the HPU emergency stop button is pushed, the motor stop push button is pressed or an ESD occurs.

The pump only uses set points if the **local/remote** switch at the HPU is set to **remote** and **Pump Auto Mode** is enabled in the **HPU Pump Control** PopUp.

Duty & Standby pumps

For each pressure circuit one pump must be the Duty pump and one must be the Standby pump.

Changeover Duty pump

After a defined period of time the assignment of duty pump and standby pump should be changed. This should be done for reasons of even usage of both pumps.

The Duty/Standby pump selection should be changed all 20 days to not have one pump running all the time.

The parameter Run Hours displays the total runtime of the pump since last restart of the HPU PLC. This counter goes up to 32000 hours and then is reset to 0.

8.2.1 Pump Depiction

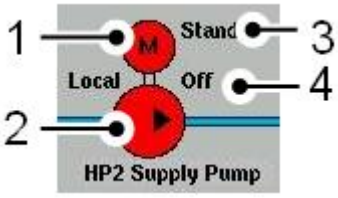


Figure 36 Pump Depiction

	Description		
1 + 2	**Motor + Pump**	■ **dark grey**	Feedback unknown
		■ **green**	Running
		■ **red**	Off
		■ **orange**	Motor Fault / Stopped
3	**Mode**	**Duty**	This pump operates as Duty pump Pump starts if the pressure drops below the **Duty Start Setpoint** (p. 69) Pump stops if the pressure reaches the **Stop Setpoint** (p. 69)
		Standby	This pump operates as Standby Pump Pump starts if the pressure drops below the **Standby Start Setpoint** (p. 69) Pump stops if the pressure reaches the **Stop Setpoint** (p. 69)
4	**Status**	**Auto On**	Pump is running (in *Duty* or *Standby* mode)
		Hand	Pump is in manual mode
		Auto Off	Pump is not running

8.2.2 HPU Pump Control

How to open this PopUp:

- In the **HPU** window ▶ click on a **Pump** symbol.

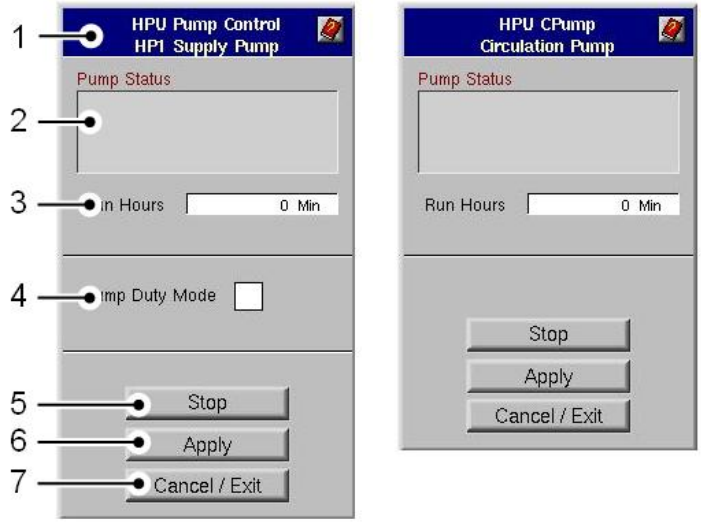


Figure 37 HPU Pump Control

	Description	
1	**Header**	The name, label of the instrument is displayed in the header of the PopUp.
2	**Status Window**	Displays pump status in the status window.
3	**Run Hours**	Each Pump has got a counter which displays the actual running hours of the pump since last restarted.
		The counter can be reset at the HPU PLC by service personal only.
4	**Pump Duty Mode**	The Pump operates if the pressure drops below the duty start limit. To change selection click in the tick box and apply.
5	**Stop**	The pumps can be stopped remote from the MCS. The control PopUp can be opened by clicking on the related pump symbol.
		Stop can only be done if the switch at the HPU is set to remote.
6	**Apply**	Applies the changes.
7	**Cancel/Exit**	Closes PopUp without applying changes.

8.2.3 HPU Pump Setup

How to open this PopUp:

- In the **HPU** window ▶ click on the **Setpoints Supply Pumps** Button.

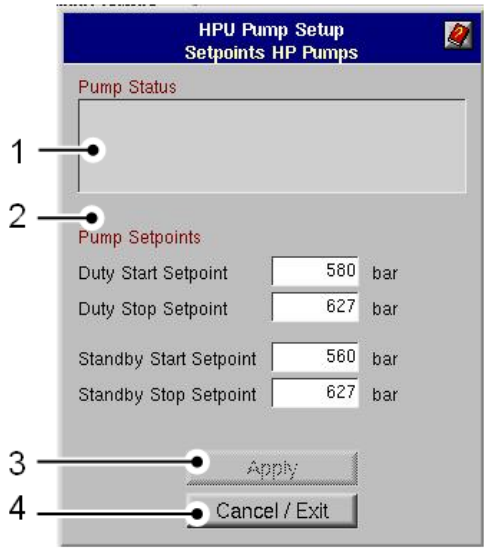


Figure 38 HPU Pump Setup

	Description		
1	**Status Window**	Displays Pump Status in the window	
2	**Pump Setpoints**	**Duty Start Setpoint**	If pressure falls below this value the Duty pump automatically starts if pumps are in **Auto** mode.
		Standby Start Setpoint	If pressure falls below this value the Standby pump automatically starts if pumps are in **Auto** mode.
3	**Apply**	Applies the changes.	
4	**Cancel/Exit**	Closes PopUp without applying changes.	

8.3 Supply & Return Reservoirs

8.3.1 Supply & Return Reservoirs Depiction

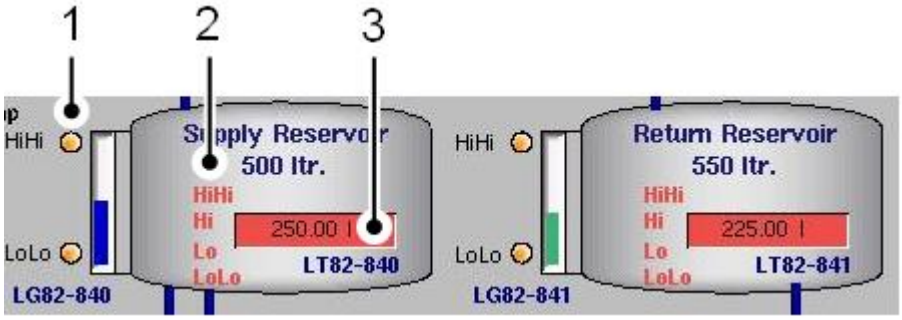


Figure 39 Supply & Return Reservoirs Depiction

1	**Supply/Return Level Alarm Display**	The HiHi, Hi, Lo and LoLo limits are defined in the **HPU Instrument – Supply Level / Return Level** PopUp (p. 71)	
		HiHi	The corresponding HiHi alarm is displayed.
		LoLo	The corresponding LoLo alarm is displayed.
2	**Supply/Return Level Instrument display**	**grey**	Feedback unknown
		magenta	OOS – Out of Service
		orange	Value under or over range
		red	Alarm
		white	Normal
3	**Supply/Return Level Alarm**	The HiHi, Hi, Lo and LoLo limits are defined in the **HPU Instrument – Supply Level / Return Level** PopUp (p. 71)	
		HiHi	The corresponding HiHi alarm is displayed.
		Hi	The corresponding Hi alarm is displayed.
		Lo	The corresponding Lo alarm is displayed.
		LoLo	The corresponding LoLo alarm is displayed.

8.3.2 HPU Instrument – Supply Level / Return Level

How to open this PopUp:

- In the **HPU** window ▶ click on the **Supply Level** / **Return Level** Instrument Transducer symbol.

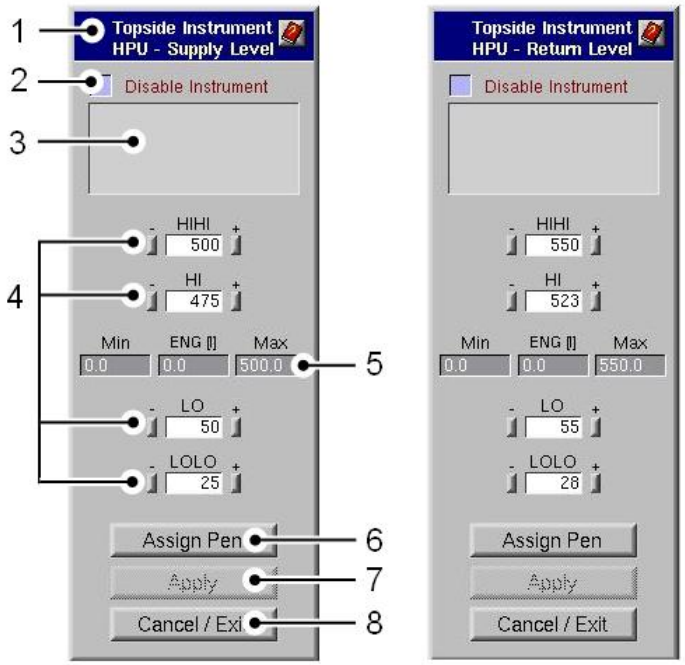


Figure 40 HPU Instrument – Supply Level / Return Level

	Description		
1	**Header**	The name, label of the instrument is displayed in the header of the PopUp.	
2	**Disable Instrument**	This will disable the transmitter, includes all alarms. The transmitter is now in Out of Service mode.	
		Even with enable Instrument selected, the alarms and trips are still disabled and have to be reset separately if required.	
3	**Status Window**	*Feedback unknown*	No feedback from device
		OOS	Device has been set “out of service”
		Value Under Range	Value has fallen 2,5% below **RawMin**.
		Value Over Range	Value has exceeded **RawMax** above 2,5%.
		HiHi Alarm	The HiHi value is exceeded.
		Hi Alarm	The Hi value is exceeded.
		Lo Alarm	The Lo value is undershot.
		LoLo Alarm	The LoLo value is undershot.

4	**HiHi** **Hi** **Lo** **LoLo** **alarm settings**	If the HiHi, Hi value is exceeded or if the Lo, LoLo value is undershoot the corresponding alarm appears. The following conditions will not be allowed: HiHi > EngMax Hi > HiHi Lo < LoLo LoLo < EngMin
5	**Readout Values**	Readout value of the selected Transmitter
6	**Assign Pen**	Assigns the Instrument to the graphical display of the **Trending** page. See *15.4 Editing Trend Page* on p. 103
7	**Apply**	Applies the changes.
8	**Cancel/Exit**	Closes PopUp without applying changes.

8.3.3 HPU Instrument – Supply / Header Pressure

How to open this PopUp:

- In the **HPU** window ▶ click on a **Supply / Header Pressure** Instrument Transducer display.

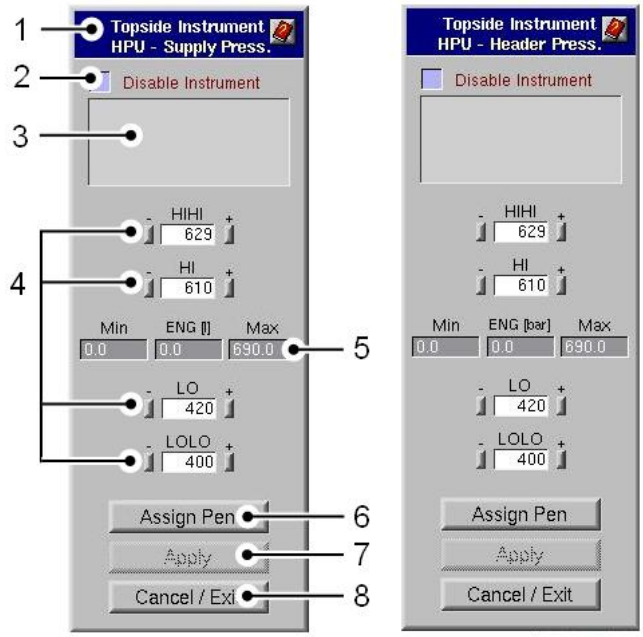


Figure 41 HPU Instrument – Supply / Header Pressure

	Description		
1	**Header**	The name, label or address of the instrument is displayed in the header of the PopUp.	
2	**Disable Instrument**	This will disable the transmitter, including all alarms. The transmitter is now in analogue override mode.	
		Even with Enable Instrument selected, the alarms and trips are still disabled and have to be reset separately if required.	
3	**Status Window**	*Feedback unknown*	No feedback from device
		OOS	Device has been set “out of service”
		Value Under Range	Value has fallen 2,5% below **RawMin**.
		Value Over Range	Value has exceeded **RawMax** above 2,5%.
		HiHi Alarm	The HiHi value is exceeded.
		Hi Alarm	The Hi value is exceeded.
		Lo Alarm	The Lo value is undershot.
		LoLo Alarm	The LoLo value is undershot.

4	**HiHi / Hi / Lo / LoLo Alarm Settings**	If the Hi, HiHi value is exceeded or if the Lo, LoLo value is undershoot the corresponding alarm appears. The following conditions will not be allowed: HiHi > EngMax Hi > HiHi Lo < LoLo LoLo < EngMin.
	Disable	This will enable / disable the related alarm or trip of the transmitter. The alarm will not appear in the alarm banner if the alarm condition is present. Related trips will not be started.
5	**Readout Values**	Readout value of the selected Transmitter
6	**Assign Pen**	Assigns the Instrument to the graphical display of the **Trending** page. See *15.4 Editing Trend Page* on p. 103
7	**Apply**	Applies the changes.
8	**Cancel/Exit**	Closes PopUp without applying changes.

HPU Trips

Some process condition will cause the pumps to stop. The logic for these trips is implemented in the HPU PLC logic. In the case the pump is tripped, it can't be restarted until the trip condition is cleared. If a specific pump is tripped this will be indicated in the pump symbol.

9 ELECTRICAL POWER & COMMUNICATION UNIT

9.1 Hotspots on the Electrical Power & Communication Unit Page

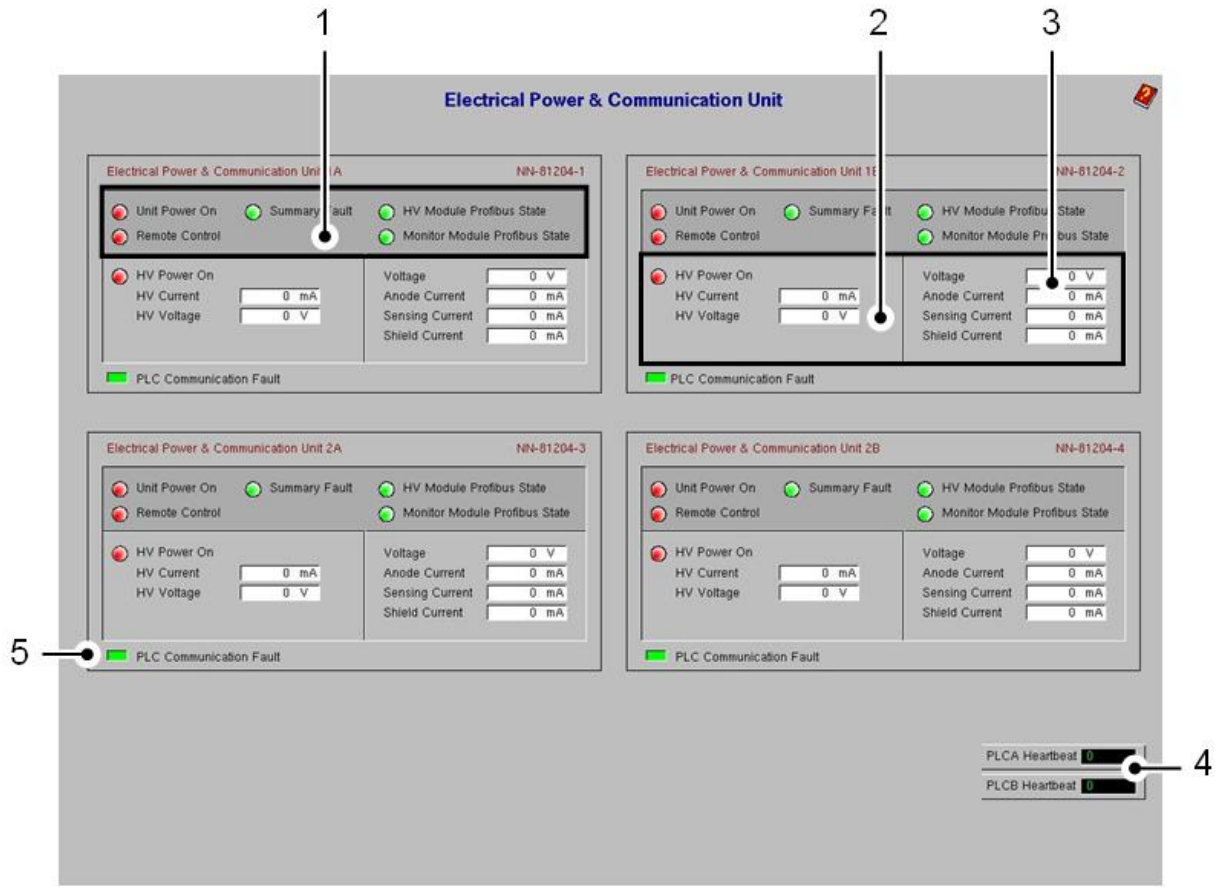


Figure 42 Electrical Power & Communication Unit Page

	Name	Description	
1	**Status LED's**	Click in the HV area to open the **EPCU Control** Popup (p. 76)	
		■ **dark grey**	Feedback unknown
		■ **green**	On
		■ **red**	Off
1	**Alarm LED's**	Click in the HV area to open the **EPCU Control** Popup (p. 76)	
		■ **dark grey**	Feedback unknown
		■ **green**	No Alarm
		■ **orange**	Alarm

2	**HV Power On**	**HV Current**	Displays the “High Voltage” Current
		HV Voltage	Displays the HV Voltage
		Voltage	Displays the Voltage
		Anode Current	Displays the Anode Current
		Sensing Current	Displays the Sensing Current
		Shield Current	Displays the Shield Current
3	**Transducer Display**	Click on a Transducer display to open the **EPCU Instrument** Popup (p. 77)	
4	**PLC Heartbeat**	Displays the PLC A/B Heartbeat	
5	**PLC Communication Fault**	Displays PLC Communication Fault Status	

9.2 EPCU Control

How to open this PopUp:

- In the **EPCU** window ▶ click on the corresponding **LED** display.

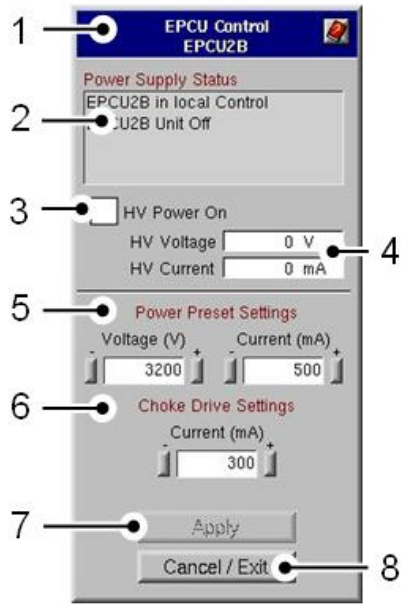


Figure 43 EPCU Control PopUp

	Description	
1	**Header**	The name, label of the instrument is displayed in the header of the PopUp.
2	**Status Window**	Displays the Power Supply Status in the PopUp

3	**HV Power On**	Mark check box and push **Apply** button to set the HV Power On.	
		⚠ For maintenance only – The HV power will be set during start-up sequence using the “Tree On” feature within the well configuration popup. See p. (33)	
4	**HV Voltage**	Shows HV Voltage in V (Volt).	
	HV Current	Shows HV Current in mA (milliampere).	
5	**Power Preset settings**	**Voltage (V)**	Preset voltage value. Manually alterable.
		Current (mA)	Preset current value. Manually alterable.
6	**Choke drive Settings**	**Current (mA)**	Attended current for driving choke in other position. Manually alterable.
7	**Apply**	Applies the changes.	
8	**Cancel/Exit**	Closes PopUp without applying changes.	

9.3 EPCU Instruments

How to open this PopUp:

- In the **EPCU** window ▶ click on the corresponding **Transducer** display.

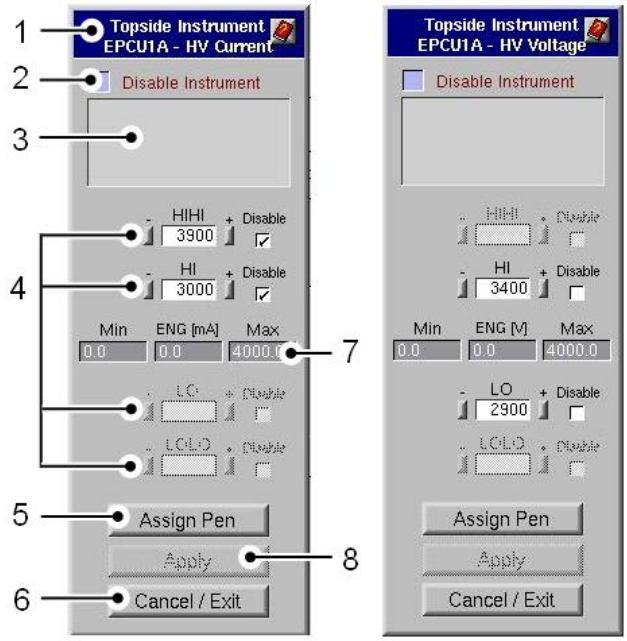


Figure 44 EPCU Instrument PopUp

	Description	
1	**Header**	The name, label of the instrument is displayed in the header of the PopUp.
2	**Disable Instrument**	This will disable the transmitter, including all alarms. The transmitter is

		now in analogue override mode. Even with Enable Instrument selected, the alarms and trips are still disabled and have to be reset separately if required.
3	**Status Window**	Displays the status of the instrument
4	**Alarm Limitts HiHi / Hi / Lo / LoLo**	If the Hi, HiHi value is exceeded or if the Lo, LoLo value is undershoot the corresponding alarm appears. The following conditions will not be allowed: HiHi > EngMax Hi > HiHi Lo < LoLo LoLo < EngMin
5	**Assign Pen**	Assigns the Instrument to the graphical display of the **Trending** page. See *15.4 Editing Trend Page* on p. 103.
6	**Cancel/Exit**	Closes PopUp without applying changes.
7	**Readout Values**	
8	**Apply**	Applies the changes.

10 EMERGENCY SHUTDOWN, TRIPS & INTERLOCKS

10.1 Hotspots on the Emergency Shutdown Page

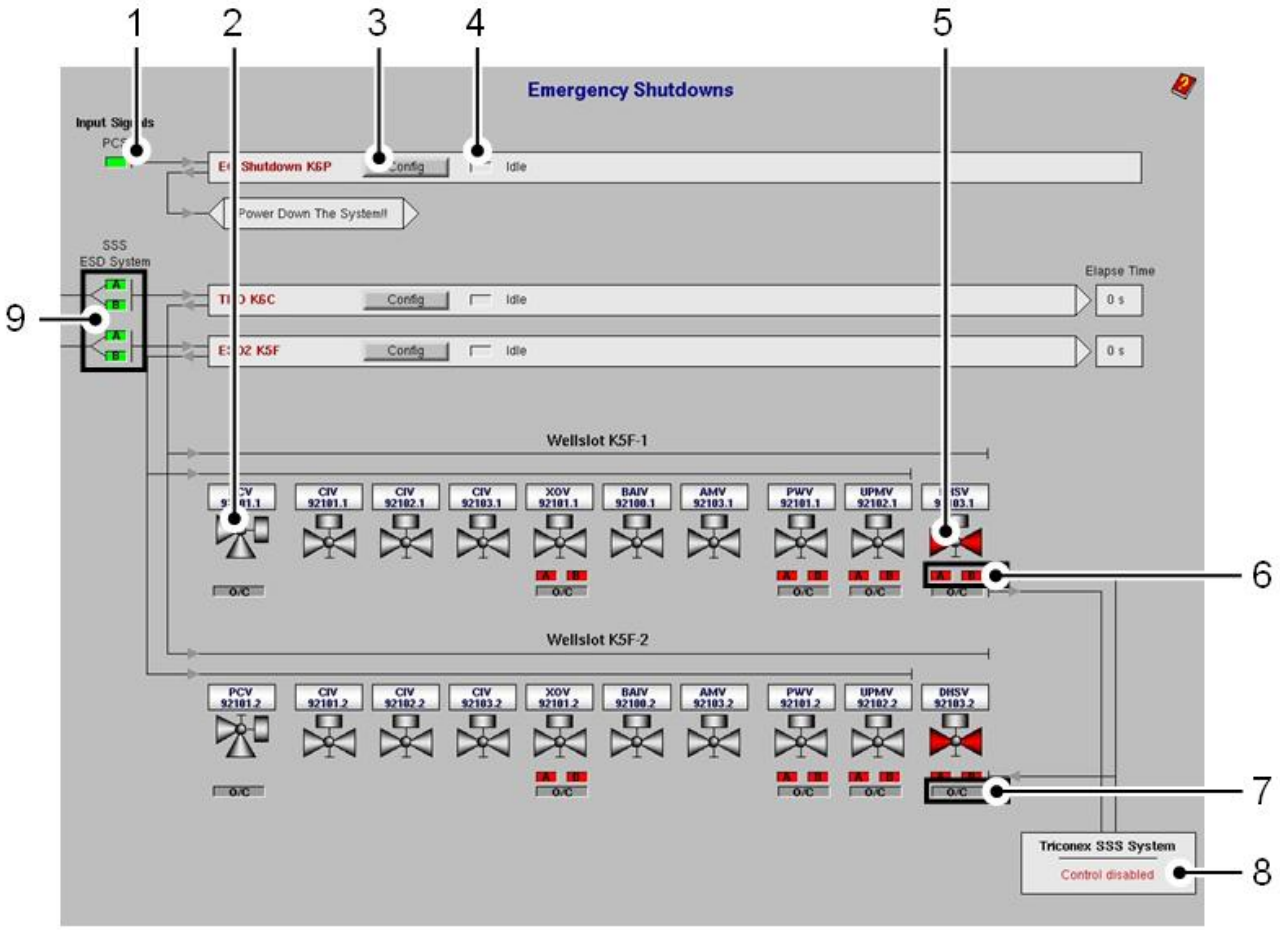


Figure 45 Emergency Shutdown and SSS System Page

	Description		
1	**Input Signal**	Input Signals that trigger the corresponding sequence.	
		The name of the Signal is shown if you keep the mouse over the LED for some seconds.	
		grey	Feedback unknown.
		green	Healthy
		red	ESD
2	**Choke**	Click here to open the **Choke Control** PopUp (p. 49)	

		For colour definitions see 7.3.1 Choke Depiction (p. 48)	
3	**Config. Button**	Opens the corresponding **Shutdown Configuration** PopUp (p. 81)	
4	**Sequence Status**	Displays the Sequence Status	
		The name of the Signal is shown if you keep the mouse over the LED for some seconds.	
		grey	Idle
		orange	Add in Queue
		yellow	Paused by Start Delay or Higher Priority
		green	Running
		red	Aborted
		blue	Disabled
		magenta	Finished
5	**Valve**	Click on a valve to open the **Valve Control** PopUp (p. 36) For colour definitions see *7.1.2 Valve Depiction* (p. 35)	
6	**Valve Command A/B**	Displays the Valve Command Status A/B from SSS system.	
		The name of the Signal is shown if you keep the mouse over the LED for some seconds.	
		grey	Feedback unknown
		green	Open
		red	Close
7	**Feedback to SSS System**	Displays Feedback to SSS System	
		The name of the Signal is shown if you keep the mouse over the LED for some seconds.	
		grey	Unknown/moving
		green	Open
		red	Close
		orange	Mimatch / Error
8	**Key Switch at MCS**	**On**	Remote Control
		Off	Local Control

9	**SSS ESD System**	Input Signals that trigger the corresponding sequence. The name of the Signal is shown if you keep the mouse over the LED for some seconds. **grey** Feedback unknown. **green** Healthy **red** ESD
10	**Feedback to SSS System (Choke)**	Displays Feedback to SSS System . The name of the Signal is shown if you keep the mouse over the LED for some seconds. **grey** Unknown/moving **green** Open (>=8%) **red** Close **orange** Mimatch / Error

10.2 Shutdown Configuration PopUp

How to open this PopUp:

- In an **ESD** window ▶ click on a **Configure** button.

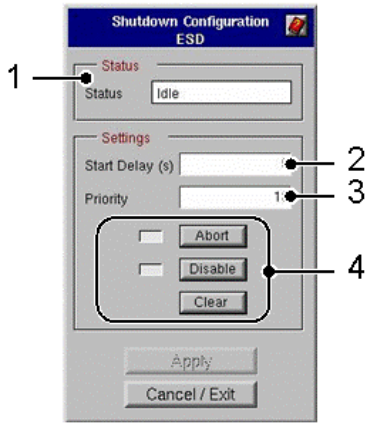


Figure 46 Shutdown Configuration PopUp

	Description	
1	**Status**	*Idle* *Add in Queue* *Paused by Start Delay* *Running*

		Paused by higher priority
		Aborted
		Disabled
		Finished
2	**Start Delay**	The start delay time can be set in intervals of one second. The range is from 0 to 3600 seconds (60 min)
3	**Priority**	The Priority of the sequence can be set from 1 to 100. The highest priority is 1 and lowest is 100. A sequence with a higher priority will pause a running sequence with lower priority.
4	**Abort**	A running sequence can be aborted. The sequence stops directly and cannot be continued. The sequence will be restarted on the next sequence start condition.
	Disable	A Sequence can be disabled. On a start condition the sequence will not run.
		An active sequence cannot be disabled.
	Clear	This will clear the sequence status and also the Sequence Status window.
		An active sequence cannot be cleared.

10.3 Sequence Server

The sequence module is responsible for serialized shutdown sequences like production shutdowns or emergency shutdowns. The sequence module is designed as a generic and stand alone server. The sequence configuration is read during start of the sequence server only. The sequence configuration file is an ASCII text file and divided into three sections. The three sections are 'Tags', 'Init' and 'Sequence'.
An active sequence is executed by one node (MCS) only. The active server (Master) has a connection to the remote sequence server to inform about its state and the current step. The remote server takes over the sequence job at any time the active server breaks and will execute the outstanding steps of the sequence.

	The sequence characteristic is written in the Master Control Station FDS. See. Ref. Documents.

10.4 Shutdown sequences

There exist three different shutdown sequences as per MCS FDS. (see ref. Docs)

EQ Shutdown K6P
TBO K6C
ESD2 K5F

All signals are hardwired inputs to the MCS PLC. On hardwired signal drop (lost) the sequences will start.

10.4.1 HPU Trips

For HPU-Trips see

HPU Trips *(*p. 74)

10.5 High Voltage Trips / Shut-in

The trip limit can be defined by the operator in the instrument popup of the corresponding transmitter.

Device	Cause	Time	Effect
EPCU	Hardwired Input	0s	HV OFF
	Door Contacts terminal area	0s	HV OFF
	Set-HV-On signal from MCS PLC via profibus lost (value = 0)	0s	HV OFF
MCS PLC	Heartbeat from MCS PLC lost	20s	HV OFF
MCS	HV Voltage above limit	5s	HV OFF
	-> Open circuit		
	HV Voltage under limit	5s	HV OFF
	-> Short circuit		
	PRCM Ring Max. Temp above limit	5s	HV OFF
	PRCM Ring Temp above critical limit, detected within PRCM (Error signal received)	0s	HV OFF
	Subsea Modem communication lost	20s	HV OFF
	EPCU signal unit off received during HV On.	0s	HV OFF
	(to overcome auto HV On on Unit On.)		

10.6 Interlocks

The following is a summary description of the typical interlock provisions incorporated within the MCS logic.

Interlock	Description
Annulus Valve Interlock	The BAIV and AMV Valve can not be operated when XOV1 is not open. This interlock can be bypassed (Supervisor Level).
AMV Interlock	The AMV Valve can not be opened when BAIV is not closed. This interlock can be bypassed (Supervisor Level).
BAIV Interlock	The BAIV Valve can not be opened when AMV is not closed. This Interlock can be bypassed (Supervisor Level)
SCSSV Protection	To protect the SCSSV Valve, the SCSSV can not be operated if UPMC is not closed. The SCSSV can not be opened if XOV1 is not closed. These Interlocks can be bypassed (Supervisor level).
HP Header Low	The HP Header Pressure Subsea (read by sensors in each SCM) is lower than the configured Low Pressure set point, preventing the SCSSV from being opened. This Interlock can be bypassed (Supervisor Level).
HP Header Unknown	The HP Header Unknown Pressure Interlock is used whenever the HP Header is not assigning information or is out of service. The SCSSV shall not be opened. This Interlock can be bypassed (Supervisor Level).
UPMV Interlock	The UPMV Valve can not be opened if PMV or XOV1 are not closed. These interlocks can be bypassed (Supervisor Level).
XOV1 Interlock	The XOV1 Valve can not be opened if UMPV or SCSSV are not closed. These interlocks can be bypassed (Supervisor Level).
Device 'Out of Service!' Interlock	The inoperable valve or choke can not be operated whenever being out of service. This interlock is applicable for every device. The interlock can be bypassed (Administrator, Software Level).
MCU Temperature Hi	The MCU Temperature is higher than the configured Hi temperature set point; preventing all valves, except for the

	SCSSV, and the PCV from being opened. These interlocks can be bypassed (Supervisor Level).
MCU Cooling Down	The PCV Choke can not be operated when MCU is in Cooling Down Mode. This interlock can be bypassed (Supervisor Level).
PRCM Temperature Hi	The PRCM Temparature is higher than the configured Hi Temperature set point; preventing all valves, except for the SCSSV, and the PCV from being opened. This interlock can be bypassed (Supervisor Level).
MCS, DCS in Control	The interlock prevents operation from a system which is not in control. This interlock can be bypassed (Administrator, Software Level).
Workover Mode	The Workover interlock prevents a tree valve open or close operation due to the well being placed in Workover mode. The interlock can be bypassed (Supervisor Level)
Maximum Valve Movement	The current Max Valve Movement count is being exceeded, preventing any more valves and chokes from being opened from the MCS. The interlock can be bypassed (Administrator, Software Level).
Maximum Choke Movement	The Max Choke Movement interlock is used whenever the PCV is operated, preventing any more valves (except SCSSV) from being opened from the MCS. The interlock can be bypassed (Administrator, Software Level).
eSCM's Not Installed	The eSCM's Not Installed interlock is used whenever a well is not installed. All devices on the well shall be inhibited. The interlock can be bypassed (Administrator, Software Level).
Sequence Condition Present	The Sequence Condition interlock is used whenever an EDS Sequence Signal is send to MCS PLC. All devices shall be inhibited. This interlock can be bypassed (Supervisor Level).
No Power Subsea Interlock	The No Power Subsea Interlock prevents a tree valve (choke) open or close operation due to the loss power of Subsea. This interlock can be bypassed (Supervisor Level).
Wellslot Not Commissioned Interlock	The Wellslot Not Commissioned interlock prevents a tree valve (choke) open or close operation due to the Wellslot Not Commissioned Mode. The interlock can be bypassed (Administrator, Software Level).

11 ALARMS

11.1 Pages and Displays

11.1.1 Online Alarm Display

The first column shows a sequential numbering. A click on alarm opens a menu to acknowledge the alarm. A right click on an alarm opens a description window of the alarm.

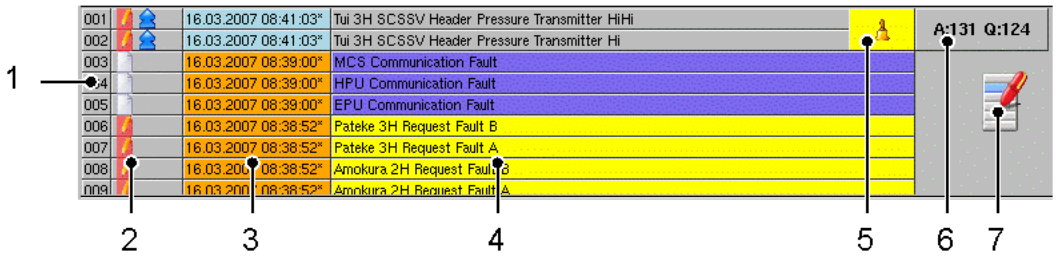


Figure 47 Online Alarm Display

	Description	Colour	State
1	**Sequential Numbering**		
2	**Status Flags**		Alarm need not be acknowledged.
			The alarm has to be acknowledged.
			Alarm is acknowledged but not gone.
			Multiple alarm. The alarm condition appears and disappears again.
3	**State and Time Stamp**	**orange**	Alarm condition present.
		light blue	Alarm condition gone.
4	**Description of the Alarm**	**red**	Trips and ESD conditions
		blue	Program crashes and heartbeat faults
		yellow	Subsea Communication errors, SCM Water Detector, critical alarms
		grey	Analogue Alarms (LoLo, Lo, Hi, HiHi) Digital Alarms
5	**Acoustic signal turn off**	Turns off the acoustic signal for the current alarm	
6	**Open Alarm Menu**	**red**	Alarm Server is not running.
		grey	Normal.
7	**Acknowledge all Alarms**		

11.1.2 Extended Online Alarm Display

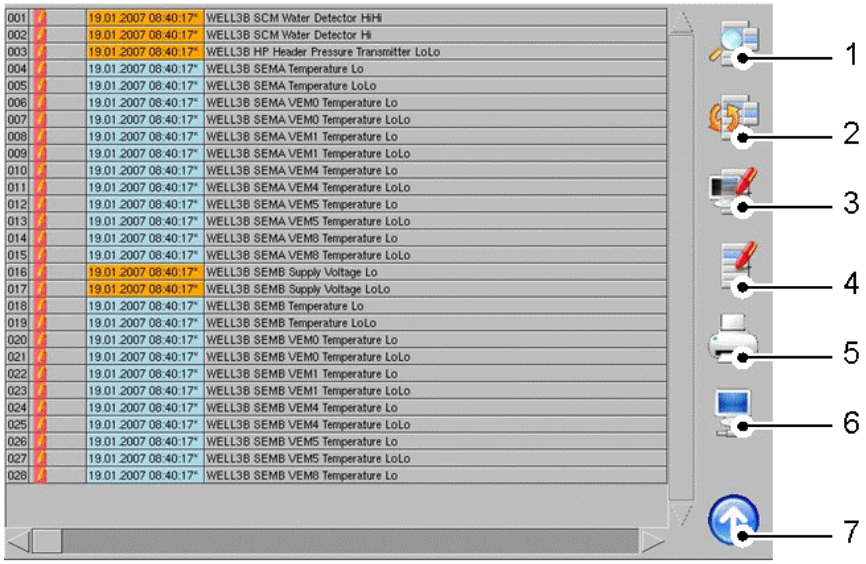


Figure 48 Extended Online Alarm Display

	Description
1	Alarm Display Configuration.
2	Sort Alarm List.
3	Acknowledge **all** visible alarms.
4	Acknowledge **all** system alarms.
5	Opens the print menu. The print function prints the list of alarms which are displayed in the online alarm window. Use the laser printer for print outs.
6	Shows state of Alarm Server
7	Close Alarm menu.

11.1.3 Alarm Page

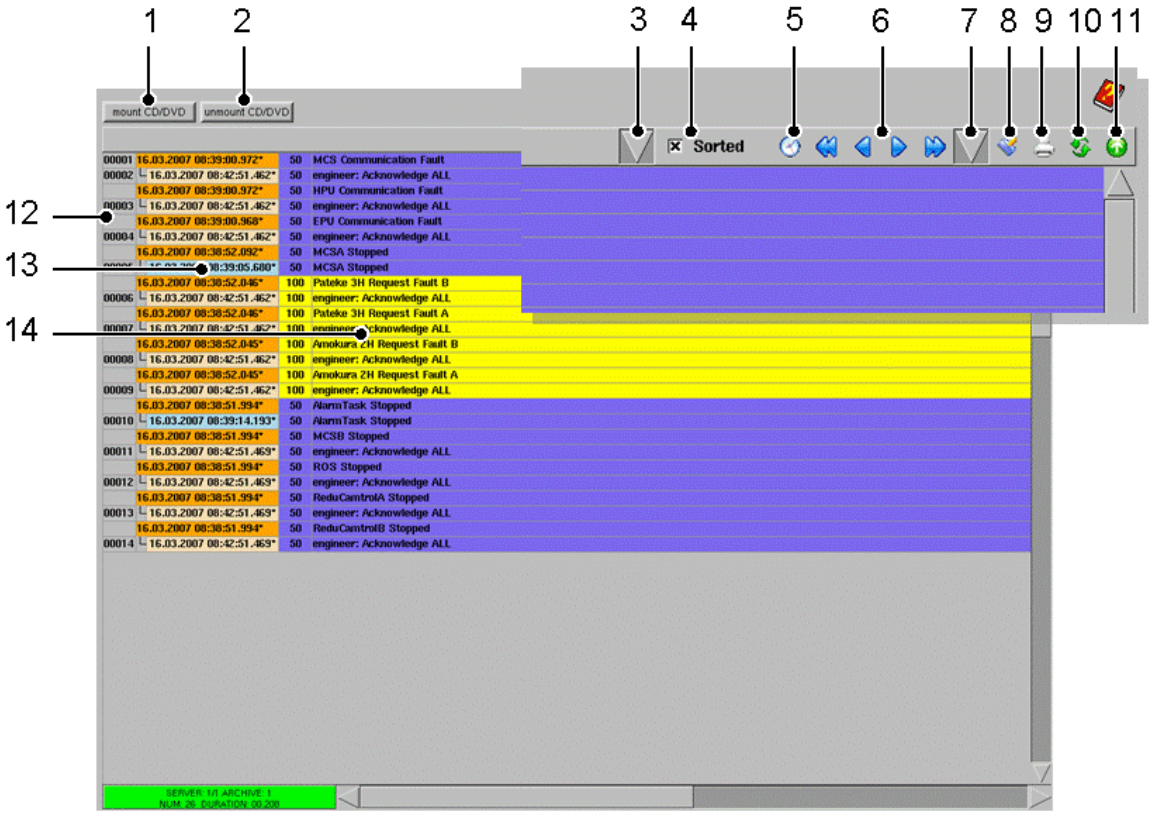


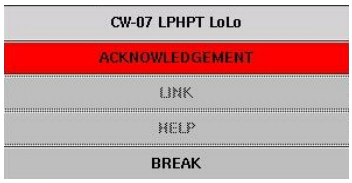
Figure 49 Alarm Page

	Description	Colour
1	**mount CD/DVD**	Click to mount the CD/DVD to the Linux file system for viewing archived data.
2	**unmount CD/DVD**	Click to get the CD/DVD out when finished.
3	**Alarm Mask Menu**	To set an alarm mask, click on the '**Arrow**' in the header to open the drop down menu and choose the alarm group you want to display. The standard mask displays all alarm groups.
4	**Sorted**	Switches between two sorting methods: • temporal sorting, and • displaying connected alarms.
5	**Set Free Time Interval**	Set a free time interval over which you would like to indicate the messages. Click for this on this button. A standard time menu appears. From this menu, you have the possibility of freely adjusting the beginning and end time of a range. In the upper part of the menu, both chosen time limits of the interval can be seen. In order to adjust one of the two limit times, click on the '**Arrow**' button next to the desired time.

6	**Navigation Button**	**<<**	Shifts the time interval by one whole indicator page to the past.
		<	Shifts the time interval by a tenth of the indicator page (1 raster part) to the past.
		>	Shifts the time interval by a tenth of the indicator page (1 raster part) to the future.
		>>	Shifts the time interval by one whole indicator page to the future.
7	**Set Time Interval**	Opens the drop down menu to select a time interval.	
8	**Fade in Statistics**	Opens a statistic window.	
9	**Print List**	Prints out the Alarm list	
10	**Reload List**	Refreshes the alarm list.	
11	**Online List**	Switches between **Online Alarm** and **Historical Alarm** mode. **Online Alarm** The Online Display shows all present alarms. Up to 500 messages can be displayed. On more than 500 messages, always the newest 500 will be displayed. **Historical Alarm** Status history of all alarms that occurred. All status changes are logged, as are appeared, acknowledged and disappeared.	
12	**Sequential Numbering**		
13	**State and Time Stamp**	**orange**	Alarm condition present.
		light orange	Alarm condition present and acknowledged.
		blue	Comment added.
		light blue	Alarm condition gone.
14	**Description of the Alarm**	**red**	Trips and ESD conditions
		blue	Program crashes and heartbeat faults
		yellow	Subsea Communication errors, SCM Water Detector, critical alarms
		grey	Analogue Alarms (LoLo, Lo, Hi, HiHi) Digital Alarms

11.2 Working with Alarms

11.2.1 Acknowledging Single Alarms



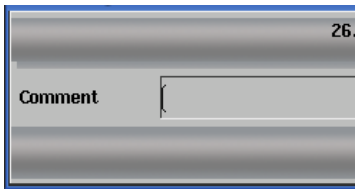
- In the online Alarm display click on the relevant alarm row to open the **Editor PopUp**.
- Press '**Acknowledgement**'
- **or**, to close the PopUp without effect, press '**Break**'.

11.2.2 Adding Comments

Only possible in the **Alarm Page**.

- Open the **Alarm Page**.
- Click on the relevant alarm row to open the **Alarm PopUp**.

- Press '**Insert Comment**' to open the **Add Comment PopUp**.



- Enter a comment.

- Acknowledge with this button.

11.2.3 Setting Alarm Limits

CAUTION
Improper Alarm Settings!

Improper Alarm settings may lead to serious damages.

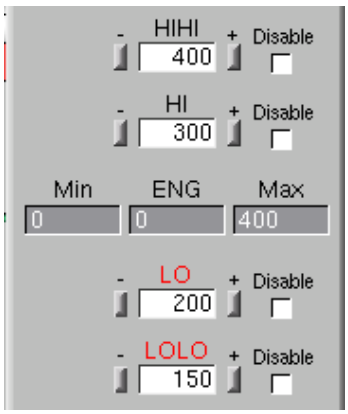
Authorized personal only should set Alarm limits!

- Click a transducer display to edit the corresponding alarm.

CAUTION
Improper Alarm detection!

For redundant transmitters Trip Limits must be set equally for both transmitters!

Make sure that trip limits for redundant transmitters do not differ!



- Enter the desired Alarm limit.

12 EVENTS

The Event Logger collects all events and writes these in specific logfiles. The maximum size of one logfile is 100 kb. The maximum number of logfiles written a day is 20. The maximum overall logfile storage is 100 days.

12.1 Event Logging Page

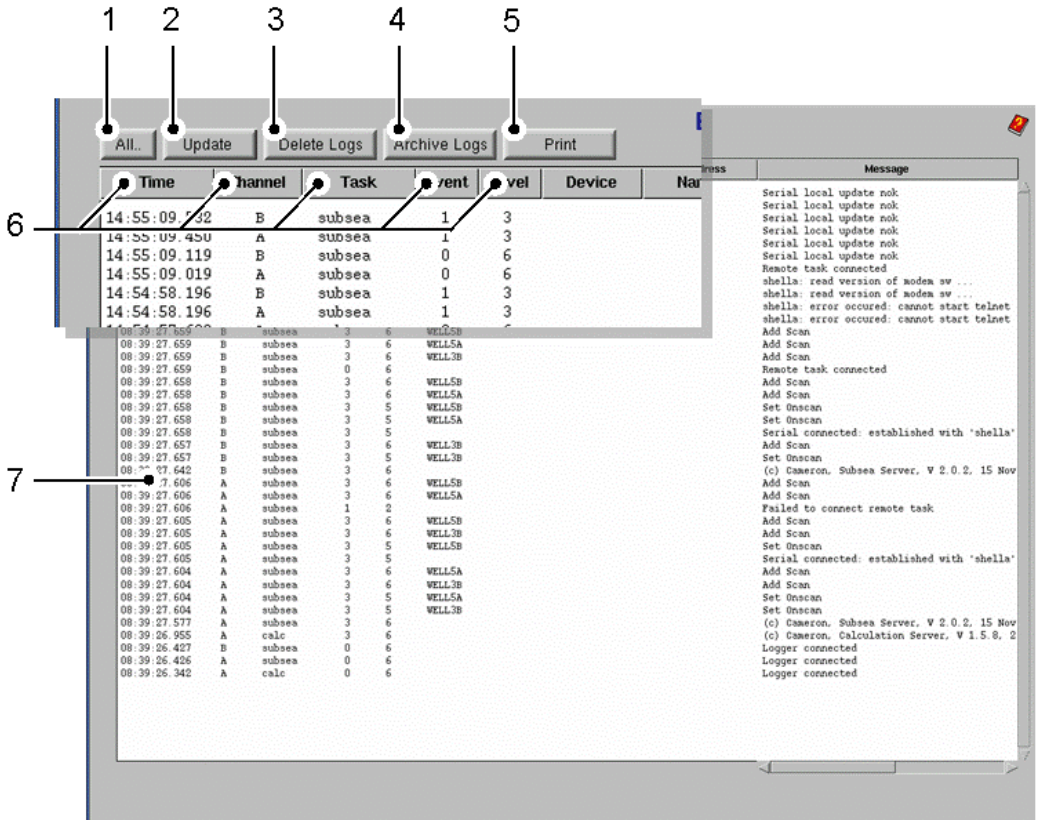


Figure 50 Event Logging Page

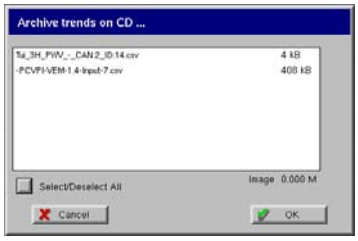
	Description	
1	**All..**	Shows all available events.
2	**Update**	Updates the event logger display.
3	**Delete File**	Deletes file from trends from disk. *These options are available for the **administrator** only.*
4	**Archive Logs**	Burns files from disk on CD. *These options are available for the **administrator** only.*
5	**Print**	Sends Event list to a printer.
6	**Columns**	Click to select filter criteria.

7	**Logger Display**	All relevant tasks on MCS A and MCS B write events to the logger. A priority **level** is assigned to each event. The highest priority is 0, the lowest is 6. An 'operator' will see the level 0 to 4 only.

0	General
1	Fault
2	Value Change
3	State Info
4	Command

12.2 Saving Events

Archive log files to CD/DVD



- Insert a CD/DVD.
- Click on the Button in the Event Logger page.
  The **Archive logs on CD…** windows opens
- Select the log files you want to archive.
- Press **OK** to burn CD/DVD
  The selected files are burned to CD/DVD.

To burn all historical data (as are alarms, trends and logfiles) on CD/DVD see page 14

13 DIAGNOSTICS

13.1 Diagnostic Page

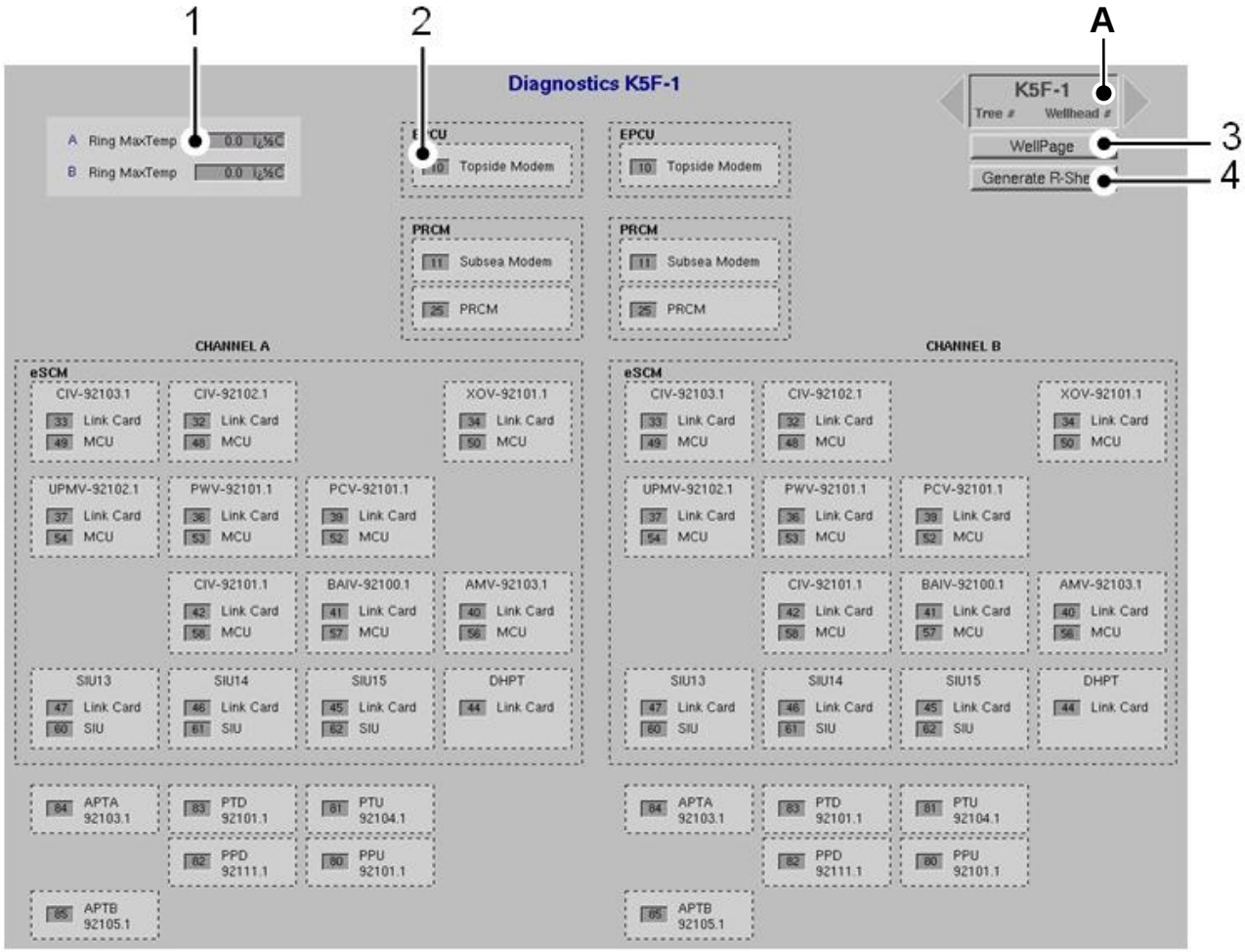


Figure 51 eSCM-Diagnostic Page

	Description	
A	**Well label**	Displays the well label, the tree number and wellhead number. The tree/wellhead number relates to serial number comparison of UPMV and AMV. Click here to open the **Well Configuration** Popup (p.33) for starting or shut-in in the Tree.
1	**Transducer Display**	Click Transducer Display to open **Subsea Instrument** PopUp (p. 63)

2	**Node Status Display**	Click Device Box to open **Diagnostics PopUp** ■ **grey** CAN node state unknown ■ **green** CAN node started up (OK) ■ **yellow** CAN node starting up (boot up phase) ■ **orange** CAN fault
3	**Well Page**	Click Button to open **Well Page** (p. 30)
4	**Generate R-Sheet**	Click Button to generate Revision Sheet. File is located under **/data/stat**.

13.2 Diagnostic PopUp

How to open this PopUp:

- In a **Diagnostics** window ▶ click on a **Device** Box.

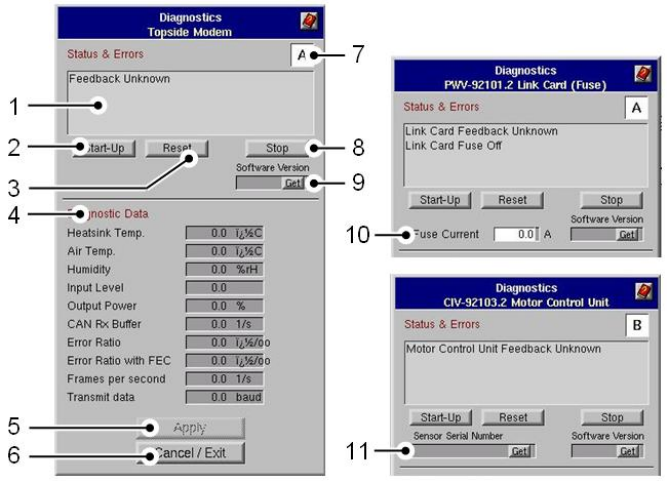


Figure 52 Diagnostics PopUp

	Description	
1	**Status Window**	Displays Status and Errors in the status window
2	**Start-Up**	Push Button to **Start-Up** Diagnostic Data and Apply.
3	**Reset**	Push Button to **Reset** the Diagnostic Data and Apply.
4	**Diagnostic Data**	Displays Housekeeping Data in the display.
5	**Apply**	Applies the changes.
6	**Cancel/Exit**	Closes PopUp without applying changes.
7	**Channel**	Shows the actual Channel A/B
8	**Stop**	Push Button to **Stop** Diagnostic Data running and Apply.

9	**Software Version**	Push "**Get**" Button to get actual Software Version
10	**Fuse Current**	Displays the Fuse Current
11	**Sensor Serial Number**	Push "**Get**" Button to get actual Sensor Serial Number

14 COMM STATISTICS

14.1 Subsea Communication Statistics Page

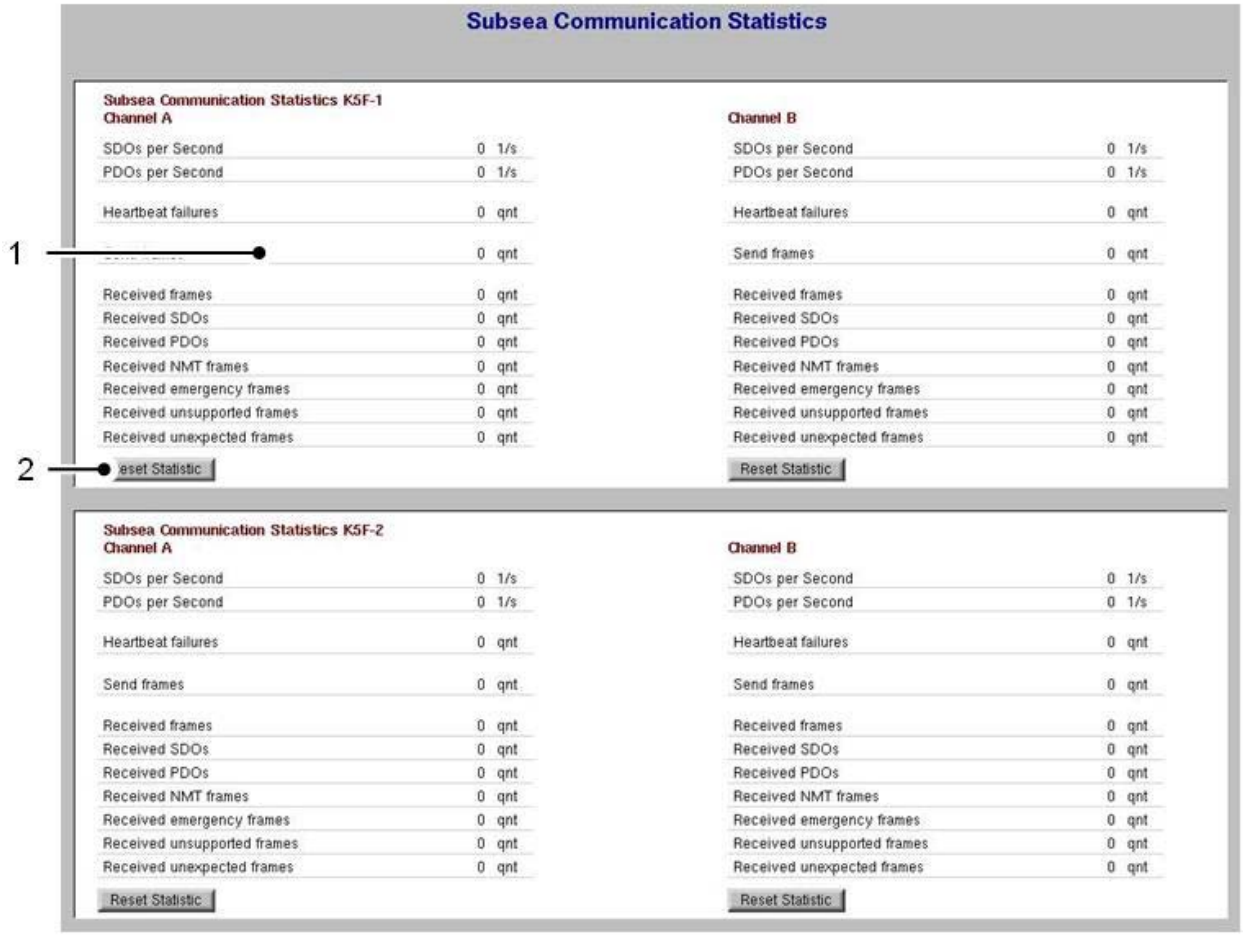


Figure 53 Subsea Communication Statistics page

	Description	
1	**Subsea Communication Diagnostics and Statistics**	There exist in the system four canmap driver which auto connects to the Ethernet/CAN bridges. Can-1 Tree 1A Can-2 Tree 1B Can-3 Tree 2A Can-4 Tree 2B The driver's can-1 to 4 are communicating on the MCS which is Master! The drivers on the Slave machine are in standby. The statistics page on the Master MCS have to be used ! **PDOs** are Process Data Objects which will be sent from the different subsea devices. **SDOs** are Service Data Objects which will be requested from topside.
2	**Reset**	The user can reset the statistics.

15 TRENDS

15.1 Trend Page

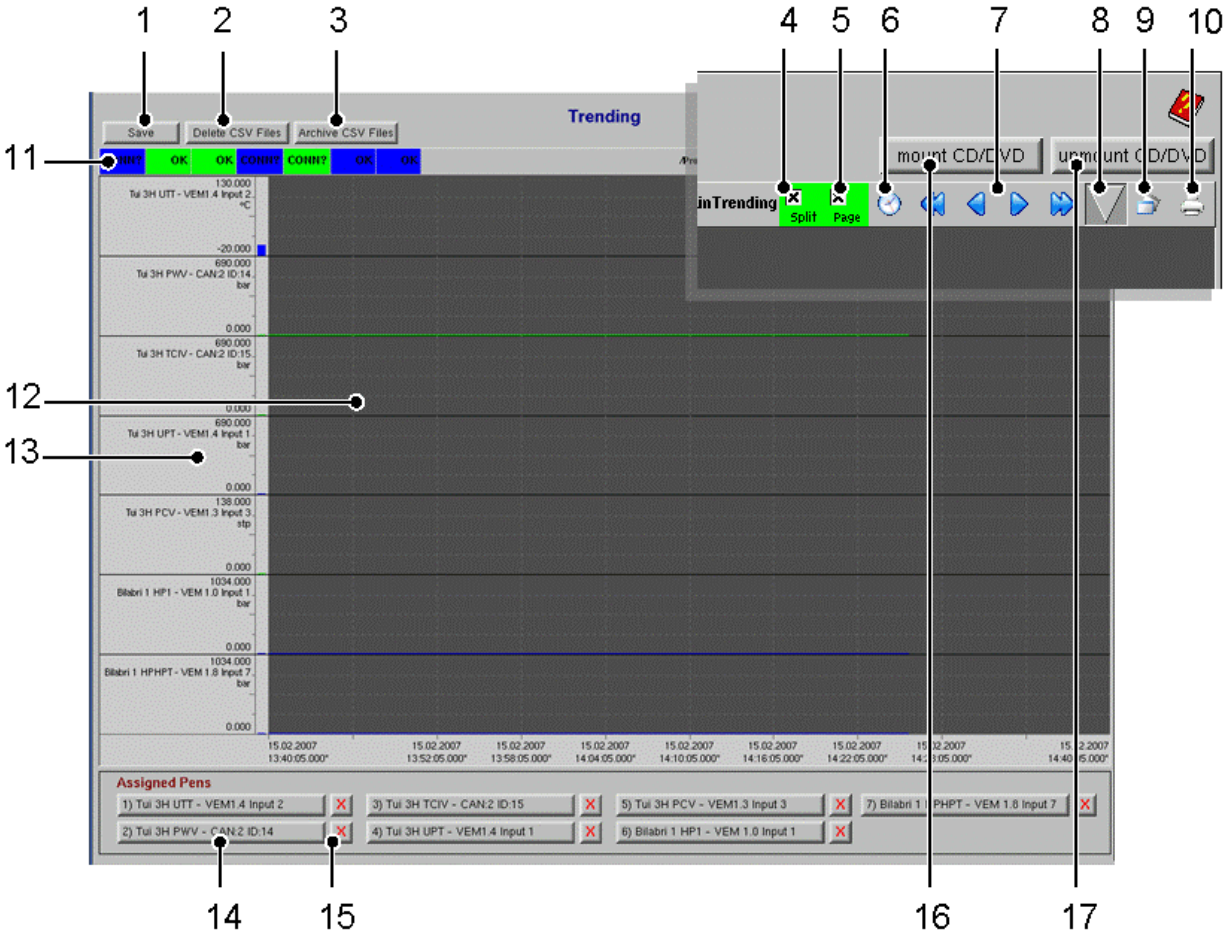


Figure 54 Trend Page

	Name	Description
1	**Save**	Saves trend display settings
2	**Delete CSV File**	Deletes file from trends from disk.
3	**Archive CSV Files**	Burns files from disk on CD.
4	**Split Mode**	In Split mode ‘On’ the Chart area is split per chart. All charts are among one another. In Split mode ‘Off’ all charts are in one display and the Y-Axis are side by side. Note: This view is for comparison of two curves. Each added curve in split mode ‘off’ decreases the chart area

5	**Page Mode**	In Page mode the Time (X)-Axis will be automatic set to the new data readback timestamp	
6	**Set Free Time Interval**	Set a free time interval, over which you would like to indicate the messages. Click for this on the button with the clock in the headline. A standard time menu appears. Over this menu you have now the possibility of adjusting a free at the beginning of and end time for the range. Within the upper range of the menu you see the two times of the time interval. In order to adjust now one of the two times, you click on the arrow button behind the desired time.	
7	**Navigation Button**	**<<**	The time interval is shifted thereby a whole indicator page into the past.
		<	The time interval is shifted with this key a tenth of the indicator page (1 raster part) into the past.
		>	The time interval is shifted with this key a tenth of the indicator page (1 raster part) into the future.
		>>	The time interval is shifted a whole indicator page into the future.
8	**Set Time Interval**	Click to open the drop down menu and choose the time interval.	
9	**Show Curve List**	Opens the **List of Curves** PopUp (p. 101).	
10	**Print Curves**	Opens the print menu.	
11	**State display**	Displays the state of the trend.	
12	**Curve display**	Displays the Curves.	
13	**Scale field**	Click and hold and move mouse up/down to change scale.	
14	**Save Curve**	Writes the trend to a csv file.	
15	**Delete Curve**	Deletes curve from the trend display.	
16	**Mount CD**	Click to mount the CD/DVD to the Linux file system for viewing archived data.	
17	**Unmount CD**	Click to get the CD/DVD out when finished.	

15.2 List of Curves PopUp

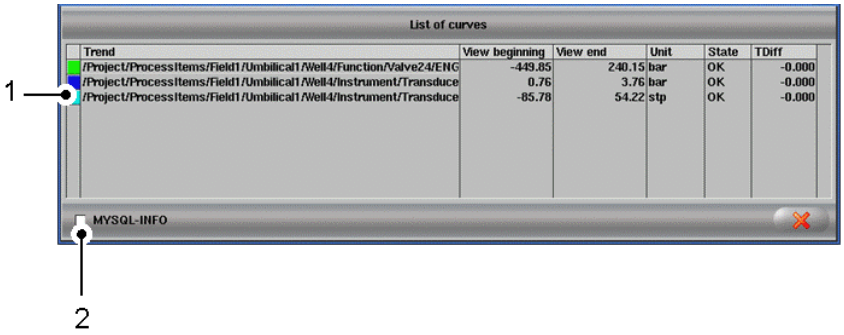


Figure 55 List of Curves PopUp

	Description	
1	**Trend List**	Click on an entry to open the **Curve Characteristics** PopUp.
2	**MYSQL INFO**	Switches between MYSQL Info View and Statistic View

15.3 Curve Characteristics PopUp

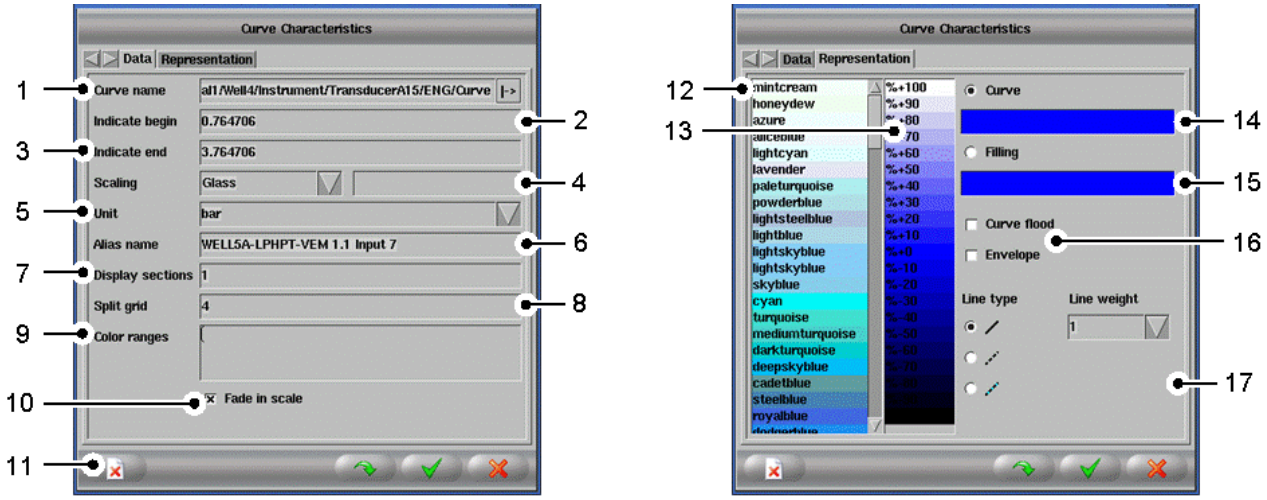


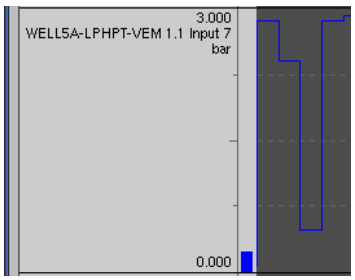
Figure 56 Curve Characteristics PopUp

	Description	
1	**Curve Name**	Name of the curve.
2	**Indicate Begin**	Min. value of the y-axis.

3	**Indicate End**	Max. value of the y-axis.
4	**Scaling**	Switches between scaling Methods Zoom and Glass.
5	**Unit**	Unit of the y-axis.
6	**Alias Name**	Display name of the curve. Changes get lost on next call of the Trend Page.
7	**Display Sections**	Available on the space in the Trend Page in relation to the other curves.
8	**Split Grid**	Number of y-axis grid lines.
9	**Colour Ranges**	Setting background colours. *Example:* 0,50,green 50,100,red Creates a green background for 0 to 50 and a red background for 50 to 100.
10	**Fade in Scale**	Shows / hides the y-axis.
11	**Delete Curve**	Deletes curve from Trend Page.
12 + 13	**Colour Selection List**	
14	**Curve Colour**	Actual curve colour.
15	**Filling Colour**	Actual filling colour.
16	**Filling Methods**	
17	**Line Settings**	

15.4 Editing Trend Page

15.4.1 Changing y-Scale



To control the y-axis (scale) manually:

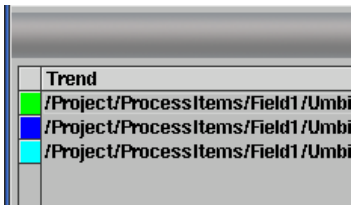
- Click in the scale field.
- Hold the left mouse button pressed and move the mouse up or down.

- Press '**Save**' to save settings.
- Otherwise the changes will be gone on next call of the Trend Page.

Or:

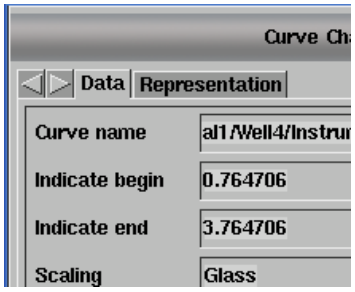
Set the minimum and maximum scale value:

- Click on the '**Show Curve List**' button.



The **List of Curves** PopUp opens.

- Click on a curve.



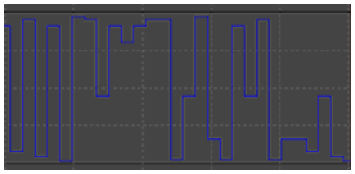
The **Curve Characteristics** PopUp opens.

- In the fields '**Indicate begin**' and '**Indicate end**' enter the minimum and maximum scale values.

- Acknowledge with this button.

- Press '**Save**' to save settings.
- Otherwise the changes will be gone on next call of the Trend Page.

15.4.2 Changing x-Scale



To control the x-axis (scale) manually:

- Click in the curve display.
- Hold the left mouse button pressed and move the mouse right to select the time scale.

- Press '**Save**' to save settings.
- Otherwise the changes will be gone on next call of the Trend Page.

Or:

To choose a time interval:

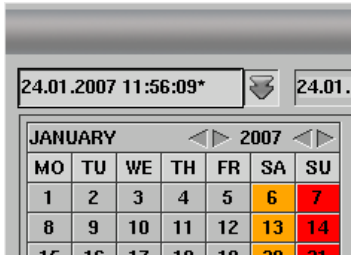
- Click on the '**Arrow**'.
  A drop down menu opens.
- Choose the time interval in the drop down menu.

- Press '**Save**' to save settings.
- Otherwise the changes will be gone on next call of the Trend Page.

Or:

To choose a free time interval:

- Click on the '**Clock**' Symbol.
  The calendar opens.



- Click on the '**Arrow**' to select the start or end time.
- Set the time.

- Acknowledge with this button.

- Press '**Save**' to save settings.
- Otherwise the changes will be gone on next call of the Trend Page.

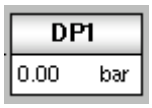
15.4.3 Assigning Pens

The analogue values, which are configured in the database as 'historical trend data' will be automatically trended in the background. The assign and de-assign to the graphical display will not stop or start the trending mechanism.

- Click on the transducer display.
  The **Instrument** PopUp opens.

- Click on '**Assign Pen**' to assign the instrument to the graphical display.

15.4.4 De-Assigning Pens



De-assigning pens in the Instrument PopUp:

- Click on the transducer display.
  The **Instrument** PopUp opens.

- Click on '**Deassign Pen**' to remove the instrument from the graphical display.
-

Or:

De-assigning pens in the Trend Page:

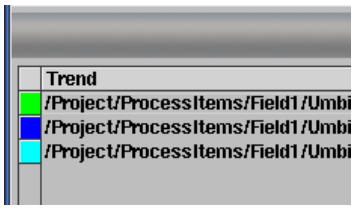
- Click the red '**X**' at the Trend page.

- Press '**Save**' to save settings.
- Otherwise the changes will be gone on next call of the Trend Page.

15.4.5 Removing Curves from Display

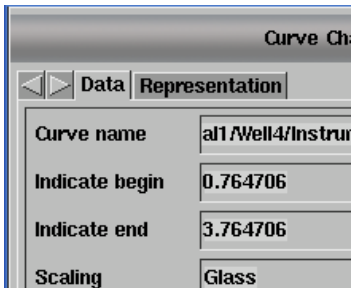
- Click on the '**Show Curve List**' button.

The **Curves** PopUp opens.



- Click on a curve.

The Curve Characteristics PopUp opens.



- Click this button to delete the curve from the display.

- Press '**Save**' to save settings.
- Otherwise the changes will be gone on next call of the Trend Page.

15.4.6 Saving Trends

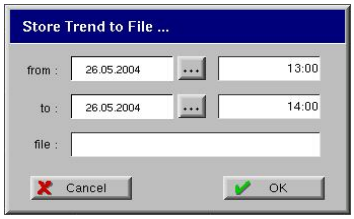
To save trends two steps are necessary:

- Saving trends to csv file
- Burning trend files to CD/DVD
  or
  Burning all historical data to CD/DVD

Saving trends to file

Whatever data is within the trend can be saved to a 'csv' file.

- Click on the Button in the Trend Page.
  The **Store Trend to File** Window opens.



- In the fields next to '**from**' enter the start time of the time range.
- In the fields next to '**to**' enter the end time of the time range.
- In the field '**file**' enter the desired name of the csv-file.

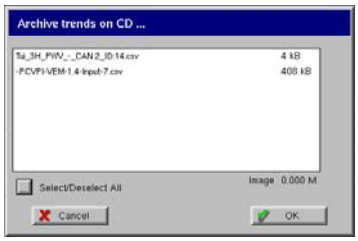
Make sure the filename is unique, otherwise an existing file will be overwritten!

- Press **OK** to burn CD/DVD

Burning trend files to CD/DVD

- Insert a CD/DVD.

- Click on the Button in the Trend page.
  The **Archive Trends on CD…** windows opens



- Select the csv files you want to save.
- Press **OK** to burn CD/DVD
  The selected csv files are burned to CD/DVD.

To burn all historical data (as are alarms, trends and logfiles) on CD/DVD see page 14

16 APPENDIX

16.1 Access Level

These passwords are on initial installation of the MCS. The administrator can change all passwords.

The software user is for Cameron Service personal and cannot be changed.

User	Password
monitor	--
operator	level2
supervisor	level3
service	ironman **(Cameron personal only)**
administrator	admin
software	******** **(Cameron personal only)**

16.2 Access Rights

Function	Monitor	Operator	Supervisor	Administrator	Cameron service / software
Page Control	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Well Configuration (tree on)	**No**	**Yes**	**Yes**	**Yes**	**Yes**
Work Over Modes	**No**	**No**	**Yes**	**Yes**	**Yes**
Wellslot Commissioning (MCS)	**No**	**No**	**Yes**	**Yes**	**Yes**
Work Over Modes (MCS)	**No**	**No**	**Yes**	**Yes**	**Yes**
Valve Control (Open/Close)	**No**	**Yes**	**Yes**	**Yes**	**Yes**
Valve Defeat Interlock	**No**	**No**	**Yes**	**Yes**	**Yes**
Valve Diagnostics	**No**	**Yes**	**Yes**	**Yes**	**Yes**
Valve Parameter	**No**	**No**	**No**	**Yes**	**Yes**
Choke Control (Move/Abort)	**No**	**Yes**	**Yes**	**Yes**	**Yes**
Choke Defeat Interlock	**No**	**No**	**Yes**	**Yes**	**Yes**
Choke Diagnostics	**No**	**Yes**	**Yes**	**Yes**	**Yes**
Choke Parameter	**No**	**No**	**No**	**Yes**	**Yes**
DHPT Toolpower On/ Off	**No**	**Yes**	**Yes**	**Yes**	**Yes**
DHPT Coeficient File load	**No**	**No**	**Yes**	**Yes**	**Yes**
Instrument	**No**	**Yes**	**Yes**	**Yes**	**Yes**

Function	Monitor	Operator	Supervisor	Administrator	Cameron service / software
Instrument Alarm Settings	**No**	**No**	**Yes**	**Yes**	**Yes**
Prod. Inst. Alarm Settings	**No**	**Yes**	**Yes**	**Yes**	**Yes**
Instrument Disable	**No**	**No**	**Yes**	**Yes**	**Yes**
HPU Pump Control	**No**	**Yes**	**Yes**	**Yes**	**Yes**
HPU Settings	**No**	**Yes**	**Yes**	**Yes**	**Yes**
ESD Configuration	**No**	**No**	**Yes**	**Yes**	**Yes**
eSCM Diagnostics	**No**	**Yes**	**Yes**	**Yes**	**Yes**
Historical Data Management	**No**	**No**	**Yes**	**Yes**	**Yes**
User/Password Management	**No**	**No**	**No**	**Yes**	**No**

16.3 List of Abbreviations

AMV	Annulus Master Valve
APTA	Annulus Pressure Transmitter A
APTB	Annulus Pressure Transmitter B
APTC	Annulus Pressure Transmitter C
APT	Annulus Pressure Temperature Transmitter
AWV	Annulus Wing Valve
BAIV	B Annulus Isolation Valve
CAN	Controller Area Network
CIV	Chemical Injection Valve
CPU	Central Processing Unit
DHPT	Downhole Pressure & Temperature Transmitter Sensor
DHPTT	Downhole Pressure/Temperature Transmitter
DHSV	Downhole Safety Valve
EPCU	Electrical Power and Communicaton Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
HP	High Pressure
HPU	Hydraulic Power Unit
HV	High Voltage
I/O	Input / Output
ICSS	Integrated Control Safety System
IP	Internet Protocol
IWOCS	Installation and Workover Control System
KDE	'K' Desktop Environment
LP	Low Pressure
N/A	Not Applicable
MCS	Master Control Station
OLE	Object Linking and Embedding
OPC	OLE for Process Control
PCS	Process/ Production Control System
PCV	Production Choke Valve
PLC	Programmable Logic Controller
PMV	Production Master Valve
PPD	Production Pressure Downstream
PPU	Production Pressure Upstream
PRCM	Power Regulation and Communication Module
PTD	Production Temperature Downstream
PTU	Production Temperature Upstream
SCM	Subsea Control Module
SCSSV	Surface Controlled Sub-Surface Safety Valve
SPCU	Subsea Power and Communication Unit
SPS	Subsea Production System
SSS	Safety Shutdown System
TCP	Transmitter Control Protocol

TUTU	Topside Umbilical Termination Unit
UPMV	Upper Production Master Valve
UPS	Uninterruptible Power Supply
UTA	Umbilical Termination Assembly
VEM	Valve Electronics Module
XOV	Cross- Over Valve

GENERAL PRESERVATION & STORAGE PROCEDURE

FOR

CAMERON CONTROLS EQUIPMENT

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Table of contents

1 Introduction

This document outlines the procedure for preservation and storage of a control system before and after use. This includes Production Control Systems, Workover Control Systems and Drilling Control Systems. The purpose of this procedure is to keep the equipment supplied by Cameron Celle in a proper shape during storage. It will be available for further operations without major refurbishment due to insufficient control during storage.

This document provides instructions to ensure preservation and protection of all typical control system equipment in order to prevent deterioration caused by corrosion, damage, influence of weather and foreign materials, during shipment, storage and installation.

2 Reference Procedures

X-065460-( )-( )	Protective Coating Procedure for Cameron Controls Equipment
X-065390-03	General Protection and Coating Procedure for Cameron Celle Controls Equipment
X-065390-03-00-01	Protection and Coating Procedure for Cameron Celle Controls Equipment
X-027055-01	Corrosion Inhibiting Coating of Machined Surfaces

3 General Storage Requirements for Environment

Before starting any activities for preservation & storage all functions need to be verified. It must be checked that maintenance and repair works have been performed by qualified service personnel and that the control system does not have any mechanical damages on framework, umbilicals, hoses and cables.

Clean and dry the equipment prior to storage and place it under cover (if available) in a clean and dry environment.

For outdoor storage use tarpaulin covers. Ensure that covers are correctly attached and check covers for any damage. Replace damaged covers.

Preferred ambient conditions for storage areas[*)]

Temperature range	:	0 to 40°C
Humidity range	:	0 to 50 % (excluding condensation and frost)

[*)] If above values are not available, humidity and temperature must be within project related specified range.

In areas with high ambient temperatures consider protection against UV light / direct sunlight to protect e.g. plastic materials or compensation systems (thermal expansion).

Atmosphere must be free from harmful substances which can effect resilient seals (e.g. high ozone level).

Store equipment and spare parts with sealing surface protection by protective devices and protect after inspection if necessary.

Consider special storage procedures for critical materials like hydraulic fluid, batteries, rubber goods etc.

Handling and transport of equipment must always be in accordance with the conform procedure, shown in the Operation and Maintenance Manual for the control system.

4 Cameron Controls Standard Hydraulic Control Fluids

This section outlines the Cameron Celle Controls standard hydraulic control fluids. If any other fluid is specified the appropriate data sheet must be considered for preparation and storage of the system.

4.1 Hydraulic Oils

The standard oil types for Cameron Celle Controls equipment are:

- SHELL TELLUS (different types)
- CASTROL BRAYCO MICRONIC 864

Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

Note: Further details for treatment of fluid before and during storage for the specific equipment are listed in section 5.

4.2 Water Based Fluid

The typical water based fluid types for Cameron Celle Controls equipment are delivered by **Mac Dermid CANNING (MARSTON BENTLEY) LTD.**:

- Oceanic HW 511
- Oceanic HW 525
- Oceanic HW 540
- Oceanic HW 443
- Oceanic HD 603 Water/Glycol with lubricant

A typical water based fluid supplied by **CASTROL**:

- TRANSAQUA HT or HT2

A typical water based fluid supplied by **CAMERON**:

- CAMERON 590 X Water / Glycol with lubricant

Note: Further details for treatment of water based fluid before and during storage are listed in the following table.

Water Based Fluid	Suitable Storage Fluid (>6 months)	Suitable Storage Fluid (>1 year)	Suitable Storage Fluid (>2 years)
Mac Dermid CANNING OCEANIC HW 525 Cameron PN 619011-36 OCEANIC HW 540 Cameron PN 619011-28 OCEANIC HW 443 Cameron PN 619011-41	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285
Mac Dermid CANNING Water based fluid with ERIFON HD 603 Cameron PN 619011-46 (Lubricant)	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285
	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	Composition Lubricant/Glycol/Water: 5 % Lubricant: PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	
CASTROL TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	TRANSAQUA HT Cameron PN 619011-53
CASTROL TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	TRANSAQUA HT2 Cameron PN 619011-84
CAMERON Fluid Cameron 590 X Cameron PN 619011-24 (Lubricant)	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 40 % Glycol PN 619011-10 55 % Demineralized Water	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285

5 Specific Equipment Preservation and Maintenance Requirements

Note: Preservation during storage shall be performed in accordance with the check lists shown in section 6.
Any damage occurring during the periodical checks must immediately be repaired and reported to the Maintenance Supervisor.

5.1 Instruments for Surface Containers and Frames

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

All moving parts are to be lubricated with Molycote 3402 or equivalent.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

5.2 Hydraulic Power Unit and Local Control Panel

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines, including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen precharge of each hydraulic accumulator down to 10 bar / 145 psi. This is for safety reasons and to keep e.g. bladder in a stable position.

Air accumulators must be vented and drained of water.

Open ends of piping must be sealed off by plugs or caps.

All moving parts including the push rod of the panel valves must be protected by Molycote 3402 or equivalent.

Operation panels must be protected by a protective cover or door.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anti-condensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect ventilation grills / air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof local control panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

All isolation valves (except drain valves) must be closed. 4/3-way panel valves must be moved to "CENTER" position. 3/2-way panel valves must be in "CLOSE" or "VENT" position.

5.2.1 Hydraulic Oil

For long term storage no fluid exchange is required to get conservation against corrosion if equipment is filled with clean hydraulic oil.

After usage or longer storage (>3 months) hydraulic reservoirs must be checked for cleanliness and water content. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

Note: Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

If the water content of the oil is too high, check the hydraulic fluid for bacterial contamination. Clean the system up if necessary by following instructions of supplier.

Hydraulic lines have to be flushed to customer required cleanliness level.

Note: Cleaning of the hydraulic lines of an empty system must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

5.2.2 Water Based Fluid

General

For long term storage (>6 months) a special fluid preparation is required to get conservation against corrosion of equipment.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Reservoirs must be checked for cleanliness.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluid should be within the system during long term storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions. The table in section 4.2 shows different possibilities for long term (>6 months) storage.

5.3 Remote Control Panel

Painting, frame and moving parts must be checked in accordance with section 5.1.

5.3.1 Electric Remote Control Panel

Cable connections are to be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Operation panel must be protected by a protective cover or door if available.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

Rack mounted equipment shipped separately from cabinets should be bagged with desiccant and tagged with shock fuses.

5.3.1.1 Control Panel for climatic controlled environment

Control panel for use in climatic controlled environment e.g. Master Control Station (MCS), Electric Power Unit (EPU), Remote Workstations etc.

Equipment should be stored in a warehouse in undamaged packaging under the following conditions excluding intensive dust and condensation of humidity.

Temperature -18 - +60°C

Humidity 20-90% RHNC

When packaging has to be opened e.g. for site receive tests it is recommended to use corrosion inhibitors (e.g. Cortec®VCI 110) for further preservation.

5.3.2 Pneumatic Remote Control Panel

Pneumatic connections are to be cleaned up and protected by non aggressive protective shield, protection against dust or mating protective cover if available. Check pneumatic jumper cable as well.

Air receivers must be vented and drained of water.

Operation panel front must be protected by a protective cover or door.

Acryl glass window panes on panels located in hazardous areas must be cleaned with wet cloth only due to electrostatic charge.

5.4 Hydraulic Umbilicals, Umbilical Jumpers & Steel Flying Leads

General Instructions

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the applicable hydraulic fluid.

All hydraulic connections must be cleaned from dirt by using cleaning solvents which do not harm the seals (see Operation and Maintenance Procedure).

The connection plate of the junction boxes must be protected by protective covers.

After cleaning mating protective caps or plugs must be mounted to the quick coupling or single connection.

Stainless steel junction boxes and plates must be covered with a thin film of non aggressive oil.

Painting, frame and moving parts must be checked in accordance with section 5.1.

The umbilical can be stored in a box or on a drum. The minimum bending radius for storage indicated by supplier may not be exceeded.

5.4.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The umbilical shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.4.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

All lines with poppets must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids and compositions (see table in section 4.2).

5.5 Electric Cables and Cable Jumpers

Contacts of electrical connectors must be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Check that cable minimum bending radius is kept for storage.

Cable materials have to be protected for storage to avoid mechanical impact and ageing impact caused by sunlight (UV).

5.6 Umbilical Reels

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cleaned piping must be sealed off by using protective plugs, caps or covers.

Parts for power transmission like gear, chain with sprockets etc. must be protected and lubricated.

Open gear drive with gear ring and cog	-	ANTI SEIZE (or equivalent)
Chain drive	-	ESSO CAZAR K2 (or equivalent)
Gear box for direct drive	-	See Operation and Maintenance Manual of gear box for specific oil type.

5.7 Uninterruptable Power Supply (UPS)

WARNING:

Hydrogen may discharge from batteries and cause explosion (depending from battery type). Sufficient ventilation is required.

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cable connections must be protected with non aggressive protective shield.

For storage of the UPS check the allowed temperature range in Operation and Maintenance Manual to avoid damage of sensitive parts like batteries etc.

Recharge batteries to full range. Deep discharge must be avoided.

Follow specific long term storage procedure for installed type of batteries.

Disconnection of batteries may be required.

Ensure that the UPS is tagged with a shock fuse indicator.

5.8 Subsea Valve Packages

Remark: Subsea valve packages are normally mounted to the subsea running tools (e.g. Lower Marine Riser Package), which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.8.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.8.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.9 Subsea Control Modules (direct / pilot hydraulic types)

Remark: This section is **not** to be applied for CAMTROL subsea control modules. Refer to the "CAMTROL Subsea Production Control Equipment" section.
Subsea Control Modules (SCM) are normally mounted to the subsea running tools which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool. Flushing and testing can be done with the appropriate flushing and testing unit.

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Hydraulic pressure from all lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

If applicable, cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

5.9.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.9.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.10 Hydraulic Flushing and Testing Units

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

Air receivers must be vented and drained of water.

Open connection ends must be sealed off by plugs or caps.

All moving parts must be protected by Molycote 3402 or equivalent.

Junction plates must be protected by an overall cover or individual caps and plugs.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anticondensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

5.10.1 Hydraulic Oil

Reservoirs must be checked for cleanliness and water content. Water content of hydraulic oil must be checked to be within the maximum allowed range. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.10.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.11 Running Tools for Subsea Modules

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines must be discharged.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Hydraulic lines are to be flushed to customer required cleanliness level.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.12 Hydraulic Cylinder (e.g. on SCM Test Stand)

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

Hydraulic cylinders are to be flushed to customer required cleanliness level. Ensure that the cavities are completely filled with hydraulic control fluid. Ensure that no air is left in the cylinders as remaining air might cause corrosion.

Painting must be checked in accordance with section 5.1.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Put piston of the cylinder in retract position. This ensures that the rod is protected inside the cylinder against corrosion or damage.

Grease the cylinder rod with silicon grease or equivalent non aggressive grease.

Store the cylinder in a dry indoor environment. Room temperature should not be below 37°F (3°C).

5.13 Float Type Accumulators

Note: Preservation has to be carried out when the float type accumulators are unused and storage will be longer than three (3) months.

<u>Disassembly of Accumulator</u>

Bleed the pressure from hydraulic fluid supply.

Ensure that the ¼" needle valve at the bottom of the accumulator is in the closed position.

Remove the ¼" NPT plug.

Open the ¼" needle valve at the bottom of the accumulator.

Ensure that the accumulator is depressurised.

Open the hammer union at the bottom of the accumulator.

Ensure that the floater is at the lower end of the accumulator.

Remove the plug at the end of the floater pipe.

Inspect the seals (floater pipe plug, hammer union).

Spray non aggressive anticorrosive lubricant into the accumulator to protect the inner surface of the accumulator.

Carefully move the accumulator in vertical position and ensure that the lubricant flows out of the accumulator.

Assembly of Accumulator

Grease the o-ring of the plug and fix the plug at the lower end of the floater pipe.

Grease the thread at the end of the accumulator bottle and connect the hammer union.

Close the ¼" needle valve at the bottom of the accumulator and install the ¼" plug.

Painting must be checked in accordance with section 5.1.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.14 Topside Umbilical Termination Unit / Assembly

Topside Umbilical Termination Units / Assemblies (TUTU / TUTA) will be treated like Hydraulic Power Units (HPU). The workload is reduced as the TUTU / TUTA does not contain motors, pumps and reservoirs.

5.15 Wire Rope

Grease the wire ropes with wire rope grease. Ommex or Kendal or equivalent wire rope grease can be used.

Store the wire ropes in a dry outdoor or indoor environment.

5.16 Load Cell

Protect the load cells by a thin film of non aggressive oil.

Store the load cells in a dry indoor environment. Room temperature should not be below 37°F (3°C).

6 Preservation Maintenance Check Lists

The following checklists must be used to get a controlled storage of the equipment with proper maintenance.

6.1 Hydraulic Power Unit and Local Control Panel (Main Control Unit)

Preservation Maintenance Check List	**Sheet: 1 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-65390-03-00-00 or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film; repair if necessary	Non aggressive oil
8.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Motors, Distribution Boxes, Relay Boxes, Subswitchboards, Junction Boxes**					
1.0			X		Inspect protection on cable connections; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0		X			Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check drain valves to be open	
6.0			X		Inspect fluid according to section 5.2.1 or 5.2.2	

6.2 Umbilical Reel with Umbilical

Preservation Maintenance Check List — **Sheet: 1 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check lines to be pressureless, drain valves to be open	
6.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.3 Electric Remote Control Panels

Preservation Maintenance Check List						**Sheet: 1 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A. General Inspection						
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, Vaseline or equivalent
4.0			X		Check pneumatic circuits to be depressurized (for purged system only)	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil

Preservation Maintenance Check List						**Sheet: 2 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.4 Pneumatic Remote Control Panels

Preservation Maintenance Check List — **Sheet: 1 of 1**

Description of Equipment: **Pneumatic Remote Control Panels**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on pneumatic hose connection, repair if necessary	Non aggressive protective shield with additional cover
4.0			X		Check pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
7.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
8.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
9.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
10.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
11.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.5 Hydraulic and Electrical Jumpers

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Hydraulic and Electrical Jumpers**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0	X				Check junction boxes and couplings for proper protection by covers, caps or plugs	
4.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield; acid free Vaseline or equivalent; protective caps
6.0			X		Check protection of electric cable against mechanical impact and ageing impact by sunlight	
7.0			X		Check that cable minimum bending radius is kept for storage	
8.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.6 Subsea Valve Package

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Valve Package**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
6.0			X		Check lines to be pressureless; drain valves to be open	
7.0			X		Inspect fluid according to section 5.8.1 or 5.8.2	

6.7 Subsea Control Module (direct / pilot hydraulic types)

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Control Module (not for CAMTROL SCM)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
6.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
7.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
8.0			X		Check lines to be pressureless; drain valves to be open	
9.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
10.0			X		Inspect fluid according to section 5.9.1 or 5.9.2	

6.8 Hydraulic Flushing and Testing Unit

Preservation Maintenance Check List						**Sheet: 1 of 3**
Description of Equipment:	**Hydraulic Flushing and Testing Unit**					
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
6.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List	**Sheet: 2 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C. Hydraulic Circuits						
1.0			X		3/2-way valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way valves to be in open centred position; function lines to be pressureless	
3.0			X		Check lines to be pressureless; drain valves to be open	
4.0			X		Inspect fluid according to section 5.10.1 or 5.10.2	

6.9 Running Tool for Subsea Module

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Running Tool for Subsea Module**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
6.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
7.0			X		Inspect fluid according to section 5.11	

7 CAMTROL Subsea Production Control Equipment

Note: Use the instructions in this section as check lists.

7.1 Subsea Control Module / SCM

Check on the bill of material if individual “Shipping, Transportation and Storage Guidelines” are available for the SCM, otherwise follow the instructions below:

Verify: _____

Store the SCM in the crate until it is required for use.

If it is necessary to gain access to the SCM, remove the top and sides of the crate, but leave the SCM on the shipping frame.

Visually inspect the SCM / packing before use and every **3 month** when it is not used.

Verify: _____

The storage environment must be free from harmful substances which can affect resilient seals (i.e. high Ozone level).

Verify: _____

The ambient temperature for storage must be within the range -10°C to 40°C to maintain the integrity of the pressure compensation system and ensure that no dielectric oil bleeds out.

Verify: _____

CAUTION:
If the loss of dielectric oil exceeds 3 Litre the SCM needs to be refilled in accordance to Cameron “Field refill procedure”. The lower reservoir of the shipping frame is seized to 3 Litre. If you are in doubt please contact Cameron Germany Engineering Department (Tel +49 (0)5141 8060).

7.2 Subsea Accumulator Module / SAM

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Any damage occurring during the periodical checks must immediately be reported and repaired by Cameron Controls.

Verify: _____

Drain the hydraulic pressure from the accumulators.

Verify: _____

Bleed nitrogen pre-charge from the accumulators. Leave 10 BAR residual pressure in the accumulator to prevent the bladder from collapsing.

Verify: _____

Close the two (2) Gas Valves on the HP Accumulators.

Verify: _____

Open ends of Accumulators must be sealed by plugs or protective caps off stainless steel on the gas side off the accumulators.

Verify: _____

Lubricate all moving parts, except the Hydraquad hydraulic connectors, by water-resistant grease.

Verify: _____

Painting, frame and moving parts must be checked for damage.

Verify: _____

Stainless Steel parts must be protected by a thin film of non aggressive oil (Pelox Protector or similar).

Verify: _____

7.3 Subsea Distribution Unit / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.3.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Set all valves to CLOSE position.

Verify: _____

Protect the mounting base of the SAM by a protective cover.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes

Verify: _____

7.3.2 Electrical Parts

Check that all ROV connectable fuses are installed.

Verify: _____

Check that all electrical connectors are protected by caps

Verify: _____

7.4 Umbilical Termination Assembly / UTA

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.4.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes.

Verify: _____

7.4.2 Electrical Parts

Check that all electrical connectors are protected by caps.

Verify: _____

7.5 Foundation Base & Mud Mate for UTA / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Foundation Base only: Verify the proper operation of the two (2) pile locks and confirm that they are in the unlocked position.

Verify: _____

Check the SDU locking mechanism by operating.

Verify: _____

Check the guide post locking mechanism by operating.

Verify: _____

Inspect all lift shackles for deformation and other damage.

Verify: _____

Check condition of all protection anodes.

Verify: _____

8 Handling Requirements for Special Materials

8.1 Rubber Goods

GENERAL

There is very little published information on the storage and care of rubber goods as used in the oil field. When we speak of rubber goods we include the synthetic packings of Nitrile Copolymers and Neoprene as well as natural rubber parts. Natural rubber parts have become relatively rare but the same things that are harmful to natural rubber are also harmful to the synthetics in varying degrees.

Generally speaking, light and air are bad for rubber goods. The exact chemical action is not fully understood and what has been written disagrees on the mechanism involved.

Ozone is known to be bad for rubber goods. Ozone (O_3) is a very active form of oxygen. As far as we know two principle sources contribute the ozone that reaches rubber goods. One is atmospheric ozone which is generated in the stratosphere carried downward by convection currents and eventually absorbed by organic matter. The other source is electrical discharges, such as lightning, high voltage corona, but more commonly, electrical machinery. Ozone attack is characterized by fairly deep cracks in the rubber parts.

Rubber is attacked by ordinary oxygen (O_2) much as steel rusts in the presence of oxygen. Oxidation is characterized by a hard skin which eventually crazes in a multitude of small cracks and may turn chalky or assume a bark-like appearance.

A strong direct light, especially sunlight, has deleterious effects on rubber goods. This is attributed to the ultraviolet content of the spectrum which accelerates cracking. Whatever the mechanism however, light, particularly sunlight, is undesirable. In extremely cold climates some rubber goods will become so brittle that upon dropping or rough handling they will shatter.

In very warm humid climates, particularly those found in some parts of the tropics, fungi and bacteria find their way to the rubber goods and attack the organic content. This is especially true on duck reinforced rubber parts. However, parts reinforced with synthetics will not be attacked in the reinforcement.

Heat also has a bad effect on rubber. This could be the result of sunlight or artificial or accidental heating of any type. Heat results in a gradual hardening of the part and if ozone or oxygen are present, will accelerate their action.

Any stretching or bending of rubber in storage will result in very accelerated ageing. By the term ageing, we mean the cumulative effects of all the above mentioned attacking agents over a period of time. Ozone attacks rubber preferentially at points of strain.

Rubber goods, both natural and synthetic, all possess some degree of susceptibility to various solvents including water, but especially the liquid hydro-carbons. These manifest themselves in various ways by either swell or shrinkage of the rubber goods with which they are in contact.

No precise figure can be given as a "storage life" of a part. This is dependent on all of the above conditions and also the size of the part, its material and function. Generally speaking, the greater the relative surface area is to the volume, the more susceptible a part is to being rendered useless by ageing. For example, a relatively bulky part such as a ram front packer might be expected to have a much longer useful shelf life than a thin large diameter o-ring type of seal such as used on the bonnet seals of preventers or the rings in 'X' bushing.

STORAGE

From the preceding section we can draw a few rules governing storage of rubber goods. Briefly put - a cool, dry, dark storage place would be the best. The ideal would be to store the packings in vacuum sealed containers. The following rules, however, should not be difficult to follow under the average storage conditions experienced throughout our operation.

- Keep the rubber storage area as dark as possible. Certainly not out of doors, and, if indoors, away from skylights or windows and with subdued or indirect artificial lighting.
- Select the coolest location possible and be sure that no heaters or stoves are near by and particularly that the direct blast from a space heater does not blow on the rubber parts.
- Be sure that no electrical machinery (motors, switch gear, or any high voltage equipment producing corona) is near the rubber goods and that drafts will not carry the atmosphere from electrical machinery to the area in which the rubber goods are stored.
- The practice of first in - first out is essential with rubber goods. There is a natural tendency to remove parts from the front of a bin and when stock is replenished to leave the parts that are in the back in place, in which case years might pass before these are finally pulled out for use.
- Store rubber goods in a relaxed position. For example, do NOT hang o-rings on nails. Where possible, do not keep assemblies in stock where the rubber goods are stretched in order to assemble them on the part. For example, o-rings on blanking plugs, tubing hangers and 'X' bushing. In some cases this is difficult as it is with the aforementioned 'X' bushings. On these, periodic inspection should be employed to detect any signs of ageing as quickly as possible.

  On parts, such as the 'X' bushing rings, where we know the rubber parts will be stretched in storage, the best age resistant compounds we can buy are used.
- Keep storage as dry as possible and remove any oil, gas, etc. of hydro-carbon nature that may accidentally get on the rubber.
- Do not store the rubber goods on top shelves near galvanized roofs. There are several reasons for this; one is that heat is passed through galvanized roofing and also there is some opinion that ozone may be generated in this area.
- If possible, store rubber goods in buildings of wooden construction and wooden shelves. Wood is believed to scavenger ozone quite effectively.
- If store for extended periods is unavoidable, sealed containers will aid considerably; impervious surface coverings such as "Sea-Peel" or waxing will help.

USABILITY CHECKS

No general rule can be drawn regarding usability. The final measure is whether or not the cumulative effects of ageing have affected the physical properties of the part to such an extent that it will no longer perform the function for which it is designed. Thus, a large heavy part might suffer the same total amount of ageing as a small, light, thin piece, and still be usable whereas the small part is rendered useless. In these cases some judgement must be used in deciding usability.

Prior to shipment or use out of stock, rubber goods should be examined to see that no "chalking" or "barking" (bark-like surface appearance) is present, that there is not a hard skin on the rubber and that there are no cracks. Sometimes cracks will be obvious, but it is wise to stretch or bend the part in question so that any incipient cracks or very thin cracks will reveal themselves. Where a part is suspect, a check of hardness should be run. In the event that the hardness runs 15 points higher than the nominal hardness of the part, it is considered non-usable. Hardness is affected by temperature and readings should be taken with the rubber part at 70°F – 100°F (21°C - 38°C).

8.2 Hydraulic Hoses

STORAGE

- Before placing hose in storage, it should be completely drained.
- Whenever feasible, store the hose in the original wooden shipping crate. This will provide some protection against the deteriorating effects of solvents, corrosive liquids, ozone and sunlight. Hose should be stored so that the coils are in a horizontal plane.
- Certain rodents and insects will damage the hose. Adequate protection from them should be provided.
- The ideal temperature for storing the hose ranges from 50°F (10°C) to 70°F (21°C) with a maximum limit of 100°F (38°C). If stored below 32°F (0°C), the hose will become stiff and would require warming before placed in service. The hose should not be stored near sources of heat, such as radiators, base heaters, etc., nor should the hose be stored under conditions of high or low humidity.
- To avoid the adverse effects of high ozone concentration, the hose should not be stored near electrical equipment that may generate ozone or be stored for any lengthy period in geographical areas of known high ozone concentration. Exposure to direct or reflected sunlight - even through windows - should also be avoided.

HANDLING

CAUTION: Care should be exercised to prevent mishandling. Crushing or kinking of the hose can cause severe damage to the reinforcement. If this occurs, remove hose from service.

- In order to minimize the danger of kinking, the hose preferably should be removed from its crate by hand, laid out in a straight line, then lifted by means of a catline attached near one end of the hose. If a catline is used to remove the hose from its crate, the crate should be rotated as the hose is removed. Recommended practice is to protect the hose in some manner when moving to a new location. It is considered bad practice to handle the hose with a winch, to hand the hose from a truck gin pole, or to place heavy pieces of equipment on the hose.

8.3 Electronic Goods and Tools containing Electronics

8.3.1 General Instructions

Rapid temperature changes must be excluded to avoid condensation of humidity and mechanical stress.

The packing should protect electronic goods against:

- Dust
- Humidity
- Electrostatic Charge
- Shock
- Direct Sunlight

Generally the original transport packing serves the above requirements best.

Normally antistatic bags, desiccant and anti-shock pads are applied to prevent damage.

Electronic goods should be stored in a warehouse secured against theft.

8.3.2 Fiberoptic Terminations

Optic Link Modules (OLM) should be capped. Caps have to be removed before installation.

8.3.3 Handling Procedure for CMOS Devices

Electrical environments such as overvoltages and electrostatic discharges damage CMOS devices and printed circuit cards containing the devices. Most CMOS devices have diode input protection circuits and gate protection structures to protect against such electrical environments.

In addition to the internal protection network, use the following steps to prevent the generation of severe electrical transient voltages during handling of CMOS devices.

- Read the manufacturer's equipment specification and data sheets before performing maintenance. Do not exceed recommended maximum voltage levels.
- Use grounding wrist straps which contact the skin.
- Ground all work surfaces.
- If lead-straightening or hand-soldering is necessary, provide ground straps for the equipment, and ground the soldering ties.
- Connect all unused inputs to an appropriate logic voltage level, either power or ground.
- Inspect test equipment for proper polarity of voltage before conduction parametric or functional testing.
- Inspect all power supplies used for testing to ensure there are no voltage transients present.
- Do not insert or remove devices from test sockets with power applied.
- Do not contact edge connectors which are wired directly to device inputs.
- If external connections to a printed circuit card address only an input of the integrated circuit, use a resistance of 10 K ohms or greater in series with the input. The resistance limits damage to the card if it is removed and contacts static generating materials.
- Connect all low impedance equipment such as pulse generators to inputs only after the device has power applied. Disconnect the equipment before power is removed.
- Do not allow nylon or other static generating materials to contact the devices.
- Store or transport the devices in materials that are antistatic. Do not insert the devices into plastic packing material, styrofoam, or plastic trays.

8.3.4 Lithium Manganese Dioxide Battery

Replacement of the Lithium Manganese Dioxide battery mounted in the subsea transmitter & battery module: The battery supports the AMF-System (Automatic Mode Function / Dead Man System) belonging to multiplex drilling control systems. Under normal operation conditions replacement is required **after each one-year period**. Battery storage conditions should be in a range of 23°F – 59°F (–5°C to 15°C).

9 Attachment

- Data Sheets of Protective Materials (if required)
- Data Sheets of Hydraulic Fluids (if required)

STATUS: Released REVISION : 02
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : MASTER CONTROL STATION / TOTAL K5F

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
001	0001	01	223439-00-56	1.000	EA	Cabinet for use with cooler unit Rittal SK 3305-500 230VAC 50/60Hz /1500W Door mounted ADD-ON		
004	0004		619044-01-18-03	1.000	EA	2 SIDE PANELS, EMC, 2000 X 800 mm, STL PROTECTION: IP 55 MATERIAL: SHEET STEEL COLOUR: LIGHT GREY (RAL 7035) INCL. 12 X PANEL HOLDERS, 12 X EARTHING INSERTS & 24 X SCREWS. SUIT. FOR PN 619044-01-01-08		
005	0005		619044-01-15-06	1.000	EA	2 BASE TRIM PANELS, 800 X 100 mm SIDE FOR TS ENCLOSURE DEPTH 800 mm MATERIAL: SHEET STEEL COLOUR: UMBRA GREY (RAL 7022) INCL. ASSEMBLY PARTS SUIT. FOR PN 619044-01-01-08		
006	0006		619044-01-15-08	1.000	EA	2 BASE COMPONENTS, 800 X 100 mm FRONT & REAR FOR TS ENCLOSURE WIDTH 800 mm MATERIAL: SHEET STEEL COLOUR: UMBRA GREY (RAL 7022) INCL. 4 COVER CAPS IN PLASTIC, 4 SCREWS AND CAPTIVE NUTS M12. NOTE: 1 BASE COMPONENT CONSISTS OF 1 TRIM PANEL AND 2 PRE-CONFIGURED CORNER PIECES. SUIT. FOR PN 619044-01-01-08		
007	0007		619044-01-14-01	1.000	EA	EMC VIEWING WINDOW, 593 x 593 mm W x H: 649 x 649 mm (OVERALL) W x H: 607 x 607 mm (DOOR CUTOUT) W x H: 593		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						x 593 mm (VISIBLE AREA) INCL. MOUNTING FRAME INSIDE, EMC SEAL, PROTECTIVE SEAL AND TRIM FRAME.		
008	0008		619044-01-23-06	1.000	EA	SWING FRAME, LARGE, 699 x 1861.5 mm WITH TRIM PANEL FOR ENCLOSURE (W x H): 800 X 2000 mm HEIGHT UNIT: 40 U ; INSTALLATION: SIDE OPENING ANGLE: 130° / 180° MATERIAL: SHEET STEEL , ZINC-PLATED TRIM PANELS: LIGHT GREY (RAL 7035) INCL. LOCKING ROD SYSTEM WITH DOUBLE-BIT LOCK INSERT AND ASSEMBLY PARTS		
009	0009		619044-01-11-03	1.000	EA	DOOR-OPERATED SWITCH W/O. CONN. CABLE INCL. MOUNTING ACCESSORIES. APPROBATION: CE, CSA & UL		
011	0011		619095-01-55	100.000	EA	NUT, CAPTIVE, M6, WITHOUT CONTACT FOR METAL THICKNESS: 0.8 - 2.0 mm FOR SECURING 19" ELECTRONIC EQUIPMENTS AND BLANKING PLATES TO THE 19" MOUNTING ANGLES.		
012	0012		619044-68	100.000	EA	SCREW, TAPPING, 5.5 X 13 mm		
013	0013		619044-01-45	1.000	EA	RIDE-UP ROLLER FOR TS, ES, PC LIFTS THE DOOR WITH HEAVY INSTALLED EQUIPMENT AS A CLOSING AID. FOR ATTACHING TO THE TUBULAR DOOR FRAME.		
014	0014		619041-54	1.000	EA	WALL-MOUNTED COOLING UNIT, 1500 W WITH COMFORT CONTROLLER. CONN.: PLUG-IN TERMINAL STRIP. OPER. VOLT.: 230 V, 50/60 Hz. COOLING OUTPUT: 1500 W. REFRIGERANT: R134a, 600 g.		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						TEMP.: +20°C / +55°C. COLOUR: LIGHT GREY (RAL 7035). W X H X D: 400 X 950 X 260 mm.		
015	0015		619038-02-15	1.000	EA	HEATER, ENCLOSURE, 230 V AC, 1000 W INSTALLATION: IN THE ENCLOSURE. CONN. CABLE WITH WIRE END FERRULES. OPER. VOLT.: 230 V AC, 50/60 Hz. CONT. THERMAL OUTPUT: 1000 W. RATED CURRENT: MAX. 5 A. TEMP.: -33°C / +65°C. AIR THROUGHOUT: 120 m3/h. MATERIAL: ALUMINIUM. SURFACE FINISH: NATURAL. W X H X D: 325 X 82 X 220 mm.		
016	0016		619044-01-08-02	1.000	EA	APPROVALS: UL AND CUL ENCL. INTERNAL THERMOSTAT, 5 - 55°C SET. RANGE: +5°C / +55°C OPER. VOLT.: 230/115/60/48/24 V (AC), 60/48/24 V (DC). BI-METAL SENSOR AS A TEMPERATURESENSITIVE ELEMENT WITH THERMAL FEEDBACK. CONTACT POPULATION: SINGLE-PIN CHANGE-OVER CONTACT AS A QUICK-BREAK CONTACT. W X H X D: 71 X 71 X 33.5 mm APPROVALS: CE, CUL, UL & VDE		
017	0017		619044-01-12-01	1.000	EA	SOCKET FOR POWER SUPPLY THROUGH-WIRING FOR SELF-ASSEMBLY APPROVAL: CE 1 187 110 SUIT. FOR PN 619038-02-02		
018	0018		2762726-01	1.000	EA	LIGHT FIXTURE, UNIVERSAL W/SOCKET, 26W, 110-240 V, 50-60 HZ, LENGTH 13.58" (345 MM)		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
019	0019		619044-98	1.000	EA	WIRING PLAN POCKET, 228 x 256 x 17 mm FOR FORMAT: DIN A4 PORTRAIT FOR AFFIXING TO THE INSIDE OF DOOR. MATERIAL: POLYSTYRENE WITH SELFADHESIVE FASTENING STRIPS. COLOR: SIMILAR SILK GREY (RAL 7044)		
020	0020		619044-01-04-05	1.000	EA	INSTALLATION KIT FOR 1 SWING FRAME WITH 130° HINGE LOAD CAPACITY: MAX. 150 kg MATERIAL: SHEET STEEL COLOUR: LIGHT GREY (RAL 7035) INCL. ASSEMBLY PARTS SUIT. FOR ENCLOSURE WIDTH 800 mm		
021	0021		619095-01-65-01	1.000	EA	SWING FRAME STOP WITH 180° HINGE LOCKS SWING FRAMES IN OPEN POSITION MATERIAL: SHEET STEEL, ZINC-PLATED, PASSIVATED. INCL. ASSEMBLY PARTS		
022	0022		619044-39	1.000	EA	DOOR STAY FOR TS/PS/ES ENCLOSURES TO SECURE THE DOOR IN OPEN POSITION		
023	0023		619095-01-66	14.000	EA	CHASSIS GUIDE FOR SWING FRAME TO SUPPORT HEAVY SLIDE-IN ELECTRONIC EQUIPMENT, 19" IN THE DATA RACK. INSTALLATION DEPTH: Tmax. > 190 mm MATERIAL: SHEET STEEL, ZINC-PLATED, PASSIVATED.		
024	0024		619044-01-09-01	4.000	EA	TS PUNCHED SECTION 23 x 73 mm, STL FOR THE INNER MOUNTING LEVEL. FOR ENCLOSURE (W x D): 800 x 800 mm. MATERIAL: SHEET STEEL, ZINC-PLATED, PASSIVATED. INCL. ASSEMBLY PARTS		
025	0025		619044-01-22-02	1.000	EA	COMFORT HANDLE FOR LOCK		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						INSERT PREPARED FOR THE INSTALLATION OF LOCK INSERTS, SAFETY AND PUSH-BUTTON INSERTS. LENGTH: 295 mm. MATERIAL: DIE-CAST ZINC. SURFACE FINISH: POWDER-COATED. COLOUR: LIGHT GREY (RAL 7035). IT MUST BE USED WITH PN 619044-01-22-03.		
026	0026		619044-01-22-03	1.000	EA	PUSH-BUTTON INSERT FOR INSTALLATION IN THE COMFORT HANDLE PN 619044-01-22-02.		
030	0030		619095-01-67	5.000	EA	BLANKING PLATE, 19", 1 U, ALU. HEIGHT UNIT: 1 U W x H x D: 483 x 44 x 3.0 mm MATERIAL: ALU , NATURAL ANODIZED		
031	0031	02	222500-02-89	1.000	EA	FRONT PLATE (LEFT) MCS		
032	0032		619095-01-67-03	1.000	EA	BLINDPLATE, 19", 3 HE, VENTED, 19" (482.6MM) W X 5.21" (132.5MM) H MATERIAL: NATURAL ANODIZED ALUMINUM (3 PIECES PER PACKAGE)		
033	0033		619095-01-67-01	2.000	EA	BLANKING PLATE, 19", 3 U, ALU. HEIGHT UNIT: 3 U W x H x D: 483 x 133 x 3.0 mm MATERIAL: ALU , NATURAL ANODIZED		
034	0034		619095-01-67-07	3.000	EA	BLANKING PLATE, 19", 2 U, ALU. HEIGHT UNIT: 2 U W x H x D: 483 x 89 x 3.0 mm MATERIAL: ALU , NATURAL ANODIZED		
041	0041		619089-12-17	1.000	EA	SPEED CONTROL, +20°C / +55°C, 230 V FOR FAN-AND-FILER & HEAT EXCHANGERS SET. RANGE: +20°C / +55°C FAN OUTPUT: MAX. 250 W OR 1.5 A PHASE		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						CROSS-OVER WITH MICROCONTROLLER FOR MOUNTING ON 35 mm SUPPORT RAIL INSTALLED IN A PK ENCLOSURE 9512.100, NTC SENSOR, LENGTH 1.80 m. W x H x D: 94 x 57 x 180 mm APPR.: CE 3 082 710 ; CUL E203342 ; UL E203342		
050	0050		619091-01-50-10	2.000	EA	POWER SUPPLY, 24 V DC, 10 A PRIMARY SWITCHED-MODE, 1-phase TYPE: QUINT-PS-100-240AC/24DC/10 NOM. INPUT VOLT.: 100 - 240 V AC NOM. OUTPUT VOLT.: 24 V DC +/- 1 % OUTPUT CURRENT: 10 A (UP TO 60°C) FREQUENCY: 45 / 65 Hz PROTECTION: IP 20 AMB. TEMP.: -25°C / +70°C W x H x D: 85 x 130 x 130000 mm APPROVAL: UL & GL		
051	0051		619097-27	1.000	EA	EX REDUDANCY MODULE, QUINT-DIODE/40 NOM. INPUT VOLT.: 24 V DC INPUT CURRENT: MAX. 30 A OPER. TEMP.: -25°C / +70°C PROT: EX II 3G EEx nA IIC T4, IP 20 TYPE OF CONN.: SCREW CONNECTION L x W x H: 102 x 62 x 84 mm Ex-Cert.: KEMA 03 ATEX 1197X		
201	0201		619089-04-39	1.000	EA	KEY-OPERATED BUTTON, 2 POSITIONS TYPE: M22-WRS. LOCK MECHANISM: MS1. POSITIONS: 2 (0 / I). FRONT RING: TITANIUM. FUNCTION: V60°. PROTECTION: IP 66. DIAMETER: 22 mm.		
202	0202		619089-25-17-01	1.000	EA	CONTACT ELEMENT WITH CAGE CLAMP		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						FRONT FASTENING TYPE: M22-CK10, RMQ-TITAN, 1 NO FOR DIAMETER 22 MM		
203	0203		619089-25-17-05	1.000	EA	FASTENING ADAPTER (FRONT FASTENING) TYPE: M22-A, RMQ-TITAN FOR DIAMETER 22 MM FOR CONTACT ELEMENTS M22-(C)K... AND LED-ELEMENTS M22-(C)LED... CLASSIFICATION NUMBER ON FASTENING ADAPTER		
205	0205		619089-28-09	2.000	EA	SWITCH, MAIN, MOUNTING AS EMERGENCY SHUTDOWN TYPE: P1-32/EA/SVB/HI11 MAIN CONTACTS: 3 X NO HELP CONTACTS: 1 X NO; 1 X NC		
206	0206		619089-25-17-10	4.000	EA	SHROUD, H-P1, TO COVER TERMINALS ON 3-POLE SWITCH-DISCONNECTORS.		
300	0300		619095-03-31	2.000	EA	DISCONTINUED CPU 317 FOR STEP 7 FROM SIEMENS WITH INTEGR. DP SLAVE / MASTER, ETHERNET CP 343 RATED VOLT.: 24 V DC CURRENT: MAX. 1.1 A DIGITAL CHANNELS: 1024 ANALOG CHANNELS: 128 MEMORY: 512 kB TIMERS / COUNTERS: 256 / 256 NO. OF MODULES: UP TO 32 IN A SINGLE ROW OPER. TEMP.: 0°C / +60°C W x H x D: 80 x 125 x 120 mm ALTERNATIVE PN 2711927-02-01. PLEASE NOTE: THE NEW PLC HAS ONE ETHERNET PORT ONLY !!! IF MORE PORTS REQUIRED PLEASE USE CP-343.		
301	0301		619095-03-28	2.000	EA	MULTI MEDIA CARD, 128 MB SYSTEM SPECIFICATION VERSION 3.0		
302	0302		619095-05-46	6.000	EA	SIMATIC S7, DIGITAL INPUT SM 326		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						24 DI ; DC 24 V, 40 PIN, FAILSAFE DIGITAL INPUTS FOR SIMATIC S7F SYSTEMS, WITH DIAGNOST. INTERRUPT.		
303	0303		619095-06-33	6.000	EA	DIGITAL OUTPUT, SM 322, 16 DO, 24 V FOR THE SIMATIC S7-300 OPTICALLY ISOLATED 16 DO DC 24 V, 0.5 A (1 X 16 DO) SHORT-CIRCUIT PROTECTION DIAGNOSTICS 40 PIN		
309	0309		619095-12-49	12.000	EA	S7-300, FRONT CONNECTOR 40 POL. WITH SCREW CONTACTS		
310	0310		619095-12-46	2.000	EA	S7-300,PROFIL BAR 482MM,IP20 PROTECTION: IP 20 LENGTH: 482 MM		
311	0311		619095-11-31	2.000	EA	BUS CONNECTOR, 9 WAY, PG CONN. TYPE: EASYCONN PB 90° DATA RATE: 12 MBIT/S END RESISTOR WITH BREAK FUNKTION WITH PG CONNECTION TEMP.: -20°C / +75°C STATUS INDICATION VIA INTGR. LEDS RETARDANT ACC. TO VDE 0472, PART 804, ICE 332,1		
312	0312		619087-12-05	12.000	ME	CABLE PROFIBUS, 1 X 2 X 0.64 QMM TYPE: 6XV1 830-0CH10 CROSS SECTION: 1 X 2 X 0.64 QMM NOM. VOLTAGE: 100 V ISOLATION: FRNC COLOUR: LIGHT VIOLET LICENCE: VDE 0472 PART 804 B		
381	0381		619088-12-45	20.000	EA	EX TERMINAL, USLKG 16 N, GN/YE UNIVERSAL GROUND TERMINAL BLOCK RIGID: 2.5 - 25 mm2 FLEXIBLE: 4 - 16 mm2 AWG: 12 - 4 COLOUR: GREEN / YELLOW W x H x D: 12.2 x 61.5 x 42.5 mm Ex Cert.: KEMA 99 ATEX 4487U		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
382	0382		619044-01-10	1.000	EA	CABLE CLAMP RAIL, 790 mm lg. FOR ENCLOSURE WIDTH: 800 mm MATERIAL: SHEET STEEL, ZINC-PLATED, PASSIVATED. INCL. ASSEMBLY PARTS		
383	0383		619088-01-05	10.000	ME	MOUNTING RAIL, 35 X 7.5 MM, STEEL TYPE: NS 35/7.5 , PERFORATED W X H X T: 35 X 7.5 X 1.0 mm MATERIAL: STEEL , YELLOW CHROMATED TEST STANDARD IN ACC. WITH EN 60715: 2001		
384	0384		619088-36-04-01	1.000	EA	COVER PROFILE, AP 2, PVC, TRANSPARENT W X H X L: 60 X 33 X 1000 MM ; TEMP.: -15°C / +65°C FOR COVERING TERMINAL STRIPS, SNAPS ONTO COVER PROFILE CARRIER AP 2-TU PN 619088-36-04-02, CAN BE MARKED WITH INSERT STRIP AP-ES.		
385	0385		619088-36-04-02	4.000	EA	COVER PROFILE CARRIER, AP 2-TU W X H X L: 60 X 68.5 X 1000 MM MATERIAL: PA , GREY INFLAMMABI. CLASS ACC. TO UL 94: V2 FOR MOUNTING ON MOUNTING RAIL, FOR FIXING THE COVER PROFILE AP, 2 MM THICK		
386	0386		619088-03-01-05	1.000	ME	NEUTRAL BUSBAR, 140 A, COPPER TYPE: NLS-CU 3/10 H X W: 3 X 10 MM CURRENT: MAX. 140 A MATERIAL: COPPER TIN-PLATED		
387	0387		619088-02-23-54	20.000	EA	TERMINAL, AKG 16, 1.5-16 MM2, GN/YE PE-CONNECTING TERMINAL BLOCK TYPE: AKG 16 GNYE ; W. INSULAT. CAP COLOUR: GREEN-YELLOW (FOR PE) LOAD CURRENT: MAX. 76 A CROSS SECTION: 1.5 - 16 MM2		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						TECH. DATA IN ACC. WITH IEC/VDE		
388	0388		619088-02-23	20.000	EA	TERMINAL, AKG 16, 1.5-16 MM2, BLACK L-CONNECTING TERMINAL BLOCK TYPE: AKG 16 BK ; W. INSULATING CAP COLOUR: BLACK (FOR L1, L2, L3) LOAD CURRENT: MAX. 76 A CROSS SECTION: 1.5 - 16 MM2 TECH. DATA IN ACC. WITH IEC/VDE		
389	0389		619044-01-36	4.000	EA	BASE ISOLATOR, HEX., 40 mm, 1 kV HEIGHT: 40 mm ; SW 36 TENSILE STRENGTH: 12 kN TORSIONAL STRENGTH: 75 Nm CONT. OPER. TEMP.: MAX. 135°C MAT.: DUROPLASTIC POLYESTER , RED FOR CONFIGURING BUSBAR SYSTEMS WITH ANY GIVEN BAR CENTRE DISTANCES AND FOR ASSEMBLING PE OR PEN BARS.		
390	0390		619088-03-02	10.000	EA	TERMINAL,END CLAMP,GREY,E/UK TYPE E/UK		
391	0391		619088-03-43	10.000	EA	LABEL HOLDER, 120° SWIVELLING		
400	0400		619088-02-01-04	500.000	EA	EX TERMINAL, GREY, 4 QMM, UK 3 N 4 QMM / 2.5 QMM 726 V 28 A / 23 A PROTECTION: EEX E II CERT.: KEMA 98ATEX1651U INT. APPROBATIONS: CSA ; CUL/UL ; GOST-R (RUSSIA)		
401	0401		619088-02-14-02	10.000	EA	EX TERMINAL, GREY, 6/4 QMM, UK 5 UK 5 N 6 mm / 4 mm 550 V / 726 V 38 A / 30 A PROTECTION: EEX E II CERT.: KEMA EX-94.C.8675U		
402	0402		619088-02-01-21	6.000	EA	EX TERMINAL, USLKG 10 N, GN/YE		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						UNIVERSAL GROUND TERMINAL BLOCK RIGID: 0.5 - 16 mm2 FLEXIBLE: 0.5 - 10 mm2 AWG: 20 - 6 COLOUR: GREEN / YELLOW W x H x D: 10.2 x 54.5 x 42.5 mm Ex Cert.: KEMA 99 ATEX 4487U		
403	0403		619088-02-01-16	40.000	EA	EX TERMINAL, USLKG 5, GN/YE		
						UNIVERSAL GROUND TERMINAL BLOCK RIGID: 0.2 - 6 mm2 FLEXIBLE: 0.2 - 4 mm2 AWG: 24 - 12 COLOUR: GREEN / YELLOW W x H x D: 6.2 x 54.5 x 42.5 mm Ex Cert.: KEMA 99 ATEX 4487U		
404	0404		619088-03-02	50.000	EA	TERMINAL,END CLAMP,GREY,E/UK TYPE E/UK		
405	0405		619088-03-44	17.000	EA	MARKING SHEET, B-KKL/S-K, 23 x 4 mm MATERIAL: CARDBOARD COLOUR: WHITE		
406	0406		619088-03-27	40.000	EA	TERMINAL, SEPARATION PLATE TYPE: ATP-UK THICKNESS: 1.5 MM CERT.: KEMA 98ATEX1651U INT. APPROBATIONS: CUL/UL ; GOST-R (RUSSIA)		
407	0407		619088-03-43	17.000	EA	LABEL HOLDER, 120° SWIVELLING		
410	0410		619088-03-55	4.000	EA	LABEL STRIP, ZB 5, WHITE (1-10) VERTICALLY LABELED		
411	0411		619088-03-56	4.000	EA	LABEL STRIP, ZB 5, WHITE (11-20) VERTICALLY LABELED		
412	0412		619088-03-57	4.000	EA	LABEL STRIP, ZB 5, WHITE (21-30) VERTICALLY LABELED		
413	0413		619088-03-58	2.000	EA	LABEL STRIP, ZB 5, WHITE (31-40) VERTICALLY LABELED		
414	0414		619088-03-59	2.000	EA	LABEL STRIP, ZB 5, WHITE (41-50) VERTICALLY LABELED		
415	0415		619088-03-60	2.000	EA	LABEL STRIP, ZB 5, WHITE (51-60)		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
416	0416		619088-03-61	2.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE (61-70)		
417	0417		619088-03-62	2.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE (71-80)		
418	0418		619088-03-63	2.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE (81-90)		
419	0419		619088-03-64	2.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE (91-100)		
420	0420		619088-03-65	2.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE (101-110)		
421	0421		619088-03-66	2.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE (111-120)		
422	0422		619088-03-67	2.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE (121-130)		
423	0423		619088-03-68	2.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE (131-140)		
424	0424		619088-03-69	2.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE (141-150)		
425	0425		619088-03-70	2.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE (151-160)		
426	0426		619088-03-71	2.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE (161-170)		
427	0427		619088-03-72	2.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE (171-180)		
428	0428		619088-03-73	2.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE (181-190)		
429	0429		619088-03-74	2.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE (191-200)		
430	0430		619088-03-31	5.000	EA	VERTICALLY LABELED LABEL STRIP, ZB 5, WHITE, (RE) TYP: ZB 5: SO/CMS, LGS: RE COLOUR: WHITE TEXT: RE WIDTH: ZB 5		
431	0431		619088-03-93	20.000	EA	LABEL STRIP, ZB 5, WHITE, (PE)		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						TYP: ZB 5: SO/CMS, LGS: PE COLOUR: WHITE TEXT: PE WIDTH: ZB 5		
450	0450		619095-74-07	6.000	EA	MULTIPOSITION REWIREABLE PLUG, 10 A VOLT.: 250 V		
600	0600		619092-01-41-16	2.000	EA	CIRCUIT BREAKER, C, 16 A, 2 NO TYPE: S 272-C 16 VOLTAGE: 440 V AC / 125 V DC CONTACTS: 2 NO CURRENT: 16 A CHARACTERISTIC: C		
602	0602		619092-01-41-10	8.000	EA	CIRCUIT BREAKER, C, 10 A, 2 NO TYPE: S 202 M-C 10 VOLTAGE: 440 V AC / 125 V DC CONTACTS: 2 NO CURRENT: 10 A CHARACTERISTIC: C		
605	0605		619092-05-04	10.000	EA	AUX. SWITCH FOR CIRCUIT BREAKER TYPE: S 2C-H11 L CONTACTS: 1 NO AND 1 NC PERMANENT CURRENT: 5 A		
606	0606		619088-02-18-02	48.000	EA	FUSE TERMINAL,GREY,4QMM,UK 5-HESI TYPE: UK 5-HESI 6.3 AMPERE 500 V INTERNATIONAL APPROBATIONS: UL ; CSA ; GL ; GOST-R (RUSSIA)		
607	0607		619092-14-14-02	60.000	EA	FUSE GLASS-TUBE 5 x 20 mm, MIDDLE 250 V AC 0.63 A		
620	0620		619092-02-02-09	4.000	EA	CONTACTOR, 230 VAC, 6 A, 2 NO, 2 NC TYPE: 3RH11 ; SERIES: S00 VOLTAGE: 230 V AC ; CURRENT: 6 A CONTACTS: 2 NO & 2 NC		
621	0621		619092-02-02-19	96.000	EA	INPUT OPTOCOUPLER TERMINAL BLOCK TYPE: DEK-OE- 24DC/48DC/100. INPUT VOLT.: 24 V DC. OUTPUT VOLT.: 3 - 48 V DC. LIMIT. CONTI. CURRENT: 100 mA. TRANSMISSION FREQUENCY: 300		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						kHz. LED: YELLOW. TYPE OF CONN.: SCREW CONNECTION		
622	0622		619097-02-01	12.000	EA	DIODE MODULE, EMG 45-DIO 8E-1N5408 WITH 8 DIODES, INDIVIDUALLY WIRED. DIODE TYPE 1N 5408. OPER. VOLT.: MAX. 250 V AC. CURRENT PER DIODE: 1 (1.5) A. TEMP.: -20°C / +50°C. L X W X H: 75 X 45 X 55 mm.		
650	0650	01	2197095-29-03	4.000	EA	Master Control Station Server PC Kontron PxV206, 19", 2HE Pentium 4, 3,0 GHz; 256 MB DDR; 1 GB RAM Removable HDD 36GB SCSI; ATAPI 5,25" Multinorm DVD		
652	0652		619095-63-11	1.000	EA	MONITOR, 17" TFT, 1280 X 1024 482.6 MM (19") X 8 HE FRONT PLATE IN LIGHT GREY RAL 7035 , OSD WITH PROTECTION GLASS BRIGHTNESS: 230 cd/m2 COLOUR: 16.7 MIO. VIEWING ANGLE (H/V): 170° / 170° CONTRAST RATIO: 400:1 INPUT VOLT.: 100 - 240 V AC VIDEO INPUT ANALOG RGB 15 PIN D-SUB		
656	0656		619095-70-11	1.000	EA	INDUSTRY KEYBOARD, TKS-088a IN 19"-DRAWER WITH TOUCHPAD TYPE: TKS-088a-TOUCH-SCHUBL-PS/2-US NO. OF KEY: 88 INTERFACE: PS/2 ; US-LAYOUT PROTECTION: IP 65 OPER. TEMP.: 0°C / +50°C SIZE: 482.6 x 43.5 x 280 mm (19" , 1 HE) FRONT PLATE: ALUMINIUM		
660	0660		619095-13-24	4.000	EA	INTEL PRO/100S SERVER ADAPTER IEEE STANDARD/NETWORK TOPOLOGY: 10BASE-T, 100BASE-TX		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						WIRING AND CONNECTORS: CAT-5, 2 PAIR, RJ45 ORDER CODE: PILA8470C3		
661	0661		619095-64-03	1.000	EA	AutoView 1515 KVM SWITCH, 8 PORTS FOR 2 USERS WITH OSD INCL. RACK MOUNT OPER. VOLT.: 100 - 240 VAC, 50/60 Hz POWER INPUT: MAX. 40 W OPER. TEMP.: +10°C / +50°C W X H X D: 431.8 X 44.4 X 279.4 mm		
662	0662		619095-64-03-98	4.000	EA	INTEGRATED ACCESS CABLE, 3 ME TYPE: PS/2 CAT 5-IAC		
663	0663		619095-11-42-01	2.000	EA	MANAGED INDUSTRIAL ETHERNET SWITCH LAYER 2 SWITCH WITH SOFTWARE ENHANCED, ETHERNET (10 MBIT/S) AND FAST ETHERNET (100 MBIT/S). TYPE: RS20-1600T1T1SDAEHH01.0. PORT TYPE & QTY.: 16 X 10/100BASE-TX, TP CABLE, RJ45 SOCKETS, AUTO- CROSSING, AUTO-NEGOTIATION, AUTO-POLARITY. OPER. VOLT.: 24 V DC DIAGNOSTICS: LED MTBF: 23.4 YEARS; MIL-HDBK 217F: GB 25°C MOUNTING: DIN RAIL 35 mm W X H X D: 110 X 131 X 111 mm APPR.: CUL 508, CUL 1604 & GER. LLOYD.		
664	0664		619095-11-34-01	2.000	EA	AUTO-CONFIGURATION ADAPTER, ACA 21-USB SAVES 2 DIFFERENT VERSIONS OF CONFIGURATION DATAS AND OPERATING SOFTWARE FROM THE CONNECTED SWITCH. IT ENABLES MANAGED SWITCHED TO BE EASILY COMISSIONED & QUICKLY REPLACED. MOUNTING: PLUG-IN MODULE		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						LENGTH: 20 cm. APPR.: CUL 508, CUL 1604, CUL 60950 & GER. LLOYD.		
665	0665		619095-11-43	2.000	EA	ENTRY LEVEL INDUSTRIAL ETHERNET RAIL SWITCH, STORE AND FORWARD SWITCHING MODE, ETHERNET (10 MBIT/S) AND FAST ETHERNET (100 MBIT/S). TYPE: SPIDER 5TX PORT TYPE & QTY.: 5 X 10/100BASE-TX, TP CABLE, RJ45 SOCKETS, AUTO- CROSSING, AUTO-NEGOTIATION, AUTO-POLARITY. OPER. VOLT.: 9.6 - 32 V DC DIAGNOSTICS: LED MTBF: 123.7 YEARS; MIL-HDBK 217F: GB 25°C MOUNTING: DIN RAIL 35 mm W X H X D: 25 X 114 X 79 mm APPR.: CUL 508 (E175531)		
666	0666		619091-03-14	2.000	EA	CONVERTER, FIBER OPTIC, 24 V DC TYPE: FL MC 10/100 BASE-T/FO G1300ST NOM. SUPPLY VOLT.: 24 V DC +/- 20%. CURRENT CONSUMPTION: MAX. 95 mA. ELEC. ISOLATION: 10/100Base-T // SUPPLY. PROTECTION: IP 20. TEMP.: 0°C / +55°C. HOUSING: PA V0 , GREEN. L X H X W: 99 X 122 X 22.5 mm. FOR CONVERTING 10/100 BASE-T(X) TO MULTIMODE GLASS FIBER (1300 mm), B-FOC (ST) FO CONNECTION, RAIL-MOUNTABLE. CONFORMANCE WITH EMC DIRECTIVE 89/336/EEC.		
672	0672		619095-68-01	8.000	EA	PATCH CABLE, SCREEN, 3 ME, GREY SPLASHED SPOUT , HALOGEN FREE AND		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						FIRE RESISTANT		
674	0674		619095-68-02	123.000	EA	PATCH CABLE, SCREEN, 5 ME, GREY SPLASHED SPOUT , HALOGEN FREE AND FIRE RESISTANT		
675	0675		619095-68-20	2.000	EA	PATCH CABLE, FTP CROSSOVER, 0.3 ME - CATEGORY 5E, CLASS D+, 10/100/1000 BaseT SUPPORT LENGTH: 0.3 ME GREY WITH RED CONNECTOR ALTERNATIVE: VENDOR: ZAJADACZ MANUFACTURER: ELCOTRONIC LENGTH: 0,5ME COLOR: RED CONNECTOR: BLACK/RED		
676	0676		619088-02-29	2.000	EA	TERMINAL BOX, FL CAT5 PASSIVE COONECTION FIELD, 4 X SCREW TERMINAL BLOCK ON RJ45 FEMALE CONNECTOR, PIN ASSIGNMENT 1,2,3,6, SHIELD CONTACTING TO MOUNTING RAIL, (MINI PATCH FIELD) AS AN ALTERNATIVE TO ON-SITE ASSEMBLY WITH PRE-ASSEMBLED RJ45 PATCH CABLES.		
700	0700		619084-04-36	20.000	EA	CBL MOUNTING HOLE,W=14.2MM,L=23.4MM TRANSPARENT NATURAL NYLON		
701	0701		619084-04-42	100.000	EA	CABLE TIE HOLE,W=25MM,L=32MM TYPE: 8-G1 S TRANSPARENT NATURAL NYLON		
702	0702		619084-04-35	20.000	EA	CBL MOUNTING HOLE,W=11.1MM,L=17MM TRANSPARENT NATURAL NYLON		
703	0703		619084-06-71	2.000	ME	CABLE CONDUIT 110 X 60 X 2000 MM TYPE: FB 60110 COLOUR: GREY RAL 7035 MATERIAL: PVC-HARD		
704	0704		619084-06-15	4.000	ME	CABLE DUCT, 40 X 60 MM, SLOTED		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						CABLE DUCT WITH COVER SIZE: 40 X 60 MM, SLOTED COLOUR: GREY (RAL 7030) MATERIAL: PVC-HARD		
705	0705		619084-06-65	12.000	ME	CABLE DUCT, 85 X 47 X 2000 MM, PPO TYPE: BA6 80040 H X W X L: 85 X 47 X 2000 MM TEMP.: -40°C / +125°C MATERIAL: POLYPHENYLENOXIDE (PPO) COLOUR: GREY RAL 7035		
706	0706		619095-01-54	100.000	EA	SCREW, PHILLIPS-HEAD, M6 x 16 mm WITH PLASTIC WASHER CAPTIVE NUT M6 USE PN 619095-01-55.		
707	0707		619084-25-01-02	20.000	EA	SPIRAL HOSE, 15 X 18 X 1000 MM LG. TYPE: SPF15 , HALOGEN FREE TEMP.: -30°C / +100°C ; BLACK MATERIAL: POLYPROPYLENE (PP) RESISTANCE: OIL, GREASE, SOLVENT, PETROL AND FIRE RETARDANT		
708	0708		619087-02-06-01	100.000	ME	WIRE, FLEX. H07Z-K, 1.5 mm2, BLACK HALOGEN-FREE SINGLE CORE , FLEXIBLE NOM. VOLT.: 450 / 750 V TEMP.: -40°C / +110°C ; OD: 3.5 mm FINE WIRE STRANDS, CORE INSULATION OF HALOGEN-FREE SPECIAL COMPOUND, FLAME RETARDANCE IN ACC. TO IEC 60332.1 UP TO IEC 60332.3. APPROVAL: VDE 0282 PART 9 / HD 22.9 S1		
709	0709		619087-02-06-02	100.000	ME	WIRE, FLEX. H07Z-K, 2.5 mm2, BLACK HALOGEN-FREE SINGLE CORE , FLEXIBLE NOM. VOLT.: 450 / 750 V TEMP.: -40°C / +110°C ; OD: 3.8 mm FINE WIRE STRANDS, CORE INSULATION		

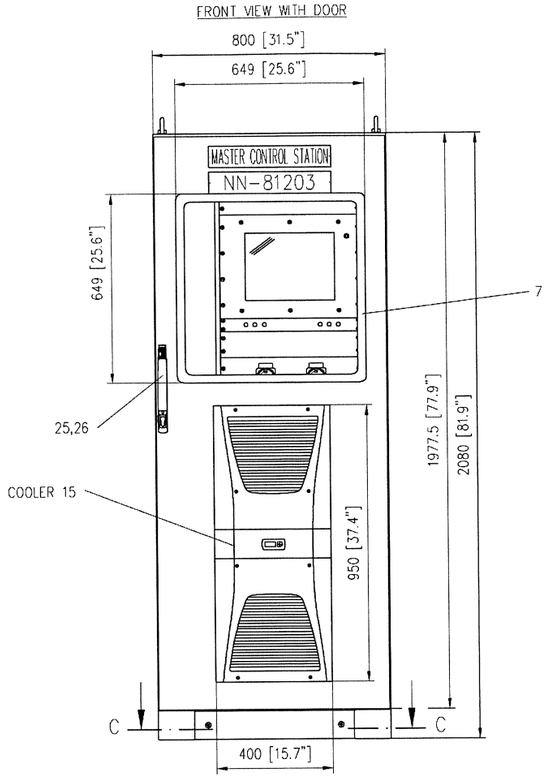
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						OF HALOGEN-FREE SPECIAL COMPOUND, FLAME RETARDANCE IN ACC. TO IEC 60332.1 UP TO IEC 60332.3. APPROVAL: VDE 0282 PART 9 / HD 22.9 S1		
710	0710		619087-02-03-01	10.000	ME	WIRE, FLEX. H07Z-K, 1.5 mm2, GN/YE HALOGEN-FREE SINGLE CORE , FLEXIBLE NOM. VOLT.: 450 / 750 V TEMP.: -40°C / +110°C ; OD: 3.5 mm FINE WIRE STRANDS, CORE INSULATION OF HALOGEN-FREE SPECIAL COMPOUND, FLAME RETARDANCE IN ACC. TO IEC 60332.1 UP TO IEC 60332.3. APPROVAL: VDE 0282 PART 9 / HD 22.9 S1		
711	0711		619087-01-01-05	900.000	ME	SINGLE CORE, H05V-K, 0.5 mm2, ORANGE TYPE: H05V-K , FLAME RETARDANCE CROSS SECTION: 0.5 mm2 NOM. VOLT.: 300 / 500 V CONDUCTOR: FINE WIRE STRAND, PVC-BASED CORE INSULATION. COLOUR: ORANGE ; OD.: 2.1 mm. CONFORM TO EEC DIRECTIVE 73/23 CE.		
712	0712		619087-02-05-01	10.000	ME	WIRE, FLEX. H07Z-K, 6.0 mm2, GN/YE HALOGEN-FREE SINGLE CORE , FLEXIBLE NOM. VOLT.: 450 / 750 V TEMP.: -40°C / +110°C ; OD: 5.4 mm FINE WIRE STRANDS, CORE INSULATION OF HALOGEN-FREE SPECIAL COMPOUND, FLAME RETARDANCE IN ACC. TO IEC 60332.1 UP TO IEC 60332.3. APPROVAL: VDE 0282 PART 9 / HD 22.9 S1		

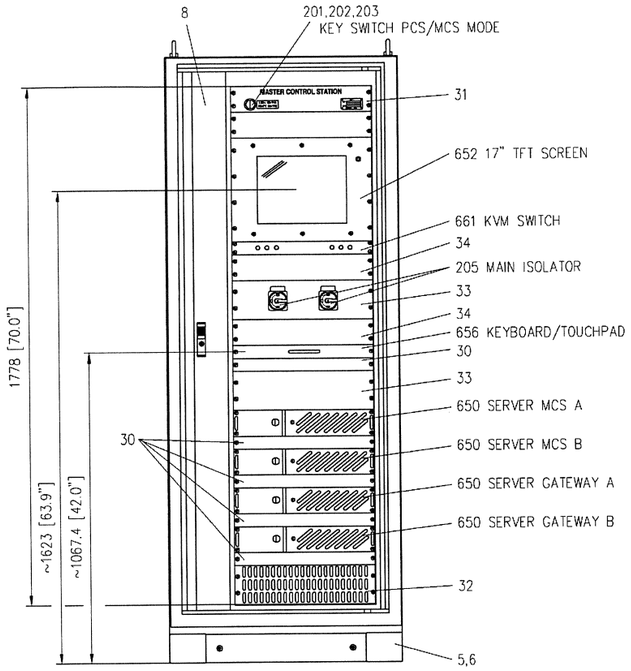
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
713	0713		619087-11-10-01	100.000	ME	CABLE, OELFLEX 110 CH, 3 G 1.5 mm2 CONTROL CABLE WITH GN/YE HALOGEN FREE, FLAME & OIL RESISTANT NOM. VOLT.: 300 / 500 V TEMP.: -30°C / +70°C ; OD: 8.9 mm COLOUR: SILVER GREY (RAL 7001) CONDUCTOR STRANDING: FINE WIRE IN ACC. TO VDE 0295, CLASS 5 / IEC CL.5 SCREENED BRAID OF TINNED COPPER WIRES WITH HIGH COVERAGE. LICENCE: IEC 60 332.3 / CEI 20.22		
720	0720		619044-73	4.000	ME	CABLE CONDUIT, 36 mm OD, POLYTHENE		
721	0721		619044-66	4.000	EA	HOLDER FOR CABLE CONDUIT DIA. 36 mm MATERIAL: POLYAMIDE		
750	0750		619088-36-03-01	1600.000	EA	TM-I MULTICARD, WHITE TYPE: TM-I 20 NEUTRAL TEMP.: -40°C / +100°C COLOUR: WHITE MATERIAL: POLYAMIDE FIRE PROTECTION CLASS UL 94: V2 MARKING SYSTEM POSSIBLE: PLOTTER, SMARK-LASER, MC-MOBILO		
752	0752		619088-03-00-15	800.000	EA	WIRE HULL, 0.75 - 6.0 MM2 TYPE: PT SLIM 1-20 CROSS SECTION: 0.75 - 6.0 MM2 OD.: 2.5 - 5.0 MM X 21 MM LG. TEMP.: -30°C / +60°C COLOUR: TRANSPARENT MATERIAL: PVC FIRE PROTECTION CLASS UL 94: V2 MARKING SYSTEM POSSIBLE: TAG MOUNTING TIP: TM-I, PF AND X-CARD		
757	0757		619088-03-45	20.000	EA	TERMINAL STRIP MARKER, 25 x 6 mm TYPE: KLM (10 04 30 6) SNAPS ONTO		

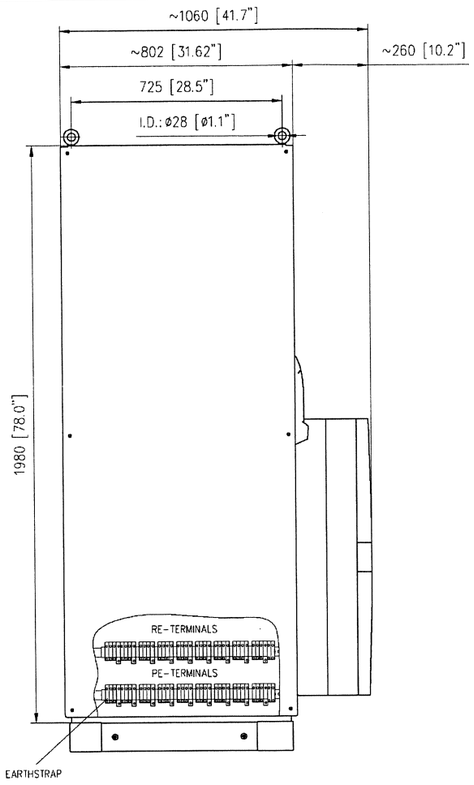
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						END BRACKET E/UK OR CLIPFIX 35, LETTERING AREA 25 x 6 mm INCL. INSERT STRIP FOR LASER PRINTER TYPE: ESL 26 x 6 (08 08 10 5)		
763	0763		619084-10-07-01	100.000	EA	CABLE MULTICORE END, 6 MM2, GREEN DESIGN: NORMAL CROSS SECTION: 6 MM2 LENGTH: 20 MM ; COLOUR: GREEN		
764	0764		619084-10-13	50.000	EA	TUBULAR CABLE-LUG, 16 QMM / M 8 CROSS SECTION: 16 QMM BORE DIAMETER: 8 MM MATERIAL: E-COPPER SURFACE: TIN PLATED		
765	0765		619084-10-16-09	200.000	EA	CABLE, END-SLEEVE, 2X0.5 MM2, 15 MM TWIN CABLE END-SLEEVE PRE-INSULATED CROSS SECTION: 2 X 0.5 MM2 LENGTH: 15 MM ; COLOUR: WHITE MATERIAL: COPPER , TIN PLATED		
766	0766		619084-04-43	500.000	EA	CABLE TIE,L=186MM, W=4.8MMM NYLON NATURAL, BLACK		
767	0767		619044-01-34-03	20.000	EA	CONDUCTOR CONN. CLAMP, 2.5 - 16 mm2 FOR BAR THICKNESS: 5 mm CONN. OF RD CONDUCTOR: 2.5 - 16 mm2 MATERIAL: STEEL SHEET, PASSIVATED APPR.: CE, CSA, CUL, DNV, GL & UL		
800	0800	C03	619046-43-64-01	1.000	EA	TAG, NEW LOGO (52 X 90)		
801	0801	A01	222740-00-62	1.000	EA	COMPANY TAG "50 X 100" (ONLY TO GLUE) "CAMERON CONTROLS"		
802	0802	02	223451-27	1.000	EA	T&M Assy MCS Total K5F		
851	0851		619095-12-66	2.000	EA	SOFTWARE, VISpro Basic (runtime) LR-XXL RUNTIME UNLIMITED TAGS. INCL.: MANUAL & INSTALLATION-CD		
853	0852		619095-12-66-03	2.000	EA	SOFTWARE, ViSpro User 01		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						1 ADDITIONAL USER INCL.: MANUAL and INSTALLATION-CD		
853	0853		619095-12-66-06	2.000	EA	SOFTWARE, ViSpro Connect L TCP S7 Siemens, ethernet, through standard ethernet card INCL.: MANUAL and INSTALLATION-CD		
854	0854		619095-59-01-04	2.000	EA	SOFTWARE, WINDOWS XP PROFESSIONAL ENGLISH, SB VERSION		
>>>B/M Category : Engrg Spec/Document item								
	0900	01	QP-000160-26-06	1.000	EA	Quality Plan MCS CAM Celle manufactured		
	0901	01	D-000200-27	1.000	EA	PART IDENT: LOW STRESS STAMP, SAP SHORT DESCRIPTION, ASSY P/N, REV, MFG ID, S/N Note: SAP SHORT DESCRIPTION: If test is too long, text should be abbreviated usefully! Refer document X-043764-01 for further instructions!		
	0910	03	SK-066380-25	1.000	EA	AS: MCS, K5-F		
	0911	03	SK-066380-25-04	1.000	EA	CD: MCS, K5-F		
	0914	03	X-076736-09	1.000	EA	MCS Hardware FAT, K5-F		
	0919	01	X-076709-03-80	1.000	EA	PIR MCS Total K5-F		
>>>B/M Category : Reference Call Outs								
	0915		X-076736-10	1.000	EA	MCS Software FAT, K5-F		
	0916	01	X-065467-02-07	1.000	EA	IP: MCS, K5F		
	0917		X-065438-02-70	1.000	EA	Maintenance Procedure: MCS, K5-F		
	0918	01	X-065438-02-71	1.000	EA	Operation Procedure: MCS, K5F		
	0920		SK-066380-25-42	1.000	EA	FTD for Master Control Station (MCS) K5F		
	0930		X-076734-03	1.000	EA	Hardware Design Specification: MCS, K5-F		

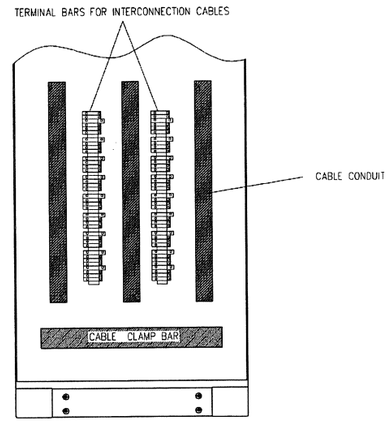
FRONT VIEW WITH DOOR



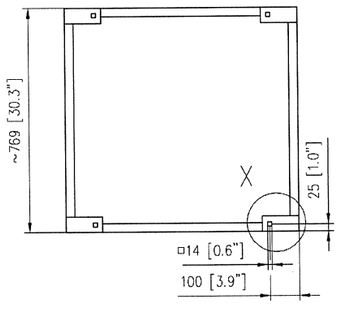


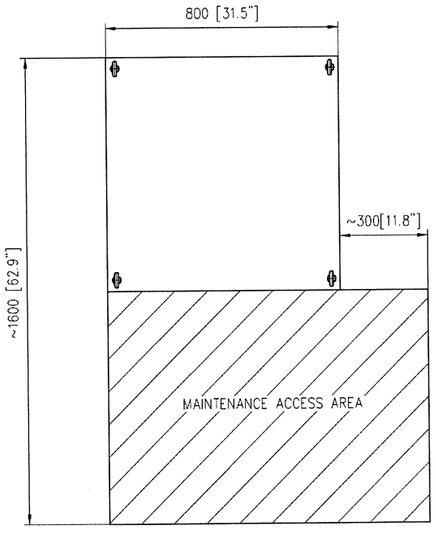


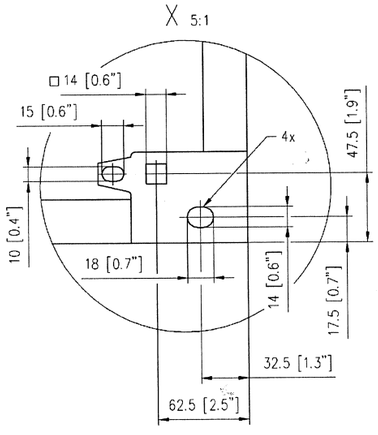
FRONT VIEW WITHOUT DOOR & SWING FRAME



C-C 4x FASTENING POINTS







NOTES:
1. CABINET COLOUR RAL7035
2. CABINETS SHIPPED WITH INTERNAL MODULES REMOVED TO PREVENT DAMAGE TO CABINET SWING FRAME OR MODULES.
3. MAX. STORAGE HUMIDITY 95% NOT CONDENSED
   MAX. STORAGE TEMPERATURE: -20°C TO 60°C.
   MAX. OPERATION HUMIDITY 20-80%
   MAX. OPERATING TEMPERATURE: -5°C TO 40°C.

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

2 SET CUSTOMER REV. "2 APPROVED FOR CONSTRUCTION"; ADD TAG, DETAIL DESCRIPTION

REASON FOR ISSUE	DATE	CLIENT REV.
REISSUED AS APPROVED FOR CONSTRUCTION	27MAR08	2
APPROVED FOR CONSTRUCTION	26JUL07	1
ISSUED FOR CLIENT COMMENT	17APR07	N/A
ISSUED FOR INTERNAL IDC	13MAR07	N/A

03

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-03-501

CAD | REV. BY: A. Siekmann | DATE: 27.03.2008 | REV.: 03

SURFACE TREATMENT | DO NOT SCALE

TOLERANCES ACCORDING TO DIN ISO 8015
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

MATERIAL AND HEAT TREATMENT

DRAWN: A. Siekmann DATE: 13.03.2007
CHECKED: A. Voges DATE: 27.03.2008
APPROVED: A. Weilandt DATE: 27.03.2008

EST. WEIGHT: 365 KG | SUPERSEDES: | SCALE: 1:10

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

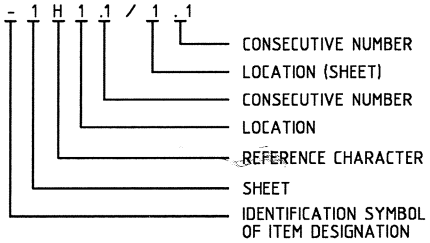
ASSEMBLY DRAWING
MASTER CONTROL STATION
(PC BASED SYSTEM)

INITIAL USE BOM: 223380-25 | SHEET: 1 OF 1 | DRAWING NUMBER: SK-066380-25

STATUS: APPROVED

SHEET	DESIGNATION
1	POWER DISTRIBUTION, COOLING, HEATING SYSTEM
2	MCS A, KVM SWITCH, HMI
3	MCS B
4	OPC GATEWAY A
5	OPC GATEWAY B
6	MCS ETHERNET NETWORK
7	OPC ETHERNET NETWORK
8+9	PLC A
10+11	PLC B
12-29	DIGITAL INPUT SIGNALS
30-39	DIGITAL OUTPUT SIGNALS

ITEM DESIGNATION



STANDARDS:
-ALL INSTALLATION SHALL BE IN ACCORDANCE WITH VDE 0100.
-ALL ELECTRIC SYMBOLS SHALL BE IN ACCORDANCE WITH IEC 617.

NOTES:
-SEPARATE LAYING OF POWER AND SIGNAL CABLES AND WIRING.
-ALL WIRINGS IN 1.5mm^2, (IF NOT SPECIFIED OTHERWISE).
-ALL WIRING HAS TO BE MARKED WITH CABLE MARKERS ON EVERY CONNECTION.
-ALL CABLES HAVE TO BE TAGGED AT BOTH ENDS (SST).
-ALL -X10 AND -X20 TERMINALS SHALL BE LOOPED (24V DC).
-ALL -X11 AND -X21 TERMINALS SHALL BE LOOPED (0V DC).
-ALL RE-TERMINALS SHALL BE LOOPED WITH TERMINAL BRIDGES AND/OR BLACK-COLOURED WIRES.
-THE LAST RE-TERMINALS HAVE TO BE CONNECTED WITH A RED MARKED, GREEN/YELLOW-COLOURED WIRE TO PE AT ONE SINGLE POINT.
-ALL IE-TERMINALS SHALL BE LOOPED WITH TERMINAL BRIDGES AND/OR BLUE-COLOURED WIRES.
-THE LAST IE-TERMINALS HAVE TO BE CONNECTED WITH A BLUE MARKED, GREEN/YELLOW-COLOURED WIRE TO PE AT ONE SINGLE POINT.
-CABLE SPLICING SHOULD BE AVOIDED.
-CABLE GLANDS FOR INTERCONNECTION CABLES HAVE TO BE INSTALLED DURING INSTALLATION (NO CUT OUTS PROVIDED).
-CABLE GLANDS NOT IN SCOPE OF SUPPLY.
-ALL METAL COMPONENTS (MOTOR HOUSINGS, CABLE TRAYS, J-BOXES, CABINETS, DOORS ENCLOSURE, ...) WHICH CARRY COMPONENTS WITH VOLTAGES 50V AC /120V DC OR HIGHER MUST BE GROUNDED TO THE CONSTRUCTION (EARTH) WITH A COPPER CONDUCTOR. MINIMUM CROSS SECTION OF THE CONDUCTOR SHALL BE 6mm^2.

REASON FOR ISSUE	DATE	CLIENT REV.
AS BUILT	12JUN09	4
AS BUILT	07APR09	3
APPROVED FOR CONSTRUCTION	18MAR08	2
APPROVED FOR CONSTRUCTION	14AUG07	1
ISSUED FOR CLIENT COMMENT	10MAY07	N/A
ISSUED FOR INTERNAL IDC	26FEB07	N/A

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-61-501

Created with ELCAD/AUCOPLAN (R) 7.4.0 SP1

STATUS: APPROVED

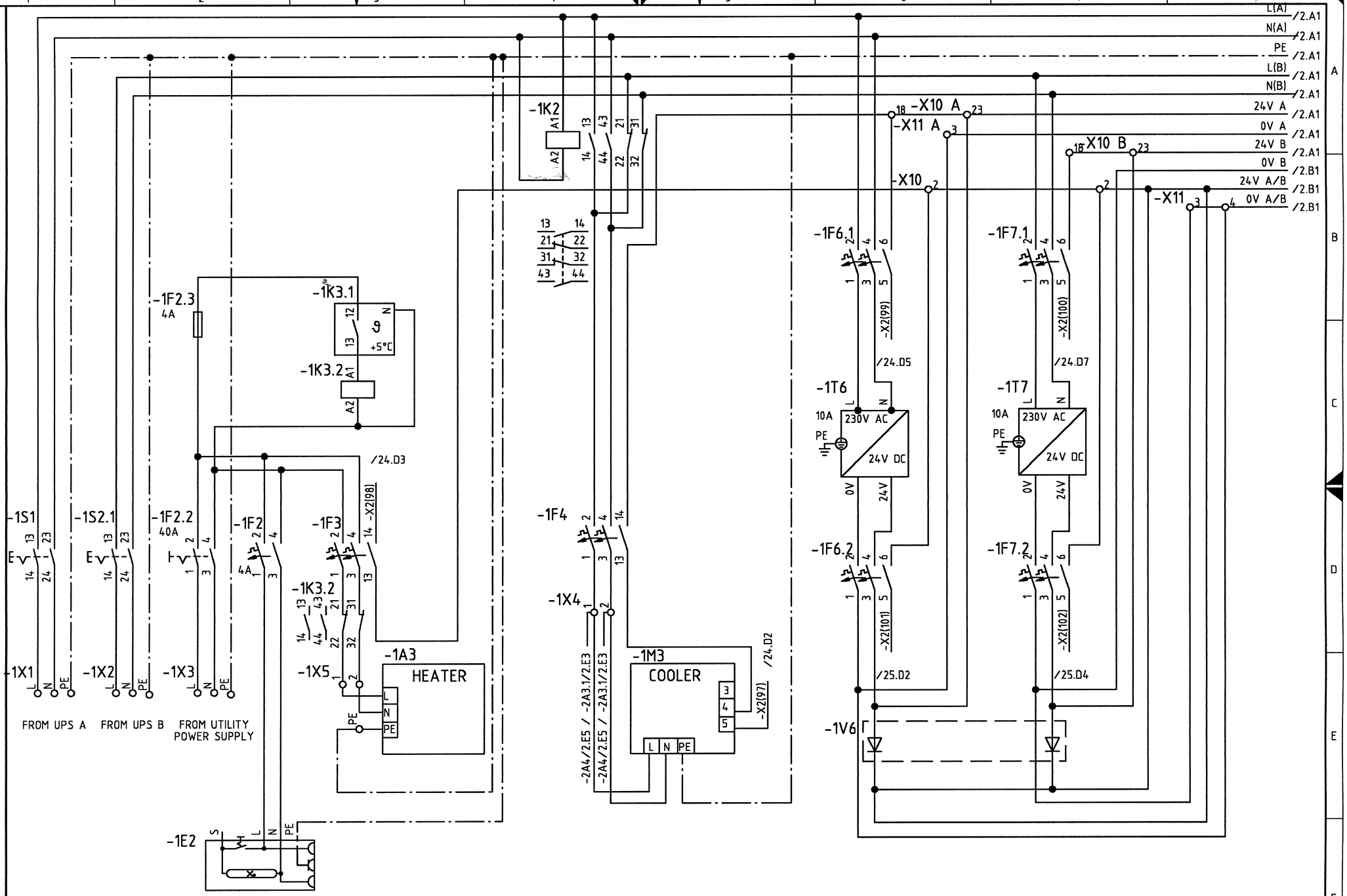
Rev	Change	Date	Created by	Checked by	Approved by
05	Minor Revision	12.06.2009	A. Siekmann	A. Voges	M. Langenstraß
02	Major Revision	07.08.2007	A. Siekmann	A. Voges	M. Langenstraß
01	Initial Release	11.05.2009	A. Siekmann	M. Langenstraß	A. Voges

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Master Control Station
Table of Contents

BOM NO.: 223380-25
Project/Customer: TOTAL / K5F
Document ID: SK-066380-25-04
Sheets: 1 of 1 Sh.



Created with ELCAD/AUCOPLAN (R) 7.4.0 SP1

STATUS: APPROVED

Rev	Change	Date	Created by	Checked by	Approved by
05	Minor Revision	12.06.2009	A. Siekmann	A. Voges	M. Langenstraß
02	Major Revision	07.08.2007	A. Siekmann	A. Voges	M. Langenstraß
01	Initial Release	11.05.2009	A. Siekmann	M. Langenstraß	A. Voges

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

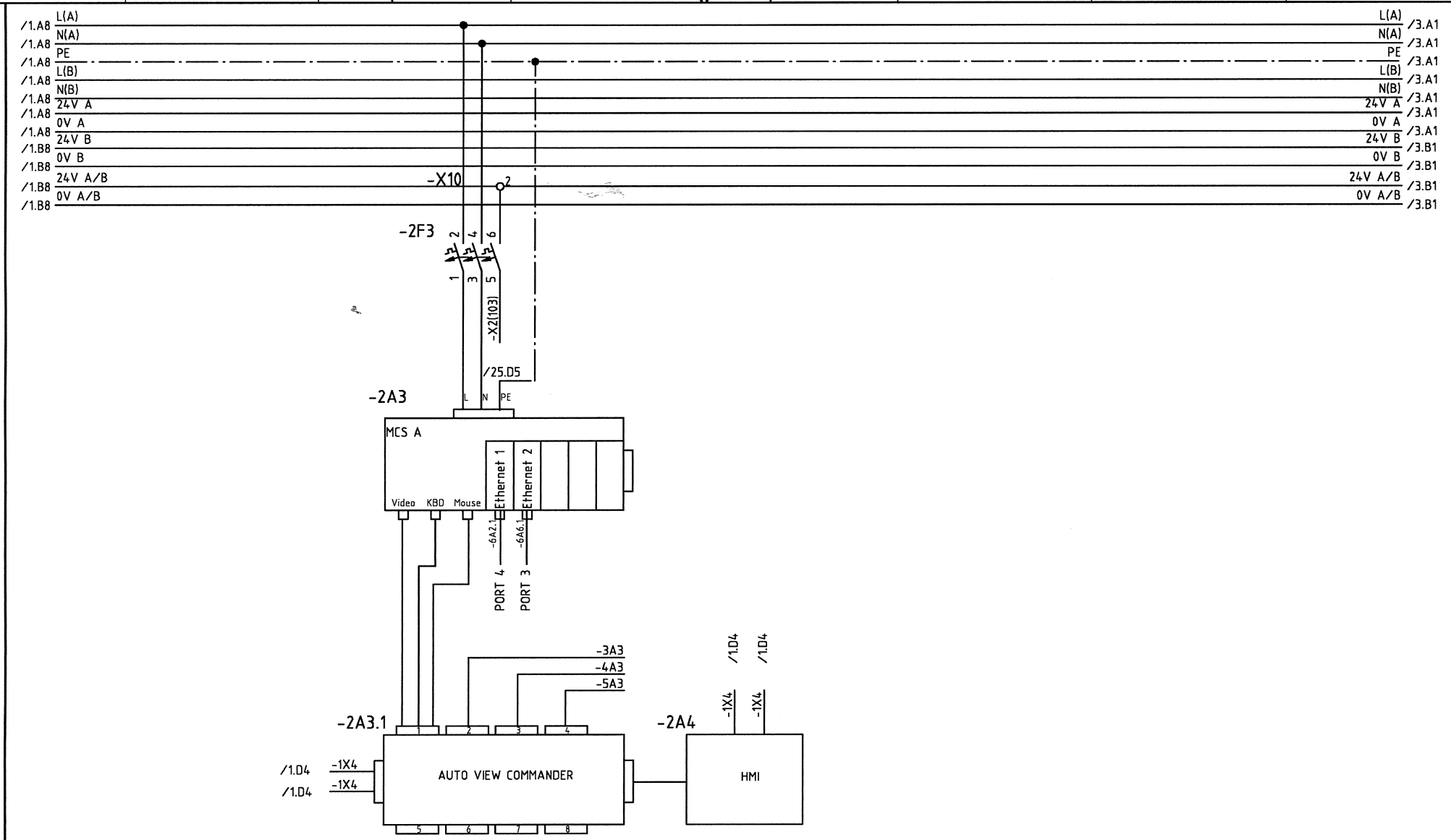
Master Control Station
Circuit diagram

BOM NO.: 223380-25

Project/Customer: TOTAL / K5F

Document ID: SK-066380-25-04

Sheets: 1 of 39 Sh.



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Rev	Change	Date	Created by	Checked by	Approved by
05	Minor Revision	12.06.2009	A. Siekmann	A. Voges	M. Langenstraß
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Project/Customer: TOTAL / K5F

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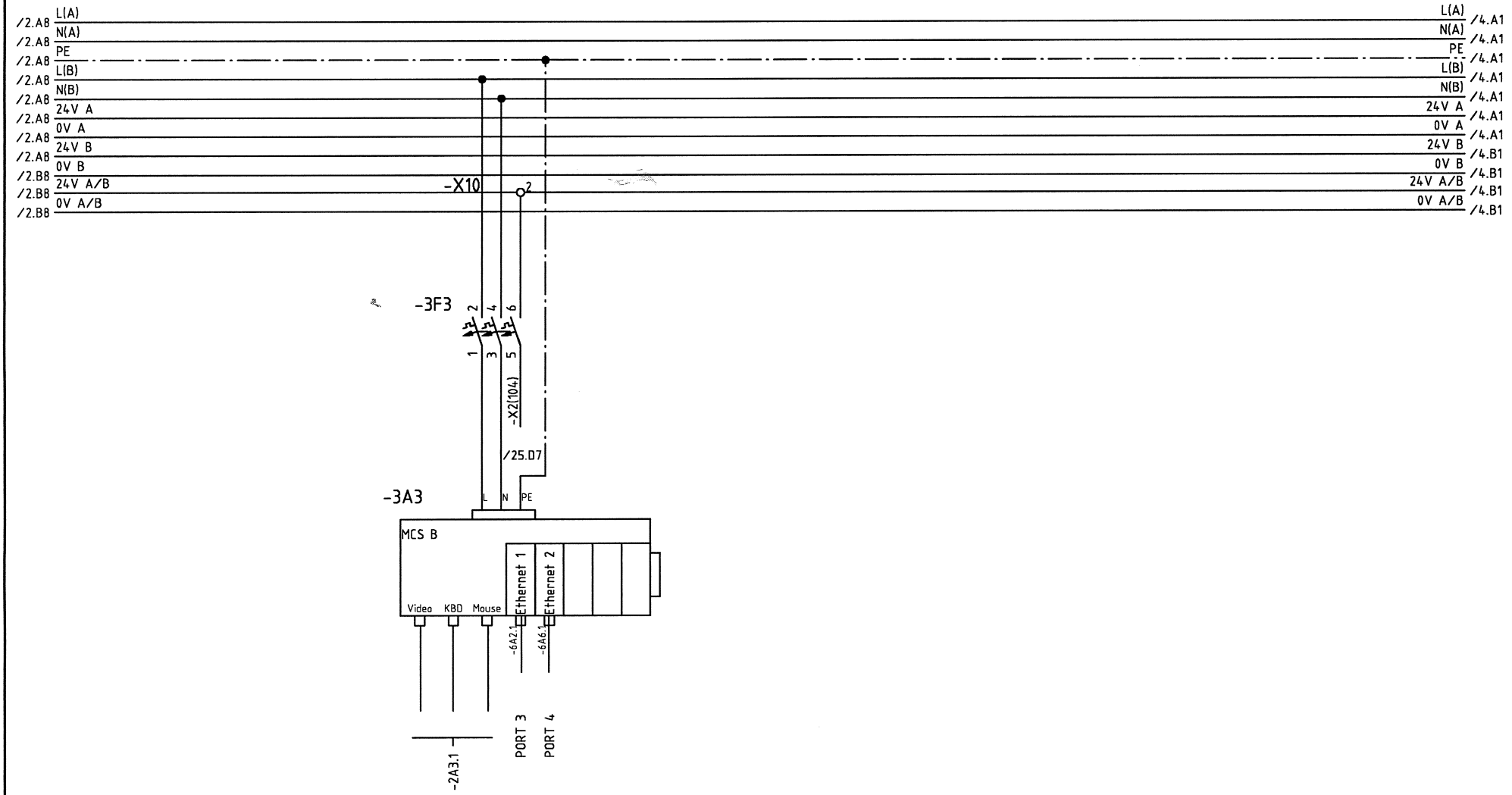

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STATUS: APPROVED

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Project/Customer: TOTAL / K5F

Document ID: SK-066380-25-04

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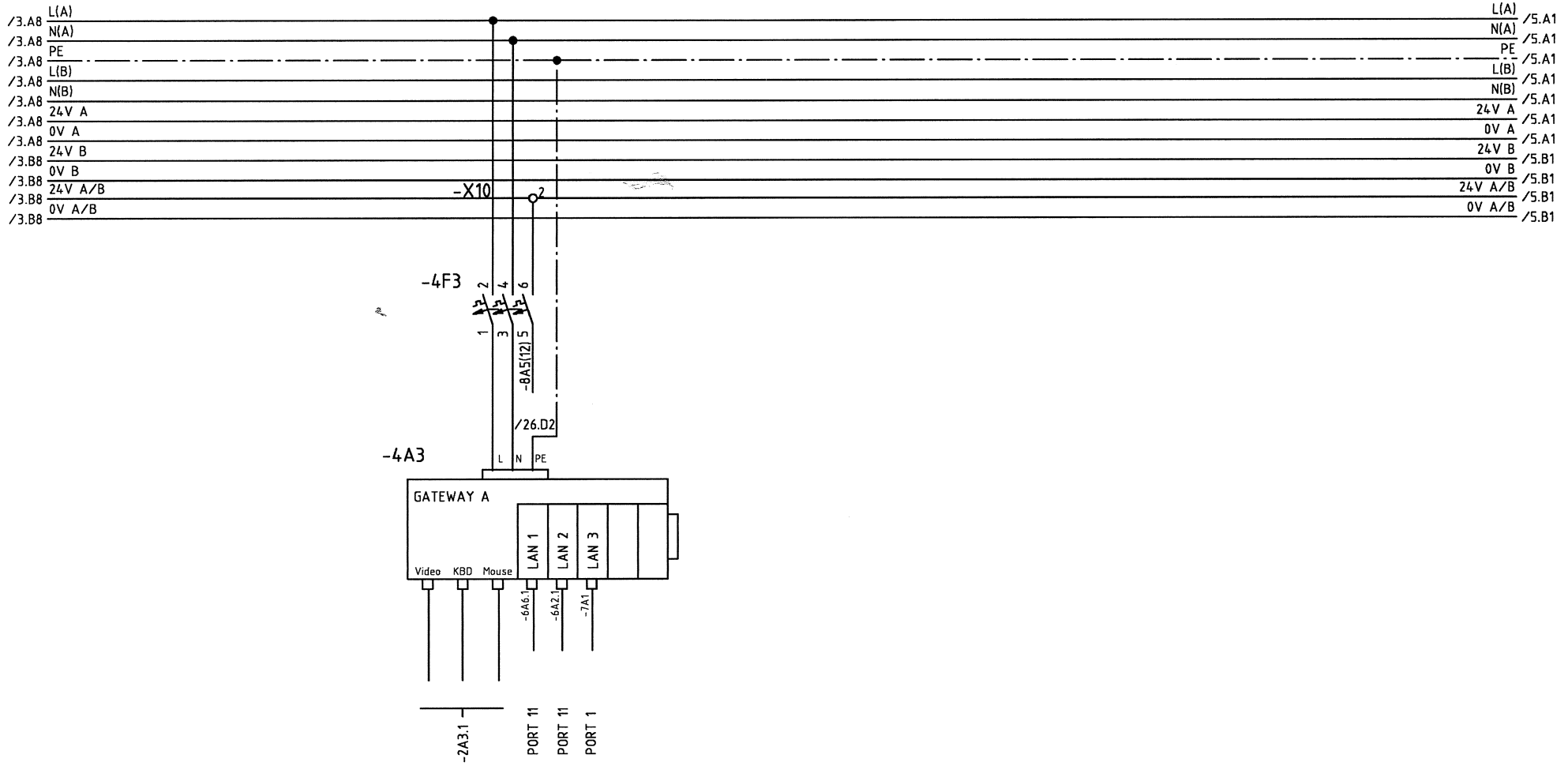

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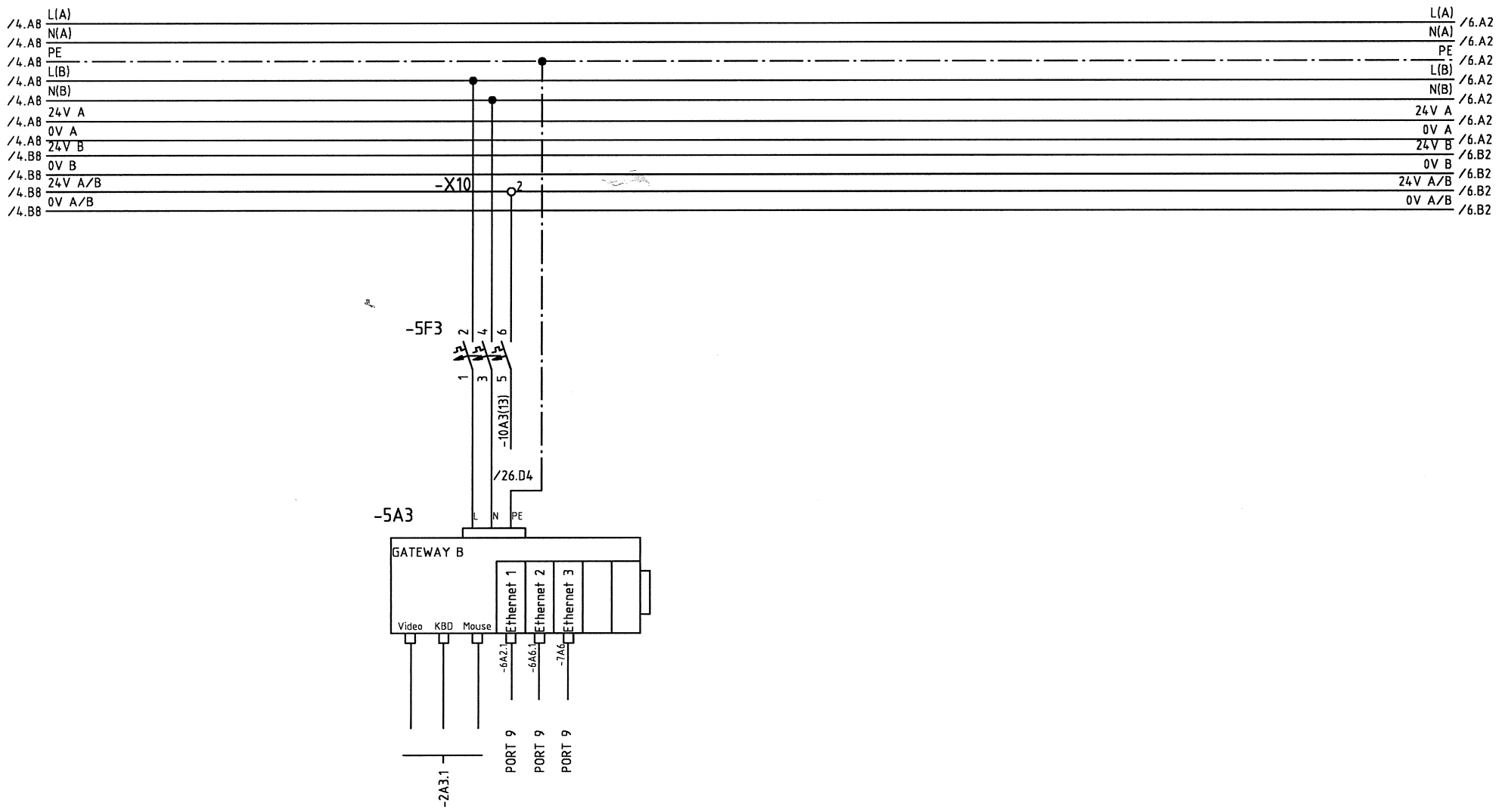

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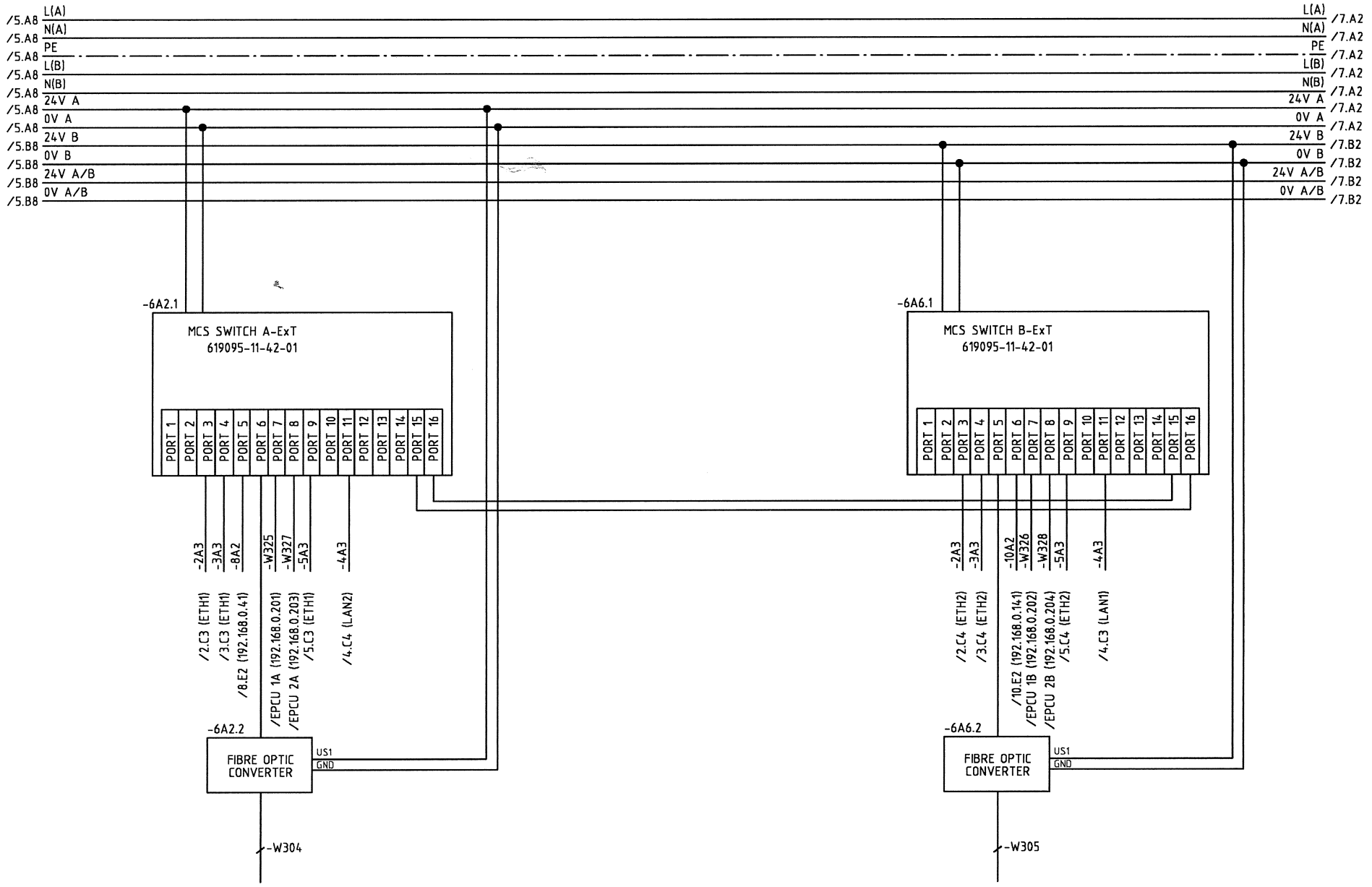

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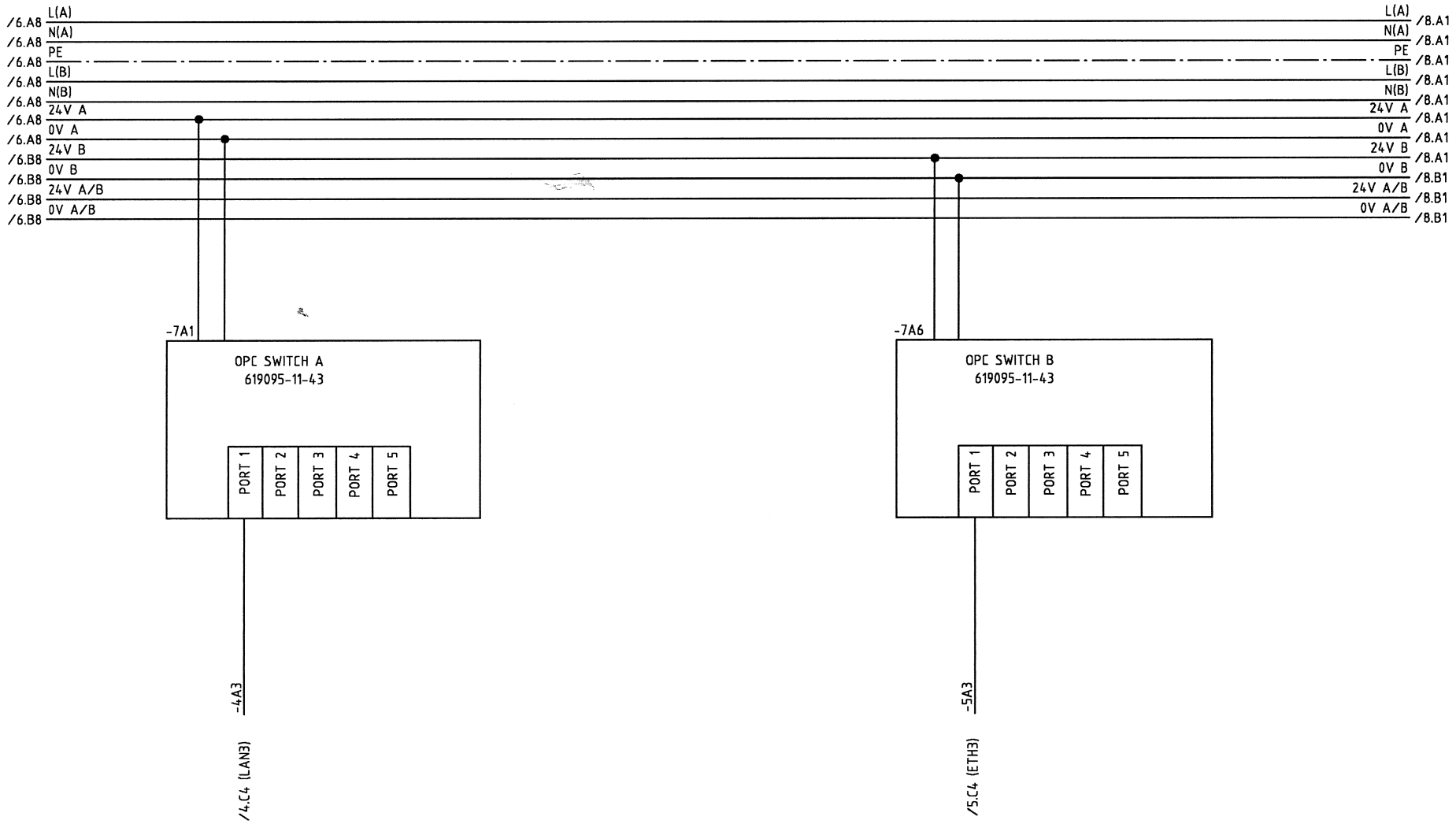
Sheets: 6 of 39 Sh.



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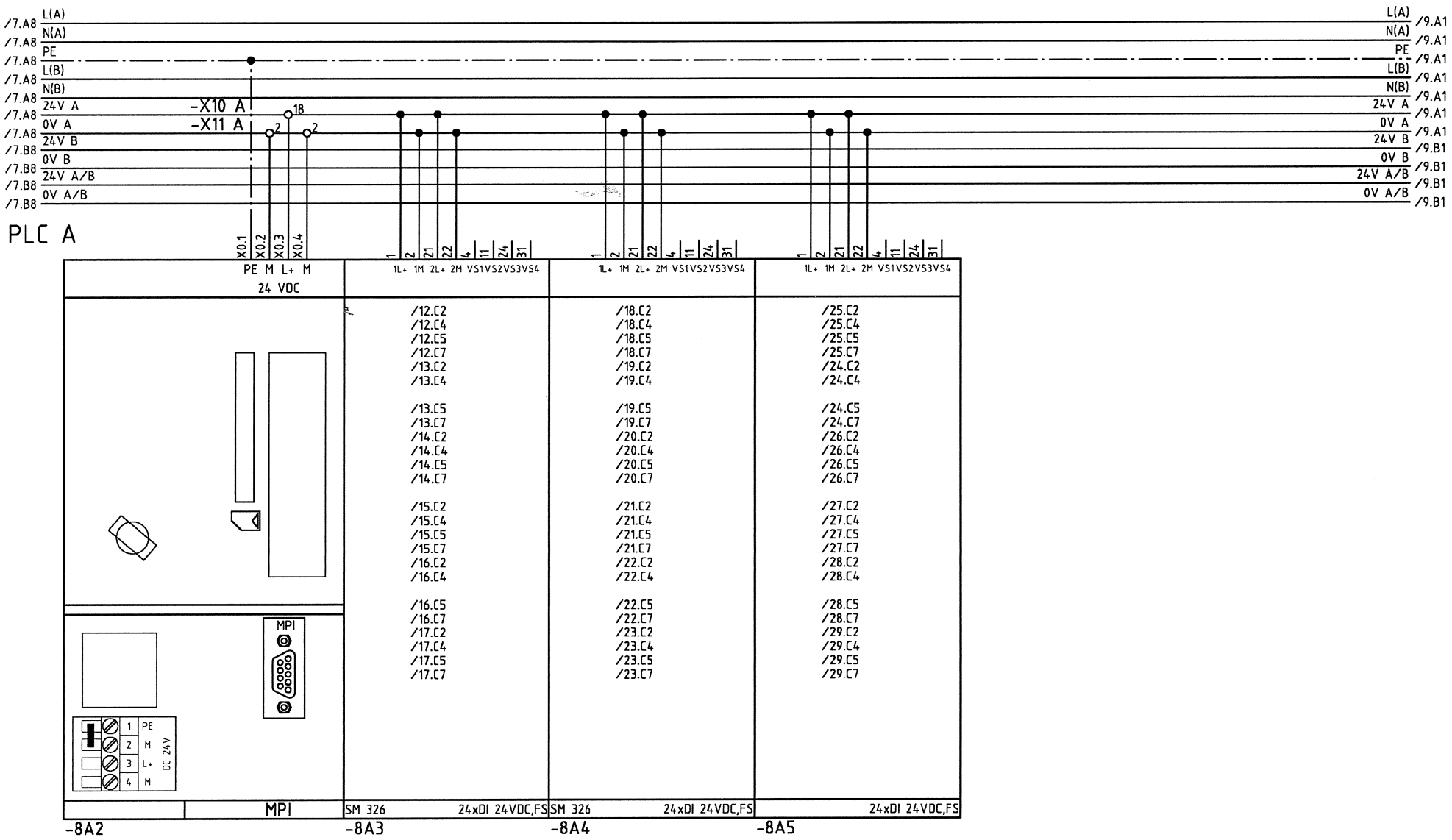

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Document ID: SK-066380-25-04

Sheets: 8 of 39 Sh.

STATUS: APPROVED

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Sheets: 9 of 39 Sh.

/8.A8 L(A) — L(A) /10.A1
/8.A8 N(A) — N(A) /10.A1
/8.A8 PE — PE /10.A1
/8.A8 L(B) — L(B) /10.A1
/8.A8 N(B) — N(B) /10.A1
/8.A8 24V A — 24V A /10.A1
/8.A8 0V A — 0V A /10.A1
/8.A8 24V B — 24V B /10.A1
/8.A8 0V B — 0V B /10.B1
/8.B8 24V A/B — 24V A/B /10.B1
/8.B8 0V A/B — 0V A/B /10.B1

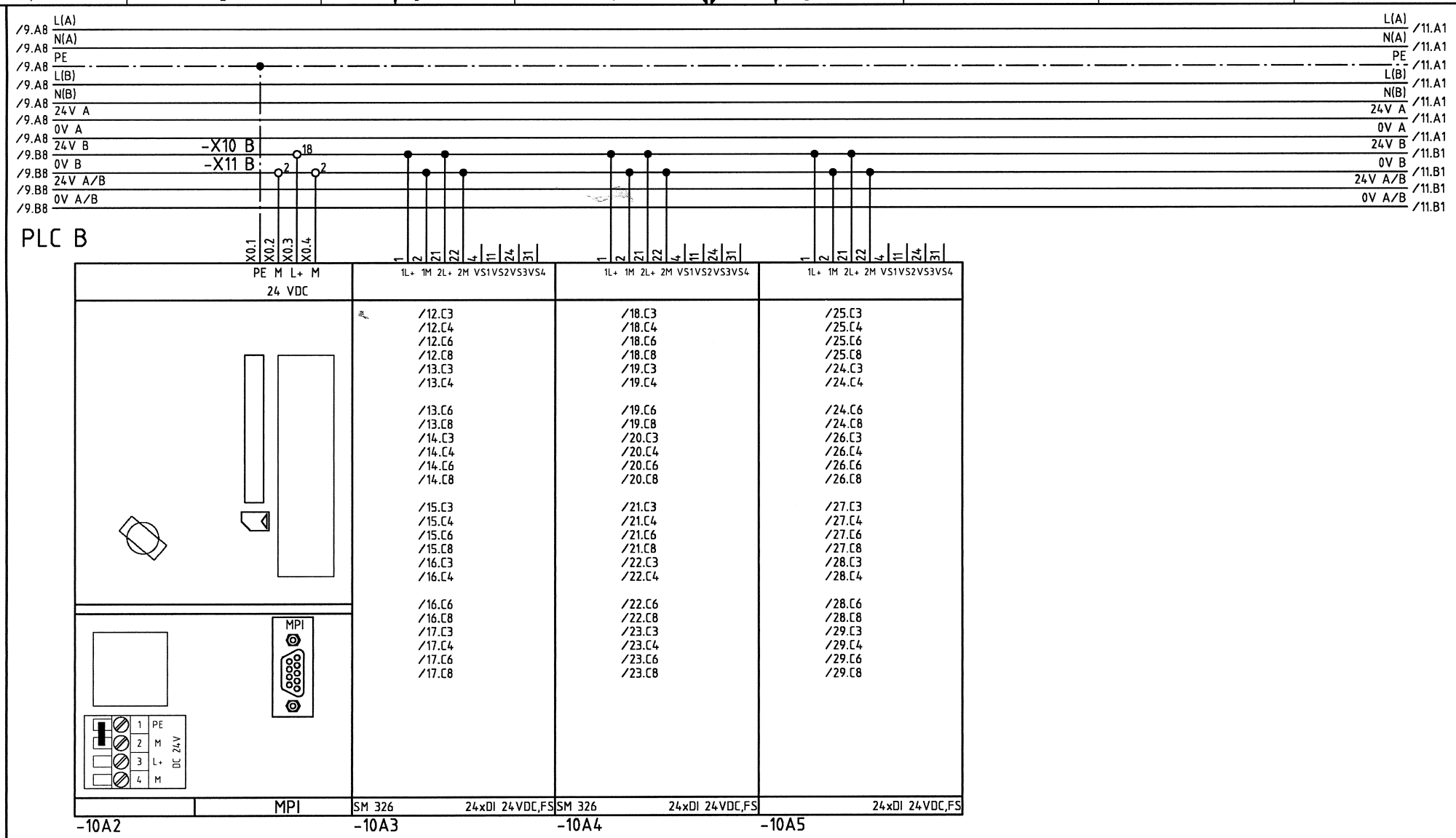
PLC A

-X10 A 17 / -X11 A 1 → -9A3 10 (L+) 20 (M)

-X10 A 17 / -X11 A 1 → -9A4 10 (L+) 20 (M)

-X10 A 19 / -X11 A 3 → -9A5 10 (L+) 20 (M)

-9A3 L+ M	-9A4 L+ M	-9A5 L+ M
/30.C2	/33.C3	/36.C5
/30.C3	/33.C5	/36.C6
/30.C5	/33.C6	/36.C7
/30.C6	/33.C7	/37.C2
/30.C7	/34.C2	/37.C3
/31.C2	/34.C3	/37.C5
/31.C3	/34.C5	/37.C6
/31.C5	/34.C6	/37.C7
/31.C6	/34.C7	/38.C2
/31.C7	/35.C2	/38.C3
/32.C2	/35.C3	/38.C5
/32.C3	/35.C5	/38.C6
/32.C5	/35.C6	/38.C7
/32.C6	/35.C7	/39.C2
/32.C7	/36.C2	/39.C3
/33.C2	/36.C3	/39.C5
SM 322 16xREL24/48VUC	SM 322 16xREL24/48VUC	16xREL24/48VUC



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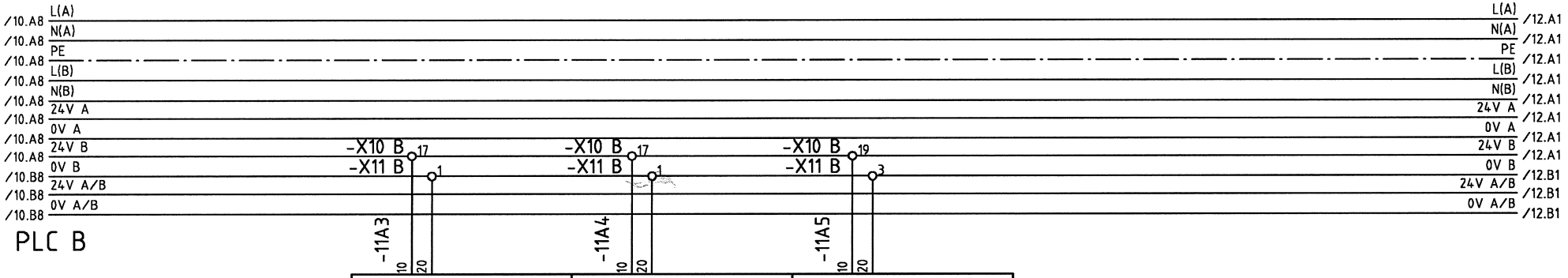
Document ID: SK-066380-25-04

Sheets: 10 of 39 Sh.



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/30.C4	/33.C5	/36.C7
/30.C5	/33.C7	/36.C8
/30.C7	/33.C8	/37.C2
/30.C8	/34.C2	/37.C4
/31.C2	/34.C4	/37.C5
/31.C4	/34.C5	/37.C7
/31.C5	/34.C7	/37.C8
/31.C7	/34.C8	/38.C2
/31.C8	/35.C2	/38.C4
/32.C2	/35.C4	/38.C5
/32.C4	/35.C5	/38.C7
/32.C5	/35.C7	/38.C8
/32.C7	/35.C8	/39.C2
/32.C8	/36.C2	/39.C4
/33.C2	/36.C4	/39.C5
SM 322 16xREL24/48VUC	SM 322 16xREL24/48VUC	SM 322 16xREL24/48VUC

STATUS: APPROVED

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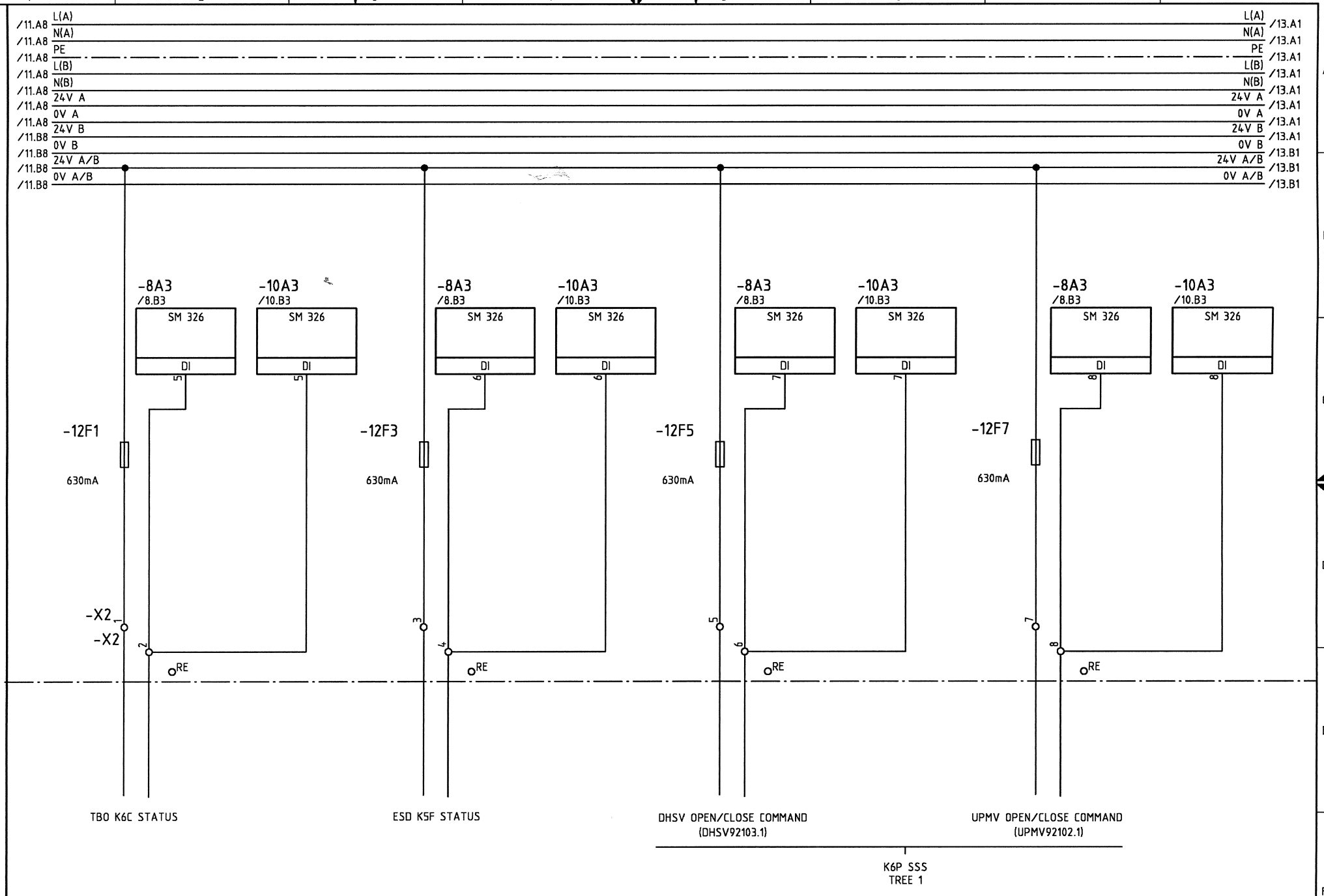
BOM NO.: 223380-25

Project/Customer: TOTAL / K5F

Document ID: SK-066380-25-04

Sheets: 11 of 39 Sh.



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BOM NO.: 223380-25
Project/Customer: TOTAL / K5F
Document ID: SK-066380-25-04
Sheets: 12 of 39 Sh.

STATUS: APPROVED

/12.A8 L(A) — L(A) /14.A1
/12.A8 N(A) — N(A) /14.A1
/12.A8 PE — PE /14.A1
/12.A8 L(B) — L(B) /14.A1
/12.A8 N(B) — N(B) /14.A1
/12.A8 24V A — 24V A /14.A1
/12.A8 0V A — 0V A /14.A1
/12.A8 24V B — 24V B /14.A1
/12.A8 0V B — 0V B /14.A1
/12.B8 24V A/B — 24V A/B /14.B1
/12.B8 0V A/B — 0V A/B /14.B1

-8A3 /8.B3 SM 326 DI — -10A3 /10.B3 SM 326 DI

-13F1 630mA — -13F3 630mA — -13F5 630mA — -13F7 630mA

-X2 -X2 RE

XOV1 OPEN/CLOSE COMMAND (XOV92101.1)
PWV OPEN/CLOSE COMMAND (PWV92101.1)
DHSV OPEN/CLOSE COMMAND (DHSV92103.2)
UPMV OPEN/CLOSE COMMAND (UPMV92102.2)

K6P SSS
K6P SSS

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BOM NO.: 223380-25
Project/Customer: TOTAL / K5F
Document ID: SK-066380-25-04
Sheets: 13 of 39 Sh.

STATUS: APPROVED

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/13.A8 N(A) — /15.A1 N(A)
/13.A8 PE — /15.A1 PE
/13.A8 L(B) — /15.A1 L(B)
/13.A8 N(B) — /15.A1 N(B)
/13.A8 24V A — /15.A1 24V A
/13.A8 0V A — /15.A1 0V A
/13.A8 24V B — /15.A1 24V B
/13.A8 0V B — /15.A1 0V B
/13.B8 24V A/B — /15.B1 24V A/B
/13.B8 0V A/B — /15.B1 0V A/B

	-8A3 /8.B3	-10A3 /10.B3	-14F	-X2	DI	RE
XOV1 OPEN/CLOSE COMMAND (XOV92101.2)	SM 326	SM 326	-14F1 630mA	-X2 17	14	18
PWV OPEN/CLOSE COMMAND (PWV92101.2)	SM 326	SM 326	-14F3 630mA	19	15	20
DHSV OPEN/CLOSE COMMAND	SM 326	SM 326	-14F5 630mA	21	16	22
UPMV OPEN/CLOSE COMMAND	SM 326	SM 326	-14F7 630mA	23	17	24

K6P SSS

K6P SSS
TREE 3

Rev	Change	Date	Created by	Checked by	Approved by
05	Minor Revision	12.06.2009	A. Siekmann	A. Voges	M. Langenstraß
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Project/Customer: TOTAL / K5F
Document ID: SK-066380-25-04
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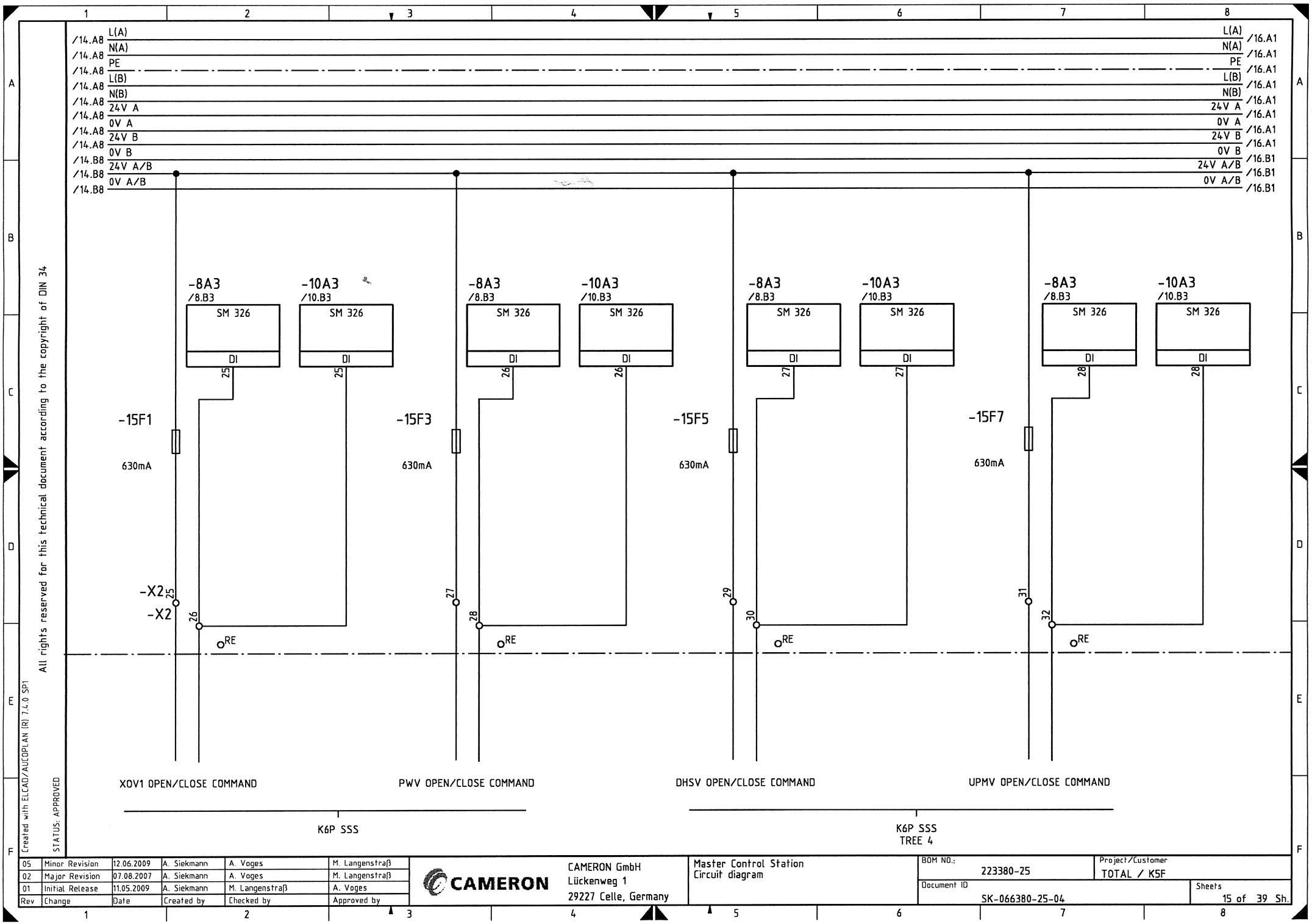

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Project/Customer: TOTAL / K5F

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Sheets: 15 of 39 Sh.

STATUS: APPROVED

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/15.A8 N(A) — N(A) /17.A1
/15.A8 PE — PE /17.A1
/15.A8 L(B) — L(B) /17.A1
/15.A8 N(B) — N(B) /17.A1
/15.A8 24V A — 24V A /17.A1
/15.A8 0V A — 0V A /17.A1
/15.A8 24V B — 24V B /17.A1
/15.A8 0V B — 0V B /17.A1
/15.B8 24V A/B — 24V A/B /17.B1
/15.B8 0V A/B — 0V A/B /17.B1

	-8A3 /8.B3	-10A3 /10.B3	-16F	DI	-X2	RE
XOV1 OPEN/CLOSE COMMAND	SM 326	SM 326	-16F1 630mA	29	33 / 34	
PWV OPEN/CLOSE COMMAND	SM 326	SM 326	-16F3 630mA	30	35 / 36	
SPARE	SM 326	SM 326	-16F5 630mA	32	37 / 38	
SPARE	SM 326	SM 326	-16F7 630mA	33	39 / 40	

K6P SSS
TREE 4

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05	Minor Revision	12.06.2009	A. Siekmann	A. Voges	M. Langenstraß
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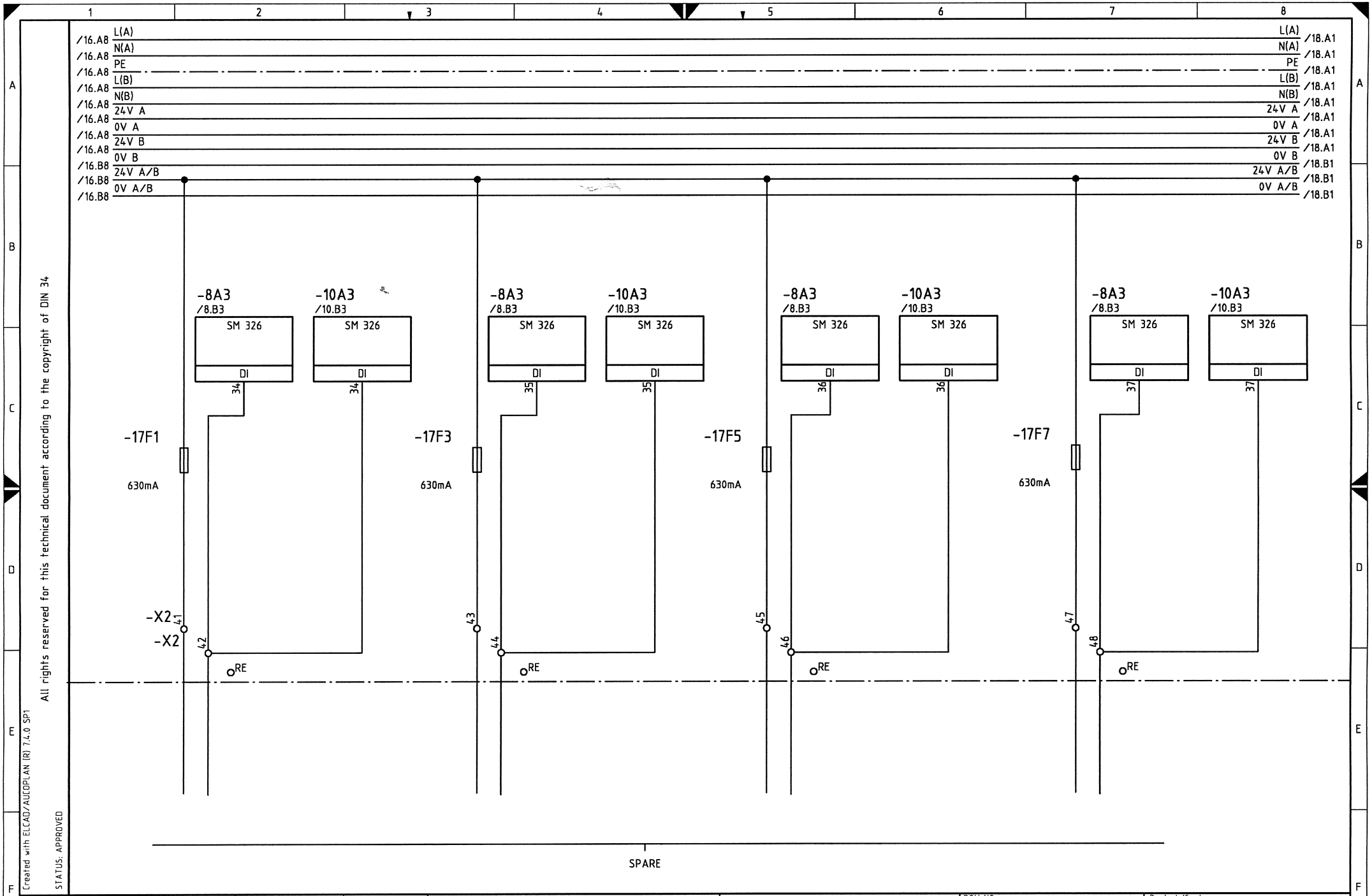

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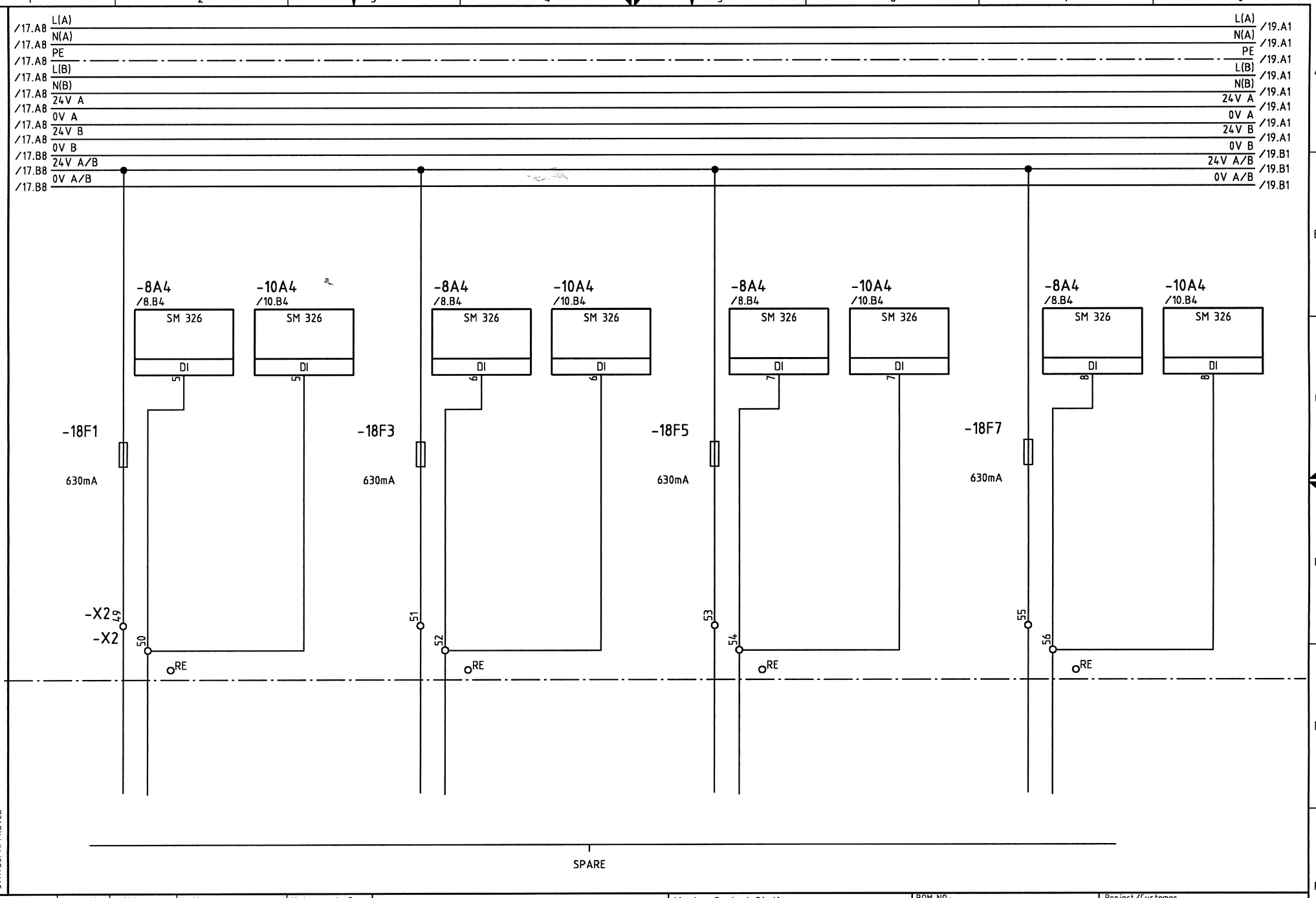
Sheets: 17 of 39 Sh.



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Project/Customer: TOTAL / K5F

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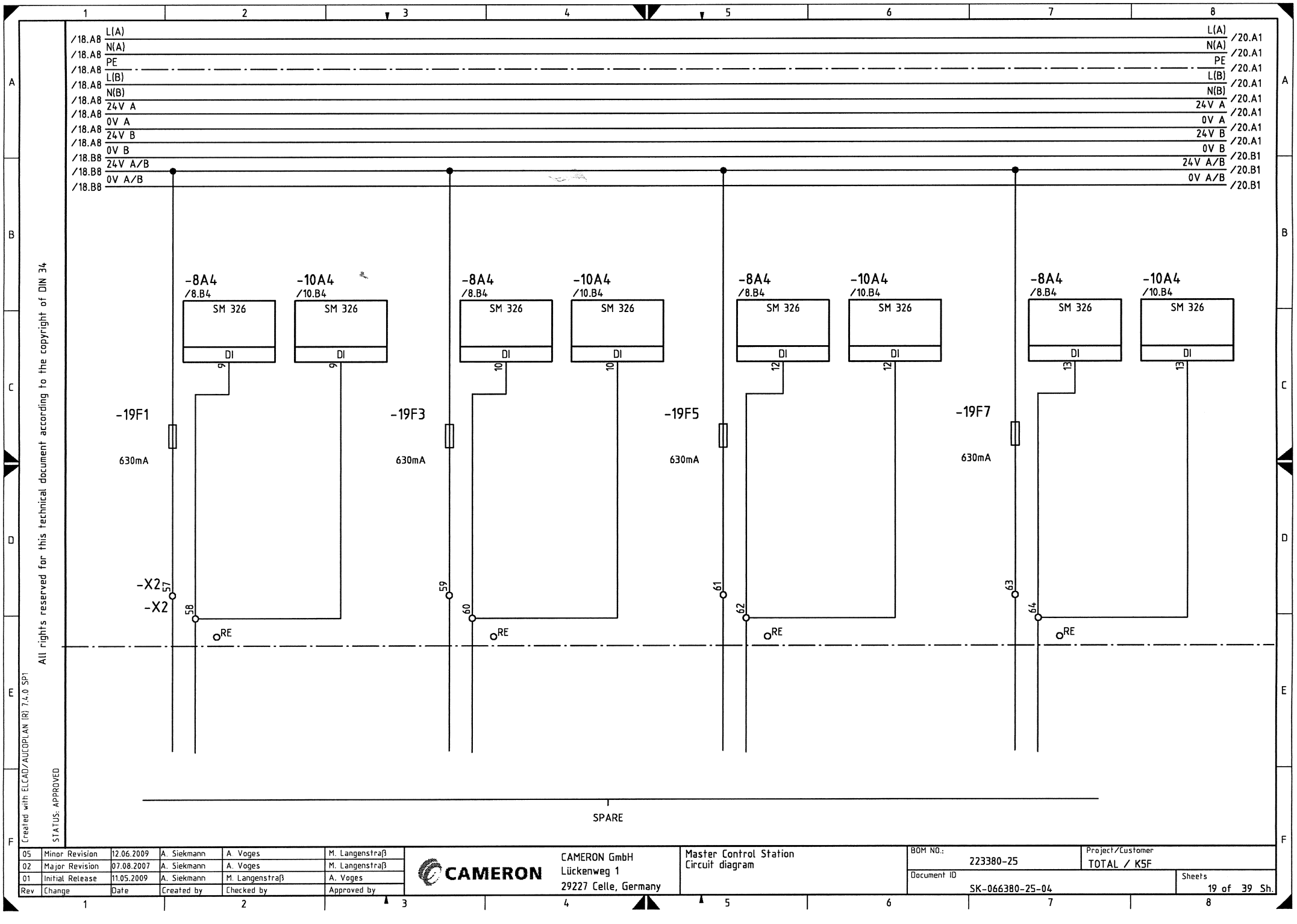
Sheets: 18 of 39 Sh.



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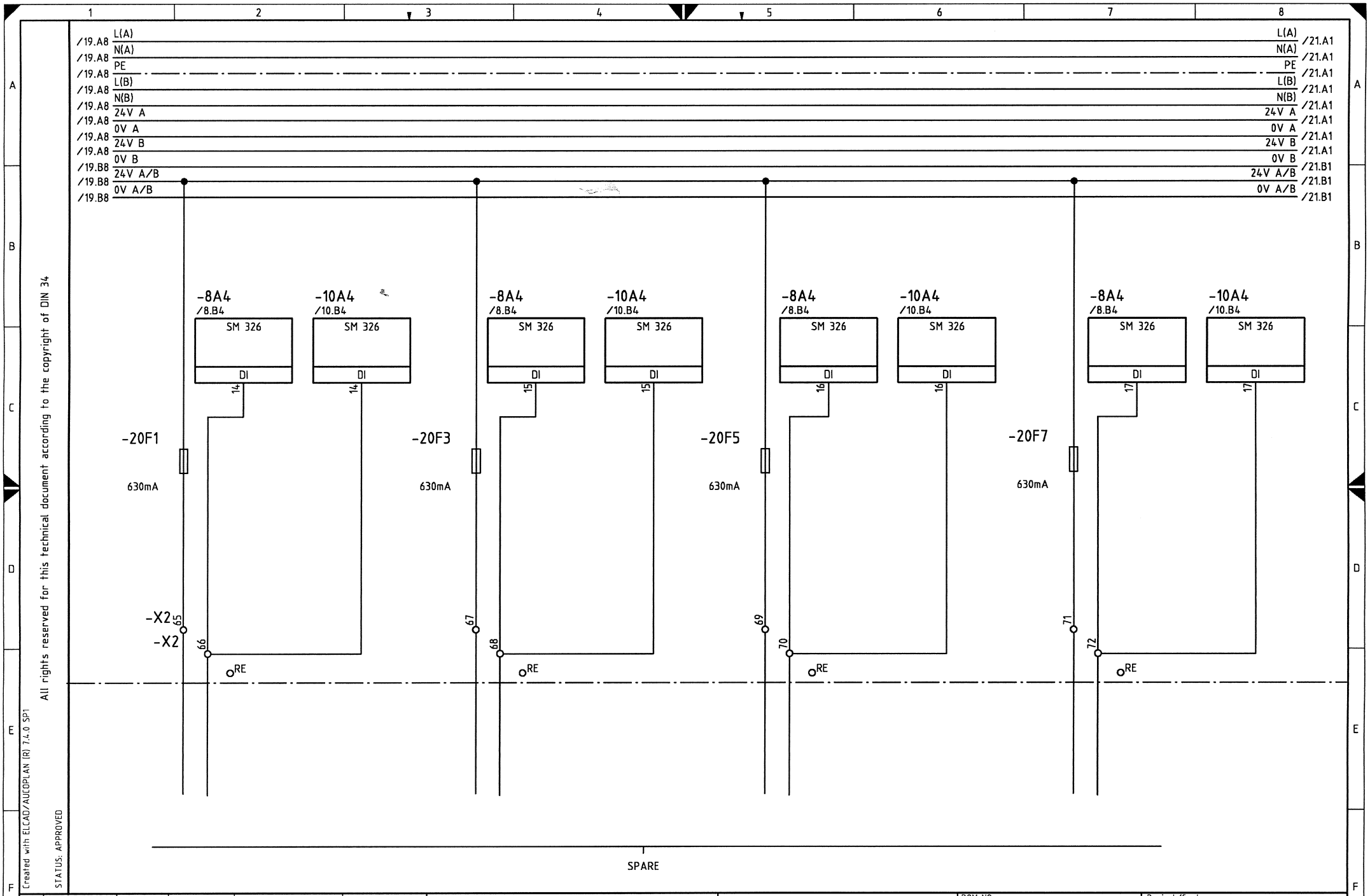
Sheets: 19 of 39 Sh.



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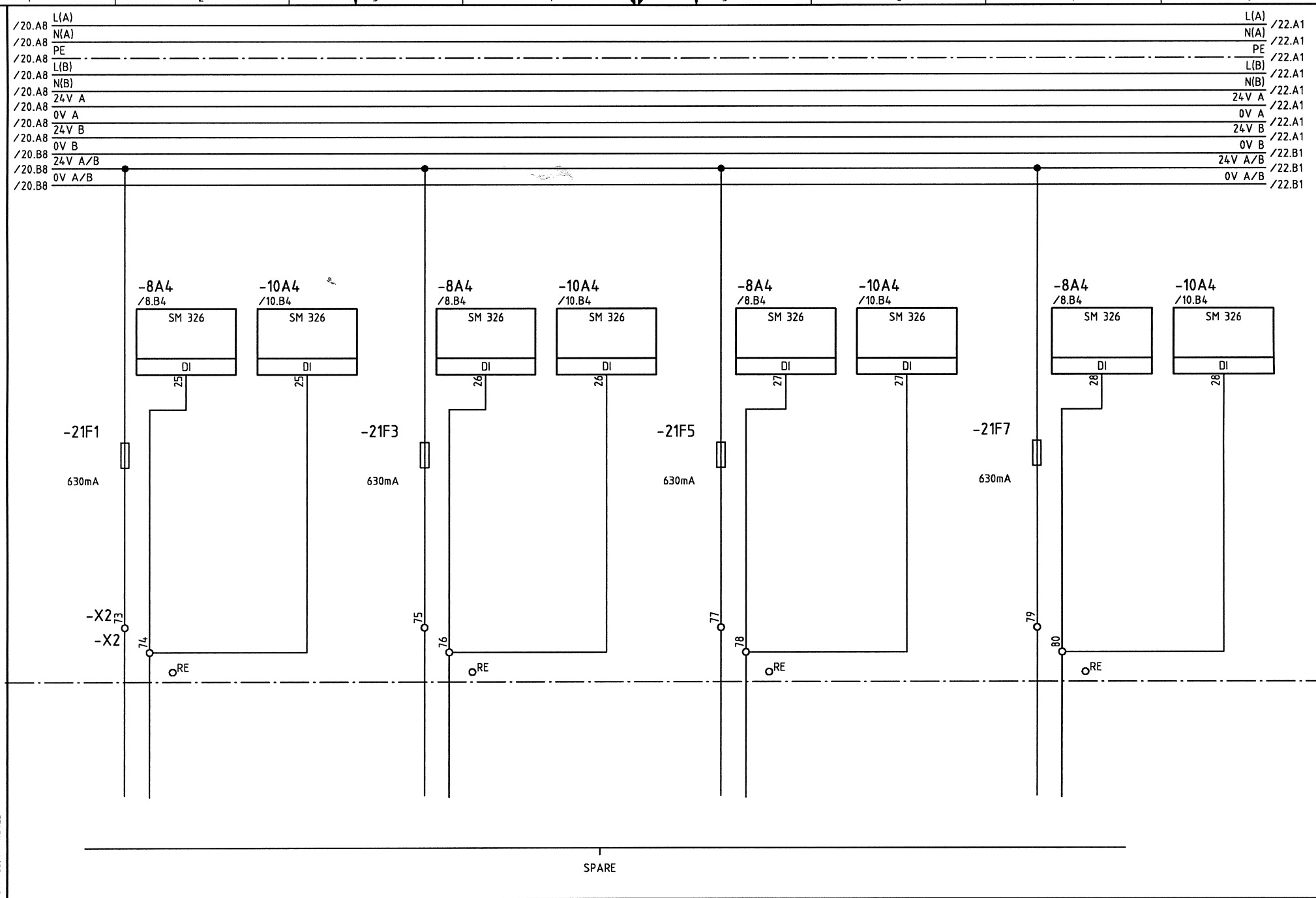

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STATUS: APPROVED

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05	Minor Revision	12.06.2009	A. Siekmann	A. Voges	M. Langenstraß
02	Major Revision	07.08.2007	A. Siekmann	A. Voges	M. Langenstraß
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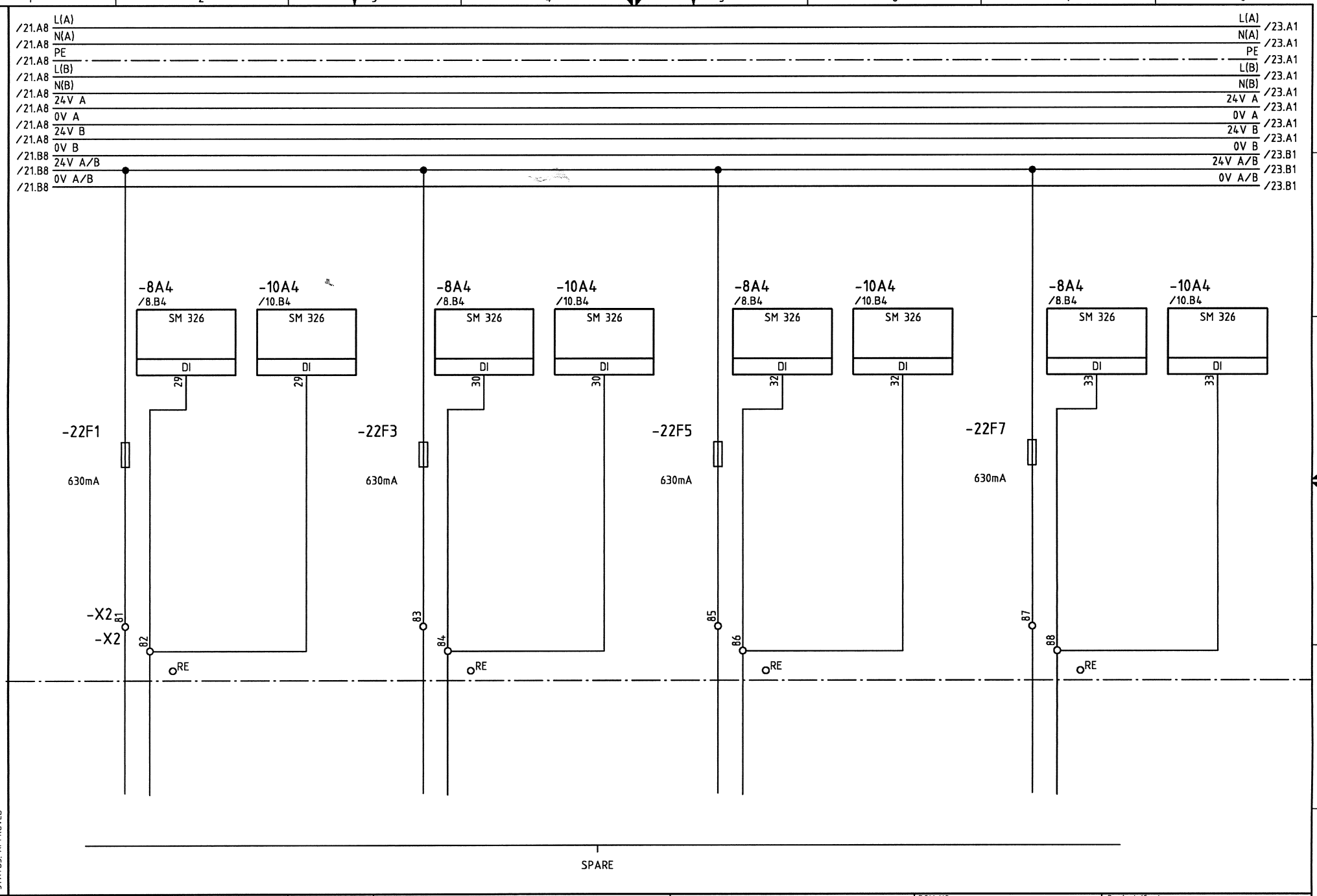

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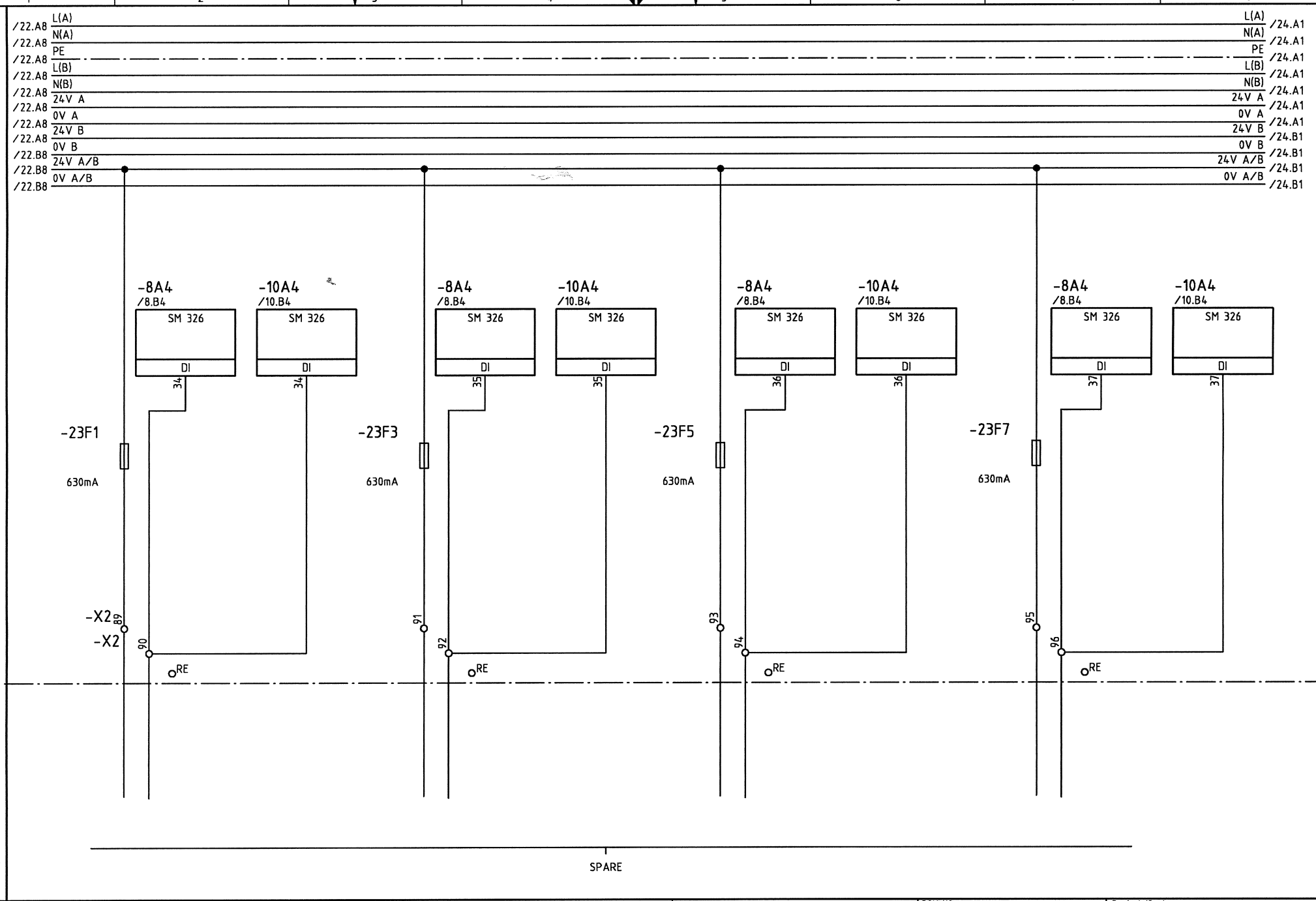

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STATUS: APPROVED

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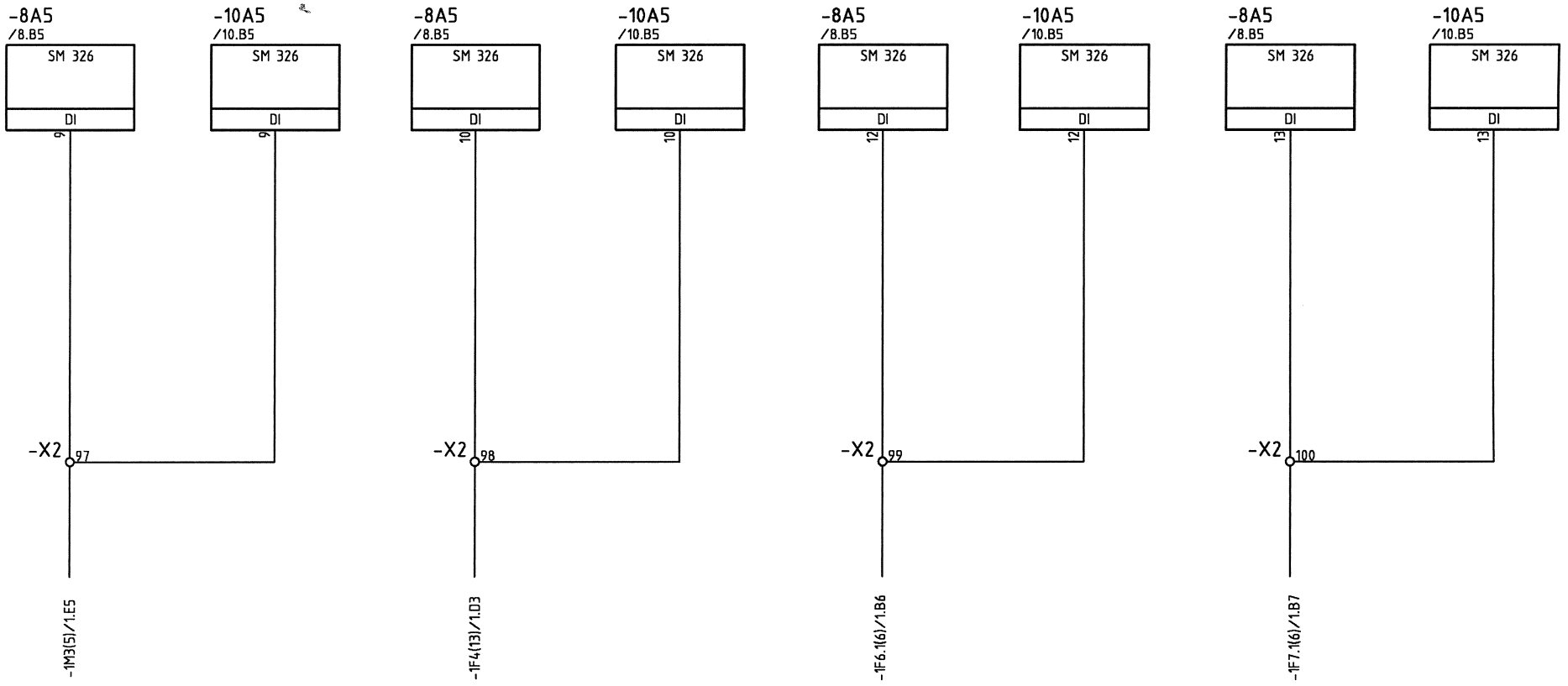
/23.A8	N(A)	/25.A1
/23.A8	PE	/25.A1
/23.A8	L(B)	/25.A1
/23.A8	N(B)	/25.A1
/23.A8	24V A	/25.A1
/23.A8	0V A	/25.A1
/23.A8	24V B	/25.B1
/23.B8	0V B	/25.B1
/23.B8	24V A/B	/25.B1
/23.B8	0V A/B	/25.B1



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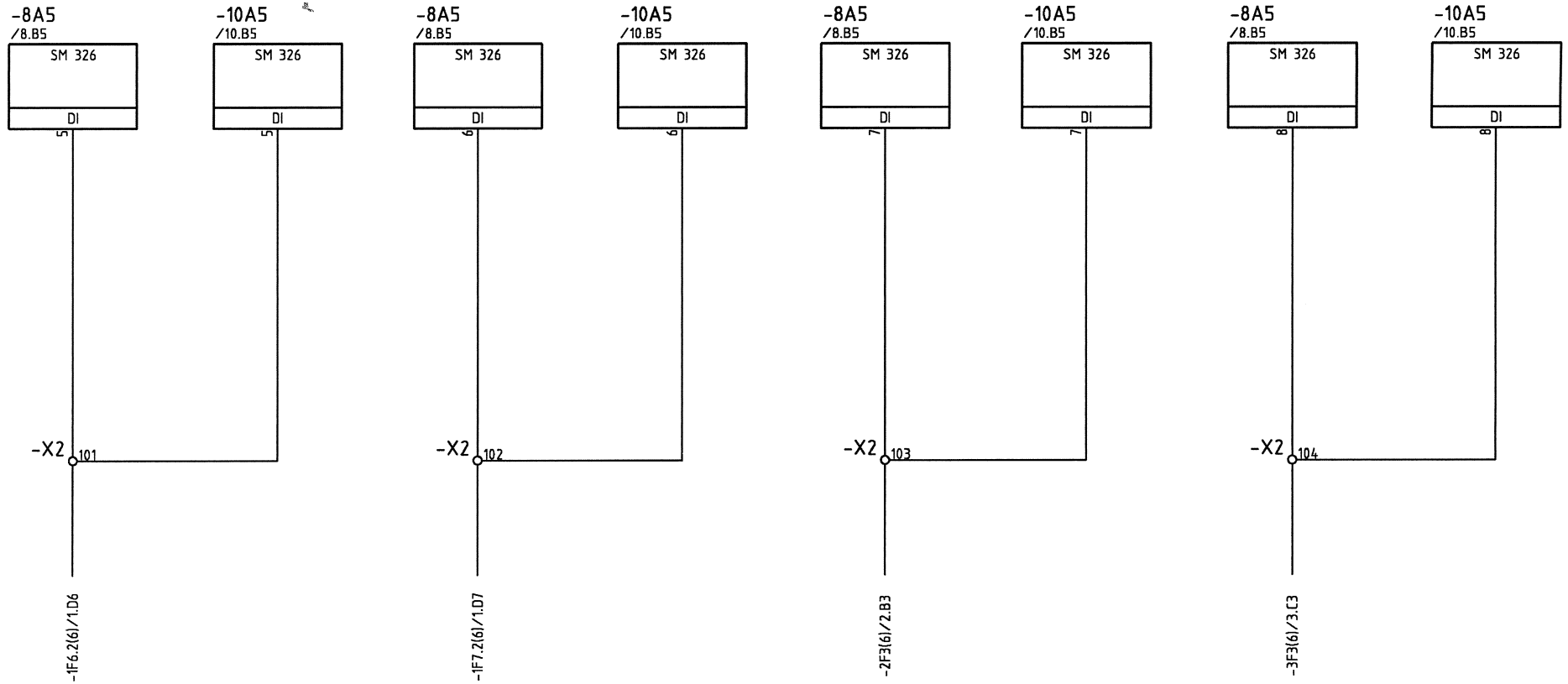
/24.A8	L(A)					L(A)	/26.A1
/24.A8	N(A)					N(A)	/26.A1
/24.A8	PE					PE	/26.A1
/24.A8	L(B)					L(B)	/26.A1
/24.A8	N(B)					N(B)	/26.A1
/24.A8	24V A					24V A	/26.A1
/24.A8	0V A					0V A	/26.A1
/24.A8	24V B					24V B	/26.B1
/24.B8	0V B					0V B	/26.B1
/24.B8	24V A/B					24V A/B	/26.B1
/24.B8	0V A/B					0V A/B	/26.B1



24V DC POWER FAULT A

24V DC POWER FAULT B

CB FAULT MCS A

CB FAULT MCS B

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STATUS: APPROVED

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/25.A8 N(A) — N(A) /27.A1
/25.A8 PE — PE /27.A1
/25.A8 L(B) — L(B) /27.A1
/25.A8 N(B) — N(B) /27.A1
/25.A8 24V A — 24V A /27.A1
/25.A8 0V A — 0V A /27.A1
/25.A8 24V B — 24V B /27.B1
/25.B8 0V B — 0V B /27.B1
/25.B8 24V A/B — 24V A/B /27.B1
/25.B8 0V A/B — 0V A/B /27.B1

-X10 3

-8A5 /8.B5 SM 326 DI — 14 — -X2 105 — -4F3(6)/4.B3 — CB FAULT GATEWAY A

-10A5 /10.B5 SM 326 DI — 14

-8A5 /8.B5 SM 326 DI — 15 — -X2 106 — -5F3(6)/5.C3 — CB FAULT GATEWAY B

-10A5 /10.B5 SM 326 DI — 15

-26S5 13 14

-8A5 /8.B5 SM 326 DI — 16 — -X2 107 — PCS / MCS KEYSWITCH

-10A5 /10.B5 SM 326 DI — 16

-8A5 /8.B5 SM 326 DI — 17 — -X2 108 — SPARE

-10A5 /10.B5 SM 326 DI — 17

STATUS: APPROVED

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/26.A8	N(A)	N(A)	/28.A1
/26.A8	PE	PE	/28.A1
/26.A8	L(B)	L(B)	/28.A1
/26.A8	N(B)	N(B)	/28.A1
/26.A8	24V A	24V A	/28.A1
/26.A8	0V A	0V A	/28.A1
/26.B8	24V B	24V B	/28.B1
/26.B8	0V B	0V B	/28.B1
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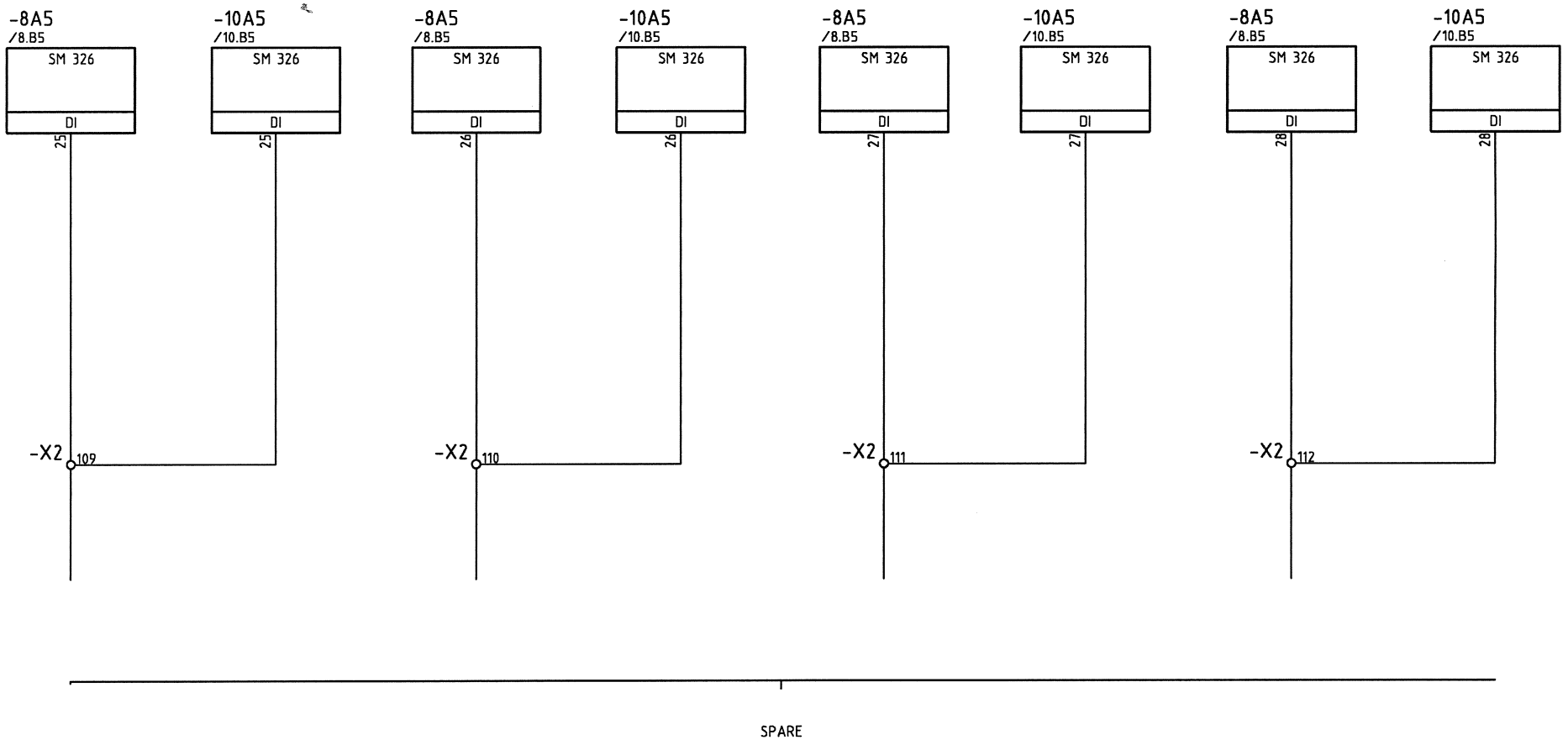

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STATUS: APPROVED

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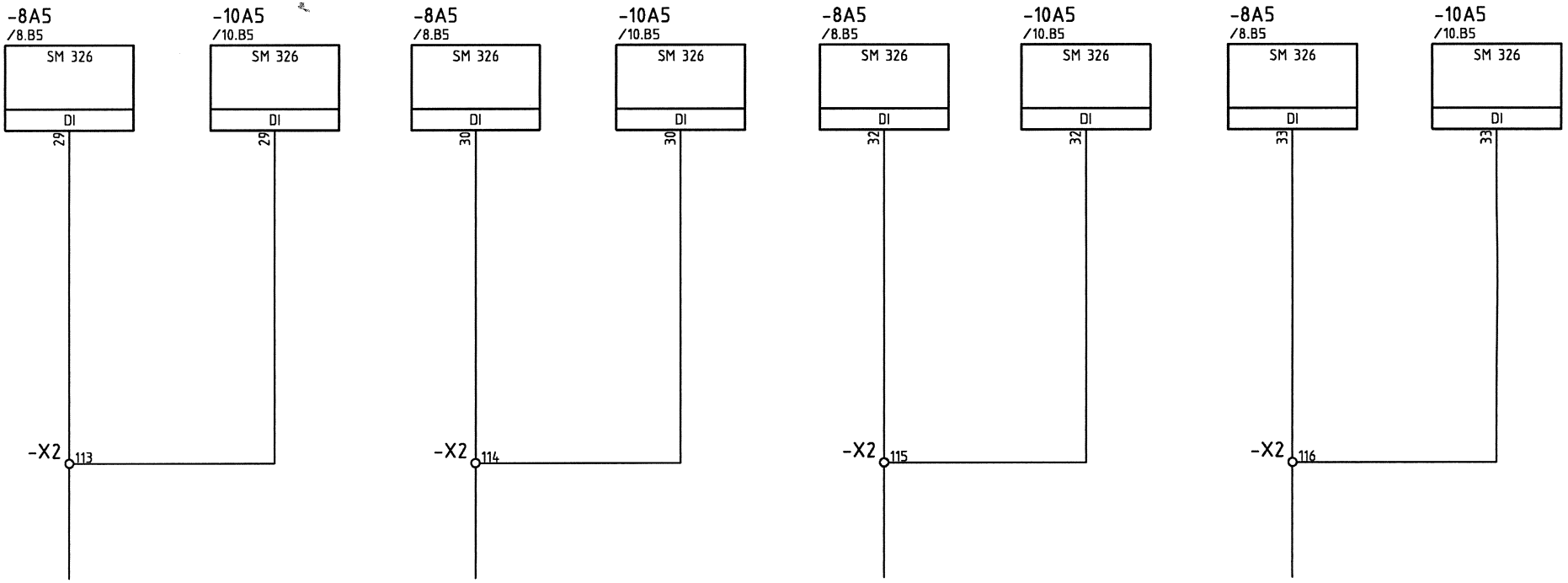
/27.A8	N(A)	/29.A1
/27.A8	PE	/29.A1
/27.A8	L(B)	/29.A1
/27.A8	N(B)	/29.A1
/27.A8	24V A	/29.A1
/27.A8	0V A	/29.A1
/27.B8	24V B	/29.B1
/27.B8	0V B	/29.B1
/27.B8	24V A/B	/29.B1
/27.B8	0V A/B	/29.B1



SPARE

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Sheets: 28 of 39 Sh.

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/28.A8	PE					PE	/30.A1
/28.A8	L(B)					L(B)	/30.A1
/28.A8	N(B)					N(B)	/30.A1
/28.A8	24V A					24V A	/30.A1
/28.A8	0V A					0V A	/30.A1
/28.B8	24V B					24V B	/30.A1
/28.B8	0V B					0V B	/30.B1
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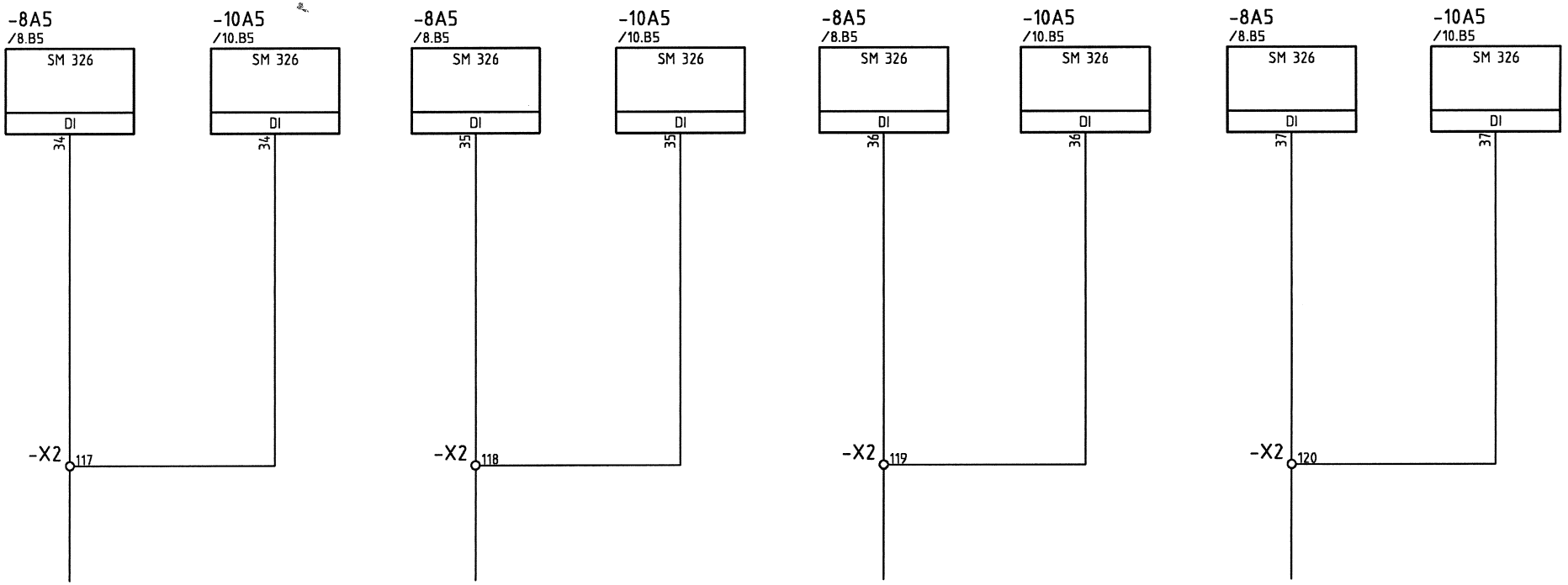

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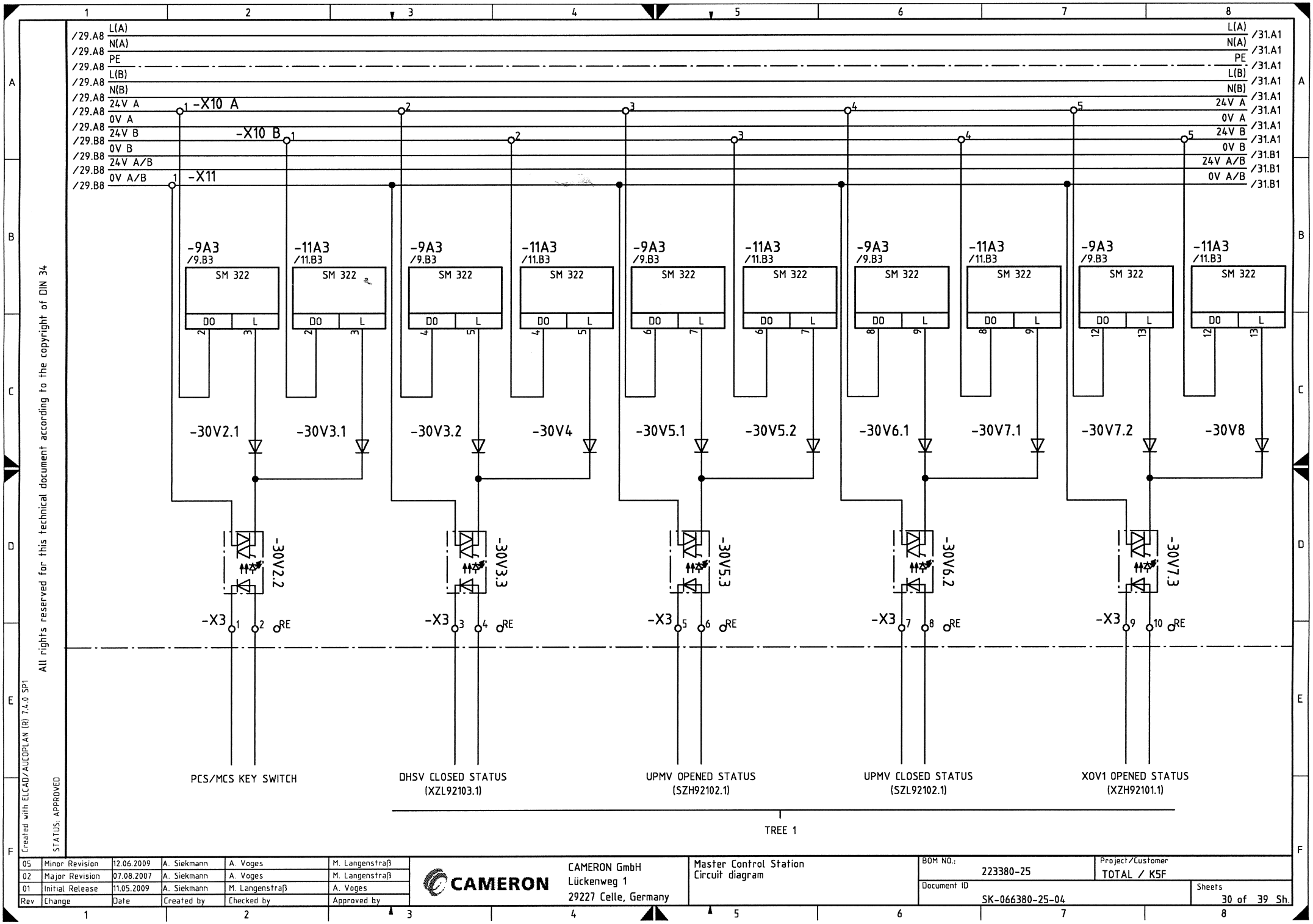

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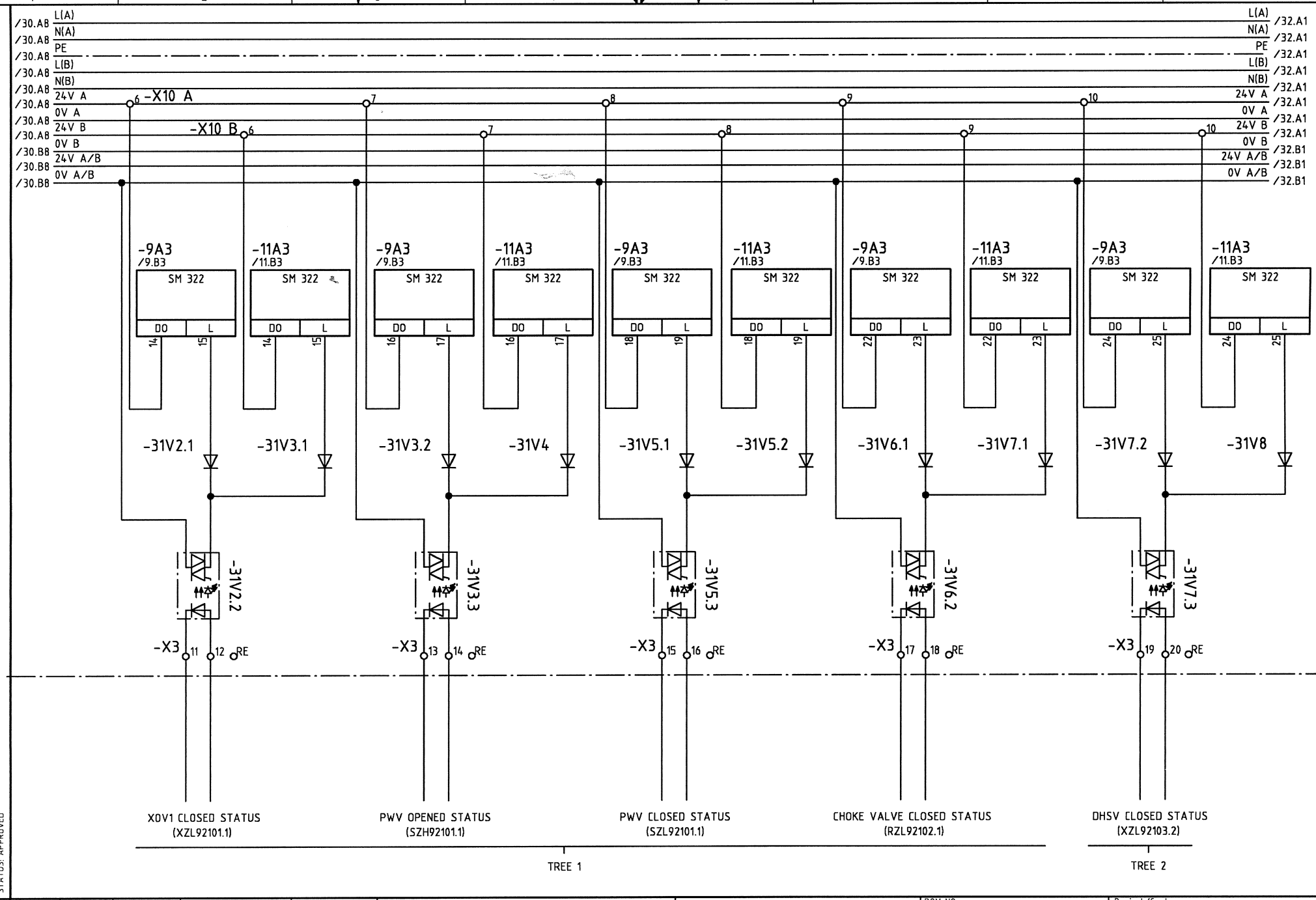

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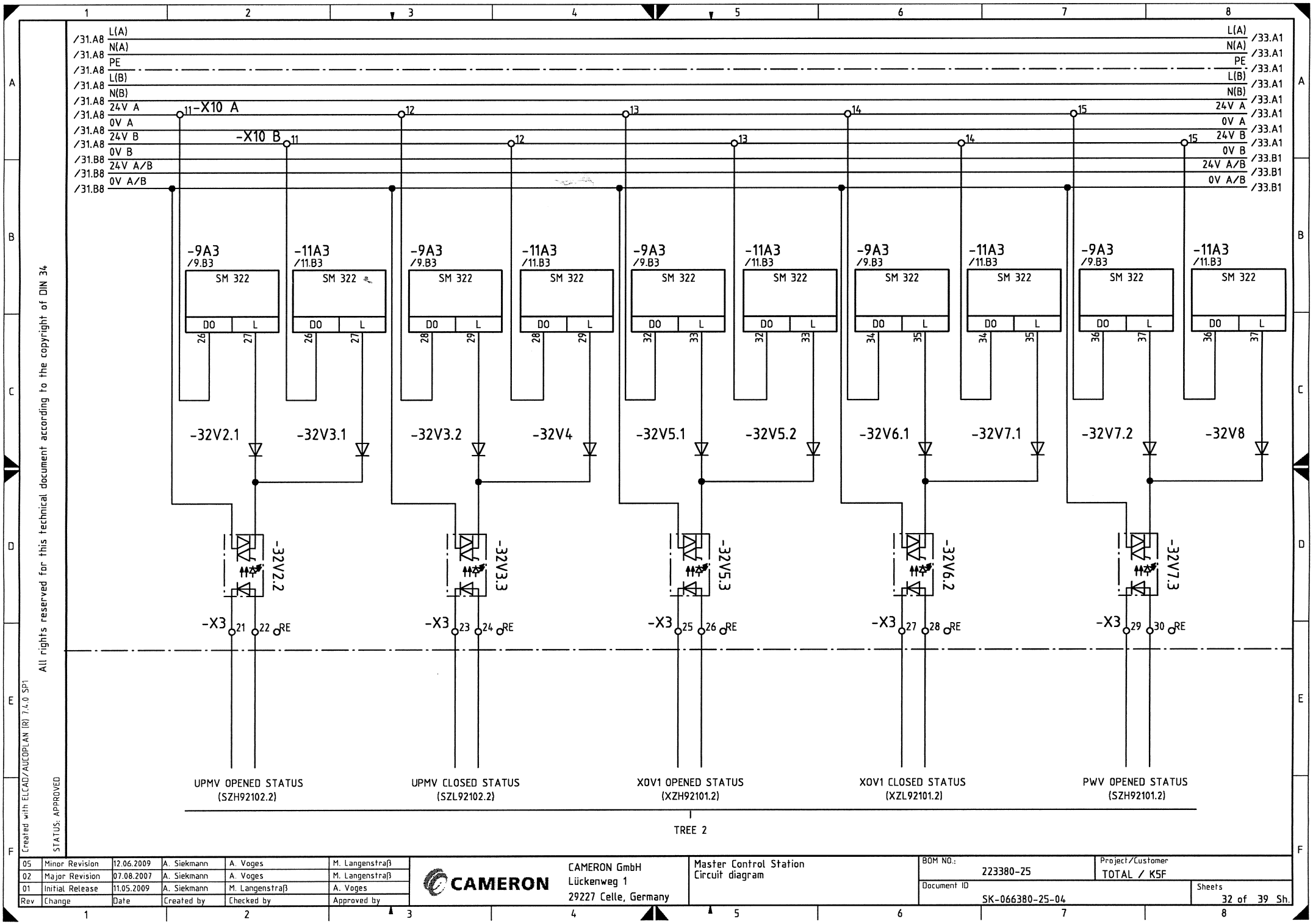

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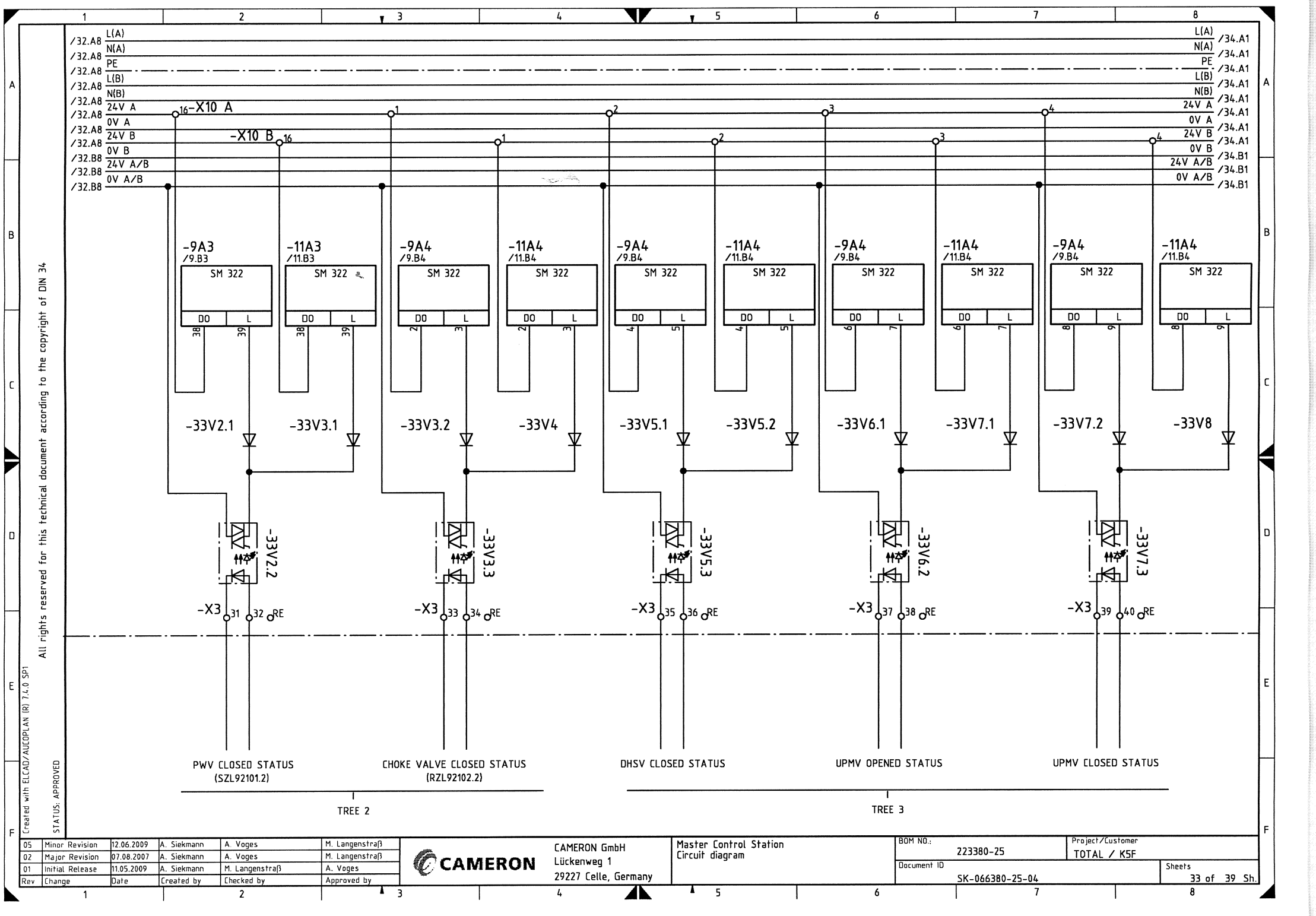

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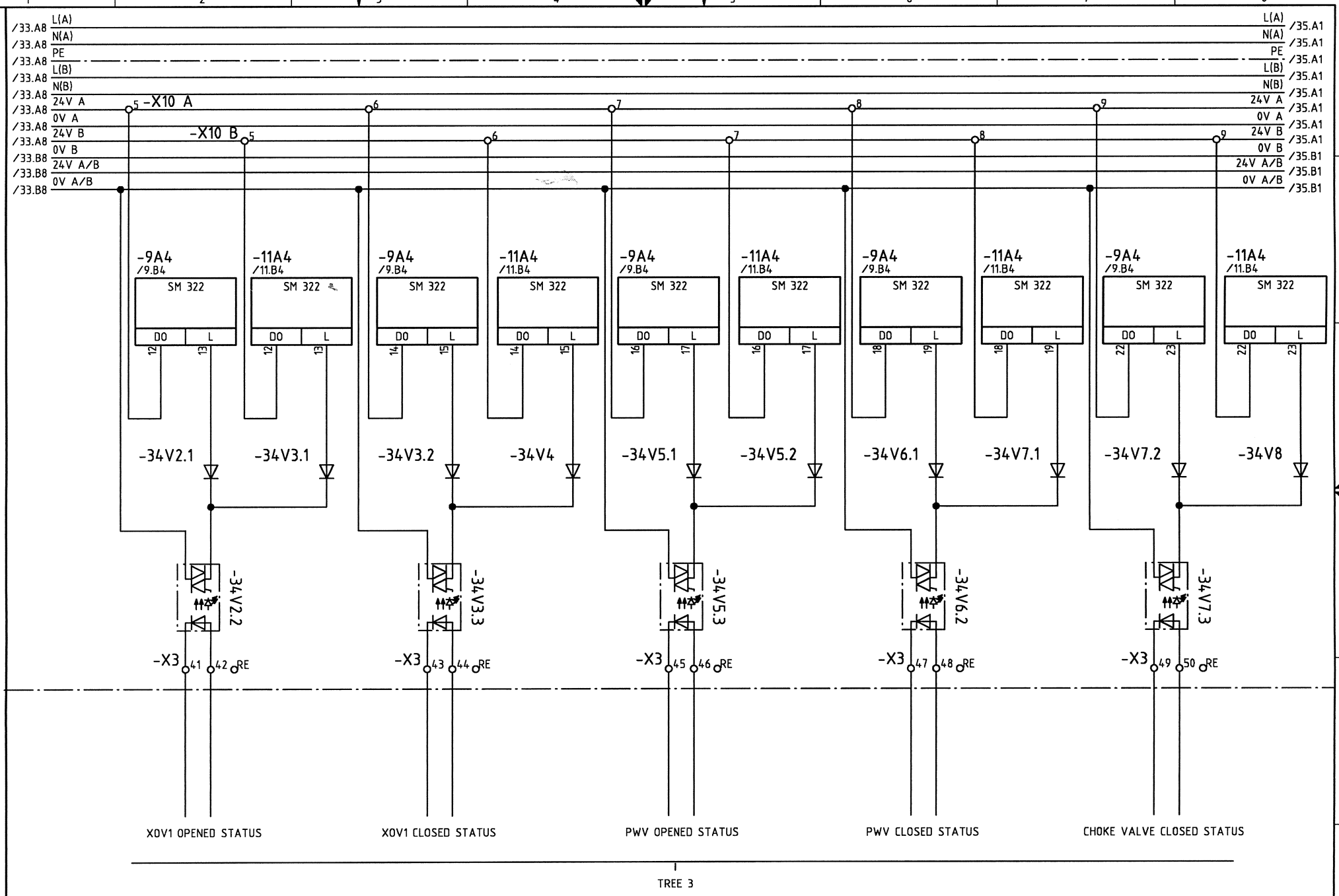

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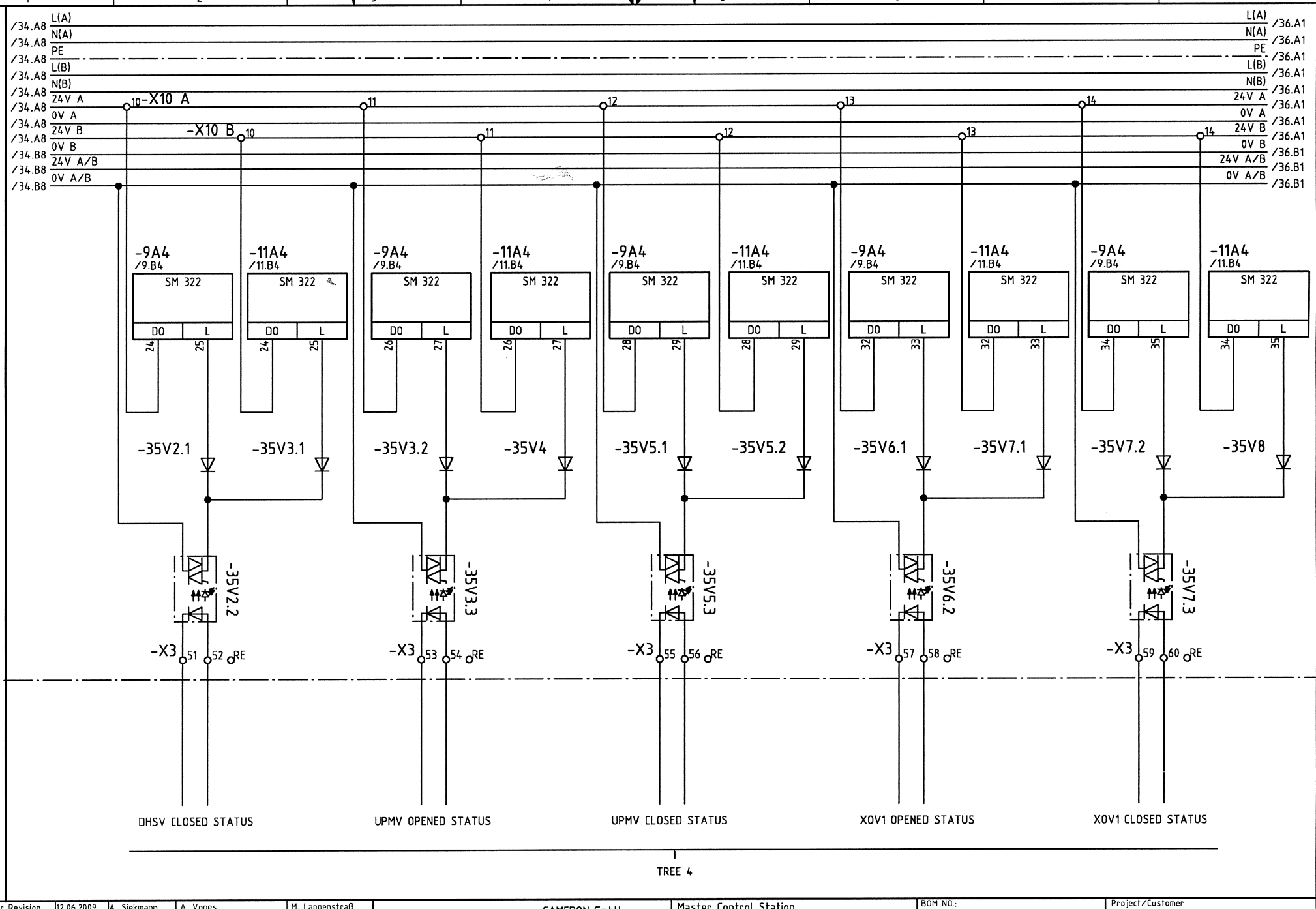

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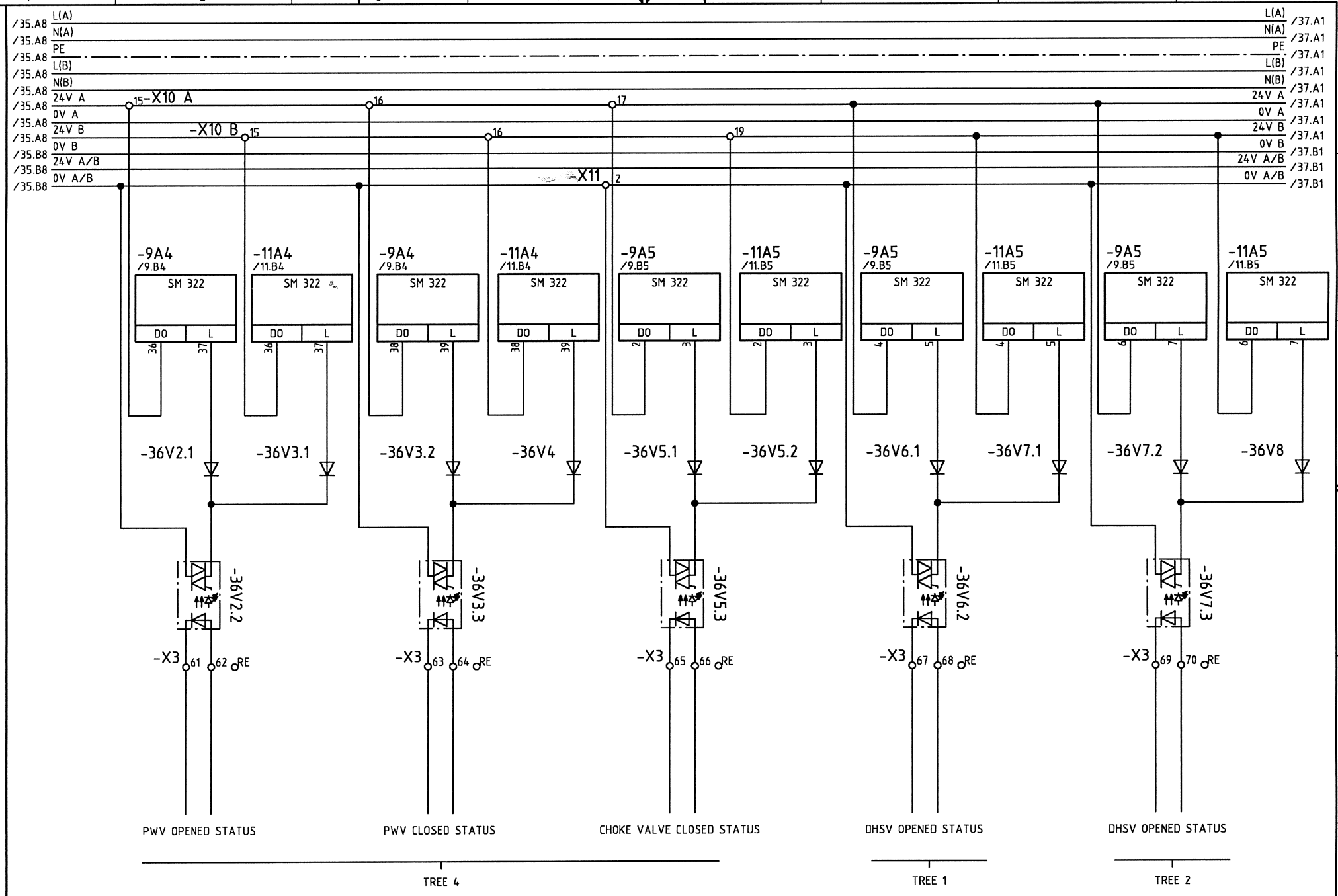

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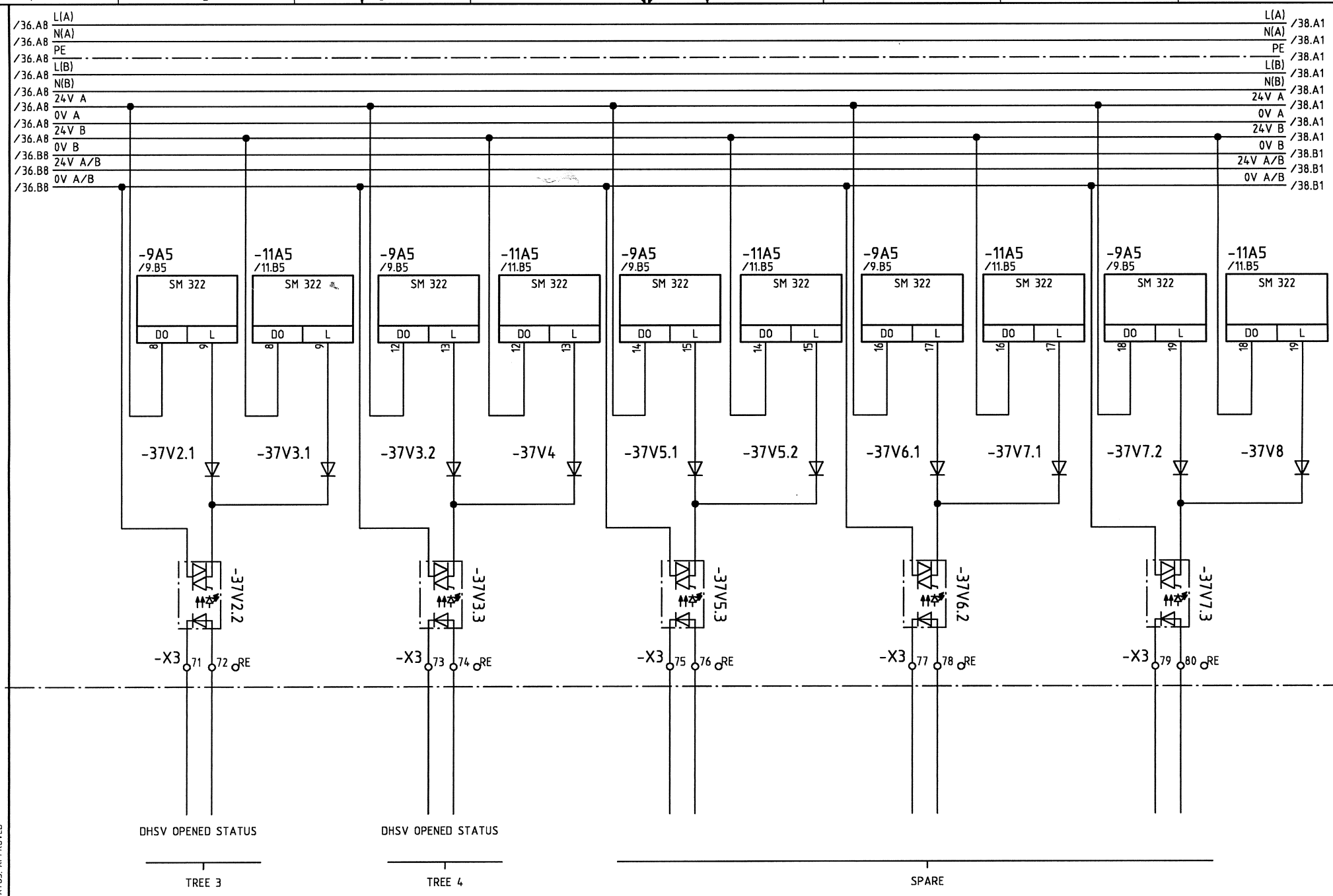

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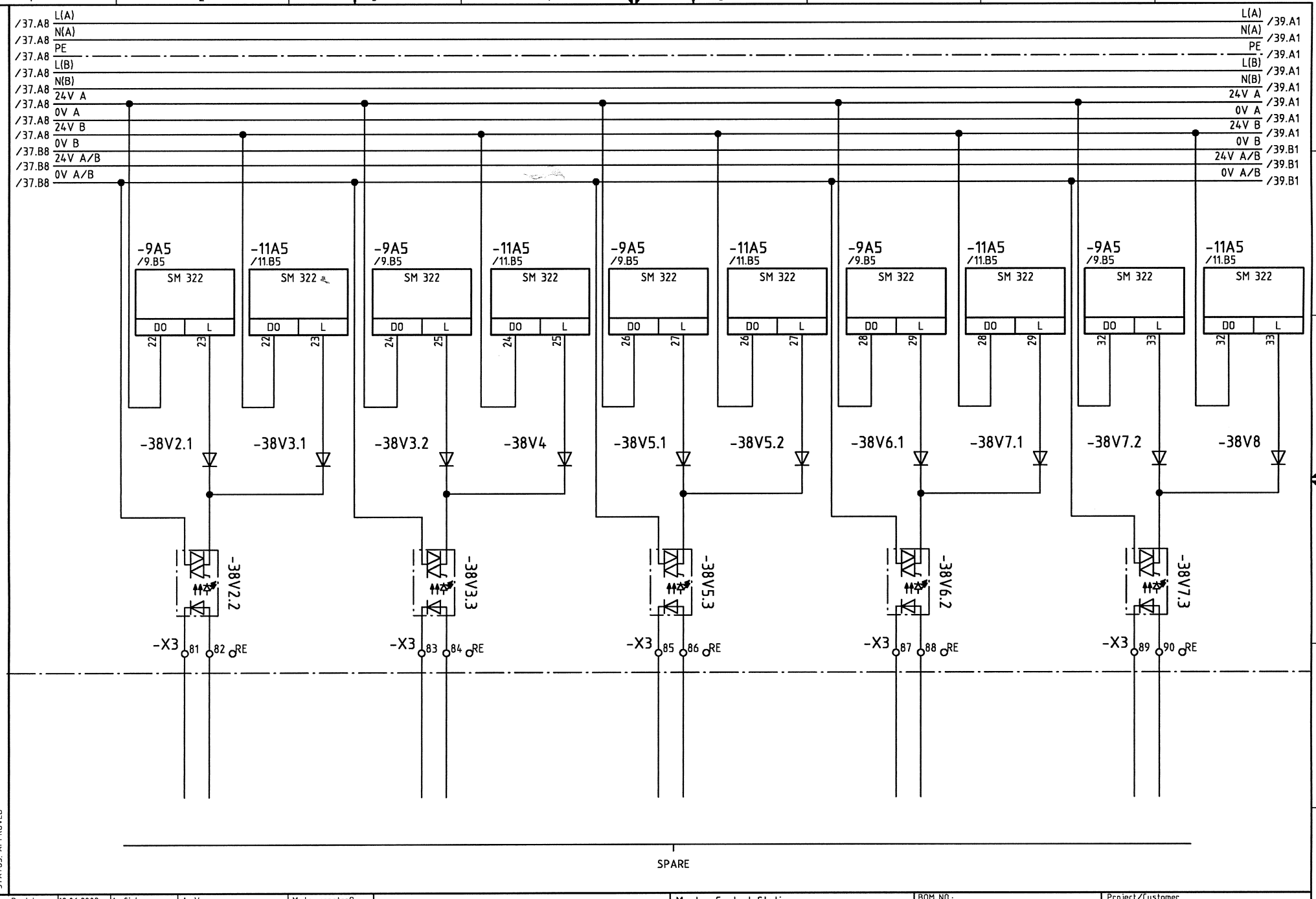

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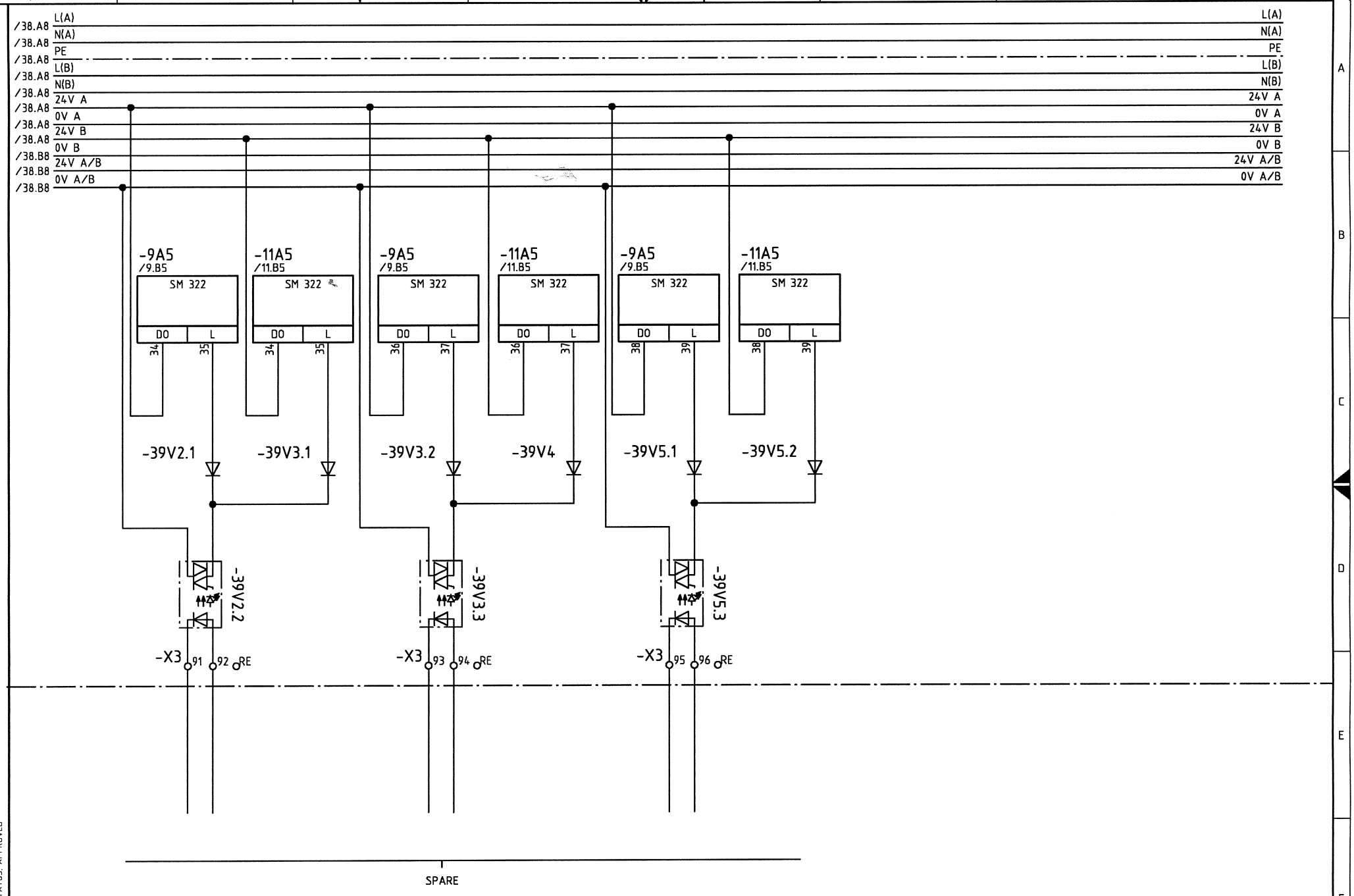

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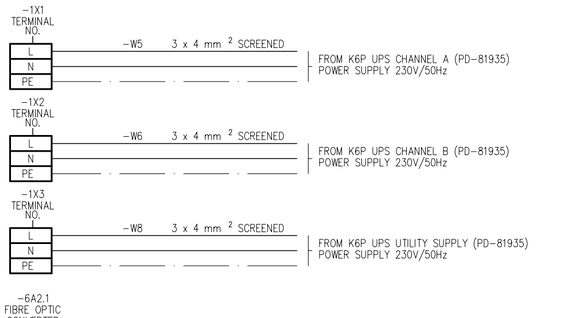

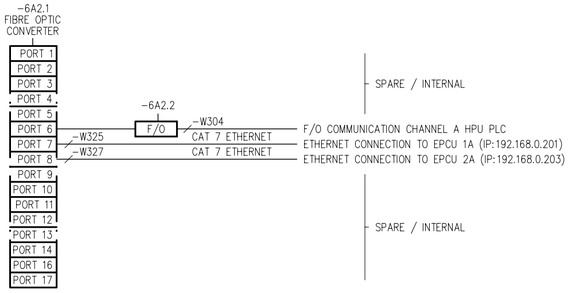

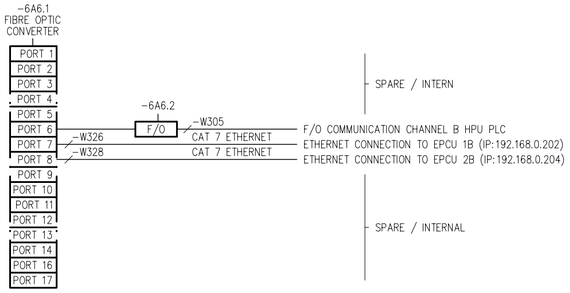

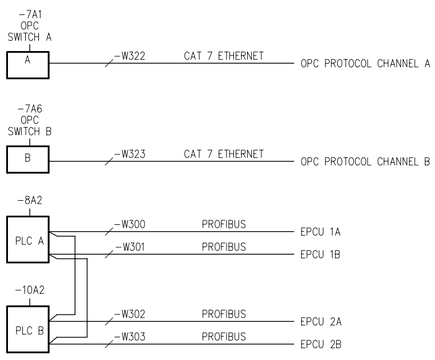

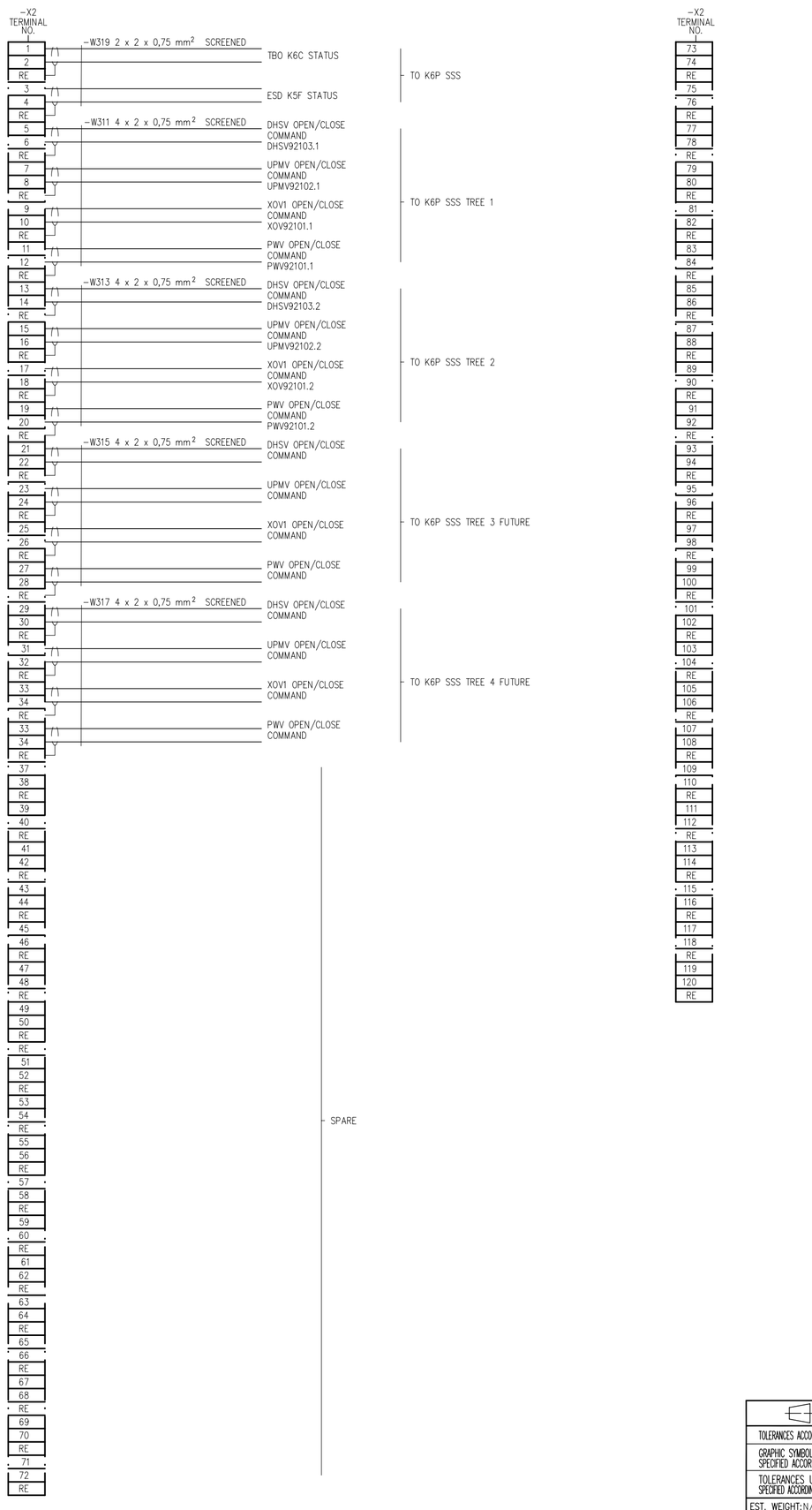

KEY PLAN/LEGEND:

NOTES/HOLDS:

REFERENCE DOCUMENTS

TOPSIDE CABLE LIST X−065451−04−06 / 54NL94−W−69−001
CIRCUIT DIAGRAM FOR HPU PLC CABINET SK−066022−33−04 / 54NL94−W−71−500
CIRCUIT DIAGRAM FOR HPU SK−066011−32−04 / 54NL94−W−06−503
CIRCUIT DIAGRAM FOR MASTER CONTROL STATION SK−066380−25−04 / 54NL94−W−61−501

ABBREVIATIONS:

EPCU	ELECTRICAL POWER AND COMMUNICATION UNIT
FO	FIBRE OPTIC
HPU	HYDRAULIC POWER UNIT
MCS	MASTER CONTROL STATION
OPC	OLE FOR PROCESS CONTROL
OLE	OBJECT LINKING & EMBEDDING
PCS	PROCESS CONTROL SYSTEM
PLC	PROGRAMMABLE LOGIC CONTROLLER
SSS	SAFETY SHUTDOWN SYSTEM

REVISION DESCRIPTIONS:

1

APPROVED FOR CONSTRUCTION

REASON FOR ISSUE	DATE	CLIENT REV.
APPROVED FOR CONSTRUCTION	07APR09	1
ISSUED FOR CLIENT COMMENT	09APR08	N/A
ISSUED FOR INTERNAL IDC	04APR08	N/A

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92−W−01−002

CAD

REV. BY: A. Siekmann
DATE: 04.04.2008
REV.: 01

TOLERANCES ACCORDING TO DIN ISO 8015

GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219

TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/k

SURFACE TREATMENT

MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN:	A. Siekmann	DATE: 04.04.2008
CHECKED:	A. Voges	DATE: 08.04.2009
APPROVED:	L. Budde	DATE: 08.04.2009

EST. WEIGHT: N/A KG | SUPERSEDES: | SCALE: /

CAMERON

CAMERON GmbH
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FIELD TERMINATION DIAGRAM FOR MASTER CONTROL STATION (MCS)

INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223380−25	1 OF 2	SK−066380−25−42

STATUS: APPROVED

-X3 TERMINAL NO.		
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2		
RE		
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RE		
5		UPMV OPENED STATUS SZH92102.1
6		
RE		
7		UPMV CLOSED STATUS SZL92102.1
8		
RE		
9		XOV1 OPENED STATUS XZH92101.1
10		
RE		
11		XOV1 CLOSED STATUS XZL92101.1
12		
RE		
13		PWV OPENED STATUS SZH92101.1
14		
RE		
15		PWV CLOSED STATUS SZL92101.1
16		
RE		
17		CHOKE VALVE CLOSED STATUS RZL92102.1
18		
RE		
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RE		
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22		
RE		
23		UPMV CLOSED STATUS SZL92102.1
24		
RE		
25		XOV1 OPENED STATUS XZH92101.1
26		
RE		
27		XOV1 CLOSED STATUS XZL92101.1
28		
RE		
29		PWV OPENED STATUS SZH92101.1
30		
RE		
31		PWV CLOSED STATUS SZL92101.1
32		
RE		
33		CHOKE VALVE CLOSED STATUS RZL92102.1
34		
RE		
33	-W314 8 x 2 x0,75 mm² SCREENED	DHSV CLOSED STATUS XZL92103.1 — TO K6P SSS TREE 3 FUTURE
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RE		
37		UPMV OPENED STATUS SZH92102.1
38		
RE		
39		UPMV CLOSED STATUS SZL92102.1
40		
RE		
41		XOV1 OPENED STATUS XZH92101.1
42		
RE		
43		XOV1 CLOSED STATUS XZL92101.1
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RE		
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RE		
59		XOV1 CLOSED STATUS XZL92101.1
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RE		
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RE		
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RE		
71		DHSV OPENED STATUS — TO K6P SSS TREE 3 FUTURE
72		
RE		
73		DHSV OPENED STATUS — TO K6P SSS TREE 4 FUTURE
74		
RE		

-X3 TERMINAL NO.	
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Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-01-002 | CLIENT REV.: 1

CAD | REV. BY: A. Siekmann | DATE: 04.04.2008 | REV.: 01

SURFACE TREATMENT: DO NOT SCALE

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DRAWN: A. Siekmann	DATE: 04.04.2008	
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APPROVED: L. Budde	DATE: 08.04.2009	

EST. WEIGHT: N/A KG | SUPERSEDES: | SCALE: /

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

FIELD TERMINATION DIAGRAM FOR MASTER CONTROL STATION (MCS)

INITIAL USE BOM: 223380-25 | SHEET: 2 OF 2 | DRAWING NUMBER: SK-066380-25-42

STATUS: APPROVED

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 1, Section 4

ELECTRICAL POWER & COMMUNICATION UNIT (EPCU)

CONTENTS

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 1, Section 4
ELECTRICAL POWER & COMMUNICATION UNIT (EPCU)

DESCRIPTION, INSTALLATION, OPERATION & MAINTENANCE

CONTENTS

Project No.	Cameron No.	Description
54NL92-W-0S-502	X-076721-87	SPS – Subsea & Topsides Functional Requirement Specif. *See Volume 1, Section 1 Total System*
54NL92-W-0S-507	X-076721-87-04	EPCU – Supplemental Requirement Specification *See Volume 1, Section 1 Total System*
54NL92-W-6S-511	X-076734-04	EPCU – Hardware Design Specification
54NL92-W-0P-503	X-065467-02-08	EPCU – Installation Manual
54NL92-W-0P-539	X-065438-02-73	EPCU – Operation Procedure
54NL92-W-0P-539	X-065438-02-72	EPCU – Maintenance Procedure
-	X-065429	General Preservation & Storage Procedure *See Volume 1, Section 1 Total System*

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 1, Section 4
ELECTRICAL POWER & COMMUNICATION UNIT (EPCU)

PARTS LISTS & DRAWINGS

CONTENTS

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

31 MAR 2009	As Built	A. Weilandt	T. Appel	A. Weilandt
06 AUG 2007	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
02 MAY 2007	Issued for Client Comment	A. Weilandt	S. Horne	
12 OCT 2006	Issued for Internal IDC	A. Weilandt	D.Coonrod	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approver**

CAMERON	**Document Title:** **Subsea and Topsides Functional Requirement Specification**		
PAGE 1 OF 34	**Customer Document Number:**	54NL92-W-0S-502	REV. 2
	Cameron Document No.	X-076721-87	REV. 02

TABLE OF CONTENTS

1 Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
A	12OCT06	Initial release Celle	- - -
B	02MAY07	Section 7.5.6.1: Use of Swagelok added for LP lines and added the need for metric size on all LP tubing Section 8.4: cable entry changed from top to bottom Section 9.2: List of Total Tag Numbers added Section 9.1.1.2: Colour for topside equipment changed from RAL5015 to RAL7035 (light grey) 10.8 & 10.9: updated description as per current design of anode and cathode package 10.10: complete section added for Anode Umbilical Assembly	Comments from internal IDC
01	06AUG07	Section 10.8: Anode Package Foundation Base added	Updated to Approved for Construction
02	31MAR09	Minor cosmetic Customer Comments implemented	Update to “As Built”

2 Introduction

This document is written to consolidate the technical requirements for the subsea control system intended to be used on the TOTAL K5F Project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

It will be submitted for approval early on in the project cycle and upon approval will be used for the design of the system.

Referenced client specifications within this document also need to be considered for the design.

3 Scope of this document

The scope of this document is to define the functional requirements for the subsea control system intended to be used on the TOTAL K5F Project.

Technical requirements relate but shall not be limited to:

- Design basis data
- Functional requirements

The Intervention & Workover Control System (IWOCS) shall **NOT** be covered by this document.

4 Abbreviations & Definitions

4.1 Abbreviations

AIV	Annulus Isolation Valve
AMV	Annulus Master Valve
APTA	Annulus Pressure Transmitter A
APTB	Annulus Pressure Transmitter B
BAIV	B Annulus Isolation Valve
CI	Corrosion Inhibitor
CIV	Chemical Injection Valve
CP	Cathodic Protection
CR	Control Room
DCS	Distributed Control System
DHSV	Downhole Safety Valve
DHPT	Downhole Pressure Temperature Transmitter
EPCU	Electrical Power and Communication Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
HPU	Hydraulic Power Unit
ICSS	Integrated Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
KHI	Kinetic Hydrate Inhibitor
LPMV	Lower Production Master Valve
MEOH	Methanol
PCS	Process Control System
PPD	Production Pressure Downstream
PPU	Production Pressure Upstream
PSV	Production Swab Valve
PTD	Production Temperature Downstream
PTU	Production Temperature Upstream
PWV	Production Wing Valve
PRCM	Power Regulation and Communication Module
SCSSV	Surface Controlled Subsurface Safety Valve
SSS	Safety Shutdown System
TUTU	Topside Umbilical Termination Unit
UPMV	Upper Production Master Valve
UPS	Uninterruptible Power Supply
UTA	Umbilical Termination Assembly
WH	Wellhead
XOV	Crossover Valve

4.2 Definitions

COMPANY	Total E&P Nederland B.V. (TEPNL)
CONTRACTOR	Cooper Cameron UK Ltd.

5 References

5.1 Cameron documents

Following documents **MUST** be considered during the design phase.

Description	Number
Subsea Production Control System Interconnection Diagram	SK-066001-88-04
K5F Field Development Project Contract	4600000416
Bill Of Material – Subsea Production Control System	223001-88
Project Quality Specification	SP-003118-15

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Design of cathodic protection of offshore structures	GS GR COR 100
External protection of off-shore and coastal structures and equipment by painting	GS EP COR 350
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Minimum CONTRACTOR document requirements	GS EP ELE 091
Electrical cables	GS EP ELE 161
Cable trays/ladders	GS EP ELE 311
Precommissioning and commissioning specification	GS EP EXP 101
Precommissioning and commissioning technical preparation	GS EP EXP 103
Precommissioning execution	GS EP EXP 105
Commissioning execution	GS EP EXP 107
Operations preparation during project – Maintenance and inspection documentation	GS EP EXP 203
Requirements for contractor quality management	GS EP PJC 501
Requirements for contractor critically rating of a unit	GS EP PJC 502
Requirements for contractor quality control	GS EP PJC 503
Valves	GS EP PVV 142
Welding of duplex and superduplex stainless steel	GS EP PVV 614
Area classification	GS EP SAF 216

Description	Number
Completed wells safety systems and safety rules	GS EP SAF 226
Impacted area, restricted area and fire zones	GS EP SAF 253
Emergency shut-down and emergency de-pressurisation (ESD & EDP)	GS EP SAF 261
Design philosophy and requirements for subsea stations	GS EP SPS 001
Subsea ball valves	GS EP SPS 005
Service valves in subsea stations	GS EP SPS 006
Tie-in systems	GS EP SPS 007
Corrosion protection of subsea stations	GS EP SPS 009
Preservation requirements for subsea package	GS EP SPS 010
Mechanical completion of subsea stations	GS EP SPS 011
Documentation requirements for subsea stations	GS EP SPS 012
Wellhead and guidance systems	GS EP SPS 013
Subsea gate valves and actuators in subsea Xmas-tree systems	GS EP SPS 015
Subsea insert chokes and associated running and retrieval tools	GS EP SPS 016
Subsea production control system	GS EP SPS 019
Subsea control unit functional requirements	GS EP SPS 020
Subsea mateable electrical/optical connectors	GS EP SPS 021
Environmental testing of subsea electronics	GS EP SPS 022
Cleaning and flushing of hydraulic systems	GS EP SPS 023
Subsea mechanical quarter turn actuator (manually operated gearbox)	GS EP SPS 024
Subsea hydraulic spring return quarter turn actuators	GS EP SPS 025
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Static 230Vac power supply units for on- and offshore installations	NL00-U-6S-037
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Typical cable tray details (offshore)	NL00-U-64-044
Elec. Cable colour seq. (onsh. + offsh.)	NL00-U-64-045
Protection and Instrument Earth. Det. (onsh. + offsh.)	NL00-U-64-046
Presentation of engineering and final documentation	NL00-Z-0S-002

Description	Number
Microstation Version 5.0: User Definable Attributes	NL00-Z-0S-005
Codification & Numbering of New Technical Documents for Offshore Installations	NL00-Z-0S-006
Instrumentation/piping interface standards	NL00-Z-4S-042
Actuators and control systems for hydraulically operated control valves	NL00-Z-7S-041
Actuators and control system for hydraulically operated ball valves	NL00-Z-7S-043
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
Codification of instrumentation links & equipment	NL00-Z-7S-077
Electrical/instrument interface diagram typicals for normally unmanned offshore installations	NL00-Z-71-002
Loop diagrams typicals	NL00-Z-71-003
Instrumentation - process hook-up typicals	NL00-Z-74-011
Hydraulic hook-up typicals	NL00-Z-74-021
Mounting typicals	NL00-Z-74-031
Instrument name plate detail	NL00-Z-74-055
Completion dossier guidelines	CS-3-OPE-EC-701 (EDMP-40657)
K5F MCS – K6CC SSS/PCS Interface	EDMP #59401

Any agreed deviations from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

Any clarifications from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

In case of conflict between documents the following order of priority shall be applied:

1) Local and international rules and regulations
2) Company Safety Specifications (GS EP SAF)
3) Project Specifications
4) Company Standards (NL00)
5) Company General Specifications

5.3 Codes, standards and regulations

Following codes, standards and regulations shall be considered during the design phase.

Description	Number
Design and operation of sub sea production systems	ISO 13628
Design & Operation Of Subsea Production Control Systems	ISO 13628-6
Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluids	SAE AS4059

Description	Number
EMC Directive	89/336-EEC
Process measurement control functions and instrumentation Symbolic representation	ISO 3511
Quality management and quality assurance standards - Part 3:Guidelines for the application of ISO 9001 to the development, supply and maintenance of software	ISO 9000-3

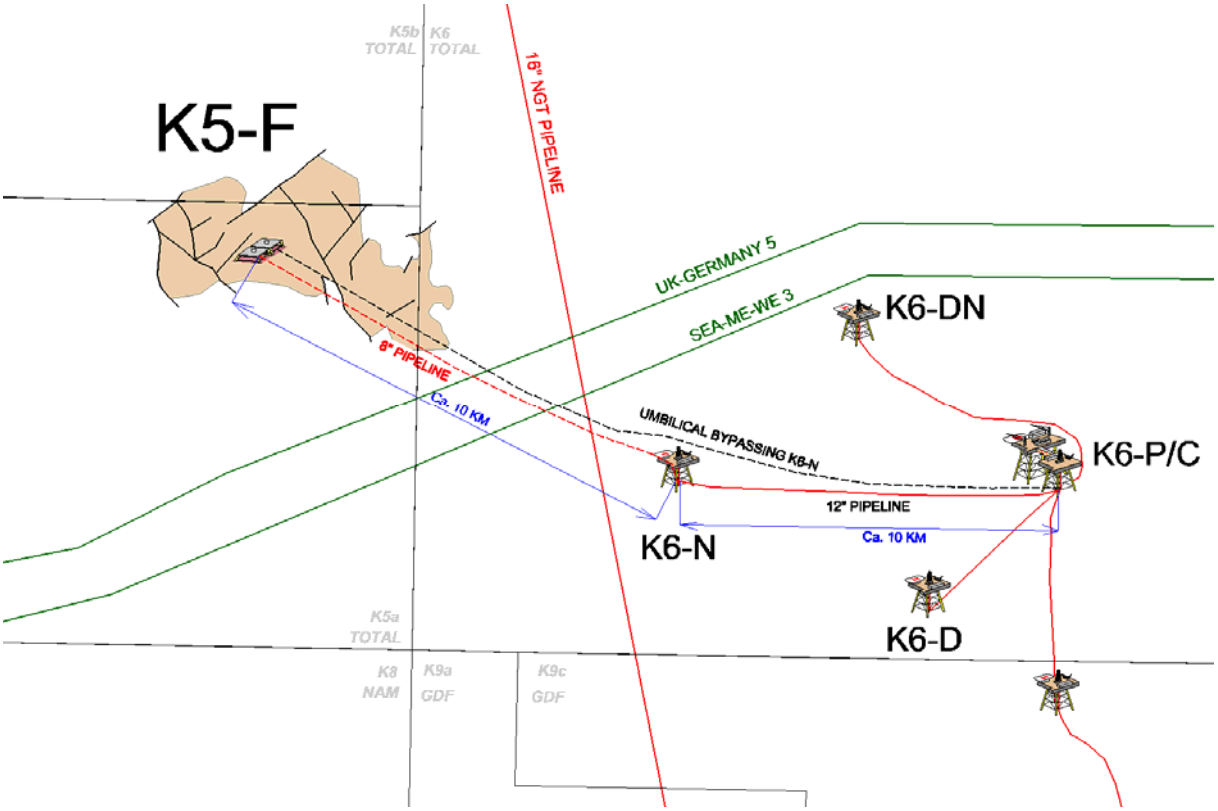
5.4 CE marking

CE marking **will** be required for the K5F project.

6 Project Overview

The K5F is a gas field located 10 km NW of the existing satellite platform K6N and 20km NW of the K6 Central Complex, all operated by TEPNL.

In the first phase, K5F will be developed with two wells. In order to be able to increase the reserves recovery in the future a third well might be connected in the future on the Subsea Protection Structure and it is also possible to connect a fourth future satellite well.



7 Design basis

The following sections are describing the systems information particularly relevant to the design of the Production Control System:

7.1 Field data

Present Number of Production Wells	Two plus two future wells
Design Life	20 years

7.2 Environmental conditions

7.2.1 Climatic data

Parameter		Data
Ambient Temperature (Outdoors)	Minimum Air Temperature	- 16°C
	Maximum Air Temperature	+ 40°C
Ambient Temperature (Indoors)	Minimum Air Temperature	-5°C
	Maximum Air Temperature	+ 40°C

7.2.2 Subsea Design Information

Parameter	Data
Water Depth	37 metres
Temperature	+4°C to +9.5°C
Seawater density	1025 kg/m³
Seawater Electrical Resistivity	0.3 OhmMeter
Wellhead Shut-in Pressure	350 barg

7.2.3 Hazardous Area Classification

The HPU and the TUTU shall be specified for hazardous area Zone 1, Gas Group IIB, Temperature Class T3, on the Platform deck.

7.2.4 Local equipment room

The platform local electrical switch room shall be used to accommodate the MCS and the ECPU cabinets. The maximum temperature during normal conditions within the LER shall be limited to 25 °C, but all of the equipment shall be able to operate as long as the room temperature does not exceed 40°C.

7.2.5 Hydraulic system pressures for the SCSSV line

The subsea production control system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
HP Hydraulics	627 barg	690 barg	1035 barg
Return Lines	< 207 barg	207 barg	N/A
Reservoir Fill Lines	<10 barg	10 barg	15 barg

NOTE: The design pressures shown above shall be used for specification of the HP hydraulic system relief valves and these shall release at the shown design pressures.

The return lines of the HPU are piped directly to the return reservoir and open to atmosphere. Pressure testing of these lines is neither necessary nor possible.

7.2.6 Chemical system pressure requirements

The chemical injection system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
Methanol Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Corrosion Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Kinetic Hydrate Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg

7.2.7 List of chemicals

The following chemicals are considered to be used for chemical injection for the K5F project:

- Methanol (MEOH)
- Corrosion Inhibitor (CI)
- Kinetic Hydrate Inhibitor (KHI)

7.3 Design life

The design life of the Subsea equipment shall be equal to the service life of the field.

The Subsea and related topside facilities shall be designed for a minimum design life of **20 years**.

7.4 Utilities

7.4.1 Platform utilities

The subsea production control system shall be designed to operate from the platform power and utilities as follows:

Electrical Supply (ECPU)	400VAC , 3 phase, 50 Hz ± 2% from UPS (floating), redundant
Electrical Supply (MCS)	230VAC 50 Hz ± 2%,from UPS (floating), redundant
Electrical supply (HPU PLC Cabinet)	230VAC 50 Hz ± 2% from UPS (floating)
Electrical supply (HPU Lighting)	230VAC 50 Hz from MCC
Electrical supply (HPU Motors)	380VAC 3ph 50 Hz, floating (3 wires) from MCC
Electrical supply (Motor heaters)	230VAC 50 Hz from MCC (if applicable)
Electrical supply (ESD solenoids)	24 V DC when healthy, 0V on ESD

7.5 Hydraulic systems

7.5.1 Sealing systems

Hydraulic couplers with primary metal seals are preferred for permanently installed Subsea equipment. Where possible, secondary, non-metallic seals should be considered as back-up for primary metal-to-metal seals. Hydraulic and chemical couplers within removable assemblies like single diver mate able hydraulic/chemical couplings shall have non-metallic primary seals and non-metallic back-up seals.

7.5.2 Hydraulic distribution

The subsea production control system high pressure (HP) hydraulic supplies shall be single from the HPU pumps. The hydraulic system shall be open utilising a water based control fluid.

7.5.3 Hydraulic fluid

The hydraulic system shall use Castrol Transaqua HT water based control fluid.

7.5.4 Fluid cleanliness

The production control system hydraulic control fluid shall be water based. All production control system hydraulic equipment shall be delivered with fluid cleanliness levels of SAE AS4059 class 6 or better. All methanol and chemical lines and equipment shall be delivered with fluid cleanliness level of SAE AS4059 class 12 or better.

Protective caps shall be provisioned for all hydraulic couplings to avoid accidental contamination. Assembly of hydraulic components shall take place in areas where the environment is controlled. The objective shall be to “assemble clean to keep clean” such that subsequent flushing operations are simplified.

Cleaning methods used for sub-assemblies shall include shop air flushing, solvent cleaning, pipe cleaning and ultrasonic bathing as appropriate. Cleaning of major assemblies shall in general be confined to flushing with control fluid of known cleanliness. As far as is practical, designs shall take due note of the subsequent flushing requirements e.g. avoiding blind holes, avoiding welding or grinding on assembled components and ensuring that systems allow turbulent flow for flushing.

All hoses and flying leads intended for chemical service (Methanol, Corrosion Inhibitor and Kinetic Hydrate Inhibitor) should be supplied filled with either control fluid or a suitable fluid compatible with the chemicals to be used.

7.5.5 Tubing

All hydraulic tubing and fittings shall be sized for efficient operation of the system with due regard to design pressures and minimising pressure drops within the system.

- For the topside equipment minimum seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the subsea equipment seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the UTA, the Methanol tubing has to be super duplex.

The tubing of the hydraulic circuits shall be accurately cut and bent using standard tube cutters and tube benders to fitting manufacturer’s recommendation. No burrs shall be allowed and each section of the tubing shall be cleaned and blown dry before assembly to ensure that no contamination is permitted to enter the control components.

All hydraulic tubing together with the associated fittings shall be capable of withstanding the application of a 1.5 times design pressure test for 15 minutes without any deformation or other damage.

7.5.6 Threaded connection systems

All threaded fittings for equipment used subsea shall withstand external ambient pressure at the design depth.

7.5.6.1 Topside equipment

For all circuits Autoclave MP Piping and fittings shall be used, except return lines where Swagelok can be used. All non Autoclave lines need to be in metric size.

7.5.6.2 Permanent subsea equipment

Ferrulok tube end reducers are to be welded to the back of hydraulic couplers, etc., where practical, rather than pipe threaded connections.

High-pressure ports requiring threaded fittings, such as valve actuator ports shall be SAE thread with 37-degree bottom taper conforming to SAE standard J514. Autoclave anti-vibration type fittings shall also be acceptable.

National Pipe Thread (NPT) fittings or any other thread seal type fitting shall **NOT** be used without specific approval from the project.

Fitting assembly torque shall be independently verified and sealed/secured to identify, that fittings have been properly made-up and inspected.

7.5.6.3 Thread sealants

Where taper threads are permitted for use, they shall be sealed using Loctite 572 fluid applied in accordance with the manufacturer's instructions. No other thread sealant shall be used. Teflon tape is **NOT** permitted for use on any equipment used with this system.

7.5.7 Welded connection systems

All couplers, whether in hydraulic or chemical services shall be butt-welded, except were otherwise specified within this document. All couplers shall be fitted with seals from identical compounds. All hydraulic or chemical service valves and fittings shall be butt welded.

- Connections shall be welded to the extent practical
- Autogenously welding shall be acceptable on 316L materials
- Liquid penetrate testing shall be performed on all tubing welds

Note: all welding has to be performed in accordance to approved Cameron welding specification.

8 Electric Systems

8.1 Terminal Type

Screw type terminals shall be used on all topside equipment.

8.2 Instrument Type

For the use in hazardous area EEx-d type instruments shall be used.

8.3 Electrical Motor Type

For the use in hazardous area EEx-d type electrical motors shall be used.

8.4 Cable entry for cabinets located in the Control Room

All cabinets located in the control room shall be designed to allow bottom cable entry only.

9 Functional Requirements

9.1 Coating & protection systems

9.1.1 Coating systems

All equipment manufactured from Carbon steels shall be protected with an approved coating system suitable for the design life of the equipment.

9.1.1.1 Subsea painting

Painting of all subsea components manufactured from Carbon steels shall be done in accordance to the approved paint specification A-020025-01

9.1.1.2 Painting of topside equipment for outside installation

Painting of all topside components located outside shall be done in accordance to the approved paint specification X-065460-04-04

- Top colour for surface equipment shall be light grey (RAL 7035).
- SST framework and parts shall normally NOT be painted, if not separately specified.

9.1.1.3 Painting of topside equipment for inside installation

Paint colour for MCS or EPU cabinet housings shall be light grey (RAL 7035).

9.1.2 Cathodic protection

9.1.2.1 General

The primary corrosion protection system for the control system Subsea equipment shall be via materials selection and suitable paint coatings.

A cathodic protection system using sacrificial anodes shall be utilised to protect the ‘bare steel’ components and to protect uncoated areas of any other control system hardware, i.e. such as those items not protected by the host equipment. Special attention shall be given to SST screws and bolts. All items to be protected shall be electrically connected using stranded, flexible SST 316 earthing braids of a suitable cross sectional area.

9.1.2.2 Calculations

Suitable CP calculations shall be carried out in accordance with the standard applicable for control system hardware i.e. not tree mounted equipment (this shall be part of the Subsea tree CP system). The CP system shall be designed to be capable of protecting the control system for the 20-year design life of the equipment.

9.1.2.3 Construction

The following principles shall be adhered when designing equipment for the subsea control system:

- All equipment metalwork shall be welded (or bolted) onto the equipment main structure to ensure any static potential build up is avoided by continuous drain to earth.
- All metallic items shall have earth continuity by physical connection i.e. metallic fastenings, clamps or earth straps. This shall include all valves, tubing, components, tubing clamps etc.

Electrical connectors may remain isolated from the structure provided suitable materials are chosen for their construction.

- When stainless steel fasteners are used in the construction of subsea structures or equipment, they shall be suitably earth bonded using earth straps. Carbon steel fasteners may alternatively be used.
- Anodes mounted on equipment sub-structures shall be manufactured from material identical and from the same batch as those fitted to the main structure.
- The anodes shall comply with the Cameron material specification MS-011310-01.
- The minimum distance from hydraulic tubing to anodes shall be 80 mm. If unavoidable it is acceptable to have a distance of less than 80 mm for some cases.
- Earthing conductors shall be of corrosion resistant material and shall be securely fastened and protected where necessary against damage and electrolytic corrosion. Where earth-bonding straps are used, conductive paste shall be smeared on contact surfaces (not threads) to ensure a lasting low resistance contact. Where the metallic composition of equipment requiring earth bonding differs from the main structure, care shall be taken in the selection of the bonding strap material to minimise possible ill effects of different contact potentials.
- Connections shall be secured using star-type shake proof washers such that they cannot work loose under vibration.

9.2 Project specific Tag Numbers

This is a list of Tag numbers to be used for K5F equipment. All units and components on this list need to be marked with these numbers as per Total Spec. NL00-Z-74-055.

Instruments	Equipment	Description	Comments
	NN-82201	TUTU	
	NN-82202	HPU	
	NN-82203	HPU PLC	
	NN-81203	MCS	
	NN-81204-1	EPCU 1	
	NN-81204-2	EPCU 2	
	NN-81204-3	EPCU 3	
	NN-81204-4	EPCU 4	
	SA-92100A	Anode Package A	
	SA-92100B	Anode Package B	
	UTA-92100	UTA	
	UTA-92101	IUTA	FUTURE
	UTA-92102	IUTA	FUTURE
	PRCM-92100.1A	PRCM A well 1	
	PRCM-92100.1B	PRCM B well 1	
	SC-92100.1A	Cathode A well 1	
	SC-92100.1B	Cathode B well 1	
	ESCM-92100.1A	ESCM A well 1	
	ESCM-92100.1B	ESCM B well 1	
	DVA-92103.1	Dump valve assembly well 1	
	DHSV-92103.1	Downhole safety valve well 1	

	PRCM-92100.2A	PRCM A well 2	
	PRCM-92100.2B	PRCM B well 2	
	SC-92100.2A	Cathode A well 2	
	SC-92100.2B	Cathode B well 2	
	ESCM-92100.2A	ESCM A well 2	
	ESCM-92100.2B	ESCM B well 2	
	DVA-92103.2	Dump valve assembly well 2	
	DHSV-92103.2	Downhole safety valve well 2	
	PRCM-92100.3A	PRCM A well 3	
	PRCM-92100.3B	PRCM B well 3	
	SC-92100.3A	Cathode A well 3	
	SC-92100.3B	Cathode B well 3	
	ESCM-92100.3A	ESCM A well 3	
	ESCM-92100.3B	ESCM B well 3	
	DVA-92103.3	Dump valve assembly well 3	
	DHSV-92103.3	Downhole safety valve well 3	
	PRCM-92100.4A	PRCM A well 4	
	PRCM-92100.4B	PRCM B well 4	
	SC-92100.4A	Cathode A well 4	
	SC-92100.4B	Cathode B well 4	
	ESCM-92100.4A	ESCM A well 4	
	ESCM-92100.4B	ESCM B well 4	
	DVA-92103.4	Dump valve assembly well 4	
	DHSV-92103.4	Downhole safety valve well 4	
	HP-92100.1	HP Jumper UTA to tree 1	
	MEOH-92100.1	MeOH Jumper UTA to tree 1	
	KHI-92100.1	KHI Jumper UTA to tree 1	
	CI-92100.1	CI Jumper UTA to tree 1	
	COAX-92100.1A	Coax Jumper UTA to PRCM A tree 1	
	COAX-92100.1B	Coax Jumper UTA to PRCM B tree 1	
	PC-92100.1A	P/C Jumper PRCM A to ESCM A tree 1	
	PC-92100.1B	P/C Jumper PRCM B to ESCM B tree 1	
	HP-92100.2	HP Jumper UTA to tree 2	
	MEOH-92100.2	MeOH Jumper UTA to tree 2	
	KHI-92100.2	KHI Jumper UTA to tree 2	
	CI-92100.2	CI Jumper UTA to tree 2	
	COAX-92100.2A	Coax Jumper UTA to PRCM A tree 2	
	COAX-92100.2B	Coax Jumper UTA to PRCM B tree 2	
	PC-92100.2A	P/C Jumper PRCM A to ESCM A tree 2	
	PC-92100.2B	P/C Jumper PRCM B to ESCM B tree 2	
	HP-92100.3	HP Jumper UTA to tree 3	FUTURE
	MEOH-92100.3	MeOH Jumper UTA to tree 3	FUTURE
	KHI-92100.3	KHI Jumper UTA to tree 3	FUTURE

	CI-92100.3	CI Jumper UTA to tree 3	FUTURE
	COAX-92100.3A	Coax Jumper UTA to PRCM A tree 3	FUTURE
	COAX-92100.3B	Coax Jumper UTA to PRCM B tree 3	FUTURE
	PC-92100.3A	P/C Jumper PRCM A to ESCM A tree 3	FUTURE
	PC-92100.3B	P/C Jumper PRCM B to ESCM B tree 3	FUTURE
PCV-92101.1		Production Choke valve well K5F-1	
PWV-92101.1		Production Wing Valve well K5F-1	
UPMV-92102.1		Upper Production Master Valve well K5F-1	
DHSV-92103.1		Down Hole Safety Valve well K5F-1	
AMV-92103.1		Annulus Master Valve well K5F-1	
BAIV-92100.1		B Annulus Isolation Valve well K5F-1	
XOV-92101.1		Crossover Valve well K5F-1	
CIV-92101.1		Chemical Injection Valve well K5F-1	
CIV-92102.1		Chemical Injection Valve well K5F-1	
CIV-92103.1		Chemical Injection Valve well K5F-1	
XEV-92103.1		HP Dump Valve (solenoid) well K5F-1	
PPU-92101.1		Production Pressure Upstream well K5F-1	
PPD-92111.1		Production Pressure Downstream well K5F-1	
APTA-92103.1		Annulus Pressure Transmitter A well K5F-1	
APTB-92105.1		Annulus Pressure transmitter B well K5F-1	
PTD-92101.1		Production Temperature Downstream well K5F-1	
PTU-92104.1		Production Temperature Upstream well K5F-1	
PT-92104.1		Downhole Pressure Transmitter	
TT-92-103.1		Downhole Temperature Transmitter	
PCV-92101.2		Production Choke valve well K5F-2	
PWV-92101.2		Production Wing Valve well K5F-2	
UPMV-92102.2		Upper Production Master Valve well K5F-2	
DHSV-92103.2		Down Hole Safety Valve well K5F-2	
AMV-92103.2		Annulus Master Valve well K5F-2	
BAIV-92100.2		B Annulus Isolation Valve well K5F-2	
XOV-92101.2		Crossover Valve well K5F-2	
CIV-92101.2		Chemical Injection Valve well K5F-2	
CIV-92102.2		Chemical Injection Valve well K5F-2	
CIV-92103.2		Chemical Injection Valve well K5F-2	
XEV-92103.2		HP Dump Valve (solenoid) well K5F-2	
PPU-92101.2		Production Pressure Upstream well K5F-2	
PPD-92111.2		Production Pressure Downstream well K5F-2	
APTA-92103.2		Annulus Pressure Transmitter A well K5F-2	
APTB-92105.2		Annulus Pressure transmitter B well K5F-2	
PTD-92101.2		Production Temperature Downstream well K5F-2	
PTU-92104.2		Production Temperature Upstream well K5F-2	
PT-92104.2		Downhole Pressure Transmitter	
TT-92103.2		Downhole Temperature Transmitter	
PCV-92101.3		Production Choke valve well K5F-3	FUTURE
PWV-92101.3		Production Wing Valve well K5F-3	FUTURE
UPMV-92102.3		Upper Production Master Valve well K5F-3	FUTURE

DHSV-92103.3		Down Hole Safety Valve well K5F-3	FUTURE
AMV-92103.3		Annulus Master Valve well K5F-3	FUTURE
BAIV-92100.3		B Annulus Isolation Valve well K5F-3	FUTURE
XOV-92101.3		Crossover Valve well K5F-3	FUTURE
CIV-92101.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92102.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92103.3		Chemical Injection Valve well K5F-3	FUTURE
XEV-92103.3		HP Dump Valve (solenoid) well K5F-3	FUTURE
PPU-92101.3		Production Pressure Upstream well K5F-3	FUTURE
PPD-92111.3		Production Pressure Downstream well K5F-3	FUTURE
APTA-92103.3		Annulus Pressure Transmitter A well K5F-3	FUTURE
APTB-92105.3		Annulus Pressure transmitter B well K5F-3	FUTURE
PTD-92101.3		Production Temperature Downstream well K5F-3	FUTURE
PTU-92104.3		Production Temperature Upstream well K5F-3	FUTURE
PT-92104.3		Downhole Pressure Transmitter	FUTURE
TT-92103.3		Downhole Temperature Transmitter	FUTURE
PCV-92101.4		Production Choke valve well K5F-4	FUTURE
PWV-92101.4		Production Wing Valve well K5F-4	FUTURE
UPMV-92102.4		Upper Production Master Valve well K5F-4	FUTURE
DHSV-92103.4		Down Hole Safety Valve well K5F-4	FUTURE
AMV-92103.4		Annulus Master Valve well K5F-4	FUTURE
BAIV-92100.4		B Annulus Isolation Valve well K5F-4	FUTURE
XOV-92101.4		Crossover Valve well K5F-4	FUTURE
CIV-92101.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92102.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92103.4		Chemical Injection Valve well K5F-4	FUTURE
XEV-92103.4		HP Dump Valve (solenoid) well K5F-4	FUTURE
PPU-92101.4		Production Pressure Upstream well K5F-4	FUTURE
PPD-92111.4		Production Pressure Downstream well K5F-4	FUTURE
APTA-92103.4		Annulus Pressure Transmitter A well K5F-4	FUTURE
APTB-92105.4		Annulus Pressure transmitter B well K5F-4	FUTURE
PTD-92101.4		Production Temperature Downstream well K5F-4	FUTURE
PTU-92104.4		Production Temperature Upstream well K5F-4	FUTURE
PT-92104.4		Downhole Pressure Transmitter	FUTURE
TT-92103.4		Downhole Temperature Transmitter	FUTURE

9.3 Special Requirements

All warning and emergency signs need to be English **and** Dutch language as per NL00-U-6S-061.

10 Equipment Requirement Specification

10.1 Master Control Station (MCS)

The redundant MCS will be the communication interface between the ICSS and the K5F electrical Subsea Control Modules (ESCM). The MCS will be located in the electrical switch room of the K6P Platform (safe area) and will be powered from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-01 Supplemental Requirements Specification for MCS Hardware

X-076721-87-02 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Control and Management

X-076721-87-03 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Process Interlocks and Shutdowns

X-076721-87-12 Supplemental Requirements Specification for MCS/ICSS Control Interface

10.2 Electrical Power and Control Unit (EPCU)

The EPCU is a redundant electrical power and communication unit for high voltage DC power supply and communication to the subsea installed ESCM's. The EPCU will be located in the electrical switch room of the K6P Platform (safe area) and will receive separate power supply for channel A and B from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-04 Supplemental Requirements Specification for EPCU

10.3 Hydraulic Power Unit (HPU)

A dedicated Hydraulic Power Unit (HPU) will be installed on the K6C platform to provide clean hydraulic HP power for the control of the K5F Downhole Safety Valves (DHSV). The HPU will be controlled from a remote PLC located in a safe area and will be monitored by the MCS/ICSS.

Design Pressure = 690 bar

Hydraulic Fluid = Castrol Transaqua HT

Refer to the following documents for detailed technical requirements:

X-076721-87-05 Supplemental Requirements Specification for HPU

10.4 Topside Umbilical Termination Unit (TUTU)

The Topside Umbilical Termination Unit (TUTU) shall terminate the main electro/hydraulic/chemical umbilical lines and provide the interface to the K6C platform equipment. It will only provide a hardware interface without any block/bleed-valves and/or Pressure gauges for testing or maintenance work. All tubing and couplers need to be supplied by others. The electrical cables shall be terminated in separately mounted explosion proof Junction Boxes or with moulded splice connections.

Refer to the following documents for detailed technical requirements:

X-076721-87-06 Supplemental Requirements Specification for TUTU

10.5 Umbilical Termination Assembly (UTA)

The Umbilical Termination Assembly (UTA) shall be a robust construction to provide interfaces with the umbilical and shall allow to suitably terminating all functions. The UTA shall be setup for the hydraulic connection of the two trees currently in the scope of supply and the two future trees.

Refer to the following documents for detailed technical requirements:

X-076721-87-07 Supplemental Requirements Specification for UTA

10.6 Power Regulation and Control Module (PRCM)

The Power Regulation and Communication Module (PRCM) regulate the power to the ESCM and provide communication to the ESCM. It also provides the connection to the external cathode package.

The PRCM shall be diver recoverable by using a special change out tool and shall be connected to a mounting base.

10.7 Electric Subsea Control Module (eSCM)

The eSCM controls various electric actuators on the tree/wellhead and acquires data from the subsea instrumentation for the transmission to the surface.

The following functions need to be controlled by the eSCM:

No.	Function	Actuator Size	Location	Note
1	CIV 1	¾”	Tree	
2	CIV 2	¾”	Tree	
3	CIV 3	¾”	Tree	
4	BAIV	¾”	Wellhead	
5	AMV	2”	Wellhead	
6	XOV 1	2”	Tree	
7	UPMV	5”	Tree	
8	PWV	5”	Tree	
9	PCV	N/A	Tree	
10	SCSSV Open	N/A	Tree	
11	SCSSV Close	N/A	Tree	

The following tree sensors need to be monitored by the eSCM:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

10.8 Anode Package / Anode Package Foundation Base

There are two separate Anode Packages for the A and the B channel of the system. The Anode Package shall be a robust frame construction for two separate and diver retrievable Anodes. The Anode package requires two separate electrical connectors for each anode for the connection via a flying lead to the anode umbilical assembly. The Anode Packages need to be clearly marked with “A” and “B”. The painted steel frame is protected by FRP grating on all four sides and on top to prevent damages caused by dropped objects. The two anode packages for the channels A and B will be placed on a further support frame to minimize the required installation effort. Both Anode Packages will be located on a Foundation Base.

10.9 Cathode Package

There are four separate Cathode Packages for the A and B channel of each tree. The Cathode Packages will be connected to the respective PRCM on the Subsea Protection Structure via an electrical flying lead. The Cathode Packages are diver installable and will be hooked into the outside plates of the Subsea Protection Structure. The Cathode Package contains the cathode itself and a frame with FRP grating on top to provide mechanical protection.

10.10 Anode Umbilical Assembly

The complete Anode Umbilical Assembly includes the following items:

- an approx. 100m long umbilical with an overall armour and four separate armoured 2,5mm² cores
- a pulling head assembly with 100mm diameter
- a hang-off assembly
- bend restrictor assembly at the Subsea end of the umbilical incl. clamping surface to fix the umbilical
- 4 pigtails, each 6m long, at the end of the umbilical

10.11 Electrical Flying Leads

The electrical flying leads shall comprise a cable moulded to the subsea connectors at both ends. The colour of these cables shall be black with a marking by means of approx. 30cm long heat shrinks at both ends. System A will be marked “blue” and System B “yellow”. These flying leads shall be designed for diver make up only.

10.12 Tree/Wellhead Pressure and Temperature Sensors

The following Pressure and Temperature Sensors are located on the Tree and the Wellhead:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

These sensors shall meet the following requirements:

- Field proven design
- The sensors shall be suitable for the intended subsea service
- Redundant with separate interconnection cables for the A and B channel
- Diver retrievable sensors
- With block-bleed-block assemblies on the pressure sensors
- Minimum accuracy of:
    - +/- 0.03% x full scale accuracy and a drift of 0.2%/year for the pressure sensors
    - +/- 0.3°C accuracy and a drift of 0.2°C/year for the temperature sensors

10.13 SCSSV Dump Valve Assembly

A 3/2 way valve shall be located on the tree for the operation of the SCSSV. The operation of this valve will be direct hydraulic by use of Transaqua HT fluid from a dedicated HPU through a single HP supply line in the main umbilical. The valve shall be designed for the design pressure of the SCSSV system and shall be activated by the ESCM. This assembly will consist of a fixed plate which will be located on the tree and a free plate with the dump valve on which is diver retrievable. Both plates will be connected via quick couplers without the use of poppets. The tree tubing will be connected to the fixed plate by using Autoclave anti-vibration couplers.

11 Quality requirements

A Quality Plan to be used for the project shall be created. For the Project Quality Specification see section 5.1 of this document.

11.1 CE Marking

The topside hardware and software is to be supplied with a CE declaration of conformity, which confirms compliance with all relevant directives.

12 Handling/Installation/Intervention & Shipping

Project shall provide detailed installation and intervention recommendations, and step-by-step project specific procedures, for review as part of the project-engineering phase.

All separately installable and retrievable items shall be provided with suitable lifting points and be generally designed to allow a smooth, simple and quick installation/retrieval process to be performed by divers. This shall include the following items:

- Electric Subsea Control Module (eSCM)
- Power Regulation & Communication Module (PRCM)
- Electrical flying leads between
  - Tree/Wellhead located junction boxes and sensors
  - UTA and PRCM
  - PRCM and ESCM
  - PRCM and Cathode Package

  Tree and Wellhead Pressure and Temperature Sensors
- SCSSV Dump Valve Assembly
- Anode Umbilical Assembly

All subsea assemblies shall be designed to withstand an abandonment period of 6 month sub sea, located where required but not connected to its services (hydraulic, chemical, electrical, ..)

12.1 Use of guidelines

All Subsea equipment (trees, choke inserts, jumpers, control modules, etc.) shall be designed for installation and retrieval by divers with the use of guidelines.

12.2 Lifting / Handling

All equipment shall be designed for safe handling and transportation, both onshore and offshore. All lifting points on all equipment handled offshore shall be:

- Physically load tested to rated weight
- Designed for loads as defined in API 17D and API RP 17G.
- Any welding and associated NDE, which is required for lifting apparatus shall be in compliance with API 17D and API RP 17G.
- All lifting points on all equipment, both purchased and rented; to be handled offshore shall be tested and labelled in accordance with API 17D and API RP 17G.
- All shipped equipment assemblies shall be labelled with their weight.
- Slings and rigging shall be provided for items that require lifting.

12.3 Connection of flying leads

The Subsea hydraulic and electrical flying leads shall be designed to be installed by the use of divers.

Following installation of the Xmas tree, the diver (after removing the LTC from the remote stab or connector) shall pick up the remote end connection and install it to the UTA or Wellhead.

The process shall be similar for the electrical connector.

For recovery the procedure shall be reversed.

12.4 ROV Interfaces

All ROV and diver interfaces shall be designed in accordance with ISO 13628-8.

12.5 ROV Marking of Subsea Stations

Marking of subsea station shall be in accordance with ISO 13628-1 and the following requirements:

- Letter size shall be 50mm

13 Testing

Each item of deliverable equipment shall be tested in accordance with a project approved and CAMERON supplied acceptance test procedure to verify the following as a minimum:

- Functionality
- Internal pressure testing
- External pressure testing
- Control fluid cleanliness to SAE AS4059

CAMERON shall provide written step-by-step procedures for these tests to be provided to COMPANY.

A Control System Integration Test shall be performed in accordance with a COMPANY approved procedure to demonstrate that all of the individual items of equipment function correctly as a system.

The testing programme for the Subsea Production Control System shall be undertaken in the stages detailed as follows:

- Factory Acceptance Test for single units (FAT's)
- System Factory Integration Testing (FIT)
- Tree EFAT
- System Integration Testing (SIT)
- Platform Commissioning
- Offshore Pre-submergence Testing/Deck Testing
- System Commissioning

13.1 Factory Acceptance Test (FAT)

Each deliverable item shall be subjected to a Factory Acceptance Test (FAT). The purpose of this FAT shall be to demonstrate the item is suitable for the intended purpose and functions correctly. FAT tests shall include hydrostatic proof pressure testing to 1.5 times the design pressure of the Subsea control system.

All FAT procedures shall be step-by-step and submitted for review and approval prior to testing commencing.

All critical equipment components shall be subjected to sub-assembly tests during the assembly phase of manufacture and to carry out these tests, the necessary equipment and fittings are specialised in-house equipment and are not project deliverable.

Each item of equipment shall be subject to an in-house FAT in accordance to an approved standard procedure document to demonstrate these meet the specified operational and functional requirements.

The tests shall include interface connections and mechanical alignment tests to verify design and manufacturing limit tolerance effects, component inter-changeability, together with hydraulic fluid system flushing and / or cleanliness checks as necessary to ensure the system meets SAE AS4059. The hydraulic tubing and piping pressure lines shall be hydrostatic pressure tested to 1,5 times the design pressure.

The test equipment shall be determined by the proposed testing programme, however in the event of additional testing or if testing in other locations is required, the quantity of test equipment detailed shall be subject to review.

Testing of fabricated items shall also include continuity testing of bolting.

Testing on subsea assemblies shall include continuity testing and earthing testing.

The maximum value for the resistance measured shall be 0.1 Ohm.

13.1.1 Environmental Stress Screening (ESS)

Modules or subassemblies containing electrical equipment and/or electronic equipment, which are intended for permanent subsea installation shall comply with section 4 of the Total specification GS EP SPS 022 “Environmental testing of Subsea Electronics”.

13.2 Factory Integration Test (FIT)

A System Factory Integration Test (FIT) shall be conducted to verify the correct interfacing and inter-working of all items of the subsea production control system equipment. External interfaces, for example Xmas tree valves & sensors, umbilical cables, DCS, MCC & ESD systems etc. shall be simulated for the purpose of the test. The testing shall be designed to verify the functional and operational integrity of the subsea production control system.

13.3 Xmas Tree/SCM system integration test (Tree eFAT)

A Xmas Tree/SCM System Integration Test shall be conducted for the Xmas tree, following completion of the Xmas tree FAT within the factory.

14 Special packing/shipping procedures/Instructions

For deliverables consisting of a main assembly with additional loose items (Lifting Slings, Test Hoses/Cables, Fill Lance, Pre-Charge Kit, Fluid in Barrels etc.), separate packing/shipping procedures/instructions with included component check-lists shall be provided.

The same shall apply for deliverables that can not be shipped as complete units, as transportation could result in damage of internal components.

These procedures/instructions should be part of the BOM from the related parts.

For all units which include any fluids or substances, COSHH sheets (Control of Substances Hazardous to Health) shall be delivered with the unit. These COSHH sheets shall be available early in the process for supply to the client.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

1	09NOV07	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
B	26SEP07	Issued for Client Comments	A. Weilandt	S. Horne	
A	20SEP07	Issued for internal IDC	A. Weilandt	S. Horne	
Rev.	**Date**	**Reason for Issue**	**Originator**	**Checked**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirement Specification** **Electrical Power and Communication Unit (EPCU)**		
PAGE 1 OF 13	**Customer Document Number:**	54NL92-W-0S-507	REV. 1
	Cameron Document No.	X-076721-87-04	REV. 01

TABLE OF CONTENTS

1 Document Revision Status / Record

Rev.	Date	Description of change	Author
A	20SEP07	Initial release	A. Weilandt
B	26SEP07	Incorporated comments from Internal IDC	A. Weilandt
01	09NOV07	Front sheet updated to “Approved for Construction”, no further changes	A. Weilandt

2 Introduction

This document is written to consolidate the technical requirements for the Electrical Power and Communication Unit (EPCU) intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

3 Scope of this document

The scope of this document is to define the technical requirements for the EPCU intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

4 Abbreviations & Definitions

4.1 Abbreviations

CCR	Central Control Room
DCS	Distributed Control System
EPCU	Electrical Power and Control Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
ICSS	Integrated Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
MCS	Master Control Station
PCS	Process Control System
PRCM	Power Regulation and Communication Module
SSS	Safety Shutdown System
UPS	Uninterruptible Power Supply

5 References

5.1 Cameron Documents

Following documents **MUST** be considered during the design phase.

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Subsea production control system	GS EP SPS 019
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073

Any agreed deviations from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

Any clarifications from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

In case of conflict between documents the following order of priority shall be applied:

1) Local and international rules and regulations
2) Company Safety Specifications (GS EP SAF)
3) Project Specifications
4) Company Standards (NL00)
5) Company General Specifications

5.3 Codes, standards and regulations

Following codes, standards and regulations shall be considered during the design phase.

Number	Description
API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platform
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment
IEC-60529	Classification of Degrees of Electrical Protection provided by Enclosures
IEC – 92	Section 9.0 “Electrical Installations in Ships”
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements

5.4 CE marking

CE marking **will** be required for the K5F project.

6 Scope of Supply

The scope of supply for the EPCU shall consist of the following:

6.1 Permanently installed Equipment

The scope for the permanently installed EPCU equipment shall consist of the following main items:

- 4 off single Cabinets

6.2 Installation and Test Equipment

The scope for the EPCU Installation and Test equipment shall consist of the following main items:

- N/A

6.3 Deliverable Documentation

The deliverable documentation for the EPCU shall consist of the following as a minimum:

6.3.1 Engineering Documentation Requirements

The scope of supply for engineering documentations shall consist of the following as a **minimum**:

- Assembly Drawing
- Circuit Diagram
- Field Termination Drawing
- PLC Data Input/Output Schedule
- Hardware Factory Acceptance Test Procedure
- Special Packing/Shipping Instructions
- Spare Parts List for Installation and Commissioning
- Spare Parts List for 1 year of Operation and Maintenance

6.3.2 Installation, Operation and Maintenance Procedure Requirements

The scope of supply for installation, operation and maintenance procedures for the EPCU shall consist of the following as a **minimum**:

- Installation Procedure

- Operation Procedure
- Maintenance Procedure

6.3.3 Quality Documentation Requirements

A Manufacturing Record Book shall be provided for the EPCU with the following information as a **minimum**:

6.3.3.1 EPCU QA Records

- Factory Acceptance Test records
- Certificate of compliance

7 EPCU Design Specifications

7.1 Equipment Design Requirements

Design requirements for the MCS are defined as follows:

Feature	Static Design Requirement	Performance Requirements	Additional Description
Operating Environment	Controlled environment in the safe area		
Maximum (not to exceed) Dimensions	606 mm (Width) 805 mm (Depth) 2225 mm (Height)		These values are for a single cabinet. Complete EPCU is therefore 2424 x 805 x 2225mm
Maximum (Not to exceed) Weights	250 kg (single cabinet) 1000 kg (complete EPCU)		
Service Access	500 mm (Front) 0 mm (Rear) 0 mm (Left) 0 mm (Right) 100 mm (Top)		
Area Classification	Located in the safe area	N/A	Located in K6P technical room
Ambient Air Temperature	Max.: not exceeding +40°C Daily average: not exceeding +35°C Minimum: not less than -5°C		
Service Life	20 years		
Cabinet Construction	Self-contained 19” rack.	Cabinet will be bolted to the floor.	
Cabinet colour	Gray, RAL 7035	Internal and external	
Cable Entry	Bottom entry	Clamp mechanism for incoming cables need to be part of the cabinet	A suitable number/size of cable trays shall be provided for all external interconnection cables.
Earthing	Cabinet to be provided with earthing bars close to cable entry in the bottom of the cabinet		
Terminals	Screw-type terminals to be used		Phoenix to be used
Power Supply	1x 3phase 380…440V / 45…65 Hz per cabinet	See Interface Requirements	

Feature	Static Design Requirement	Performance Requirements	Additional Description
Output Voltage	Max. 4kV DC / 4 A		
Tagging (Drawing/ equipment)	Refer to General Design Basis		
Safety / Warning Signs	All safety and warning signs shall be in English **and** Dutch language.	White letters on red background to be used.	
Lifting/ Handling	Each Cabinet has to have suitable lifting eyes		Lifting slings not included in scope of supply
Marking	- Equipment Name - Equipment Tag - Company Name - Contract/Purchase Order Number - Cameron PN - Unique Serial Number	All marking shall be manufactured in such a manner so as to ensure legibility throughout design life.	All shipped items shall be marked with this info as a minimum.

7.2 Interface Requirements

7.2.1 Electrical Interface Requirements

Electrical interfaces shall be finally detailed during the detail engineering phase.

Table 7-1 – Electrical Interface Requirements

Description	Voltage	Interface to
Power Supply A	380…440V / 45…65Hz, 3ph	K6P UPS
Power Supply B	380…440V / 45…65Hz, 3ph	K6P UPS
EPCU 1A Control	Profibus	MCS
EPCU 1B Control	Profibus	MCS
EPCU 2A Control	Profibus	MCS
EPCU 1B Control	Profibus	MCS
EPCU 1A Control	Ethernet connection	MCS
EPCU 1B Control	Ethernet connection	MCS
EPCU 2A Control	Ethernet connection	MCS
EPCU 1B Control	Ethernet connection	MCS
Hardwired I/O from to SSS	24 VDC	SSS
Earthing connection (PE)	N/A	Platform Earthing system

7.3 Maintainability Requirements

The cabinet layout shall be such that items can be easily removed from the unit for repair and/or replacement trough the cabinet door.

7.4 FAT Test Procedure

The EPCU shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- Insulation Test Channel A & B
- Earthing verification
- Power Supply Check
- Fan test

- Heater test
- SSS Interface test
- Weighing
- Final inspection

7.5 Special Packing & Shipping Instructions

If applicable for packing and shipping special instructions shall be provided addressing the following as a **minimum**:

- Internal components to be removed prior to shipment
- Loose Item Check List

8 Hold Points

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

11 Feb. 2008	Approved for Construction	J. Dannehl	M. Lehmker	J. Dannehl
19 October 2007	Issued for Client Comment	J. Dannehl	R. Gabel	J. Dannehl
03 May 2007	Issued for internal IDC	J. Dannehl	R. Gabel	J. Dannehl
Date	**Reason for Issue**	**Originator**	**Checker**	**Approver**

CAMERON	**Document Title:** **Hardware Design Specification for Electrical Power & Communication Unit (EPCU)**		
	Customer Document Number:	**54NL92-W-6S-511**	REV. 1
	Cameron Document No.	X-076734-04	REV. 02

Hardware Design Specification (HDS)

For

Electrical Power & Communication Unit (EPCU)

With Modem
4000V, 4A

Cameron Part Number:
223022-31

Cameron Revision	Date	Prepared by	Checked by
02	11 February 2008	J. Dannehl	M. Lehmker
01	16 November 2007	J. Dannehl	M. Lehmker
B	19 October 2007	J. Dannehl	R. Gabel
A	04 May 2007	J. Dannehl	R. Gabel

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1 REVISION STATUS RECORD

REV.	DATE	DESCRIPTION OF CHANGE	SECT.	REASON FOR CHANGE
A	04 May 2007			Initial Release
B	19 October 2007	IDC comments implemented Additional information implemented	Misc.	Comments
01	16 November 2007	No change; SAP release	NA	BOM release required
02	11 February 2008	IT Grounding System added	9.4.1	Customer request

2 SCOPE OF DOCUMENT

The purpose of this Hard Design Specification (HDS) is as following:

- The HDS shall provide a short technical description of a single Electrical Power & Communication Unit, used for the TOTAL K5F project

3 ABBREVIATIONS

a	Absolute Pressure
AC	Alternating Current
Assy	Assembly
API	American Petroleum Institute
AWG	American Wire Gauge
BOM	Bill of Material
°C	Degree Celsius
CE	Community European
CP	Cathodic Protection
EB	Electron Beam
EN	European Norm
EPCU	Electric Power & Communication Unit
°F	Degree Fahrenheit
Fa.	Firma (german, = company)
FAT	Factory Acceptance Test
HV	High Voltage (>1000VAC; >1500VDC)
ISO	International Organisation for Standardization
MCS	Master Control Station
MFG	Manufacturer
MTBF	Mean Time Between Failure
NACE	National Association Corrosion Engineers
N/C	Not Connected
Pa	Pascal
PLM	Power Line Modem
POM	Polyoxymethylene (plastic)
PRCM	Power Regulation & Communication Module
QP	Quality Plan
SST	Stainless Steel
TBA	To be advised
TBC	To be confirmed
TBD	To be defined
TSP	Twisted Screened Pair
UNS	Unified Numbering System for Metals and Alloys

4 HEALTH, SAFETY AND ENVIRONMENT ISSUES

Cameron is committed to ensuring that any work carried out with respect to the supply of any equipment or process on their behalf is carried out in a manner which addresses, safety, human health and respect for the environment. Cameron is committed to compliance with applicable laws and regulations wherever it conducts its business and expects Contactors or Vendors to demonstrate the same commitment to Health, Safety and Environmental issues. Vendors or Contractors must demonstrate compliance in a verifiable manner, which may be subject to the inspection and approval of by Cameron's.

5 DEFINITIONS

DD.MM.YYYY	Date format → DD = day, MM = month, YYYY= year
, (comma)	Decimal symbol
. (point)	Digital grouping symbol

6 REFERENCE DRAWINGS

Following drawings are for reference:

- SK-066001-88-04 System Interconnection Diagram
- SK-066022-31 Assembly Drawing (General Arrangement Drawing)
- SK-066022-31-04 Circuit Diagram
- SK-066022-31-42 Field Termination Diagram

7 INTRODUCTION

For the Total K5F Project, four EPCUs will be used.

Each EPCU supplies one PRCM with electrical power and communication data, via an integrated modem and diplexer.

The arrangement of all four EPCU is shown on reference drawing SK-066022-31

All four High Voltage Power Supplies are identical and therefore interchangeable.

An EPCU consists of a commercial High Voltage (HV) Power Supply (Supplier: Fa. FUG, Rosenheim, Germany) and a Modem/Diplexer Unit (Supplier: Fa. Kunow, Berlin, Germany).

Both components are assembled by Cameron, Celle, Germany.

8 APPLICABLE CODES, GUIDELINES AND STANDARDS

The EPCU is minimum designed to following standards:

- ISO 9001 Quality Systems: Model for Quality Assurance in Design, Development, Production, Installation and Servicing
- Directive 89/336/EWG Directive on Electromagnetic Compatibility
- Directive 73/23/EWG Low-Voltage Equipment Directive

Conformity is proven by compliance with the following standards:

- EN 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use
- EN 61000-6-2 Electromagnetic compatibility (EMC) - Generic standards - Immunity for industrial environments
- EN 61000-6-4 Generic standards- Emission standard for industrial environments

Note. Where there is any ambiguity between codes, consult Cameron Engineering. Generally the more stringent standard will apply.

Following codes and standards are for reference:

- IEC 529 Classification Of Degrees Of Electrical Protection Provided By Enclosures
- IEC 617 Graphic symbols for diagrams

9 TECHNICAL DATA

9.1 General

The EPCU is a standard high voltage power supply. For every path, one power supply is needed (e.g. Tree 1, Channel A).

In normal operation, the EPCU will be controlled (ON/OFF, voltage, current) and monitored (voltage, current, return currents, status) by the MCS.

For test purposes only, the power supply can be operated locally (key switch).

The Surface Modem, which modulates the data onto the DC supply voltage, is also located in the EPCU. The EPCU supplies the Surface Modem with 1 phase.

9.2 Environmental Requirements

The EPCU with modem is designed for following environmental conditions:

Operating Temperature:	-5°C	to	+40°C
Storage Temperature:	-18°C	to	+50°C

9.3 Dimension / Layout / Weight

Refer SK-066022-31 Assembly Drawing

and/or attachment **A**

9.4 Power Supply & Power Consumption

9.4.1 Single EPCU

Each EPCU require a three-phase alternating current supply:

- Voltage: **380V.. 440V**, three phases with **NEUTRAL**
- Frequency: **45 …65Hz** Hz
- 3 Phase Input Current Breaker: **63A**
- Nominal Input Current: **max.~55A**
- Maximal Power Consumption: **22** kW
- Standby (Basic) Power Cons. **3** kW
- Grounding System: **TN** or **IT**

9.4.2 Four EPCUs, Two Channels

EPCUs for channel A and EPCUs for channel B should be supplies from different, uninterruptible power supplies, to be in line with the “philosophy of redundancy”.

9.5 Circuit Diagram and Electrical Interfaces:

For details of the power supply and electrical interfaces, refer

- SK-066022-31-04 Circuit Diagram
- SK-066022-31-42 Field Termination Diagram

9.6 Other & Additional Technical Data: High Voltage Power Supply

Type:	**FUG HKC 10000-5000 MOD**
Supplier:	Fa. FUG
Cameron PN	2197096-45

AC - Input	380…440V, Mains connection thee-phase 45 - 65 Hz, depending on the type, see type label. Over voltage category II according to IEC664. PE (non fused earth) always necessary! Over voltage category II according to IEC664.
EMC Standards	see emc-measuring com. 14587-02-01 series
Safety	The units are in accordance with **EN 61010** (VDE 0411)
Environment Conditions	**Operating room :** Only for indoor usage (see section 2.1.) **Temperature** : >5 °C to 40 °C **Air humidity** : Max. relative humidity 80% until 31 ºC, linear decreasing until 50% relative humidity with 40 ºC **Atm press :** Height until 2000 m over NN **Contamination :** 2, according to IEC664
Protection Class	IP20 / Roof ventilator IP 43
Output Voltage / Current	0 … **4000V (modification)**, 0 … 4A
Output Isolation	The A+ output to <±10V against earth.(Without current between A+ and earth). The A+ output to <±20V against earth.(With 4A current between A+ and earth).
Setting Range Voltage **Current**	appr. 1% to 100% from nominal value appr. 1% to 100% from nominal value
Reproducibility of the charging voltage	at ±10% mains voltage variation <±0,01% from nominal value, over 8 h: <±0,1% from nominal value within the temperature range: <±0,02%/K at repetition frequency <10Hz: <±0,1% from nominal value at repetition frequency >10Hz: <±1% from nominal value
Repetition frequency	max. 10Hz
Setting Resolution	With potentiometer on the front panel $1x10^{-4}$ from nominal value
Display	DVM 3½ digits for voltage and current. At the high end value a display overflow can occur. The display than shows only "1" LEDs for status report voltage control / current control.

9.7 Digital Interface Data: High Voltage Power Supply

Refer attachment **B**

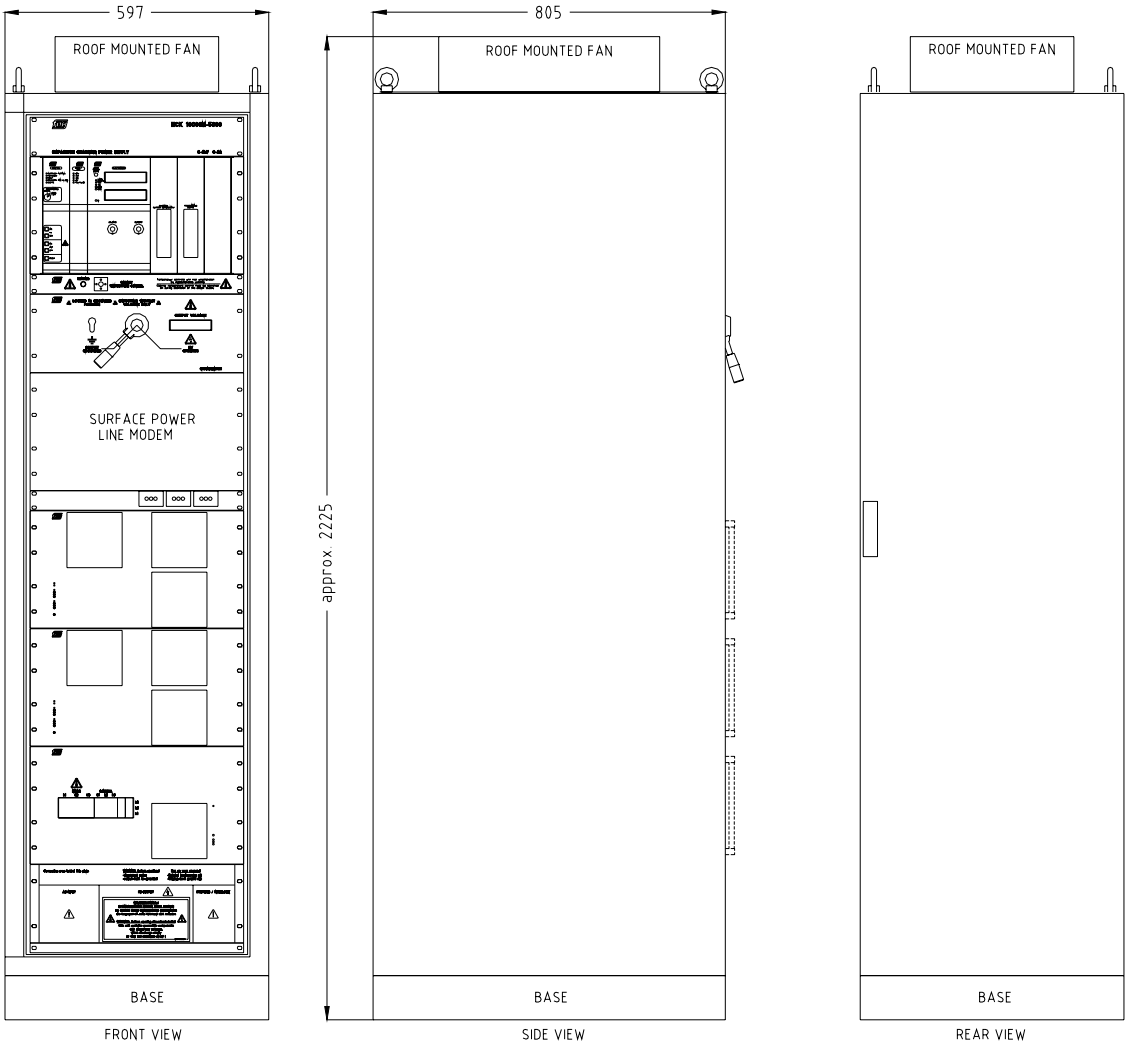
9.8 Technical Data: Modem

Type:	**Surface PLM**
Supplier:	Fa. Kunow
Cameron PN	2197096-42
Data transmission	Half duplex, 19200 baud
Modulation	4Q PSK (4-quadtrant phase shift keying)
Transmit Signal Voltage	Max. 320 Vpp @ 40Ohm
Cable Attenuation	80 dB (equivalent to 160km Cameron coaxial cable)
Power Consumption	1850W
Weight	45 kg
Dimensions (L x W x H)	486mm x 483mm x 265mm

10 ATTACHMENT A

Weight with Modem: approx. **365kg**

Dimension & Layout:



11 ATTACHMENT B

11.1 Control power supply

Data format input data block				
Byte				
0	LSB	Voltage setvalue 0...4000	>S0	Output Voltage = 0...4000V
1	MSB			
2	LSB	Current setvalue 0...4	>S1	Output Current = 0...4A
3	MSB			
4	Bit 0	not used		
	Bit 1	not used		
	Bit 2	not used		
	Bit 3	not used		
	Bit 4	not used		
	Bit 5	not used		
	Bit 6	not used		
	Bit 7	Timeout <500ms	>CASM 3	Shutdown power supply
5	Bit 0..3	not used		
	Bit 4..7	not used		
6	Bit 0..3	not used		
	Bit 4..7	not used		
7	Bit 0	not used		
	Bit 1	not used		
	Bit 2	not used		
	Bit 3	HV ON/OFF (COMMAND) output X1	>B1	1' = HV ON '0' = HV OFF
	Bit 4	not used		
	Bit 5	not used		
	Bit 6	not used		
	Bit 7	not used		
8	LSB	not used		
9	MSB	not used		
10	LSB	not used		
11	MSB	not used		
12		not used		
13		not used		
14		not used		
15		SYNC Byte, value is copied from input data block		

Data format output data block				
Byte				
0	LSB	Voltage Monitor 0...4000 = 0...4000V	>M0	Output Voltage 0...4000V = Voltage monitor 0...4000
1	MSB			
2	LSB	Current Monitor 0...4 = 0...4A	>M1	Output Current 0...4A = Current monitor 0...4
3	MSB			
4	Bit 0	not used		
	Bit 1	not used		
	Bit 2	not used		
	Bit 3	not used		
	Bit 4	not used		
	Bit 5	not used		
	Bit 6	not used		
	Bit 7	not used		
5	Bit 0	PROGRAMMING MODE DIGITAL (STATUS)	>DON	1' = DIGITAL '0' = LOCAL
	Bit 1	not used		
	Bit 2	not used		
	Bit 3	HV ON/OFF (STATUS)	>DX	1' = HV ON '0' = HV OFF
	Bit 4	Summary fault (STATUS)	>D3R	1' = OKAY '0' = FAULT
	Bit 5	UNIT ON/OFF (STATUS)	>DON	1' = UNIT ON '0' = UNIT OFF
	Bit 6	Voltage Reg. (STATUS)	>DVR	1' = V-REG
	Bit 7	Current Reg. (STATUS)	>DIR	1' = I-REG
6		not used		
7		not used		
8		not used		
9		not used		
10	LSB	serial number		
11				
12				
13	MSB			
14		Errorcode of the most recent command		
15		SYNC Byte, value is copied from input data block		

11.2 External current measurement

Profibus DP

Data format input data block			
Byte			
0	LSB	not used	
1	MSB		
2	LSB	not used	
3	MSB		
4	Bit 0	not used	
	Bit 1	not used	
	Bit 2	not used	
	Bit 3	not used	
	Bit 4	not used	
	Bit 5	not used	
	Bit 6	not used	
	Bit 7	not used	
5	Bit 0..3	not used	
	Bit 4..7	not used	
6	Bit 0..3	not used	
	Bit 4..7	not used	
7	Bit 0	not used	
	Bit 1	not used	
	Bit 2 (output X0 >B0)	**Bit 3 (output X1 >B1)**	**Function**
	0	**0**	**Current shield**
	1	**0**	**Current Anode**
	0	**1**	**Current A+ / earth**
	Bit 4	not used	
	Bit 5	not used	
	Bit 6	not used	
	Bit 7	not used	
8	LSB	not used	
9	MSB	not used	
10	LSB	not used	
11	MSB	not used	
12		not used	
13		not used	
14		not used	
15		SYNC Byte, value is copied to output data block	

Profibus DP

Data format output data block			
Byte			
0	LSB	**Monitor Voltage = 0...±22V (between A+ and earth)**	**>M0**
1	MSB		
2	LSB	**Current Monitor 0...±4,5A (Shield = >B0 0 / >B1 0) (Anode = >B0 1 / B1 0) (A+/earth = >B0 0 / >B1 1)**	**>M1**
3	MSB		
4	Bit 0	not used	
	Bit 1	not used	
	Bit 2	not used	
	Bit 3	not used	
	Bit 4	not used	
	Bit 5	not used	
	Bit 6	not used	
	Bit 7	not used	
5	Bit 0	not used	
	Bit 1	not used	
	Bit 2	not used	
	Bit 3	not used	
	Bit 4	not used	
	Bit 5	not used	
	Bit 6	not used	
	Bit 7	not used	
6		not used	
7		not used	
8		not used	
9		not used	
10	LSB	serial number	
11			
12			
13	MSB		
14		not used	
15		SYNC Byte, value is copied from input data block	

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

28 February 2008	Re-Issued as Approved for Construction	J. Dannehl	M. Lehmker	J. Dannehl
21. Nov 2007	Approved for Construction	J. Grochowski	S. Fischer	J. Dannehl
16. Nov 2007	Issued for Client Comm.	J. Grochowski	J. Dannehl	R. Wrede
19.Oct 2007	Issued for project IDC	J. Grochowski	J. Dannehl	R. Wrede
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Installation Procedure for** **Electric Power & Communication Unit**		
PAGE 1 OF 10	**Customer Document Number:**	54NL92-W-0P-530	REV. 2
	Cameron Document No.	X-065467-02-08	REV. 02

Document Revision History

Rev	Date	Description of change	Reason for change
A	19. October 2007		Initial Release
B	16. November 2007	Comments included	Internal review
01	21. November 2007	Revision increased	Required by customer
02	28 February 2008	ESD Relay added	Customer Change Request

Table of Contents

1 Introduction

1.1 Scope of this Document

This document outlines the procedure for the installation of the Electrical Power & Communication Unit (EPCU) within the TOTAL K5F project.

1.2 Abbreviations

BOM	Bill of Material
CAM	CAMERON
EPCU	Electric Power & Communication Unit
FAT	Factory Acceptance Test
N/A	Not applicable

1.3 Reference Documents / Drawings

Item	Description	Cameron Doc. No.	Customer Doc. No.
1	Bill of Material EPCU	223022-31	N/A
2	Assembly Drawing EPCU	SK-066022-31	54NL92-W-03-502
3	Circuit Diagram EPCU	SK-066022-31-04	N/A
4	Field Termination Diagram EPCU	SK-066022-31-42	54NL92-W-01-501
5	Operation Procedure for EPCU	X-065438-02-73	54NL92-W-0P-541
6	Maintenance Procedure for EPCU	X-065438-02-72	54NL92-W-0P-540
7	Interconnection Diagram Production Control System	SK-066001-88-04	54NL92-W-03-530

1.4 Equipment Description

The EPCU provides the electric power and communication components in 19” rack assembly. The two main components are a 4000 Volt DC electric power supply and a modem in each of the four (4) racks (1A, 1B, 2A, 2B).

1.5 Tools

Only insulated tools must be used.

2 Safety Warnings

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

All personnel must acquaint themselves fully and strictly adhere to all company sites' HEALTH AND SAFETY AT WORK REGULATIONS, together with other specific requirements detailed in this procedure.

All personnel working on the equipment must have the required experience, training and qualifications.

ENSURE THAT NO ELECTRICAL POWER IS APPLIED TO ANY OF THE CONNECTIONS BEFORE RACK HOUSING IS OPENED OR CONNECTIONS ARE MADE – UP OR DISCONNECTED.

DANGER!

The EPCU may contain high electric voltages (400 Volts AC and 4000 Volt DC) also it is disconnected from power supply. Wait 5 minutes before the rack housing is opened to allow discharge of capacitors.

Verify that installation personnel have received a High Voltage training.

Verify (Sign): _____

3 Preparations

3.1 Environment Inspection

Ensure that the environment for the EPCU is clean and dry.

Verify: _____

Check that the floor is prepared for cables that enter the EPCU racks from bottom side.

Verify: _____

Ensure that there are no flammable gases as the EPCU may produce sparks when in operation. Permanent gas monitoring may be required.

Verify: _____

The maximum ambient temperature shall not exceed 40°C.
Maximum relative air humidity: 80% until 31°C linear decreasing to 50% at 40°C.

3.2 Visual Inspection

Verify that the unit is free from external damage.

Verify: _____

Check that there are no loose objects inside the rack housing.

Verify: _____

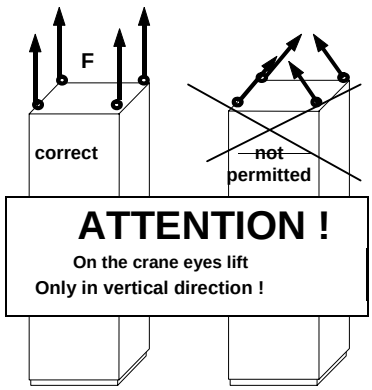
Record the Serial Number of the rack: _____

3.3 Lifting

Lifting weight: Approx. 370 kg

Only 4 point lifting is allowed to the EPCU racks (slings are not in scope of supply):

Verify: _____



4 Installation

Check that the modems are correctly mounted in the racks secured by 4 screws (delivery expected with modems in place). Position and fix the racks as required.

Verify: _____

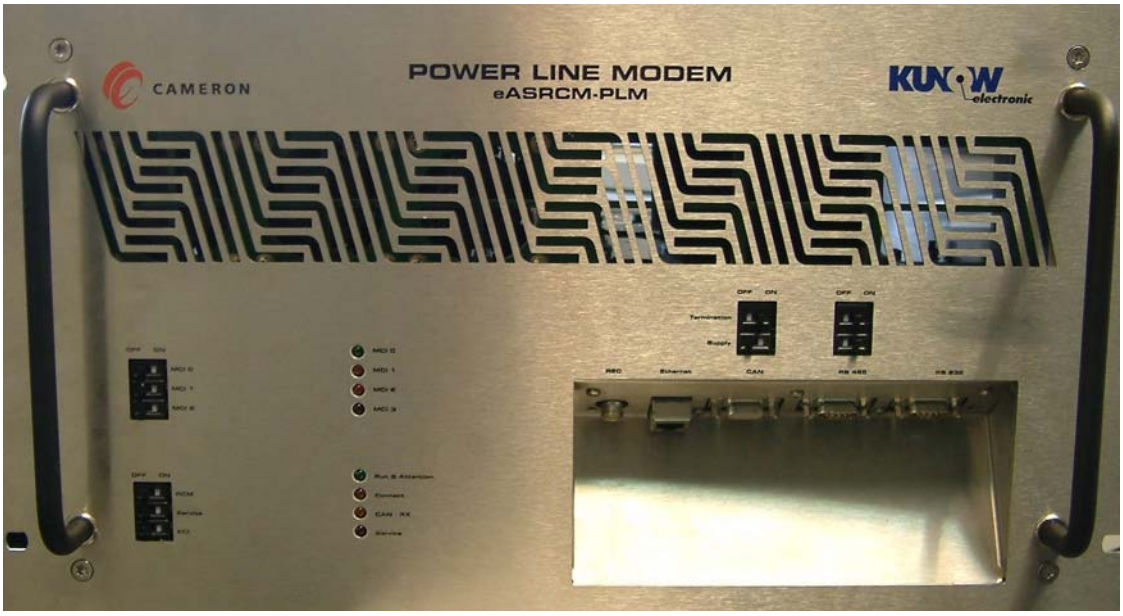


Figure: Modem

Proper air flow to the front panel and from the roof must be possible. Minimum 20 cm air gap is recommended.

Verify: _____

Ensure that the power supply is at 0 Volt.

Verify: _____

Connect the EPCU according to drawings as stated in section “Reference Documents / Drawings”.

Verify: _____

4.1 Output panel (bottom area)

Note: Above picture is typical; arrangement may vary.

name of clamp	type	specification	clamp size	clamp size
1 X1	MAIN INPUT	L1	0,75mm²..35mm²	AWG 10 - 1
1 X2	MAIN INPUT	L2	0,75mm²..35mm²	AWG10 - 1
1 X3	MAIN INPUT	L3	0,75mm²..35mm²	AWG10 - 1
1 X4	MAIN INPUT	N	0,75mm²..35mm²	AWG10 - 1
1 X5	MAIN INPUT	PE	0,75mm²..35mm²	AWG10 - 1
1 X8	MAIN OUTPUT	L1	0,75mm²..35mm²	AWG10 - 1
1 X9	MAIN OUTPUT	L2	0,75mm²..35mm²	AWG10 - 1
1 X10	MAIN OUTPUT	L3	0,75mm²..35mm²	AWG10 - 1
1 X11	MAIN OUTPUT	N	0,75mm²..35mm²	AWG10 - 1
1 X12	MAIN OUTPUT	PE	0,75mm²..35mm²	AWG10 - 1
1 X6	ESD (INTERLOCK)	+ 24 V DC	0,2mm²..2,5mm²	AWG24 - 14
1 X7	ESD (INTERLOCK)	(-) 24 V_ GND	0,2mm²..2,5mm²	AWG24 - 14

2 X1	OUTPUT SIGNAL	A- / 0...4kV / 0...4A	10mm²..16mm²	AWG6 - 4
2 X2	OUTPUT SIGNAL	A+	special for cable shield – diameter approx. 14mm	
2 X3	ANODE SEAWATER	ANODE SEAWATER	10mm²..16mm²	AWG6 - 4
2 X4	EARTH	EARTH	10mm²..16mm²	AWG6 - 4
2 X5	PROFIBUS OUT	A	0,2mm²..2,5mm²	AWG24 - 14
2 X6	PROFIBUS OUT	B	0,2mm²..2,5mm²	AWG24 - 14
2 X7	PROFIBUS OUT	IE	0,2mm²..2,5mm²	AWG24 - 14
2 X8	PROFIBUS IN	A	0,2mm²..2,5mm²	AWG24 - 14
2 X9	PROFIBUS IN	B	0,2mm²..2,5mm²	AWG24 - 14
2 X10	PROFIBUS IN	IE	0,2mm²..2,5mm²	AWG24 - 14

Check that high voltage connections are fully mated together. Use table above.

Verify: _____

Check that the cable of the correct anode is connected to the rack. Interchange is not allowed.

Verify: _____

Ensure that earth connection is correctly made up to the earth stud. Earth continuity resistance measurement is required. Fuses are not allowed in earth connection.

Verify: _____

For further questions please contact:

CAMERON GmbH
Lueckenweg 1
29227 Celle
Germany

Phone: +49 5141 806 0
Fax: +49 5141 806 333

5 Sign Off Sheet for EPCU Installation

EPCU PN : 223022-31

Rack type (1A, 1B, 2A or 2B) : _____

Rack serial no : _____

Installation was carried out by:

Company: _____

Name	Signature	Date

Installation was accepted by:

Company: _____

Name	Signature	Date

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

28 February 2008	Re-Issued as Approved for Construction	J. Dannehl	M. Lehmker	J. Dannehl
15. Jan 2008	Approved for Construction	J. Grochowski	J. Dannehl	R. Wrede
27. Nov 2007	Issued for Client Comm.	J. Grochowski	J. Dannehl	R. Wrede
7. Nov 2007	Issued for internal IDC	J. Grochowski	J. Dannehl	R. Wrede
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON

Document Title:

Operation Procedure for
Electric Power & Communication Unit

PAGE 1 OF 22	**Customer Document Number:**	54NL92-W-0P-541	REV. 2
	Cameron Document No.	X-065438-02-73	REV. 02

Document Revision History

Rev	Date	Description of change	Reason for change
A	7. November 2007		Initial Release
B	27. November 2007	Comments included	Internal review
01	15. January 2008	Revision increased	Required by project
02	28 February 2008	New ESD Relay added	Customer Change Request

Table of Contents

1 Introduction

1.1 Scope of this Document

This document outlines the procedure for the operation of the Electrical Power & Communication Unit (EPCU) within the TOTAL K5F subsea production control system.

1.2 Abbreviations

BOM	Bill of Material
CAM	CAMERON
EPCU	Electric Power & Communication Unit
MCS	Master Control Station
N/A	Not applicable

1.3 Reference Documents

Item	Description	Cameron Doc. No.	Customer Doc. No.
1	Bill of Material EPCU	223022-31	N/A
2	Installation Procedure for EPCU	X-065467-02-08	54NL92-W-0P-530
3	Maintenance Procedure for EPCU	X-065438-02-72	54NL92-W-0P-540
4	Assembly Drawing EPCU	SK-066022-31	54NL92-W-03-502
5	Field Termination Diagram EPCU	SK-066022-31-42	54NL92-W-01-501
6	Interconnection Diagram Production Control System	SK-066001-88-04	54NL92-W-03-530

1.4 Equipment Description

The EPCU provides the electric power and communication components in 19” rack assembly. All operation elements are accessible at the front panel. The two main components are a 4000 Volt DC electric power supply and a modem in each of the four (4) racks (1A, 1B, 2A, 2B). The communication signal is modulated onto the DC high voltage via the modem. Voltage and current of the power supply are controlled from Master Control Station via Profibus.

2 Safety Warnings

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

All personnel must acquaint themselves fully and strictly adhere to all company sites' HEALTH AND SAFETY AT WORK REGULATIONS, together with other specific requirements detailed in this procedure.

All personnel working on the equipment must have the required experience, training and qualifications.

WARNING!

The EPCU contains high electric voltages (400 Volts AC and 4000 Volt DC). Never open a rack housing during operation.

WARNING!

The EPCU must always be operated in PROGRAMMING DIGITAL mode. This mode is physically locked by a key switch. Operation in another mode can destroy the Power Regulation & Communication Module that is located subsea.

3 Operation

3.1 Configuration prior Start-Up

Note: Configuration has to be done for each rack.

3.1.1 EPCU general Configuration

Ensure that the EPCU was correctly installed according to its installation procedure before configuration and start-up. Check that parties have signed the installation.
Ensure the rack housing doors on the rear side are closed.

Verify: _____

3.1.2 Power Supply Configuration

The regulation of voltage and current is controlled via software. It is not allowed to adjust voltage / current of the power supply manually. Therefore the PROGRAMMING key switch on the upper section of the front panel must always stay in position DIGITAL. The potentiometer VOLTAGE and CURRENT are then without function. Furthermore the switches HV ON and HV OFF are without function but the lamp indications still in operation.

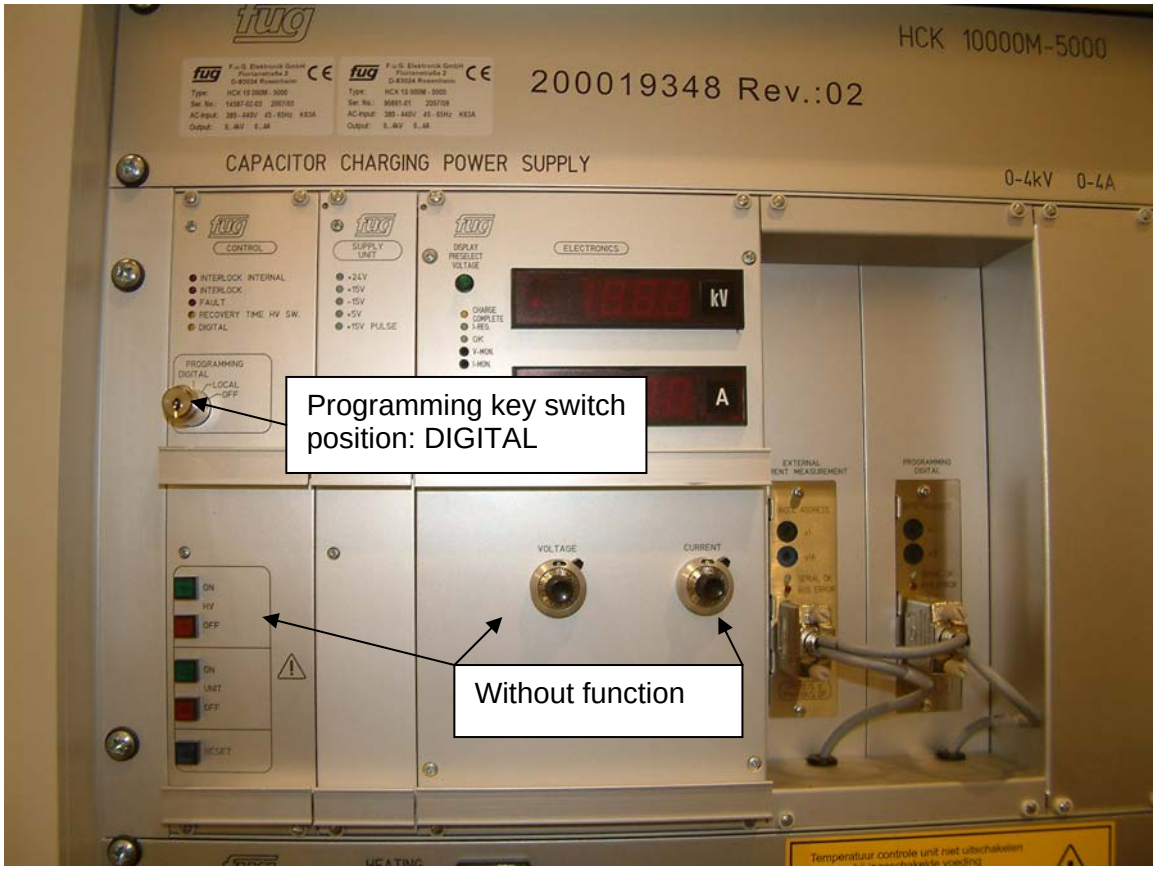


Figure: Front panel upper section

Ensure that the key switch for PROGRAMMING is locked in position DIGITAL.

Verify: _____

Set the potentiometer for VOLTAGE and CURRENT counter clockwise to minimum output (also they are not in operation).

Verify: _____

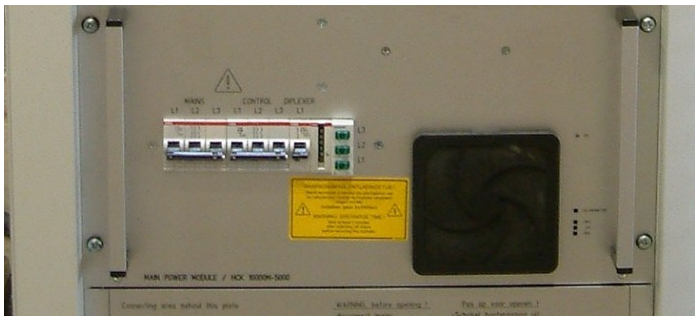


Figure: Fuses on front panel lower section

Ensure that the 7 circuit breakers on the lower section of the front panel are in interrupted position (OPEN).

Verify: _____

Figure: Groundswitch with its lock

Ensure that the GROUNDSWITCH is in OUTPUT GROUND position.

Verify: _____

Figure: Cabinet Temperature Control

Ensure that the CABINET TEMPERATURE CONTROL is in ON position.

Verify: _____

Ensure that Main ESD relay -K1A is supplied with 24 V DC at terminals -1X6 (+) and -1X7 (-).

Verify: _____

3.1.3 Modem Configuration

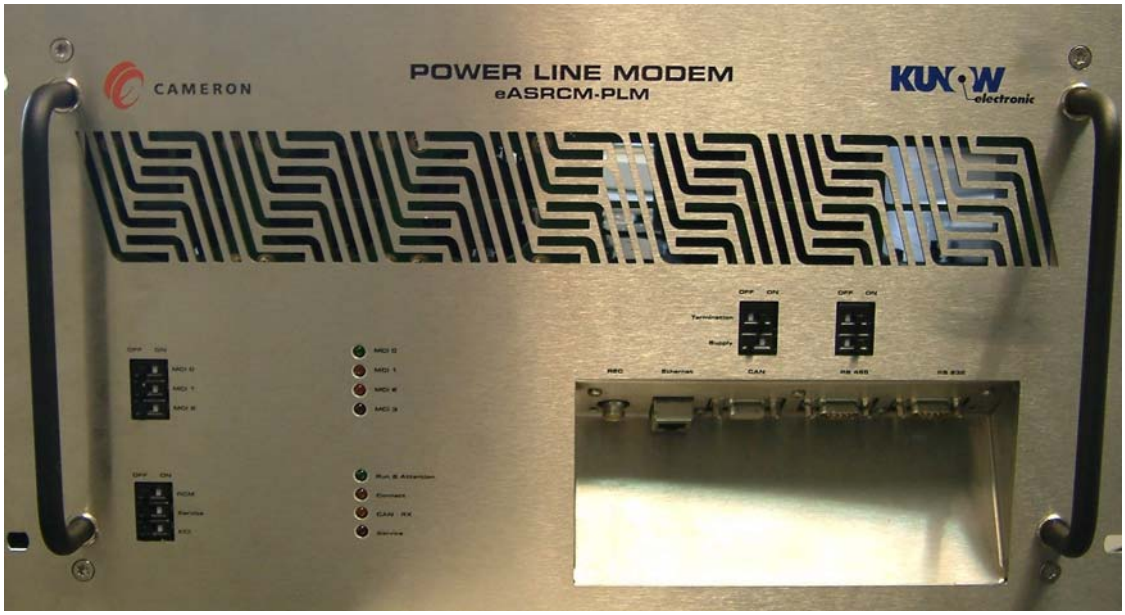


Figure: Modem

Set the switches on the front panel of the modem as follows:

Switch	Position	Function	Verify
MCI 0	OFF	No function	
MCI 1	OFF	No function	
MCI 2	OFF	No function	
RCM	OFF	Stop Coldfire debug mode on bridge processor	
Service	OFF	Bridge connection active	
ECI	OFF	No function	
Termination (CAN)	ON	CAN-Bus termination resistor turned on	
Supply (CAN)	OFF	No +5V at pin 5 and 9 of CAN socket	
Termination (RS485)	ON	RS485-Bus termination resistor turned on	
Supply (RS485)	OFF	No +5V at pin 4 of RS485 socket	

3.2 Start-Up Procedure

WARNING:
The start-up procedure enables the full 4000 Volt DC to the umbilical and subsea system. That requires the subsea system is installed and in controlled condition before a EPCU rack is started up. Permit to work system has to be followed.

Start-Up is identical for each rack as follows:

1. Ensure that section “Configuration prior Start-Up” was carried out.
2. Close the 7 circuit breakers on the lower section of the front panel.
3. Insert the key and unlock the GROUDSWITCH.
4. Move GROUDSWITCH to OPERATE position.
5. Upper front panel section: Push the RESET button and check that the lamp INTERLOCK INTERNAL turns off.
6. Push the button UNIT ON in upper front panel section.

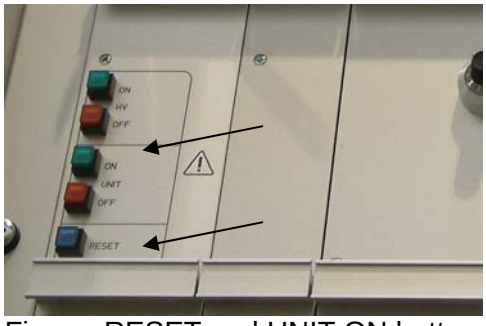


Figure: RESET and UNIT ON buttons

3.3 Indications on Panel

Figure: Indications on Panel

Indication	Description
INTERLOCK INTERNAL	Normally off: The LED lights up if the internal interlock loop is open
INTERLOCK	Normally off: (Not used)
FAULT	Normally off: The LED light up if a fault occurs (fault summary)
RECOVRTY TIME HV SW.	This LED lights up if the High Voltage Switch is in function, the HV-Output is blocked for appr. 5 sec.
DIGITAL	Must be on: This LED lights up if the communication profibus interface is active

3.4 RESET Button

The RESET button (as shown on previous page) resets the messages

- ”Fault”,
- “Interlock” and
- “Interlock internal”.

3.5 Requirements during EPCU is in Operation

CABIMET TEMPERATURE CONTROL must always be ON. Unrestricted air flow must be possible to front panel and from roof exhaust.

Never open the rack housing door on the rear side during operation. This will cause uncontrolled shutdown and risk of electric shock.

3.6 Shutdown Procedure

DANGER!

The EPCU may contain high electric voltages from capacitors also it is shut down. Wait 5 minutes after shutdown before a rack housing is opened to allow discharge of capacitors.

Follow Permit to Work system. Set the Production Control System to safe condition. Shutdown an EPCU rack as follows:

1. Verify at Master Control Station that High Voltage (HV) is switched off.
2. Push the UNIT OFF button on the upper section of the front panel.
3. Wait until the umbilical is discharged: Watch the OUTPUT VOLTAGE instrument near the GROUND SWITCH until it indicates 0 kV (kilo Volt).
4. Unlock and move the GROUNDSWITCH to position OUTPUT GROUND.
5. Lock the GROUNDSWITCH by key.
6. Open / interrupt the 7 circuit breakers on the lower section of the front panel.

3.7 Company Contact

CAMERON GmbH
Lueckenweg 1
29227 Celle
Germany

Phone: +49 5141 806 0
Fax: +49 5141 806 333

4 Appendix: Modem Operation Manual (Uncontrolled Copy)

Operating Manual

Product Name:	Surface Power Line Modem
Short description:	Surface PLM
Part Number:	3.00.009.1.01
Serial Number:	610-001-07-0001

This Operating Manual is part of the above mentioned product. It contains important information for operating and handling. This procedure is only addressed to skilled electrical personnel and those with a suitable technical training, who are aware of the electrical risks and are able to keep such hazard to a minimum level for themselves and others. Only such personnel are permitted to operate and handle this tool.

Kunow electronic GmbH
Krokustrasse 9
D-12357 Berlin
Telefon: +49 (0)30/667 65 77-0
Fax: +49 (0)30/667 65 77-29
Mail: info@kunow-electronic.de

Table of Contents:

1 Safety Instructions

	Please carefully read this Operating Manual prior to operation. It contains important information for correct operation, which are implicitly to be observed. For damages occurring through nonobservance of this Manual any warranty claim expires! We assume no liability for consequential damages! We assume no liability for damage to property or persons caused by incorrect handling or nonobservance of the Safety Instructions. Any warranty claim expires in such cases. For safety and registration reasons it is not allowed to rebuild or modify the tool. **The tool is fed with <u>dangerous high voltage</u> during operation! Prior to operation, you need to ensure that nothing and no one is at risk through this high voltage!**
Supply Voltage	Check, whether below mentioned supply voltage / frequency corresponds to your local supply voltage.
Earthing	The tool is equipped with protective earth. For protection against electrical strokes the tool is connected with the protective conductor via the Harting connector on the rear panel to the Backplane.
Service Rooms	The tools may only be operated in clean and dry areas. Please make sure, that no particles or fluids can reach into the housing through the ventilation openings. Because of sparking danger, the tool may not be operated near inflammable gases and steams.
Cooling	To enable sufficient heat flow, the ambient temperature may not exceed **40°C**. The lost heat generated in the tool is dissipated to the rear via forced convection; therefore air convection with the ambient air needs to be possible. Do not put anything in front of the tool, which impacts the air convection.
Opening the Tool	**Prior to opening the tool needs to be disconnected from the power line!** The tool may only be opened from the operating staff to redirect internal switches, which are described in the Operating Manual.
CAUTION!	**There are condensers in the tool which are only slowly discharging (typical discharge period 5 min) or do not discharge at all in case of fault.** Only use insulated tools. Maintenance and repair works are only to be conducted through trained service personnel.

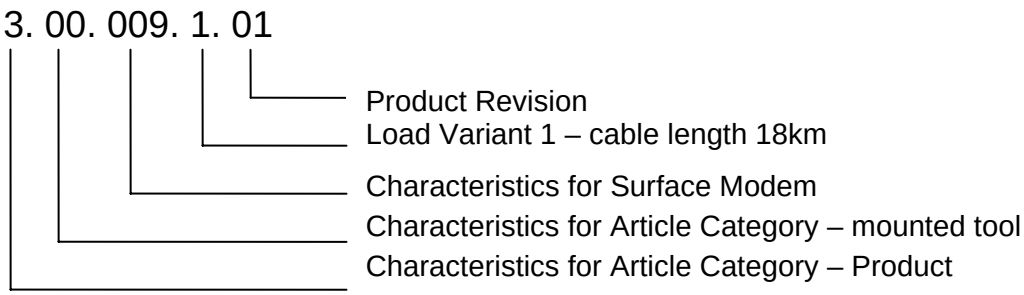
2 General

2.1 Short description of Product

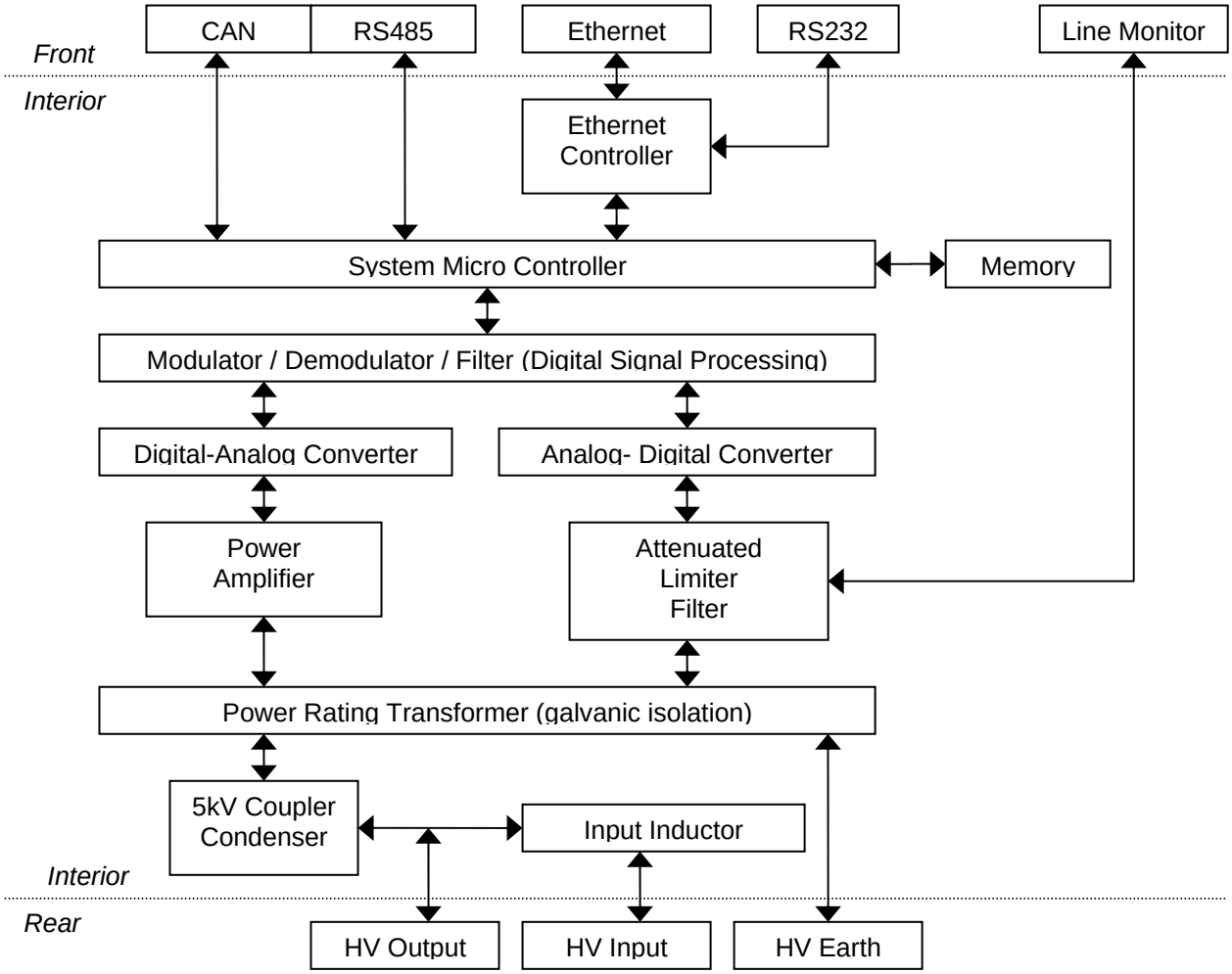
The modem is employed for bi-directional data transfer (surface to sub sea) for the Electric DC-Tree System.
Data attached via different data interfaces, which needs to be transmitted from surface to sub sea are modulated up onto the high voltage provided by the voltage supply source and transmitted to the sub sea modem via a high voltage transmission line.
Data received from sub sea are respectively disrupted from the high voltage and transferred to the integrated data interfaces.
The modem is supplied as a compact device as 19“ rack.

3 Variant Overview

The modem is designed for data transfer times up to 160 km. Depending on cable length (project specific) certain jumpers are plugged to allow for optimum data transfer. The Kunow part number comprises the following:



3.1 Block Diagram for Data Transmission with E/A-Interfaces



The tool mainly consists of five functional units:

1. Mains Supply with Power Factor Converter (PFC) Input
2. Conductor Coupler
3. Modulator Power Amplifier and Input Limiter
4. Triple Processor Control Unit (Ethernet PC , System Microcontroller & DSP based Modulator/Demodulator)
5. Data Interface Modules: Ethernet, CAN, RS485, RS232

4 Operation

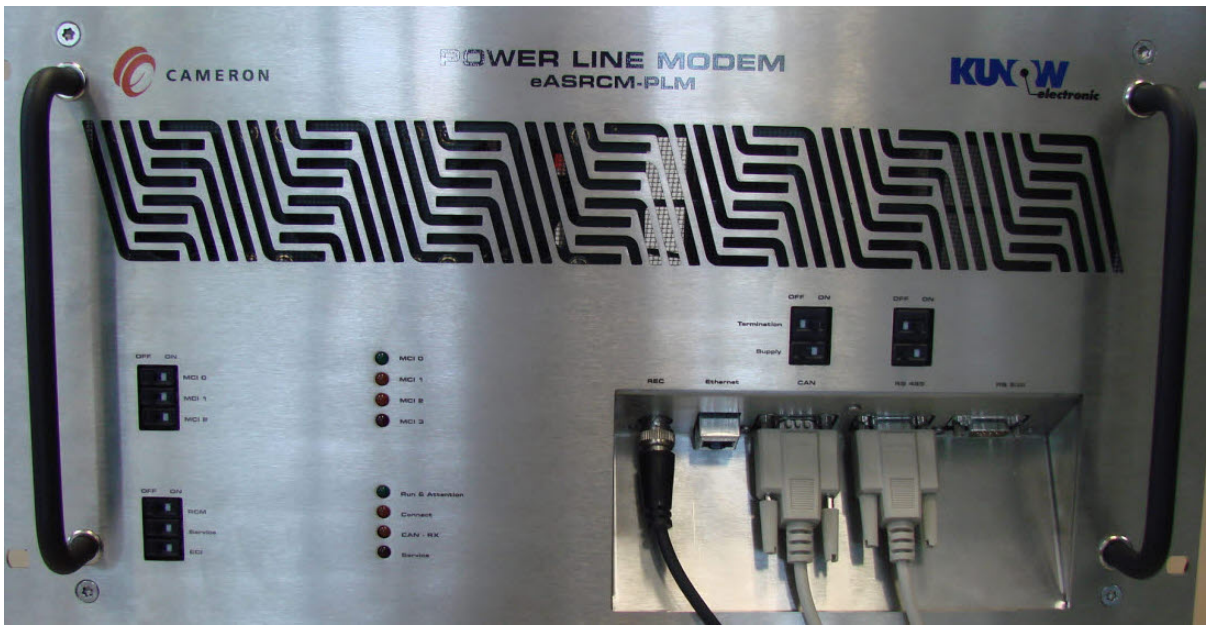
4.1 Equipment Installation

Carefully insert the tool into the designated 19“ rack. Pay attention that connectors which are mounted to the rear side are properly plugged into the mating connectors, which are installed on the backplane of the power supply. If necessary, the position of the mating connectors needs to be adjusted according to Operating Instructions of the power supply. Finally, the tool is bolted to the 19“ rack of the power supply with four screws (included in the delivery of the power supply) at the front wall.

Never immediately switch the tool on, when it is moved from a cold into a warm area! The condensate could possibly destroy the tool. Leave the tool switched off until it reaches ambient temperature.

4.2 Operating Controls

All operating controls are located at the front side. The individual functions are described in the below table.



	Switch Marking	Function	
Modem	MCI 0	No function	
	MCI 1	No function	
	MCI 2	No function	
Bridge	RCM	ON	Start Coldfire Debugmode
		OFF	Stop Coldfire Debugmode (default)
	Service	ON	Stop all connections (Service)
		OFF	(default)
	ECI	No function	
Interfaces	Termination (CAN)	ON	CAN-Bus Terminal Resistor switched on (default)
		OFF	CAN-Bus Terminal Resistor switched off
	Supply (CAN)	ON	+5V Voltage provision at Pin 5 and 9 of CAN connector
		OFF	No +5V Voltage provision at Pin 5 and 9 of CAN connector (default)
	Termination (RS485)	ON	RS485- Bus Terminal Resistor switched on (default)
		OFF	RS485- Bus Terminal Resistor switched off
	Supply (RS485)	ON	+5V Voltage provision at Pin 4 of RS485 connector
		OFF	No +5V Voltage provision at Pin 4 of RS485 connector (default)

4.3 Displays

The following LED status displays are integrated at the front side:

	LED Description	LED Colour	Meaning
Modem	MCI 0	Green	Run – Modem Function OK
	MCI 1	Yellow	Send – Modem sends Data
	MCI 2	Yellow	No Function
	MCI 3	Red	Error (Details see CAN Open Object 2004-3)
Bridge	Run & Attention	Green	Program run indicator and flashing at special command via Ethernet
	Connect	Yellow	Minimum one Ethernet connection established
	CAN - RX	Yellow	Incoming CAN Data
	Service	Red	Shows that Service Mode is switched on

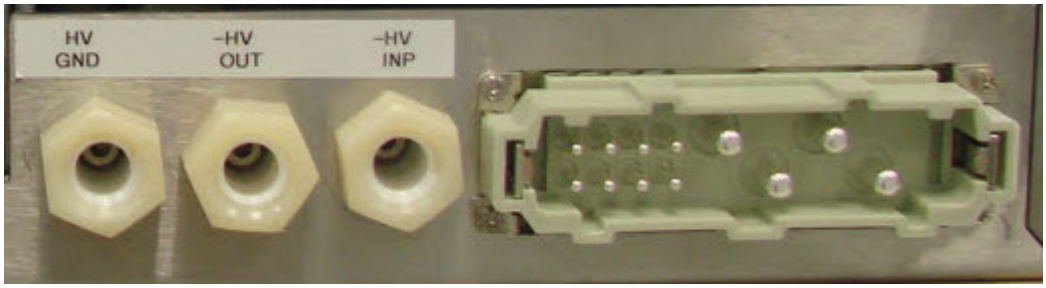
4.4 Equipment Interfaces

Front side:

Connector description	Connector Type	Meaning
REC (Line Monitor)	BNC	Connector socket for optimal display of data transfer on an oscilloscope (only for service purposes)
Ethernet	RJ45	Ethernet Interface (default)
CAN	Sub-D socket (9-pin)	9-pin for CAN interface (only for service purposes)
RS485	Sub-D socket (9-pin)	9-pin Sub-D socket for RS485 interface (only for service purposes)
RS232	Sub-D socket (9-pin)	9-pin Sub-D socket for RS232 interface for configuration of installed CAN-Bridge (Ethernet-Controller) (only for service purposes)

During normal operation the Ethernet interface is occupied. During service an additional interface can be used for data transfer.

Rear side:



Connector description	Connector Type	Meaning
HV GND	FUG HV-socket (301051010)	Input of Coax Outer contact from the power supply
- HV OUT		High voltage output with up-modulated data (connection to COAX-Seawater Cable)
- HV IN		High voltage input from the power supply
- - -	HAN K4/8-STI-S	01 – Neutral Line (N) 02 – 220VAC / 50Hz Input Voltage 11 – Interlock bridge to power supply 12 – Interlock bridge to power supply housing – protective conductor

4.5 Maintenance

Depending on local air pollution, dust particles on ventilation openings need to be removed, in order that the cooling is not negatively impacted. Apart from that, the tool is maintenance-free.

5 Technical Data

5.1 Internal Power Supply

Input Voltage:	200 – 240 V AC
Input Frequency:	50 / 60 Hz
Input Current:	8,4 A rms *1)
Input Protection:	A Thyristor reduces the Input Current. The power supply is protected against short circuits via a fuse at the input. Protection value: 30A @ 250V
Switch on Current:	60 A typical, 120 A max.
Leakage Current:	1,2 mA typical, 1,5 mA max. (according to IEC 950)
Power Factor:	0,95 typical
Isolation: (at 15-35°C, 10-85% relative humidity)	Between input and housing 2000 VAC for 1 minute, Holding Current 20 mA
Leakage resistance: (at 15-35°C, 10-85% relative humidity)	Between output and housing, input and output, min. 100 Megaohm (500 VDC)

*1) for protection of the tool a slow-blow lead fuse of the next size should be used. When using automatic circuit breakers we recommend those with characteristics „G“ or „K“.

5.2 Modem Data

Data transfer:	Half duplex , 19200 Baud
Modulation:	4Q PSK (Four Quadrants Phase Shift Keying)
Transmission Voltage:	Max. 320 Vpp at 40 Ohm (resolution = 0,1 % steps)
Cable Attenuation:	Max. 80 dB without crosstalk (corresponding to 160 km with NSW Coax cable)
Cable DC Offset Voltage:	Max. ± 5 kV
Leistungsaufnahme:	Max. 1850 W
Operating temperature:	-10 °C to +40°C
Storage temperature:	-30°C to +75°C Relative humidity < 80%; non condensing
Weight:	45 kg
Dimensions (LxWxH):	485 x 483 x 265
Electro-magnetic compatibility (acc. to EN6100-4-2 to 7/8) / EN6100-3-2) (Modem installed FUG-Power Supply):	Fault-free operation passed Transient emissions passed Details see Test Report FUG No. 166-2007-01E / 02E

6 Document History

Revision	Modified	Originator	Reason for Issue
01	26-Oct-2007	V.Phielipeit-Spiess	Initial Release

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

15. Jan 2008	Approved for Construc.	J. Grochowski	J. Dannehl	R. Wrede
20. Nov 2007	Issued for Client Comm.	J. Grochowski	J. Dannehl	R. Wrede
18. Oct 2007	Issued for internal IDC	J. Grochowski	J. Dannehl	R. Wrede
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Maintenance Procedure for** **Electric Power & Communication Unit**		
PAGE 1 OF 5	**Customer Document Number:**	54NL92-W-0P-540	REV. 1
	Cameron Document No.	X-065438-02-72	REV. 01

Document Revision History

Rev	Date	Description of change	Reason for change
A	18. October 2007		Initial Release
B	20. November 2007	Comments included	Internal review
01	15. January 2008	Revision increased	Required by Project

Table of Contents

1 Introduction

1.1 Scope of this Document

This document outlines the procedure for the maintenance of the Electrical Power & Communication Unit (EPCU) within the TOTAL K5F project.

1.2 Abbreviations

BOM	Bill of Material
CAM	CAMERON
EPCU	Electric Power & Communication Unit
N/A	Not applicable

1.3 Reference Documents

Item	Description	Cameron Doc. No.	Customer Doc. No.
1	Bill of Material EPCU	223022-31	N/A
2	Operation Procedure for EPCU	X-065438-02-73	54NL92-W-0P-541

1.4 Equipment Description

The EPCU provides the electric power and communication components in 19” rack assembly. The two main components are a 4000 Volt DC electric power supply and a modem in each of the four (4) racks (1A, 1B, 2A, 2B).

2 Safety Warnings

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

All personnel must acquaint themselves fully and strictly adhere to all company sites' HEALTH AND SAFETY AT WORK REGULATIONS, together with other specific requirements detailed in this procedure.

All personnel working on the equipment must have the required experience, training and qualifications.

WARNING!

The EPCU contains high electric voltages (400 Volts AC and 4000 Volt DC). Never open the rack housing during routine maintenance.

3 Maintenance

Weekly check as follows for proper ventilation:

- Ensure that fan grids at front panels are free of pollution.
- Visually check that air exhaust on top of the racks allows unrestricted air flow.

No further maintenance is required.

If repair work is required please contact:

CAMERON GmbH
Lueckenweg 1
29227 Celle
Germany

Phone: +49 5141 806 0
Fax: +49 5141 806 333

GENERAL PRESERVATION & STORAGE PROCEDURE

FOR

CAMERON CONTROLS EQUIPMENT

07	12. March 2008	J. Grochowski	K. Yahosseini	J. Grochowski
06	14. March 2007	J. Grochowski	B. Müller	J. Grochowski
05	12. May 2006	J. Grochowski	F. Duensing	J. Grochowski
04	18. July 2005	J. Grochowski	F. Duensing	J. Gronstedt
03	6. January 2005	J. Grochowski	A. Kamp	T. Loi
02	14. May 2004	H. Mohwinkel	M. Lehmker	A. Voges
01	27. August 2002	J. Grochowski	K. Seidel	K. Yahosseini
Cameron Rev	**Date**	**Prepared by**	**Checked by**	**Approved by**

Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
D 07	02. April 02	Document layout revised Document Revision Status sheet added	
01	27. Aug 02	CAMTROL equipment added	Request from project
02	14. May 04	Chapter 3: tarpaulin cover usage for outdoor storage added; Chapter 4.2: Storage fluid (for storage of 1 to 2 years) Castrol Anvol changed to Transaqua HT; Chapter 5.3.1.1 added	Requested by project
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05	12. May 06	TUTA requirements included	Required by project
06	14. Mar 07	Umbilical poppet requirement included	Required by project
07	12. Mar 08	Comments included	Required by project

Table of contents

1 Introduction

This document outlines the procedure for preservation and storage of a control system before and after use. This includes Production Control Systems, Workover Control Systems and Drilling Control Systems. The purpose of this procedure is to keep the equipment supplied by Cameron Celle in a proper shape during storage. It will be available for further operations without major refurbishment due to insufficient control during storage.

This document provides instructions to ensure preservation and protection of all typical control system equipment in order to prevent deterioration caused by corrosion, damage, influence of weather and foreign materials, during shipment, storage and installation.

2 Reference Procedures

X-065460-( )-( )	Protective Coating Procedure for Cameron Controls Equipment
X-065390-03	General Protection and Coating Procedure for Cameron Celle Controls Equipment
X-065390-03-00-01	Protection and Coating Procedure for Cameron Celle Controls Equipment
X-027055-01	Corrosion Inhibiting Coating of Machined Surfaces

3 General Storage Requirements for Environment

Before starting any activities for preservation & storage all functions need to be verified. It must be checked that maintenance and repair works have been performed by qualified service personnel and that the control system does not have any mechanical damages on framework, umbilicals, hoses and cables.

Clean and dry the equipment prior to storage and place it under cover (if available) in a clean and dry environment.

For outdoor storage use tarpaulin covers. Ensure that covers are correctly attached and check covers for any damage. Replace damaged covers.

Preferred ambient conditions for storage areas[*)]

Temperature range	:	0 to 40°C
Humidity range	:	0 to 50 % (excluding condensation and frost)

[*)] If above values are not available, humidity and temperature must be within project related specified range.

In areas with high ambient temperatures consider protection against UV light / direct sunlight to protect e.g. plastic materials or compensation systems (thermal expansion).

Atmosphere must be free from harmful substances which can effect resilient seals (e.g. high ozone level).

Store equipment and spare parts with sealing surface protection by protective devices and protect after inspection if necessary.

Consider special storage procedures for critical materials like hydraulic fluid, batteries, rubber goods etc.

Handling and transport of equipment must always be in accordance with the conform procedure, shown in the Operation and Maintenance Manual for the control system.

4 Cameron Controls Standard Hydraulic Control Fluids

This section outlines the Cameron Celle Controls standard hydraulic control fluids. If any other fluid is specified the appropriate data sheet must be considered for preparation and storage of the system.

4.1 Hydraulic Oils

The standard oil types for Cameron Celle Controls equipment are:

- SHELL TELLUS (different types)
- CASTROL BRAYCO MICRONIC 864

Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

Note: Further details for treatment of fluid before and during storage for the specific equipment are listed in section 5.

4.2 Water Based Fluid

The typical water based fluid types for Cameron Celle Controls equipment are delivered by **Mac Dermid CANNING (MARSTON BENTLEY) LTD.**:

- Oceanic HW 511
- Oceanic HW 525
- Oceanic HW 540
- Oceanic HW 443
- Oceanic HD 603 Water/Glycol with lubricant

A typical water based fluid supplied by **CASTROL**:

- TRANSAQUA HT or HT2

A typical water based fluid supplied by **CAMERON**:

- CAMERON 590 X Water / Glycol with lubricant

Note: Further details for treatment of water based fluid before and during storage are listed in the following table.

Water Based Fluid	Suitable Storage Fluid (>6 months)	Suitable Storage Fluid (>1 year)	Suitable Storage Fluid (>2 years)
Mac Dermid CANNING OCEANIC HW 525 Cameron PN 619011-36 OCEANIC HW 540 Cameron PN 619011-28 OCEANIC HW 443 Cameron PN 619011-41	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285
Mac Dermid CANNING Water based fluid with ERIFON HD 603 Cameron PN 619011-46 (Lubricant)	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285
	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	Composition Lubricant/Glycol/Water: 5 % Lubricant: PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	
CASTROL TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	TRANSAQUA HT Cameron PN 619011-53
CASTROL TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	TRANSAQUA HT2 Cameron PN 619011-84
CAMERON Fluid Cameron 590 X Cameron PN 619011-24 (Lubricant)	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 40 % Glycol PN 619011-10 55 % Demineralized Water	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285

5 Specific Equipment Preservation and Maintenance Requirements

Note: Preservation during storage shall be performed in accordance with the check lists shown in section 6.
Any damage occurring during the periodical checks must immediately be repaired and reported to the Maintenance Supervisor.

5.1 Instruments for Surface Containers and Frames

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

All moving parts are to be lubricated with Molycote 3402 or equivalent.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

5.2 Hydraulic Power Unit and Local Control Panel

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines, including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen precharge of each hydraulic accumulator down to 10 bar / 145 psi. This is for safety reasons and to keep e.g. bladder in a stable position.

Air accumulators must be vented and drained of water.

Open ends of piping must be sealed off by plugs or caps.

All moving parts including the push rod of the panel valves must be protected by Molycote 3402 or equivalent.

Operation panels must be protected by a protective cover or door.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anti-condensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect ventilation grills / air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof local control panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

All isolation valves (except drain valves) must be closed. 4/3-way panel valves must be moved to "CENTER" position. 3/2-way panel valves must be in "CLOSE" or "VENT" position.

5.2.1 Hydraulic Oil

For long term storage no fluid exchange is required to get conservation against corrosion if equipment is filled with clean hydraulic oil.

After usage or longer storage (>3 months) hydraulic reservoirs must be checked for cleanliness and water content. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

Note: Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

If the water content of the oil is too high, check the hydraulic fluid for bacterial contamination. Clean the system up if necessary by following instructions of supplier.

Hydraulic lines have to be flushed to customer required cleanliness level.

Note: Cleaning of the hydraulic lines of an empty system must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

5.2.2 Water Based Fluid

General

For long term storage (>6 months) a special fluid preparation is required to get conservation against corrosion of equipment.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Reservoirs must be checked for cleanliness.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluid should be within the system during long term storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions. The table in section 4.2 shows different possibilities for long term (>6 months) storage.

5.3 Remote Control Panel

Painting, frame and moving parts must be checked in accordance with section 5.1.

5.3.1 Electric Remote Control Panel

Cable connections are to be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Operation panel must be protected by a protective cover or door if available.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

Rack mounted equipment shipped separately from cabinets should be bagged with desiccant and tagged with shock fuses.

5.3.1.1 Control Panel for climatic controlled environment

Control panel for use in climatic controlled environment e.g. Master Control Station (MCS), Electric Power Unit (EPU), Remote Workstations etc.

Equipment should be stored in a warehouse in undamaged packaging under the following conditions excluding intensive dust and condensation of humidity.

Temperature -18 - +60°C

Humidity 20-90% RHNC

When packaging has to be opened e.g. for site receive tests it is recommended to use corrosion inhibitors (e.g. Cortec®VCI 110) for further preservation.

5.3.2 Pneumatic Remote Control Panel

Pneumatic connections are to be cleaned up and protected by non aggressive protective shield, protection against dust or mating protective cover if available. Check pneumatic jumper cable as well.

Air receivers must be vented and drained of water.

Operation panel front must be protected by a protective cover or door.

Acryl glass window panes on panels located in hazardous areas must be cleaned with wet cloth only due to electrostatic charge.

5.4 Hydraulic Umbilicals, Umbilical Jumpers & Steel Flying Leads

General Instructions

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the applicable hydraulic fluid.

All hydraulic connections must be cleaned from dirt by using cleaning solvents which do not harm the seals (see Operation and Maintenance Procedure).

The connection plate of the junction boxes must be protected by protective covers.

After cleaning mating protective caps or plugs must be mounted to the quick coupling or single connection.

Stainless steel junction boxes and plates must be covered with a thin film of non aggressive oil.

Painting, frame and moving parts must be checked in accordance with section 5.1.

The umbilical can be stored in a box or on a drum. The minimum bending radius for storage indicated by supplier may not be exceeded.

5.4.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The umbilical shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.4.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

All lines with poppets must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids and compositions (see table in section 4.2).

5.5 Electric Cables and Cable Jumpers

Contacts of electrical connectors must be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Check that cable minimum bending radius is kept for storage.

Cable materials have to be protected for storage to avoid mechanical impact and ageing impact caused by sunlight (UV).

5.6 Umbilical Reels

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cleaned piping must be sealed off by using protective plugs, caps or covers.

Parts for power transmission like gear, chain with sprockets etc. must be protected and lubricated.

Open gear drive with gear ring and cog	-	ANTI SEIZE (or equivalent)
Chain drive	-	ESSO CAZAR K2 (or equivalent)
Gear box for direct drive	-	See Operation and Maintenance Manual of gear box for specific oil type.

5.7 Uninterruptable Power Supply (UPS)

WARNING:

Hydrogen may discharge from batteries and cause explosion (depending from battery type). Sufficient ventilation is required.

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cable connections must be protected with non aggressive protective shield.

For storage of the UPS check the allowed temperature range in Operation and Maintenance Manual to avoid damage of sensitive parts like batteries etc.

Recharge batteries to full range. Deep discharge must be avoided.

Follow specific long term storage procedure for installed type of batteries.

Disconnection of batteries may be required.

Ensure that the UPS is tagged with a shock fuse indicator.

5.8 Subsea Valve Packages

Remark: Subsea valve packages are normally mounted to the subsea running tools (e.g. Lower Marine Riser Package), which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.8.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.8.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.9 Subsea Control Modules (direct / pilot hydraulic types)

Remark: This section is **not** to be applied for CAMTROL subsea control modules. Refer to the "CAMTROL Subsea Production Control Equipment" section.
Subsea Control Modules (SCM) are normally mounted to the subsea running tools which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool. Flushing and testing can be done with the appropriate flushing and testing unit.

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Hydraulic pressure from all lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

If applicable, cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

5.9.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.9.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.10 Hydraulic Flushing and Testing Units

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

Air receivers must be vented and drained of water.

Open connection ends must be sealed off by plugs or caps.

All moving parts must be protected by Molycote 3402 or equivalent.

Junction plates must be protected by an overall cover or individual caps and plugs.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anticondensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

5.10.1 Hydraulic Oil

Reservoirs must be checked for cleanliness and water content. Water content of hydraulic oil must be checked to be within the maximum allowed range. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.10.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.11 Running Tools for Subsea Modules

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines must be discharged.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Hydraulic lines are to be flushed to customer required cleanliness level.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.12 Hydraulic Cylinder (e.g. on SCM Test Stand)

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

Hydraulic cylinders are to be flushed to customer required cleanliness level. Ensure that the cavities are completely filled with hydraulic control fluid. Ensure that no air is left in the cylinders as remaining air might cause corrosion.

Painting must be checked in accordance with section 5.1.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Put piston of the cylinder in retract position. This ensures that the rod is protected inside the cylinder against corrosion or damage.

Grease the cylinder rod with silicon grease or equivalent non aggressive grease.

Store the cylinder in a dry indoor environment. Room temperature should not be below 37°F (3°C).

5.13 Float Type Accumulators

Note: Preservation has to be carried out when the float type accumulators are unused and storage will be longer than three (3) months.

<u>Disassembly of Accumulator</u>

Bleed the pressure from hydraulic fluid supply.

Ensure that the ¼" needle valve at the bottom of the accumulator is in the closed position.

Remove the ¼" NPT plug.

Open the ¼" needle valve at the bottom of the accumulator.

Ensure that the accumulator is depressurised.

Open the hammer union at the bottom of the accumulator.

Ensure that the floater is at the lower end of the accumulator.

Remove the plug at the end of the floater pipe.

Inspect the seals (floater pipe plug, hammer union).

Spray non aggressive anticorrosive lubricant into the accumulator to protect the inner surface of the accumulator.

Carefully move the accumulator in vertical position and ensure that the lubricant flows out of the accumulator.

Assembly of Accumulator

Grease the o-ring of the plug and fix the plug at the lower end of the floater pipe.

Grease the thread at the end of the accumulator bottle and connect the hammer union.

Close the ¼" needle valve at the bottom of the accumulator and install the ¼" plug.

Painting must be checked in accordance with section 5.1.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.14 Topside Umbilical Termination Unit / Assembly

Topside Umbilical Termination Units / Assemblies (TUTU / TUTA) will be treated like Hydraulic Power Units (HPU). The workload is reduced as the TUTU / TUTA does not contain motors, pumps and reservoirs.

5.15 Wire Rope

Grease the wire ropes with wire rope grease. Ommex or Kendal or equivalent wire rope grease can be used.

Store the wire ropes in a dry outdoor or indoor environment.

5.16 Load Cell

Protect the load cells by a thin film of non aggressive oil.

Store the load cells in a dry indoor environment. Room temperature should not be below 37°F (3°C).

6 Preservation Maintenance Check Lists

The following checklists must be used to get a controlled storage of the equipment with proper maintenance.

6.1 Hydraulic Power Unit and Local Control Panel (Main Control Unit)

Preservation Maintenance Check List	**Sheet: 1 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-65390-03-00-00 or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film; repair if necessary	Non aggressive oil
8.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Motors, Distribution Boxes, Relay Boxes, Subswitchboards, Junction Boxes**					
1.0			X		Inspect protection on cable connections; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0		X			Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check drain valves to be open	
6.0			X		Inspect fluid according to section 5.2.1 or 5.2.2	

6.2 Umbilical Reel with Umbilical

Preservation Maintenance Check List — **Sheet: 1 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check lines to be pressureless, drain valves to be open	
6.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.3 Electric Remote Control Panels

Preservation Maintenance Check List						**Sheet: 1 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A. General Inspection						
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, Vaseline or equivalent
4.0			X		Check pneumatic circuits to be depressurized (for purged system only)	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil

Preservation Maintenance Check List						**Sheet: 2 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.4 Pneumatic Remote Control Panels

Preservation Maintenance Check List — **Sheet: 1 of 1**

Description of Equipment: **Pneumatic Remote Control Panels**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on pneumatic hose connection, repair if necessary	Non aggressive protective shield with additional cover
4.0			X		Check pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
7.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
8.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
9.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
10.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
11.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.5 Hydraulic and Electrical Jumpers

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Hydraulic and Electrical Jumpers**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0	X				Check junction boxes and couplings for proper protection by covers, caps or plugs	
4.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield; acid free Vaseline or equivalent; protective caps
6.0			X		Check protection of electric cable against mechanical impact and ageing impact by sunlight	
7.0			X		Check that cable minimum bending radius is kept for storage	
8.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.6 Subsea Valve Package

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Valve Package**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
6.0			X		Check lines to be pressureless; drain valves to be open	
7.0			X		Inspect fluid according to section 5.8.1 or 5.8.2	

6.7 Subsea Control Module (direct / pilot hydraulic types)

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Control Module (not for CAMTROL SCM)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
6.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
7.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
8.0			X		Check lines to be pressureless; drain valves to be open	
9.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
10.0			X		Inspect fluid according to section 5.9.1 or 5.9.2	

6.8 Hydraulic Flushing and Testing Unit

Preservation Maintenance Check List						**Sheet: 1 of 3**
Description of Equipment:	**Hydraulic Flushing and Testing Unit**					
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
6.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List	**Sheet: 2 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C. Hydraulic Circuits						
1.0			X		3/2-way valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way valves to be in open centred position; function lines to be pressureless	
3.0			X		Check lines to be pressureless; drain valves to be open	
4.0			X		Inspect fluid according to section 5.10.1 or 5.10.2	

6.9 Running Tool for Subsea Module

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Running Tool for Subsea Module**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
6.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
7.0			X		Inspect fluid according to section 5.11	

7 CAMTROL Subsea Production Control Equipment

Note: Use the instructions in this section as check lists.

7.1 Subsea Control Module / SCM

Check on the bill of material if individual “Shipping, Transportation and Storage Guidelines” are available for the SCM, otherwise follow the instructions below:

Verify: _____

Store the SCM in the crate until it is required for use.

If it is necessary to gain access to the SCM, remove the top and sides of the crate, but leave the SCM on the shipping frame.

Visually inspect the SCM / packing before use and every **3 month** when it is not used.

Verify: _____

The storage environment must be free from harmful substances which can affect resilient seals (i.e. high Ozone level).

Verify: _____

The ambient temperature for storage must be within the range -10°C to 40°C to maintain the integrity of the pressure compensation system and ensure that no dielectric oil bleeds out.

Verify: _____

CAUTION:
If the loss of dielectric oil exceeds 3 Litre the SCM needs to be refilled in accordance to Cameron “Field refill procedure”. The lower reservoir of the shipping frame is seized to 3 Litre. If you are in doubt please contact Cameron Germany Engineering Department (Tel +49 (0)5141 8060).

7.2 Subsea Accumulator Module / SAM

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Any damage occurring during the periodical checks must immediately be reported and repaired by Cameron Controls.

Verify: _____

Drain the hydraulic pressure from the accumulators.

Verify: _____

Bleed nitrogen pre-charge from the accumulators. Leave 10 BAR residual pressure in the accumulator to prevent the bladder from collapsing.

Verify: _____

Close the two (2) Gas Valves on the HP Accumulators.

Verify: _____

Open ends of Accumulators must be sealed by plugs or protective caps off stainless steel on the gas side off the accumulators.

Verify: _____

Lubricate all moving parts, except the Hydraquad hydraulic connectors, by water-resistant grease.

Verify: _____

Painting, frame and moving parts must be checked for damage.

Verify: _____

Stainless Steel parts must be protected by a thin film of non aggressive oil (Pelox Protector or similar).

Verify: _____

7.3 Subsea Distribution Unit / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.3.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Set all valves to CLOSE position.

Verify: _____

Protect the mounting base of the SAM by a protective cover.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes

Verify: _____

7.3.2 Electrical Parts

Check that all ROV connectable fuses are installed.

Verify: _____

Check that all electrical connectors are protected by caps

Verify: _____

7.4 Umbilical Termination Assembly / UTA

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.4.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes.

Verify: _____

7.4.2 Electrical Parts

Check that all electrical connectors are protected by caps.

Verify: _____

7.5 Foundation Base & Mud Mate for UTA / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Foundation Base only: Verify the proper operation of the two (2) pile locks and confirm that they are in the unlocked position.

Verify: _____

Check the SDU locking mechanism by operating.

Verify: _____

Check the guide post locking mechanism by operating.

Verify: _____

Inspect all lift shackles for deformation and other damage.

Verify: _____

Check condition of all protection anodes.

Verify: _____

8 Handling Requirements for Special Materials

8.1 Rubber Goods

GENERAL

There is very little published information on the storage and care of rubber goods as used in the oil field. When we speak of rubber goods we include the synthetic packings of Nitrile Copolymers and Neoprene as well as natural rubber parts. Natural rubber parts have become relatively rare but the same things that are harmful to natural rubber are also harmful to the synthetics in varying degrees.

Generally speaking, light and air are bad for rubber goods. The exact chemical action is not fully understood and what has been written disagrees on the mechanism involved.

Ozone is known to be bad for rubber goods. Ozone (O_3) is a very active form of oxygen. As far as we know two principle sources contribute the ozone that reaches rubber goods. One is atmospheric ozone which is generated in the stratosphere carried downward by convection currents and eventually absorbed by organic matter. The other source is electrical discharges, such as lightning, high voltage corona, but more commonly, electrical machinery. Ozone attack is characterized by fairly deep cracks in the rubber parts.

Rubber is attacked by ordinary oxygen (O_2) much as steel rusts in the presence of oxygen. Oxidation is characterized by a hard skin which eventually crazes in a multitude of small cracks and may turn chalky or assume a bark-like appearance.

A strong direct light, especially sunlight, has deleterious effects on rubber goods. This is attributed to the ultraviolet content of the spectrum which accelerates cracking. Whatever the mechanism however, light, particularly sunlight, is undesirable. In extremely cold climates some rubber goods will become so brittle that upon dropping or rough handling they will shatter.

In very warm humid climates, particularly those found in some parts of the tropics, fungi and bacteria find their way to the rubber goods and attack the organic content. This is especially true on duck reinforced rubber parts. However, parts reinforced with synthetics will not be attacked in the reinforcement.

Heat also has a bad effect on rubber. This could be the result of sunlight or artificial or accidental heating of any type. Heat results in a gradual hardening of the part and if ozone or oxygen are present, will accelerate their action.

Any stretching or bending of rubber in storage will result in very accelerated ageing. By the term ageing, we mean the cumulative effects of all the above mentioned attacking agents over a period of time. Ozone attacks rubber preferentially at points of strain.

Rubber goods, both natural and synthetic, all possess some degree of susceptibility to various solvents including water, but especially the liquid hydro-carbons. These manifest themselves in various ways by either swell or shrinkage of the rubber goods with which they are in contact.

No precise figure can be given as a "storage life" of a part. This is dependent on all of the above conditions and also the size of the part, its material and function. Generally speaking, the greater the relative surface area is to the volume, the more susceptible a part is to being rendered useless by ageing. For example, a relatively bulky part such as a ram front packer might be expected to have a much longer useful shelf life than a thin large diameter o-ring type of seal such as used on the bonnet seals of preventers or the rings in 'X' bushing.

STORAGE

From the preceding section we can draw a few rules governing storage of rubber goods. Briefly put - a cool, dry, dark storage place would be the best. The ideal would be to store the packings in vacuum sealed containers. The following rules, however, should not be difficult to follow under the average storage conditions experienced throughout our operation.

- Keep the rubber storage area as dark as possible. Certainly not out of doors, and, if indoors, away from skylights or windows and with subdued or indirect artificial lighting.
- Select the coolest location possible and be sure that no heaters or stoves are near by and particularly that the direct blast from a space heater does not blow on the rubber parts.
- Be sure that no electrical machinery (motors, switch gear, or any high voltage equipment producing corona) is near the rubber goods and that drafts will not carry the atmosphere from electrical machinery to the area in which the rubber goods are stored.
- The practice of first in - first out is essential with rubber goods. There is a natural tendency to remove parts from the front of a bin and when stock is replenished to leave the parts that are in the back in place, in which case years might pass before these are finally pulled out for use.
- Store rubber goods in a relaxed position. For example, do NOT hang o-rings on nails. Where possible, do not keep assemblies in stock where the rubber goods are stretched in order to assemble them on the part. For example, o-rings on blanking plugs, tubing hangers and 'X' bushing. In some cases this is difficult as it is with the aforementioned 'X' bushings. On these, periodic inspection should be employed to detect any signs of ageing as quickly as possible.

  On parts, such as the 'X' bushing rings, where we know the rubber parts will be stretched in storage, the best age resistant compounds we can buy are used.
- Keep storage as dry as possible and remove any oil, gas, etc. of hydro-carbon nature that may accidentally get on the rubber.
- Do not store the rubber goods on top shelves near galvanized roofs. There are several reasons for this; one is that heat is passed through galvanized roofing and also there is some opinion that ozone may be generated in this area.
- If possible, store rubber goods in buildings of wooden construction and wooden shelves. Wood is believed to scavenger ozone quite effectively.
- If store for extended periods is unavoidable, sealed containers will aid considerably; impervious surface coverings such as "Sea-Peel" or waxing will help.

USABILITY CHECKS

No general rule can be drawn regarding usability. The final measure is whether or not the cumulative effects of ageing have affected the physical properties of the part to such an extent that it will no longer perform the function for which it is designed. Thus, a large heavy part might suffer the same total amount of ageing as a small, light, thin piece, and still be usable whereas the small part is rendered useless. In these cases some judgement must be used in deciding usability.

Prior to shipment or use out of stock, rubber goods should be examined to see that no "chalking" or "barking" (bark-like surface appearance) is present, that there is not a hard skin on the rubber and that there are no cracks. Sometimes cracks will be obvious, but it is wise to stretch or bend the part in question so that any incipient cracks or very thin cracks will reveal themselves. Where a part is suspect, a check of hardness should be run. In the event that the hardness runs 15 points higher than the nominal hardness of the part, it is considered non-usable. Hardness is affected by temperature and readings should be taken with the rubber part at 70°F – 100°F (21°C - 38°C).

8.2 Hydraulic Hoses

STORAGE

- Before placing hose in storage, it should be completely drained.
- Whenever feasible, store the hose in the original wooden shipping crate. This will provide some protection against the deteriorating effects of solvents, corrosive liquids, ozone and sunlight. Hose should be stored so that the coils are in a horizontal plane.
- Certain rodents and insects will damage the hose. Adequate protection from them should be provided.
- The ideal temperature for storing the hose ranges from 50°F (10°C) to 70°F (21°C) with a maximum limit of 100°F (38°C). If stored below 32°F (0°C), the hose will become stiff and would require warming before placed in service. The hose should not be stored near sources of heat, such as radiators, base heaters, etc., nor should the hose be stored under conditions of high or low humidity.
- To avoid the adverse effects of high ozone concentration, the hose should not be stored near electrical equipment that may generate ozone or be stored for any lengthy period in geographical areas of known high ozone concentration. Exposure to direct or reflected sunlight - even through windows - should also be avoided.

HANDLING

CAUTION: Care should be exercised to prevent mishandling. Crushing or kinking of the hose can cause severe damage to the reinforcement. If this occurs, remove hose from service.

- In order to minimize the danger of kinking, the hose preferably should be removed from its crate by hand, laid out in a straight line, then lifted by means of a catline attached near one end of the hose. If a catline is used to remove the hose from its crate, the crate should be rotated as the hose is removed. Recommended practice is to protect the hose in some manner when moving to a new location. It is considered bad practice to handle the hose with a winch, to hand the hose from a truck gin pole, or to place heavy pieces of equipment on the hose.

8.3 Electronic Goods and Tools containing Electronics

8.3.1 General Instructions

Rapid temperature changes must be excluded to avoid condensation of humidity and mechanical stress.

The packing should protect electronic goods against:

- Dust
- Humidity
- Electrostatic Charge
- Shock
- Direct Sunlight

Generally the original transport packing serves the above requirements best.

Normally antistatic bags, desiccant and anti-shock pads are applied to prevent damage.

Electronic goods should be stored in a warehouse secured against theft.

8.3.2 Fiberoptic Terminations

Optic Link Modules (OLM) should be capped. Caps have to be removed before installation.

8.3.3 Handling Procedure for CMOS Devices

Electrical environments such as overvoltages and electrostatic discharges damage CMOS devices and printed circuit cards containing the devices. Most CMOS devices have diode input protection circuits and gate protection structures to protect against such electrical environments.

In addition to the internal protection network, use the following steps to prevent the generation of severe electrical transient voltages during handling of CMOS devices.

- Read the manufacturer's equipment specification and data sheets before performing maintenance. Do not exceed recommended maximum voltage levels.
- Use grounding wrist straps which contact the skin.
- Ground all work surfaces.
- If lead-straightening or hand-soldering is necessary, provide ground straps for the equipment, and ground the soldering ties.
- Connect all unused inputs to an appropriate logic voltage level, either power or ground.
- Inspect test equipment for proper polarity of voltage before conduction parametric or functional testing.
- Inspect all power supplies used for testing to ensure there are no voltage transients present.
- Do not insert or remove devices from test sockets with power applied.
- Do not contact edge connectors which are wired directly to device inputs.
- If external connections to a printed circuit card address only an input of the integrated circuit, use a resistance of 10 K ohms or greater in series with the input. The resistance limits damage to the card if it is removed and contacts static generating materials.
- Connect all low impedance equipment such as pulse generators to inputs only after the device has power applied. Disconnect the equipment before power is removed.
- Do not allow nylon or other static generating materials to contact the devices.
- Store or transport the devices in materials that are antistatic. Do not insert the devices into plastic packing material, styrofoam, or plastic trays.

8.3.4 Lithium Manganese Dioxide Battery

Replacement of the Lithium Manganese Dioxide battery mounted in the subsea transmitter & battery module: The battery supports the AMF-System (Automatic Mode Function / Dead Man System) belonging to multiplex drilling control systems. Under normal operation conditions replacement is required **after each one-year period**. Battery storage conditions should be in a range of 23°F – 59°F (–5°C to 15°C).

9 Attachment

- Data Sheets of Protective Materials (if required)
- Data Sheets of Hydraulic Fluids (if required)

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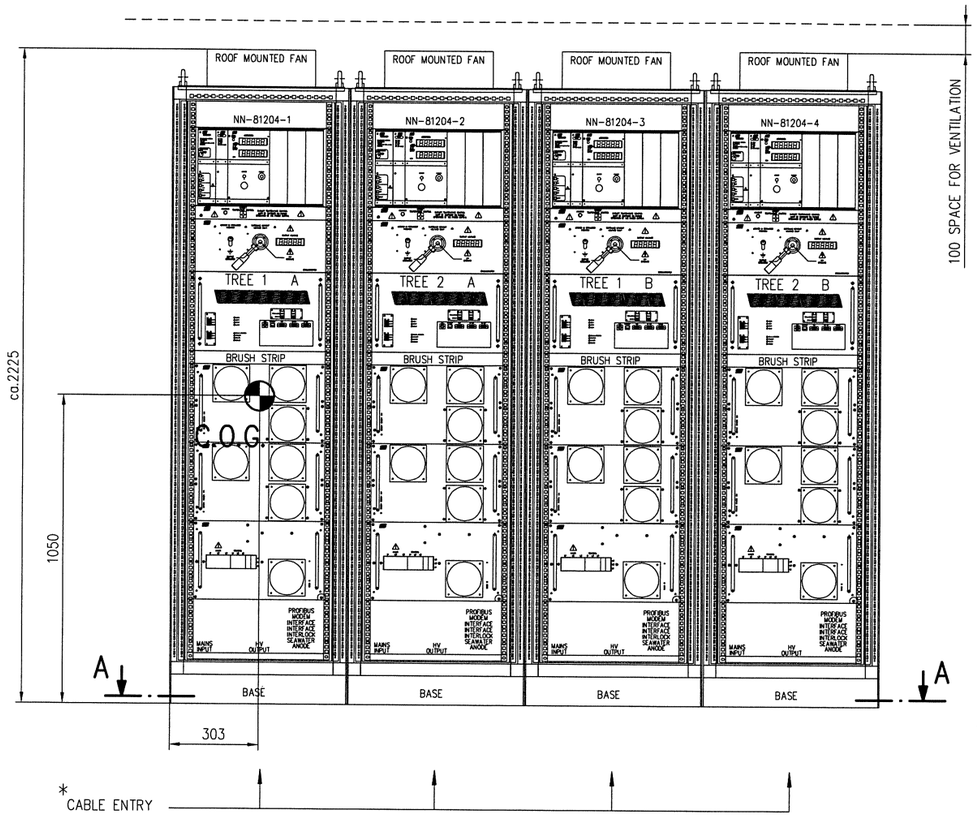
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : EPCU, K5-F

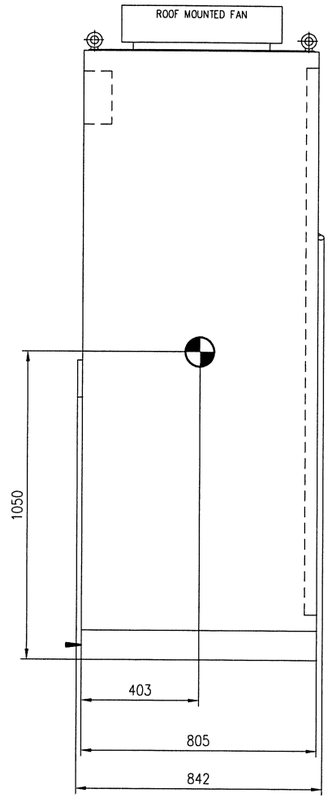
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
010	0010	03	2197096-45	1.000	EA	HV Power Supply -FUG- For DC-System 5000 VDC / 4A complete with Rittal Cabinet TS8 (HxWxD: 2100x600x800) without Modem Front Access		
020	0020	01	2197096-42	1.000	EA	DC: Surface Modem for HV Power Supply from FUG Supplier: Kunow		
500	0500	C03	619046-43-64-01	1.000	EA	TAG, NEW LOGO (52 X 90)		
>>>B/M Category : Engrg Spec/Document item								
900	0900	01	SK-066022-31	1.000	EA	AS: EPCU, K5-F		
901	0901	03	SK-066022-31-04	1.000	EA	CIRCUIT DIAGRAM: EPCU		
902	0902	03	SK-066022-31-42	1.000	EA	Field Term. Diagram: EPCU, K5F		
910	0910	03	X-065437-01-09	1.000	EA	FAT: EPCU, K5F		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	07	D-000100-02-17	1.000	EA	PART IDENT: MARK PKG OR ON AFFIXED TAG, "ASSY", ASSY P/N, "REV" REV, "CAM" SAP PLANT NO, S/N ("CCV" MAY BE USED IN PLACE OF "CAM". SEE X-043764-01 FOR DETAILS)		
>>>B/M Category : Reference Call Outs								
1000	1000	01	X-065438-02-72	1.000	EA	Maintenance Procedure: EPCU, K5F for Electric Power & Communication Unit Project: TOTAL K5F		
970	0970	02	X-076734-04	1.000	EA	Hardware Design Specification: EPCU, K5		
980	0980	02	X-065467-02-08	1.000	EA	Installation Procedure: EPCU, K5F for Electric Power & Communication Unit Project: TOTAL K5F		
990	0990	02	X-065438-02-73	1.000	EA	Operation Procedure: EPCU, K5F for Electric Power & Communication Unit		

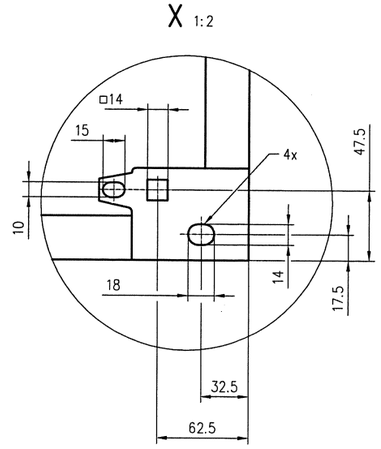
SORT ITEM INDI No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART

Project: TOTAL K5F

FRONT VIEW





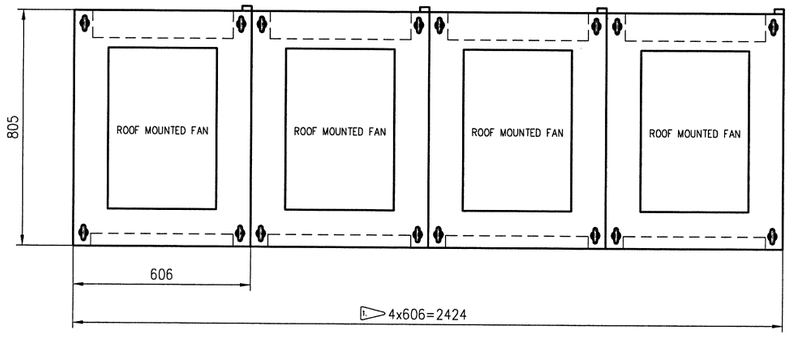


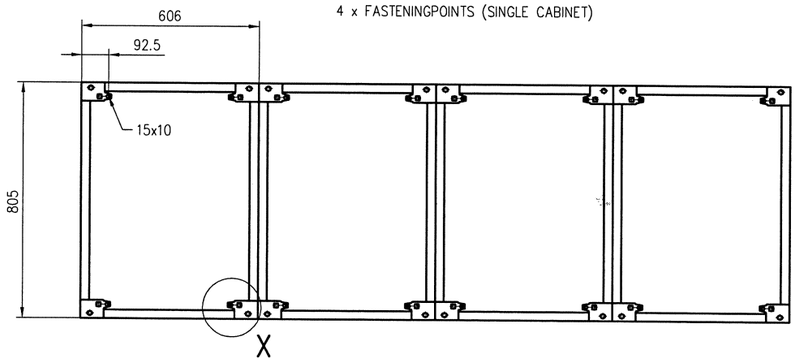
NOTE:

▷ FOUR SINGLE CABINETS, EACH 600mm

A–A

4 x FASTENINGPOINTS (SINGLE CABINET)





OPERATING TEMPERATURE	-5°C TO +40°C
STORAGE TEMPERATURE	-18°C TO +50°C
IP RATING TOP SIDE	MIN. IP22
IP RATING ALL OTHER SIDES	MIN. IP20
WEIGHT (SINGLE CABINET)	~240 KG

2x POWER SUPPLY, 3~, 400V/50Hz,18kVA
4x POWER OUTPUT, 3kV-4kV DC/4A
4x PROFIBUS DP INTERFACE TO MCS
4x ETHERNET INTERFACE TO MCS

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

REASON FOR ISSUE	DATE	CLIENT REV.
APPROVED FOR CONSTRUCTION	02NOV07	1
ISSUED FOR CLIENT COMMENT	31OCT07	N/A
ISSUED FOR INTERNAL IDC	28MAR07	N/A

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-03-502

CAD | REV. BY: T. Hein | DATE: 19.03.2007 | REV.: 01

TOLERANCES ACCORDING TO DIN ISO 8015
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/k
SURFACE TREATMENT
MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN:	T. Hein	DATE: 19.03.2007
CHECKED:	M. Lehmker	DATE: 16.11.2007
APPROVED:	J. Dannehl	DATE: 16.11.2007

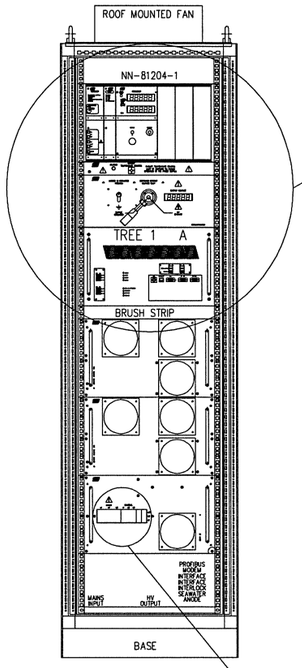
EST. WEIGHT: 960.000 KG | SUPERSEDES: | SCALE:

CAMERON
CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

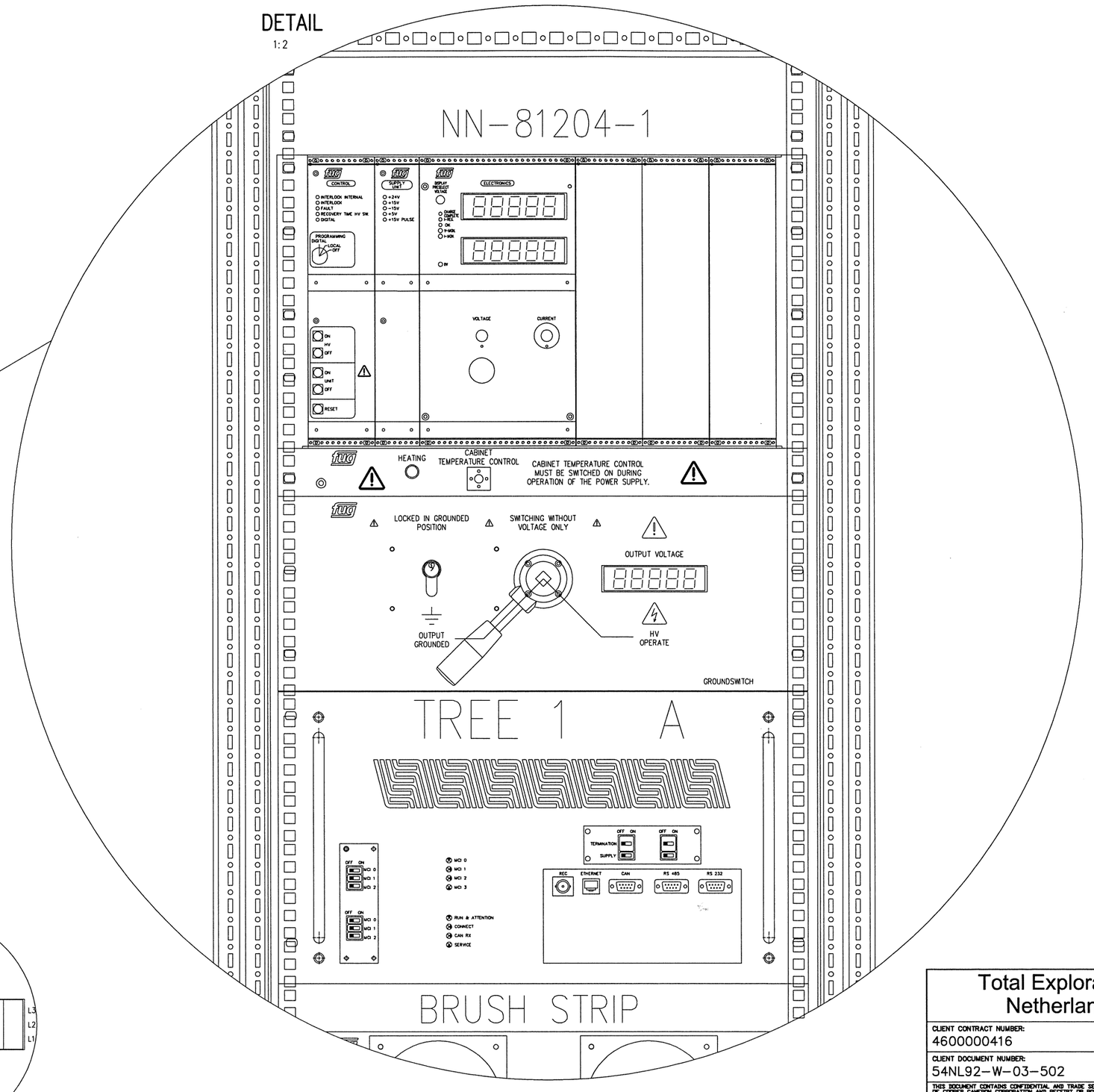
ASSEMBLY DRAWING:
EPCU

INITIAL USE BOM: 223022-31 | SHEET: 1 OF 2 | DRAWING NUMBER: SK-066022-31

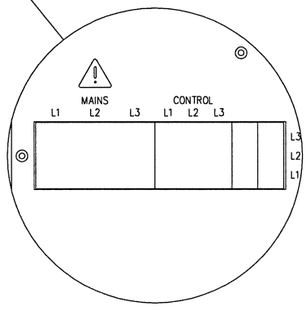
STATUS: APPROVED



DETAIL
1:2



DETAIL
1:2



Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-03-502 | CLIENT REV.: 1

CAD

REV. BY: T. Hein | DATE: 20.03.2007 | REV.: 01

TOLERANCES ACCORDING TO DIN ISO 8015	SURFACE TREATMENT	DO NOT SCALE	
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219		DRAWN: T. Hein	DATE: 20.03.2007
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K	MATERIAL AND HEAT TREATMENT	CHECKED: M. Lehmker	DATE: 16.11.2007
		APPROVED: J. Dannehl	DATE: 16.11.2007
EST. WEIGHT: 960.000 KG	SUPERSEDES:	SCALE: 1:10	

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

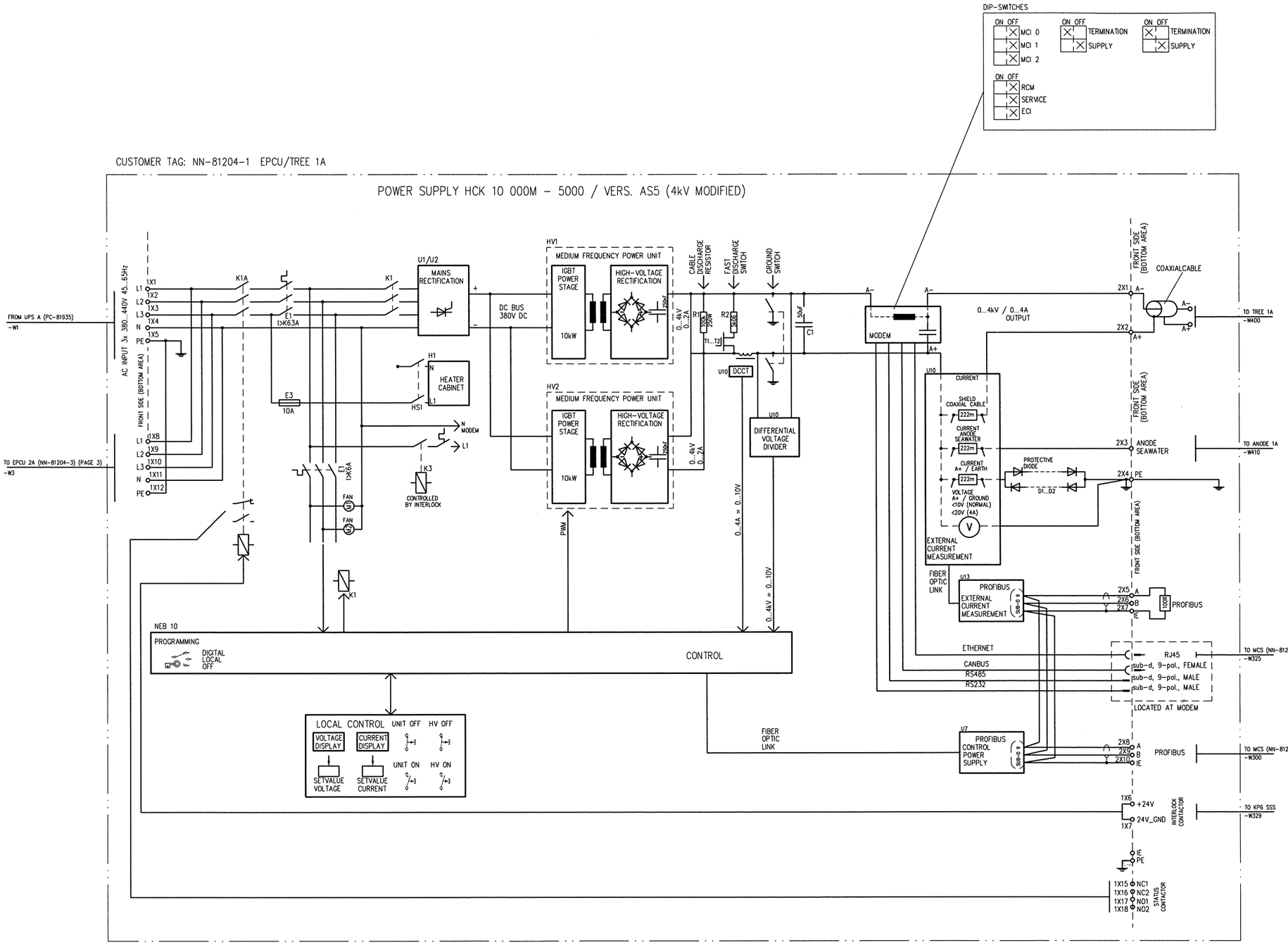
ASSEMBLY DRAWING:
EPCU

INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223022-31	2 OF 2	SK-066022-31

STATUS: APPROVED

CUSTOMER TAG: NN-81204-1 EPCU/TREE 1A

POWER SUPPLY HCK 10 000M - 5000 / VERS. AS5 (4kV MODIFIED)



KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

REISSUED AS APPROVED FOR CONSTRUCTION	11JUN08	3
REISSUED AS APPROVED FOR CONSTRUCTION	27FEB08	2
APPROVED FOR CONSTRUCTION	14JAN08	1
ISSUED FOR CLIENT COMMENT	30OCT07	N/A
ISSUED FOR INTERNAL IDC	21SEP07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-06-502

CAD

REV. BY: T. Hein | DATE: 11.06.2008 | REV.: 04

SURFACE TREATMENT

DO NOT SCALE

TOLERANCES ACCORDING TO DIN ISO 8015

GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219

TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

MATERIAL AND HEAT TREATMENT

DRAWN: T. Hein	DATE: 18.09.2007
CHECKED: F. Tegt	DATE: 11.06.2008
APPROVED: J. Dannehl	DATE: 11.06.2008

EST. WEIGHT: .000 KG | SUPERSEDES: | SCALE:

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

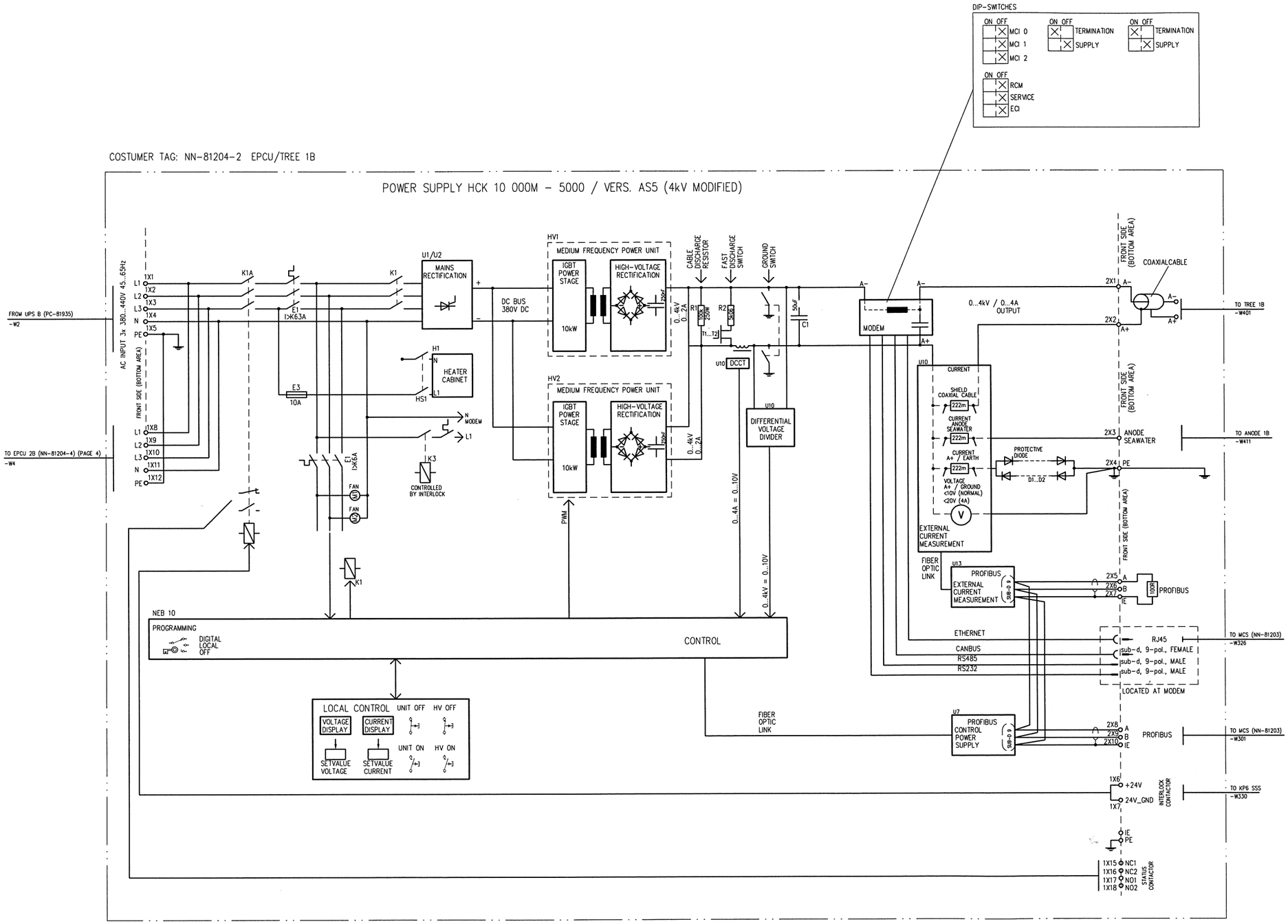
CIRCUIT DIAGRAM:
ELECTRICAL POWER & COMMUNICATION UNIT (EPCU)

INITIAL USE BOM: 223022-31 | SHEET: 1 OF 4 | DRAWING NUMBER: SK-066022-31-04

STATUS:

COSTUMER TAG: NN-81204-2 EPCU/TREE 1B

POWER SUPPLY HCK 10 000M - 5000 / VERS. AS5 (4kV MODIFIED)



Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-06-502 | CLIENT REV.: 3

CAD | REV. BY: T. Hein | DATE: 11.06.2008 | REV.: 04

TOLERANCES ACCORDING TO DIN ISO 8015

GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219

TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

SURFACE TREATMENT | DO NOT SCALE

MATERIAL AND HEAT TREATMENT

DRAWN: T. Hein DATE: 20.09.2007

CHECKED: F. Tegt DATE: 11.06.2008

APPROVED: J. Donnehl DATE: 11.06.2008

EST. WEIGHT: 000 KG | SUPERSEDES: | SCALE:

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

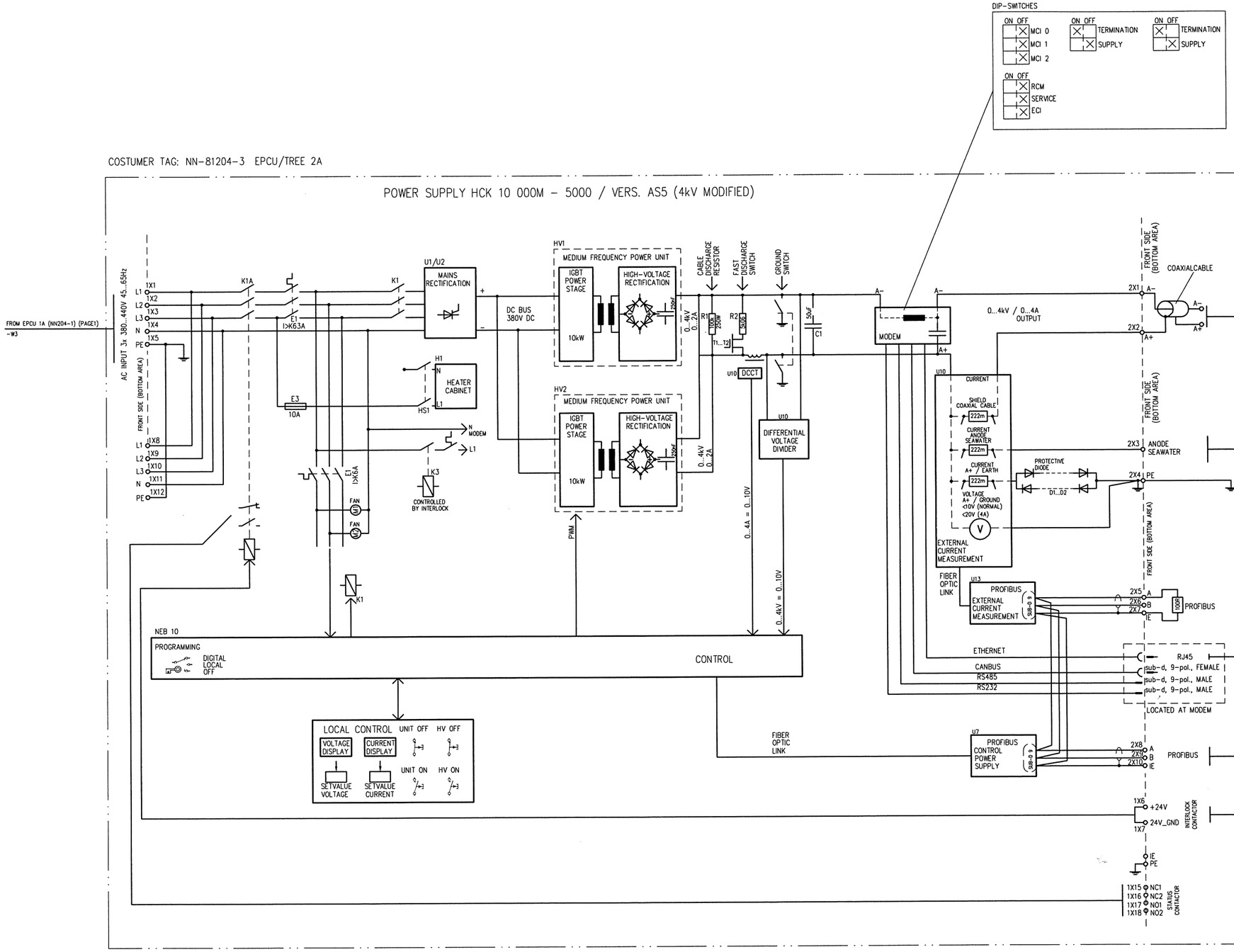
CIRCUIT DIAGRAM:
ELECTRICAL POWER & COMMUNICATION UNIT (EPCU)

INITIAL USE BOM: 223022-31 | SHEET: 2 OF 4 | DRAWING NUMBER: SK-066022-31-04

STATUS:

COSTUMER TAG: NN-81204-3 EPCU/TREE 2A

POWER SUPPLY HCK 10 000M - 5000 / VERS. AS5 (4kV MODIFIED)



Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-06-502 | CLIENT REV.: 3

CAD	REV. BY:	DATE:	REV.:
	T. Hein	11.06.2008	04

TOLERANCES ACCORDING TO DIN ISO 8015	SURFACE TREATMENT	DO NOT SCALE	
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219		DRAWN: T. Hein	DATE: 20.09.2007
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K	MATERIAL AND HEAT TREATMENT	CHECKED: F. Tegt	DATE: 11.06.2008
		APPROVED: J. Dannehl	DATE: 11.06.2008
EST. WEIGHT: 000 KG	SUPERSEDES:	SCALE:	

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

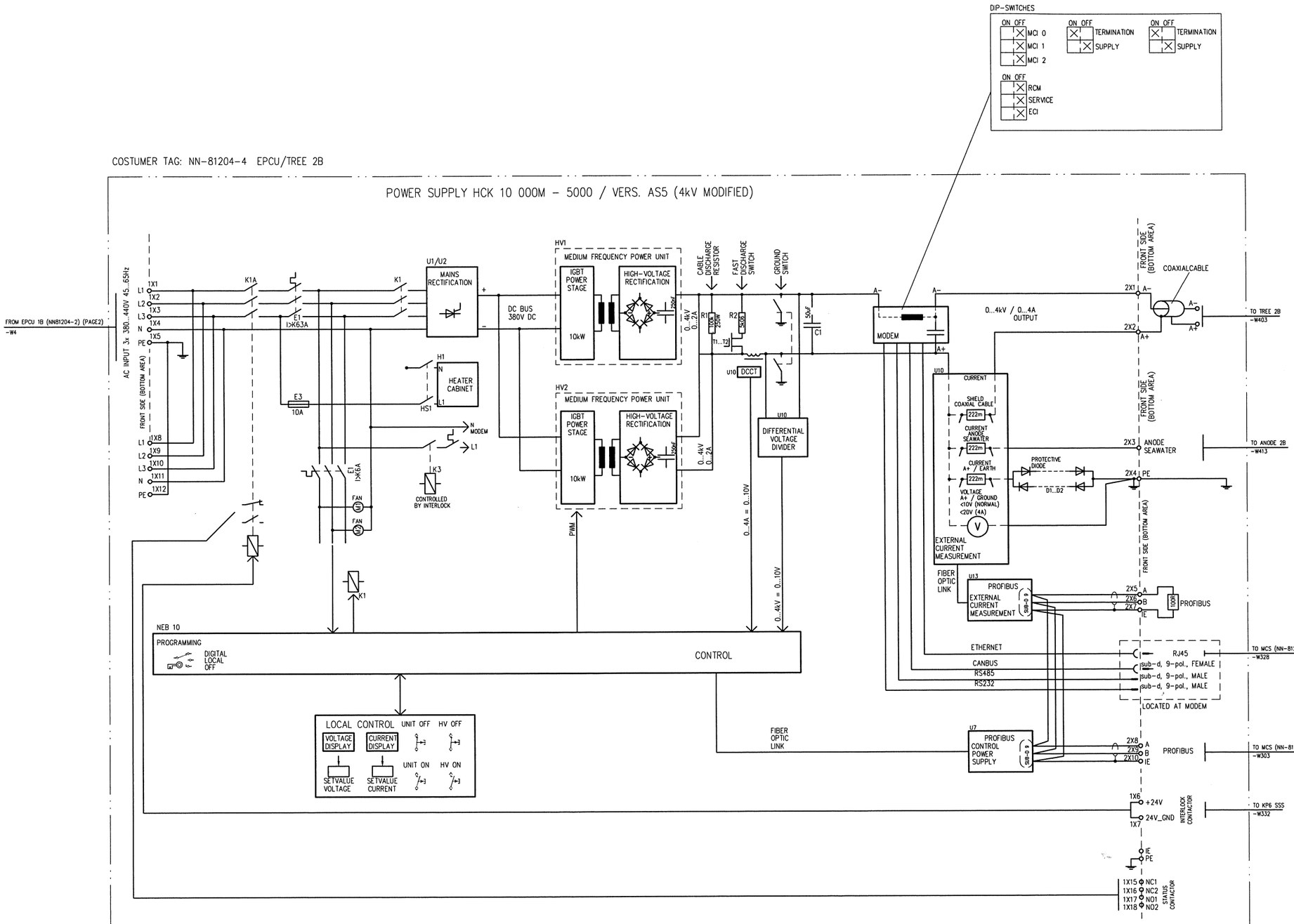
CIRCUIT DIAGRAM:
ELECTRICAL POWER & COMMUNICATION UNIT (EPCU)

INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223022-31	3 OF 4	SK-066022-31-04

STATUS:

COSTUMER TAG: NN-81204-4 EPCU/TREE 2B

POWER SUPPLY HCK 10 000M - 5000 / VERS. AS5 (4kV MODIFIED)



Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-06-502 | CLIENT REV.: 3

CAD	REV. BY: T. Hein	DATE: 11.06.2008	REV.: 04

TOLERANCES ACCORDING TO DIN ISO 8015	SURFACE TREATMENT	DO NOT SCALE	
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219		DRAWN: T. Hein	DATE: 20.09.2007
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K	MATERIAL AND HEAT TREATMENT	CHECKED: F. Tegt	DATE: 11.06.2008
		APPROVED: J. Dannehl	DATE: 11.06.2008
EST. WEIGHT: 000 KG	SUPERSEDES:	SCALE:	

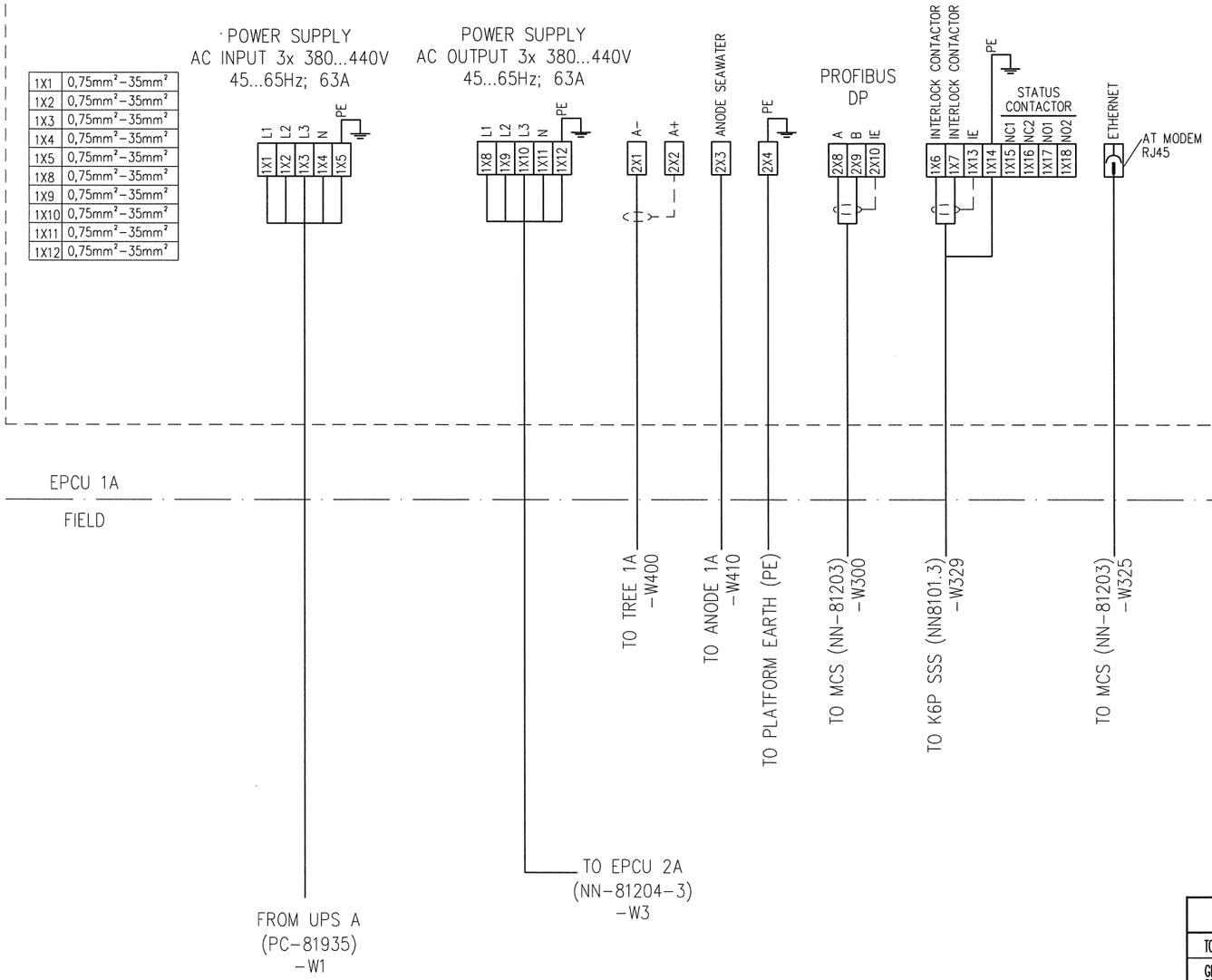
CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

CIRCUIT DIAGRAM:
ELECTRICAL POWER & COMMUNICATION UNIT (EPCU)

INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223022-31	4 OF 4	SK-066022-31-04

STATUS:

CUSTOMER TAG: NN-81204-1 EPCU/TREE 1A



1X1	0,75mm²–35mm²
1X2	0,75mm²–35mm²
1X3	0,75mm²–35mm²
1X4	0,75mm²–35mm²
1X5	0,75mm²–35mm²
1X8	0,75mm²–35mm²
1X9	0,75mm²–35mm²
1X10	0,75mm²–35mm²
1X11	0,75mm²–35mm²
1X12	0,75mm²–35mm²

2X1	10mm²–16mm²	AWG6–4
2X2	SPECIAL FOR CABLE SHIELD–DIAMETER APPROX. 14mm	
2X3	2,5mm²	
2X4	0,75mm²–35mm²	AWG18–1
2X8	0,2mm²–2,5mm²	AWG24–14
2X9	0,2mm²–2,5mm²	AWG24–14
2X10	0,2mm²–2,5mm²	AWG24–14
1X6	0,2mm²–2,5mm²	AWG24–14
1X7	0,2mm²–2,5mm²	AWG24–14
1X13	0,2mm²–2,5mm²	AWG24–14
1X14	0,2mm²–2,5mm²	AWG24–14
1X15	0,2mm²–2,5mm²	AWG24–14
1X16	0,2mm²–2,5mm²	AWG24–14
1X17	0,2mm²–2,5mm²	AWG24–14
1X18	0,2mm²–2,5mm²	AWG24–14

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

REASON FOR ISSUE	DATE	CLIENT REV.
AS BUILT	03JUN09	3
REISSUED AS APPROVED FOR CONSTRUCTION	27FEB08	2
APPROVED FOR CONSTRUCTION	14JAN08	1
ISSUED FOR CLIENT COMMENT	30OCT07	N/A
ISSUED FOR INTERNAL IDC	21SEP07	N/A

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-01-501

CAD

REV. BY: A. Sonnemann | DATE: 03.06.2009 | REV.: 04

TOLERANCES ACCORDING TO DIN ISO 8015
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

SURFACE TREATMENT

MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN:	T. Hein	DATE: 18.09.2007
CHECKED:	M. Lehmker	DATE: 03.06.2009
APPROVED:	J. Dannehl	DATE: 03.06.2009

EST. WEIGHT: .000 KG | SUPERSEDES: | SCALE:

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

FIELD TERMINATION DIAGRAM:
ELECTRICAL POWER&COMMUNICATION UNIT
(EPCU)

INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223022-31	1 OF 4	SK-066022-31-42

STATUS: APPROVED

COSTUMER TAG: NN-81204-2 EPCU/TREE 1B

1X1	0,75mm²–35mm²
1X2	0,75mm²–35mm²
1X3	0,75mm²–35mm²
1X4	0,75mm²–35mm²
1X5	0,75mm²–35mm²
1X8	0,75mm²–35mm²
1X9	0,75mm²–35mm²
1X10	0,75mm²–35mm²
1X11	0,75mm²–35mm²
1X12	0,75mm²–35mm²

POWER SUPPLY
AC INPUT 3x 380...440V
45...65Hz; 63A

L1 L2 L3 N PE
1X1 1X2 1X3 1X4 1X5

POWER SUPPLY
AC OUTPUT 3x 380...440V
45...65Hz; 63A

L1 L2 L3 N PE
1X8 1X9 1X10 1X11 1X12

A– A+
2X1 2X2

ANODE SEAWATER
2X3

PE
2X4

PROFIBUS
DP

A B IE
2X8 2X9 2X10

INTERLOCK INTERLOCK IE
1X6 1X7 1X13

PE

STATUS
CONTACTOR

1X14 NC1 NC2 NO1 NO2
1X15 1X16 1X17 1X18

ETHERNET

AT MODEM
RJ45

2X1	10mm²–16mm²	AWG6–4
2X2	SPECIAL FOR CABLE SHIELD–DIAMETER APPROX. 14mm	
2X3	2,5mm²	
2X4	0,75mm²–35mm²	AWG18–1
2X8	0,2mm²–2,5mm²	AWG24–14
2X9	0,2mm²–2,5mm²	AWG24–14
2X10	0,2mm²–2,5mm²	AWG24–14
1X6	0,2mm²–2,5mm²	AWG24–14
1X7	0,2mm²–2,5mm²	AWG24–14
1X13	0,2mm²–2,5mm²	AWG24–14
1X14	0,2mm²–2,5mm²	AWG24–14
1X15	0,2mm²–2,5mm²	AWG24–14
1X16	0,2mm²–2,5mm²	AWG24–14
1X17	0,2mm²–2,5mm²	AWG24–14
1X18	0,2mm²–2,5mm²	AWG24–14

EPCU 1B
FIELD

TO TREE 1B
-W401

TO ANODE 1B
-W411

TO PLATFORM EARTH (PE)

TO MCS (NN-81203)
-W301

TO K6P SSS (NN8101.3)
-W330

TO MCS (NN-81203)
-W326

FROM UPS B
(PC-81935)
-W2

TO EPCU 2B
(NN-81204-4)
-W4

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-01-501

CLIENT REV.:
3

CAD

REV. BY: A. Sonnemann
DATE: 03.06.2008
REV.: 04

TOLERANCES ACCORDING TO DIN ISO 8015
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

SURFACE TREATMENT
MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN:	T. Hein	DATE: 24.09.2007
CHECKED:	M. Lehmker	DATE: 03.06.2009
APPROVED:	J. Dannehl	DATE: 03.06.2009

EST. WEIGHT: .000 KG | SUPERSEDES: | SCALE:

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

FIELD TERMINATION DIAGRAM:
ELECTRICAL POWER&COMMUNICATION UNIT
(EPCU)

INITIAL USE BOM: 223022-31
SHEET: 2 OF 4
DRAWING NUMBER: SK-066022-31-42

STATUS: APPROVED

COSTUMER TAG: NN-81204-3 EPCU/TREE 2A

1X1	0,75mm²-35mm²
1X2	0,75mm²-35mm²
1X3	0,75mm²-35mm²
1X4	0,75mm²-35mm²
1X5	0,75mm²-35mm²
1X8	0,75mm²-35mm²
1X9	0,75mm²-35mm²
1X10	0,75mm²-35mm²
1X11	0,75mm²-35mm²
1X12	0,75mm²-35mm²

POWER SUPPLY
AC INPUT 3x 380...440V
45...65Hz; 63A

L1 L2 L3 N PE
1X1 1X2 1X3 1X4 1X5

POWER SUPPLY
AC OUTPUT 3x 380...440V
45...65Hz; 63A

L1 L2 L3 N PE
1X8 1X9 1X10 1X11 1X12

2X1 A- A+

2X3 ANODE SEAWATER

PE
2X4

PROFIBUS
DP

A B IE
2X8 2X9 2X10

INTERLOCK INTERLOCK IE
1X6 1X7 1X13 1X14

PE

STATUS CONTACTOR
NC1 NC2 NO1 NO2
1X15 1X16 1X17 1X18

ETHERNET

AT MODEM
RJ45

2X1	10mm²-16mm²	AWG6-4
2X2	SPECIAL FOR CABLE SHIELD-DIAMETER APPROX. 14mm	
2X3	2,5mm²	
2X4	0,75mm²-35mm²	AWG18-1
2X8	0,2mm²-2,5mm²	AWG24-14
2X9	0,2mm²-2,5mm²	AWG24-14
2X10	0,2mm²-2,5mm²	AWG24-14
1X6	0,2mm²-2,5mm²	AWG24-14
1X7	0,2mm²-2,5mm²	AWG24-14
1X13	0,2mm²-2,5mm²	AWG24-14
1X14	0,2mm²-2,5mm²	AWG24-14
1X15	0,2mm²-2,5mm²	AWG24-14
1X16	0,2mm²-2,5mm²	AWG24-14
1X17	0,2mm²-2,5mm²	AWG24-14
1X18	0,2mm²-2,5mm²	AWG24-14

EPCU 2A

FIELD

FROM EPCU 1A
(NN204-1)
-W3

TO TREE 2A
-W402

TO ANODE 2A
-W412

TO PLATFORM EARTH (PE)

TO MCS (NN-81203)
-W302

TO K6P SSS (NN8101.3)
-W331

TO MCS (NN-81203)
-W327

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-01-501

CLIENT REV.: 3

CAD

REV. BY: A. Sonnemann — DATE: 03.06.2009 — REV.: 04

TOLERANCES ACCORDING TO DIN ISO 8015

GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219

TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

SURFACE TREATMENT

MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN: T. Hein	DATE: 24.09.2007	
CHECKED: M. Lehmker	DATE: 03.06.2009	
APPROVED: J. Dannehl	DATE: 03.06.2009	

EST. WEIGHT: .000 KG | SUPERSEDES: | SCALE:

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

FIELD TERMINATION DIAGRAM:
ELECTRICAL POWER&COMMUNICATION UNIT
(EPCU)

INITIAL USE BOM: 223022-31

SHEET: 3 OF 4

DRAWING NUMBER: SK-066022-31-42

STATUS: APPROVED

COSTUMER TAG: NN-81204-4 EPCU/TREE 2B

1X1	0,75mm²-35mm²
1X2	0,75mm²-35mm²
1X3	0,75mm²-35mm²
1X4	0,75mm²-35mm²
1X5	0,75mm²-35mm²
1X8	0,75mm²-35mm²
1X9	0,75mm²-35mm²
1X10	0,75mm²-35mm²
1X11	0,75mm²-35mm²
1X12	0,75mm²-35mm²

POWER SUPPLY
AC INPUT 3x 380...440V
45...65Hz; 63A

L1 L2 L3 N PE
1X1 1X2 1X3 1X4 1X5

POWER SUPPLY
AC OUTPUT 3x 380...440V
45...65Hz; 63A

L1 L2 L3 N PE
1X8 1X9 1X10 1X11 1X12

A- A+
2X1 2X2

ANODE SEAWATER
2X3

PE
2X4

PROFIBUS
DP

A B IE
2X8 2X9 2X10

INTERLOCK INTERLOCK IE
1X6 1X7 1X13 1X14

PE

STATUS
CONTACTOR

NC1 NC2 NO1 NO2
1X15 1X16 1X17 1X18

ETHERNET

AT MODEM
RJ45

2X1	10mm²-16mm²	AWG6-4
2X2	SPECIAL FOR CABLE SHIELD-DIAMETER APPROX. 14mm	
2X3	2,5mm²	
2X4	0,75mm²-35mm²	AWG18-1
2X8	0,2mm²-2,5mm²	AWG24-14
2X9	0,2mm²-2,5mm²	AWG24-14
2X10	0,2mm²-2,5mm²	AWG24-14
1X6	0,2mm²-2,5mm²	AWG24-14
1X7	0,2mm²-2,5mm²	AWG24-14
1X13	0,2mm²-2,5mm²	AWG24-14
1X14	0,2mm²-2,5mm²	AWG24-14
1X15	0,2mm²-2,5mm²	AWG24-14
1X16	0,2mm²-2,5mm²	AWG24-14
1X17	0,2mm²-2,5mm²	AWG24-14
1X18	0,2mm²-2,5mm²	AWG24-14

EPCU 2B

FIELD

FROM UPS 1B
(NN81204-2)
-W4

TO TREE 2B
-W403

TO ANODE 2B
-W413

TO PLATFORM EARTH (PE)

TO MCS (NN-81203)
-W303

TO K6P SSS (NN8101.3)
-W332

TO MCS (NN-81203)
-W327

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

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54NL92-W-01-501

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REV. BY: A. Sonnemann | DATE: 03.06.2009 | REV.: 04

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CAMERON

CAMERON GmbH
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STATUS: APPROVED

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 1, Section 5

TOPSIDE UMBILICAL TERMINATION UNIT (TUTU)

CONTENTS

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 1, Section 5
TOPSIDE UMBILICAL TERMINATION UNIT (TUTU)

DESCRIPTION, INSTALLATION, OPERATION & MAINTENANCE

CONTENTS

Project No.	Cameron No.	Description
54NL92-W-0S-502	X-076721-87	SPS – Subsea & Topsides Functional Requirement Specif. *See Volume 1, Section 1 Total System*
54NL92-W-0S-512	X-076721-87-06	TUTU – Supplemental Requirement Specification *See Volume 1, Section 1 Total System*
-	X-065429	General Preservation & Storage Procedure *See Volume 1, Section 1 Total System*

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 1, Section 5
TOPSIDE UMBILICAL TERMINATION UNIT (TUTU)

PARTS LISTS & DRAWINGS

CONTENTS

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

31 MAR 2009	As Built	A. Weilandt	T. Appel	A. Weilandt
06 AUG 2007	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
02 MAY 2007	Issued for Client Comment	A. Weilandt	S. Horne	
12 OCT 2006	Issued for Internal IDC	A. Weilandt	D.Coonrod	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approver**

CAMERON	**Document Title:** **Subsea and Topsides Functional Requirement Specification**		
PAGE 1 OF 34	**Customer Document Number:**	54NL92-W-0S-502	REV. 2
	Cameron Document No.	X-076721-87	REV. 02

TABLE OF CONTENTS

1 Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
A	12OCT06	Initial release Celle	- - -
B	02MAY07	Section 7.5.6.1: Use of Swagelok added for LP lines and added the need for metric size on all LP tubing Section 8.4: cable entry changed from top to bottom Section 9.2: List of Total Tag Numbers added Section 9.1.1.2: Colour for topside equipment changed from RAL5015 to RAL7035 (light grey) 10.8 & 10.9: updated description as per current design of anode and cathode package 10.10: complete section added for Anode Umbilical Assembly	Comments from internal IDC
01	06AUG07	Section 10.8: Anode Package Foundation Base added	Updated to Approved for Construction
02	31MAR09	Minor cosmetic Customer Comments implemented	Update to “As Built”

2 Introduction

This document is written to consolidate the technical requirements for the subsea control system intended to be used on the TOTAL K5F Project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

It will be submitted for approval early on in the project cycle and upon approval will be used for the design of the system.

Referenced client specifications within this document also need to be considered for the design.

3 Scope of this document

The scope of this document is to define the functional requirements for the subsea control system intended to be used on the TOTAL K5F Project.

Technical requirements relate but shall not be limited to:

- Design basis data
- Functional requirements

The Intervention & Workover Control System (IWOCS) shall **NOT** be covered by this document.

4 Abbreviations & Definitions

4.1 Abbreviations

AIV	Annulus Isolation Valve
AMV	Annulus Master Valve
APTA	Annulus Pressure Transmitter A
APTB	Annulus Pressure Transmitter B
BAIV	B Annulus Isolation Valve
CI	Corrosion Inhibitor
CIV	Chemical Injection Valve
CP	Cathodic Protection
CR	Control Room
DCS	Distributed Control System
DHSV	Downhole Safety Valve
DHPT	Downhole Pressure Temperature Transmitter
EPCU	Electrical Power and Communication Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
HPU	Hydraulic Power Unit
ICSS	Integrated Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
KHI	Kinetic Hydrate Inhibitor
LPMV	Lower Production Master Valve
MEOH	Methanol
PCS	Process Control System
PPD	Production Pressure Downstream
PPU	Production Pressure Upstream
PSV	Production Swab Valve
PTD	Production Temperature Downstream
PTU	Production Temperature Upstream
PWV	Production Wing Valve
PRCM	Power Regulation and Communication Module
SCSSV	Surface Controlled Subsurface Safety Valve
SSS	Safety Shutdown System
TUTU	Topside Umbilical Termination Unit
UPMV	Upper Production Master Valve
UPS	Uninterruptible Power Supply
UTA	Umbilical Termination Assembly
WH	Wellhead
XOV	Crossover Valve

4.2 Definitions

COMPANY	Total E&P Nederland B.V. (TEPNL)
CONTRACTOR	Cooper Cameron UK Ltd.

5 References

5.1 Cameron documents

Following documents **MUST** be considered during the design phase.

Description	Number
Subsea Production Control System Interconnection Diagram	SK-066001-88-04
K5F Field Development Project Contract	4600000416
Bill Of Material – Subsea Production Control System	223001-88
Project Quality Specification	SP-003118-15

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Design of cathodic protection of offshore structures	GS GR COR 100
External protection of off-shore and coastal structures and equipment by painting	GS EP COR 350
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Minimum CONTRACTOR document requirements	GS EP ELE 091
Electrical cables	GS EP ELE 161
Cable trays/ladders	GS EP ELE 311
Precommissioning and commissioning specification	GS EP EXP 101
Precommissioning and commissioning technical preparation	GS EP EXP 103
Precommissioning execution	GS EP EXP 105
Commissioning execution	GS EP EXP 107
Operations preparation during project – Maintenance and inspection documentation	GS EP EXP 203
Requirements for contractor quality management	GS EP PJC 501
Requirements for contractor critically rating of a unit	GS EP PJC 502
Requirements for contractor quality control	GS EP PJC 503
Valves	GS EP PVV 142
Welding of duplex and superduplex stainless steel	GS EP PVV 614
Area classification	GS EP SAF 216

Description	Number
Completed wells safety systems and safety rules	GS EP SAF 226
Impacted area, restricted area and fire zones	GS EP SAF 253
Emergency shut-down and emergency de-pressurisation (ESD & EDP)	GS EP SAF 261
Design philosophy and requirements for subsea stations	GS EP SPS 001
Subsea ball valves	GS EP SPS 005
Service valves in subsea stations	GS EP SPS 006
Tie-in systems	GS EP SPS 007
Corrosion protection of subsea stations	GS EP SPS 009
Preservation requirements for subsea package	GS EP SPS 010
Mechanical completion of subsea stations	GS EP SPS 011
Documentation requirements for subsea stations	GS EP SPS 012
Wellhead and guidance systems	GS EP SPS 013
Subsea gate valves and actuators in subsea Xmas-tree systems	GS EP SPS 015
Subsea insert chokes and associated running and retrieval tools	GS EP SPS 016
Subsea production control system	GS EP SPS 019
Subsea control unit functional requirements	GS EP SPS 020
Subsea mateable electrical/optical connectors	GS EP SPS 021
Environmental testing of subsea electronics	GS EP SPS 022
Cleaning and flushing of hydraulic systems	GS EP SPS 023
Subsea mechanical quarter turn actuator (manually operated gearbox)	GS EP SPS 024
Subsea hydraulic spring return quarter turn actuators	GS EP SPS 025
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Static 230Vac power supply units for on- and offshore installations	NL00-U-6S-037
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Typical cable tray details (offshore)	NL00-U-64-044
Elec. Cable colour seq. (onsh. + offsh.)	NL00-U-64-045
Protection and Instrument Earth. Det. (onsh. + offsh.)	NL00-U-64-046
Presentation of engineering and final documentation	NL00-Z-0S-002

Description	Number
Microstation Version 5.0: User Definable Attributes	NL00-Z-0S-005
Codification & Numbering of New Technical Documents for Offshore Installations	NL00-Z-0S-006
Instrumentation/piping interface standards	NL00-Z-4S-042
Actuators and control systems for hydraulically operated control valves	NL00-Z-7S-041
Actuators and control system for hydraulically operated ball valves	NL00-Z-7S-043
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
Codification of instrumentation links & equipment	NL00-Z-7S-077
Electrical/instrument interface diagram typicals for normally unmanned offshore installations	NL00-Z-71-002
Loop diagrams typicals	NL00-Z-71-003
Instrumentation - process hook-up typicals	NL00-Z-74-011
Hydraulic hook-up typicals	NL00-Z-74-021
Mounting typicals	NL00-Z-74-031
Instrument name plate detail	NL00-Z-74-055
Completion dossier guidelines	CS-3-OPE-EC-701 (EDMP-40657)
K5F MCS – K6CC SSS/PCS Interface	EDMP #59401

Any agreed deviations from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

Any clarifications from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

In case of conflict between documents the following order of priority shall be applied:

1) Local and international rules and regulations
2) Company Safety Specifications (GS EP SAF)
3) Project Specifications
4) Company Standards (NL00)
5) Company General Specifications

5.3 Codes, standards and regulations

Following codes, standards and regulations shall be considered during the design phase.

Description	Number
Design and operation of sub sea production systems	ISO 13628
Design & Operation Of Subsea Production Control Systems	ISO 13628-6
Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluids	SAE AS4059

Description	Number
EMC Directive	89/336-EEC
Process measurement control functions and instrumentation Symbolic representation	ISO 3511
Quality management and quality assurance standards - Part 3:Guidelines for the application of ISO 9001 to the development, supply and maintenance of software	ISO 9000-3

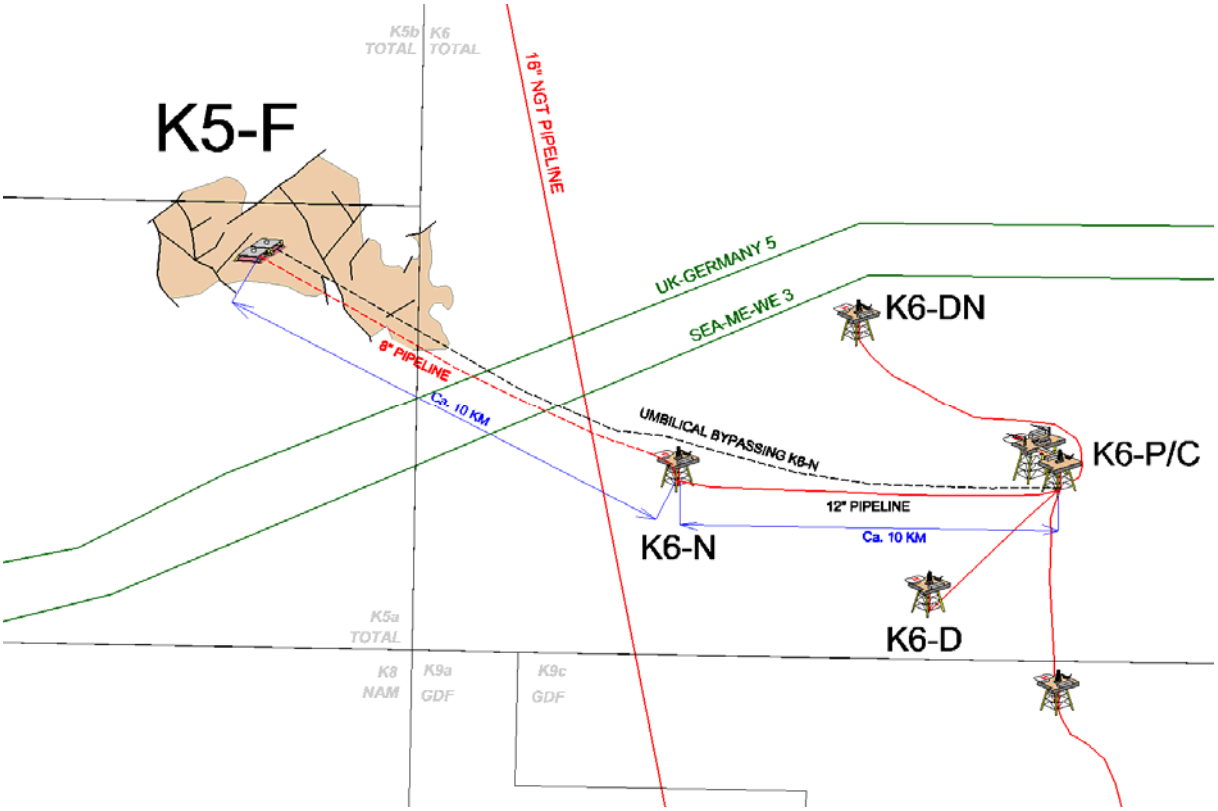
5.4 CE marking

CE marking **will** be required for the K5F project.

6 Project Overview

The K5F is a gas field located 10 km NW of the existing satellite platform K6N and 20km NW of the K6 Central Complex, all operated by TEPNL.

In the first phase, K5F will be developed with two wells. In order to be able to increase the reserves recovery in the future a third well might be connected in the future on the Subsea Protection Structure and it is also possible to connect a fourth future satellite well.



7 Design basis

The following sections are describing the systems information particularly relevant to the design of the Production Control System:

7.1 Field data

Present Number of Production Wells	Two plus two future wells
Design Life	20 years

7.2 Environmental conditions

7.2.1 Climatic data

Parameter		Data
Ambient Temperature (Outdoors)	Minimum Air Temperature	- 16°C
	Maximum Air Temperature	+ 40°C
Ambient Temperature (Indoors)	Minimum Air Temperature	-5°C
	Maximum Air Temperature	+ 40°C

7.2.2 Subsea Design Information

Parameter	Data
Water Depth	37 metres
Temperature	+4°C to +9.5°C
Seawater density	1025 kg/m³
Seawater Electrical Resistivity	0.3 OhmMeter
Wellhead Shut-in Pressure	350 barg

7.2.3 Hazardous Area Classification

The HPU and the TUTU shall be specified for hazardous area Zone 1, Gas Group IIB, Temperature Class T3, on the Platform deck.

7.2.4 Local equipment room

The platform local electrical switch room shall be used to accommodate the MCS and the ECPU cabinets. The maximum temperature during normal conditions within the LER shall be limited to 25 °C, but all of the equipment shall be able to operate as long as the room temperature does not exceed 40°C.

7.2.5 Hydraulic system pressures for the SCSSV line

The subsea production control system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
HP Hydraulics	627 barg	690 barg	1035 barg
Return Lines	< 207 barg	207 barg	N/A
Reservoir Fill Lines	<10 barg	10 barg	15 barg

NOTE: The design pressures shown above shall be used for specification of the HP hydraulic system relief valves and these shall release at the shown design pressures.

The return lines of the HPU are piped directly to the return reservoir and open to atmosphere. Pressure testing of these lines is neither necessary nor possible.

7.2.6 Chemical system pressure requirements

The chemical injection system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
Methanol Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Corrosion Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Kinetic Hydrate Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg

7.2.7 List of chemicals

The following chemicals are considered to be used for chemical injection for the K5F project:

- Methanol (MEOH)
- Corrosion Inhibitor (CI)
- Kinetic Hydrate Inhibitor (KHI)

7.3 Design life

The design life of the Subsea equipment shall be equal to the service life of the field.

The Subsea and related topside facilities shall be designed for a minimum design life of **20 years**.

7.4 Utilities

7.4.1 Platform utilities

The subsea production control system shall be designed to operate from the platform power and utilities as follows:

Electrical Supply (ECPU)	400VAC , 3 phase, 50 Hz ± 2% from UPS (floating), redundant
Electrical Supply (MCS)	230VAC 50 Hz ± 2%,from UPS (floating), redundant
Electrical supply (HPU PLC Cabinet)	230VAC 50 Hz ± 2% from UPS (floating)
Electrical supply (HPU Lighting)	230VAC 50 Hz from MCC
Electrical supply (HPU Motors)	380VAC 3ph 50 Hz, floating (3 wires) from MCC
Electrical supply (Motor heaters)	230VAC 50 Hz from MCC (if applicable)
Electrical supply (ESD solenoids)	24 V DC when healthy, 0V on ESD

7.5 Hydraulic systems

7.5.1 Sealing systems

Hydraulic couplers with primary metal seals are preferred for permanently installed Subsea equipment. Where possible, secondary, non-metallic seals should be considered as back-up for primary metal-to-metal seals. Hydraulic and chemical couplers within removable assemblies like single diver mate able hydraulic/chemical couplings shall have non-metallic primary seals and non-metallic back-up seals.

7.5.2 Hydraulic distribution

The subsea production control system high pressure (HP) hydraulic supplies shall be single from the HPU pumps. The hydraulic system shall be open utilising a water based control fluid.

7.5.3 Hydraulic fluid

The hydraulic system shall use Castrol Transaqua HT water based control fluid.

7.5.4 Fluid cleanliness

The production control system hydraulic control fluid shall be water based. All production control system hydraulic equipment shall be delivered with fluid cleanliness levels of SAE AS4059 class 6 or better. All methanol and chemical lines and equipment shall be delivered with fluid cleanliness level of SAE AS4059 class 12 or better.

Protective caps shall be provisioned for all hydraulic couplings to avoid accidental contamination. Assembly of hydraulic components shall take place in areas where the environment is controlled. The objective shall be to “assemble clean to keep clean” such that subsequent flushing operations are simplified.

Cleaning methods used for sub-assemblies shall include shop air flushing, solvent cleaning, pipe cleaning and ultrasonic bathing as appropriate. Cleaning of major assemblies shall in general be confined to flushing with control fluid of known cleanliness. As far as is practical, designs shall take due note of the subsequent flushing requirements e.g. avoiding blind holes, avoiding welding or grinding on assembled components and ensuring that systems allow turbulent flow for flushing.

All hoses and flying leads intended for chemical service (Methanol, Corrosion Inhibitor and Kinetic Hydrate Inhibitor) should be supplied filled with either control fluid or a suitable fluid compatible with the chemicals to be used.

7.5.5 Tubing

All hydraulic tubing and fittings shall be sized for efficient operation of the system with due regard to design pressures and minimising pressure drops within the system.

- For the topside equipment minimum seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the subsea equipment seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the UTA, the Methanol tubing has to be super duplex.

The tubing of the hydraulic circuits shall be accurately cut and bent using standard tube cutters and tube benders to fitting manufacturer’s recommendation. No burrs shall be allowed and each section of the tubing shall be cleaned and blown dry before assembly to ensure that no contamination is permitted to enter the control components.

All hydraulic tubing together with the associated fittings shall be capable of withstanding the application of a 1.5 times design pressure test for 15 minutes without any deformation or other damage.

7.5.6 Threaded connection systems

All threaded fittings for equipment used subsea shall withstand external ambient pressure at the design depth.

7.5.6.1 Topside equipment

For all circuits Autoclave MP Piping and fittings shall be used, except return lines where Swagelok can be used. All non Autoclave lines need to be in metric size.

7.5.6.2 Permanent subsea equipment

Ferrulok tube end reducers are to be welded to the back of hydraulic couplers, etc., where practical, rather than pipe threaded connections.

High-pressure ports requiring threaded fittings, such as valve actuator ports shall be SAE thread with 37-degree bottom taper conforming to SAE standard J514. Autoclave anti-vibration type fittings shall also be acceptable.

National Pipe Thread (NPT) fittings or any other thread seal type fitting shall **NOT** be used without specific approval from the project.

Fitting assembly torque shall be independently verified and sealed/secured to identify, that fittings have been properly made-up and inspected.

7.5.6.3 Thread sealants

Where taper threads are permitted for use, they shall be sealed using Loctite 572 fluid applied in accordance with the manufacturer's instructions. No other thread sealant shall be used. Teflon tape is **NOT** permitted for use on any equipment used with this system.

7.5.7 Welded connection systems

All couplers, whether in hydraulic or chemical services shall be butt-welded, except were otherwise specified within this document. All couplers shall be fitted with seals from identical compounds. All hydraulic or chemical service valves and fittings shall be butt welded.

- Connections shall be welded to the extent practical
- Autogenously welding shall be acceptable on 316L materials
- Liquid penetrate testing shall be performed on all tubing welds

Note: all welding has to be performed in accordance to approved Cameron welding specification.

8 Electric Systems

8.1 Terminal Type

Screw type terminals shall be used on all topside equipment.

8.2 Instrument Type

For the use in hazardous area EEx-d type instruments shall be used.

8.3 Electrical Motor Type

For the use in hazardous area EEx-d type electrical motors shall be used.

8.4 Cable entry for cabinets located in the Control Room

All cabinets located in the control room shall be designed to allow bottom cable entry only.

9 Functional Requirements

9.1 Coating & protection systems

9.1.1 Coating systems

All equipment manufactured from Carbon steels shall be protected with an approved coating system suitable for the design life of the equipment.

9.1.1.1 Subsea painting

Painting of all subsea components manufactured from Carbon steels shall be done in accordance to the approved paint specification A-020025-01

9.1.1.2 Painting of topside equipment for outside installation

Painting of all topside components located outside shall be done in accordance to the approved paint specification X-065460-04-04

- Top colour for surface equipment shall be light grey (RAL 7035).
- SST framework and parts shall normally NOT be painted, if not separately specified.

9.1.1.3 Painting of topside equipment for inside installation

Paint colour for MCS or EPU cabinet housings shall be light grey (RAL 7035).

9.1.2 Cathodic protection

9.1.2.1 General

The primary corrosion protection system for the control system Subsea equipment shall be via materials selection and suitable paint coatings.

A cathodic protection system using sacrificial anodes shall be utilised to protect the ‘bare steel’ components and to protect uncoated areas of any other control system hardware, i.e. such as those items not protected by the host equipment. Special attention shall be given to SST screws and bolts. All items to be protected shall be electrically connected using stranded, flexible SST 316 earthing braids of a suitable cross sectional area.

9.1.2.2 Calculations

Suitable CP calculations shall be carried out in accordance with the standard applicable for control system hardware i.e. not tree mounted equipment (this shall be part of the Subsea tree CP system). The CP system shall be designed to be capable of protecting the control system for the 20-year design life of the equipment.

9.1.2.3 Construction

The following principles shall be adhered when designing equipment for the subsea control system:

- All equipment metalwork shall be welded (or bolted) onto the equipment main structure to ensure any static potential build up is avoided by continuous drain to earth.
- All metallic items shall have earth continuity by physical connection i.e. metallic fastenings, clamps or earth straps. This shall include all valves, tubing, components, tubing clamps etc.

Electrical connectors may remain isolated from the structure provided suitable materials are chosen for their construction.

- When stainless steel fasteners are used in the construction of subsea structures or equipment, they shall be suitably earth bonded using earth straps. Carbon steel fasteners may alternatively be used.
- Anodes mounted on equipment sub-structures shall be manufactured from material identical and from the same batch as those fitted to the main structure.
- The anodes shall comply with the Cameron material specification MS-011310-01.
- The minimum distance from hydraulic tubing to anodes shall be 80 mm. If unavoidable it is acceptable to have a distance of less than 80 mm for some cases.
- Earthing conductors shall be of corrosion resistant material and shall be securely fastened and protected where necessary against damage and electrolytic corrosion. Where earth-bonding straps are used, conductive paste shall be smeared on contact surfaces (not threads) to ensure a lasting low resistance contact. Where the metallic composition of equipment requiring earth bonding differs from the main structure, care shall be taken in the selection of the bonding strap material to minimise possible ill effects of different contact potentials.
- Connections shall be secured using star-type shake proof washers such that they cannot work loose under vibration.

9.2 Project specific Tag Numbers

This is a list of Tag numbers to be used for K5F equipment. All units and components on this list need to be marked with these numbers as per Total Spec. NL00-Z-74-055.

Instruments	Equipment	Description	Comments
	NN-82201	TUTU	
	NN-82202	HPU	
	NN-82203	HPU PLC	
	NN-81203	MCS	
	NN-81204-1	EPCU 1	
	NN-81204-2	EPCU 2	
	NN-81204-3	EPCU 3	
	NN-81204-4	EPCU 4	
	SA-92100A	Anode Package A	
	SA-92100B	Anode Package B	
	UTA-92100	UTA	
	UTA-92101	IUTA	FUTURE
	UTA-92102	IUTA	FUTURE
	PRCM-92100.1A	PRCM A well 1	
	PRCM-92100.1B	PRCM B well 1	
	SC-92100.1A	Cathode A well 1	
	SC-92100.1B	Cathode B well 1	
	ESCM-92100.1A	ESCM A well 1	
	ESCM-92100.1B	ESCM B well 1	
	DVA-92103.1	Dump valve assembly well 1	
	DHSV-92103.1	Downhole safety valve well 1	

	PRCM-92100.2A	PRCM A well 2	
	PRCM-92100.2B	PRCM B well 2	
	SC-92100.2A	Cathode A well 2	
	SC-92100.2B	Cathode B well 2	
	ESCM-92100.2A	ESCM A well 2	
	ESCM-92100.2B	ESCM B well 2	
	DVA-92103.2	Dump valve assembly well 2	
	DHSV-92103.2	Downhole safety valve well 2	
	PRCM-92100.3A	PRCM A well 3	
	PRCM-92100.3B	PRCM B well 3	
	SC-92100.3A	Cathode A well 3	
	SC-92100.3B	Cathode B well 3	
	ESCM-92100.3A	ESCM A well 3	
	ESCM-92100.3B	ESCM B well 3	
	DVA-92103.3	Dump valve assembly well 3	
	DHSV-92103.3	Downhole safety valve well 3	
	PRCM-92100.4A	PRCM A well 4	
	PRCM-92100.4B	PRCM B well 4	
	SC-92100.4A	Cathode A well 4	
	SC-92100.4B	Cathode B well 4	
	ESCM-92100.4A	ESCM A well 4	
	ESCM-92100.4B	ESCM B well 4	
	DVA-92103.4	Dump valve assembly well 4	
	DHSV-92103.4	Downhole safety valve well 4	
	HP-92100.1	HP Jumper UTA to tree 1	
	MEOH-92100.1	MeOH Jumper UTA to tree 1	
	KHI-92100.1	KHI Jumper UTA to tree 1	
	CI-92100.1	CI Jumper UTA to tree 1	
	COAX-92100.1A	Coax Jumper UTA to PRCM A tree 1	
	COAX-92100.1B	Coax Jumper UTA to PRCM B tree 1	
	PC-92100.1A	P/C Jumper PRCM A to ESCM A tree 1	
	PC-92100.1B	P/C Jumper PRCM B to ESCM B tree 1	
	HP-92100.2	HP Jumper UTA to tree 2	
	MEOH-92100.2	MeOH Jumper UTA to tree 2	
	KHI-92100.2	KHI Jumper UTA to tree 2	
	CI-92100.2	CI Jumper UTA to tree 2	
	COAX-92100.2A	Coax Jumper UTA to PRCM A tree 2	
	COAX-92100.2B	Coax Jumper UTA to PRCM B tree 2	
	PC-92100.2A	P/C Jumper PRCM A to ESCM A tree 2	
	PC-92100.2B	P/C Jumper PRCM B to ESCM B tree 2	
	HP-92100.3	HP Jumper UTA to tree 3	FUTURE
	MEOH-92100.3	MeOH Jumper UTA to tree 3	FUTURE
	KHI-92100.3	KHI Jumper UTA to tree 3	FUTURE

	CI-92100.3	CI Jumper UTA to tree 3	FUTURE
	COAX-92100.3A	Coax Jumper UTA to PRCM A tree 3	FUTURE
	COAX-92100.3B	Coax Jumper UTA to PRCM B tree 3	FUTURE
	PC-92100.3A	P/C Jumper PRCM A to ESCM A tree 3	FUTURE
	PC-92100.3B	P/C Jumper PRCM B to ESCM B tree 3	FUTURE
PCV-92101.1		Production Choke valve well K5F-1	
PWV-92101.1		Production Wing Valve well K5F-1	
UPMV-92102.1		Upper Production Master Valve well K5F-1	
DHSV-92103.1		Down Hole Safety Valve well K5F-1	
AMV-92103.1		Annulus Master Valve well K5F-1	
BAIV-92100.1		B Annulus Isolation Valve well K5F-1	
XOV-92101.1		Crossover Valve well K5F-1	
CIV-92101.1		Chemical Injection Valve well K5F-1	
CIV-92102.1		Chemical Injection Valve well K5F-1	
CIV-92103.1		Chemical Injection Valve well K5F-1	
XEV-92103.1		HP Dump Valve (solenoid) well K5F-1	
PPU-92101.1		Production Pressure Upstream well K5F-1	
PPD-92111.1		Production Pressure Downstream well K5F-1	
APTA-92103.1		Annulus Pressure Transmitter A well K5F-1	
APTB-92105.1		Annulus Pressure transmitter B well K5F-1	
PTD-92101.1		Production Temperature Downstream well K5F-1	
PTU-92104.1		Production Temperature Upstream well K5F-1	
PT-92104.1		Downhole Pressure Transmitter	
TT-92-103.1		Downhole Temperature Transmitter	
PCV-92101.2		Production Choke valve well K5F-2	
PWV-92101.2		Production Wing Valve well K5F-2	
UPMV-92102.2		Upper Production Master Valve well K5F-2	
DHSV-92103.2		Down Hole Safety Valve well K5F-2	
AMV-92103.2		Annulus Master Valve well K5F-2	
BAIV-92100.2		B Annulus Isolation Valve well K5F-2	
XOV-92101.2		Crossover Valve well K5F-2	
CIV-92101.2		Chemical Injection Valve well K5F-2	
CIV-92102.2		Chemical Injection Valve well K5F-2	
CIV-92103.2		Chemical Injection Valve well K5F-2	
XEV-92103.2		HP Dump Valve (solenoid) well K5F-2	
PPU-92101.2		Production Pressure Upstream well K5F-2	
PPD-92111.2		Production Pressure Downstream well K5F-2	
APTA-92103.2		Annulus Pressure Transmitter A well K5F-2	
APTB-92105.2		Annulus Pressure transmitter B well K5F-2	
PTD-92101.2		Production Temperature Downstream well K5F-2	
PTU-92104.2		Production Temperature Upstream well K5F-2	
PT-92104.2		Downhole Pressure Transmitter	
TT-92103.2		Downhole Temperature Transmitter	
PCV-92101.3		Production Choke valve well K5F-3	FUTURE
PWV-92101.3		Production Wing Valve well K5F-3	FUTURE
UPMV-92102.3		Upper Production Master Valve well K5F-3	FUTURE

DHSV-92103.3		Down Hole Safety Valve well K5F-3	FUTURE
AMV-92103.3		Annulus Master Valve well K5F-3	FUTURE
BAIV-92100.3		B Annulus Isolation Valve well K5F-3	FUTURE
XOV-92101.3		Crossover Valve well K5F-3	FUTURE
CIV-92101.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92102.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92103.3		Chemical Injection Valve well K5F-3	FUTURE
XEV-92103.3		HP Dump Valve (solenoid) well K5F-3	FUTURE
PPU-92101.3		Production Pressure Upstream well K5F-3	FUTURE
PPD-92111.3		Production Pressure Downstream well K5F-3	FUTURE
APTA-92103.3		Annulus Pressure Transmitter A well K5F-3	FUTURE
APTB-92105.3		Annulus Pressure transmitter B well K5F-3	FUTURE
PTD-92101.3		Production Temperature Downstream well K5F-3	FUTURE
PTU-92104.3		Production Temperature Upstream well K5F-3	FUTURE
PT-92104.3		Downhole Pressure Transmitter	FUTURE
TT-92103.3		Downhole Temperature Transmitter	FUTURE
PCV-92101.4		Production Choke valve well K5F-4	FUTURE
PWV-92101.4		Production Wing Valve well K5F-4	FUTURE
UPMV-92102.4		Upper Production Master Valve well K5F-4	FUTURE
DHSV-92103.4		Down Hole Safety Valve well K5F-4	FUTURE
AMV-92103.4		Annulus Master Valve well K5F-4	FUTURE
BAIV-92100.4		B Annulus Isolation Valve well K5F-4	FUTURE
XOV-92101.4		Crossover Valve well K5F-4	FUTURE
CIV-92101.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92102.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92103.4		Chemical Injection Valve well K5F-4	FUTURE
XEV-92103.4		HP Dump Valve (solenoid) well K5F-4	FUTURE
PPU-92101.4		Production Pressure Upstream well K5F-4	FUTURE
PPD-92111.4		Production Pressure Downstream well K5F-4	FUTURE
APTA-92103.4		Annulus Pressure Transmitter A well K5F-4	FUTURE
APTB-92105.4		Annulus Pressure transmitter B well K5F-4	FUTURE
PTD-92101.4		Production Temperature Downstream well K5F-4	FUTURE
PTU-92104.4		Production Temperature Upstream well K5F-4	FUTURE
PT-92104.4		Downhole Pressure Transmitter	FUTURE
TT-92103.4		Downhole Temperature Transmitter	FUTURE

9.3 Special Requirements

All warning and emergency signs need to be English **and** Dutch language as per NL00-U-6S-061.

10 Equipment Requirement Specification

10.1 Master Control Station (MCS)

The redundant MCS will be the communication interface between the ICSS and the K5F electrical Subsea Control Modules (ESCM). The MCS will be located in the electrical switch room of the K6P Platform (safe area) and will be powered from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-01 Supplemental Requirements Specification for MCS Hardware

X-076721-87-02 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Control and Management

X-076721-87-03 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Process Interlocks and Shutdowns

X-076721-87-12 Supplemental Requirements Specification for MCS/ICSS Control Interface

10.2 Electrical Power and Control Unit (EPCU)

The EPCU is a redundant electrical power and communication unit for high voltage DC power supply and communication to the subsea installed ESCM's. The EPCU will be located in the electrical switch room of the K6P Platform (safe area) and will receive separate power supply for channel A and B from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-04 Supplemental Requirements Specification for EPCU

10.3 Hydraulic Power Unit (HPU)

A dedicated Hydraulic Power Unit (HPU) will be installed on the K6C platform to provide clean hydraulic HP power for the control of the K5F Downhole Safety Valves (DHSV). The HPU will be controlled from a remote PLC located in a safe area and will be monitored by the MCS/ICSS.

Design Pressure = 690 bar

Hydraulic Fluid = Castrol Transaqua HT

Refer to the following documents for detailed technical requirements:

X-076721-87-05 Supplemental Requirements Specification for HPU

10.4 Topside Umbilical Termination Unit (TUTU)

The Topside Umbilical Termination Unit (TUTU) shall terminate the main electro/hydraulic/chemical umbilical lines and provide the interface to the K6C platform equipment. It will only provide a hardware interface without any block/bleed-valves and/or Pressure gauges for testing or maintenance work. All tubing and couplers need to be supplied by others. The electrical cables shall be terminated in separately mounted explosion proof Junction Boxes or with moulded splice connections.

Refer to the following documents for detailed technical requirements:

X-076721-87-06 Supplemental Requirements Specification for TUTU

10.5 Umbilical Termination Assembly (UTA)

The Umbilical Termination Assembly (UTA) shall be a robust construction to provide interfaces with the umbilical and shall allow to suitably terminating all functions. The UTA shall be setup for the hydraulic connection of the two trees currently in the scope of supply and the two future trees.

Refer to the following documents for detailed technical requirements:

X-076721-87-07 Supplemental Requirements Specification for UTA

10.6 Power Regulation and Control Module (PRCM)

The Power Regulation and Communication Module (PRCM) regulate the power to the ESCM and provide communication to the ESCM. It also provides the connection to the external cathode package.

The PRCM shall be diver recoverable by using a special change out tool and shall be connected to a mounting base.

10.7 Electric Subsea Control Module (eSCM)

The eSCM controls various electric actuators on the tree/wellhead and acquires data from the subsea instrumentation for the transmission to the surface.

The following functions need to be controlled by the eSCM:

No.	Function	Actuator Size	Location	Note
1	CIV 1	¾”	Tree	
2	CIV 2	¾”	Tree	
3	CIV 3	¾”	Tree	
4	BAIV	¾”	Wellhead	
5	AMV	2”	Wellhead	
6	XOV 1	2”	Tree	
7	UPMV	5”	Tree	
8	PWV	5”	Tree	
9	PCV	N/A	Tree	
10	SCSSV Open	N/A	Tree	
11	SCSSV Close	N/A	Tree	

The following tree sensors need to be monitored by the eSCM:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

10.8 Anode Package / Anode Package Foundation Base

There are two separate Anode Packages for the A and the B channel of the system. The Anode Package shall be a robust frame construction for two separate and diver retrievable Anodes. The Anode package requires two separate electrical connectors for each anode for the connection via a flying lead to the anode umbilical assembly. The Anode Packages need to be clearly marked with “A” and “B”. The painted steel frame is protected by FRP grating on all four sides and on top to prevent damages caused by dropped objects. The two anode packages for the channels A and B will be placed on a further support frame to minimize the required installation effort. Both Anode Packages will be located on a Foundation Base.

10.9 Cathode Package

There are four separate Cathode Packages for the A and B channel of each tree. The Cathode Packages will be connected to the respective PRCM on the Subsea Protection Structure via an electrical flying lead. The Cathode Packages are diver installable and will be hooked into the outside plates of the Subsea Protection Structure. The Cathode Package contains the cathode itself and a frame with FRP grating on top to provide mechanical protection.

10.10 Anode Umbilical Assembly

The complete Anode Umbilical Assembly includes the following items:

- an approx. 100m long umbilical with an overall armour and four separate armoured 2,5mm² cores
- a pulling head assembly with 100mm diameter
- a hang-off assembly
- bend restrictor assembly at the Subsea end of the umbilical incl. clamping surface to fix the umbilical
- 4 pigtails, each 6m long, at the end of the umbilical

10.11 Electrical Flying Leads

The electrical flying leads shall comprise a cable moulded to the subsea connectors at both ends. The colour of these cables shall be black with a marking by means of approx. 30cm long heat shrinks at both ends. System A will be marked “blue” and System B “yellow”. These flying leads shall be designed for diver make up only.

10.12 Tree/Wellhead Pressure and Temperature Sensors

The following Pressure and Temperature Sensors are located on the Tree and the Wellhead:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

These sensors shall meet the following requirements:

- Field proven design
- The sensors shall be suitable for the intended subsea service
- Redundant with separate interconnection cables for the A and B channel
- Diver retrievable sensors
- With block-bleed-block assemblies on the pressure sensors
- Minimum accuracy of:
    - +/- 0.03% x full scale accuracy and a drift of 0.2%/year for the pressure sensors
    - +/- 0.3°C accuracy and a drift of 0.2°C/year for the temperature sensors

10.13 SCSSV Dump Valve Assembly

A 3/2 way valve shall be located on the tree for the operation of the SCSSV. The operation of this valve will be direct hydraulic by use of Transaqua HT fluid from a dedicated HPU through a single HP supply line in the main umbilical. The valve shall be designed for the design pressure of the SCSSV system and shall be activated by the ESCM. This assembly will consist of a fixed plate which will be located on the tree and a free plate with the dump valve on which is diver retrievable. Both plates will be connected via quick couplers without the use of poppets. The tree tubing will be connected to the fixed plate by using Autoclave anti-vibration couplers.

11 Quality requirements

A Quality Plan to be used for the project shall be created. For the Project Quality Specification see section 5.1 of this document.

11.1 CE Marking

The topside hardware and software is to be supplied with a CE declaration of conformity, which confirms compliance with all relevant directives.

12 Handling/Installation/Intervention & Shipping

Project shall provide detailed installation and intervention recommendations, and step-by-step project specific procedures, for review as part of the project-engineering phase.

All separately installable and retrievable items shall be provided with suitable lifting points and be generally designed to allow a smooth, simple and quick installation/retrieval process to be performed by divers. This shall include the following items:

- Electric Subsea Control Module (eSCM)
- Power Regulation & Communication Module (PRCM)
- Electrical flying leads between
  - Tree/Wellhead located junction boxes and sensors
  - UTA and PRCM
  - PRCM and ESCM
  - PRCM and Cathode Package

  Tree and Wellhead Pressure and Temperature Sensors
- SCSSV Dump Valve Assembly
- Anode Umbilical Assembly

All subsea assemblies shall be designed to withstand an abandonment period of 6 month sub sea, located where required but not connected to its services (hydraulic, chemical, electrical, ..)

12.1 Use of guidelines

All Subsea equipment (trees, choke inserts, jumpers, control modules, etc.) shall be designed for installation and retrieval by divers with the use of guidelines.

12.2 Lifting / Handling

All equipment shall be designed for safe handling and transportation, both onshore and offshore. All lifting points on all equipment handled offshore shall be:

- Physically load tested to rated weight
- Designed for loads as defined in API 17D and API RP 17G.
- Any welding and associated NDE, which is required for lifting apparatus shall be in compliance with API 17D and API RP 17G.
- All lifting points on all equipment, both purchased and rented; to be handled offshore shall be tested and labelled in accordance with API 17D and API RP 17G.
- All shipped equipment assemblies shall be labelled with their weight.
- Slings and rigging shall be provided for items that require lifting.

12.3 Connection of flying leads

The Subsea hydraulic and electrical flying leads shall be designed to be installed by the use of divers.

Following installation of the Xmas tree, the diver (after removing the LTC from the remote stab or connector) shall pick up the remote end connection and install it to the UTA or Wellhead.

The process shall be similar for the electrical connector.

For recovery the procedure shall be reversed.

12.4 ROV Interfaces

All ROV and diver interfaces shall be designed in accordance with ISO 13628-8.

12.5 ROV Marking of Subsea Stations

Marking of subsea station shall be in accordance with ISO 13628-1 and the following requirements:

- Letter size shall be 50mm

13 Testing

Each item of deliverable equipment shall be tested in accordance with a project approved and CAMERON supplied acceptance test procedure to verify the following as a minimum:

- Functionality
- Internal pressure testing
- External pressure testing
- Control fluid cleanliness to SAE AS4059

CAMERON shall provide written step-by-step procedures for these tests to be provided to COMPANY.

A Control System Integration Test shall be performed in accordance with a COMPANY approved procedure to demonstrate that all of the individual items of equipment function correctly as a system.

The testing programme for the Subsea Production Control System shall be undertaken in the stages detailed as follows:

- Factory Acceptance Test for single units (FAT's)
- System Factory Integration Testing (FIT)
- Tree EFAT
- System Integration Testing (SIT)
- Platform Commissioning
- Offshore Pre-submergence Testing/Deck Testing
- System Commissioning

13.1 Factory Acceptance Test (FAT)

Each deliverable item shall be subjected to a Factory Acceptance Test (FAT). The purpose of this FAT shall be to demonstrate the item is suitable for the intended purpose and functions correctly. FAT tests shall include hydrostatic proof pressure testing to 1.5 times the design pressure of the Subsea control system.

All FAT procedures shall be step-by-step and submitted for review and approval prior to testing commencing.

All critical equipment components shall be subjected to sub-assembly tests during the assembly phase of manufacture and to carry out these tests, the necessary equipment and fittings are specialised in-house equipment and are not project deliverable.

Each item of equipment shall be subject to an in-house FAT in accordance to an approved standard procedure document to demonstrate these meet the specified operational and functional requirements.

The tests shall include interface connections and mechanical alignment tests to verify design and manufacturing limit tolerance effects, component inter-changeability, together with hydraulic fluid system flushing and / or cleanliness checks as necessary to ensure the system meets SAE AS4059. The hydraulic tubing and piping pressure lines shall be hydrostatic pressure tested to 1,5 times the design pressure.

The test equipment shall be determined by the proposed testing programme, however in the event of additional testing or if testing in other locations is required, the quantity of test equipment detailed shall be subject to review.

Testing of fabricated items shall also include continuity testing of bolting.

Testing on subsea assemblies shall include continuity testing and earthing testing.

The maximum value for the resistance measured shall be 0.1 Ohm.

13.1.1 Environmental Stress Screening (ESS)

Modules or subassemblies containing electrical equipment and/or electronic equipment, which are intended for permanent subsea installation shall comply with section 4 of the Total specification GS EP SPS 022 “Environmental testing of Subsea Electronics”.

13.2 Factory Integration Test (FIT)

A System Factory Integration Test (FIT) shall be conducted to verify the correct interfacing and inter-working of all items of the subsea production control system equipment. External interfaces, for example Xmas tree valves & sensors, umbilical cables, DCS, MCC & ESD systems etc. shall be simulated for the purpose of the test. The testing shall be designed to verify the functional and operational integrity of the subsea production control system.

13.3 Xmas Tree/SCM system integration test (Tree eFAT)

A Xmas Tree/SCM System Integration Test shall be conducted for the Xmas tree, following completion of the Xmas tree FAT within the factory.

14 Special packing/shipping procedures/Instructions

For deliverables consisting of a main assembly with additional loose items (Lifting Slings, Test Hoses/Cables, Fill Lance, Pre-Charge Kit, Fluid in Barrels etc.), separate packing/shipping procedures/instructions with included component check-lists shall be provided.

The same shall apply for deliverables that can not be shipped as complete units, as transportation could result in damage of internal components.

These procedures/instructions should be part of the BOM from the related parts.

For all units which include any fluids or substances, COSHH sheets (Control of Substances Hazardous to Health) shall be delivered with the unit. These COSHH sheets shall be available early in the process for supply to the client.

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

07AUG07	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
10APR07	Issued for Client Comment	A. Weilandt	S. Horne	
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Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirements Specification for TUTU**		
PAGE 1 OF 10	**Customer Document Number:**	54NL92-W-0S-512	REV. 1
	Cameron Document No.	X-076721-87-06	REV. 01

1 INTRODUCTION

This document is written to consolidate the technical requirements for the Topside Umbilical Termination Unit (TUTU) intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

2 SCOPE OF THIS DOCUMENT

The scope of this document is to define the technical requirements for the Topside Umbilical Termination Unit intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

3 Document revision status / record

Table 3-1 – Amendments

Date	Rev.	Description	Author
01DEC06	A	Initial Release	Alex Weilandt
10APR07	B	- new front sheet added - updated as per internal IDC comments	Alex Weilandt
07AUG07	01	- Updated to “Approved for Construction”	Alex Weilandt

4 ABBREVIATIONS & DEFINITIONS

For abbreviations and definitions used within the Total K5F Project see related documents referenced within section 5.1 of this document.

Abbreviations and Acronyms that are specific to this document alone, for readability purposes are listed in this section:

Table 4-1 – Abbreviation/Acronym

Abbreviation/Acronym	Description
AVL	Approved Vendor List
CI	Corrosion Inhibitor
CoP	Comms on Power
DP	Design Pressure
FAT	Factory Acceptance Test
HP	High Pressure
HPU	Hydraulic Power Unit
KHI	Kinetic Hydrate Inhibitor
MEOH	Methanol
MOP	Maximum Operation Pressure
SCSSV	Surface Controlled Sub-Surface Safety Valve
SST	Stainless Steel
TBD	To be determined
TUTU	Topside Umbilical Termination Unit

5 References

5.1 Cameron Reference Documents

This section defines the supporting Cameron documents to be used for evaluations against overall project requirements.

Table 5-1 – Cameron Reference Documents

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

5.2 Customer Reference Documents

This section defines the supporting customer documents to be used for evaluations against overall project requirements.

Table 5-2 – Customer Reference Documents

Description	Number
Total “Design basis for K5F project”	EDMP #32611
External protection of offshore and coastal structures/equipment by painting	GS EP COR 350
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Electrical cables	GS EP ELE 161
Cable trays/ladders	GS EP ELE 311
Subsea production control system	GS EP SPS 019
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Typical earthing details	NL00-U-64-042
Typical cable tray details (offshore)	NL00-U-64-044

5.3 Industry Reference Documents

This section defines supporting industry and regulatory documents to be used for evaluations against overall project requirements.

Table 5-3 – Industry Reference Documents

Number	Description
API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platform
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment
ANSI/AWS D1.1	Structural Steel Welding Code
ANSI/AWS D1.6	Structural Welding Code – Stainless Steel
PED/97/23EC	Manufacturing and Certifcation of Accumulators
IEC-60529	Classification of Degrees of Electrical Protection provided by Enclosures
IEC – 92	Section 9.0 “Electrical Installations in Ships”
IEC – 60079 (EN 50014)	Section 9.0 “Electrical Apparatus for Explosive Gas Atmosphere”
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements
SAE AS4059	Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluid

6 Scope of Supply

The scope of supply for the TUTU shall consist of the following:

6.1 Permanently installed TUTU Equipment

The scope for the permanently installed TUTU equipment shall consist of the following main items:

- TUTU Frame
- Cable Mouldings for High Voltage and Return Cables

6.2 Deliverable Documentation

The deliverable documentation for the TUTU shall consist of the following as a minimum:

6.2.1 Engineering Documentation Requirements

The scope of supply for engineering documentations for the TUTU shall consists of the following as a **minimum** for approval:

- TUTU Interface Data Sheet
- TUTU Assembly Drawing
- TUTU Field Termination Drawing
- TUTU Factory Acceptance Test Procedure
- Special Packing/Shipping Instructions

6.2.2 Installation, Operation and Maintenance Documentation Requirements

The scope of supply for installation, operation and maintenance documentations for the TUTU shall consist of the following as a **minimum** for approval:

- TUTU Installation Procedure

7 Topside umbilical Termination Unit Specifications

7.1 Equipment Design Requirements

Feature	Static Design Requirement	Performance Requirements	Additional Description
Operating Environment	Offshore, salt spray, IP56 protection		
Maximum (not to exceed) Dimensions	810 mm (Width) 1400 mm (Height) 150 mm (Depth)		The electrical junction boxes will be mounted on the back of this frame.
Service Access	750 mm (Front) 300 mm (Rear) 150 mm (Left) 150 mm (Right) 1000 mm (Top)		
Area Classification	Zone 1, Gas Group IIB, Temperature Class T3	N/A	
Service Life	20 years		
HP Design Pressure	690 barg	N/A	
Chemical Design Pressure	450 barg	N/A	
HP Control Fluid	Castrol Transaqua HT or HT2	N/A	
Construction	All frame plate material to be SST 316		
Moulded connections	as per manufacturer instructions for umbilical connection	A separate moulded connection for each high voltage tree supply (1A, 1B, 2A, 2B) cable and the four return cables from the Anode Umbilical => 8 connections in total	These connections need to have a mechanical protection
Hydraulic Tubing	N/A		All hydraulic tubing will be supplied by others
Hydraulic Fitting	Autoclave fittings shall be used on all lines		All hydraulic fittings will be supplied by others

Feature	Static Design Requirement	Performance Requirements	Additional Description
Tube clamps	As per DIN 3015 T1/T2	Material: PP and SST316 clamp surface need to be closed to avoid water ingress	Stauff clamps to be used.
Local Control Panel	There is no control panel. The TUTU does not contain any control facilities (gauges, valves, …)		
Nameplates	To be attached with a min. of two (2) 316 SST screws.		
Tagging (Drawing/ equipment)	Refer to General Design Basis		
Lifting/ Handling	2-point lifting pad eyes		
Marking	- TUTU Equipment Tag - Company Name - Contract/Purchase Order Number - Weight (Gross / Net) - Cameron PN - Unique Serial Number - Supplier PN	All marking shall be manufactured in such a manner to ensure legibility throughout design life.	All shipped items shall be marked with this info as a minimum.
Misc.	- If dissimilar metals are used on this unit, then isolation material shall be placed between these materials. - All written instructions, specification and warning notices or plates shall be in English and Dutch.		It shall be not intended that any element of the TUTU will come into contact with hydrocarbons (produced fluids)

7.2 Interface Requirements

7.2.1 Electrical Interface Requirements

Electrical interfaces shall be finally detailed during the detail engineering phase.

Table 7-1 – Electrical Interface Requirements

Description	Voltage	Interface to	Note
CoP Tree 1A	3 kV DC	EPCU 1A	Molded Coax-Cable
CoP Tree 1A	3 kV DC	Umbilical	Molded Coax-Cable
CoP Tree 1B	3 kV DC	EPCU 1B	Molded Coax-Cable
CoP Tree 1B	3 kV DC	Umbilical	Molded Coax-Cable
CoP Tree 2A	3 kV DC	EPCU 2A	Molded Coax-Cable
CoP Tree 2A	3 kV DC	Umbilical	Molded Coax-Cable
CoP Tree 2B	3 kV DC	EPCU 2B	Molded Coax-Cable
CoP Tree 2B	3 kV DC	Umbilical	Molded Coax-Cable
Return Line System 1A	230V DC	EPCU 1A	Molded cable
Return Line System 1A	230V DC	Anode umbilical cable	Molded cable
Return Line System 1B	230V DC	EPCU 1B	Molded cable
Return Line System 1B	230V DC	Anode umbilical cable	Molded cable
Return Line System 2A	230V DC	EPCU 2A	Molded cable
Return Line System 2A	230V DC	Anode umbilical cable	Molded cable
Return Line System 2B	230V DC	EPCU 2B	Molded cable
Return Line System 2B	230V DC	Anode umbilical cable	Molded cable

7.2.2 Hydraulic Interface Requirements

Hydraulic interfaces shall be finally detailed during the detail engineering phase.

Table 7-2 – Hydraulic Interface Requirements

Interface on TUTU	Quantity	Size	Note
MEOH	1	19,05 mm ID	Line 1
KHI A	1	12,7 mm ID	Line 2
KHI B	1	12,7 mm ID	Line 3
CI A	1	12,7 mm ID	Line 4
CI B	1	12,7 mm ID	Line 5

Interface on TUTU	Quantity	Size	Note
HP	1	6,3mm ID	Line 6
Spare	1	12,7 mm ID	Line 7

7.3 Specific Electric Cabling, Junction Boxes and Earthing Requirements

Cables shall also be connected by using an epoxy or compound filled joint if this joint is not subject to mechanical stress. These joints need to be done in accordance to manufacturer's instructions and need to be installed in that way that a suitable mechanical protection is provided.

A minimum of two earthing bosses shall be provided on the TUTU frame to allow earth bonding to the platform.

7.4 TUTU FAT Test Procedure

The TUTU shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- Visual Inspection (incl. check of hose and cable supports to verify that any loose parts can be installed on the TUTU.
- Weight control
- Final inspection

8 Hold Points

GENERAL PRESERVATION & STORAGE PROCEDURE

FOR

CAMERON CONTROLS EQUIPMENT

07	12. March 2008	J. Grochowski	K. Yahosseini	J. Grochowski
06	14. March 2007	J. Grochowski	B. Müller	J. Grochowski
05	12. May 2006	J. Grochowski	F. Duensing	J. Grochowski
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03	6. January 2005	J. Grochowski	A. Kamp	T. Loi
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Document Revision Status / Record

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05	12. May 06	TUTA requirements included	Required by project
06	14. Mar 07	Umbilical poppet requirement included	Required by project
07	12. Mar 08	Comments included	Required by project

Table of contents

1 Introduction

This document outlines the procedure for preservation and storage of a control system before and after use. This includes Production Control Systems, Workover Control Systems and Drilling Control Systems. The purpose of this procedure is to keep the equipment supplied by Cameron Celle in a proper shape during storage. It will be available for further operations without major refurbishment due to insufficient control during storage.

This document provides instructions to ensure preservation and protection of all typical control system equipment in order to prevent deterioration caused by corrosion, damage, influence of weather and foreign materials, during shipment, storage and installation.

2 Reference Procedures

X-065460-( )-( )	Protective Coating Procedure for Cameron Controls Equipment
X-065390-03	General Protection and Coating Procedure for Cameron Celle Controls Equipment
X-065390-03-00-01	Protection and Coating Procedure for Cameron Celle Controls Equipment
X-027055-01	Corrosion Inhibiting Coating of Machined Surfaces

3 General Storage Requirements for Environment

Before starting any activities for preservation & storage all functions need to be verified. It must be checked that maintenance and repair works have been performed by qualified service personnel and that the control system does not have any mechanical damages on framework, umbilicals, hoses and cables.

Clean and dry the equipment prior to storage and place it under cover (if available) in a clean and dry environment.

For outdoor storage use tarpaulin covers. Ensure that covers are correctly attached and check covers for any damage. Replace damaged covers.

Preferred ambient conditions for storage areas[*)]

Temperature range	:	0 to 40°C
Humidity range	:	0 to 50 % (excluding condensation and frost)

[*)] If above values are not available, humidity and temperature must be within project related specified range.

In areas with high ambient temperatures consider protection against UV light / direct sunlight to protect e.g. plastic materials or compensation systems (thermal expansion).

Atmosphere must be free from harmful substances which can effect resilient seals (e.g. high ozone level).

Store equipment and spare parts with sealing surface protection by protective devices and protect after inspection if necessary.

Consider special storage procedures for critical materials like hydraulic fluid, batteries, rubber goods etc.

Handling and transport of equipment must always be in accordance with the conform procedure, shown in the Operation and Maintenance Manual for the control system.

4 Cameron Controls Standard Hydraulic Control Fluids

This section outlines the Cameron Celle Controls standard hydraulic control fluids. If any other fluid is specified the appropriate data sheet must be considered for preparation and storage of the system.

4.1 Hydraulic Oils

The standard oil types for Cameron Celle Controls equipment are:

- SHELL TELLUS (different types)
- CASTROL BRAYCO MICRONIC 864

Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

Note: Further details for treatment of fluid before and during storage for the specific equipment are listed in section 5.

4.2 Water Based Fluid

The typical water based fluid types for Cameron Celle Controls equipment are delivered by **Mac Dermid CANNING (MARSTON BENTLEY) LTD.**:

- Oceanic HW 511
- Oceanic HW 525
- Oceanic HW 540
- Oceanic HW 443
- Oceanic HD 603 Water/Glycol with lubricant

A typical water based fluid supplied by **CASTROL**:

- TRANSAQUA HT or HT2

A typical water based fluid supplied by **CAMERON**:

- CAMERON 590 X Water / Glycol with lubricant

Note: Further details for treatment of water based fluid before and during storage are listed in the following table.

Water Based Fluid	Suitable Storage Fluid (>6 months)	Suitable Storage Fluid (>1 year)	Suitable Storage Fluid (>2 years)
Mac Dermid CANNING OCEANIC HW 525 Cameron PN 619011-36 OCEANIC HW 540 Cameron PN 619011-28 OCEANIC HW 443 Cameron PN 619011-41	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285
Mac Dermid CANNING Water based fluid with ERIFON HD 603 Cameron PN 619011-46 (Lubricant)	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285
	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	Composition Lubricant/Glycol/Water: 5 % Lubricant: PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	
CASTROL TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	TRANSAQUA HT Cameron PN 619011-53
CASTROL TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	TRANSAQUA HT2 Cameron PN 619011-84
CAMERON Fluid Cameron 590 X Cameron PN 619011-24 (Lubricant)	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 40 % Glycol PN 619011-10 55 % Demineralized Water	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285

5 Specific Equipment Preservation and Maintenance Requirements

Note: Preservation during storage shall be performed in accordance with the check lists shown in section 6.
Any damage occurring during the periodical checks must immediately be repaired and reported to the Maintenance Supervisor.

5.1 Instruments for Surface Containers and Frames

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

All moving parts are to be lubricated with Molycote 3402 or equivalent.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

5.2 Hydraulic Power Unit and Local Control Panel

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines, including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen precharge of each hydraulic accumulator down to 10 bar / 145 psi. This is for safety reasons and to keep e.g. bladder in a stable position.

Air accumulators must be vented and drained of water.

Open ends of piping must be sealed off by plugs or caps.

All moving parts including the push rod of the panel valves must be protected by Molycote 3402 or equivalent.

Operation panels must be protected by a protective cover or door.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anti-condensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect ventilation grills / air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof local control panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

All isolation valves (except drain valves) must be closed. 4/3-way panel valves must be moved to "CENTER" position. 3/2-way panel valves must be in "CLOSE" or "VENT" position.

5.2.1 Hydraulic Oil

For long term storage no fluid exchange is required to get conservation against corrosion if equipment is filled with clean hydraulic oil.

After usage or longer storage (>3 months) hydraulic reservoirs must be checked for cleanliness and water content. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

Note: Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

If the water content of the oil is too high, check the hydraulic fluid for bacterial contamination. Clean the system up if necessary by following instructions of supplier.

Hydraulic lines have to be flushed to customer required cleanliness level.

Note: Cleaning of the hydraulic lines of an empty system must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

5.2.2 Water Based Fluid

General

For long term storage (>6 months) a special fluid preparation is required to get conservation against corrosion of equipment.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Reservoirs must be checked for cleanliness.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluid should be within the system during long term storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions. The table in section 4.2 shows different possibilities for long term (>6 months) storage.

5.3 Remote Control Panel

Painting, frame and moving parts must be checked in accordance with section 5.1.

5.3.1 Electric Remote Control Panel

Cable connections are to be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Operation panel must be protected by a protective cover or door if available.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

Rack mounted equipment shipped separately from cabinets should be bagged with desiccant and tagged with shock fuses.

5.3.1.1 Control Panel for climatic controlled environment

Control panel for use in climatic controlled environment e.g. Master Control Station (MCS), Electric Power Unit (EPU), Remote Workstations etc.

Equipment should be stored in a warehouse in undamaged packaging under the following conditions excluding intensive dust and condensation of humidity.

Temperature -18 - +60°C

Humidity 20-90% RHNC

When packaging has to be opened e.g. for site receive tests it is recommended to use corrosion inhibitors (e.g. Cortec®VCI 110) for further preservation.

5.3.2 Pneumatic Remote Control Panel

Pneumatic connections are to be cleaned up and protected by non aggressive protective shield, protection against dust or mating protective cover if available. Check pneumatic jumper cable as well.

Air receivers must be vented and drained of water.

Operation panel front must be protected by a protective cover or door.

Acryl glass window panes on panels located in hazardous areas must be cleaned with wet cloth only due to electrostatic charge.

5.4 Hydraulic Umbilicals, Umbilical Jumpers & Steel Flying Leads

General Instructions

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the applicable hydraulic fluid.

All hydraulic connections must be cleaned from dirt by using cleaning solvents which do not harm the seals (see Operation and Maintenance Procedure).

The connection plate of the junction boxes must be protected by protective covers.

After cleaning mating protective caps or plugs must be mounted to the quick coupling or single connection.

Stainless steel junction boxes and plates must be covered with a thin film of non aggressive oil.

Painting, frame and moving parts must be checked in accordance with section 5.1.

The umbilical can be stored in a box or on a drum. The minimum bending radius for storage indicated by supplier may not be exceeded.

5.4.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The umbilical shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.4.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

All lines with poppets must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids and compositions (see table in section 4.2).

5.5 Electric Cables and Cable Jumpers

Contacts of electrical connectors must be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Check that cable minimum bending radius is kept for storage.

Cable materials have to be protected for storage to avoid mechanical impact and ageing impact caused by sunlight (UV).

5.6 Umbilical Reels

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cleaned piping must be sealed off by using protective plugs, caps or covers.

Parts for power transmission like gear, chain with sprockets etc. must be protected and lubricated.

Open gear drive with gear ring and cog	-	ANTI SEIZE (or equivalent)
Chain drive	-	ESSO CAZAR K2 (or equivalent)
Gear box for direct drive	-	See Operation and Maintenance Manual of gear box for specific oil type.

5.7 Uninterruptable Power Supply (UPS)

WARNING:

Hydrogen may discharge from batteries and cause explosion (depending from battery type). Sufficient ventilation is required.

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cable connections must be protected with non aggressive protective shield.

For storage of the UPS check the allowed temperature range in Operation and Maintenance Manual to avoid damage of sensitive parts like batteries etc.

Recharge batteries to full range. Deep discharge must be avoided.

Follow specific long term storage procedure for installed type of batteries.

Disconnection of batteries may be required.

Ensure that the UPS is tagged with a shock fuse indicator.

5.8 Subsea Valve Packages

Remark: Subsea valve packages are normally mounted to the subsea running tools (e.g. Lower Marine Riser Package), which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.8.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.8.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.9 Subsea Control Modules (direct / pilot hydraulic types)

Remark: This section is **not** to be applied for CAMTROL subsea control modules. Refer to the "CAMTROL Subsea Production Control Equipment" section.
Subsea Control Modules (SCM) are normally mounted to the subsea running tools which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool. Flushing and testing can be done with the appropriate flushing and testing unit.

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Hydraulic pressure from all lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

If applicable, cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

5.9.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.9.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.10 Hydraulic Flushing and Testing Units

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

Air receivers must be vented and drained of water.

Open connection ends must be sealed off by plugs or caps.

All moving parts must be protected by Molycote 3402 or equivalent.

Junction plates must be protected by an overall cover or individual caps and plugs.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anticondensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

5.10.1 Hydraulic Oil

Reservoirs must be checked for cleanliness and water content. Water content of hydraulic oil must be checked to be within the maximum allowed range. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.10.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.11 Running Tools for Subsea Modules

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines must be discharged.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Hydraulic lines are to be flushed to customer required cleanliness level.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.12 Hydraulic Cylinder (e.g. on SCM Test Stand)

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

Hydraulic cylinders are to be flushed to customer required cleanliness level. Ensure that the cavities are completely filled with hydraulic control fluid. Ensure that no air is left in the cylinders as remaining air might cause corrosion.

Painting must be checked in accordance with section 5.1.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Put piston of the cylinder in retract position. This ensures that the rod is protected inside the cylinder against corrosion or damage.

Grease the cylinder rod with silicon grease or equivalent non aggressive grease.

Store the cylinder in a dry indoor environment. Room temperature should not be below 37°F (3°C).

5.13 Float Type Accumulators

Note: Preservation has to be carried out when the float type accumulators are unused and storage will be longer than three (3) months.

<u>Disassembly of Accumulator</u>

Bleed the pressure from hydraulic fluid supply.

Ensure that the ¼" needle valve at the bottom of the accumulator is in the closed position.

Remove the ¼" NPT plug.

Open the ¼" needle valve at the bottom of the accumulator.

Ensure that the accumulator is depressurised.

Open the hammer union at the bottom of the accumulator.

Ensure that the floater is at the lower end of the accumulator.

Remove the plug at the end of the floater pipe.

Inspect the seals (floater pipe plug, hammer union).

Spray non aggressive anticorrosive lubricant into the accumulator to protect the inner surface of the accumulator.

Carefully move the accumulator in vertical position and ensure that the lubricant flows out of the accumulator.

Assembly of Accumulator

Grease the o-ring of the plug and fix the plug at the lower end of the floater pipe.

Grease the thread at the end of the accumulator bottle and connect the hammer union.

Close the ¼" needle valve at the bottom of the accumulator and install the ¼" plug.

Painting must be checked in accordance with section 5.1.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.14 Topside Umbilical Termination Unit / Assembly

Topside Umbilical Termination Units / Assemblies (TUTU / TUTA) will be treated like Hydraulic Power Units (HPU). The workload is reduced as the TUTU / TUTA does not contain motors, pumps and reservoirs.

5.15 Wire Rope

Grease the wire ropes with wire rope grease. Ommex or Kendal or equivalent wire rope grease can be used.

Store the wire ropes in a dry outdoor or indoor environment.

5.16 Load Cell

Protect the load cells by a thin film of non aggressive oil.

Store the load cells in a dry indoor environment. Room temperature should not be below 37°F (3°C).

6 Preservation Maintenance Check Lists

The following checklists must be used to get a controlled storage of the equipment with proper maintenance.

6.1 Hydraulic Power Unit and Local Control Panel (Main Control Unit)

Preservation Maintenance Check List	**Sheet: 1 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-65390-03-00-00 or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film; repair if necessary	Non aggressive oil
8.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Motors, Distribution Boxes, Relay Boxes, Subswitchboards, Junction Boxes**					
1.0			X		Inspect protection on cable connections; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0		X			Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check drain valves to be open	
6.0			X		Inspect fluid according to section 5.2.1 or 5.2.2	

6.2 Umbilical Reel with Umbilical

Preservation Maintenance Check List — **Sheet: 1 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check lines to be pressureless, drain valves to be open	
6.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.3 Electric Remote Control Panels

Preservation Maintenance Check List						**Sheet: 1 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A. General Inspection						
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, Vaseline or equivalent
4.0			X		Check pneumatic circuits to be depressurized (for purged system only)	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil

Preservation Maintenance Check List						**Sheet: 2 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.4 Pneumatic Remote Control Panels

Preservation Maintenance Check List — **Sheet: 1 of 1**

Description of Equipment: **Pneumatic Remote Control Panels**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on pneumatic hose connection, repair if necessary	Non aggressive protective shield with additional cover
4.0			X		Check pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
7.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
8.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
9.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
10.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
11.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.5 Hydraulic and Electrical Jumpers

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Hydraulic and Electrical Jumpers**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0	X				Check junction boxes and couplings for proper protection by covers, caps or plugs	
4.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield; acid free Vaseline or equivalent; protective caps
6.0			X		Check protection of electric cable against mechanical impact and ageing impact by sunlight	
7.0			X		Check that cable minimum bending radius is kept for storage	
8.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.6 Subsea Valve Package

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Valve Package**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
6.0			X		Check lines to be pressureless; drain valves to be open	
7.0			X		Inspect fluid according to section 5.8.1 or 5.8.2	

6.7 Subsea Control Module (direct / pilot hydraulic types)

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Control Module (not for CAMTROL SCM)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
6.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
7.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
8.0			X		Check lines to be pressureless; drain valves to be open	
9.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
10.0			X		Inspect fluid according to section 5.9.1 or 5.9.2	

6.8 Hydraulic Flushing and Testing Unit

Preservation Maintenance Check List						**Sheet: 1 of 3**
Description of Equipment:	**Hydraulic Flushing and Testing Unit**					
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
6.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List	**Sheet: 2 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C. Hydraulic Circuits						
1.0			X		3/2-way valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way valves to be in open centred position; function lines to be pressureless	
3.0			X		Check lines to be pressureless; drain valves to be open	
4.0			X		Inspect fluid according to section 5.10.1 or 5.10.2	

6.9 Running Tool for Subsea Module

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Running Tool for Subsea Module**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
6.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
7.0			X		Inspect fluid according to section 5.11	

7 CAMTROL Subsea Production Control Equipment

Note: Use the instructions in this section as check lists.

7.1 Subsea Control Module / SCM

Check on the bill of material if individual “Shipping, Transportation and Storage Guidelines” are available for the SCM, otherwise follow the instructions below:

Verify: _____

Store the SCM in the crate until it is required for use.

If it is necessary to gain access to the SCM, remove the top and sides of the crate, but leave the SCM on the shipping frame.

Visually inspect the SCM / packing before use and every **3 month** when it is not used.

Verify: _____

The storage environment must be free from harmful substances which can affect resilient seals (i.e. high Ozone level).

Verify: _____

The ambient temperature for storage must be within the range -10°C to 40°C to maintain the integrity of the pressure compensation system and ensure that no dielectric oil bleeds out.

Verify: _____

CAUTION:
If the loss of dielectric oil exceeds 3 Litre the SCM needs to be refilled in accordance to Cameron “Field refill procedure”. The lower reservoir of the shipping frame is seized to 3 Litre. If you are in doubt please contact Cameron Germany Engineering Department (Tel +49 (0)5141 8060).

7.2 Subsea Accumulator Module / SAM

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Any damage occurring during the periodical checks must immediately be reported and repaired by Cameron Controls.

Verify: _____

Drain the hydraulic pressure from the accumulators.

Verify: _____

Bleed nitrogen pre-charge from the accumulators. Leave 10 BAR residual pressure in the accumulator to prevent the bladder from collapsing.

Verify: _____

Close the two (2) Gas Valves on the HP Accumulators.

Verify: _____

Open ends of Accumulators must be sealed by plugs or protective caps off stainless steel on the gas side off the accumulators.

Verify: _____

Lubricate all moving parts, except the Hydraquad hydraulic connectors, by water-resistant grease.

Verify: _____

Painting, frame and moving parts must be checked for damage.

Verify: _____

Stainless Steel parts must be protected by a thin film of non aggressive oil (Pelox Protector or similar).

Verify: _____

7.3 Subsea Distribution Unit / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.3.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Set all valves to CLOSE position.

Verify: _____

Protect the mounting base of the SAM by a protective cover.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes

Verify: _____

7.3.2 Electrical Parts

Check that all ROV connectable fuses are installed.

Verify: _____

Check that all electrical connectors are protected by caps

Verify: _____

7.4 Umbilical Termination Assembly / UTA

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.4.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes.

Verify: _____

7.4.2 Electrical Parts

Check that all electrical connectors are protected by caps.

Verify: _____

7.5 Foundation Base & Mud Mate for UTA / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Foundation Base only: Verify the proper operation of the two (2) pile locks and confirm that they are in the unlocked position.

Verify: _____

Check the SDU locking mechanism by operating.

Verify: _____

Check the guide post locking mechanism by operating.

Verify: _____

Inspect all lift shackles for deformation and other damage.

Verify: _____

Check condition of all protection anodes.

Verify: _____

8 Handling Requirements for Special Materials

8.1 Rubber Goods

GENERAL

There is very little published information on the storage and care of rubber goods as used in the oil field. When we speak of rubber goods we include the synthetic packings of Nitrile Copolymers and Neoprene as well as natural rubber parts. Natural rubber parts have become relatively rare but the same things that are harmful to natural rubber are also harmful to the synthetics in varying degrees.

Generally speaking, light and air are bad for rubber goods. The exact chemical action is not fully understood and what has been written disagrees on the mechanism involved.

Ozone is known to be bad for rubber goods. Ozone (O_3) is a very active form of oxygen. As far as we know two principle sources contribute the ozone that reaches rubber goods. One is atmospheric ozone which is generated in the stratosphere carried downward by convection currents and eventually absorbed by organic matter. The other source is electrical discharges, such as lightning, high voltage corona, but more commonly, electrical machinery. Ozone attack is characterized by fairly deep cracks in the rubber parts.

Rubber is attacked by ordinary oxygen (O_2) much as steel rusts in the presence of oxygen. Oxidation is characterized by a hard skin which eventually crazes in a multitude of small cracks and may turn chalky or assume a bark-like appearance.

A strong direct light, especially sunlight, has deleterious effects on rubber goods. This is attributed to the ultraviolet content of the spectrum which accelerates cracking. Whatever the mechanism however, light, particularly sunlight, is undesirable. In extremely cold climates some rubber goods will become so brittle that upon dropping or rough handling they will shatter.

In very warm humid climates, particularly those found in some parts of the tropics, fungi and bacteria find their way to the rubber goods and attack the organic content. This is especially true on duck reinforced rubber parts. However, parts reinforced with synthetics will not be attacked in the reinforcement.

Heat also has a bad effect on rubber. This could be the result of sunlight or artificial or accidental heating of any type. Heat results in a gradual hardening of the part and if ozone or oxygen are present, will accelerate their action.

Any stretching or bending of rubber in storage will result in very accelerated ageing. By the term ageing, we mean the cumulative effects of all the above mentioned attacking agents over a period of time. Ozone attacks rubber preferentially at points of strain.

Rubber goods, both natural and synthetic, all possess some degree of susceptibility to various solvents including water, but especially the liquid hydro-carbons. These manifest themselves in various ways by either swell or shrinkage of the rubber goods with which they are in contact.

No precise figure can be given as a "storage life" of a part. This is dependent on all of the above conditions and also the size of the part, its material and function. Generally speaking, the greater the relative surface area is to the volume, the more susceptible a part is to being rendered useless by ageing. For example, a relatively bulky part such as a ram front packer might be expected to have a much longer useful shelf life than a thin large diameter o-ring type of seal such as used on the bonnet seals of preventers or the rings in 'X' bushing.

STORAGE

From the preceding section we can draw a few rules governing storage of rubber goods. Briefly put - a cool, dry, dark storage place would be the best. The ideal would be to store the packings in vacuum sealed containers. The following rules, however, should not be difficult to follow under the average storage conditions experienced throughout our operation.

- Keep the rubber storage area as dark as possible. Certainly not out of doors, and, if indoors, away from skylights or windows and with subdued or indirect artificial lighting.
- Select the coolest location possible and be sure that no heaters or stoves are near by and particularly that the direct blast from a space heater does not blow on the rubber parts.
- Be sure that no electrical machinery (motors, switch gear, or any high voltage equipment producing corona) is near the rubber goods and that drafts will not carry the atmosphere from electrical machinery to the area in which the rubber goods are stored.
- The practice of first in - first out is essential with rubber goods. There is a natural tendency to remove parts from the front of a bin and when stock is replenished to leave the parts that are in the back in place, in which case years might pass before these are finally pulled out for use.
- Store rubber goods in a relaxed position. For example, do NOT hang o-rings on nails. Where possible, do not keep assemblies in stock where the rubber goods are stretched in order to assemble them on the part. For example, o-rings on blanking plugs, tubing hangers and 'X' bushing. In some cases this is difficult as it is with the aforementioned 'X' bushings. On these, periodic inspection should be employed to detect any signs of ageing as quickly as possible.

  On parts, such as the 'X' bushing rings, where we know the rubber parts will be stretched in storage, the best age resistant compounds we can buy are used.
- Keep storage as dry as possible and remove any oil, gas, etc. of hydro-carbon nature that may accidentally get on the rubber.
- Do not store the rubber goods on top shelves near galvanized roofs. There are several reasons for this; one is that heat is passed through galvanized roofing and also there is some opinion that ozone may be generated in this area.
- If possible, store rubber goods in buildings of wooden construction and wooden shelves. Wood is believed to scavenger ozone quite effectively.
- If store for extended periods is unavoidable, sealed containers will aid considerably; impervious surface coverings such as "Sea-Peel" or waxing will help.

USABILITY CHECKS

No general rule can be drawn regarding usability. The final measure is whether or not the cumulative effects of ageing have affected the physical properties of the part to such an extent that it will no longer perform the function for which it is designed. Thus, a large heavy part might suffer the same total amount of ageing as a small, light, thin piece, and still be usable whereas the small part is rendered useless. In these cases some judgement must be used in deciding usability.

Prior to shipment or use out of stock, rubber goods should be examined to see that no "chalking" or "barking" (bark-like surface appearance) is present, that there is not a hard skin on the rubber and that there are no cracks. Sometimes cracks will be obvious, but it is wise to stretch or bend the part in question so that any incipient cracks or very thin cracks will reveal themselves. Where a part is suspect, a check of hardness should be run. In the event that the hardness runs 15 points higher than the nominal hardness of the part, it is considered non-usable. Hardness is affected by temperature and readings should be taken with the rubber part at 70°F – 100°F (21°C - 38°C).

8.2 Hydraulic Hoses

STORAGE

- Before placing hose in storage, it should be completely drained.
- Whenever feasible, store the hose in the original wooden shipping crate. This will provide some protection against the deteriorating effects of solvents, corrosive liquids, ozone and sunlight. Hose should be stored so that the coils are in a horizontal plane.
- Certain rodents and insects will damage the hose. Adequate protection from them should be provided.
- The ideal temperature for storing the hose ranges from 50°F (10°C) to 70°F (21°C) with a maximum limit of 100°F (38°C). If stored below 32°F (0°C), the hose will become stiff and would require warming before placed in service. The hose should not be stored near sources of heat, such as radiators, base heaters, etc., nor should the hose be stored under conditions of high or low humidity.
- To avoid the adverse effects of high ozone concentration, the hose should not be stored near electrical equipment that may generate ozone or be stored for any lengthy period in geographical areas of known high ozone concentration. Exposure to direct or reflected sunlight - even through windows - should also be avoided.

HANDLING

CAUTION: Care should be exercised to prevent mishandling. Crushing or kinking of the hose can cause severe damage to the reinforcement. If this occurs, remove hose from service.

- In order to minimize the danger of kinking, the hose preferably should be removed from its crate by hand, laid out in a straight line, then lifted by means of a catline attached near one end of the hose. If a catline is used to remove the hose from its crate, the crate should be rotated as the hose is removed. Recommended practice is to protect the hose in some manner when moving to a new location. It is considered bad practice to handle the hose with a winch, to hand the hose from a truck gin pole, or to place heavy pieces of equipment on the hose.

8.3 Electronic Goods and Tools containing Electronics

8.3.1 General Instructions

Rapid temperature changes must be excluded to avoid condensation of humidity and mechanical stress.

The packing should protect electronic goods against:

- Dust
- Humidity
- Electrostatic Charge
- Shock
- Direct Sunlight

Generally the original transport packing serves the above requirements best.

Normally antistatic bags, desiccant and anti-shock pads are applied to prevent damage.

Electronic goods should be stored in a warehouse secured against theft.

8.3.2 Fiberoptic Terminations

Optic Link Modules (OLM) should be capped. Caps have to be removed before installation.

8.3.3 Handling Procedure for CMOS Devices

Electrical environments such as overvoltages and electrostatic discharges damage CMOS devices and printed circuit cards containing the devices. Most CMOS devices have diode input protection circuits and gate protection structures to protect against such electrical environments.

In addition to the internal protection network, use the following steps to prevent the generation of severe electrical transient voltages during handling of CMOS devices.

- Read the manufacturer's equipment specification and data sheets before performing maintenance. Do not exceed recommended maximum voltage levels.
- Use grounding wrist straps which contact the skin.
- Ground all work surfaces.
- If lead-straightening or hand-soldering is necessary, provide ground straps for the equipment, and ground the soldering ties.
- Connect all unused inputs to an appropriate logic voltage level, either power or ground.
- Inspect test equipment for proper polarity of voltage before conduction parametric or functional testing.
- Inspect all power supplies used for testing to ensure there are no voltage transients present.
- Do not insert or remove devices from test sockets with power applied.
- Do not contact edge connectors which are wired directly to device inputs.
- If external connections to a printed circuit card address only an input of the integrated circuit, use a resistance of 10 K ohms or greater in series with the input. The resistance limits damage to the card if it is removed and contacts static generating materials.
- Connect all low impedance equipment such as pulse generators to inputs only after the device has power applied. Disconnect the equipment before power is removed.
- Do not allow nylon or other static generating materials to contact the devices.
- Store or transport the devices in materials that are antistatic. Do not insert the devices into plastic packing material, styrofoam, or plastic trays.

8.3.4 Lithium Manganese Dioxide Battery

Replacement of the Lithium Manganese Dioxide battery mounted in the subsea transmitter & battery module: The battery supports the AMF-System (Automatic Mode Function / Dead Man System) belonging to multiplex drilling control systems. Under normal operation conditions replacement is required **after each one-year period**. Battery storage conditions should be in a range of 23°F – 59°F (–5°C to 15°C).

9 Attachment

- Data Sheets of Protective Materials (if required)
- Data Sheets of Hydraulic Fluids (if required)

STATUS: Released REVISION : 06
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : TOPSIDE UMBILICAL TERMINATION UNIT
TOTAL K5-F

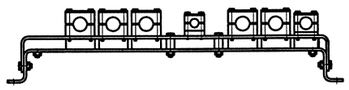
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
010	0010	02	223997-03	1.000	EA	FRAME ASSY TOPSIDE UMBILICAL TERMINATION UNIT TOTAL K5-F		
015	0015	02	223451-05	1.000	EA	TAGGING AND MARKING ASSY (TUTU) TOPSIDE UMBILICAL REMINATION UNIT TOTAL K5-F		
070	0070		619024-06-01-23	10.000	EA	2 CLAMP HALVES FOR TUBE OD 33.7 mm SINGLE , TYPE: A , SIZE: 5 , SMOOTH MATERIAL: POLYPROPYLENE		
071	0071		619024-02-63-01	10.000	EA	COVER PLATE, SINGLE, TYPE A, SIZE 5 FOR TUBE CLAMP ; MAT.: SST 316 (A4)		
072	0072		619901-11-26-09	20.000	EA	SCREW, HEX, DIN 933, M6 X 70, SST MATERIAL: AISI 316 (1.4401)		
080	0080		619024-06-01-22	2.000	EA	2 CLAMP HALVES FOR TUBE OD 30 mm SINGLE , TYPE: A , SIZE: 4 , SMOOTH MATERIAL: POLYPROPYLENE		
081	0081		619024-03-32-01	2.000	EA	COVER PLATE, SINGLE, TYPE A, SIZE 4 FOR TUBE CLAMP ; MAT.: SST 316 (A4)		
082	0082		619901-11-24-09	10.000	EA	SCREW, HEX, DIN 933, M6 X 60, SST MATERIAL: AISI 316 (1.4401)		
090	0090		619024-06-01-20	5.000	EA	2 CLAMP HALVES FOR TUBE OD 14 mm SINGLE , TYPE: B , SIZE: 2 , SMOOTH MATERIAL: POLYPROPYLENE		
091	0091		619024-02-61-01	5.000	EA	COVER PLATE, SINGLE, TYPE A, SIZE 2 FOR TUBE CLAMP ; MAT.: SST 316 (A4)		
092	0092		619901-11-21-09	10.000	EA	SCREW, HEX, DIN 933, M6 X 45, SST		

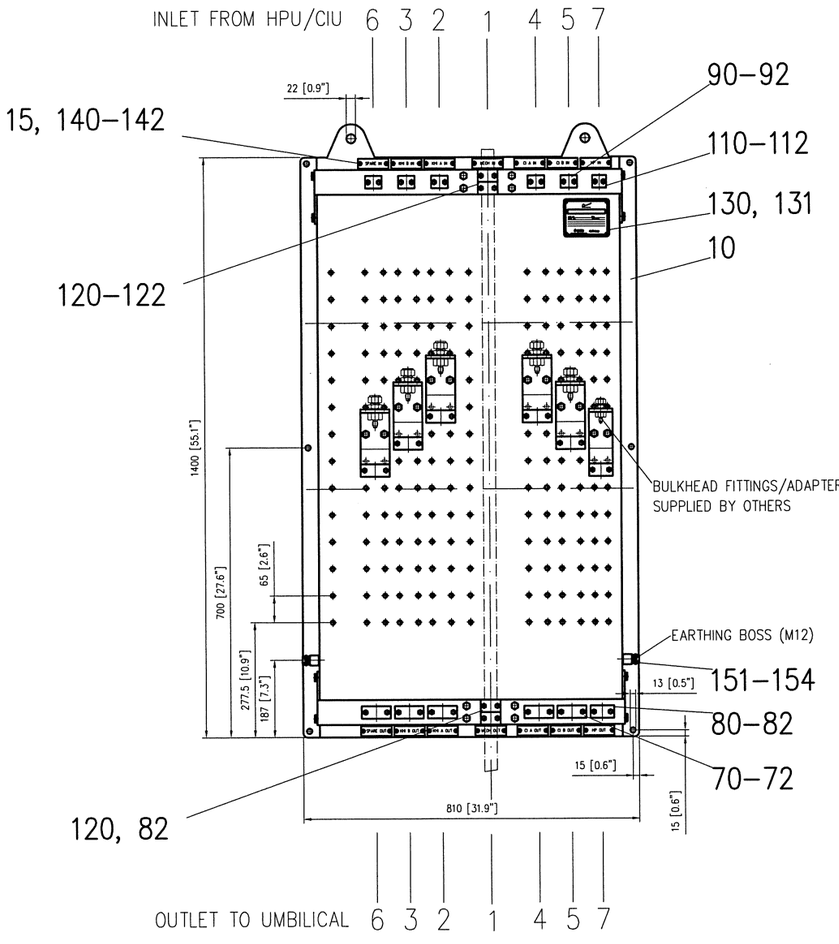
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						MATERIAL: AISI 316 (1.4401)		
110	0110		619024-06-01-18	1.000	EA	2 CLAMP HALVES FOR TUBE OD 9.5 mm SINGLE , TYPE: A , SIZE: 1 , SMOOTH		
						MATERIAL: POLYPROPYLENE		
111	0111		619024-02-60-01	1.000	EA	COVER PLATE, SINGLE, TYPE A, SIZE 1 FOR TUBE CLAMP ; MAT.: SST 316 (A4)		
112	0112		619901-11-20-09	2.000	EA	SCREW, HEX, DIN 933, M6 X 40, SST		
						MATERIAL: AISI 316 (1.4401)		
120	0120		619024-06-01-27	4.000	EA	2 CLAMP HALVES FOR TUBE OD 21.3 mm SINGLE , TYPE: A , SIZE: 3 , SMOOTH		
						MATERIAL: POLYPROPYLENE		
121	0121		619024-02-62-01	4.000	EA	COVER PLATE, SINGLE, TYPE A, SIZE 3 FOR TUBE CLAMP ; MAT.: SST 316 (A4)		
122	0122		619901-11-22-09	4.000	EA	SCREW, HEX, DIN 933, M6 X 50, SST		
						MATERIAL: AISI 316 (1.4401)		
130	0130	A01	619046-20-55	1.000	EA	TAG: UNIVERSAL (90X110) BLANK, 1.4301 COLOUR OF WRITING: BLACK		
131	0131		619906-11-02-08	4.000	EA	GROOVED PIN, DIN 1476, 3 X 10, SST WITH ROUND HEAD ; MAT.: AISI 305 (1.4303)		
140	0140		619901-09-12-09	28.000	EA	SCREW, HEX, DIN 933, M4 X 16, SST		
						MATERIAL: AISI 316 (1.4401)		
141	0141		619910-12-09	28.000	EA	NUT, HEX, DIN 934, M4, SST		
						MATERIAL: AISI 316 (1.4401)		
142	0142		619919-09-01-08	56.000	EA	WASHER, MEDIUM, DIN 125, A 4.3, SST TYPE A: W/O. CHAMFER ; ID: 4.3 MM		
						MATERIAL: AISI 316 (1.4401)		
151	0151		619901-15-16-09	2.000	EA	SCREW, HEX, DIN 933, M12 X 25, SST	for earth bosses	
						MATERIAL: AISI 316 (1.4401)		
153	0153		619919-15-02-08	2.000	EA	WASHER, MEDIUM, DIN 125, B 13, SST TYPE B: WITH CHAMFER ; ID: 13 MM	for earth bosses	
						MATERIAL: AISI 316 (1.4401)		
154	0154		619954-01-18-03	2.000	EA	WASHER, DIN 6798, TYPE A,	for earth bosses	

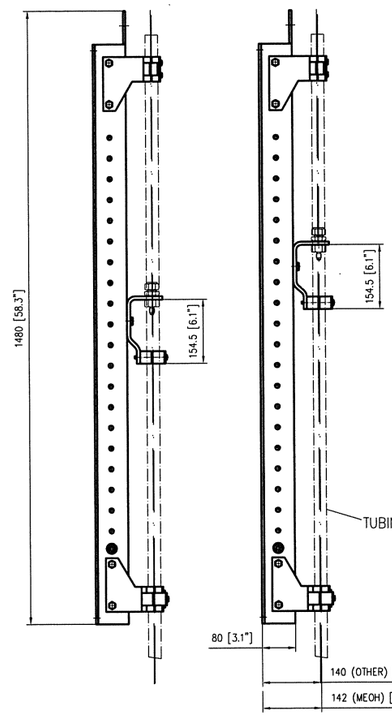
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						12.5 ID SERRATED LOCK WASHER EXTERNAL TOOTH MATERIAL: AISI 316 (1.4401)		
170	0170	01	2197010-02-98	2.000	EA	HIGH-STRENGTH SHACKLE FORM C TYPE:HEX HD BOLT, NUT & COTTER PIN, SWL: 3.25t, OPEN. WIDTH (B): 26MM, SHACKLE CROSS SECTION DIAMETER (d):16MM, BOLT DIAMETER (D): 19MM, MATERIAL: STEEL ZINC PLATED, CERTIFICATE DIN EN 10204 3.1 SHACKLE HANDLE FROM MANGANESE STEEL BOLT TYPE: HEX HD BOLT WITH NUT AND SPLIT PIN PROTECTION, FROM ALLOYED STEEL, RECOMPENSES		
>>>B/M Category : Engrg Spec/Document item								
900	0900	03	SK-066398-98	1.000	EA	GA TOPSIDE UMBILICAL TERMINATION UNIT TOTAL K5-F		
901	0901	08	QP-000160-01-18	1.000	EA	Main Quality Plan for DC Tree Systems		
905	0905	25	D-000100-09-17	1.000	EA	PART IDENT: LOW STRESS STAMP, "ASSY", ASSY P/N, "REV" REV, "CAM" SAP PLANT NO, S/N ("CCV" MAY BE USED IN PLACE OF "CAM". SEE X-043764-01 FOR DETAILS)		
911	0911	01	X-076711-59	1.000	EA	PACKING INSPECTION RECORD TOPSIDE UMBILICAL TERMINATION UNIT (TUTU) TOTAL K5-F		
912	0920	02	X-065437-01-13	1.000	EA	FAT: TUTU, K5-F		
>>>B/M Category : Reference Call Outs								
801	0801		PF-104351-02-01	1.000	EA	Project file TUTU - TOTAL K5-F		
802	0802	07	X-065429	1.000	EA	GENERAL PRESERVATION AND STORAGE PROCEDURE FOR CAMERON CONTROLS EQUIPMENT		
803	0803	06	SP-003118-15	1.000	EA	TOTAL K5F Project Quality Plan		

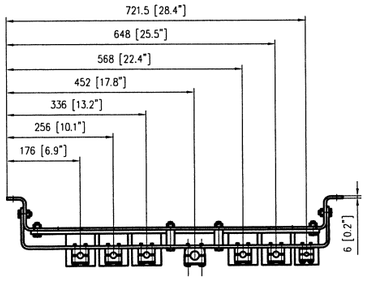
LIST OF CHEMICAL / HYDRAULIC FUNCTIONS

DESCRIPTION	ABBREVIATION	DP [PSI / BAR]	ID HOSE / TUBE mm [inch]	CLAMP DIAMETER INLET [mm] FROM HPU / CIU	CLAMP DIAMETER OUTLET [mm] TO UMBILICAL	BULKHEAD CONNECTOR			UMBILICAL LINE NO.
						CONNECTION TYPE (TUBE SIDE x HOSE SIDE)	HOLE SIZE IN BRACKET [MM]	AUTOCLAVE CATALOG NUMBER	
METHANOL INJECTION	MEOH	6500 / 449	19.05 [3/4"]	21.25	21.25	–	–	–	1
CORROSION INHIBITOR A	CI A	6500 / 449	12.7 [1/2"]	14.3	33.7	AE MP 9/16" SF562CX x JIC 8 MALE	29	20BAMJ8FM9	4
KINETIC HYDRATE INHIBITOR A	KHI A	6500 / 449	12.7 [1/2"]	14.3	33.7	AE MP 9/16" SF562CX x JIC 8 MALE	29	20BAMJ8FM9	2
CORROSION INHIBITOR B	CI B	6500 / 449	12.7 [1/2"]	14.3	33.7	AE MP 9/16" SF562CX x JIC 8 MALE	29	20BAMJ8FM9	5
KINETIC HYDRATE INHIBITOR B	KHI B	6500 / 449	12.7 [1/2"]	14.3	33.7	AE MP 9/16" SF562CX x JIC 8 MALE	29	20BAMJ8FM9	3
HYDRAULIC SUPPLY HP	HP	10000 / 690	6.3 [1/4"]	9.5	30	AE MP 3/8" SF375CX x JIC 6 MALE	24	20BAMJ6FM6	7
SPARE	SPARE	10000 / 690	12.7 [1/2"]	14.3	33.7	AE MP 9/16" SF562CX x JIC 8 MALE	29	20BAMJ8FM9	6









NOTES
1. ITEMS IN CHAIN DOTTED LINES, BULKHEAD CONNECTORS, HOSES AND TUBING ARE SUPPLIED BY OTHERS
2. ALL FRAME PLATE MATERIAL: 316TI
3. PIPE CLAMPS DIN 3015 T1 AND T2 (STAUFF OR EQUIVALENT); MATERIAL: PP/316SST
4. FASTENING MATERIAL FOR SITE MOUNTING (SCREWS, NUTS, ETC.) IS SUPPLIED BY OTHERS

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

REASON FOR ISSUE	DATE	CLIENT REV.
AS BUILT	21NOV07	2
APPROVED FOR CONSTRUCTION	10APR07	1
ISSUED FOR CLIENT COMMENT	09MAR07	N/A
ISSUED FOR INTERNAL IDC	15DEC06	N/A

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92–W–03–504

03

CAD

REV. BY: C. Reitz | DATE: 21.11.2007 | REV.: 03

TOLERANCES ACCORDING TO DIN ISO 8015
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

SURFACE TREATMENT
MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN: C. Reitz	DATE: 13.11.2006	
CHECKED: A. Pohl	DATE: 21.11.2007	
APPROVED: C. Reitz	DATE: 21.11.2007	

EST. WEIGHT: 140.000 KG | SUPERSEDES: | SCALE: 1:10

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

ASSEMBLY DRAWING
TOPSIDE UMBILICAL TERMINATION UNIT

INITIAL USE BOM: 223398-98 | SHEET: 1 OF 1 | DRAWING NUMBER: SK-066398-98

STATUS: APPROVED

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 2, Section 2

POWER REGULATION COMMUNICATION MODULE (PRCM) & PRCM MOUNTING BASE (PRCMMB)

CONTENTS

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 2, Section 2
POWER REGULATION COMMUNICATION MODULE (PRCM) & PRCM MOUNTING BASE (PRCMMB)

DESCRIPTION, INSTALLATION, OPERATION & MAINTENANCE

CONTENTS

Total
K5F FIELD DEVELOPMENT PROJECT
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INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 2, Section 2
POWER REGULATION COMMUNICATION MODULE (PRCM) & PRCM MOUNTING BASE (PRCMMB)

PARTS LISTS & DRAWINGS

CONTENTS

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

31 MAR 2009	As Built	A. Weilandt	T. Appel	A. Weilandt
06 AUG 2007	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
02 MAY 2007	Issued for Client Comment	A. Weilandt	S. Horne	
12 OCT 2006	Issued for Internal IDC	A. Weilandt	D.Coonrod	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approver**

CAMERON	**Document Title:** **Subsea and Topsides Functional Requirement Specification**		
PAGE 1 OF 34	**Customer Document Number:**	54NL92-W-0S-502	REV. 2
	Cameron Document No.	X-076721-87	REV. 02

TABLE OF CONTENTS

1 Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
A	12OCT06	Initial release Celle	- - -
B	02MAY07	Section 7.5.6.1: Use of Swagelok added for LP lines and added the need for metric size on all LP tubing Section 8.4: cable entry changed from top to bottom Section 9.2: List of Total Tag Numbers added Section 9.1.1.2: Colour for topside equipment changed from RAL5015 to RAL7035 (light grey) 10.8 & 10.9: updated description as per current design of anode and cathode package 10.10: complete section added for Anode Umbilical Assembly	Comments from internal IDC
01	06AUG07	Section 10.8: Anode Package Foundation Base added	Updated to Approved for Construction
02	31MAR09	Minor cosmetic Customer Comments implemented	Update to “As Built”

2 Introduction

This document is written to consolidate the technical requirements for the subsea control system intended to be used on the TOTAL K5F Project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

It will be submitted for approval early on in the project cycle and upon approval will be used for the design of the system.

Referenced client specifications within this document also need to be considered for the design.

3 Scope of this document

The scope of this document is to define the functional requirements for the subsea control system intended to be used on the TOTAL K5F Project.

Technical requirements relate but shall not be limited to:

- Design basis data
- Functional requirements

The Intervention & Workover Control System (IWOCS) shall **NOT** be covered by this document.

4 Abbreviations & Definitions

4.1 Abbreviations

AIV	Annulus Isolation Valve
AMV	Annulus Master Valve
APTA	Annulus Pressure Transmitter A
APTB	Annulus Pressure Transmitter B
BAIV	B Annulus Isolation Valve
CI	Corrosion Inhibitor
CIV	Chemical Injection Valve
CP	Cathodic Protection
CR	Control Room
DCS	Distributed Control System
DHSV	Downhole Safety Valve
DHPT	Downhole Pressure Temperature Transmitter
EPCU	Electrical Power and Communication Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
HPU	Hydraulic Power Unit
ICSS	Integrated Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
KHI	Kinetic Hydrate Inhibitor
LPMV	Lower Production Master Valve
MEOH	Methanol
PCS	Process Control System
PPD	Production Pressure Downstream
PPU	Production Pressure Upstream
PSV	Production Swab Valve
PTD	Production Temperature Downstream
PTU	Production Temperature Upstream
PWV	Production Wing Valve
PRCM	Power Regulation and Communication Module
SCSSV	Surface Controlled Subsurface Safety Valve
SSS	Safety Shutdown System
TUTU	Topside Umbilical Termination Unit
UPMV	Upper Production Master Valve
UPS	Uninterruptible Power Supply
UTA	Umbilical Termination Assembly
WH	Wellhead
XOV	Crossover Valve

4.2 Definitions

COMPANY	Total E&P Nederland B.V. (TEPNL)
CONTRACTOR	Cooper Cameron UK Ltd.

5 References

5.1 Cameron documents

Following documents **MUST** be considered during the design phase.

Description	Number
Subsea Production Control System Interconnection Diagram	SK-066001-88-04
K5F Field Development Project Contract	4600000416
Bill Of Material – Subsea Production Control System	223001-88
Project Quality Specification	SP-003118-15

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Design of cathodic protection of offshore structures	GS GR COR 100
External protection of off-shore and coastal structures and equipment by painting	GS EP COR 350
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Minimum CONTRACTOR document requirements	GS EP ELE 091
Electrical cables	GS EP ELE 161
Cable trays/ladders	GS EP ELE 311
Precommissioning and commissioning specification	GS EP EXP 101
Precommissioning and commissioning technical preparation	GS EP EXP 103
Precommissioning execution	GS EP EXP 105
Commissioning execution	GS EP EXP 107
Operations preparation during project – Maintenance and inspection documentation	GS EP EXP 203
Requirements for contractor quality management	GS EP PJC 501
Requirements for contractor critically rating of a unit	GS EP PJC 502
Requirements for contractor quality control	GS EP PJC 503
Valves	GS EP PVV 142
Welding of duplex and superduplex stainless steel	GS EP PVV 614
Area classification	GS EP SAF 216

Description	Number
Completed wells safety systems and safety rules	GS EP SAF 226
Impacted area, restricted area and fire zones	GS EP SAF 253
Emergency shut-down and emergency de-pressurisation (ESD & EDP)	GS EP SAF 261
Design philosophy and requirements for subsea stations	GS EP SPS 001
Subsea ball valves	GS EP SPS 005
Service valves in subsea stations	GS EP SPS 006
Tie-in systems	GS EP SPS 007
Corrosion protection of subsea stations	GS EP SPS 009
Preservation requirements for subsea package	GS EP SPS 010
Mechanical completion of subsea stations	GS EP SPS 011
Documentation requirements for subsea stations	GS EP SPS 012
Wellhead and guidance systems	GS EP SPS 013
Subsea gate valves and actuators in subsea Xmas-tree systems	GS EP SPS 015
Subsea insert chokes and associated running and retrieval tools	GS EP SPS 016
Subsea production control system	GS EP SPS 019
Subsea control unit functional requirements	GS EP SPS 020
Subsea mateable electrical/optical connectors	GS EP SPS 021
Environmental testing of subsea electronics	GS EP SPS 022
Cleaning and flushing of hydraulic systems	GS EP SPS 023
Subsea mechanical quarter turn actuator (manually operated gearbox)	GS EP SPS 024
Subsea hydraulic spring return quarter turn actuators	GS EP SPS 025
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Static 230Vac power supply units for on- and offshore installations	NL00-U-6S-037
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Typical cable tray details (offshore)	NL00-U-64-044
Elec. Cable colour seq. (onsh. + offsh.)	NL00-U-64-045
Protection and Instrument Earth. Det. (onsh. + offsh.)	NL00-U-64-046
Presentation of engineering and final documentation	NL00-Z-0S-002

Description	Number
Microstation Version 5.0: User Definable Attributes	NL00-Z-0S-005
Codification & Numbering of New Technical Documents for Offshore Installations	NL00-Z-0S-006
Instrumentation/piping interface standards	NL00-Z-4S-042
Actuators and control systems for hydraulically operated control valves	NL00-Z-7S-041
Actuators and control system for hydraulically operated ball valves	NL00-Z-7S-043
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
Codification of instrumentation links & equipment	NL00-Z-7S-077
Electrical/instrument interface diagram typicals for normally unmanned offshore installations	NL00-Z-71-002
Loop diagrams typicals	NL00-Z-71-003
Instrumentation - process hook-up typicals	NL00-Z-74-011
Hydraulic hook-up typicals	NL00-Z-74-021
Mounting typicals	NL00-Z-74-031
Instrument name plate detail	NL00-Z-74-055
Completion dossier guidelines	CS-3-OPE-EC-701 (EDMP-40657)
K5F MCS – K6CC SSS/PCS Interface	EDMP #59401

Any agreed deviations from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

Any clarifications from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

In case of conflict between documents the following order of priority shall be applied:

1) Local and international rules and regulations
2) Company Safety Specifications (GS EP SAF)
3) Project Specifications
4) Company Standards (NL00)
5) Company General Specifications

5.3 Codes, standards and regulations

Following codes, standards and regulations shall be considered during the design phase.

Description	Number
Design and operation of sub sea production systems	ISO 13628
Design & Operation Of Subsea Production Control Systems	ISO 13628-6
Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluids	SAE AS4059

Description	Number
EMC Directive	89/336-EEC
Process measurement control functions and instrumentation Symbolic representation	ISO 3511
Quality management and quality assurance standards - Part 3:Guidelines for the application of ISO 9001 to the development, supply and maintenance of software	ISO 9000-3

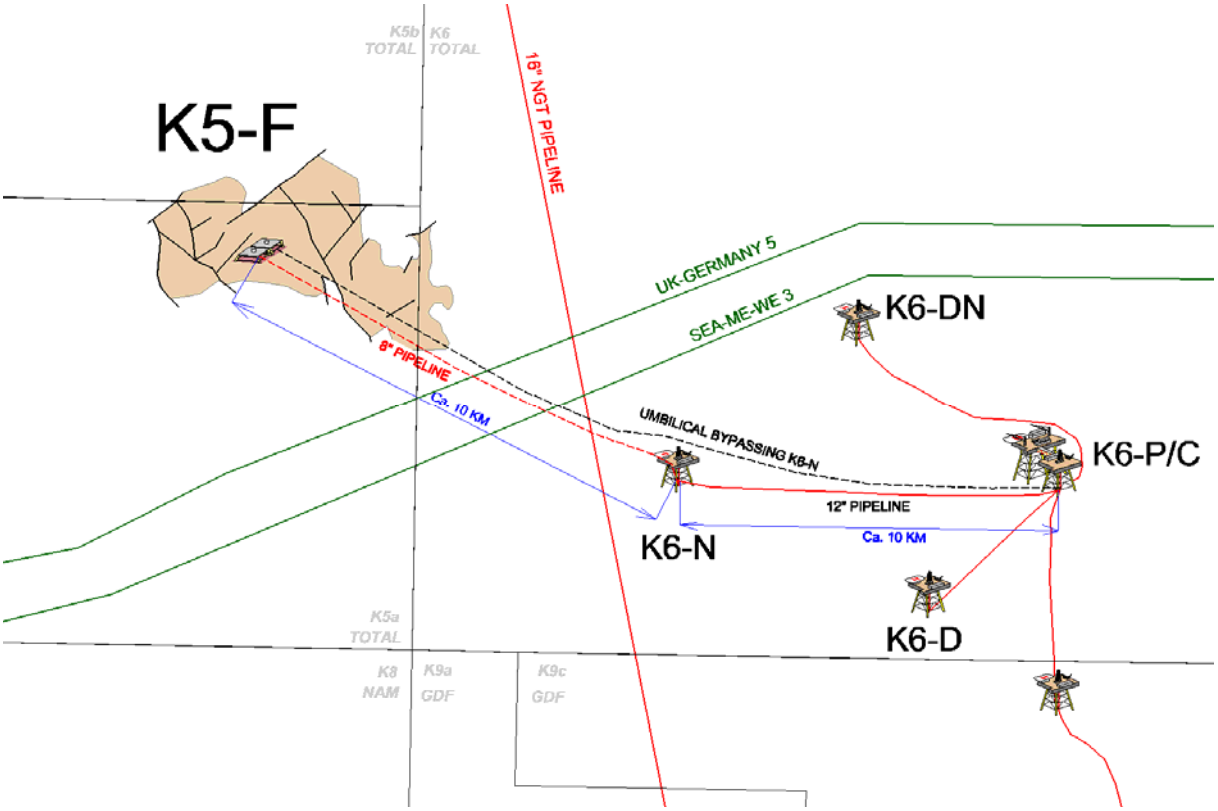
5.4 CE marking

CE marking **will** be required for the K5F project.

6 Project Overview

The K5F is a gas field located 10 km NW of the existing satellite platform K6N and 20km NW of the K6 Central Complex, all operated by TEPNL.

In the first phase, K5F will be developed with two wells. In order to be able to increase the reserves recovery in the future a third well might be connected in the future on the Subsea Protection Structure and it is also possible to connect a fourth future satellite well.



7 Design basis

The following sections are describing the systems information particularly relevant to the design of the Production Control System:

7.1 Field data

Present Number of Production Wells	Two plus two future wells
Design Life	20 years

7.2 Environmental conditions

7.2.1 Climatic data

Parameter		Data
Ambient Temperature (Outdoors)	Minimum Air Temperature	- 16°C
	Maximum Air Temperature	+ 40°C
Ambient Temperature (Indoors)	Minimum Air Temperature	-5°C
	Maximum Air Temperature	+ 40°C

7.2.2 Subsea Design Information

Parameter	Data
Water Depth	37 metres
Temperature	+4°C to +9.5°C
Seawater density	1025 kg/m³
Seawater Electrical Resistivity	0.3 OhmMeter
Wellhead Shut-in Pressure	350 barg

7.2.3 Hazardous Area Classification

The HPU and the TUTU shall be specified for hazardous area Zone 1, Gas Group IIB, Temperature Class T3, on the Platform deck.

7.2.4 Local equipment room

The platform local electrical switch room shall be used to accommodate the MCS and the ECPU cabinets. The maximum temperature during normal conditions within the LER shall be limited to 25 °C, but all of the equipment shall be able to operate as long as the room temperature does not exceed 40°C.

7.2.5 Hydraulic system pressures for the SCSSV line

The subsea production control system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
HP Hydraulics	627 barg	690 barg	1035 barg
Return Lines	< 207 barg	207 barg	N/A
Reservoir Fill Lines	<10 barg	10 barg	15 barg

NOTE: The design pressures shown above shall be used for specification of the HP hydraulic system relief valves and these shall release at the shown design pressures.

The return lines of the HPU are piped directly to the return reservoir and open to atmosphere. Pressure testing of these lines is neither necessary nor possible.

7.2.6 Chemical system pressure requirements

The chemical injection system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
Methanol Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Corrosion Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Kinetic Hydrate Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg

7.2.7 List of chemicals

The following chemicals are considered to be used for chemical injection for the K5F project:

- Methanol (MEOH)
- Corrosion Inhibitor (CI)
- Kinetic Hydrate Inhibitor (KHI)

7.3 Design life

The design life of the Subsea equipment shall be equal to the service life of the field.

The Subsea and related topside facilities shall be designed for a minimum design life of **20 years**.

7.4 Utilities

7.4.1 Platform utilities

The subsea production control system shall be designed to operate from the platform power and utilities as follows:

Electrical Supply (ECPU)	400VAC , 3 phase, 50 Hz ± 2% from UPS (floating), redundant
Electrical Supply (MCS)	230VAC 50 Hz ± 2%,from UPS (floating), redundant
Electrical supply (HPU PLC Cabinet)	230VAC 50 Hz ± 2% from UPS (floating)
Electrical supply (HPU Lighting)	230VAC 50 Hz from MCC
Electrical supply (HPU Motors)	380VAC 3ph 50 Hz, floating (3 wires) from MCC
Electrical supply (Motor heaters)	230VAC 50 Hz from MCC (if applicable)
Electrical supply (ESD solenoids)	24 V DC when healthy, 0V on ESD

7.5 Hydraulic systems

7.5.1 Sealing systems

Hydraulic couplers with primary metal seals are preferred for permanently installed Subsea equipment. Where possible, secondary, non-metallic seals should be considered as back-up for primary metal-to-metal seals. Hydraulic and chemical couplers within removable assemblies like single diver mate able hydraulic/chemical couplings shall have non-metallic primary seals and non-metallic back-up seals.

7.5.2 Hydraulic distribution

The subsea production control system high pressure (HP) hydraulic supplies shall be single from the HPU pumps. The hydraulic system shall be open utilising a water based control fluid.

7.5.3 Hydraulic fluid

The hydraulic system shall use Castrol Transaqua HT water based control fluid.

7.5.4 Fluid cleanliness

The production control system hydraulic control fluid shall be water based. All production control system hydraulic equipment shall be delivered with fluid cleanliness levels of SAE AS4059 class 6 or better. All methanol and chemical lines and equipment shall be delivered with fluid cleanliness level of SAE AS4059 class 12 or better.

Protective caps shall be provisioned for all hydraulic couplings to avoid accidental contamination. Assembly of hydraulic components shall take place in areas where the environment is controlled. The objective shall be to “assemble clean to keep clean” such that subsequent flushing operations are simplified.

Cleaning methods used for sub-assemblies shall include shop air flushing, solvent cleaning, pipe cleaning and ultrasonic bathing as appropriate. Cleaning of major assemblies shall in general be confined to flushing with control fluid of known cleanliness. As far as is practical, designs shall take due note of the subsequent flushing requirements e.g. avoiding blind holes, avoiding welding or grinding on assembled components and ensuring that systems allow turbulent flow for flushing.

All hoses and flying leads intended for chemical service (Methanol, Corrosion Inhibitor and Kinetic Hydrate Inhibitor) should be supplied filled with either control fluid or a suitable fluid compatible with the chemicals to be used.

7.5.5 Tubing

All hydraulic tubing and fittings shall be sized for efficient operation of the system with due regard to design pressures and minimising pressure drops within the system.

- For the topside equipment minimum seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the subsea equipment seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the UTA, the Methanol tubing has to be super duplex.

The tubing of the hydraulic circuits shall be accurately cut and bent using standard tube cutters and tube benders to fitting manufacturer’s recommendation. No burrs shall be allowed and each section of the tubing shall be cleaned and blown dry before assembly to ensure that no contamination is permitted to enter the control components.

All hydraulic tubing together with the associated fittings shall be capable of withstanding the application of a 1.5 times design pressure test for 15 minutes without any deformation or other damage.

7.5.6 Threaded connection systems

All threaded fittings for equipment used subsea shall withstand external ambient pressure at the design depth.

7.5.6.1 Topside equipment

For all circuits Autoclave MP Piping and fittings shall be used, except return lines where Swagelok can be used. All non Autoclave lines need to be in metric size.

7.5.6.2 Permanent subsea equipment

Ferrulok tube end reducers are to be welded to the back of hydraulic couplers, etc., where practical, rather than pipe threaded connections.

High-pressure ports requiring threaded fittings, such as valve actuator ports shall be SAE thread with 37-degree bottom taper conforming to SAE standard J514. Autoclave anti-vibration type fittings shall also be acceptable.

National Pipe Thread (NPT) fittings or any other thread seal type fitting shall **NOT** be used without specific approval from the project.

Fitting assembly torque shall be independently verified and sealed/secured to identify, that fittings have been properly made-up and inspected.

7.5.6.3 Thread sealants

Where taper threads are permitted for use, they shall be sealed using Loctite 572 fluid applied in accordance with the manufacturer's instructions. No other thread sealant shall be used. Teflon tape is **NOT** permitted for use on any equipment used with this system.

7.5.7 Welded connection systems

All couplers, whether in hydraulic or chemical services shall be butt-welded, except were otherwise specified within this document. All couplers shall be fitted with seals from identical compounds. All hydraulic or chemical service valves and fittings shall be butt welded.

- Connections shall be welded to the extent practical
- Autogenously welding shall be acceptable on 316L materials
- Liquid penetrate testing shall be performed on all tubing welds

Note: all welding has to be performed in accordance to approved Cameron welding specification.

8 Electric Systems

8.1 Terminal Type

Screw type terminals shall be used on all topside equipment.

8.2 Instrument Type

For the use in hazardous area EEx-d type instruments shall be used.

8.3 Electrical Motor Type

For the use in hazardous area EEx-d type electrical motors shall be used.

8.4 Cable entry for cabinets located in the Control Room

All cabinets located in the control room shall be designed to allow bottom cable entry only.

9 Functional Requirements

9.1 Coating & protection systems

9.1.1 Coating systems

All equipment manufactured from Carbon steels shall be protected with an approved coating system suitable for the design life of the equipment.

9.1.1.1 Subsea painting

Painting of all subsea components manufactured from Carbon steels shall be done in accordance to the approved paint specification A-020025-01

9.1.1.2 Painting of topside equipment for outside installation

Painting of all topside components located outside shall be done in accordance to the approved paint specification X-065460-04-04

- Top colour for surface equipment shall be light grey (RAL 7035).
- SST framework and parts shall normally NOT be painted, if not separately specified.

9.1.1.3 Painting of topside equipment for inside installation

Paint colour for MCS or EPU cabinet housings shall be light grey (RAL 7035).

9.1.2 Cathodic protection

9.1.2.1 General

The primary corrosion protection system for the control system Subsea equipment shall be via materials selection and suitable paint coatings.

A cathodic protection system using sacrificial anodes shall be utilised to protect the ‘bare steel’ components and to protect uncoated areas of any other control system hardware, i.e. such as those items not protected by the host equipment. Special attention shall be given to SST screws and bolts. All items to be protected shall be electrically connected using stranded, flexible SST 316 earthing braids of a suitable cross sectional area.

9.1.2.2 Calculations

Suitable CP calculations shall be carried out in accordance with the standard applicable for control system hardware i.e. not tree mounted equipment (this shall be part of the Subsea tree CP system). The CP system shall be designed to be capable of protecting the control system for the 20-year design life of the equipment.

9.1.2.3 Construction

The following principles shall be adhered when designing equipment for the subsea control system:

- All equipment metalwork shall be welded (or bolted) onto the equipment main structure to ensure any static potential build up is avoided by continuous drain to earth.
- All metallic items shall have earth continuity by physical connection i.e. metallic fastenings, clamps or earth straps. This shall include all valves, tubing, components, tubing clamps etc.

Electrical connectors may remain isolated from the structure provided suitable materials are chosen for their construction.

- When stainless steel fasteners are used in the construction of subsea structures or equipment, they shall be suitably earth bonded using earth straps. Carbon steel fasteners may alternatively be used.
- Anodes mounted on equipment sub-structures shall be manufactured from material identical and from the same batch as those fitted to the main structure.
- The anodes shall comply with the Cameron material specification MS-011310-01.
- The minimum distance from hydraulic tubing to anodes shall be 80 mm. If unavoidable it is acceptable to have a distance of less than 80 mm for some cases.
- Earthing conductors shall be of corrosion resistant material and shall be securely fastened and protected where necessary against damage and electrolytic corrosion. Where earth-bonding straps are used, conductive paste shall be smeared on contact surfaces (not threads) to ensure a lasting low resistance contact. Where the metallic composition of equipment requiring earth bonding differs from the main structure, care shall be taken in the selection of the bonding strap material to minimise possible ill effects of different contact potentials.
- Connections shall be secured using star-type shake proof washers such that they cannot work loose under vibration.

9.2 Project specific Tag Numbers

This is a list of Tag numbers to be used for K5F equipment. All units and components on this list need to be marked with these numbers as per Total Spec. NL00-Z-74-055.

Instruments	Equipment	Description	Comments
	NN-82201	TUTU	
	NN-82202	HPU	
	NN-82203	HPU PLC	
	NN-81203	MCS	
	NN-81204-1	EPCU 1	
	NN-81204-2	EPCU 2	
	NN-81204-3	EPCU 3	
	NN-81204-4	EPCU 4	
	SA-92100A	Anode Package A	
	SA-92100B	Anode Package B	
	UTA-92100	UTA	
	UTA-92101	IUTA	FUTURE
	UTA-92102	IUTA	FUTURE
	PRCM-92100.1A	PRCM A well 1	
	PRCM-92100.1B	PRCM B well 1	
	SC-92100.1A	Cathode A well 1	
	SC-92100.1B	Cathode B well 1	
	ESCM-92100.1A	ESCM A well 1	
	ESCM-92100.1B	ESCM B well 1	
	DVA-92103.1	Dump valve assembly well 1	
	DHSV-92103.1	Downhole safety valve well 1	

	PRCM-92100.2A	PRCM A well 2	
	PRCM-92100.2B	PRCM B well 2	
	SC-92100.2A	Cathode A well 2	
	SC-92100.2B	Cathode B well 2	
	ESCM-92100.2A	ESCM A well 2	
	ESCM-92100.2B	ESCM B well 2	
	DVA-92103.2	Dump valve assembly well 2	
	DHSV-92103.2	Downhole safety valve well 2	
	PRCM-92100.3A	PRCM A well 3	
	PRCM-92100.3B	PRCM B well 3	
	SC-92100.3A	Cathode A well 3	
	SC-92100.3B	Cathode B well 3	
	ESCM-92100.3A	ESCM A well 3	
	ESCM-92100.3B	ESCM B well 3	
	DVA-92103.3	Dump valve assembly well 3	
	DHSV-92103.3	Downhole safety valve well 3	
	PRCM-92100.4A	PRCM A well 4	
	PRCM-92100.4B	PRCM B well 4	
	SC-92100.4A	Cathode A well 4	
	SC-92100.4B	Cathode B well 4	
	ESCM-92100.4A	ESCM A well 4	
	ESCM-92100.4B	ESCM B well 4	
	DVA-92103.4	Dump valve assembly well 4	
	DHSV-92103.4	Downhole safety valve well 4	
	HP-92100.1	HP Jumper UTA to tree 1	
	MEOH-92100.1	MeOH Jumper UTA to tree 1	
	KHI-92100.1	KHI Jumper UTA to tree 1	
	CI-92100.1	CI Jumper UTA to tree 1	
	COAX-92100.1A	Coax Jumper UTA to PRCM A tree 1	
	COAX-92100.1B	Coax Jumper UTA to PRCM B tree 1	
	PC-92100.1A	P/C Jumper PRCM A to ESCM A tree 1	
	PC-92100.1B	P/C Jumper PRCM B to ESCM B tree 1	
	HP-92100.2	HP Jumper UTA to tree 2	
	MEOH-92100.2	MeOH Jumper UTA to tree 2	
	KHI-92100.2	KHI Jumper UTA to tree 2	
	CI-92100.2	CI Jumper UTA to tree 2	
	COAX-92100.2A	Coax Jumper UTA to PRCM A tree 2	
	COAX-92100.2B	Coax Jumper UTA to PRCM B tree 2	
	PC-92100.2A	P/C Jumper PRCM A to ESCM A tree 2	
	PC-92100.2B	P/C Jumper PRCM B to ESCM B tree 2	
	HP-92100.3	HP Jumper UTA to tree 3	FUTURE
	MEOH-92100.3	MeOH Jumper UTA to tree 3	FUTURE
	KHI-92100.3	KHI Jumper UTA to tree 3	FUTURE

	CI-92100.3	CI Jumper UTA to tree 3	FUTURE
	COAX-92100.3A	Coax Jumper UTA to PRCM A tree 3	FUTURE
	COAX-92100.3B	Coax Jumper UTA to PRCM B tree 3	FUTURE
	PC-92100.3A	P/C Jumper PRCM A to ESCM A tree 3	FUTURE
	PC-92100.3B	P/C Jumper PRCM B to ESCM B tree 3	FUTURE
PCV-92101.1		Production Choke valve well K5F-1	
PWV-92101.1		Production Wing Valve well K5F-1	
UPMV-92102.1		Upper Production Master Valve well K5F-1	
DHSV-92103.1		Down Hole Safety Valve well K5F-1	
AMV-92103.1		Annulus Master Valve well K5F-1	
BAIV-92100.1		B Annulus Isolation Valve well K5F-1	
XOV-92101.1		Crossover Valve well K5F-1	
CIV-92101.1		Chemical Injection Valve well K5F-1	
CIV-92102.1		Chemical Injection Valve well K5F-1	
CIV-92103.1		Chemical Injection Valve well K5F-1	
XEV-92103.1		HP Dump Valve (solenoid) well K5F-1	
PPU-92101.1		Production Pressure Upstream well K5F-1	
PPD-92111.1		Production Pressure Downstream well K5F-1	
APTA-92103.1		Annulus Pressure Transmitter A well K5F-1	
APTB-92105.1		Annulus Pressure transmitter B well K5F-1	
PTD-92101.1		Production Temperature Downstream well K5F-1	
PTU-92104.1		Production Temperature Upstream well K5F-1	
PT-92104.1		Downhole Pressure Transmitter	
TT-92-103.1		Downhole Temperature Transmitter	
PCV-92101.2		Production Choke valve well K5F-2	
PWV-92101.2		Production Wing Valve well K5F-2	
UPMV-92102.2		Upper Production Master Valve well K5F-2	
DHSV-92103.2		Down Hole Safety Valve well K5F-2	
AMV-92103.2		Annulus Master Valve well K5F-2	
BAIV-92100.2		B Annulus Isolation Valve well K5F-2	
XOV-92101.2		Crossover Valve well K5F-2	
CIV-92101.2		Chemical Injection Valve well K5F-2	
CIV-92102.2		Chemical Injection Valve well K5F-2	
CIV-92103.2		Chemical Injection Valve well K5F-2	
XEV-92103.2		HP Dump Valve (solenoid) well K5F-2	
PPU-92101.2		Production Pressure Upstream well K5F-2	
PPD-92111.2		Production Pressure Downstream well K5F-2	
APTA-92103.2		Annulus Pressure Transmitter A well K5F-2	
APTB-92105.2		Annulus Pressure transmitter B well K5F-2	
PTD-92101.2		Production Temperature Downstream well K5F-2	
PTU-92104.2		Production Temperature Upstream well K5F-2	
PT-92104.2		Downhole Pressure Transmitter	
TT-92103.2		Downhole Temperature Transmitter	
PCV-92101.3		Production Choke valve well K5F-3	FUTURE
PWV-92101.3		Production Wing Valve well K5F-3	FUTURE
UPMV-92102.3		Upper Production Master Valve well K5F-3	FUTURE

DHSV-92103.3		Down Hole Safety Valve well K5F-3	FUTURE
AMV-92103.3		Annulus Master Valve well K5F-3	FUTURE
BAIV-92100.3		B Annulus Isolation Valve well K5F-3	FUTURE
XOV-92101.3		Crossover Valve well K5F-3	FUTURE
CIV-92101.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92102.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92103.3		Chemical Injection Valve well K5F-3	FUTURE
XEV-92103.3		HP Dump Valve (solenoid) well K5F-3	FUTURE
PPU-92101.3		Production Pressure Upstream well K5F-3	FUTURE
PPD-92111.3		Production Pressure Downstream well K5F-3	FUTURE
APTA-92103.3		Annulus Pressure Transmitter A well K5F-3	FUTURE
APTB-92105.3		Annulus Pressure transmitter B well K5F-3	FUTURE
PTD-92101.3		Production Temperature Downstream well K5F-3	FUTURE
PTU-92104.3		Production Temperature Upstream well K5F-3	FUTURE
PT-92104.3		Downhole Pressure Transmitter	FUTURE
TT-92103.3		Downhole Temperature Transmitter	FUTURE
PCV-92101.4		Production Choke valve well K5F-4	FUTURE
PWV-92101.4		Production Wing Valve well K5F-4	FUTURE
UPMV-92102.4		Upper Production Master Valve well K5F-4	FUTURE
DHSV-92103.4		Down Hole Safety Valve well K5F-4	FUTURE
AMV-92103.4		Annulus Master Valve well K5F-4	FUTURE
BAIV-92100.4		B Annulus Isolation Valve well K5F-4	FUTURE
XOV-92101.4		Crossover Valve well K5F-4	FUTURE
CIV-92101.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92102.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92103.4		Chemical Injection Valve well K5F-4	FUTURE
XEV-92103.4		HP Dump Valve (solenoid) well K5F-4	FUTURE
PPU-92101.4		Production Pressure Upstream well K5F-4	FUTURE
PPD-92111.4		Production Pressure Downstream well K5F-4	FUTURE
APTA-92103.4		Annulus Pressure Transmitter A well K5F-4	FUTURE
APTB-92105.4		Annulus Pressure transmitter B well K5F-4	FUTURE
PTD-92101.4		Production Temperature Downstream well K5F-4	FUTURE
PTU-92104.4		Production Temperature Upstream well K5F-4	FUTURE
PT-92104.4		Downhole Pressure Transmitter	FUTURE
TT-92103.4		Downhole Temperature Transmitter	FUTURE

9.3 Special Requirements

All warning and emergency signs need to be English **and** Dutch language as per NL00-U-6S-061.

10 Equipment Requirement Specification

10.1 Master Control Station (MCS)

The redundant MCS will be the communication interface between the ICSS and the K5F electrical Subsea Control Modules (ESCM). The MCS will be located in the electrical switch room of the K6P Platform (safe area) and will be powered from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-01 Supplemental Requirements Specification for MCS Hardware

X-076721-87-02 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Control and Management

X-076721-87-03 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Process Interlocks and Shutdowns

X-076721-87-12 Supplemental Requirements Specification for MCS/ICSS Control Interface

10.2 Electrical Power and Control Unit (EPCU)

The EPCU is a redundant electrical power and communication unit for high voltage DC power supply and communication to the subsea installed ESCM's. The EPCU will be located in the electrical switch room of the K6P Platform (safe area) and will receive separate power supply for channel A and B from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-04 Supplemental Requirements Specification for EPCU

10.3 Hydraulic Power Unit (HPU)

A dedicated Hydraulic Power Unit (HPU) will be installed on the K6C platform to provide clean hydraulic HP power for the control of the K5F Downhole Safety Valves (DHSV). The HPU will be controlled from a remote PLC located in a safe area and will be monitored by the MCS/ICSS.

Design Pressure = 690 bar

Hydraulic Fluid = Castrol Transaqua HT

Refer to the following documents for detailed technical requirements:

X-076721-87-05 Supplemental Requirements Specification for HPU

10.4 Topside Umbilical Termination Unit (TUTU)

The Topside Umbilical Termination Unit (TUTU) shall terminate the main electro/hydraulic/chemical umbilical lines and provide the interface to the K6C platform equipment. It will only provide a hardware interface without any block/bleed-valves and/or Pressure gauges for testing or maintenance work. All tubing and couplers need to be supplied by others. The electrical cables shall be terminated in separately mounted explosion proof Junction Boxes or with moulded splice connections.

Refer to the following documents for detailed technical requirements:

X-076721-87-06 Supplemental Requirements Specification for TUTU

10.5 Umbilical Termination Assembly (UTA)

The Umbilical Termination Assembly (UTA) shall be a robust construction to provide interfaces with the umbilical and shall allow to suitably terminating all functions. The UTA shall be setup for the hydraulic connection of the two trees currently in the scope of supply and the two future trees.

Refer to the following documents for detailed technical requirements:

X-076721-87-07 Supplemental Requirements Specification for UTA

10.6 Power Regulation and Control Module (PRCM)

The Power Regulation and Communication Module (PRCM) regulate the power to the ESCM and provide communication to the ESCM. It also provides the connection to the external cathode package.

The PRCM shall be diver recoverable by using a special change out tool and shall be connected to a mounting base.

10.7 Electric Subsea Control Module (eSCM)

The eSCM controls various electric actuators on the tree/wellhead and acquires data from the subsea instrumentation for the transmission to the surface.

The following functions need to be controlled by the eSCM:

No.	Function	Actuator Size	Location	Note
1	CIV 1	¾”	Tree	
2	CIV 2	¾”	Tree	
3	CIV 3	¾”	Tree	
4	BAIV	¾”	Wellhead	
5	AMV	2”	Wellhead	
6	XOV 1	2”	Tree	
7	UPMV	5”	Tree	
8	PWV	5”	Tree	
9	PCV	N/A	Tree	
10	SCSSV Open	N/A	Tree	
11	SCSSV Close	N/A	Tree	

The following tree sensors need to be monitored by the eSCM:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

10.8 Anode Package / Anode Package Foundation Base

There are two separate Anode Packages for the A and the B channel of the system. The Anode Package shall be a robust frame construction for two separate and diver retrievable Anodes. The Anode package requires two separate electrical connectors for each anode for the connection via a flying lead to the anode umbilical assembly. The Anode Packages need to be clearly marked with “A” and “B”. The painted steel frame is protected by FRP grating on all four sides and on top to prevent damages caused by dropped objects. The two anode packages for the channels A and B will be placed on a further support frame to minimize the required installation effort. Both Anode Packages will be located on a Foundation Base.

10.9 Cathode Package

There are four separate Cathode Packages for the A and B channel of each tree. The Cathode Packages will be connected to the respective PRCM on the Subsea Protection Structure via an electrical flying lead. The Cathode Packages are diver installable and will be hooked into the outside plates of the Subsea Protection Structure. The Cathode Package contains the cathode itself and a frame with FRP grating on top to provide mechanical protection.

10.10 Anode Umbilical Assembly

The complete Anode Umbilical Assembly includes the following items:

- an approx. 100m long umbilical with an overall armour and four separate armoured 2,5mm² cores
- a pulling head assembly with 100mm diameter
- a hang-off assembly
- bend restrictor assembly at the Subsea end of the umbilical incl. clamping surface to fix the umbilical
- 4 pigtails, each 6m long, at the end of the umbilical

10.11 Electrical Flying Leads

The electrical flying leads shall comprise a cable moulded to the subsea connectors at both ends. The colour of these cables shall be black with a marking by means of approx. 30cm long heat shrinks at both ends. System A will be marked “blue” and System B “yellow”. These flying leads shall be designed for diver make up only.

10.12 Tree/Wellhead Pressure and Temperature Sensors

The following Pressure and Temperature Sensors are located on the Tree and the Wellhead:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

These sensors shall meet the following requirements:

- Field proven design
- The sensors shall be suitable for the intended subsea service
- Redundant with separate interconnection cables for the A and B channel
- Diver retrievable sensors
- With block-bleed-block assemblies on the pressure sensors
- Minimum accuracy of:
    - +/- 0.03% x full scale accuracy and a drift of 0.2%/year for the pressure sensors
    - +/- 0.3°C accuracy and a drift of 0.2°C/year for the temperature sensors

10.13 SCSSV Dump Valve Assembly

A 3/2 way valve shall be located on the tree for the operation of the SCSSV. The operation of this valve will be direct hydraulic by use of Transaqua HT fluid from a dedicated HPU through a single HP supply line in the main umbilical. The valve shall be designed for the design pressure of the SCSSV system and shall be activated by the ESCM. This assembly will consist of a fixed plate which will be located on the tree and a free plate with the dump valve on which is diver retrievable. Both plates will be connected via quick couplers without the use of poppets. The tree tubing will be connected to the fixed plate by using Autoclave anti-vibration couplers.

11 Quality requirements

A Quality Plan to be used for the project shall be created. For the Project Quality Specification see section 5.1 of this document.

11.1 CE Marking

The topside hardware and software is to be supplied with a CE declaration of conformity, which confirms compliance with all relevant directives.

12 Handling/Installation/Intervention & Shipping

Project shall provide detailed installation and intervention recommendations, and step-by-step project specific procedures, for review as part of the project-engineering phase.

All separately installable and retrievable items shall be provided with suitable lifting points and be generally designed to allow a smooth, simple and quick installation/retrieval process to be performed by divers. This shall include the following items:

- Electric Subsea Control Module (eSCM)
- Power Regulation & Communication Module (PRCM)
- Electrical flying leads between
  - Tree/Wellhead located junction boxes and sensors
  - UTA and PRCM
  - PRCM and ESCM
  - PRCM and Cathode Package

  Tree and Wellhead Pressure and Temperature Sensors
- SCSSV Dump Valve Assembly
- Anode Umbilical Assembly

All subsea assemblies shall be designed to withstand an abandonment period of 6 month sub sea, located where required but not connected to its services (hydraulic, chemical, electrical, ..)

12.1 Use of guidelines

All Subsea equipment (trees, choke inserts, jumpers, control modules, etc.) shall be designed for installation and retrieval by divers with the use of guidelines.

12.2 Lifting / Handling

All equipment shall be designed for safe handling and transportation, both onshore and offshore. All lifting points on all equipment handled offshore shall be:

- Physically load tested to rated weight
- Designed for loads as defined in API 17D and API RP 17G.
- Any welding and associated NDE, which is required for lifting apparatus shall be in compliance with API 17D and API RP 17G.
- All lifting points on all equipment, both purchased and rented; to be handled offshore shall be tested and labelled in accordance with API 17D and API RP 17G.
- All shipped equipment assemblies shall be labelled with their weight.
- Slings and rigging shall be provided for items that require lifting.

12.3 Connection of flying leads

The Subsea hydraulic and electrical flying leads shall be designed to be installed by the use of divers.

Following installation of the Xmas tree, the diver (after removing the LTC from the remote stab or connector) shall pick up the remote end connection and install it to the UTA or Wellhead.

The process shall be similar for the electrical connector.

For recovery the procedure shall be reversed.

12.4 ROV Interfaces

All ROV and diver interfaces shall be designed in accordance with ISO 13628-8.

12.5 ROV Marking of Subsea Stations

Marking of subsea station shall be in accordance with ISO 13628-1 and the following requirements:

- Letter size shall be 50mm

13 Testing

Each item of deliverable equipment shall be tested in accordance with a project approved and CAMERON supplied acceptance test procedure to verify the following as a minimum:

- Functionality
- Internal pressure testing
- External pressure testing
- Control fluid cleanliness to SAE AS4059

CAMERON shall provide written step-by-step procedures for these tests to be provided to COMPANY.

A Control System Integration Test shall be performed in accordance with a COMPANY approved procedure to demonstrate that all of the individual items of equipment function correctly as a system.

The testing programme for the Subsea Production Control System shall be undertaken in the stages detailed as follows:

- Factory Acceptance Test for single units (FAT's)
- System Factory Integration Testing (FIT)
- Tree EFAT
- System Integration Testing (SIT)
- Platform Commissioning
- Offshore Pre-submergence Testing/Deck Testing
- System Commissioning

13.1 Factory Acceptance Test (FAT)

Each deliverable item shall be subjected to a Factory Acceptance Test (FAT). The purpose of this FAT shall be to demonstrate the item is suitable for the intended purpose and functions correctly. FAT tests shall include hydrostatic proof pressure testing to 1.5 times the design pressure of the Subsea control system.

All FAT procedures shall be step-by-step and submitted for review and approval prior to testing commencing.

All critical equipment components shall be subjected to sub-assembly tests during the assembly phase of manufacture and to carry out these tests, the necessary equipment and fittings are specialised in-house equipment and are not project deliverable.

Each item of equipment shall be subject to an in-house FAT in accordance to an approved standard procedure document to demonstrate these meet the specified operational and functional requirements.

The tests shall include interface connections and mechanical alignment tests to verify design and manufacturing limit tolerance effects, component inter-changeability, together with hydraulic fluid system flushing and / or cleanliness checks as necessary to ensure the system meets SAE AS4059. The hydraulic tubing and piping pressure lines shall be hydrostatic pressure tested to 1,5 times the design pressure.

The test equipment shall be determined by the proposed testing programme, however in the event of additional testing or if testing in other locations is required, the quantity of test equipment detailed shall be subject to review.

Testing of fabricated items shall also include continuity testing of bolting.

Testing on subsea assemblies shall include continuity testing and earthing testing.

The maximum value for the resistance measured shall be 0.1 Ohm.

13.1.1 Environmental Stress Screening (ESS)

Modules or subassemblies containing electrical equipment and/or electronic equipment, which are intended for permanent subsea installation shall comply with section 4 of the Total specification GS EP SPS 022 “Environmental testing of Subsea Electronics”.

13.2 Factory Integration Test (FIT)

A System Factory Integration Test (FIT) shall be conducted to verify the correct interfacing and inter-working of all items of the subsea production control system equipment. External interfaces, for example Xmas tree valves & sensors, umbilical cables, DCS, MCC & ESD systems etc. shall be simulated for the purpose of the test. The testing shall be designed to verify the functional and operational integrity of the subsea production control system.

13.3 Xmas Tree/SCM system integration test (Tree eFAT)

A Xmas Tree/SCM System Integration Test shall be conducted for the Xmas tree, following completion of the Xmas tree FAT within the factory.

14 Special packing/shipping procedures/Instructions

For deliverables consisting of a main assembly with additional loose items (Lifting Slings, Test Hoses/Cables, Fill Lance, Pre-Charge Kit, Fluid in Barrels etc.), separate packing/shipping procedures/instructions with included component check-lists shall be provided.

The same shall apply for deliverables that can not be shipped as complete units, as transportation could result in damage of internal components.

These procedures/instructions should be part of the BOM from the related parts.

For all units which include any fluids or substances, COSHH sheets (Control of Substances Hazardous to Health) shall be delivered with the unit. These COSHH sheets shall be available early in the process for supply to the client.

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

10NOV08	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
07MAY08	Issued for Client Comment	A. Weilandt	S. Horne	
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Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirements Specification for PRCM**		
PAGE 1 OF 8	**Customer Document Number:**	54NL92-W-0S-515	REV. 1
	Cameron Document No.	X-076721-87-14	REV. 01

1 INTRODUCTION

This document is written to consolidate the technical requirements for the Power Regulation and Communication Module (PRCM) intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

2 SCOPE OF THIS DOCUMENT

The scope of this document is to define the technical requirements for the PRCM intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

3 Document revision status / record

Table 3-1 – Amendments

Date	Rev.	Description	Author
05MAY08	A	Initial Release	A. Weilandt
07MAY08	B	Issued for Client Comment	A. Weilandt
10NOV08	01	Approved for Construction	A. Weilandt

4 ABBREVIATIONS & DEFINITIONS

For abbreviations and definitions used within the Total K5F Project see related documents referenced within section 5.1 of this document.

Abbreviations and Acronyms that are specific to this document alone, for readability purposes are listed in this section:

Table 4-1 – Abbreviation/Acronym

Abbreviation/Acronym	Description
AVL	Approved Vendor List
SCAP	Subsea Cathode Package Assembly
DOCOT	Diver operated change out tool
ESCM	Electric Subsea Control Module
FAT	Factory Acceptance Test
PRCMMB	PRCM Mounting Base
TBD	To be determined

5 References

5.1 Cameron Reference Documents

This section defines the supporting Cameron documents to be used for evaluations against overall project requirements.

Table 5-1 – Cameron Reference Documents

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

5.2 Customer Reference Documents

This section defines the supporting customer documents to be used for evaluations against overall project requirements.

Table 5-2 – Customer Reference Documents

Description	Number
Total “Design basis for K5F project”	EDMP #32611
External protection of offshore and coastal structures/equipment by painting	GS EP COR 350
Subsea production control system	GS EP SPS 019
Environmental Testing of subsea electronics	GS EP SPS 022

5.3 Industry Reference Documents

This section defines supporting industry and regulatory documents to be used for evaluations against overall project requirements.

Table 5-3 – Industry Reference Documents

Number	Description
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 13628-8 (Comparable to API Spec.17H)	Design and Operation of ROV Interfaces on Subsea Production Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements

6 Scope of Supply

The scope of supply for the PRCM shall consist of the following:

6.1 Deliverable Documentation

The deliverable documentation for the PRCM shall consist of the following as a minimum:

NOTE: All documents shall show metric units of measure as a minimum.

6.1.1 Engineering Documentation Requirements for PRCM

- Assembly Drawing
- Circuit Diagram
- Factory Acceptance Test Procedure
- Installation, Retrievable & Maintenance Procedure

7 PRCM Design Specifications

7.1 Equipment Design Requirements

Design requirements for the PRCM are defined as follows:

Features	Design Requirements	Comments
Maximum Dimensions	760mm x 760mm (Footprint) Height: 920mm (in locked position) Height: 1023mm (in unlocked position)	With open and non oil-filled cover design
Maximum Weights	1000 kg (in air) 765 kg (in water)	
Service Life	20 years	
Interface	The PRCM is installed and latched onto its associated PRCMMB using a diver operated running/retrieving tool (DOCOT). Interface to the PRCM is via an Lift/Latch mandrel in accordance to API17H / ISO 13628-8 Type “A”.	
Electrical Connections	All electrical connections are made through 90° angled electrical connectors at the front. 1x Coax connector for Power/Comms (4KV DC/4A) from UTA 1x 12pin connector for separate Power and Comms to the ESCM (300V DC/40A) 1x 4pin connector for Return path connection to SCPA	
Input Data	4000V DC, max. 4A	From the UTA
Output Data	300V DC, max. 40A	To the ESCM
Marking	- Equipment Tag Number - Weight in air - “Front” - Cameron PN - Unique Serial Number - “COP” for Coax connector - “PC” for connector to ESCM - “RP” for Connector to SCPA	

7.2 PRCM FAT Procedure

The PRCM shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- Lockdown Test
- Electrical Continuity and Insulation Resistance checks
- Communication and Diagnostics checks

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

14.07.2008	Internal Revision	J. Grochowski	M. Lehmker	J. G.
04.09.2007	Approved for Construc.	J. Grochowski	M. Lehmker	S. Fischer
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CAMERON	**Document Title:** **Installation , Retrieval & Maintenance Procedure** **For Power Regulation Communication Module**		
PAGE 1 OF 13	**Customer Document Number:**	54NL92-W-0P-534	REV. 1
	Cameron Document No.	X-065467-02-14	REV. 02

Document Revision History

Rev	Date	Description of change	Reason for change
A	9. May 2007		Initial Release
B	28.08.2007	Comments included	Internal review
01	4. September 2007	Cross references checked	released
02	14. July 2008	Offshore shipping frame included	Internal feedback

Table of Contents

1 Abbreviations

BOM	Bill Of Material
CAM	CAMERON
DDCOT	DC Diver Change Out Tool
EPCU	Electrical Power & Communication Unit
FAT	Factory Acceptance Test
HP	High Pressure
LTC	Long Term Cover
MCS	Master Control Station
N/A	Not applicable
PN	Part Number
PRCM	Power Regulation & Communication Module
eSCM	electric Subsea Control Module
MB	Mounting Base

2 Scope

This document covers the requirements for the Installation & retrieval of the CAMERON Power Regulation & Communication Module (PRCM) within the K5F project. Offshore and onshore activities (for example FAT, FIT, SIT) are covered. It is applicable for:

- PRCM Part Number 223052-98

3 Reference Documents / Drawings

Description	CAM Doc. No.
Bill of Material (BOM): PRCM	223052-98
ASSEMBLY DRAWING: PRCM	SK-066052-98
ASSEMBLY DRAWING: PRCM Mounting Base	SK-066415-99

4 Required Equipment

4.1 Equipment for Subsea Installation

1 Offshore Shipping Frame PN 223211-53 to be configured for PRCM
1 DC Diver Change Out Tool PN 2175479-35-01
1 Lifting Eye (for safe PRCM lifting) PN 223260-99

4.2 Equipment for Surface Installation

1 Transport Frame PRCM PN 223211-13
1 Lockdown Device PN TBA
1 Lifting Eye (for safe PRCM lifting) PN 223260-99

5 Safety Warning

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

All personnel must acquaint themselves fully and strictly adhere to all company sites' HEALTH AND SAFETY AT WORK REGULATIONS, together with other specific requirements detailed in this procedure.

All work is to be carried out within either a dedicated test bay area with authorised personnel entry points, or an area adequately protected from unauthorised access with a visible cordoned zone and adequately displayed warning signs detailing the test type and associated hazards.

The lifting and handling of the equipment must be carried out with extreme caution and with regard to the safety regulations.

All personnel in contact with the hydraulic fluid must wear suitable protective clothing and gloves if required, regarding all the necessary precautions detailed on the fluid data sheets.

For work, which includes the use of pressurised fluid, compressed gas and/or electrical voltage, all necessary suitable and adequate precautions must be taken prior beginning of work.

All personal working on the equipment must have the required experience, training and qualifications.

ENSURE THAT NO ELECTRICAL POWER IS APPLIED TO ANY OF THE CONNECTIONS IF CONNECTIONS ARE MADE – UP OR DISCONNECTED.

6 Equipment Description

The PRCM is designed to be mounted on its MB that is located at the Subsea Protection Structure. PRCM contains the electronic to control the power and communication for the eSCM. The electric connectors are mounted on the front side of the PRCM. The PRCM fits only with the correct orientation to its mounting base. Therefore several guide pins and profiles are installed under the skirt. The lockdown mechanism is operated by the lifting mandrel of the PRCM centred on top. Two yellow rings mark the UNLOCKED and LOCKED position:

Photo: PRCM mandrel in UNLOCKED position, hanging from a crane secured by lifting eye PN 223260-99

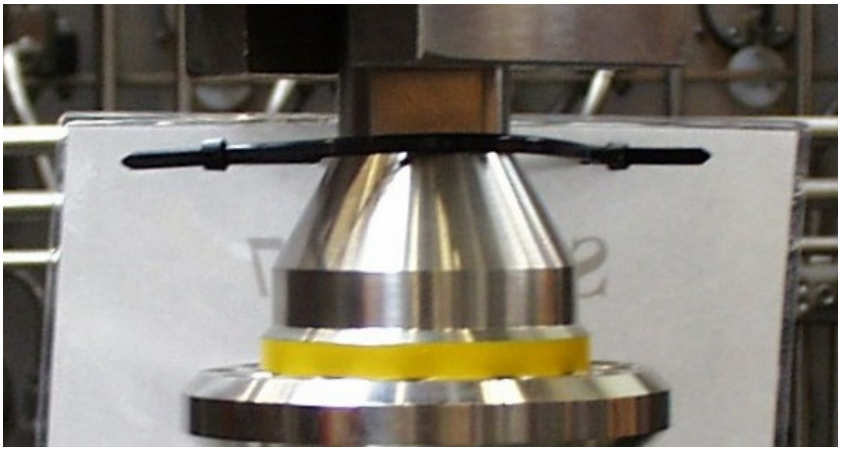

Photo: PRCM mandrel in LOCKED position, located on test stand

7 Lifting of the PRCM

Note: All offshore operations to comply with appropriate Permit to Work system.

Lifting weight: approx. 0.9 t in air

Visually inspect the PRCM for damage before and after lifting.

Verify:_____

Ensure that a wooden pallet or transport frame (PN 223211-13) is available to set down the lifted PRCM. Wooden pallet is not to be used offshore.

Verify:_____

Refer lift point (lift mandrel) on top of the PRCM. A special lifting eye Cameron P/N 223260-99 has to be used for safe lifting (Photo on previous page). To ensure that the PRCM is not damaged, never set the PRCM directly on the ground.

Verify:_____

Attach the lifting eye to the lift mandrel and then onto the crane. Ensure the wooden packing is removed and the PRCM is not fixed to the transport frame.

Verify:_____

Lift the PRCM off the transport frame and carefully set the PRCM down onto the destination point with the correct orientation (Front is marked). If the PRCM is installed on a aTest Structure, refer to section “Installation on the Test Structure”.

Verify:_____

8 Subsea Retrieval and Installation

8.1 General Requirements for Retrieval and Installation

DANGER!

Risk of electric shock for diver. Switch off electric power for the correct PRCM at EPCU before disconnection / connection. Secure electric power against turning on. Refer to tagging and never confuse PRCM modules subsea.

Use the PRCM together with the DDCOT.

PRCM Lifting Weight: Approx. 0.6 t in water.

8.2 Retrieval of PRCM

Switch off the EPCU power supply of the PRCM that will be removed.

Verify:_____

Diver must identify PRCM and disconnect the three (3) plugs at the front:

- Connection to eSCM
- Connection to cathode
- Connection to supply

Verify:_____

Set up DDCOT, carry out pre-deployment checks in accordance with manuals.

Verify:_____

Prior to retrieval ensure that a replacement PRCM is prepared for immediate installation. Refer to section “Preparation of the PRCM for Installation”.

Verify:_____

Ensure that the route to the Subsea Protection Structure is clear for the DDCOT. Any Subsea Protection Structure protection or cover shall be moved / opened.

Verify:_____

Maximum deployment speed and unlock pressure have to be advised:

Maximum Deployment Speed	Unlock Force
0.3 m/s	Refer PRCM Assembly Drawing

Note limits of DDCOT: Maximum velocity 1.5 m/s
Maximum acceleration 1.5 g
Maximum load-out velocity 300 mm/s

Lower the DDCOT to the PRCM mounting base (John Brown Interface).

Verify:_____

Land / latch the DDCOT on the mounting base according to DDCOT manual.

Verify:_____

Extend the DDCOT to the PRCM. Operate the Unlock mechanism of the PRCM using the DDCOT. Two yellow rings around the locking tube mark the Lock and Unlock position of the PRCM. Refer PRCM Assembly Drawing.

Verify:_____

Withdraw the PRCM in the DDCOT according to manuals.

Verify:_____

Unlatch the DDCOT from the mounting base.

Verify:_____

Retrieve the PRCM in accordance with DDCOT manual.

Verify:_____

Land DDCOT on the DOCOT shipping frame, and deposit the PRCM into it temporary location. Unload PRCM from the DDCOT in accordance to DDCOT manual. Carry out DDCOT post-deployment checks as applicable.

Verify:_____

WARNING!
The PRCM mounting base is not to be left uncovered indefinitely. Deploy a replacement PRCM within 48 hours of PRCM removal.

8.3 Preparation of a PRCM for Installation

Note: These steps have to be followed before the PRCM goes subsea.

Visually inspect the underside and front of the PRCM for damage or dirt.

Verify:_____

Ensure that all protective covers have been removed from the PRCM electrical connectors.

Verify:_____

Ensure that the 2 guide pins below the base plate are lubricated with water resistant grease.

Verify:_____

8.4 Subsea Installation of PRCM

Check that the electric power supply to the PRCM is still interrupted.

Verify:_____

Carry out DDCOT pre-deployment checks in accordance with the manuals.

Verify:_____

Check the orientation of PRCM with relation to the DDCOT. Load PRCM into the DDCOT according to DDCOT manual.

Verify:_____

Ensure that the route to the Subsea Protection Structure for the DDCOT is cleared, any protection shall be moved / opened.

Verify:_____

Ensure that the mounting base cover (or Long Term Cover) has been removed prior to the deployment of the DDCOT.

Verify:_____

If the mounting base is topside & available for inspection, visually inspect the mounting base for damage or dirt.

Verify:_____

Maximum deployment speed and lockdown pressure have to be advised:

Maximum Deployment Speed	Lockdown Force
0.3 m/s	Refer PRCM Assembly Drawing

Note limits of DDCOT: Maximum velocity 1.5 m/s
Maximum acceleration 1.5 g
Maximum load-out velocity 300 mm/s

Deploy the DDCOT to subsea.

Verify:_____

Land / latch the DDCOT on the mounting base (John Brown Interface) according to manuals.

Verify:_____

Deploy the PRCM to the mounting base using the DDCOT. Operate the lockdown mechanism of the PRCM using the DDCOT. Two yellow rings around the locking tube mark the Lock and Unlock position of the PRCM (photos in section “Equipment Description”).

Verify:_____

Unlatch the DDCOT from the PRCM according to manuals.

Verify:_____

Unlatch the DDCOT from the mounting base (John Brown Interface).

Verify:_____

Retrieve the DDCOT to the surface.

Verify:_____

Land DDCOT on the shipping frame and carry out post deployment checks.

Verify:_____

Diver must identify PRCM and connect the three (3) plugs at the front.

Verify:_____

Commission the PRCM within 48 hours after installation.

9 Surface Installation

Note
This section is to be used when installing the PRCM on the Subsea Protection Structure in the workshop or on side.

WARNING!
Ensure that the Electric Power to the PRCM is switched off before connections are made up or disconnected. Voltage is up to 4000V DC. Installation or retrieval with power on will cause connector damage.

9.1 Unpacking the PRCM

Carefully remove the top and the sides of the box.

Verify:_____

9.2 Handling and Lifting the PRCM in the Workshop

If the PRCM is not mounted on a transport frame it has to be lifted as stated in the “Lifting of the PRCM” section of this document.

Verify:_____

Make the transport frame on which the PRCM is mounted accessible for a fork lift truck. The PRCM mounted on the transport frame moved by a fork lift truck is the preferred transport method.

Verify:_____

Remove the steel band that fixes the PRCM on transport frame after the PRCM reaches its destination location.

Verify:_____

9.3 Installation on the Test Structure

Ensure that all protective covers have been removed from the PRCM electrical connectors:

Verify:_____

Ensure that the 2 guide pins below the base plate are lubricated with water resistant grease.

Verify:_____

Ensure that electric power is switched off at all test equipment.

Verify:_____

Lift the PRCM according to lifting section of this document. Very slowly and with the correct orientation lower the PRCM to the mounting base on Test Structure.

Verify:_____

Maximum deployment speed and lockdown pressure have to be advised:

Maximum Deployment Speed	Lockdown Force
0.2 m/s	Refer PRCM Assembly Drawing

Lockdown the PRCM using the Lockdown Device.

Verify:_____

9.4 Post Installation Testing

Test of functions and instruments should be done according to the applicable test procedures.

9.5 PRCM Removal from the Test Structure

Switch off electric power to all test equipment. Disconnect the three (3) plugs at the front of the PRCM.

Maximum deployment speed and unlock pressure have to be advised:

Maximum Deployment Speed	Unlock Force
0.2 m/s	Refer PRCM Assembly Drawing

Unlock the PRCM using the Lockdown Device.

Lift the PRCM to the transport frame (refer lifting section). Set the PRCM on the transport frame with the correct orientation. FRONT is marked.

9.6 Repacking the PRCM

Install protective caps onto the electrical connectors. Protect the PRCM housing by foam foil and fix the PRCM on transport frame by steel bands. Do not damage the PRCM.
The PRCM shall be packed in an export quality wooden box that is built around the PRCM:

1. Construct a transit pallet that has fork lift truck lifting points.
2. Place a sheet of 6mm Neoprene on the top of the base of the packing case. This can protect the PRCM / transport frame and prevent contamination of the environment.
3. Set the PRCM / transport frame on the Neoprene sheet.
4. Attach four constraining slats to the top of the base of the packing case to protect the PRCM / transport frame from lateral movement.
5. Build the sides and top of the crate around the PRCM. Secure the PRCM against vertical movement by crosswise fixed beams above the PRCM.
6. Attach clear labels outside the box that the box has to be **HANDLED VERY CAREFULLY** and mark the top. The box should not be tipped.

The packed PRCM should be stored in a general warehouse.

10 Maintenance & Repair

The PRCM is free of maintenance. If repair work is required send it back to:

CAMERON GmbH
Lueckenweg 1
29227 Celle
Germany

Phone: +49 5141 806 0
Fax: +49 5141 806 333

Installation Procedure

for

Power Regulation & Communication Module Mounting Base

Cameron P/N 223415-99

Supplier:
CAMERON GmbH
Lueckenweg 1
29227 Celle
Germany
Phone: +49 5141 806 0
Fax: +49 5141 806 333

02	07. May 2007	M. Lehmker	R. Gabel	M. Lehmker
01	15. January 2007	J. Grochowski	M. Lehmker	J. Grochowski
CAM Rev	**Date**	**Prepared by**	**Checked by**	**Appoved by**

Document Revision History

Rev	Date	Description of change	Reason for change
01	15. January 2007		Initial Release
02	07. May 2007	Changed per K5F IDC comments	IDC comments

Table of Contents

1 Scope

This document covers the requirements for the Installation of the Power Regulation & Communication Module Mounting Bases (PRCMMB) on a subsea structure.

2 Reference Documents / Drawings

Description	CAM Doc. No.
BILL OF MATERIAL: PRCM Mounting Base	223415-99
ASSEMBLY DRAWING: PRCM Mounting Base	SK-066415-99

3 Abbreviations

BOM	Bill of material
CAM	CAMERON
PRCM	Power Regulation & Communication Module
PRCMMB	Power Regulation & Communication Module Mounting Base

4 Safety Warning

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

All personnel must acquaint themselves fully and strictly adhere to all company sites' HEALTH AND SAFETY AT WORK REGULATIONS', together with other specific requirements detailed in this procedure.

All work is to be carried out within either a dedicated test bay area with authorised personnel entry points, or an area adequately protected from unauthorised access with a visible cordoned zone and adequately displayed warning signs detailing the test type and associated hazards.

The lifting and handling of the equipment must be carried out with extreme caution and with regard to the safety regulations.

All personnel in contact with the hydraulic fluid must wear suitable protective clothing and gloves if required, regarding all the necessary precautions detailed on the fluid data sheets.

For work, which includes the use of pressurised fluid, compressed gas and/or electrical voltage, all necessary suitable and adequate precautions must be taken prior beginning of work.

All personal working on the equipment must have the required experience, training and qualifications.

5 Equipment Description

The PRCMMB is bolted on an intermediate frame that is welded to the subsea structure. After installation a PRCM will be mounted on the PRCMMB.

6 Lifting of the PRCM Mounting Base

This procedure is to be used only after the PRCM has been removed from the PRCMMB.

Verify: _____

Lifting weight: Approx. 1.3 t in air.

Visually inspect the package for damage before and after lifting.

Verify: _____

Ensure that the transport bracket is installed between the John Brown Interfaces according to the PRCMMB assembly drawing.

Verify: _____

Apply four (4) point lifting with soft slings to the PRCMMB top frame.

Verify: _____

Ensure that a wooden pallet is available to set down the lifted PRCMMB. Never set the PRCMMB on ground, otherwise painting will be damaged.

Verify: _____

Lift the PRCMMB carefully.

Verify: _____

Set the PRCMMB down to the wooden pallet.

Verify: _____

Secure the PRCMMB when it is not used.

Verify: _____

7 Installation of the PRCMMB

Lift the PRCMMB to the required location on the subsea structure.

Verify: _____

Ensure that the PRCMMB has the correct orientation on the subsea structure. The FRONT of the PRCMMB is marked.

Verify: _____

An intermediate frame is welded to the subsea structure.
Fix the PRCMMB to the intermediate frame by fourteen (14) ¾" bolts of stainless steel grade A4-70, torque 200 Nm (148 lbf ft).

Verify: _____

Connect two (2) earth points of the subsea structure to the PRCMMB by stainless steel bolts M16.

Verify: _____

Remove the transport bracket from John Brown Interfaces.

Verify: _____

Visually inspect the whole PRCMMB for damage or dirt.

Verify: _____

7.1 Final checks

Check all mechanical connections to the PRCMMB for tightness.

Verify: _____

Check that John Brown Interfaces are empty.

Verify: _____

Ensure that the PRCMMB base plate is free from damage.

Verify: _____

Check the earth resistance between subsea structure and PRCMMB.
Resistance has to be < 0.1 Ohm.

Verify: _____

GENERAL PRESERVATION & STORAGE PROCEDURE

FOR

CAMERON CONTROLS EQUIPMENT

07	12. March 2008	J. Grochowski	K. Yahosseini	J. Grochowski
06	14. March 2007	J. Grochowski	B. Müller	J. Grochowski
05	12. May 2006	J. Grochowski	F. Duensing	J. Grochowski
04	18. July 2005	J. Grochowski	F. Duensing	J. Gronstedt
03	6. January 2005	J. Grochowski	A. Kamp	T. Loi
02	14. May 2004	H. Mohwinkel	M. Lehmker	A. Voges
01	27. August 2002	J. Grochowski	K. Seidel	K. Yahosseini
Cameron Rev	**Date**	**Prepared by**	**Checked by**	**Approved by**

Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
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01	27. Aug 02	CAMTROL equipment added	Request from project
02	14. May 04	Chapter 3: tarpaulin cover usage for outdoor storage added; Chapter 4.2: Storage fluid (for storage of 1 to 2 years) Castrol Anvol changed to Transaqua HT; Chapter 5.3.1.1 added	Requested by project
03	6. Jan 05	No content change	SAP upload
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05	12. May 06	TUTA requirements included	Required by project
06	14. Mar 07	Umbilical poppet requirement included	Required by project
07	12. Mar 08	Comments included	Required by project

Table of contents

1 Introduction

This document outlines the procedure for preservation and storage of a control system before and after use. This includes Production Control Systems, Workover Control Systems and Drilling Control Systems. The purpose of this procedure is to keep the equipment supplied by Cameron Celle in a proper shape during storage. It will be available for further operations without major refurbishment due to insufficient control during storage.

This document provides instructions to ensure preservation and protection of all typical control system equipment in order to prevent deterioration caused by corrosion, damage, influence of weather and foreign materials, during shipment, storage and installation.

2 Reference Procedures

X-065460-( )-( )	Protective Coating Procedure for Cameron Controls Equipment
X-065390-03	General Protection and Coating Procedure for Cameron Celle Controls Equipment
X-065390-03-00-01	Protection and Coating Procedure for Cameron Celle Controls Equipment
X-027055-01	Corrosion Inhibiting Coating of Machined Surfaces

3 General Storage Requirements for Environment

Before starting any activities for preservation & storage all functions need to be verified. It must be checked that maintenance and repair works have been performed by qualified service personnel and that the control system does not have any mechanical damages on framework, umbilicals, hoses and cables.

Clean and dry the equipment prior to storage and place it under cover (if available) in a clean and dry environment.

For outdoor storage use tarpaulin covers. Ensure that covers are correctly attached and check covers for any damage. Replace damaged covers.

Preferred ambient conditions for storage areas[*)]

Temperature range	:	0 to 40°C
Humidity range	:	0 to 50 % (excluding condensation and frost)

[*)] If above values are not available, humidity and temperature must be within project related specified range.

In areas with high ambient temperatures consider protection against UV light / direct sunlight to protect e.g. plastic materials or compensation systems (thermal expansion).

Atmosphere must be free from harmful substances which can effect resilient seals (e.g. high ozone level).

Store equipment and spare parts with sealing surface protection by protective devices and protect after inspection if necessary.

Consider special storage procedures for critical materials like hydraulic fluid, batteries, rubber goods etc.

Handling and transport of equipment must always be in accordance with the conform procedure, shown in the Operation and Maintenance Manual for the control system.

4 Cameron Controls Standard Hydraulic Control Fluids

This section outlines the Cameron Celle Controls standard hydraulic control fluids. If any other fluid is specified the appropriate data sheet must be considered for preparation and storage of the system.

4.1 Hydraulic Oils

The standard oil types for Cameron Celle Controls equipment are:

- SHELL TELLUS (different types)
- CASTROL BRAYCO MICRONIC 864

Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

Note: Further details for treatment of fluid before and during storage for the specific equipment are listed in section 5.

4.2 Water Based Fluid

The typical water based fluid types for Cameron Celle Controls equipment are delivered by **Mac Dermid CANNING (MARSTON BENTLEY) LTD.**:

- Oceanic HW 511
- Oceanic HW 525
- Oceanic HW 540
- Oceanic HW 443
- Oceanic HD 603 Water/Glycol with lubricant

A typical water based fluid supplied by **CASTROL**:

- TRANSAQUA HT or HT2

A typical water based fluid supplied by **CAMERON**:

- CAMERON 590 X Water / Glycol with lubricant

Note: Further details for treatment of water based fluid before and during storage are listed in the following table.

Water Based Fluid	Suitable Storage Fluid (>6 months)	Suitable Storage Fluid (>1 year)	Suitable Storage Fluid (>2 years)
Mac Dermid CANNING OCEANIC HW 525 Cameron PN 619011-36 OCEANIC HW 540 Cameron PN 619011-28 OCEANIC HW 443 Cameron PN 619011-41	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285
Mac Dermid CANNING Water based fluid with ERIFON HD 603 Cameron PN 619011-46 (Lubricant)	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285
	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	Composition Lubricant/Glycol/Water: 5 % Lubricant: PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	
CASTROL TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	TRANSAQUA HT Cameron PN 619011-53
CASTROL TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	TRANSAQUA HT2 Cameron PN 619011-84
CAMERON Fluid Cameron 590 X Cameron PN 619011-24 (Lubricant)	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 40 % Glycol PN 619011-10 55 % Demineralized Water	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285

5 Specific Equipment Preservation and Maintenance Requirements

Note: Preservation during storage shall be performed in accordance with the check lists shown in section 6.
Any damage occurring during the periodical checks must immediately be repaired and reported to the Maintenance Supervisor.

5.1 Instruments for Surface Containers and Frames

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

All moving parts are to be lubricated with Molycote 3402 or equivalent.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

5.2 Hydraulic Power Unit and Local Control Panel

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines, including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen precharge of each hydraulic accumulator down to 10 bar / 145 psi. This is for safety reasons and to keep e.g. bladder in a stable position.

Air accumulators must be vented and drained of water.

Open ends of piping must be sealed off by plugs or caps.

All moving parts including the push rod of the panel valves must be protected by Molycote 3402 or equivalent.

Operation panels must be protected by a protective cover or door.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anti-condensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect ventilation grills / air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof local control panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

All isolation valves (except drain valves) must be closed. 4/3-way panel valves must be moved to "CENTER" position. 3/2-way panel valves must be in "CLOSE" or "VENT" position.

5.2.1 Hydraulic Oil

For long term storage no fluid exchange is required to get conservation against corrosion if equipment is filled with clean hydraulic oil.

After usage or longer storage (>3 months) hydraulic reservoirs must be checked for cleanliness and water content. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

Note: Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

If the water content of the oil is too high, check the hydraulic fluid for bacterial contamination. Clean the system up if necessary by following instructions of supplier.

Hydraulic lines have to be flushed to customer required cleanliness level.

Note: Cleaning of the hydraulic lines of an empty system must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

5.2.2 Water Based Fluid

General

For long term storage (>6 months) a special fluid preparation is required to get conservation against corrosion of equipment.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Reservoirs must be checked for cleanliness.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluid should be within the system during long term storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions. The table in section 4.2 shows different possibilities for long term (>6 months) storage.

5.3 Remote Control Panel

Painting, frame and moving parts must be checked in accordance with section 5.1.

5.3.1 Electric Remote Control Panel

Cable connections are to be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Operation panel must be protected by a protective cover or door if available.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

Rack mounted equipment shipped separately from cabinets should be bagged with desiccant and tagged with shock fuses.

5.3.1.1 Control Panel for climatic controlled environment

Control panel for use in climatic controlled environment e.g. Master Control Station (MCS), Electric Power Unit (EPU), Remote Workstations etc.

Equipment should be stored in a warehouse in undamaged packaging under the following conditions excluding intensive dust and condensation of humidity.

Temperature -18 - +60°C

Humidity 20-90% RHNC

When packaging has to be opened e.g. for site receive tests it is recommended to use corrosion inhibitors (e.g. Cortec®VCI 110) for further preservation.

5.3.2 Pneumatic Remote Control Panel

Pneumatic connections are to be cleaned up and protected by non aggressive protective shield, protection against dust or mating protective cover if available. Check pneumatic jumper cable as well.

Air receivers must be vented and drained of water.

Operation panel front must be protected by a protective cover or door.

Acryl glass window panes on panels located in hazardous areas must be cleaned with wet cloth only due to electrostatic charge.

5.4 Hydraulic Umbilicals, Umbilical Jumpers & Steel Flying Leads

General Instructions

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the applicable hydraulic fluid.

All hydraulic connections must be cleaned from dirt by using cleaning solvents which do not harm the seals (see Operation and Maintenance Procedure).

The connection plate of the junction boxes must be protected by protective covers.

After cleaning mating protective caps or plugs must be mounted to the quick coupling or single connection.

Stainless steel junction boxes and plates must be covered with a thin film of non aggressive oil.

Painting, frame and moving parts must be checked in accordance with section 5.1.

The umbilical can be stored in a box or on a drum. The minimum bending radius for storage indicated by supplier may not be exceeded.

5.4.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The umbilical shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.4.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

All lines with poppets must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids and compositions (see table in section 4.2).

5.5 Electric Cables and Cable Jumpers

Contacts of electrical connectors must be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Check that cable minimum bending radius is kept for storage.

Cable materials have to be protected for storage to avoid mechanical impact and ageing impact caused by sunlight (UV).

5.6 Umbilical Reels

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cleaned piping must be sealed off by using protective plugs, caps or covers.

Parts for power transmission like gear, chain with sprockets etc. must be protected and lubricated.

Open gear drive with gear ring and cog	-	ANTI SEIZE (or equivalent)
Chain drive	-	ESSO CAZAR K2 (or equivalent)
Gear box for direct drive	-	See Operation and Maintenance Manual of gear box for specific oil type.

5.7 Uninterruptable Power Supply (UPS)

WARNING:

Hydrogen may discharge from batteries and cause explosion (depending from battery type). Sufficient ventilation is required.

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cable connections must be protected with non aggressive protective shield.

For storage of the UPS check the allowed temperature range in Operation and Maintenance Manual to avoid damage of sensitive parts like batteries etc.

Recharge batteries to full range. Deep discharge must be avoided.

Follow specific long term storage procedure for installed type of batteries.

Disconnection of batteries may be required.

Ensure that the UPS is tagged with a shock fuse indicator.

5.8 Subsea Valve Packages

Remark: Subsea valve packages are normally mounted to the subsea running tools (e.g. Lower Marine Riser Package), which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.8.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.8.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.9 Subsea Control Modules (direct / pilot hydraulic types)

Remark: This section is **not** to be applied for CAMTROL subsea control modules. Refer to the "CAMTROL Subsea Production Control Equipment" section.
Subsea Control Modules (SCM) are normally mounted to the subsea running tools which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool. Flushing and testing can be done with the appropriate flushing and testing unit.

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Hydraulic pressure from all lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

If applicable, cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

5.9.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.9.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.10 Hydraulic Flushing and Testing Units

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

Air receivers must be vented and drained of water.

Open connection ends must be sealed off by plugs or caps.

All moving parts must be protected by Molycote 3402 or equivalent.

Junction plates must be protected by an overall cover or individual caps and plugs.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anticondensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

5.10.1 Hydraulic Oil

Reservoirs must be checked for cleanliness and water content. Water content of hydraulic oil must be checked to be within the maximum allowed range. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.10.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.11 Running Tools for Subsea Modules

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines must be discharged.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Hydraulic lines are to be flushed to customer required cleanliness level.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.12 Hydraulic Cylinder (e.g. on SCM Test Stand)

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

Hydraulic cylinders are to be flushed to customer required cleanliness level. Ensure that the cavities are completely filled with hydraulic control fluid. Ensure that no air is left in the cylinders as remaining air might cause corrosion.

Painting must be checked in accordance with section 5.1.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Put piston of the cylinder in retract position. This ensures that the rod is protected inside the cylinder against corrosion or damage.

Grease the cylinder rod with silicon grease or equivalent non aggressive grease.

Store the cylinder in a dry indoor environment. Room temperature should not be below 37°F (3°C).

5.13 Float Type Accumulators

Note: Preservation has to be carried out when the float type accumulators are unused and storage will be longer than three (3) months.

<u>Disassembly of Accumulator</u>

Bleed the pressure from hydraulic fluid supply.

Ensure that the ¼" needle valve at the bottom of the accumulator is in the closed position.

Remove the ¼" NPT plug.

Open the ¼" needle valve at the bottom of the accumulator.

Ensure that the accumulator is depressurised.

Open the hammer union at the bottom of the accumulator.

Ensure that the floater is at the lower end of the accumulator.

Remove the plug at the end of the floater pipe.

Inspect the seals (floater pipe plug, hammer union).

Spray non aggressive anticorrosive lubricant into the accumulator to protect the inner surface of the accumulator.

Carefully move the accumulator in vertical position and ensure that the lubricant flows out of the accumulator.

Assembly of Accumulator

Grease the o-ring of the plug and fix the plug at the lower end of the floater pipe.

Grease the thread at the end of the accumulator bottle and connect the hammer union.

Close the ¼" needle valve at the bottom of the accumulator and install the ¼" plug.

Painting must be checked in accordance with section 5.1.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.14 Topside Umbilical Termination Unit / Assembly

Topside Umbilical Termination Units / Assemblies (TUTU / TUTA) will be treated like Hydraulic Power Units (HPU). The workload is reduced as the TUTU / TUTA does not contain motors, pumps and reservoirs.

5.15 Wire Rope

Grease the wire ropes with wire rope grease. Ommex or Kendal or equivalent wire rope grease can be used.

Store the wire ropes in a dry outdoor or indoor environment.

5.16 Load Cell

Protect the load cells by a thin film of non aggressive oil.

Store the load cells in a dry indoor environment. Room temperature should not be below 37°F (3°C).

6 Preservation Maintenance Check Lists

The following checklists must be used to get a controlled storage of the equipment with proper maintenance.

6.1 Hydraulic Power Unit and Local Control Panel (Main Control Unit)

Preservation Maintenance Check List	**Sheet: 1 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-65390-03-00-00 or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film; repair if necessary	Non aggressive oil
8.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Motors, Distribution Boxes, Relay Boxes, Subswitchboards, Junction Boxes**					
1.0			X		Inspect protection on cable connections; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0		X			Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check drain valves to be open	
6.0			X		Inspect fluid according to section 5.2.1 or 5.2.2	

6.2 Umbilical Reel with Umbilical

Preservation Maintenance Check List — **Sheet: 1 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check lines to be pressureless, drain valves to be open	
6.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.3 Electric Remote Control Panels

Preservation Maintenance Check List						**Sheet: 1 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A. General Inspection						
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, Vaseline or equivalent
4.0			X		Check pneumatic circuits to be depressurized (for purged system only)	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil

Preservation Maintenance Check List						**Sheet: 2 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.4 Pneumatic Remote Control Panels

Preservation Maintenance Check List — **Sheet: 1 of 1**

Description of Equipment: **Pneumatic Remote Control Panels**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on pneumatic hose connection, repair if necessary	Non aggressive protective shield with additional cover
4.0			X		Check pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
7.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
8.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
9.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
10.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
11.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.5 Hydraulic and Electrical Jumpers

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Hydraulic and Electrical Jumpers**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0	X				Check junction boxes and couplings for proper protection by covers, caps or plugs	
4.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield; acid free Vaseline or equivalent; protective caps
6.0			X		Check protection of electric cable against mechanical impact and ageing impact by sunlight	
7.0			X		Check that cable minimum bending radius is kept for storage	
8.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.6 Subsea Valve Package

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Valve Package**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
6.0			X		Check lines to be pressureless; drain valves to be open	
7.0			X		Inspect fluid according to section 5.8.1 or 5.8.2	

6.7 Subsea Control Module (direct / pilot hydraulic types)

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Control Module (not for CAMTROL SCM)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
6.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
7.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
8.0			X		Check lines to be pressureless; drain valves to be open	
9.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
10.0			X		Inspect fluid according to section 5.9.1 or 5.9.2	

6.8 Hydraulic Flushing and Testing Unit

Preservation Maintenance Check List						**Sheet: 1 of 3**
Description of Equipment:	**Hydraulic Flushing and Testing Unit**					
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
6.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List	**Sheet: 2 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C. Hydraulic Circuits						
1.0			X		3/2-way valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way valves to be in open centred position; function lines to be pressureless	
3.0			X		Check lines to be pressureless; drain valves to be open	
4.0			X		Inspect fluid according to section 5.10.1 or 5.10.2	

6.9 Running Tool for Subsea Module

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Running Tool for Subsea Module**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
6.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
7.0			X		Inspect fluid according to section 5.11	

7 CAMTROL Subsea Production Control Equipment

Note: Use the instructions in this section as check lists.

7.1 Subsea Control Module / SCM

Check on the bill of material if individual “Shipping, Transportation and Storage Guidelines” are available for the SCM, otherwise follow the instructions below:

Verify: _____

Store the SCM in the crate until it is required for use.

If it is necessary to gain access to the SCM, remove the top and sides of the crate, but leave the SCM on the shipping frame.

Visually inspect the SCM / packing before use and every **3 month** when it is not used.

Verify: _____

The storage environment must be free from harmful substances which can affect resilient seals (i.e. high Ozone level).

Verify: _____

The ambient temperature for storage must be within the range -10°C to 40°C to maintain the integrity of the pressure compensation system and ensure that no dielectric oil bleeds out.

Verify: _____

CAUTION:
If the loss of dielectric oil exceeds 3 Litre the SCM needs to be refilled in accordance to Cameron “Field refill procedure”. The lower reservoir of the shipping frame is seized to 3 Litre. If you are in doubt please contact Cameron Germany Engineering Department (Tel +49 (0)5141 8060).

7.2 Subsea Accumulator Module / SAM

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Any damage occurring during the periodical checks must immediately be reported and repaired by Cameron Controls.

Verify: _____

Drain the hydraulic pressure from the accumulators.

Verify: _____

Bleed nitrogen pre-charge from the accumulators. Leave 10 BAR residual pressure in the accumulator to prevent the bladder from collapsing.

Verify: _____

Close the two (2) Gas Valves on the HP Accumulators.

Verify: _____

Open ends of Accumulators must be sealed by plugs or protective caps off stainless steel on the gas side off the accumulators.

Verify: _____

Lubricate all moving parts, except the Hydraquad hydraulic connectors, by water-resistant grease.

Verify: _____

Painting, frame and moving parts must be checked for damage.

Verify: _____

Stainless Steel parts must be protected by a thin film of non aggressive oil (Pelox Protector or similar).

Verify: _____

7.3 Subsea Distribution Unit / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.3.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Set all valves to CLOSE position.

Verify: _____

Protect the mounting base of the SAM by a protective cover.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes

Verify: _____

7.3.2 Electrical Parts

Check that all ROV connectable fuses are installed.

Verify: _____

Check that all electrical connectors are protected by caps

Verify: _____

7.4 Umbilical Termination Assembly / UTA

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.4.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes.

Verify: _____

7.4.2 Electrical Parts

Check that all electrical connectors are protected by caps.

Verify: _____

7.5 Foundation Base & Mud Mate for UTA / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Foundation Base only: Verify the proper operation of the two (2) pile locks and confirm that they are in the unlocked position.

Verify: _____

Check the SDU locking mechanism by operating.

Verify: _____

Check the guide post locking mechanism by operating.

Verify: _____

Inspect all lift shackles for deformation and other damage.

Verify: _____

Check condition of all protection anodes.

Verify: _____

8 Handling Requirements for Special Materials

8.1 Rubber Goods

GENERAL

There is very little published information on the storage and care of rubber goods as used in the oil field. When we speak of rubber goods we include the synthetic packings of Nitrile Copolymers and Neoprene as well as natural rubber parts. Natural rubber parts have become relatively rare but the same things that are harmful to natural rubber are also harmful to the synthetics in varying degrees.

Generally speaking, light and air are bad for rubber goods. The exact chemical action is not fully understood and what has been written disagrees on the mechanism involved.

Ozone is known to be bad for rubber goods. Ozone (O_3) is a very active form of oxygen. As far as we know two principle sources contribute the ozone that reaches rubber goods. One is atmospheric ozone which is generated in the stratosphere carried downward by convection currents and eventually absorbed by organic matter. The other source is electrical discharges, such as lightning, high voltage corona, but more commonly, electrical machinery. Ozone attack is characterized by fairly deep cracks in the rubber parts.

Rubber is attacked by ordinary oxygen (O_2) much as steel rusts in the presence of oxygen. Oxidation is characterized by a hard skin which eventually crazes in a multitude of small cracks and may turn chalky or assume a bark-like appearance.

A strong direct light, especially sunlight, has deleterious effects on rubber goods. This is attributed to the ultraviolet content of the spectrum which accelerates cracking. Whatever the mechanism however, light, particularly sunlight, is undesirable. In extremely cold climates some rubber goods will become so brittle that upon dropping or rough handling they will shatter.

In very warm humid climates, particularly those found in some parts of the tropics, fungi and bacteria find their way to the rubber goods and attack the organic content. This is especially true on duck reinforced rubber parts. However, parts reinforced with synthetics will not be attacked in the reinforcement.

Heat also has a bad effect on rubber. This could be the result of sunlight or artificial or accidental heating of any type. Heat results in a gradual hardening of the part and if ozone or oxygen are present, will accelerate their action.

Any stretching or bending of rubber in storage will result in very accelerated ageing. By the term ageing, we mean the cumulative effects of all the above mentioned attacking agents over a period of time. Ozone attacks rubber preferentially at points of strain.

Rubber goods, both natural and synthetic, all possess some degree of susceptibility to various solvents including water, but especially the liquid hydro-carbons. These manifest themselves in various ways by either swell or shrinkage of the rubber goods with which they are in contact.

No precise figure can be given as a "storage life" of a part. This is dependent on all of the above conditions and also the size of the part, its material and function. Generally speaking, the greater the relative surface area is to the volume, the more susceptible a part is to being rendered useless by ageing. For example, a relatively bulky part such as a ram front packer might be expected to have a much longer useful shelf life than a thin large diameter o-ring type of seal such as used on the bonnet seals of preventers or the rings in 'X' bushing.

STORAGE

From the preceding section we can draw a few rules governing storage of rubber goods. Briefly put - a cool, dry, dark storage place would be the best. The ideal would be to store the packings in vacuum sealed containers. The following rules, however, should not be difficult to follow under the average storage conditions experienced throughout our operation.

- Keep the rubber storage area as dark as possible. Certainly not out of doors, and, if indoors, away from skylights or windows and with subdued or indirect artificial lighting.
- Select the coolest location possible and be sure that no heaters or stoves are near by and particularly that the direct blast from a space heater does not blow on the rubber parts.
- Be sure that no electrical machinery (motors, switch gear, or any high voltage equipment producing corona) is near the rubber goods and that drafts will not carry the atmosphere from electrical machinery to the area in which the rubber goods are stored.
- The practice of first in - first out is essential with rubber goods. There is a natural tendency to remove parts from the front of a bin and when stock is replenished to leave the parts that are in the back in place, in which case years might pass before these are finally pulled out for use.
- Store rubber goods in a relaxed position. For example, do NOT hang o-rings on nails. Where possible, do not keep assemblies in stock where the rubber goods are stretched in order to assemble them on the part. For example, o-rings on blanking plugs, tubing hangers and 'X' bushing. In some cases this is difficult as it is with the aforementioned 'X' bushings. On these, periodic inspection should be employed to detect any signs of ageing as quickly as possible.

  On parts, such as the 'X' bushing rings, where we know the rubber parts will be stretched in storage, the best age resistant compounds we can buy are used.
- Keep storage as dry as possible and remove any oil, gas, etc. of hydro-carbon nature that may accidentally get on the rubber.
- Do not store the rubber goods on top shelves near galvanized roofs. There are several reasons for this; one is that heat is passed through galvanized roofing and also there is some opinion that ozone may be generated in this area.
- If possible, store rubber goods in buildings of wooden construction and wooden shelves. Wood is believed to scavenger ozone quite effectively.
- If store for extended periods is unavoidable, sealed containers will aid considerably; impervious surface coverings such as "Sea-Peel" or waxing will help.

USABILITY CHECKS

No general rule can be drawn regarding usability. The final measure is whether or not the cumulative effects of ageing have affected the physical properties of the part to such an extent that it will no longer perform the function for which it is designed. Thus, a large heavy part might suffer the same total amount of ageing as a small, light, thin piece, and still be usable whereas the small part is rendered useless. In these cases some judgement must be used in deciding usability.

Prior to shipment or use out of stock, rubber goods should be examined to see that no "chalking" or "barking" (bark-like surface appearance) is present, that there is not a hard skin on the rubber and that there are no cracks. Sometimes cracks will be obvious, but it is wise to stretch or bend the part in question so that any incipient cracks or very thin cracks will reveal themselves. Where a part is suspect, a check of hardness should be run. In the event that the hardness runs 15 points higher than the nominal hardness of the part, it is considered non-usable. Hardness is affected by temperature and readings should be taken with the rubber part at 70°F – 100°F (21°C - 38°C).

8.2 Hydraulic Hoses

STORAGE

- Before placing hose in storage, it should be completely drained.
- Whenever feasible, store the hose in the original wooden shipping crate. This will provide some protection against the deteriorating effects of solvents, corrosive liquids, ozone and sunlight. Hose should be stored so that the coils are in a horizontal plane.
- Certain rodents and insects will damage the hose. Adequate protection from them should be provided.
- The ideal temperature for storing the hose ranges from 50°F (10°C) to 70°F (21°C) with a maximum limit of 100°F (38°C). If stored below 32°F (0°C), the hose will become stiff and would require warming before placed in service. The hose should not be stored near sources of heat, such as radiators, base heaters, etc., nor should the hose be stored under conditions of high or low humidity.
- To avoid the adverse effects of high ozone concentration, the hose should not be stored near electrical equipment that may generate ozone or be stored for any lengthy period in geographical areas of known high ozone concentration. Exposure to direct or reflected sunlight - even through windows - should also be avoided.

HANDLING

CAUTION: Care should be exercised to prevent mishandling. Crushing or kinking of the hose can cause severe damage to the reinforcement. If this occurs, remove hose from service.

- In order to minimize the danger of kinking, the hose preferably should be removed from its crate by hand, laid out in a straight line, then lifted by means of a catline attached near one end of the hose. If a catline is used to remove the hose from its crate, the crate should be rotated as the hose is removed. Recommended practice is to protect the hose in some manner when moving to a new location. It is considered bad practice to handle the hose with a winch, to hand the hose from a truck gin pole, or to place heavy pieces of equipment on the hose.

8.3 Electronic Goods and Tools containing Electronics

8.3.1 General Instructions

Rapid temperature changes must be excluded to avoid condensation of humidity and mechanical stress.

The packing should protect electronic goods against:

- Dust
- Humidity
- Electrostatic Charge
- Shock
- Direct Sunlight

Generally the original transport packing serves the above requirements best.

Normally antistatic bags, desiccant and anti-shock pads are applied to prevent damage.

Electronic goods should be stored in a warehouse secured against theft.

8.3.2 Fiberoptic Terminations

Optic Link Modules (OLM) should be capped. Caps have to be removed before installation.

8.3.3 Handling Procedure for CMOS Devices

Electrical environments such as overvoltages and electrostatic discharges damage CMOS devices and printed circuit cards containing the devices. Most CMOS devices have diode input protection circuits and gate protection structures to protect against such electrical environments.

In addition to the internal protection network, use the following steps to prevent the generation of severe electrical transient voltages during handling of CMOS devices.

- Read the manufacturer's equipment specification and data sheets before performing maintenance. Do not exceed recommended maximum voltage levels.
- Use grounding wrist straps which contact the skin.
- Ground all work surfaces.
- If lead-straightening or hand-soldering is necessary, provide ground straps for the equipment, and ground the soldering ties.
- Connect all unused inputs to an appropriate logic voltage level, either power or ground.
- Inspect test equipment for proper polarity of voltage before conduction parametric or functional testing.
- Inspect all power supplies used for testing to ensure there are no voltage transients present.
- Do not insert or remove devices from test sockets with power applied.
- Do not contact edge connectors which are wired directly to device inputs.
- If external connections to a printed circuit card address only an input of the integrated circuit, use a resistance of 10 K ohms or greater in series with the input. The resistance limits damage to the card if it is removed and contacts static generating materials.
- Connect all low impedance equipment such as pulse generators to inputs only after the device has power applied. Disconnect the equipment before power is removed.
- Do not allow nylon or other static generating materials to contact the devices.
- Store or transport the devices in materials that are antistatic. Do not insert the devices into plastic packing material, styrofoam, or plastic trays.

8.3.4 Lithium Manganese Dioxide Battery

Replacement of the Lithium Manganese Dioxide battery mounted in the subsea transmitter & battery module: The battery supports the AMF-System (Automatic Mode Function / Dead Man System) belonging to multiplex drilling control systems. Under normal operation conditions replacement is required **after each one-year period**. Battery storage conditions should be in a range of 23°F – 59°F (–5°C to 15°C).

9 Attachment

- Data Sheets of Protective Materials (if required)
- Data Sheets of Hydraulic Fluids (if required)

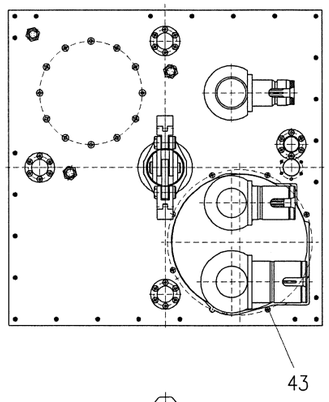
STATUS: Released REVISION : 04
DATE PRINTED : 06/17/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : PRCM Total / K-5
Power Regulation and Communication Module
Production Control System
Project: K-5
Client: Total

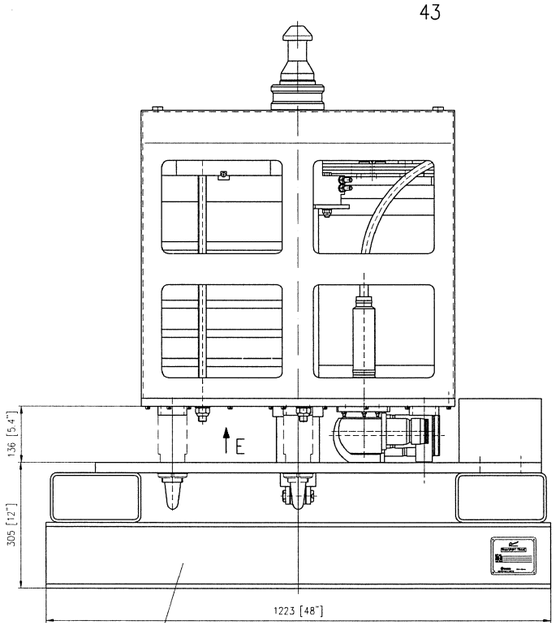
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
001	0001	05	222511-94	1.000	EA	BASE PLATE, 20 X 760 X 760 POWER REGULATION AND COMMUNICATION MODULE		
002	0002	05	222652-01-10	1.000	EA	COVER POWER REGULATION AND COMMUNICATION MODULE		
003	0003	01	223262-07	1.000	EA	LIFT MANDREL AND LOCKING DEVICE DISTANCE 714,5 MM		
008	0008	01	222203-39	3.000	EA	GUIDE PIN ESCM / PRCM		
009	0009	01	222201-25	1.000	EA	DISTANCE ROD FOR PRCM, 136 MM		
010	0010	01	222478-28	1.000	EA	2x SYM HALF CLAMPS ON PRCM LIFT MNDRL		
011	0011	01	222453-10	1.000	EA	CM CLAMP HOLDER FOR PRCM		
012	0012	01	222524-01-59	1.000	EA	PRM TOP HOLDER PLATE for K5F PRCM		
015	0015	01	2197089-15-02	1.000	EA	SS Internal Jumper eSCM/PRCM Type 3 Length 520mm		
016	0016	01	2197089-16-01	1.000	EA	SS Internal Jumper HV/LV PRCM Type 4 Length 830mm		
017	0017	01	2197089-22	1.000	EA	SS Jumper PRCM Cath. to Basepl. Type 10 Internal Subsea Jumper from Powerring Module (Topside), PRCM to Baseplate (10/6/1,90° to 80/3/1,Special) Colour: Black; Lenght: 1700mm +- 50mm		
042	0042		619903-09-11-06	24.000	EA	SCREW, SOC, DIN 912, M8 X 20, SST MATERIAL: AISI 316 (1.4401)		
044	0044		619903-08-14-06	24.000	EA	SCREW, SOC, DIN 912, M6 X 35, SST MATERIAL: AISI 316 (1.4401)		
045	0045		619903-10-14-06	24.000	EA	SCREW, SOC, DIN 912, M10 X		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						35, SST MATERIAL: AISI 316 (1.4401)		
046	0046		619901-14-21-09	1.000	EA	SCREW, HEX, DIN 933, M10 X 45, SST MATERIAL: AISI 316 (1.4401)		
048	0048		619901-15-33-09	2.000	EA	SCREW, HEX, DIN 933, M12 X 110, SST MATERIAL: AISI 316 (1.4401)		
049	0049		619901-15-37-09	2.000	EA	SCREW, HEX, DIN 933, M12 X 150, SST MATERIAL: AISI 316 (1.4401)		
050	0050		619941-02-03	24.000	EA	NUT, SELF LOCK., DIN 985, M5, SST MATERIAL: AISI 316 (1.4401)		
051	0051		619941-05-03	9.000	EA	NUT, SELF LOCK., DIN 985, M10, SST MATERIAL: AISI 316 (1.4401)		
052	0052		619941-06-03	4.000	EA	NUT, SELF LOCK., DIN 985, M12, SST MATERIAL: AISI 316 (1.4401)		
053	0053		619941-08-03	6.000	EA	NUT, SELF LOCK., DIN 985, M20, SST MATERIAL: AISI 316 (1.4401)		
060	0060		619919-14-02-08	9.000	EA	WASHER, MEDIUM, DIN 125, B 10.5,SST TYPE B: WITH CHAMFER ; ID: 10.5 MM MATERIAL: AISI 316 (1.4401)		
061	0061		619919-15-02-08	4.000	EA	WASHER, MEDIUM, DIN 125, B 13, SST TYPE B: WITH CHAMFER ; ID: 13 MM MATERIAL: AISI 316 (1.4401)		
062	0062		619919-19-01-08	6.000	EA	WASHER, MEDIUM, DIN 125, A 21, SST TYPE A: W/O. CHAMFER ; ID: 21 MM MATERIAL: AISI 316 (1.4401)		
070	0070		619931-10-25-08	4.000	EA	THREADED PIN, DIN 976, M10 x 250, SST MATERIAL: AISI 316 (1.4401)		
071	0071		619931-20-70-08	3.000	EA	THREADED PIN, DIN 976, M20X700, SST THREAD: M20 X 700 MM LG. MATERIAL: AISI 316 (1.4401) STRENGTH CLASS: 80		
090	0090	G01	619046-20-61-51	1.000	EA	TAG: "CONTROL UNIT" (90X110) BLANK, 1.4301 COLOUR OF WRITING: BLACK		
100	0100	01	223211-13	1.000	EA	TRANSPORT FRAME FOR PRCM		
101	0101	01	223260-99	1.000	EA	SCM/SAM LIFTING EYE ASSY		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
500	0500	02	223388-54-07	1.000	EA	DC: CM, ESS tested		
501	0501	03	223388-54-06	1.000	EA	DC: PRM, ESS tested		
600	0600	01	222273-19	3.000	EA	Disc Weight for K5F PRCM, t=8mm, 4 holes		
601	0601	01	222273-20	1.000	EA	Disc Weight for K5F PRCM, t=8mm, 7 holes		
602	0602		619903-09-22-06	4.000	EA	SCREW, SOC, DIN 912, M8 X 80, SST MATERIAL: AISI 316 (1.4401)		
>>>B/M Category : Engrg Spec/Document item								
900	0900	04	SK-066052-98	1.000	EA	AD: POWER REGULATION AND COMMUNICATION MODULE ELECTRIC SUBSEA TREE		
902	0902	01	SK-066052-98-03	1.000	EA	Block Diagram: PRCM, K5F Power Regulator and Communication Module Project: Total / K5F DC-System		
903	0903	03	SK-066052-98-04	1.000	EA	ID: PRODUCTION CONTROL SYSTEM		
904	0904	25	D-000100-09-17	1.000	EA	PART IDENT: LOW STRESS STAMP, "ASSY", ASSY P/N, "REV" REV, "CAM" SAP PLANT NO, S/N ("CCV" MAY BE USED IN PLACE OF "CAM". SEE X-043764-01 FOR DETAILS)		
905	0905	05	X-065437-01-25	1.000	EA	FAT: PRCM, K5F DC-System		
906	0906	01	X-065437-02-06	1.000	EA	PRCM Functional Test Procedure PRCM, DC-System		
907	0907	01	X-065467-02-14	1.000	EA	Installation, Retrieval & Maint. PRCM K5-F Procedure for Power Regulation Communication Module Project: TOTAL K5-F		
908	0908	08	QP-000160-01-18	1.000	EA	Main Quality Plan for DC Tree Systems		
>>>B/M Category : Reference Call Outs								
920	0920	01	SK-066052-98-40	1.000	EA	TEST-SETUP PRCM		
921	0921	01	X-065464-23-01	1.000	EA	DC: ESS Test Procedure PRCM ESS requirements in reference to ISO 13628-6 for Power Regulator (PR) and Communication Module (CM)		

VIEW E





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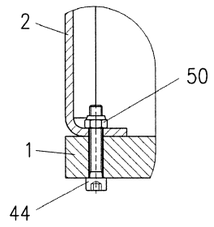

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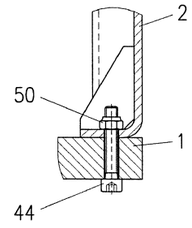
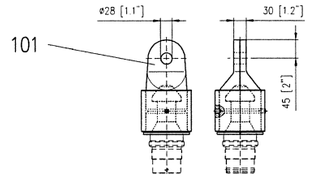


USE PN 223260-99
FOR LIFTING

CONNECTED TO THE
LIFT/LATCH MANDREL OF ITEM 3



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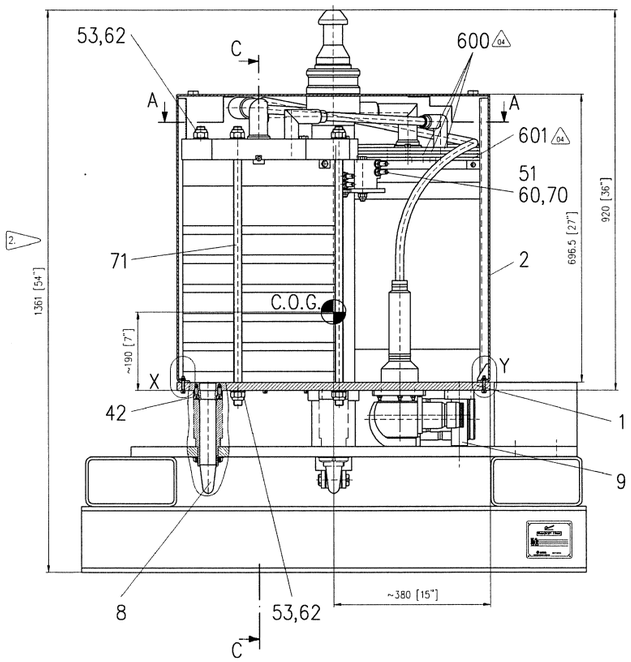
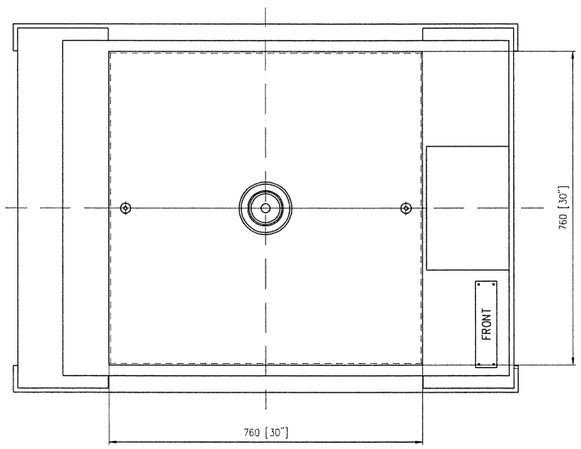
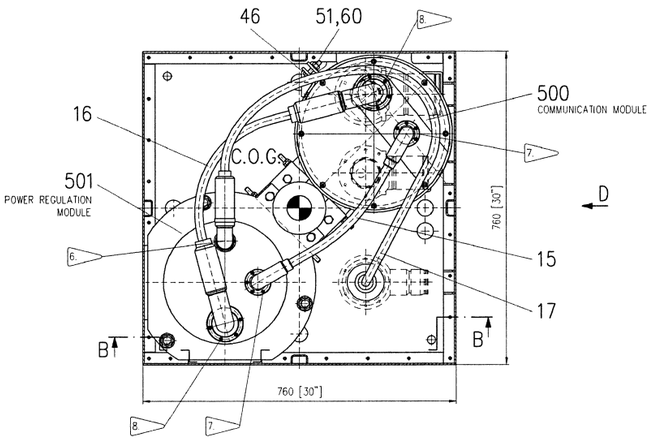
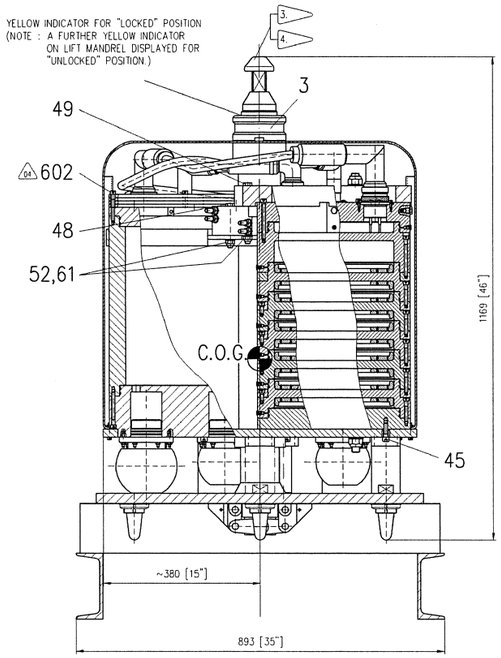


A–A

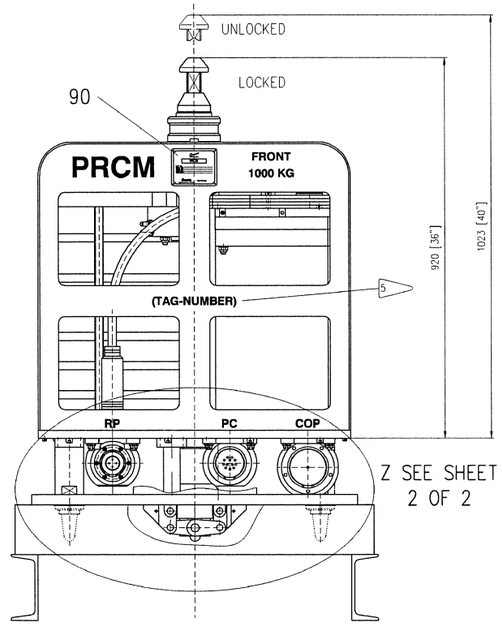




C–C



VIEW D



NOTES:

1. WEIGHT IN AIR: 1000 KG
   WEIGHT IN WATER: 765 KG
   DIMENSIONS SHOWN ARE IN mm [inch]
2. THESE DIMENSIONS ARE FOR SHIPPING INFORMATION ONLY.
3. LIFT/LATCH MANDREL IN ACCORDANCE WITH API SPEC. 17H
   (ISO 13628-8 TYPE "A")
4.

UNLOCK IN WATER	765 kg	7505 N
UNLOCK IN AIR	1000 kg	9810 N
LOCK IN WATER	100 kg	981 N
LOCK IN AIR	100 kg	981 N

5.

TABLE OF TAG NUMBERS	
PRCM	TAG NUMBER
1	PRCM-92100.1A
2	PRCM-92100.1B
3	PRCM-92100.2A
4	PRCM-92100.2B
5	PRCM-92100.3A
6	PRCM-92100.3B
7	PRCM-92100.4A
8	PRCM-92100.4B
9	PRCM-SPARE

6. TIGHTENING TORQUE : 15 Nm
7. TIGHTENING TORQUE : 21 Nm
8. TIGHTENING TORQUE : 25 Nm
9. SECURE ALL SCREWS WITH LOCTITE TYPE: 243 OR EQUIVALENT
10.

Tightening Torque		
Pos	Nm	lbs.ft
42	14.5	10.6
43	14.5	10.6
44	6	4.4

Tightening Torque		
Pos	Nm	lbs.ft
45	30	22.2
51	30	22.2
52	45	33.3

Tightening Torque		
Pos	Nm	lbs.ft
53	300	222

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

REISSUED AS APPROVED FOR CONSTRUCTION	16JAN08	0
REISSUED FOR CLIENT COMMENT	18JAN08	A
ISSUED FOR CLIENT COMMENT	22MAY07	N/A
ISSUED FOR INTERNAL IDC	14MAR07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-03-509

CAD

REV BY: T. Hein DATE: 16.06.2008 REV.: 04

TOLERANCES ACCORDING TO DIN ISO 8015

CHANGE SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219

TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

EST. WEIGHT: 1000.000 kG | SUPERSEDES: | SCALE: 1:5

SURFACE TREATMENT: DO NOT SCALE

MATERIAL AND HEAT TREATMENT

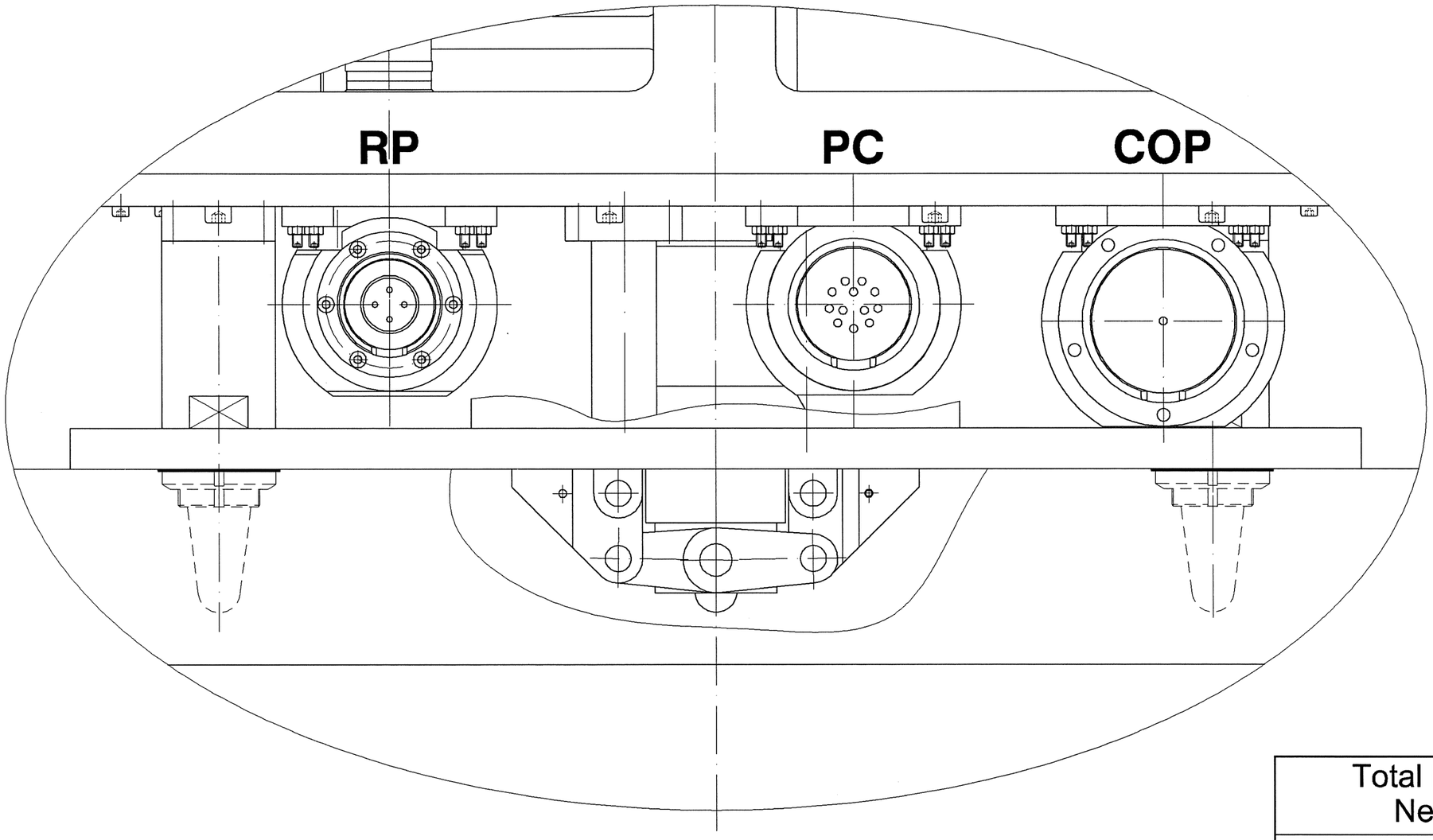
DRAWN: VV Dill DATE: 17.05.2006
CHECKED: F. Tegt DATE: 16.06.2008
APPROVED: R. Wrede DATE: 16.06.2008

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

ASSEMBLY DRAWING:
POWER REGULATION AND
COMMUNICATION MODULE

INITIAL USE DOC#: 223052-98 | SHEET: 1 OF 2 | DRAWING NUMBER: SK-066052-98

Z



ABBREVIATIONS:

PC	POWER/COMMS TO ESCM
RP	RETURN PATH TO CATHODE
COP	COMMS ON POWER FROM UTA

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-03-509

CLIENT REV.: 0

CAD

REV. BY: T. Hein | DATE: 16.06.2008 | REV.: 04

TOLERANCES ACCORDING TO DIN ISO 8015

GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219

TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

SURFACE TREATMENT

MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN: W. Dill	DATE: 06.08.2007	
CHECKED: F. Tegt	DATE: 16.06.2008	
APPROVED: R. Wrede	DATE: 16.06.2008	

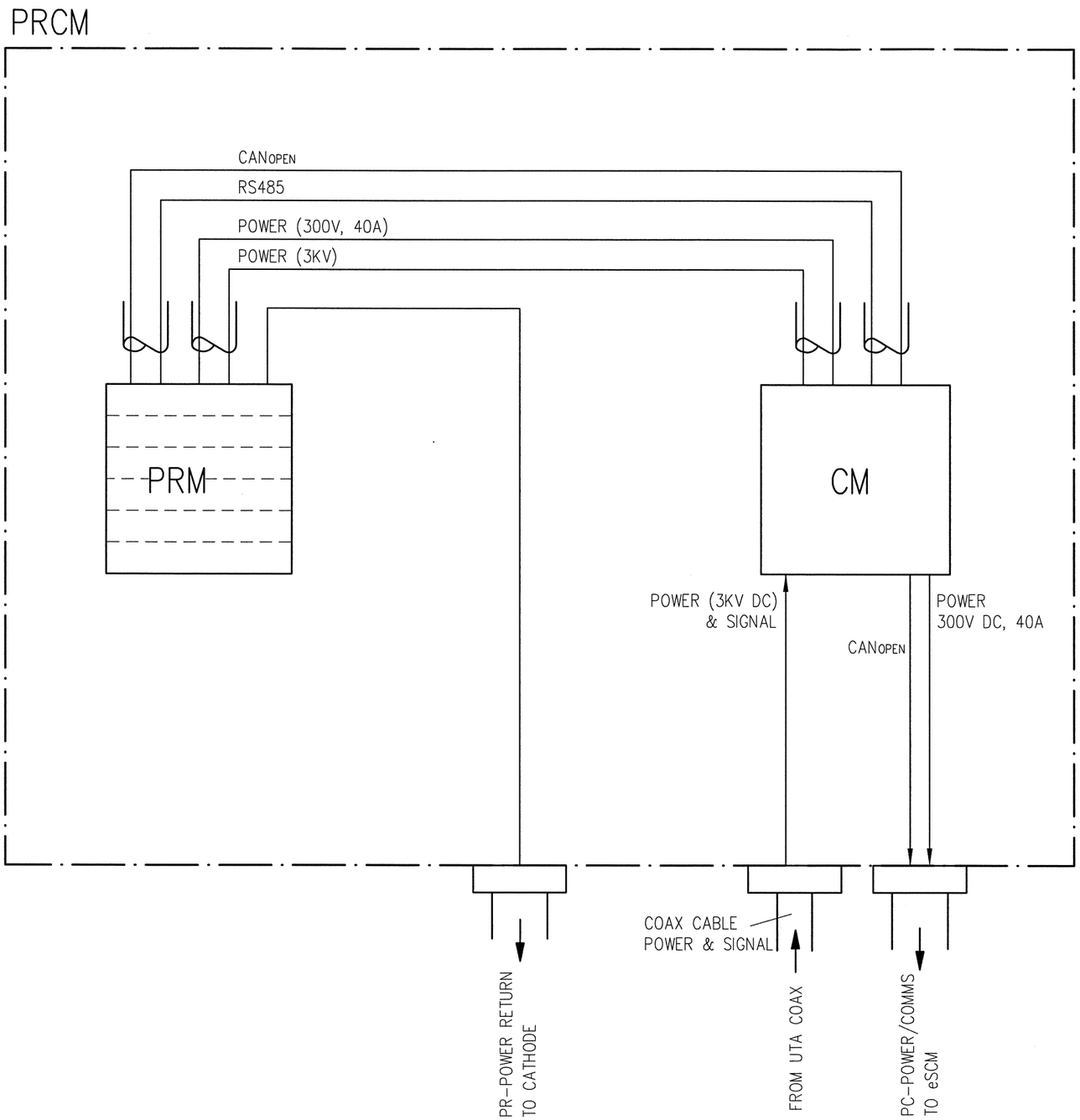
EST. WEIGHT: 1000.000 KG | SUPERSEDES: | SCALE: 1:2

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

ASSEMBLY DRAWING:
POWER REGULATION AND
COMMUNICATION MODULE

INITIAL USE BOM: 223052-98 | SHEET: 2 OF 2 | DRAWING NUMBER: SK-066052-98

STATUS:



LEGEND:

PRCM	-POWER REGULATION AND COMMUNICATION MODULE
PRM	-POWER REGULATOR MODULE
CM	-COMMUNICATION MODULE

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

ISSUED FOR INTERNAL IDC	12JUNE07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-06-507

CAD

REV. BY: C. Schulze | DATE: 13.09.2007 | REV.: 01

TOLERANCES ACCORDING TO DIN ISO 8015
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

SURFACE TREATMENT
MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN:	C. Schulze	DATE: 13.09.2007
CHECKED:	R. Gabel	DATE: 17.09.2007
APPROVED:	S. Fischer	DATE: 17.09.2007

EST. WEIGHT: 850.000 KG | SUPERSEDES: | SCALE: /

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

BLOCK DIAGRAM
PRODUCTION CONTROL SYSTEM

INITIAL USE BOM: 223001-98 | SHEET: 1 OF 1 | DRAWING NUMBER: SK-066052-98-03

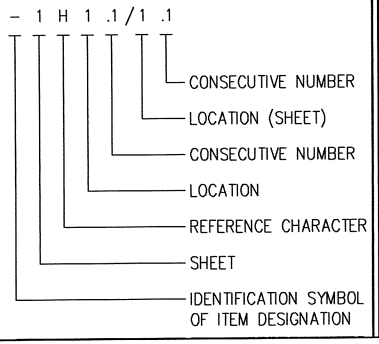
STATUS: APPROVED

SHEET	DESIGNATION
2	PRM, CM
3	CM
4	CONNECTOR OVERVIEW

CABLE NO.	TERMINAL

TERMINAL TYPE	TERMINALS
SINGLE PIN	-2X2
4-WAY MALE	-2X2.1, -2X2.2, -2x7
12-WAY MALE	-2X4, -2X5, -3X3
COAX CONNECTOR	-3X5

ITEM DESIGNATION/CROSS-REFERENCES



LIST OF REFERENCE CHARACTERS (IN ACCORDANCE WITH IEC 61346-1)

A → AMPLIFIER; SPS COMPONENT
B → CONVERTER
C → CAPACITOR
E → MISCELLANEOUS
F → FUSE; MOTOR PROTECTION
H → LAMP; HORN
K → RELAY
M → MOTOR
P → MEASURING INSTRUMENT
Q → MOTOR-, POWER PROTECTION SWITCH
R → RESISTOR
S → SWITCH
T → TRANSFORMER
U → MODULATOR
V → DIODE
W → CABLES
X → TERMINAL
Y → VALVE

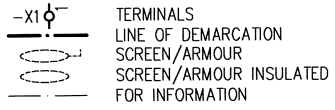
STANDARDS:

- ALL INSTALLATION SHALL BE IN ACCORDANCE WITH VDE 0100.
- ALL ELECTRIC SYMBOLS SHALL BE IN ACCORDANCE WITH IEC 617.

NOTES:

- SEPARATE LAYING OF POWER AND SIGNAL CABLES AND WIRING.
- ALL WIRINGS IN 1.5mm^2, (IF NOT SPECIFIED OTHERWISE).
- ALL WIRING HAS TO BE MARKED WITH CABLE MARKERS ON EVERY CONNECTION.
- CABLE SPLICING SHOULD BE AVOIDED.
- ALL METAL COMPONENTS (MOTOR HOUSINGS, CABLE TRAYS, J-BOXES, CABINETS, DOORS ENCLOSURE, ...) WHICH CARRY COMPONENTS WITH VOLTAGES 50V AC /120V DC OR HIGHER MUST BE GROUNDED TO THE CONSTRUCTION (EARTH) WITH A COPPER CONDUCTOR. MINIMUM CROSS SECTION OF THE CONDUCTOR SHALL BE 6mm^2 .

REMARKS:



KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

REASON FOR ISSUE	DATE	CLIENT REV.
REISSUED AS APPROVED FOR CONSTRUCTION	21NOV07	2
APPROVED FOR CONSTRUCTION	10SEP07	1
ISSUED FOR CLIENT COMMENT	08AUG07	N/A
ISSUED FOR INTERNAL IDC	08AUG07	N/A

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-06-507

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	C. Schulze	21.11.2007	S. Fischer	22.11.2007
A	I. Karras	12.06.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lilienweg 1
29227 Celle, Germany

Supersedes

Title
CIRCUIT DIAGRAM
POWER REGULATOR&COMMUNIC. MODULE

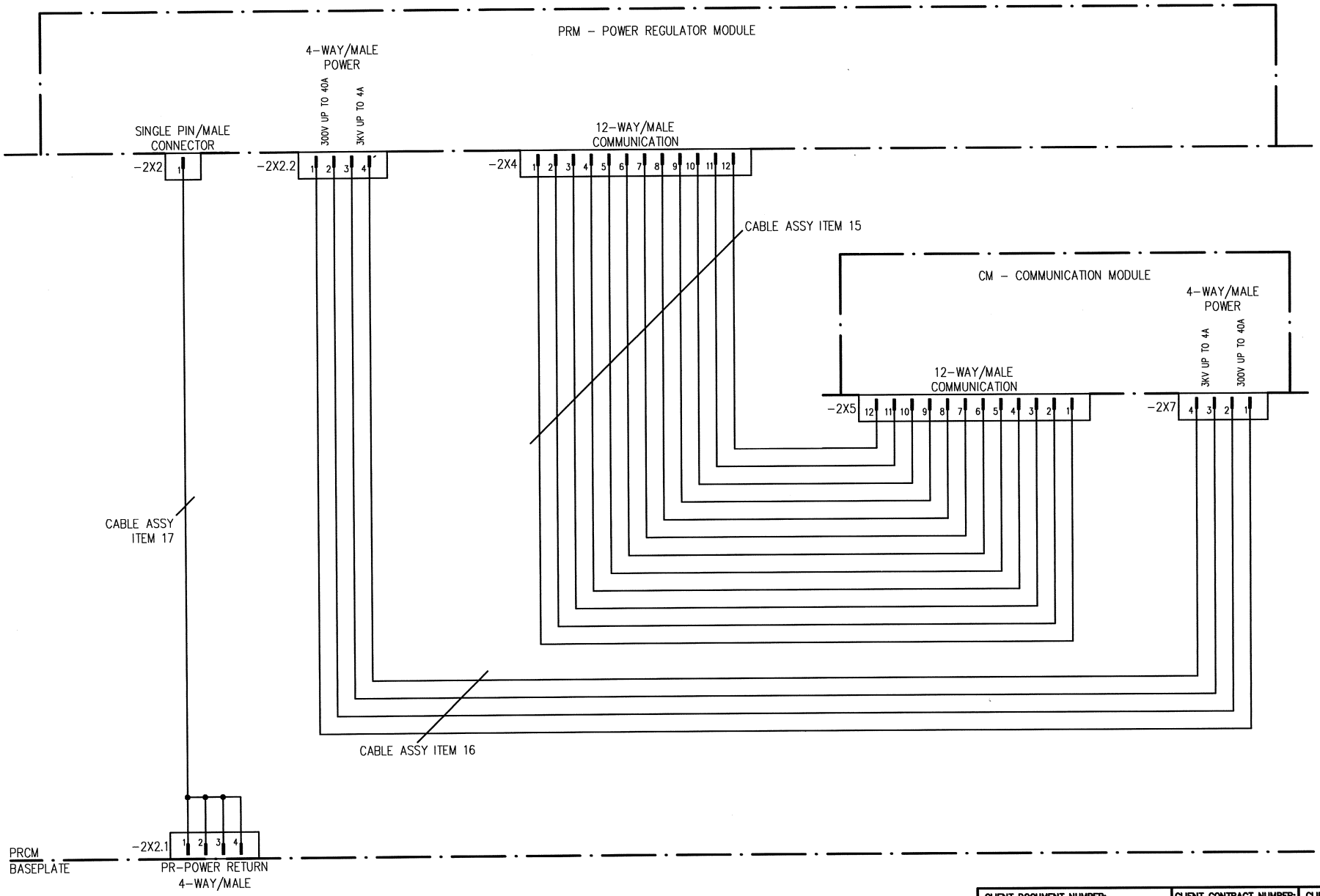
DWG. NO.
SK-066052-98-04

B.O.M. NO.
223052-98

= TOTAL K5F
+ PRCM

SHEET
1 of 4

STATUS: APPROVED



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92–W–06–507	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	C. Schulze	21.11.2007	S. Fischer	22.11.2007
A	I. Karras	05.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lilienweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM POWER REGULATOR&COMMUNIC. MODULE

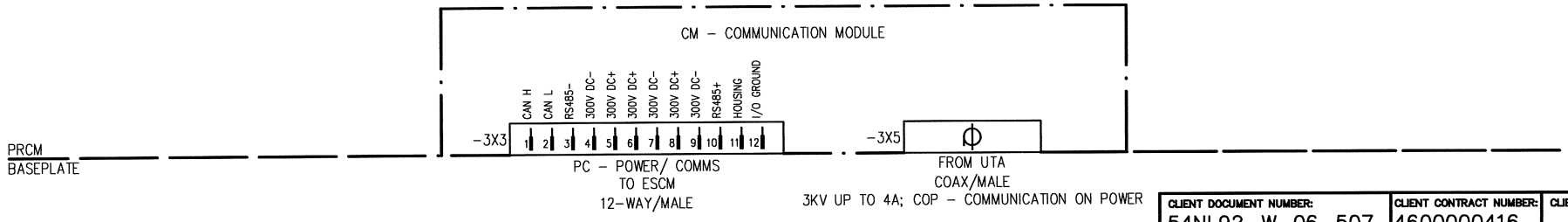
DWG. NO.: SK–066052–98–04

B.O.M. NO.: 223052–98

= TOTAL K5F
+ PRCM

SHEET: 2 of 4

STATUS: APPROVED



Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	C. Schulze	21.11.2007	S. Fischer	22.11.2007
A	I. Karras	05.07.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Supersedes

Title
CIRCUIT DIAGRAM
POWER REGULATOR&COMMUNIC. MODULE

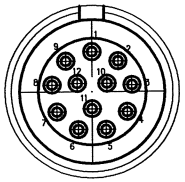
CLIENT DOCUMENT NUMBER:	54NL92–W–06–507
CLIENT CONTRACT NUMBER:	4600000416
CLIENT REV.:	2
DWG. NO.	SK–066052–98–04
B.O.M. NO.	223052–98
SHEET	3 of 4

= TOTAL K5F
+ PRCM

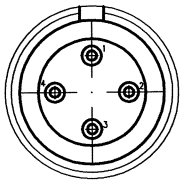
STATUS: APPROVED

BULKHEAD CONNECTOR OVERVIEW

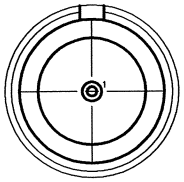
VIEW X
BULKHEAD CONNECTOR
SERIES 80, 12-WAY/MALE
(1:2)



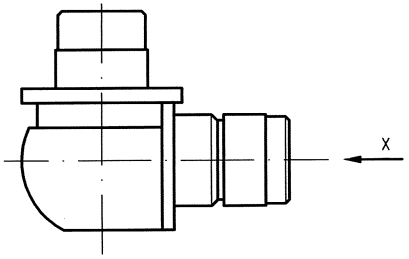
VIEW X
BULKHEAD CONNECTOR
SERIES 80, 4-WAY/MALE
(1:2)



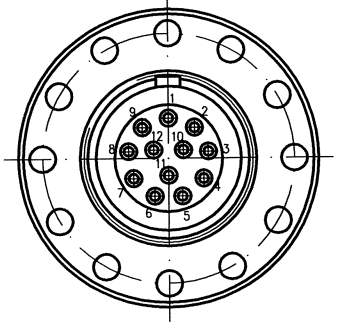
VIEW X
BULKHEAD CONNECTOR
SERIES 80 MALE OR COAX
(1:2)



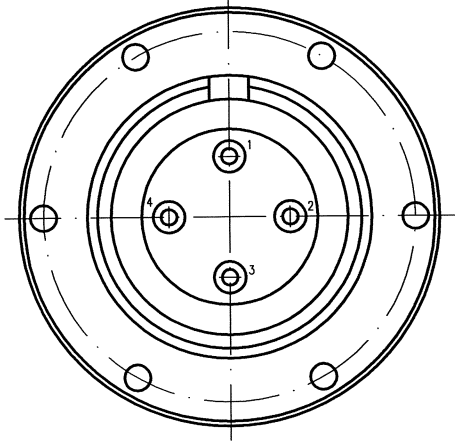
SIDE VIEW FOR BULKHEAD CONNECTORS
NOT FULL-SCALE



SERIE 10, 12-WAY, MALE
PIN VIEW
(1:1)



SERIE 10, 4-WAY, MALE
PIN VIEW
(1:1)



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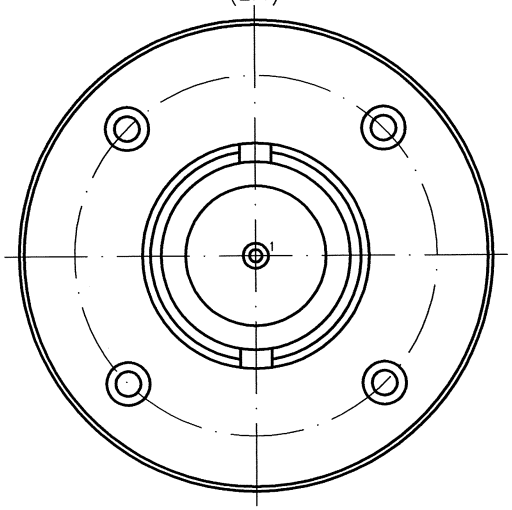
PIN VIEW
(2:1)



CLIENT DOCUMENT NUMBER:	CLIENT CONTRACT NUMBER:	CLIENT REV.:
54NL92-W-06-507	4600000416	2

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	C. Schulze	21.11.2007	S. Fischer	22.11.2007
A	I. Karras	08.08.2007	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON
CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Supersedes

Title
CIRCUIT DIAGRAM
POWER REGULATOR&COMMUNIC. MODULE

DWG. NO. SK-066052-98-04
B.O.M. NO. 223052-98
SHEET 4 of 4

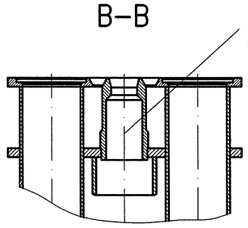
= TOTAL K5F
+ PRCM

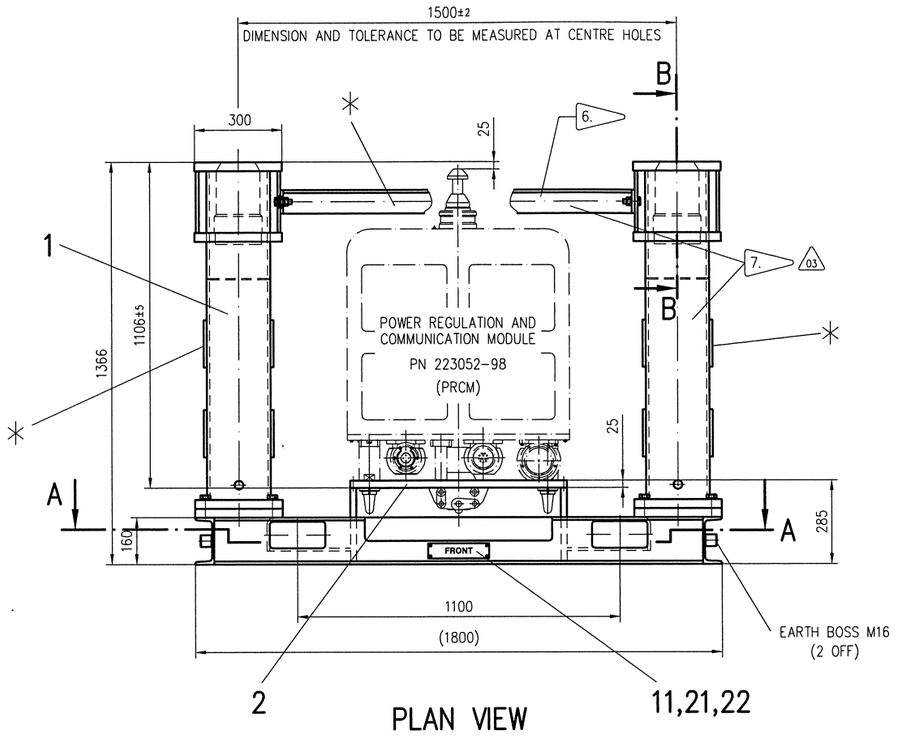
STATUS: APPROVED

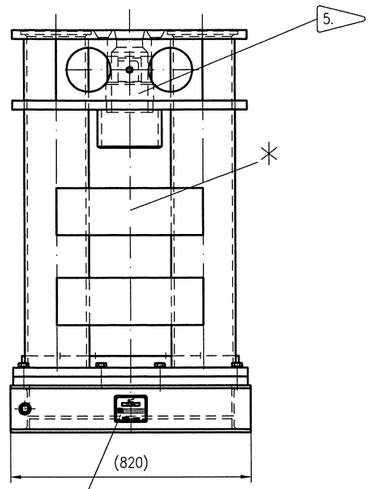
STATUS: Released REVISION : 03
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : PRCM MOUNTING BASE (PRCMMB)
WITH INTERFACE ISO 13628-8

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
001	0001	03	222416-65	1.000	EA	MOUNTING BASE FRAME FOR eSCM AND PRCM WITH INTERFACE ISO 13628-8		
002	0002	02	223052-99	1.000	EA	MODULE MOUNTING BASE, PRCM Power Regulator and Communication Module Mounting Base Production Control System Project: K-5 Client: Total		
010	0010	G01	619046-20-61-51	1.000	EA	TAG: "CONTROL UNIT" (90X110) BLANK, 1.4301 COLOUR OF WRITING: BLACK		
011	0011	A01	223253-86	1.000	EA	TAGGING AND MARKING ASSY FOR PRODUCTION SCMMB		
021	0021		619901-09-07-09	4.000	EA	SCREW, HEX, DIN 933, M4 X 8, SST MATERIAL: AISI 316 (1.4401)	For item 11	
022	0022		619919-09-01-08	4.000	EA	WASHER, MEDIUM, DIN 125, A 4.3, SST TYPE A: W/O. CHAMFER ; ID: 4.3 MM MATERIAL: AISI 316 (1.4401)	For item 11	
023	0023		202117	4.000	EA	SCREW, DRIVE-RND HD TYPE U #4 X.188 SST ANSI B18.6.4	For item 10	
025	0025		619901-17-16-09	2.000	EA	SCREW, HEX, DIN 933, M16 X 25, SST MATERIAL: AISI 316 (1.4401)	Use for earth boss connection	
026	0026		619954-01-20-03	2.000	EA	WASHER, DIN 6798, TYPE A, 16.5 ID SERRATED LOCK WASHER EXTERNAL TOOTH MATERIAL: AISI 316 (1.4401)	For item 25	
027	0027		619919-17-02-08	2.000	EA	WASHER, MEDIUM, DIN 125, B 17, SST TYPE B: WITH CHAMFER ; ID: 17 MM MATERIAL: AISI 316 (1.4401)	For item 25	
>>>B/M Category : Reference Call Outs								
900	0900	03	SK-066415-99	1.000	EA	AS: POWER REGULATION AND COMMUNICATION MODULE MOUNTING BASE (PRCMMB)		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
901	0901	25	D-000100-09-17	1.000	EA	PART IDENT: LOW STRESS STAMP, "ASSY", ASSY P/N, "REV" REV, "CAM" SAP PLANT NO, S/N ("CCV" MAY BE USED IN PLACE OF "CAM". SEE X-043764-01 FOR DETAILS)		
905	0905	02	X-065472-99	1.000	EA	Inspection Procedure and Record Sheet (FAT) PRCMMB		
906	0906	02	X-065467-02-15	1.000	EA	IP: PRCMMB, K5-F Installation Procedure Power Regulation & Communication Module Mounting Base Project: TOTAL K5-F		
910	0910	08	QP-000160-01-18	1.000	EA	Main Quality Plan for DC Tree Systems		



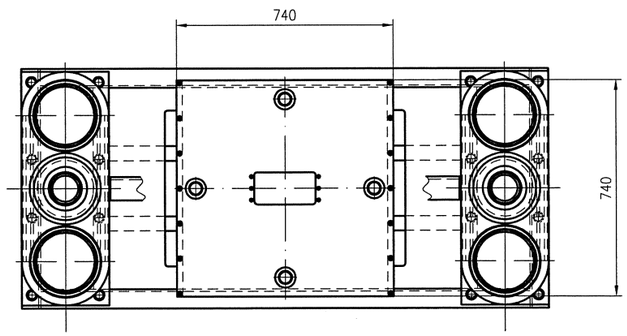




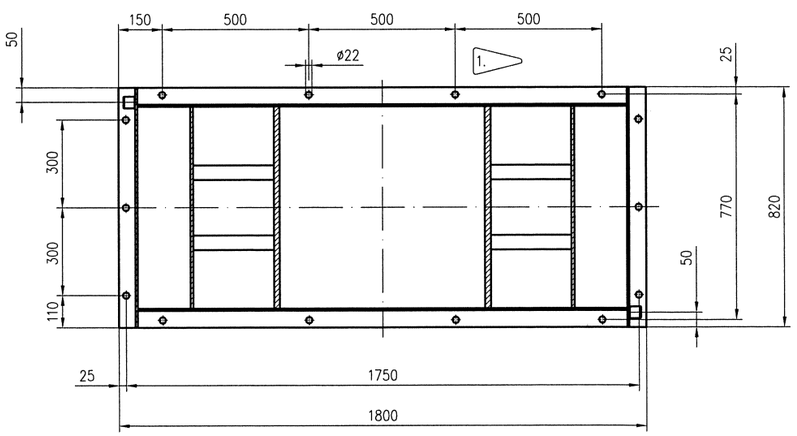
NOTES:

1. USE 3/4" SCREWS & NUTS (14 OFF) TO BOLT THE PRCMMB TO THE SUBSEA PROTECTION STRUCTURE.
2. SECURE SCREWS ITEM 18 OF THE MODULE MOUNTING BASE WITH LOCTITE 222 OR EQUIVALENT.
3. APPROX WEIGHT IN AIR 1260 KG
   APPROX WEIGHT IN WATER 1100 KG
4. EARTH REQUIREMENTS REFER TO INSTALLATION PROCEDURE. INSTALLATION PROCEDURE PART OF BOM.
5. FOR LIFTING USE SUITABLE FOUR (4) POINT LIFTING WITH SOFT SLINGS TO THE PRCMMB TOP FRAME. LIFTING OF PRCMMB WITHOUT PRCM ONLY.
6. ONLY FOR TRANSPORT. BRACKET HAS TO BE REMOVED AFTER INSTALLATION TO THE SUBSEA PROTECTION STRUCTURE.
7. (03) LABEL TRANSPORT BRACKET AND FRONT SIDE OF THE SCMMB WITH THE TEXT: "DO NOT LIFT WITHOUT TRANSPORT BRACKET". USE STENCIL AND BLACK COLOUR.

✳ FOR TRANSPORT ENSURE THAT THE TRANSPORT BRACKET IS INSTALLED.



A–A
STRUCTURAL FIXING INTERFACE VIEW



KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

(03) ADDED NOTE FOR TRANSPORT BRACKET

APPROVED FOR CONSTRUCTION	14JUN07	2
APPROVED FOR CONSTRUCTION	03MAY07	1
ISSUED FOR CLIENT COMMENT	14MAR07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-03-510

CAD | REV. BY: C. Mindermann | DATE: 08.06.2007 | REV.: 03

TOLERANCES ACCORDING TO DIN ISO 8015	SURFACE TREATMENT	DO NOT SCALE	
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	MATERIAL AND HEAT TREATMENT	DRAWN: T. Hein	DATE: 26.10.2006
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K		CHECKED: J. Herper	DATE: 14.06.2007
		APPROVED: A. Schueller	DATE: 14.06.2007
EST. WEIGHT: 1260.000 KG	SUPERSEDES:		SCALE: 1:10

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

ASSEMBLY DRAWING
POWER REGULATION AND COMMUNICATION
MODULE MOUNTING BASE (PRCMMB)

INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223415-99	1 OF 1	SK-066415-99

STATUS: APPROVED

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 2, Section 3

TREE MOUNTED EQUIPMENT

CONTENTS

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 2, Section 3
TREE MOUNTED EQUIPMENT

DESCRIPTION, INSTALLATION, OPERATION & MAINTENANCE

CONTENTS

Project No.	Cameron No.	Description
54NL92-W-0S-502	X-076721-87	SPS – Subsea & Topsides Functional Requirement Specif. *See Volume 1, Section 1 Total System*
54NL92-W-0S-518	X-076721-87-11	Tree & Wellhead Mounted Instrumentation – Supplemental Requirement Specification *See Volume 1, Section 1 Total System*
54NL92-W-OP-581	X-065467-02-28	SCSSV Dump Valve – Installation & Retrieval Procedure
54NL92-W-0P-586	X-065467-02-87	DC Choke Actuator – Exchange Procedure
-	713205	Gas Production Choke Assembly – Maintenance & Repair Manual (Cameron Longford, Ireland)
-	X-065429	General Preservation & Storage Procedure *See Volume 1, Section 1 Total System*

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 2, Section 3
TREE MOUNTED EQUIPMENT

PARTS LISTS & DRAWINGS

CONTENTS

Project No.	Cameron No.	Description
Actuators (cont.)		
-	223350-27	DC Actuator, 3/4" – Parts List
54NL92-W-03-526	SK-066350-27	DC Actuator, 3/4" – Assy Drawing
-	SK-066350-27-04	DC Actuator,3/4" – Assy Drawing
Choke		
-	223446-01	Choke – Parts List
54NL92-W-03-304	SK-066446-01	Choke & DC Actuator – Assy Drawing

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

31 MAR 2009	As Built	A. Weilandt	T. Appel	A. Weilandt
06 AUG 2007	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
02 MAY 2007	Issued for Client Comment	A. Weilandt	S. Horne	
12 OCT 2006	Issued for Internal IDC	A. Weilandt	D.Coonrod	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approver**

CAMERON	**Document Title:** **Subsea and Topsides Functional Requirement Specification**		
PAGE 1 OF 34	**Customer Document Number:**	54NL92-W-0S-502	REV. 2
	Cameron Document No.	X-076721-87	REV. 02

TABLE OF CONTENTS

1 Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
A	12OCT06	Initial release Celle	- - -
B	02MAY07	Section 7.5.6.1: Use of Swagelok added for LP lines and added the need for metric size on all LP tubing Section 8.4: cable entry changed from top to bottom Section 9.2: List of Total Tag Numbers added Section 9.1.1.2: Colour for topside equipment changed from RAL5015 to RAL7035 (light grey) 10.8 & 10.9: updated description as per current design of anode and cathode package 10.10: complete section added for Anode Umbilical Assembly	Comments from internal IDC
01	06AUG07	Section 10.8: Anode Package Foundation Base added	Updated to Approved for Construction
02	31MAR09	Minor cosmetic Customer Comments implemented	Update to “As Built”

2 Introduction

This document is written to consolidate the technical requirements for the subsea control system intended to be used on the TOTAL K5F Project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

It will be submitted for approval early on in the project cycle and upon approval will be used for the design of the system.

Referenced client specifications within this document also need to be considered for the design.

3 Scope of this document

The scope of this document is to define the functional requirements for the subsea control system intended to be used on the TOTAL K5F Project.

Technical requirements relate but shall not be limited to:

- Design basis data
- Functional requirements

The Intervention & Workover Control System (IWOCS) shall **NOT** be covered by this document.

4 Abbreviations & Definitions

4.1 Abbreviations

AIV	Annulus Isolation Valve
AMV	Annulus Master Valve
APTA	Annulus Pressure Transmitter A
APTB	Annulus Pressure Transmitter B
BAIV	B Annulus Isolation Valve
CI	Corrosion Inhibitor
CIV	Chemical Injection Valve
CP	Cathodic Protection
CR	Control Room
DCS	Distributed Control System
DHSV	Downhole Safety Valve
DHPT	Downhole Pressure Temperature Transmitter
EPCU	Electrical Power and Communication Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
HPU	Hydraulic Power Unit
ICSS	Integrated Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
KHI	Kinetic Hydrate Inhibitor
LPMV	Lower Production Master Valve
MEOH	Methanol
PCS	Process Control System
PPD	Production Pressure Downstream
PPU	Production Pressure Upstream
PSV	Production Swab Valve
PTD	Production Temperature Downstream
PTU	Production Temperature Upstream
PWV	Production Wing Valve
PRCM	Power Regulation and Communication Module
SCSSV	Surface Controlled Subsurface Safety Valve
SSS	Safety Shutdown System
TUTU	Topside Umbilical Termination Unit
UPMV	Upper Production Master Valve
UPS	Uninterruptible Power Supply
UTA	Umbilical Termination Assembly
WH	Wellhead
XOV	Crossover Valve

4.2 Definitions

COMPANY	Total E&P Nederland B.V. (TEPNL)
CONTRACTOR	Cooper Cameron UK Ltd.

5 References

5.1 Cameron documents

Following documents **MUST** be considered during the design phase.

Description	Number
Subsea Production Control System Interconnection Diagram	SK-066001-88-04
K5F Field Development Project Contract	4600000416
Bill Of Material – Subsea Production Control System	223001-88
Project Quality Specification	SP-003118-15

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Design of cathodic protection of offshore structures	GS GR COR 100
External protection of off-shore and coastal structures and equipment by painting	GS EP COR 350
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Minimum CONTRACTOR document requirements	GS EP ELE 091
Electrical cables	GS EP ELE 161
Cable trays/ladders	GS EP ELE 311
Precommissioning and commissioning specification	GS EP EXP 101
Precommissioning and commissioning technical preparation	GS EP EXP 103
Precommissioning execution	GS EP EXP 105
Commissioning execution	GS EP EXP 107
Operations preparation during project – Maintenance and inspection documentation	GS EP EXP 203
Requirements for contractor quality management	GS EP PJC 501
Requirements for contractor critically rating of a unit	GS EP PJC 502
Requirements for contractor quality control	GS EP PJC 503
Valves	GS EP PVV 142
Welding of duplex and superduplex stainless steel	GS EP PVV 614
Area classification	GS EP SAF 216

Description	Number
Completed wells safety systems and safety rules	GS EP SAF 226
Impacted area, restricted area and fire zones	GS EP SAF 253
Emergency shut-down and emergency de-pressurisation (ESD & EDP)	GS EP SAF 261
Design philosophy and requirements for subsea stations	GS EP SPS 001
Subsea ball valves	GS EP SPS 005
Service valves in subsea stations	GS EP SPS 006
Tie-in systems	GS EP SPS 007
Corrosion protection of subsea stations	GS EP SPS 009
Preservation requirements for subsea package	GS EP SPS 010
Mechanical completion of subsea stations	GS EP SPS 011
Documentation requirements for subsea stations	GS EP SPS 012
Wellhead and guidance systems	GS EP SPS 013
Subsea gate valves and actuators in subsea Xmas-tree systems	GS EP SPS 015
Subsea insert chokes and associated running and retrieval tools	GS EP SPS 016
Subsea production control system	GS EP SPS 019
Subsea control unit functional requirements	GS EP SPS 020
Subsea mateable electrical/optical connectors	GS EP SPS 021
Environmental testing of subsea electronics	GS EP SPS 022
Cleaning and flushing of hydraulic systems	GS EP SPS 023
Subsea mechanical quarter turn actuator (manually operated gearbox)	GS EP SPS 024
Subsea hydraulic spring return quarter turn actuators	GS EP SPS 025
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Static 230Vac power supply units for on- and offshore installations	NL00-U-6S-037
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Typical cable tray details (offshore)	NL00-U-64-044
Elec. Cable colour seq. (onsh. + offsh.)	NL00-U-64-045
Protection and Instrument Earth. Det. (onsh. + offsh.)	NL00-U-64-046
Presentation of engineering and final documentation	NL00-Z-0S-002

Description	Number
Microstation Version 5.0: User Definable Attributes	NL00-Z-0S-005
Codification & Numbering of New Technical Documents for Offshore Installations	NL00-Z-0S-006
Instrumentation/piping interface standards	NL00-Z-4S-042
Actuators and control systems for hydraulically operated control valves	NL00-Z-7S-041
Actuators and control system for hydraulically operated ball valves	NL00-Z-7S-043
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
Codification of instrumentation links & equipment	NL00-Z-7S-077
Electrical/instrument interface diagram typicals for normally unmanned offshore installations	NL00-Z-71-002
Loop diagrams typicals	NL00-Z-71-003
Instrumentation - process hook-up typicals	NL00-Z-74-011
Hydraulic hook-up typicals	NL00-Z-74-021
Mounting typicals	NL00-Z-74-031
Instrument name plate detail	NL00-Z-74-055
Completion dossier guidelines	CS-3-OPE-EC-701 (EDMP-40657)
K5F MCS – K6CC SSS/PCS Interface	EDMP #59401

Any agreed deviations from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

Any clarifications from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

In case of conflict between documents the following order of priority shall be applied:

1) Local and international rules and regulations
2) Company Safety Specifications (GS EP SAF)
3) Project Specifications
4) Company Standards (NL00)
5) Company General Specifications

5.3 Codes, standards and regulations

Following codes, standards and regulations shall be considered during the design phase.

Description	Number
Design and operation of sub sea production systems	ISO 13628
Design & Operation Of Subsea Production Control Systems	ISO 13628-6
Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluids	SAE AS4059

Description	Number
EMC Directive	89/336-EEC
Process measurement control functions and instrumentation Symbolic representation	ISO 3511
Quality management and quality assurance standards - Part 3:Guidelines for the application of ISO 9001 to the development, supply and maintenance of software	ISO 9000-3

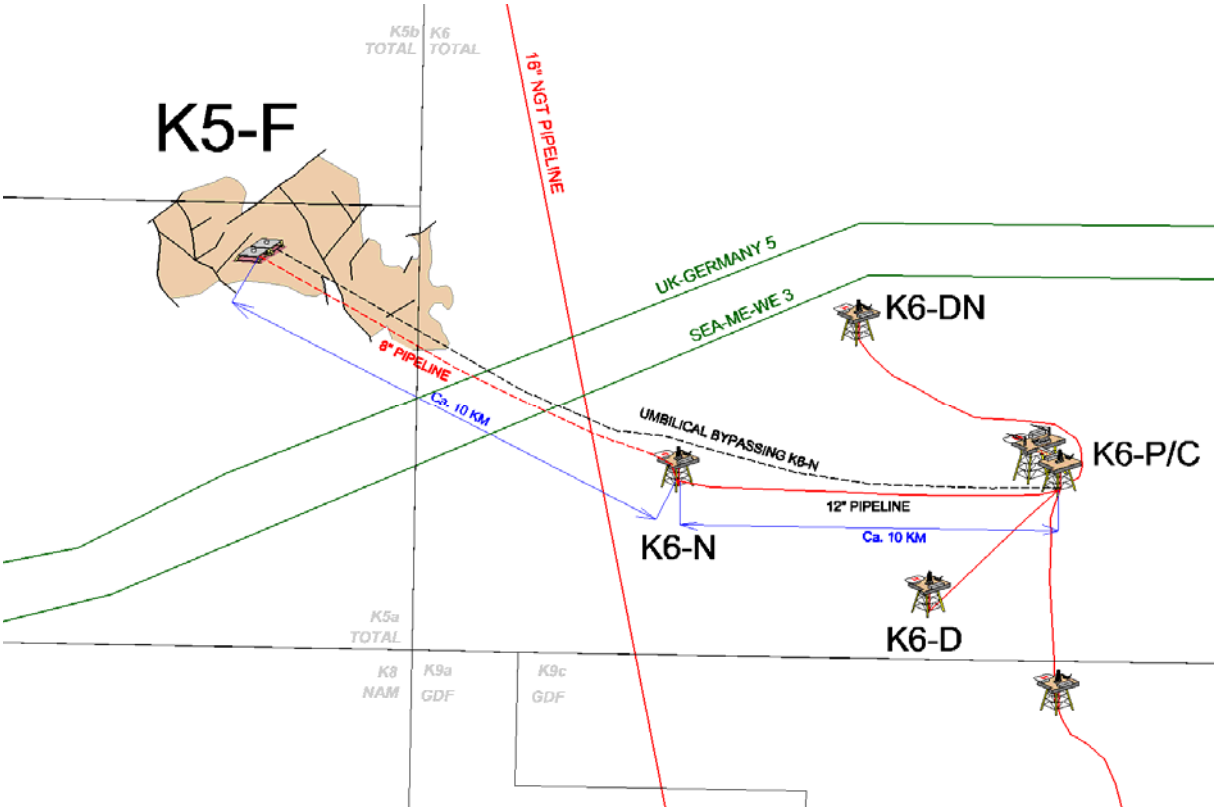
5.4 CE marking

CE marking **will** be required for the K5F project.

6 Project Overview

The K5F is a gas field located 10 km NW of the existing satellite platform K6N and 20km NW of the K6 Central Complex, all operated by TEPNL.

In the first phase, K5F will be developed with two wells. In order to be able to increase the reserves recovery in the future a third well might be connected in the future on the Subsea Protection Structure and it is also possible to connect a fourth future satellite well.



7 Design basis

The following sections are describing the systems information particularly relevant to the design of the Production Control System:

7.1 Field data

Present Number of Production Wells	Two plus two future wells
Design Life	20 years

7.2 Environmental conditions

7.2.1 Climatic data

Parameter		Data
Ambient Temperature (Outdoors)	Minimum Air Temperature	- 16°C
	Maximum Air Temperature	+ 40°C
Ambient Temperature (Indoors)	Minimum Air Temperature	-5°C
	Maximum Air Temperature	+ 40°C

7.2.2 Subsea Design Information

Parameter	Data
Water Depth	37 metres
Temperature	+4°C to +9.5°C
Seawater density	1025 kg/m³
Seawater Electrical Resistivity	0.3 OhmMeter
Wellhead Shut-in Pressure	350 barg

7.2.3 Hazardous Area Classification

The HPU and the TUTU shall be specified for hazardous area Zone 1, Gas Group IIB, Temperature Class T3, on the Platform deck.

7.2.4 Local equipment room

The platform local electrical switch room shall be used to accommodate the MCS and the ECPU cabinets. The maximum temperature during normal conditions within the LER shall be limited to 25 °C, but all of the equipment shall be able to operate as long as the room temperature does not exceed 40°C.

7.2.5 Hydraulic system pressures for the SCSSV line

The subsea production control system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
HP Hydraulics	627 barg	690 barg	1035 barg
Return Lines	< 207 barg	207 barg	N/A
Reservoir Fill Lines	<10 barg	10 barg	15 barg

NOTE: The design pressures shown above shall be used for specification of the HP hydraulic system relief valves and these shall release at the shown design pressures.

The return lines of the HPU are piped directly to the return reservoir and open to atmosphere. Pressure testing of these lines is neither necessary nor possible.

7.2.6 Chemical system pressure requirements

The chemical injection system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
Methanol Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Corrosion Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Kinetic Hydrate Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg

7.2.7 List of chemicals

The following chemicals are considered to be used for chemical injection for the K5F project:

- Methanol (MEOH)
- Corrosion Inhibitor (CI)
- Kinetic Hydrate Inhibitor (KHI)

7.3 Design life

The design life of the Subsea equipment shall be equal to the service life of the field.

The Subsea and related topside facilities shall be designed for a minimum design life of **20 years**.

7.4 Utilities

7.4.1 Platform utilities

The subsea production control system shall be designed to operate from the platform power and utilities as follows:

Electrical Supply (ECPU)	400VAC , 3 phase, 50 Hz ± 2% from UPS (floating), redundant
Electrical Supply (MCS)	230VAC 50 Hz ± 2%,from UPS (floating), redundant
Electrical supply (HPU PLC Cabinet)	230VAC 50 Hz ± 2% from UPS (floating)
Electrical supply (HPU Lighting)	230VAC 50 Hz from MCC
Electrical supply (HPU Motors)	380VAC 3ph 50 Hz, floating (3 wires) from MCC
Electrical supply (Motor heaters)	230VAC 50 Hz from MCC (if applicable)
Electrical supply (ESD solenoids)	24 V DC when healthy, 0V on ESD

7.5 Hydraulic systems

7.5.1 Sealing systems

Hydraulic couplers with primary metal seals are preferred for permanently installed Subsea equipment. Where possible, secondary, non-metallic seals should be considered as back-up for primary metal-to-metal seals. Hydraulic and chemical couplers within removable assemblies like single diver mate able hydraulic/chemical couplings shall have non-metallic primary seals and non-metallic back-up seals.

7.5.2 Hydraulic distribution

The subsea production control system high pressure (HP) hydraulic supplies shall be single from the HPU pumps. The hydraulic system shall be open utilising a water based control fluid.

7.5.3 Hydraulic fluid

The hydraulic system shall use Castrol Transaqua HT water based control fluid.

7.5.4 Fluid cleanliness

The production control system hydraulic control fluid shall be water based. All production control system hydraulic equipment shall be delivered with fluid cleanliness levels of SAE AS4059 class 6 or better. All methanol and chemical lines and equipment shall be delivered with fluid cleanliness level of SAE AS4059 class 12 or better.

Protective caps shall be provisioned for all hydraulic couplings to avoid accidental contamination. Assembly of hydraulic components shall take place in areas where the environment is controlled. The objective shall be to “assemble clean to keep clean” such that subsequent flushing operations are simplified.

Cleaning methods used for sub-assemblies shall include shop air flushing, solvent cleaning, pipe cleaning and ultrasonic bathing as appropriate. Cleaning of major assemblies shall in general be confined to flushing with control fluid of known cleanliness. As far as is practical, designs shall take due note of the subsequent flushing requirements e.g. avoiding blind holes, avoiding welding or grinding on assembled components and ensuring that systems allow turbulent flow for flushing.

All hoses and flying leads intended for chemical service (Methanol, Corrosion Inhibitor and Kinetic Hydrate Inhibitor) should be supplied filled with either control fluid or a suitable fluid compatible with the chemicals to be used.

7.5.5 Tubing

All hydraulic tubing and fittings shall be sized for efficient operation of the system with due regard to design pressures and minimising pressure drops within the system.

- For the topside equipment minimum seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the subsea equipment seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the UTA, the Methanol tubing has to be super duplex.

The tubing of the hydraulic circuits shall be accurately cut and bent using standard tube cutters and tube benders to fitting manufacturer’s recommendation. No burrs shall be allowed and each section of the tubing shall be cleaned and blown dry before assembly to ensure that no contamination is permitted to enter the control components.

All hydraulic tubing together with the associated fittings shall be capable of withstanding the application of a 1.5 times design pressure test for 15 minutes without any deformation or other damage.

7.5.6 Threaded connection systems

All threaded fittings for equipment used subsea shall withstand external ambient pressure at the design depth.

7.5.6.1 Topside equipment

For all circuits Autoclave MP Piping and fittings shall be used, except return lines where Swagelok can be used. All non Autoclave lines need to be in metric size.

7.5.6.2 Permanent subsea equipment

Ferrulok tube end reducers are to be welded to the back of hydraulic couplers, etc., where practical, rather than pipe threaded connections.

High-pressure ports requiring threaded fittings, such as valve actuator ports shall be SAE thread with 37-degree bottom taper conforming to SAE standard J514. Autoclave anti-vibration type fittings shall also be acceptable.

National Pipe Thread (NPT) fittings or any other thread seal type fitting shall **NOT** be used without specific approval from the project.

Fitting assembly torque shall be independently verified and sealed/secured to identify, that fittings have been properly made-up and inspected.

7.5.6.3 Thread sealants

Where taper threads are permitted for use, they shall be sealed using Loctite 572 fluid applied in accordance with the manufacturer's instructions. No other thread sealant shall be used. Teflon tape is **NOT** permitted for use on any equipment used with this system.

7.5.7 Welded connection systems

All couplers, whether in hydraulic or chemical services shall be butt-welded, except were otherwise specified within this document. All couplers shall be fitted with seals from identical compounds. All hydraulic or chemical service valves and fittings shall be butt welded.

- Connections shall be welded to the extent practical
- Autogenously welding shall be acceptable on 316L materials
- Liquid penetrate testing shall be performed on all tubing welds

Note: all welding has to be performed in accordance to approved Cameron welding specification.

8 Electric Systems

8.1 Terminal Type

Screw type terminals shall be used on all topside equipment.

8.2 Instrument Type

For the use in hazardous area EEx-d type instruments shall be used.

8.3 Electrical Motor Type

For the use in hazardous area EEx-d type electrical motors shall be used.

8.4 Cable entry for cabinets located in the Control Room

All cabinets located in the control room shall be designed to allow bottom cable entry only.

9 Functional Requirements

9.1 Coating & protection systems

9.1.1 Coating systems

All equipment manufactured from Carbon steels shall be protected with an approved coating system suitable for the design life of the equipment.

9.1.1.1 Subsea painting

Painting of all subsea components manufactured from Carbon steels shall be done in accordance to the approved paint specification A-020025-01

9.1.1.2 Painting of topside equipment for outside installation

Painting of all topside components located outside shall be done in accordance to the approved paint specification X-065460-04-04

- Top colour for surface equipment shall be light grey (RAL 7035).
- SST framework and parts shall normally NOT be painted, if not separately specified.

9.1.1.3 Painting of topside equipment for inside installation

Paint colour for MCS or EPU cabinet housings shall be light grey (RAL 7035).

9.1.2 Cathodic protection

9.1.2.1 General

The primary corrosion protection system for the control system Subsea equipment shall be via materials selection and suitable paint coatings.

A cathodic protection system using sacrificial anodes shall be utilised to protect the ‘bare steel’ components and to protect uncoated areas of any other control system hardware, i.e. such as those items not protected by the host equipment. Special attention shall be given to SST screws and bolts. All items to be protected shall be electrically connected using stranded, flexible SST 316 earthing braids of a suitable cross sectional area.

9.1.2.2 Calculations

Suitable CP calculations shall be carried out in accordance with the standard applicable for control system hardware i.e. not tree mounted equipment (this shall be part of the Subsea tree CP system). The CP system shall be designed to be capable of protecting the control system for the 20-year design life of the equipment.

9.1.2.3 Construction

The following principles shall be adhered when designing equipment for the subsea control system:

- All equipment metalwork shall be welded (or bolted) onto the equipment main structure to ensure any static potential build up is avoided by continuous drain to earth.
- All metallic items shall have earth continuity by physical connection i.e. metallic fastenings, clamps or earth straps. This shall include all valves, tubing, components, tubing clamps etc.

Electrical connectors may remain isolated from the structure provided suitable materials are chosen for their construction.

- When stainless steel fasteners are used in the construction of subsea structures or equipment, they shall be suitably earth bonded using earth straps. Carbon steel fasteners may alternatively be used.
- Anodes mounted on equipment sub-structures shall be manufactured from material identical and from the same batch as those fitted to the main structure.
- The anodes shall comply with the Cameron material specification MS-011310-01.
- The minimum distance from hydraulic tubing to anodes shall be 80 mm. If unavoidable it is acceptable to have a distance of less than 80 mm for some cases.
- Earthing conductors shall be of corrosion resistant material and shall be securely fastened and protected where necessary against damage and electrolytic corrosion. Where earth-bonding straps are used, conductive paste shall be smeared on contact surfaces (not threads) to ensure a lasting low resistance contact. Where the metallic composition of equipment requiring earth bonding differs from the main structure, care shall be taken in the selection of the bonding strap material to minimise possible ill effects of different contact potentials.
- Connections shall be secured using star-type shake proof washers such that they cannot work loose under vibration.

9.2 Project specific Tag Numbers

This is a list of Tag numbers to be used for K5F equipment. All units and components on this list need to be marked with these numbers as per Total Spec. NL00-Z-74-055.

Instruments	Equipment	Description	Comments
	NN-82201	TUTU	
	NN-82202	HPU	
	NN-82203	HPU PLC	
	NN-81203	MCS	
	NN-81204-1	EPCU 1	
	NN-81204-2	EPCU 2	
	NN-81204-3	EPCU 3	
	NN-81204-4	EPCU 4	
	SA-92100A	Anode Package A	
	SA-92100B	Anode Package B	
	UTA-92100	UTA	
	UTA-92101	IUTA	FUTURE
	UTA-92102	IUTA	FUTURE
	PRCM-92100.1A	PRCM A well 1	
	PRCM-92100.1B	PRCM B well 1	
	SC-92100.1A	Cathode A well 1	
	SC-92100.1B	Cathode B well 1	
	ESCM-92100.1A	ESCM A well 1	
	ESCM-92100.1B	ESCM B well 1	
	DVA-92103.1	Dump valve assembly well 1	
	DHSV-92103.1	Downhole safety valve well 1	

	PRCM-92100.2A	PRCM A well 2	
	PRCM-92100.2B	PRCM B well 2	
	SC-92100.2A	Cathode A well 2	
	SC-92100.2B	Cathode B well 2	
	ESCM-92100.2A	ESCM A well 2	
	ESCM-92100.2B	ESCM B well 2	
	DVA-92103.2	Dump valve assembly well 2	
	DHSV-92103.2	Downhole safety valve well 2	
	PRCM-92100.3A	PRCM A well 3	
	PRCM-92100.3B	PRCM B well 3	
	SC-92100.3A	Cathode A well 3	
	SC-92100.3B	Cathode B well 3	
	ESCM-92100.3A	ESCM A well 3	
	ESCM-92100.3B	ESCM B well 3	
	DVA-92103.3	Dump valve assembly well 3	
	DHSV-92103.3	Downhole safety valve well 3	
	PRCM-92100.4A	PRCM A well 4	
	PRCM-92100.4B	PRCM B well 4	
	SC-92100.4A	Cathode A well 4	
	SC-92100.4B	Cathode B well 4	
	ESCM-92100.4A	ESCM A well 4	
	ESCM-92100.4B	ESCM B well 4	
	DVA-92103.4	Dump valve assembly well 4	
	DHSV-92103.4	Downhole safety valve well 4	
	HP-92100.1	HP Jumper UTA to tree 1	
	MEOH-92100.1	MeOH Jumper UTA to tree 1	
	KHI-92100.1	KHI Jumper UTA to tree 1	
	CI-92100.1	CI Jumper UTA to tree 1	
	COAX-92100.1A	Coax Jumper UTA to PRCM A tree 1	
	COAX-92100.1B	Coax Jumper UTA to PRCM B tree 1	
	PC-92100.1A	P/C Jumper PRCM A to ESCM A tree 1	
	PC-92100.1B	P/C Jumper PRCM B to ESCM B tree 1	
	HP-92100.2	HP Jumper UTA to tree 2	
	MEOH-92100.2	MeOH Jumper UTA to tree 2	
	KHI-92100.2	KHI Jumper UTA to tree 2	
	CI-92100.2	CI Jumper UTA to tree 2	
	COAX-92100.2A	Coax Jumper UTA to PRCM A tree 2	
	COAX-92100.2B	Coax Jumper UTA to PRCM B tree 2	
	PC-92100.2A	P/C Jumper PRCM A to ESCM A tree 2	
	PC-92100.2B	P/C Jumper PRCM B to ESCM B tree 2	
	HP-92100.3	HP Jumper UTA to tree 3	FUTURE
	MEOH-92100.3	MeOH Jumper UTA to tree 3	FUTURE
	KHI-92100.3	KHI Jumper UTA to tree 3	FUTURE

	CI-92100.3	CI Jumper UTA to tree 3	FUTURE
	COAX-92100.3A	Coax Jumper UTA to PRCM A tree 3	FUTURE
	COAX-92100.3B	Coax Jumper UTA to PRCM B tree 3	FUTURE
	PC-92100.3A	P/C Jumper PRCM A to ESCM A tree 3	FUTURE
	PC-92100.3B	P/C Jumper PRCM B to ESCM B tree 3	FUTURE
PCV-92101.1		Production Choke valve well K5F-1	
PWV-92101.1		Production Wing Valve well K5F-1	
UPMV-92102.1		Upper Production Master Valve well K5F-1	
DHSV-92103.1		Down Hole Safety Valve well K5F-1	
AMV-92103.1		Annulus Master Valve well K5F-1	
BAIV-92100.1		B Annulus Isolation Valve well K5F-1	
XOV-92101.1		Crossover Valve well K5F-1	
CIV-92101.1		Chemical Injection Valve well K5F-1	
CIV-92102.1		Chemical Injection Valve well K5F-1	
CIV-92103.1		Chemical Injection Valve well K5F-1	
XEV-92103.1		HP Dump Valve (solenoid) well K5F-1	
PPU-92101.1		Production Pressure Upstream well K5F-1	
PPD-92111.1		Production Pressure Downstream well K5F-1	
APTA-92103.1		Annulus Pressure Transmitter A well K5F-1	
APTB-92105.1		Annulus Pressure transmitter B well K5F-1	
PTD-92101.1		Production Temperature Downstream well K5F-1	
PTU-92104.1		Production Temperature Upstream well K5F-1	
PT-92104.1		Downhole Pressure Transmitter	
TT-92-103.1		Downhole Temperature Transmitter	
PCV-92101.2		Production Choke valve well K5F-2	
PWV-92101.2		Production Wing Valve well K5F-2	
UPMV-92102.2		Upper Production Master Valve well K5F-2	
DHSV-92103.2		Down Hole Safety Valve well K5F-2	
AMV-92103.2		Annulus Master Valve well K5F-2	
BAIV-92100.2		B Annulus Isolation Valve well K5F-2	
XOV-92101.2		Crossover Valve well K5F-2	
CIV-92101.2		Chemical Injection Valve well K5F-2	
CIV-92102.2		Chemical Injection Valve well K5F-2	
CIV-92103.2		Chemical Injection Valve well K5F-2	
XEV-92103.2		HP Dump Valve (solenoid) well K5F-2	
PPU-92101.2		Production Pressure Upstream well K5F-2	
PPD-92111.2		Production Pressure Downstream well K5F-2	
APTA-92103.2		Annulus Pressure Transmitter A well K5F-2	
APTB-92105.2		Annulus Pressure transmitter B well K5F-2	
PTD-92101.2		Production Temperature Downstream well K5F-2	
PTU-92104.2		Production Temperature Upstream well K5F-2	
PT-92104.2		Downhole Pressure Transmitter	
TT-92103.2		Downhole Temperature Transmitter	
PCV-92101.3		Production Choke valve well K5F-3	FUTURE
PWV-92101.3		Production Wing Valve well K5F-3	FUTURE
UPMV-92102.3		Upper Production Master Valve well K5F-3	FUTURE

DHSV-92103.3		Down Hole Safety Valve well K5F-3	FUTURE
AMV-92103.3		Annulus Master Valve well K5F-3	FUTURE
BAIV-92100.3		B Annulus Isolation Valve well K5F-3	FUTURE
XOV-92101.3		Crossover Valve well K5F-3	FUTURE
CIV-92101.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92102.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92103.3		Chemical Injection Valve well K5F-3	FUTURE
XEV-92103.3		HP Dump Valve (solenoid) well K5F-3	FUTURE
PPU-92101.3		Production Pressure Upstream well K5F-3	FUTURE
PPD-92111.3		Production Pressure Downstream well K5F-3	FUTURE
APTA-92103.3		Annulus Pressure Transmitter A well K5F-3	FUTURE
APTB-92105.3		Annulus Pressure transmitter B well K5F-3	FUTURE
PTD-92101.3		Production Temperature Downstream well K5F-3	FUTURE
PTU-92104.3		Production Temperature Upstream well K5F-3	FUTURE
PT-92104.3		Downhole Pressure Transmitter	FUTURE
TT-92103.3		Downhole Temperature Transmitter	FUTURE
PCV-92101.4		Production Choke valve well K5F-4	FUTURE
PWV-92101.4		Production Wing Valve well K5F-4	FUTURE
UPMV-92102.4		Upper Production Master Valve well K5F-4	FUTURE
DHSV-92103.4		Down Hole Safety Valve well K5F-4	FUTURE
AMV-92103.4		Annulus Master Valve well K5F-4	FUTURE
BAIV-92100.4		B Annulus Isolation Valve well K5F-4	FUTURE
XOV-92101.4		Crossover Valve well K5F-4	FUTURE
CIV-92101.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92102.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92103.4		Chemical Injection Valve well K5F-4	FUTURE
XEV-92103.4		HP Dump Valve (solenoid) well K5F-4	FUTURE
PPU-92101.4		Production Pressure Upstream well K5F-4	FUTURE
PPD-92111.4		Production Pressure Downstream well K5F-4	FUTURE
APTA-92103.4		Annulus Pressure Transmitter A well K5F-4	FUTURE
APTB-92105.4		Annulus Pressure transmitter B well K5F-4	FUTURE
PTD-92101.4		Production Temperature Downstream well K5F-4	FUTURE
PTU-92104.4		Production Temperature Upstream well K5F-4	FUTURE
PT-92104.4		Downhole Pressure Transmitter	FUTURE
TT-92103.4		Downhole Temperature Transmitter	FUTURE

9.3 Special Requirements

All warning and emergency signs need to be English **and** Dutch language as per NL00-U-6S-061.

10 Equipment Requirement Specification

10.1 Master Control Station (MCS)

The redundant MCS will be the communication interface between the ICSS and the K5F electrical Subsea Control Modules (ESCM). The MCS will be located in the electrical switch room of the K6P Platform (safe area) and will be powered from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-01 Supplemental Requirements Specification for MCS Hardware

X-076721-87-02 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Control and Management

X-076721-87-03 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Process Interlocks and Shutdowns

X-076721-87-12 Supplemental Requirements Specification for MCS/ICSS Control Interface

10.2 Electrical Power and Control Unit (EPCU)

The EPCU is a redundant electrical power and communication unit for high voltage DC power supply and communication to the subsea installed ESCM's. The EPCU will be located in the electrical switch room of the K6P Platform (safe area) and will receive separate power supply for channel A and B from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-04 Supplemental Requirements Specification for EPCU

10.3 Hydraulic Power Unit (HPU)

A dedicated Hydraulic Power Unit (HPU) will be installed on the K6C platform to provide clean hydraulic HP power for the control of the K5F Downhole Safety Valves (DHSV). The HPU will be controlled from a remote PLC located in a safe area and will be monitored by the MCS/ICSS.

Design Pressure = 690 bar

Hydraulic Fluid = Castrol Transaqua HT

Refer to the following documents for detailed technical requirements:

X-076721-87-05 Supplemental Requirements Specification for HPU

10.4 Topside Umbilical Termination Unit (TUTU)

The Topside Umbilical Termination Unit (TUTU) shall terminate the main electro/hydraulic/chemical umbilical lines and provide the interface to the K6C platform equipment. It will only provide a hardware interface without any block/bleed-valves and/or Pressure gauges for testing or maintenance work. All tubing and couplers need to be supplied by others. The electrical cables shall be terminated in separately mounted explosion proof Junction Boxes or with moulded splice connections.

Refer to the following documents for detailed technical requirements:

X-076721-87-06 Supplemental Requirements Specification for TUTU

10.5 Umbilical Termination Assembly (UTA)

The Umbilical Termination Assembly (UTA) shall be a robust construction to provide interfaces with the umbilical and shall allow to suitably terminating all functions. The UTA shall be setup for the hydraulic connection of the two trees currently in the scope of supply and the two future trees.

Refer to the following documents for detailed technical requirements:

X-076721-87-07 Supplemental Requirements Specification for UTA

10.6 Power Regulation and Control Module (PRCM)

The Power Regulation and Communication Module (PRCM) regulate the power to the ESCM and provide communication to the ESCM. It also provides the connection to the external cathode package.

The PRCM shall be diver recoverable by using a special change out tool and shall be connected to a mounting base.

10.7 Electric Subsea Control Module (eSCM)

The eSCM controls various electric actuators on the tree/wellhead and acquires data from the subsea instrumentation for the transmission to the surface.

The following functions need to be controlled by the eSCM:

No.	Function	Actuator Size	Location	Note
1	CIV 1	¾”	Tree	
2	CIV 2	¾”	Tree	
3	CIV 3	¾”	Tree	
4	BAIV	¾”	Wellhead	
5	AMV	2”	Wellhead	
6	XOV 1	2”	Tree	
7	UPMV	5”	Tree	
8	PWV	5”	Tree	
9	PCV	N/A	Tree	
10	SCSSV Open	N/A	Tree	
11	SCSSV Close	N/A	Tree	

The following tree sensors need to be monitored by the eSCM:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

10.8 Anode Package / Anode Package Foundation Base

There are two separate Anode Packages for the A and the B channel of the system. The Anode Package shall be a robust frame construction for two separate and diver retrievable Anodes. The Anode package requires two separate electrical connectors for each anode for the connection via a flying lead to the anode umbilical assembly. The Anode Packages need to be clearly marked with “A” and “B”. The painted steel frame is protected by FRP grating on all four sides and on top to prevent damages caused by dropped objects. The two anode packages for the channels A and B will be placed on a further support frame to minimize the required installation effort. Both Anode Packages will be located on a Foundation Base.

10.9 Cathode Package

There are four separate Cathode Packages for the A and B channel of each tree. The Cathode Packages will be connected to the respective PRCM on the Subsea Protection Structure via an electrical flying lead. The Cathode Packages are diver installable and will be hooked into the outside plates of the Subsea Protection Structure. The Cathode Package contains the cathode itself and a frame with FRP grating on top to provide mechanical protection.

10.10 Anode Umbilical Assembly

The complete Anode Umbilical Assembly includes the following items:

- an approx. 100m long umbilical with an overall armour and four separate armoured 2,5mm² cores
- a pulling head assembly with 100mm diameter
- a hang-off assembly
- bend restrictor assembly at the Subsea end of the umbilical incl. clamping surface to fix the umbilical
- 4 pigtails, each 6m long, at the end of the umbilical

10.11 Electrical Flying Leads

The electrical flying leads shall comprise a cable moulded to the subsea connectors at both ends. The colour of these cables shall be black with a marking by means of approx. 30cm long heat shrinks at both ends. System A will be marked “blue” and System B “yellow”. These flying leads shall be designed for diver make up only.

10.12 Tree/Wellhead Pressure and Temperature Sensors

The following Pressure and Temperature Sensors are located on the Tree and the Wellhead:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

These sensors shall meet the following requirements:

- Field proven design
- The sensors shall be suitable for the intended subsea service
- Redundant with separate interconnection cables for the A and B channel
- Diver retrievable sensors
- With block-bleed-block assemblies on the pressure sensors
- Minimum accuracy of:
    - +/- 0.03% x full scale accuracy and a drift of 0.2%/year for the pressure sensors
    - +/- 0.3°C accuracy and a drift of 0.2°C/year for the temperature sensors

10.13 SCSSV Dump Valve Assembly

A 3/2 way valve shall be located on the tree for the operation of the SCSSV. The operation of this valve will be direct hydraulic by use of Transaqua HT fluid from a dedicated HPU through a single HP supply line in the main umbilical. The valve shall be designed for the design pressure of the SCSSV system and shall be activated by the ESCM. This assembly will consist of a fixed plate which will be located on the tree and a free plate with the dump valve on which is diver retrievable. Both plates will be connected via quick couplers without the use of poppets. The tree tubing will be connected to the fixed plate by using Autoclave anti-vibration couplers.

11 Quality requirements

A Quality Plan to be used for the project shall be created. For the Project Quality Specification see section 5.1 of this document.

11.1 CE Marking

The topside hardware and software is to be supplied with a CE declaration of conformity, which confirms compliance with all relevant directives.

12 Handling/Installation/Intervention & Shipping

Project shall provide detailed installation and intervention recommendations, and step-by-step project specific procedures, for review as part of the project-engineering phase.

All separately installable and retrievable items shall be provided with suitable lifting points and be generally designed to allow a smooth, simple and quick installation/retrieval process to be performed by divers. This shall include the following items:

- Electric Subsea Control Module (eSCM)
- Power Regulation & Communication Module (PRCM)
- Electrical flying leads between
  - Tree/Wellhead located junction boxes and sensors
  - UTA and PRCM
  - PRCM and ESCM
  - PRCM and Cathode Package

  Tree and Wellhead Pressure and Temperature Sensors
- SCSSV Dump Valve Assembly
- Anode Umbilical Assembly

All subsea assemblies shall be designed to withstand an abandonment period of 6 month sub sea, located where required but not connected to its services (hydraulic, chemical, electrical, ..)

12.1 Use of guidelines

All Subsea equipment (trees, choke inserts, jumpers, control modules, etc.) shall be designed for installation and retrieval by divers with the use of guidelines.

12.2 Lifting / Handling

All equipment shall be designed for safe handling and transportation, both onshore and offshore. All lifting points on all equipment handled offshore shall be:

- Physically load tested to rated weight
- Designed for loads as defined in API 17D and API RP 17G.
- Any welding and associated NDE, which is required for lifting apparatus shall be in compliance with API 17D and API RP 17G.
- All lifting points on all equipment, both purchased and rented; to be handled offshore shall be tested and labelled in accordance with API 17D and API RP 17G.
- All shipped equipment assemblies shall be labelled with their weight.
- Slings and rigging shall be provided for items that require lifting.

12.3 Connection of flying leads

The Subsea hydraulic and electrical flying leads shall be designed to be installed by the use of divers.

Following installation of the Xmas tree, the diver (after removing the LTC from the remote stab or connector) shall pick up the remote end connection and install it to the UTA or Wellhead.

The process shall be similar for the electrical connector.

For recovery the procedure shall be reversed.

12.4 ROV Interfaces

All ROV and diver interfaces shall be designed in accordance with ISO 13628-8.

12.5 ROV Marking of Subsea Stations

Marking of subsea station shall be in accordance with ISO 13628-1 and the following requirements:

- Letter size shall be 50mm

13 Testing

Each item of deliverable equipment shall be tested in accordance with a project approved and CAMERON supplied acceptance test procedure to verify the following as a minimum:

- Functionality
- Internal pressure testing
- External pressure testing
- Control fluid cleanliness to SAE AS4059

CAMERON shall provide written step-by-step procedures for these tests to be provided to COMPANY.

A Control System Integration Test shall be performed in accordance with a COMPANY approved procedure to demonstrate that all of the individual items of equipment function correctly as a system.

The testing programme for the Subsea Production Control System shall be undertaken in the stages detailed as follows:

- Factory Acceptance Test for single units (FAT's)
- System Factory Integration Testing (FIT)
- Tree EFAT
- System Integration Testing (SIT)
- Platform Commissioning
- Offshore Pre-submergence Testing/Deck Testing
- System Commissioning

13.1 Factory Acceptance Test (FAT)

Each deliverable item shall be subjected to a Factory Acceptance Test (FAT). The purpose of this FAT shall be to demonstrate the item is suitable for the intended purpose and functions correctly. FAT tests shall include hydrostatic proof pressure testing to 1.5 times the design pressure of the Subsea control system.

All FAT procedures shall be step-by-step and submitted for review and approval prior to testing commencing.

All critical equipment components shall be subjected to sub-assembly tests during the assembly phase of manufacture and to carry out these tests, the necessary equipment and fittings are specialised in-house equipment and are not project deliverable.

Each item of equipment shall be subject to an in-house FAT in accordance to an approved standard procedure document to demonstrate these meet the specified operational and functional requirements.

The tests shall include interface connections and mechanical alignment tests to verify design and manufacturing limit tolerance effects, component inter-changeability, together with hydraulic fluid system flushing and / or cleanliness checks as necessary to ensure the system meets SAE AS4059. The hydraulic tubing and piping pressure lines shall be hydrostatic pressure tested to 1,5 times the design pressure.

The test equipment shall be determined by the proposed testing programme, however in the event of additional testing or if testing in other locations is required, the quantity of test equipment detailed shall be subject to review.

Testing of fabricated items shall also include continuity testing of bolting.

Testing on subsea assemblies shall include continuity testing and earthing testing.

The maximum value for the resistance measured shall be 0.1 Ohm.

13.1.1 Environmental Stress Screening (ESS)

Modules or subassemblies containing electrical equipment and/or electronic equipment, which are intended for permanent subsea installation shall comply with section 4 of the Total specification GS EP SPS 022 “Environmental testing of Subsea Electronics”.

13.2 Factory Integration Test (FIT)

A System Factory Integration Test (FIT) shall be conducted to verify the correct interfacing and inter-working of all items of the subsea production control system equipment. External interfaces, for example Xmas tree valves & sensors, umbilical cables, DCS, MCC & ESD systems etc. shall be simulated for the purpose of the test. The testing shall be designed to verify the functional and operational integrity of the subsea production control system.

13.3 Xmas Tree/SCM system integration test (Tree eFAT)

A Xmas Tree/SCM System Integration Test shall be conducted for the Xmas tree, following completion of the Xmas tree FAT within the factory.

14 Special packing/shipping procedures/Instructions

For deliverables consisting of a main assembly with additional loose items (Lifting Slings, Test Hoses/Cables, Fill Lance, Pre-Charge Kit, Fluid in Barrels etc.), separate packing/shipping procedures/instructions with included component check-lists shall be provided.

The same shall apply for deliverables that can not be shipped as complete units, as transportation could result in damage of internal components.

These procedures/instructions should be part of the BOM from the related parts.

For all units which include any fluids or substances, COSHH sheets (Control of Substances Hazardous to Health) shall be delivered with the unit. These COSHH sheets shall be available early in the process for supply to the client.

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

09NOV07	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
26SEP07	Issued for Client Comment	A. Weilandt	S. Horne	
20SEP07	Issued for Internal IDC	A. Weilandt	S. Horne	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirements Specification for Tree and Wellhead mounted Instrumentation**		
PAGE 1 OF 10	**Customer Document Number:**	54NL92-W-0S-518	REV. 1
	Cameron Document No.	X-076721-87-11	REV. 01

1 Table of Contents

2 INTRODUCTION

This document is written to consolidate the technical requirements for the Tree and Wellhead mounted Instrumentation intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

3 SCOPE OF THIS DOCUMENT

The scope of this document is to define the technical requirements for the Tree and Wellhead mounted Instrumentation intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

4 Document revision status / record

Table 4-1 – Amendments

Date	Rev.	Description	Author
20SEP07	A	Initial Release	A. Weilandt
26SEP07	B	Incorporated comments from internal IDC and updated to "Issued for Client Comment"	A. Weilandt
09NOV07	1	Front sheet updated to "Approved for Construction"	A. Weilandt

5 ABBREVIATIONS & DEFINITIONS

For abbreviations and definitions used within the Total K5F Project see related documents referenced within section 6.1 of this document.

Abbreviations and Acronyms that are specific to this document alone, for readability purposes are listed in this section:

Table 5-1 – Abbreviation/Acronym

Abbreviation/Acronym	Description
FAT	Factory Acceptance Test
SST	Stainless Steel

6 References

6.1 Cameron Reference Documents

This section defines the supporting Cameron documents to be used for evaluations against overall project requirements.

Table 6-1 – Cameron Reference Documents

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

6.2 Customer Reference Documents

This section defines the supporting customer documents to be used for evaluations against overall project requirements.

Table 6-2 – Customer Reference Documents

Description	Number
Total “Design basis for K5F project”	EDMP #32611
K5F Project Specification for Subsea Process Control System (SPCS)	#46643
External protection of offshore and coastal structures/equipment by painting	GS EP COR 350

6.3 Industry Reference Documents

This section defines supporting industry and regulatory documents to be used for evaluations against overall project requirements.

Table 6-3 – Industry Reference Documents

Number	Description
API RP 14F	Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platform
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment
ANSI/AWS D1.1	Structural Steel Welding Code
ANSI/AWS D1.6	Structural Welding Code – Stainless Steel
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements
SAE AS4059	Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluid

7 Scope of Supply

The scope of supply for the Tree and Wellhead mounted Instrumentation shall consist of the following:

Item	Location	Acronym	Range
Production **P**ressure Transmitter **U**pstream	Tree	PPU	0 to 400 bar
Production **T**emperature Transmitter **U**pstream	Tree	PTU	-60°C to +100°C
Production **P**ressure Transmitter **D**ownstream	Tree	PPD	0 to 400 bar
Production **T**emperature Transmitter **D**ownstream	Tree	PTD	-60°C to +100°C
Annulus **P**ressure **T**ransmitter 'A'	Wellhead	APT 'A'	0 to 500 bar
Annulus **P**ressure **T**ransmitter 'B'	Wellhead	APT 'B'	0 to 200 bar

7.1 Deliverable Documentation

The deliverable documentation for the Tree and Wellhead mounted Instrumentation shall consist of the following as a minimum:

7.1.1 Engineering Documentation Requirements

The scope of supply for engineering documentations shall consists of the following as a **minimum** for approval:

7.1.1.1 Engineering Documentation Requirements for Hydraulic Power Unit

- Assembly Drawing
- Factory Acceptance Test Procedure

7.1.2 Installation Documentation Requirements

The scope of supply for installation, operation and maintenance documentations for the Tree and Wellhead mounted Instrumentation shall consists of the following as a **minimum** for approval:

- Installation Procedure for Pressure and Temperature Sensor

7.1.3 Quality Documentation Requirements

A Manufacturing Record Book shall be provided for the Tree and Wellhead mounted Instrumentation with the following information as a **minimum** for approval:

7.1.3.1 Quality Documentation Requirements

7.1.3.1.1 QA Records

- Factory acceptance test records/charts

8 Tree and Wellhead Instrumentation Design Specifications

8.1 Equipment Design Requirements

Design requirements are defined as follows:

Feature	Static Design Requirement	Performance Requirements	Additional Description
Ambient Temperature	+4 to +9,5 °C		
Service Life	20 years		
Material Compatibility	All Materials used in the instrument shall be compatible with the following: Seawater. Hydraulic Control Fluid Methanol Xylene Scale Inhibitor Production Fluids Corrosion Inhibitors Low Dosage Hydrate Inhibitor		
Pressure Sensor:		Combined accuracy: +/- 0,02% full scale Calibrated range: +/- 1 bar (-60 to 0°C) +/- 0,14 bar (0 to 100°C) Drift: <0,05 % full scale per year	
Temperature Sensor		Combined accuracy: +/- 0,3% full scale Calibrated range: +/- 0,3°C (-60 to 121°C) +/- 1°C (-60 to 0°C) +/- 0,5°C (0 to 100°C) Drift: <0,05 % full scale per year	If required themal gel to be used for installation in cavity of tree body..
Protocol	CAN Fault tolerant Interface with CANopen Protocol		
Electrical Interface	2off receptacle connectors		
Mechanical Interface	API17D flange with BX152 gasket	Flange material Super Duplex or Duplex with Inconel inlay	
Coating	No coating required		

Feature	Static Design Requirement	Performance Requirements	Additional Description
Qualification requirements	All sensors incl connectors shall be qualified according to ISO13628-6.		
Marking	Manufacturer Name and Model Number Cameron Part Number, Revision Level, and PO Number Unique Manufacturer's Serial Number		
Shipping provisions	The probe and the sealing area need to be protected by an "Acetal" protective cap. The electrical connector need to be protected by a dummy connector		

8.2 FAT Test Procedure

The pressure and temperature sensors shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- Pressure barrier testing according to API17D
- Hyperbaric Test as 1,5 times design water depth
- Helium Leak test
- Pressure and Temperature sensor calibration
- Insulation resistance test
- Function Test (incl. test at minimum voltage supply
- Record label and revision of software
- Dimensional and visual check of sensor assemblies

9 Hold Points

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

27MAR08	Approved for Const.	J. Grochowski	C. Reitz	R. Wrede
19NOV07	Issued for Client Comm.	J. Grochowski	C. Reitz	R. Wrede
23OCT07	Issued for internal IDC	G. Durand	R. Wrede	G. Durand
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON

Document Title:

Installation & Retrieval Procedure for SCSSV DUMP VALVE

PAGE 1 OF 10	**Customer Document Number:**	X-065467-02-28	REV. 01
	Cameron Document Number:	54NL92-W-OP-581	REV. 1

Document Revision History

Rev	Date	Description of change	Reason for change
A	23OCT07		Initial Release
B	19NOV07	Comments included	Internal review
01	27MAR08	Comments included	External review

Table of Contents

1 Abbreviations

BOM	Bill Of Material
CAM	CAMERON
DVV	Dump Valve Vent
EFL	Electrical Flying Lead
EPCU	Electric Power & Communication Unit
ESCM	Electrical Subsea Control Module
HPU	Hydraulic Power Unit
LTC	Long Term Cover
N/A	Not applicable
PCS	Production Control System
PN	Part Number
SCSSV	Surface Control Subsurface Safety Valve

2 Scope

This document covers the requirements for the installation, of the CAMERON SCSSV DUMP VALVE within the K5F project.

3 Reference Documents / Drawings

Description	CAM Doc. No.
Bill of Material (BOM): SCSSV DUMP VALVE ASSEMBLY	223293-20
Assembly Drawing: SCSSV DUMP VALVE	SK-066293-20 (54NL92-W-03-514)
Electrical Jumper Installation Procedure Generic Installation Procedure (IP) for Gisma Connectors Series 10 & Series 80	X-065467-02-19
Assembly Drawing: ELECTRICAL & HYDRAULIC CIRCUIT SCHEMATIC XMAS TREE AND CONVERSION WELLHEAD	SK-118071-04 (54NL92-W-61-301)
Assembly Drawing: XMAS TREE	SK-119969-01 (54NL92-W-03-301)

4 Equipment

Description	quantity	CAM Doc. No.
Jumper LTC	4	2197088-17-08
Torque Wrench 26-30mm	1	N/A

5 Safety / Warnings

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

All personnel must acquaint themselves fully and strictly adhere to all company sites' HEALTH AND SAFETY AT WORK REGULATIONS, together with other specific requirements detailed in this procedure.

All work is to be carried out within either a dedicated test bay area with authorised personnel entry points, or an area adequately protected from unauthorised access with a visible cordoned zone and adequately displayed warning signs detailing the test type and associated hazards.

The lifting and handling of the equipment must be carried out with extreme caution and with regard to the safety regulations.

All personnel in contact with the hydraulic fluid must wear suitable protective clothing and gloves if required, regarding all the necessary precautions detailed on the fluid data sheets.

For work, which includes the use of pressurised fluid, compressed gas and/or electrical voltage, all necessary suitable and adequate precautions must be taken prior beginning of work.

All personal working on the equipment must have the required experience, training and qualifications.

ENSURE THAT NO HYDRAULIC PRESSURE IS APPLIED TO ANY OF THE CONNECTIONS BEFORE COUPLINGS ARE MADE – UP OR DISCONNECTED.

ENSURE THAT NO ELECTRICAL POWER IS APPLIED TO ANY OF THE CONNECTIONS IF CONNECTIONS ARE MADE – UP OR DISCONNECTED.

6 System Description

The SCSSV DUMP VALVE is a replaceable part of the TREE.
It is constituted of 2 solenoids valves A & B controlling one HP line (690 bar design pressure).
It is controlled by eSCM through Junction boxes with 4 Jumpers:
The control voltage for solenoid valves is approx. 24V DC. The external hydraulic connections contain no poppet valves.

Figure: SCSSV DUMP VALVE and PROCESS / DVV / INSTRUMENT valve block

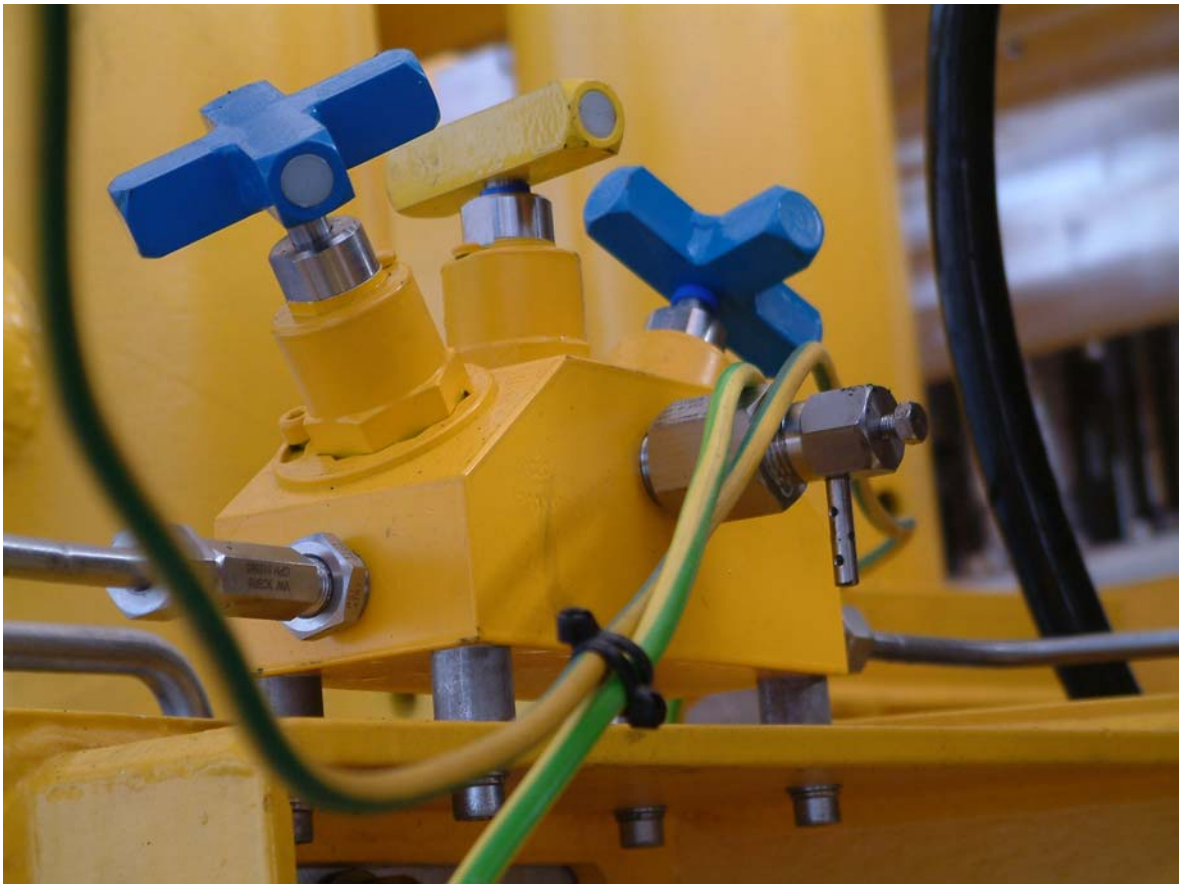


Figure: PROCESS / DVV / INSTRUMENT valve block, rear side with plug

7 Surface Installation

- Ensure the Tree hydraulic and electric power supplies are vented / switched off at HPU and EPCU.

Verify:_____

- Handle the SCSSV DUMP VALVE by 2 persons and support of crane. Correctly align the plates. Fix the SCSSV DUMP VALVE on the Tree according to torque indications described in SK-066293-20.

Verify:_____

- Connect the 4 EFL on SCSSV DUMP VALVE according to
  - SK-118071-04 (or SK-119969-01)
    - Jumper P/N 2197089-20-33 Tag: “open A” item 56
    - Jumper P/N 2197089-20-86 Tag: “open B” item 57
    - Jumper P/N 2197089-20-20 Tag: “close A” item 54
    - Jumper P/N 2197089-20-68 Tag: “close B” item 55
  - X-065467-02-19
  - Function test is expected after installation.

Verify:_____

8 Guidelines for Retrieval from Subsea

- Ensure a controlled shutdown of all Trees.

Verify:_____

WARNING!
Risk of trapped pressure. SCSSV DUMP VALVE must be correctly depressurised from supply and SCSSV line before it is removed.

- Bleed SCSSV HP line through HPU.
- Switch off electric power supply A&B at the EPCU.

Verify:_____

- Refer to tree drawings. Check HP line bleed at DVV valve of the tree. Plug and DVV have to be opened.
  Note: Because SCSSV DUMP VALVE is closed during HPU bleeding, it is necessary to carry out this additional checking.

Verify:_____

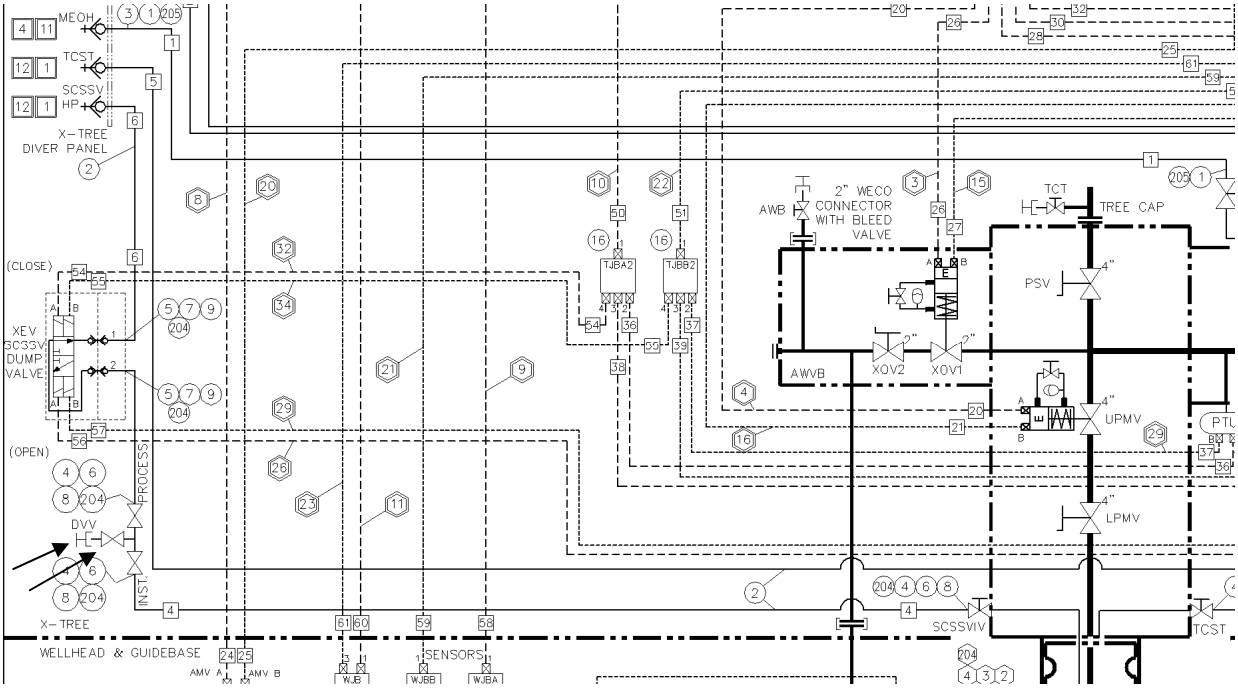


Figure: Extraction from TREE schematic drawing

- Refer to DUMP VALVE assembly drawing. Remove the 4 EFL connections from SCSSV DUMP VALVE.

Verify:_____

- If EFL are disconnected for more than 1 hour, then LTC P/N 2197088-17-08 should be installed at the EFL unplugged connectors.

Verify:_____

- Close PROCESS valve to isolate the Tree HP line from DHPT Valve
  Note: there is no check valve at the half couplings connection between the SCSSV DUMP VALVE and the Tree. Therefore, sea water comes into HP line.

  Verify:_____

- Remove bolting from the SCSSV DUMP VALVE

  Verify:_____

- Remove SCSSV DUMP VALVE from the Tree
  Note: Here, diver should consider which lifting equipment is suitable

  Verify:_____

9 Guidelines for Subsea Installation

- Check that all Trees are still shut down.

  Verify:_____

- Check the electric and hydraulic supplies are still vented switched off at HPU and EPCU.

  Verify:_____

- Carefully align the plates. Fix the SCSSV DUMP VALVE on the Tree according to torque indications described in SK-066293-20 (Swing bolt torque: 85Nm).
  Note: Here, diver should consider which lifting equipment is suitable.

  Verify:_____

- Connect the 4 EFL on SCSSV DUMP VALVE according to:
  - SK-118071-04 (or SK-119969-01)
    - Jumper P/N 2197089-20-33 Tag: “open A” item 56
    - Jumper P/N 2197089-20-86 Tag: “open B” item 57
    - Jumper P/N 2197089-20-20 Tag: “close A” item 54
    - Jumper P/N 2197089-20-68 Tag: “close B” item 55
  - X-065467-02-19 (surface procedure also valid subsea)

  Verify:_____

- Ensure DVV is closed. Open PROCESS valve. Ensure INSTRUMENT valve is open.

  Verify:_____

- Restart the Production Control System as per applicable procedure.

  Verify:_____

10 Maintenance & Repair

If repair work is required send SCSSV DUMP VALVE back to:

CAMERON GmbH
Lueckenweg 1
29227 Celle
Germany

Phone: +49 5141 806 0
Fax: +49 5141 806 333

11 Drawings

Drawings are not included in this document as drawings are subject of revision control and are not comfortable to read on A4 paper.

Exchange Procedure

for

DC Choke Actuator

P/N 223350-28

TOTAL / K5F

Supplier:
CAMERON GmbH
Lueckenweg 1
29227 Celle
Germany
Phone: +49 5141 806 0
Fax: +49 5141 806 333

02	02. April 2009	F. Tegt	D. Abicht	F. Tegt
01	18. February 2009	J. Grochowski	M. Lehmker	F. Tegt
CAM Rev	**Date**	**Prepared by**	**Checked by**	**Approved by**

Document Revision History

Rev	Date	Description of change	Reason for change
01	18. February 2009		Initial Release
02	02. April 2009	Added Appendix B Updated table in Section 5.1.3	---

Table of Contents

1 Introduction

1.1 Scope of this Document

This document outlines the procedure for exchange of the DC Choke Actuator or choke insert. The purpose of the document is to provide a service procedure for CAMERON personnel.

1.2 Limitations of this Document

CAUTION!
The application of this document is limited to trained CAMERON service personnel.
The application of this document is forbidden during heavy sea states and bad weather.

1.3 Abbreviations

BOM	Bill of Material
CAM	CAMERON
eSCM	electric Subsea Control Module
MCU	Motor Controller Unit
MSDS	Magnetic Sound Distance Sensor
OD	Outer Diameter
PN	Part Number

1.4 Reference Documents / Drawings

Item	Description	Cameron Doc. No.
1	Bill of Material: Choke Actuator	223350-28
2	Assembly Drawing: Choke Actuator	SK-066350-28
3	Assembly Drawing: Choke Top Level	SK-066446-01
4	Assembly Detail: Clamp & Trim Assy	SK-079326-01
5	Parameter List: Electric Subsea Actuators, Project K5 F	X-065451-04-59

1.5 Required Equipment

- Test stand to mount DC actuator and choke insert.
- Fixing /securing equipment.
- 2 off eyebolts 5/8”-11 UNC for actuator lifting.
- Sliding calliper (0.1 mm accuracy) to measure actuator stem / choke stem movement.
- O-ring (item 20 of BOM 2259786-01, Clamp & Trim Assy).
- Loctite type 243 or equivalent.
- Torque wrench
- Power supply, Output: 300 VDC, min. 4 A
  Example: FUG, NTN 1400 – 350, Input Voltage 230 V ± 10%
- Actuator Test Box, P/N: 223182-55
- Communication cable, P/N: 223208-85
- Power cable, P/N: 223208-62
- Actuator cable, P/N: 223208-84 (2X)
- Miscellaneous cables for connection between Power cable and Power supply
  (Banana Plug to Harting connector for FUG, NTN 1400 – 350)
- Laptop with Test Software, CAN Explorer and EDS File for Choke Actuator

Test Software:

Description	Cameron PN	Version
Project Test Application	TBD	
CAN Explorer (R&D App. V. 2.2 or higher)	CP-032034-29-03	

Equipment Software:

Description	Cameron PN	Version / Label
MSDS Software* (V. 3.14 or higher) (Object 0x2F00sub004 “Sensor SVersion”)	N.A.	
MCU “A” Software: - Actuator Software (Object 0x100A “Software Version”) - Stepper Controller Software* (Object 0x2F00sub006 “Stepper SVersion”) - Motor Controller Software* (Object 0x2F00sub005 “Drive SVersion”)	 CP-032034-49-01 N.A. N.A.	
MCU “B” Software (if applicable) - Actuator Software (Object 0x100A “Software Version”) - Stepper Controller Software* (Object 0x2F00sub006 “Stepper SVersion”) - Motor Controller Software* (Object 0x2F00sub005 “Drive SVersion”)	 CP-032034-49-01 N.A. N.A.	

*Note: Software provided by 3rd party

2 Safety Warnings

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

All personnel must acquaint themselves fully and strictly adhere to all company sites' HEALTH AND SAFETY AT WORK REGULATIONS, together with other specific requirements detailed in this procedure.

All personnel working on the equipment must have the required experience, training and qualifications.

All work is to be carried out within either a dedicated test bay area with authorised personnel entry points, or an area adequately protected from unauthorised access with a visible cordoned zone and adequately displayed warning signs detailing the test type and associated hazards.

The lifting and handling of the equipment must be carried out with extreme caution and with regard to the safety regulations.

All personnel in contact with the hydraulic fluid must wear suitable protective clothing and gloves if required, regarding all the necessary precautions detailed on the fluid data sheets.

For work, which includes the use of pressurised fluid, compressed gas and/or electrical voltage, all necessary suitable and adequate precautions must be taken prior beginning of work.

ENSURE THAT NO ELECTRICAL POWER IS APPLIED TO ANY OF THE CONNECTIONS BEFORE A PANEL OR BOX IS OPENED OR CONNECTIONS ARE MADE – UP OR DISCONNECTED.

3 Lifting of DC Actuator without Choke Equipment

Weight of actuator without choke equipment approx. 370 Kg

Visually inspect the actuator for damage before and after lifting.

Screw 2 off eyebolts (5/8”-11 UNC) into the hub at the upper end of the actuator and fix the eyebolts with shackles to a crane.

Carefully lift off the actuator a few centimetres to test that safe lifting is possible.

Secure the actuator after lifting against movement / damage.

4 Separation of DC Actuator from Choke Insert

4.1 Pre-Requisites

The choke insert (here now named “choke”) and DC actuator (here now named “actuator”) are still assembled after retrieval and secured on the test stand.

Verify: _____

Choke and actuator are cleaned and dried.

Verify: _____

Note SN of the actuator: _____

4.2 Removal of Actuator

WARNING!
Ensure that electric power is switched off before electric connections are made up or disconnected to the actuator.

Connect all electric test equipment as per diagram on appendix A.

Verify: _____

Open the Test Software (CAN Explorer) and switch on the power to system A and B.

Verify: _____

Note: Ensure that power supply output does not exceed 308 V DC

Check the parameter of the MCU’s in accordance to X-065451-04-59.

Verify: _____

To edit / change the parameters:
Double click the reqired parameter.
Enter new value and click OK.

!!! All Parameters must be saved after any changes otherwise changes could be lost !!!
Select **PROCESS > PARAMETER > SAVE**
Ensure “ALL” is selected in the pop-up box and click OK

Verify: _____

Ensure that the actuator is in the close position (stem extended).

Verify: _____

Switch off the test box and the power supply and disconnect all cables form the actuator.

Verify: _____

Crosswise loosen the 8 nuts (7/8”) that connect choke and actuator.

Verify: _____

Prepare the actuator for lifting.

Verify: _____

Remove the 8 nuts and separate choke and actuator to get access to the connection clamp of the stems.

Verify: _____

Secure the gap and remove the 3/8” screws (in hex) of the clamp that connects actuator stem to choke stem.

Verify: _____

Remove the actuator.

Verify: _____

Ensure that the O-ring (item 20 of BOM 2259786-01, Clamp & Trim Assy) is removed. A new one should be installed later.

Verify: _____

5 Pre Installation Setup of DC Actuator

WARNING!
As the actuator has very high forces it must be avoided to drive the actuator against the stops of the choke. Otherwise the actuator will be damaged.

The actuator incorporates a sensor that measures the movement / way of the actuator stem. The motor controller software of each actuator must be preset to limit the way of the stem before the actuator is connected to the choke. The sensor has a redundant electronic for channel A & B.

5.1 Actuator Motor Controller Adjustment

WARNING!
Ensure that electric power is switched off before electric connections are made up or disconnected to the actuator.

The motor start and stop positions have to be preset to the motor controllers (A & B) of the actuator. The MCU´s are located in the eSCM of the Production Control System. Therefore the start and stop positions will be find out by measurement and must be transferred into the Master Control Station software before the choke is operated from the Master Control Station.

The actuator is disconnected from the choke.

Connect again all electric test equipment as per diagram on appendix A.

Verify: _____

Open the Test Software (CAN Explorer) and switch on the power to system A and B.

Verify: _____

Note: Ensure that power supply output does not exceed 308 V DC

5.1.1 Aim

Adjustment of the stroke and to demonstrate that the sensor shows the correct readings.

5.1.2 Procedure

Note: This test has to carried out with motor controller system "A" and "B".

1. Draw the stem of the choke to the end stop, max. extended (open) position. Measure and record the distance "X" between the end of the stem and the hub area (actuator/choke). Refer figure below.
2. Push the stem of the choke to the max. retracted (closed) position. Measure and record the stroke of the stem, dimension "S".
3. Adjust the open position of the actuator. Distance between hub area and end of the stem is the dimension "X" minus 2 mm. Record the sensor reading for this zero point.
   Note: The safety distance of 2 mm ensures to drive the actuator not to the stops of the choke.

4. Adjust the stroke of the actuator (choke closed position).
   Distance is the dimension "S" minus 4 mm.
5. Stroke out the stem of the actuator in steps of 20% until the closed position is reached. Record for each hold point the sensor reading and compare these values with the measured distances (use a gauge, accuracy 0.1 mm).
6. Retract the stem of the actuator to the open position in two steps, half open and fully open. Record for each hold point the sensor reading and compare this value with the measured distance.
7. Stroke out the stem of the actuator until the closed position is reached. Record the sensor reading and compare this value with the measured distance.

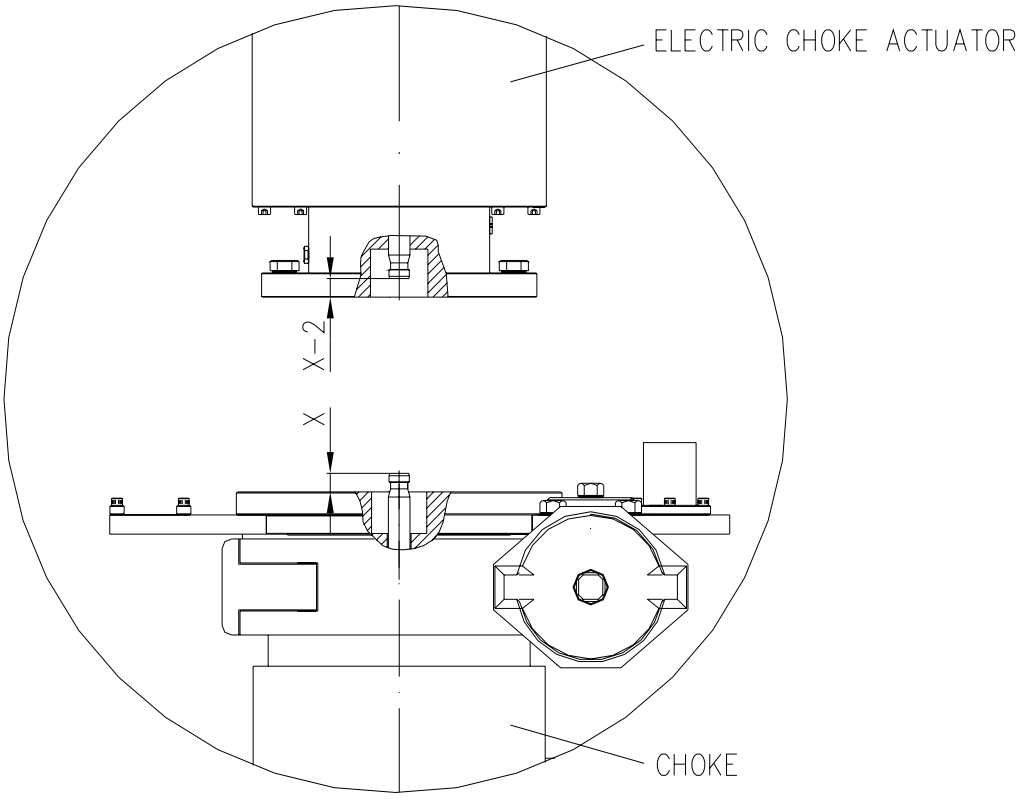


Figure: Actuator and Choke

5.1.3 Results of the Adjustment

Step	Activity	Verify	Results
1	Draw choke stem to extended position (stem visible)		X=
2	Push choke stem to retracted position		Stroke S=
3	Adjust actuator stem position: open		X-2 = zero point, choke OPEN pos. sensor reading =
4	Adjust actuator stroke		S-4 = choke CLOSE position Sensor reading =
5	Stroke out (max. 50 mm) stem of the actuator in steps of 20 %		Measured values [mm] / sensor readings A&B
6	Stem of actuator: Choke half open Choke fully open		Measured values [mm] / sensor readings A&B
7	Stroke out the stem of the actuator (choke close)		Measured values [mm] / sensor readings A&B

Perform the above test for sensor electronic A & B.

Record the correct open and close positions that are required for the MCU software setup via Master Control Station or Test System:

Position	Stem Position	Channel A	Channel B
Choke open position (sensor reading at X-2)	STEM IN	mm	mm
Choke close position (sensor reading at S-4)	STEM OUT	mm	mm

Switch OFF and disconnect the electric test equipment.

Verify: _____

Record the adjustments on Sign Off sheet.

6 Installation of DC Actuator

Motor controllers A & B of DC choke actuator are adjusted to start / stop the stem at the correct positions.

Verify: _____

Check that 8 mounting bolts are fitted to the choke flange.

Verify: _____

Ensure that the O-ring (item 20 of BOM 2259786-01, Clamp & Trim Assy) is installed according to Drawing SK-079326-01 between Actuator and the Clamp & Trim Assy.

Verify: _____

Orientation of choke to actuator must be according to drawing SK-066446-01.
Guide pins are in place.

Verify: _____

Connect actuator stem and choke stem by clamp.
The 3/8” screws have to be tightened by 20 Nm (14 lbs.ft.). Secure the screws with Loctite type 243 or equivalent.

Verify: _____

Carefully lower and retract actuator onto the choke flange.
The actuator is fixed to the choke by 7/8” nuts with a torque of 424 Nm (313 lbs.ft.).

Verify: _____

WARNING!
Ensure that electric power is switched off before electric connections are made up or disconnected to the actuator.

Connect the A & B cables to the actuator. Start up test equipment with correct Open / close parameters.

Verify: _____

Move the choke trim to a position of 100% and 0% via MCU A.

Verify: _____

Move the choke trim to a position of 100% and 0% via MCU B.

Verify: _____

Move the choke trim to a position greater then 50% open.

Verify: _____

Switch OFF and remove electric test equipment.

Verify: _____

Record the installation on Sign Off sheet.

7 Parameter upload via Master Control Station

Ensure that the new open / close parameters are loaded and saved to the MCU A&B via Master Control Station. Parameters shall also be communicated to the software department in Celle.

Verify: _____

For detail information how to upload the parameter see appendix B.

8 Sign Off Sheet for DC Actuator Installation

Project : _____

Actuator PN : 223350-28

Actuator serial no : _____

Choke serial no : _____

Actuator motor controller adjustments were carried out by:

Name	Signature	Date

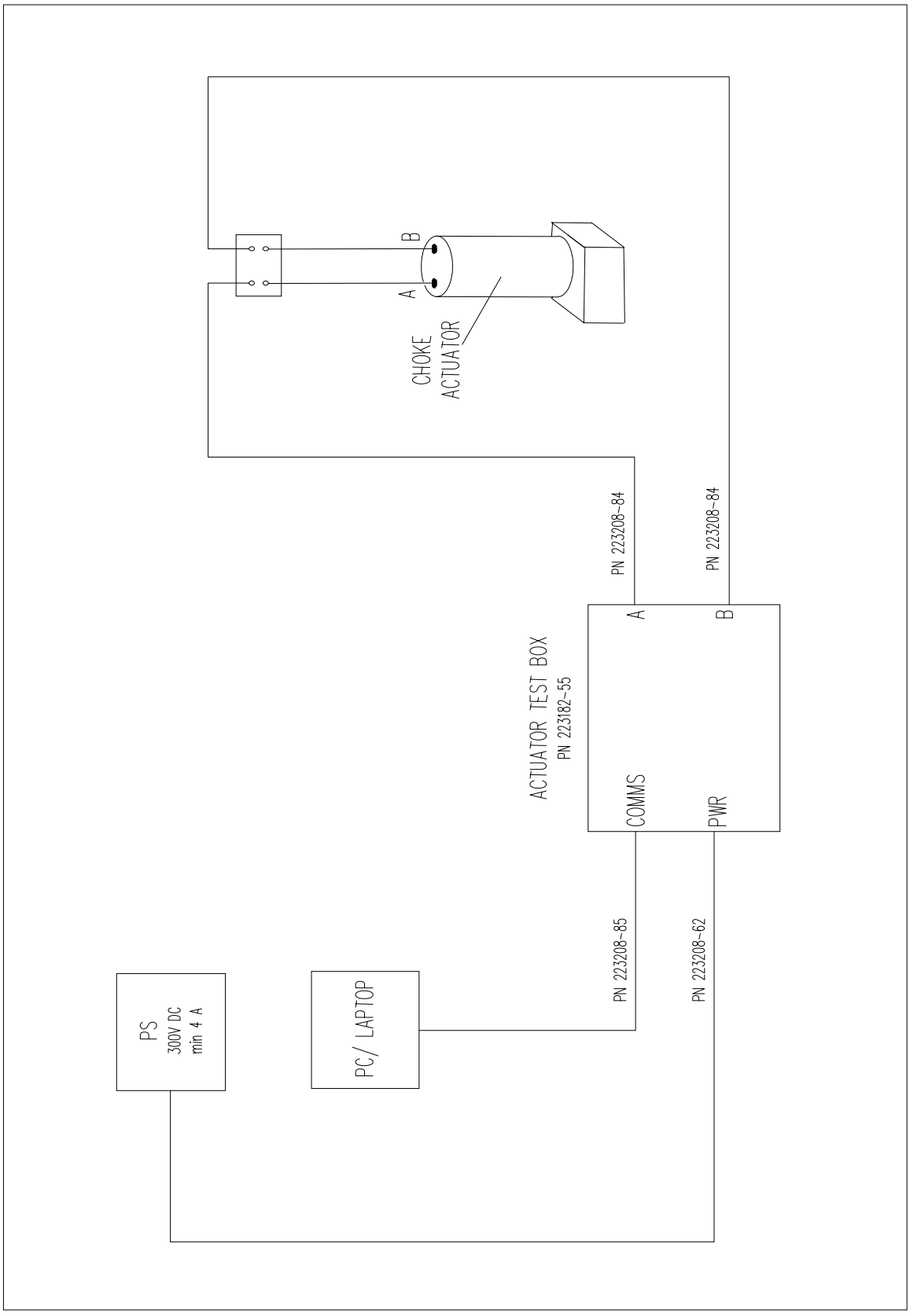
Actuator installation was carried out by:

Name	Signature	Date

Actuator open / close parameters were loaded to MCU A&B via Master Control Station:

Name	Signature	Date

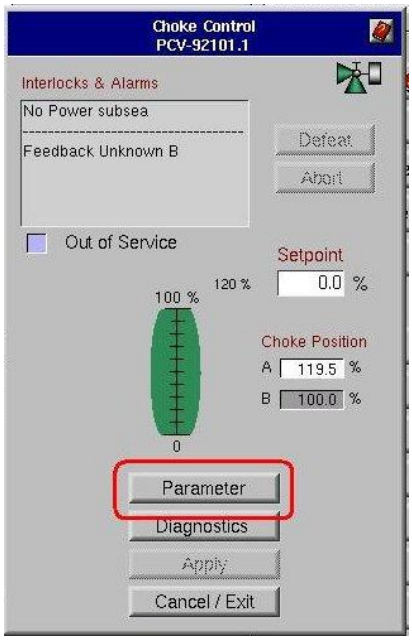
9 Appendix A


B
A
CHOKE
ACTUATOR
PN 223208-84
PN 223208-84
A
B
ACTUATOR TEST BOX
PN 223182-55
COMMS
PWR
PN 223208-85
PN 223208-62
PS
300V DC
min 4 A
PC/ LAPTOP

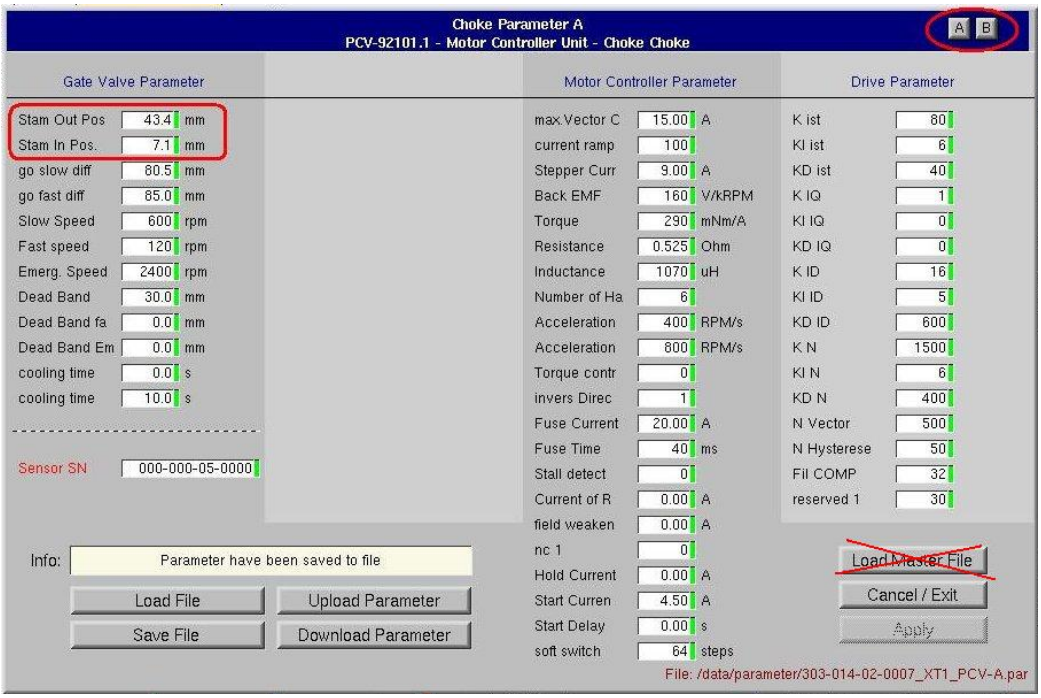
10 Appendix B

How to upload parameter to the MCU

1. Login as “software”
2. Select the related wellslot (K5F1, K5F2)
3. Click on the PCV symbol to open the Choke Control popup
4. Click the [Parameter] button to open the Choke Parameter popup



5. Select [A] or [B] channel in the upper right corner, the popup will be auto re-open on change - The header in the popup shows the selection i.e. “Choke Parameter A”



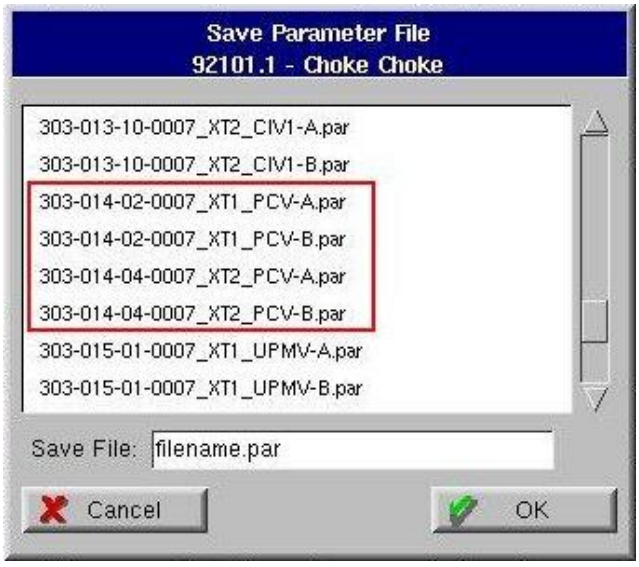
6. Click on the [Download Parameter] button to download the parameter **FROM** the MCU
7. Verify that all data received, all values shall show a green indicator
8. Change the “Stam in” and “Stam out” values.
   - Click in the text field
   - Type in the value (see table in section 5.1.3)
   - Hit **ENTER**

     The indicator becomes “yellow”
9. Click on the [Upload Parameter] button and push [Apply] to upload the parameter **TO** the MCU
10. Verify that the both value indicators change to green → upload O.K.
11. Click on the [Download Parameter] button and verify that the values are correct stored within the MCU, all indicators shall change to green → O.K.
12. Save the changes to the parameter file
    - Click the [Save File] button
    - Click on the correct “choke parameter file name”;

      “SerialNumber_Tree number_Tagname_Channel.par”

      i.e:. 303-014-02-0007_XT1_PCU_A.par

      XT1 == K5F1 ; XT2 == K5F2
    - Click [OK], a popup “File name already exist” appear, click [yes] to overwrite the existing file.



13. Repeat steps 5 to 12 for the other channel; i.e. “B”
14. Copy the files to an USB stick and send them to software department in Celle, Germany

    The files are located under “/data/parameter”

Maintenance and Repair Manual

Total K5F

GAS PRODUCTION CHOKE ASSEMBLY

CC30SR CHOKE ASSEMBLY **P/N : 223446-01**

CUSTOMER
TOTAL

Manufactured at: CAMERON, Longford, Ireland

Manual No:	**713205 Rev 02**	
Prepared by:	**Mark Lowe**	**Date: 15th Oct '07**
Approved by:	**Eugene O'Reilly**	**Date: 16th Oct '07**

CONTENTS

1.0
GENERAL

1.1 INTRODUCTION

Cameron's scope of supply for the Total K5F project includes CC30SR External Sleeve choke assemblies. This manual is intended to provide the relevant backup information for each assembly to allow the safe and successful integration and operation of these components.
The following manual begins with a brief summary of each assembly in Section 1.0 while Section 2.0 provides detailed performance data and product descriptions for the main components. Section 3.0 and 4.0 give recommendations for the safe handling and transportation of Cameron equipment, together with data sheets outlining the additional precautions required for the handling of the hydraulic oils. Section 5.0 gives specific details on the operational features of the equipment and includes all necessary precautions for the safe integration of the Cameron equipment into the subsea system. Section 6.0 outlines the recommended Cameron maintenance procedures, including changeout of the primary seals. This section also includes a detailed breakdown of possible operational and intervention problems as well as proposed solutions. Section 7.0 gives recommendations on the safe storage of Cameron equipment and spare parts.

1.2 CHOKE ASSEMBLY

The choke assemblies supplied are Cameron CC30SR External Sleeve subsea insert retrievable chokes.

The choke consists of two major assemblies:

a) The actuator/trim package: hereafter called the insert.
and b) The choke body

The choke body is permanently fixed to the X-mas tree while the insert may be retrieved by divers.

The inserts all have the same external geometry and are inter-changeable between the choke bodies. The trim is actuated using a Cameron DC Electric Choke Actuator.

Sections 2.2.1 and 2.2.2 give more detailed information on these assemblies.

1.3 ABBREVIATIONS

Abbreviation	Meaning
Assy.	Assembly
API	American Petroleum Institute
B.O.M.	Bill of Materials
C.L.	Centre Line
CVRT	Choke Valve Running Tool
D.C.	Direct Current
Dia.	Diameter
Dwg.	Drawing
ID	Internal Diameter
F.A.T.	Factory Acceptance Test
JQR	Job Quality Requirements
lg	Long
Max.	Maximum
m.w.p.	Maximum Working Pressure
NACE	National Association of Corrosion Engineers
Ni	Nickel
NOM	Nominal
NPT	National Pipe Threads
PCB	Printed Circuit Board
Press.Bal	Pressure Balance
PSL	Product Specification Level
Pt	Point
PTFE	Polytetrafluoroethylene
Ref.	Reference
Rev.	Revision
ROV	Remotely Operated Vehicle
S.C.M.	Subsea Control Module
Soc Hd	Socket Head
SR	Subsea Retrievable

2.0
TECHNICAL DESCRIPTION

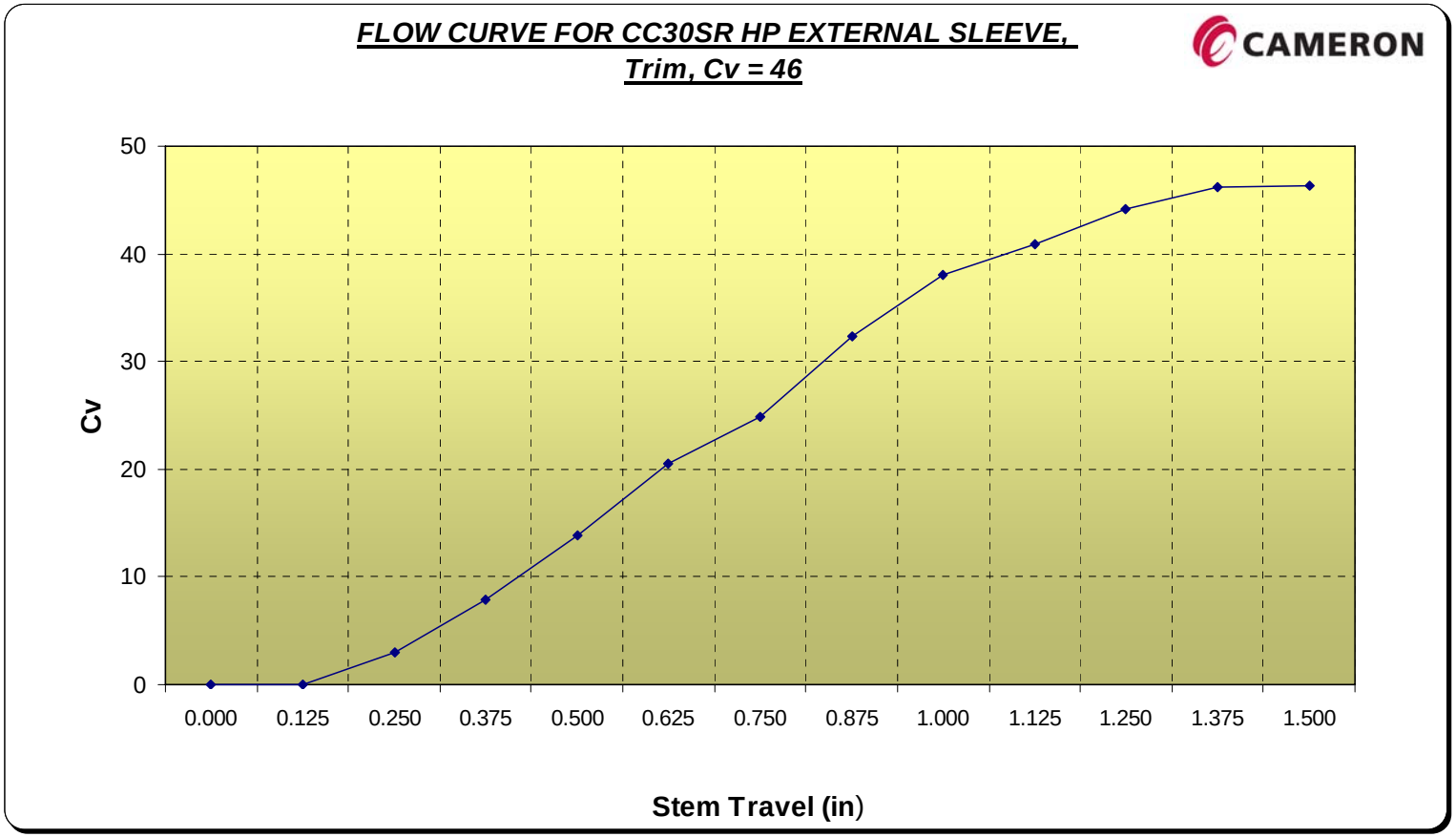


Figure 2.1

Cv	0	0	3	7.9	13.8	20.5	24.9	32.3	38	40.9	44.2	46.2	46.3
Travel	0	0.125	0.25	0.375	0.5	0.625	0.75	0.875	1	1.125	1.25	1.375	1.5

2.1 PERFORMANCE DATA

The choke is primarily designed for forward flow production. The External Sleeve trim has a maximum rated Cv of 46 per the theoretical curves as shown in figure 2.1.

2.2 DESCRIPTION OF MAIN EQUIPMENT

2.2.1 *Choke Body Assembly*

Drawing ref.: SK-079366-01

The choke body assembly consists of three basic systems:

(1) Choke body

(2) Alignment system

(3) Corrosion protection system

(1) Choke body

The choke body is a right-angled body configuration with an orientation and envelope dimensions as specified per SK-079366-01. The maximum working pressure rating for the choke is 10,000 psi with a maximum allowable hydrotest pressure of 15,000 psi. 4 1/16" API 10,000 psi flanged inlet and outlet are provided for hook-up. The body is manufactured from ASTM A182 grade F22 low alloy steel fully clad with Nickel alloy 625 to a minimum depth of 0.125" thickness. The interfaces to the choke insert at the rear hub of the body are moly-coated for protection. The choke body is incorporated with a bonnet seal test port.

(2) Alignment system

Two mounting brackets are bolted to the exterior of the choke body and incorporate two guide funnels. These are the receptacles for the guide pins on the choke insert assembly and provide alignment for the insert during installation. The guide pins engage in the guide funnels and final alignment is provided by the choke insert centralising within the choke body bore with the aid of the bearing rings. When the choke insert is fully installed, the choke body hub and the clamp hub mate and the clamp may be closed. A lockdown indicator positioned on a body bracket provides visual indication of lockdown of the insert in the choke body.

(3) Corrosion protection system

The primary corrosion protection is provided by anodes attached to the Xmas tree structure and this is supplemented by secondary corrosion protection from an anode attached to the choke insert. To ensure electrical continuity throughout the choke body assembly, serrated washers are positioned on all low alloy bolting exposed to seawater and additional strapping is also provided between the body coupler bracket and the guide funnel.

2.2.2 *Choke Insert Assembly*

Drawing ref.: SK-079326-01 – Insert
Drawing ref.: SK-066350-28 – DC Actuator

The retrievable choke insert assembly consists primarily of six basic systems:

(1) The (a) trim and (b) seals for controlling the flow

(2) The clamp for securing the insert to the body.

(3) The actuator for adjusting the trim

(4) The insert installation/retrieval lifting mandrel.

(5) The alignment system

(6) The corrosion protection system

(1A) TRIM

The trim is an external sleeve design which controls the flow by moving the sleeve, which is attached to the stem. The stem is moved linearly by the lead screw of the stem drive sleeve, mating with the lead screw of the actuator power nut. Rotation of the stem is prevented by using a spline. The stem/sleeve assembly is supplied with pressure balance ports which minimise stem loads and actuation forces. These ports are designed to be self-flushing to prevent solid particle build up.

This eternal sleeve trim has a maximum Cv of 46.

In order to maximise wear life, the inner section of the external sleeve is manufactured from tungsten carbide. This is shrunk-fit on to the 17-4 PH SS stem.

The cage consists of a tungsten carbide ported sleeve, which is shrunk fit into a 17-4 PH SS cage carrier.

The cage is threaded onto the bonnet, which is manufactured from Super Duplex.

(1B) SEALS

Drawing ref.: SK-079326-01

The primary sealing systems for the choke assembly are mounted on the choke trim.

The primary body to bonnet seal is located on the upper rim of the cage and is a pressure energised Cameron metal lip seal manufactured from Nickel alloy 718. One Cameron elastomeric S-seal is positioned in front of the metal seal to act as a scraper during installation and also acts as an upstream back-up seal to the bonnet for pressures between the cage and choke body. A second S-seal prevents hydrostatic pressure acting on the back side of the metal lip seal. The S-seal features anti-extrusion springs and is manufactured from Camlast™, which is a proprietary Cameron material.

A dual S-seal arrangement is utilised for the primary bean seal at the base of the cage.

The stem seal is a Varipak™ pressure energised, multiple lip, non-elastomer seal which is spring energised for sealing at low pressures. In the unlikely event of leakage past the stem seal, a secondary seal prevents over-pressurisation of the actuator and a check valve, mounted in the bonnet between the two seals, allows the pressure to vent to sea. A support ring is installed in front of the stem packing to enable it to withstand hydrostatic back-pressure in the event of check valve failure.

Two bearing rings are mounted on the cage to aid the correct positioning of the insert in the choke body bore during installation

(2) CLAMP

Drawing Ref: WSK-1949L.

A hinged hub clamp connector with single bolt lockdown is used to lock the non-retrievable choke body to the retrievable choke insert subsea. The clamp assembly is manufactured from low alloy steel and incorporates a moly-coated clamp plate for attachment to the choke insert. The mating hub to the choke body is connected directly to this clamp plate. It is manufactured from low alloy steel and is also moly-coated at the body hub/clamp interfaces. The clamp setting torque rating is 1,250 ft lbs. Maximum required torque to breakout is 1,500 ft lbs. & damage torque is 2200 ft.lbs.

An ROV torque bucket receptacle is supplied fitted to the clamp to interface with the horizontal valve tool for clamp lockdown. In the absence of this tool, diver interface with this receptacle is utilised (drawing ref.: WSK-1949L).

Clockwise/counter-clockwise rotation of the ROV torque shaft locks/unlocks the clamp and a clamp lockdown indicator marking is provided on the clamp hinge adjacent to the torque bucket, to indicate the open/close position of the clamp.

(3) CAMERON DC ELECTRIC CHOKE ACTUATOR

Drawing Ref: SK-066350-28

The electric choke actuator is bolted to the top plate of the clamp assembly, and is by means of seals isolated from the process fluid. The actuator mechanism operates in an oil-filled, pressure compensated housing. The compensating fluid also provides lubrication and its thermal conductivity stabilizes component temperatures. The outer housing is made from 316 stainless steel. Inside the actuator housing are dual-redundant servomotors employed with a low duty cycle and high efficiency design gear reduction, & planetary roller spindle drive. The brushless DC motors and their wiring are duplicated to make the actuator dual redundant up to the gear reduction unit. A redundant position indication systems by means of magnetic sound distance sensing provides exact position. Two electric connectors mounted on the actuator housing provide connection for power and communication.

The brushless DC motor is driven at a constant rate so power supplied from the controller is that required to overcome reaction from the valve. The feedback from the servo motor drive provides data on the motor torque required to move the actuator and valve, and valve position.

The actuator includes an independent position transducer. All of this data is retrieved to the surface equipment for diagnostic monitoring.

(4) INSERT INSTALLATION/RETRIEVAL LIFTING INTERFACE

The choke clamp top plate incorporates 4 off holes for 1" eye bolts (Ref drawing SK-079326-01), to enable diver retrieval of the insert assembly.

(5) ALIGNMENT SYSTEM

Two guide pins provide alignment of the insert with the choke body during installation. Complete vertical stab-in of the insert is verified by an indicator, mounted on the choke body coupler bracket, aligning with the lower edge of the clamp plate.

The guide pins engage in the guide funnels and final alignment is provided by the choke insert centralising within the choke body bore with the aid of the bearing rings. When the choke insert is fully installed, the choke body hub and the clamp hub mate and the clamp may be closed.

(6) CORROSION PROTECTION SYSTEM

The primary corrosion protection is provided by anodes attached to the Xmas tree structure and this is supplemented by secondary corrosion protection from an anode attached to the choke insert.

Electrical continuity of components not protected by direct contact with the cathodic protection system is provided by braided straps earthed between components. Main body parts are assembled with serrated washers.

2.3 DRAWINGS & REFERENCE PROCEDURES

The following table lists all the drawings and procedures referenced in this report with hard copies provided in the Appendices.

Drawing no.	No. of pages	Title
X-175160-01	8	Pre-submergence Checklist for subsea Retrievable Choke with Clamp Connector.
WSK-1949L	1	Modified API 17H High Torque clamp interface drawing.
WSK-2314L	1	Exploded detail for installation / removal of metal seal.
SK-066350-28	1	Assy Detail, DC electric actuator.
SK-079326-01	3	Assy Detail, Insert Assembly, CC30SR, Subsea Retrievable Insert Choke.
SK-079366-01	2	Assy Detail, Body Assembly, CC40SR, Subsea Retrievable Insert Choke.
SK-066446-01	1	Assy Detail, Choke with DC Electric Actuator. Body CC40SR, Clamp & Trim CC30SR.
SK-066446-01-01	1	Assy Detail, Choke with DC Electric Actuator. Body CC40SR, Clamp & Trim CC30SR.

Table 2.2 Report drawings

3.0
SAFETY AND PRECAUTIONS

3.1 SAFETY AND PRECAUTIONS

The data and safety sheets for Kluebersynth GH 6-32 Oil are contained in the appendix section at the back of the IOM.

4.0
HANDLING AND TRANSPORTATION

4.1 TRANSPORT AND UNPACKING

All the boxes are equipped with internal supporting timber skids to prevent movement of the components during transport. The boxes may be transported to the unpacking/inspection location by forklift.

NOTE: Due care must be taken with the transportation of the choke assembly as the box container is likely to be top heavy. The choke is transported in the VERTICAL position.

To facilitate receiving inspection, the boxes may be **DISMANTLED WITH CARE** and all timber skids removed. If there are any loose components in the box or there is any evidence that the components have suffered damage in transit, **PLEASE NOTIFY CAMERON IMMEDIATELY.**

4.2 LIFTING

The choke assembly may be lifted using 4 off 1" eyebolts to be fitted as follows;

The choke clamp top plate incorporates 4 off holes for 1" eye bolts (Ref drawing SK-079326-01), to enable diver retrieval of the insert assembly.

Required lifting tools:

- 4 off eyebolt 1"-8 UNC, e.g. Cameron PN 012185-05
- 1 off wire rope sling with 4 single wires, lengths min. 2 meter, SWL min 5 tons, e.g. Cameron PN 2197010-01-14
- 4 off high strength shackle, form C or D, SWL min 3.25 tons, e.g. Cameron PN 2197010-02-98

4.3 INSPECTION

The relevant component part numbers should be checked against the component identification tags. The components should be inspected for any obvious signs of damage during transit and if there is any damage apparent **CAMERON SHOULD BE ADVISED IMMEDIATELY.**

For components due for immediate service, the product descriptions give relevant operational data etc., and for the choke assembly, additional pre-installation checks etc. are outlined in Section 5.0.

If the components are assigned to stores, Section 7.0 outlines the relevant procedure for the storage and preservation of Cameron products.

4.4 GENERAL HANDLING RECOMMENDATIONS

The following points are taken from Cameron quality procedure QI-E-1102 and are intended to clarify aspects of handling for Cameron individual and assembled components.

(a) All machined components shall be placed on plastic or wooden pallets.

(b) Critical machined surfaces of all stems, shafts, forks, needles shall be protected with nylon sleeving or equivalent to prevent damage during transit.

(c) All externally threaded components shall have their threading protected by nylon sleeving or equivalent to prevent damage during transit.

(d) Machined components that require lifting by hoist or similar lifting mechanisms shall only be lifted using nylon slings as securing straps.

(e) Other lifting devices such as wire slings, chains and eye hook or mechanical lifting devices can be used provided that the machined surfaces are not in contact with any material which may damage or scratch finished machined surfaces.

(f) Parts shall not be placed directly onto metal benches or racks unless the machined surfaces are protected using nylon sleeving or equivalent.

(g) Rust Inhibitor shall not be applied to finished machined parts. All machine coolant has adequate rust protection incorporated.

4.5 GENERAL TRANSPORTATION RECOMMENDATIONS

The following Cameron Export Packaging Procedure outlines the general requirements and standards for the packaging of equipment, components and materials supplied for export by Cameron.

Scope

This document defines the general requirements and standards for the packaging of equipment, components and materials supplied for export by Cameron. All equipment, components and materials supplied by Cameron for export shall be packed in accordance with this specification. Any additional specifications or requirements requested by the customer shall be noted on the “Request for Crates” document.
The export packaging requirements contained herein have the following purposes:-

- To provide adequate protection during shipment, handling and storage, thus minimising the risk of physical damage, deterioration, contamination, loss or other destructive influences that could degrade the quality and/or functional capabilities of the item being shipped.

- To ensure complete and proper marking so that identification, delivery and protective handling are facilitated.

General

The packaging requirements in this specification are based on the assumption that shipments will travel by vessel and may require storage at dockside and destination with consequent exposure to the outside environment with no additional weather protection. They are intended to provide a high level of protection against hazards that may be encountered during this type of exposure.

Preparation for shipment

Before packaging, the materials and/or equipment shall be cleaned. All completed valves shall be sprayed internally with Arrow Shield or other approved rust inhibitor before being packed. Surfaces with close tolerances or those associated with critical equipment functions (disks, turning forks, etc.) shall be adequately protected by applying hot dip strippable coating or a plastic sleeving. They shall also be adequately cushioned with an expanded polystyrene cushioning material. Bare wood, halogenated or lead containing materials, or carbon or low alloy steels shall not contact stainless steel or nickel alloy surfaces.

For spares orders, all unpainted surfaces shall be sprayed with Arrow Shield, or other approved rust inhibitor, by personnel in the boxing area.

Box construction Materials

All timber shall be sound, commercial grade. Knots shall be sound and not in excess of one third the width of any board.

All plywood used for sheeting shall be a minimum of ½ inch thick.

All nails shall be standard box nails. They shall be sized so that there will be not less than 33 % penetration of the secondary box member. For maximum strength, they shall be driven into the side grain of timber used for packaging. End grain nailing or nailing of plywood to plywood shall not be allowed.

All cases shall be banded with steel strapping in a minimum of two places. Straps shall be spaced within 3 to 4 inches from each end and along the length of the case so that there is no more than 24 inches between straps. Edge protectors shall be used on all edges under straps. Strapping shall be at least 0.75 inch wide and 0.023 inch thick.

Stacking

The stacking strength of all boxes shall be equal to three times the weight of the loaded box.

Boxes shall be constructed in one of two ways. They may be either plywood sheeted or cleated (internally or externally) and so constructed as to protect the contents from damage and from the elements (moisture, salt, air, etc.)

Small Boxes

Small boxes for spares which are only six inches high shall be constructed of 6" X 1" timber sides and a plywood top and bottom. No internal bracing of these type boxes shall be required.

They shall not be lined unless specifically requested by the customer and shall have at least three ¾” steel straps, fitted with edge protectors at all edges.

These small boxes shall have skids fitted at no more than 12 inches apart, centre to centre, across the width of the base. Minimum skid sizes are as follows:

Dims of box (inches)	Nominal size of skids (inches)
Above 30" x 24" From 15" x 18" to 30" x 24" Up to 15" x 18"	3" x 3" 3" x 2" (flat) 2" x 2

Table 4.1 Box sizes

All items packed in these boxes shall be secured within the box using expanded polystyrene foam. The lid shall be nailed on and secured with two steel bands.

Large boxes

Larger boxes for finished valves etc shall be constructed from plywood sheeting or they may be cleated (internally or externally) if specifically required by a customer. The base of all these boxes shall be made from 6" x 1" boards or equivalent and they shall be braced internally at the corners.

Cleats shall range from nominal 1" x 3" through 1" x 6" commercial grade timber, and they shall be spaced at a maximum of 36" (centre to centre) along the length of the box. Nails shall be driven into cleats in a staggered pattern. When assembling the panels, nails shall be driven in a straight pattern.

All boxes shall be equipped with skids fabricated from 3"x 3" nominal timber size. Skids shall be spaced no greater than 24" apart (centre to centre) across the width of the base.

Water and vapour barrier

Only larger boxes shall be lined with a water and vapour barrier. The plywood sheeted boxes shall be lined on all panels, top and bottom with bitumen paper by stapling it to the plywood.

The cleated boxes shall be lined with plastic sheeting stapled to the inside of all panels, top and bottom.

Blocking, bracing and securing

Material shall be sufficiently blocked, braced and secured within the container so as to prevent shifting during transit.
No bare timber bracing, etc., shall come in contact with paintwork. When necessary, all such bracing shall be covered to protect the paintwork.
All material shall be adequately cushioned and anchored in a manner that will protect its integrity during transportation and handling.

Caps, plugs and desiccants

Wooden or plastic caps and plugs shall be used to seal openings in equipment having critical internal surfaces, and to protect threads and weld end preparations. Plastics shall be of the non-halogenated type. They shall be strapped or taped on as necessary to give maximum protection.

Desiccant shall only be used if it is specifically requested by the customer. If desiccants are used, they shall be used in accordance with customer specifications. These requirements shall be entered on the JQR and actioned on the assembly work order.

5.0
OPERATIONAL PROCEDURES

5.1 INTRODUCTION

The section 5.2 & 5.3 describes the necessary preparations and pre-operational checks prior to the installation and retrieval of a choke insert.

Operations, including the method for lowering the insert to the XMT, will be performed by divers. These operations are outside the scope of this procedure.

It is assumed that a parking point for the retrieved insert is present on the rig.

Reference Drawings & Procedures (per section 2.3):

SK-066350-28	SK-079366-01
SK-066446-01	WSK-1949L
SK-079326-01	X-175160-01

5.2 TRANSPORT OF CHOKE INSERT

The choke insert is oriented vertically. Section 4.0 gives recommendations for the unpacking of Cameron boxed components etc. The insert is transferred to its parked position using the clamp operation procedure outlined in Section 5.2.1 below; together with the choke insert lifting procedure outlined in Section 4.2.

5.2.1 Clamp Operation

Refer to drawing WSK-1949L for detail of clamp interface.
The bonnet clamp may be operated by turning the shaft until end stop is reached.

CLAMP: **TO OPEN: TURN SHAFT COUNTER-CLOCKWISE**

TO CLOSE: TURN SHAFT CLOCKWISE

Locking torque	: 1,250 ft lbs.
Maximum torque	: 1,500 ft lbs.
Damage torque	: 2,200 ft lbs.

Approximately 42 turns of clamp lockdown shaft are required for full clamp operation.

Verify that the clamp lockdown indicator, located near the hinge pin of the clamp, moves to open or closed position as required.

5.3 PRE-OPERATIONAL CHECKS ON CHOKE INSERT

In order to facilitate inspection of the choke insert prior to installation, the following pre-operational checks are carried out.

1. Thoroughly degrease the nose of the choke insert and the clamping/hub surfaces.
   NOTE: ENSURE ALL DEBRIS IS REMOVED

2. Visually inspect the condition of all insert seals to ensure good condition.

3. **Prior to final stab-in of the insert (i.e. before going into service), Cameron recommend that unused metal seals are fitted on the trim using the procedure outlined in section 6.3.**

4. Apply a light film of petroleum based oil (e.g. ISO grade 32 oil) to the nose of the insert.

   NOTE: DO NOT APPLY MOLYBDENUM DISULPHIDE GREASE

5. Ensure the bonnet clamp is fully open by turning the shaft counter-clockwise until end stop is reached. Apply unlocking torque of 1,250 ft lbs.

   Approximately 42 turns of clamp lockdown shaft are required for full clamp operation. Verify that the clamp lockdown indicator, located near the hinge pin of the clamp, moves to open position.

5.4 PRE-SUBMERGENCE CHECK LIST.

A pre-submergence check to be performed per X-175160-01, see Appendix B.

5.5 SUBSEA PREPARATIONS FOR INSERT RETRIEVAL

Prior to retrieving the choke insert from subsea, the following checklist must be completed.

SUMMARY CHECK LIST (full details are provided in referenced sections)
1. Production of hydrocarbons from Xmas tree stopped
2. Choke trim is greater than 50% open & Choke vented (Ref. Section 5.5.1)
3. Clamp in fully open position (Ref. Section 5.5.3)

5.5.1 VALVE STATUS

CHOKE AND TRIM IS GREATER THAN 50% OPEN & CHOKE VENTED

1. Using the local position indicator in conjunction with the ROV camera, check that the choke trim is greater than 50% open.

2. THERE MUST NOT BE ANY INTERNAL PRESSURE IN THE CHOKE. CREATION OF A VACUUM MUST BE AVOIDED. IF THIS IS NOT DONE RETRIEVAL IS IMPOSSIBLE. THIS CAN BE ACHIEVED BY VENTING THE FLOWLINE.

5.5.2 COUPLER STATUS

ELECTRICAL CONNECTOR DISENGAGED

The disengagement of the electrical coupler occurs automatically as the insert assembly is separated from the body assembly.

5.5.3 CLAMP STATUS

CLAMP IN FULLY OPEN POSITION

1. Running tool to engage torque tool onto the lockdown shaft on the clamp ROV bucket.

2. Apply an unlocking torque of 1,500 ft lbs. and rotate the clamp lockdown shaft counter-clockwise until end stop is reached.

   Approximately 42 turns of clamp lockdown shaft are required to operate the clamp from the fully closed to the fully open position.

   SPEED OF ROTATION SHOULD NOT EXCEED 20 RPM

3. Verify that the clamp is unlocked by viewing the indicator near the hinge pin of the clamp, which should indicate open.

5.6 RETRIEVAL OF CHOKE INSERT

When Sections 5.5.1 to 5.5.3 are complete, the choke insert may be retrieved.

The choke clamp top plate incorporates 4 off holes for 1" eye bolts (Ref drawing SK-079326-01), to enable diver retrieval of the insert assembly.

5.7 SUBSEA PRE-INSTALLATION CHECKS

After retrieval of the old choke insert and prior to the installation of a new insert, the choke body should be inspected and cleaned as necessary.

1. Visually check that the choke body and bore seal surfaces are free from debris.

2. Check that the body hub surfaces are clean.

3. Ensure the necessary operational tasks are completed to achieve the above.

4. After retrieval of the old choke insert and inspection of the choke body, a temporary protection cap should be fitted to the choke body until the new insert is ready for installation.

5.8 INSTALLATION OF THE CHOKE INSERT

Prior to the installation of the new insert, all checks outlined in Section 5.7 should be completed and the temporary debris cap removed from the choke body.

1. Ensure the choke trim is greater than 50% open (Ref. Section 5.5.1).

2. Ensure the flowline is vented, to allow displacement of water upon installation of the insert.

NOTE: IT IS ESSENTIAL THAT UPON INSTALLATION OF THE INSERT, BORE FLUID CAN BE DISPLACED TO PREVENT HYDRAULIC LOCK.

3. Using the 4 off holes provided on the clamp top plate reattach suitable lifting apparatus to the plate (orientation per SK-079326-01). Suspend and lower the insert into the choke body (velocity not to exceed 0.1 m/s.)

4. When the insert is fully seated, the black line on the yellow background indicator mounted on the body will align with the lower edge of the clamp plate (black in colour) on the insert. This confirms completed stab-in and make-up of the clamp hub faces.

5. Visually check that all clamp hubs are mated.

6. Running tool to engage torque tool onto the lockdown shaft of the clamp ROV bucket.

7. Apply a locking torque of 1,250 ft lbs. and rotate the clamp lockdown shaft clockwise until the end stop is reached.

Approximately 42 turns of the clamp lockdown shaft are required to operate the clamp from the fully open to the fully closed position.

SPEED OF ROTATION SHOULD NOT EXCEED 20 RPM.

8. Verify that the clamp make-up indicator, located near the hinge pin of the clamp, moves to the closed position.

9. Carry out checks to confirm hydraulic functioning and correct electrical feedback.

10. The choke is now ready for service.

5.9 BONNET SEAL TEST

Following re-installation of the choke insert, a bonnet seal test can be preformed to verify the integrity of the bonnet metal seal and the elastomeric test seal. Test pressure is set at 10,000 psig and is applied through the 3/8" MT Autoclave test port in the body. Typical hold time is fifteen minutes. Observe for any leakage.

5.10 POST-INSTALLATION

It is assumed that the retrieved choke insert shall be shipped back to shore for major service and touch-up. The choke insert should be transported using the procedures outlined in Section 5.2 earlier.

6.0
MAINTENANCE

6.1 GENERAL

Reference drawing: WSK-2314L (see Appendix A).

NOTE: Numbers in brackets, ( ), refer to the component parts as specified on Drawing Number WSK-2314L.

The choke is designed to be maintenance free once in service. Periodically, depending on service conditions, it may be necessary to retrieve the insert and perform a maintenance overhaul. **This work should be carried out at a Cameron service/repair facility**. Except where specified, the maintenance work detailed in this section may be carried out offshore.

During integration testing and extended factory acceptance testing, the choke insert may be run and retrieved a number of times. While the main bonnet metal seal item 75 (1 off) will function successfully after a number of stab-ins for integration testing, **Cameron recommend that, prior to the insert going into service, this seal be replaced using the procedure detailed in Section 6.2. Cameron also recommends that the changeout of the metal seal should only be performed by a person who is trained in the procedure.**

The elastomer seals and bearing rings on the cage (2) and the bonnet (1) should be examined carefully for any damage and replaced if necessary.

The clamp assembly does not require re-greasing etc. before going into service.

The two position indicators should be maintenance free during service. The indicators are:
(a) Insert Lockdown Indicator (angled bracket attached to body bracket)
(b) Clamp Lockdown Indicator (anti-foul strips attached at hinge of clamp)

The diaphragm balance ports (located in mandrel assembly) should be open and free of any marine growth or obstruction.

6.2 PROCEDURE FOR CHANGING SEALS

Reference drawing:
WSK-2314L - Exploded details for installation / removal of bonnet metal seal.
SK-079326-01 – Assembly detail of the choke insert.

NOTE: Numbers in brackets, ( ), refer to the component parts as specified on Drawing Number WSK-2314L and corresponding part numbers are listed in the choke insert bill of material 2259786-01.

6.2.1 *Removal of the Bonnet Metal Seal.*

Special Tools/Equipment required:
Chain wrench or a 160mm nom. 'C' Spanner.

ENSURE THAT THE CHOKE IS GREATER THAN 20% OPEN BEFORE CHANGEOUT OF THE METAL SEAL COMMENCES

(1) To allow full examination of the seals, thoroughly clean the externals of the cage and bonnet with cleaning agent Trichfree (manufactured by Amity UK) or equivalent.

(2) Using a 'marker' or equivalent, mark a vertical axial line between the bonnet (1) and cage (2). This line shows the relative orientation position between the bonnet and cage for re-assembly.

(3) Remove setscrew (8).

(4) Using a chain wrench with a sheet of sandpaper rotate the cage (2) counter-clockwise until it disengages from the bonnet (1). This will leave the metal seal sitting in the seal groove on the bonnet.

WARNINGS:

(a) If a 'C' spanner is used instead of a chain wrench, ensure the 'C' spanner only engages on the 17-4 PH SS holes as engagement on the carbide will result in fracture of the carbide.

(b) Support the cage carefully during removal to ensure it does not fall as it contains tungsten carbide, which is very brittle.

(5) Remove the metal seal (75) from the groove, taking care not to damage the groove. The metal seal may be removed using a centre punch and hammer. The punch is tapped gently against the metal seal at intermittent points on the outer circumference of the seal, and eased out of the seal groove. **Use of a screwdriver should be avoided as it could result in damage to the seal groove**.

6.2.2 *Installation Of The Bonnet Metal Seal*

(1) Visually inspect the seal groove for signs of damage and remove any surface marks/scratches by very light polishing with fine emery or scotchbrite. After polishing, a 16 RMS finish on a 6.898/6.900 Ø has to be met. Thoroughly clean the seal groove with Trichfree (manufactured by Amity UK) or equivalent and apply a light film of Castrol LM grease or equivalent.

(2) Visually inspect all the elastomeric bonnet and cage seals. Replace the seals (Ref. 6.3.3) where lip damage, excessive flash, breaks, cracks, excessive trimming or mould mismatch is present. Visually inspect the new metal seal and ensure it is clean, free from debris and the silver plating has adhered to the base material.

(3) Position the new metal seal into position as shown per WSK-2314L. Push the seal onto the seal groove using finger pressure. Care to be taken that components align properly.

(4) One indentation should be present on the bonnet from the setscrew (8). This indentation needs to be 'point' marked with a bright paint.

(5) The final installation task is loading of the seal to be completed by screwing the cage into place. Ensure the mating threads of the bonnet (1) and cage (2) are free from debris, clean as appropriate.

(6) Apply 'Kopr-Kote' (manufactured by Jet Lube UK) copper grease or equivalent to the mating threads of the cage and bonnet. Place Castrol LM grease or equivalent on the lead-in chamfer of the sleeve/stem assembly.

(6) Carefully pass the cage inner diameter over the stem/sleeve and rotate the cage to allow the threads to engage with the mating threads on the bonnet. Using the chain wrench (or C-spanner) rotate the cage into position. Further rotation will result in the cage loading the metal seal into its groove. Continue rotation until the painted indentation on the bonnet is aligned with the setscrew hole. A max torque of 400 ft-lbs. may be applied. The 'mark' as positioned per item 2 of section 1.0 can also be used as a reference.

(7) Insert the setscrew (8), applying Loctite 242 or equivalent and torque to 20 ft lbs.

6.2.3 *Change-out of the Elastomer Seals and Bearing Rings*

'S' seals

To Remove:

(1) Using a small screwdriver, **gently** work the tip under the seal and lever the seal out of the groove, **taking great care not to damage the seal groove**.

(2) The 'S' seal may then be slipped off the insert.

To Replace:

(1) Position the new 'S' seal **close** to the groove.

(2) Slide about 75% of the seal into the groove and keep hold of the remainder in a small loop with the finger.

(3) **Carefully** insert the shaft of a small screwdriver through the loop and slide it around the groove. Manoeuvre the seal into the correct orientation as it is turned.

(4) Inspect the seal to ensure it is correctly aligned in the groove and then carefully retract the screwdriver.

Bearing Rings

To Remove:

(1) If the bearing ring is not already split due to the damage incurred, it has to be cut in order to facilitate removal from the groove.

(2) Using a sharp blade, cut the bearing ring through, **taking care not to damage the groove.**

To Replace:

(1) Place new bearing ring in a container of boiling water.

(2) Leave for approximately one minute.

(3) The bearing ring will slide easily into groove and will contract on cooling.

6.3 FAULT ANALYSIS / SOLUTIONS

The following tables, 6.1 and 6.2, outline possible operational and intervention problems which may occur on-site, together with Cameron's recommended corrective actions. Should the attached not offer a solution, a Cameron Service Facility should be contacted.

6.3.1 Intervention Problems

PROBLEM	POSSIBLE CAUSES	CORRECTIVE ACTION/CHECK LIST
Insert fails to engage fully in choke body.	Clamp obstructing connection	Ensure clamp is fully open.
	Couplers obstructing connection	Ensure guide pins have engaged correctly Ensure couplers have correctly aligned.
	Debris preventing engagement	Check choke body and insert for debris and clean fully. Check for any damage to seal areas.
Connector clamp fails to close at choke insertion.	Insert not fully engaged	Check as above. Check clamp lockdown indicator.
	Applying torque in wrong direction	Ensure tool applies torque in clockwise direction to close.
Connector clamp fails to open at choke retrieval.	Applying torque in wrong direction	Ensure tool applies torque in counter-clockwise direction to open.
	Check for foreign object preventing clamp opening	Remove foreign object.

TABLE 6.1 Intervention problems.

7.0
STORAGE AND PRESERVATION

7.1 Storage/Preservation procedure

The following procedure defines the conditions required for long term storage of Cameron flow control spare parts and equipment.

7.1.1 Scope

This procedure defines the conditions required for long term storage of Cameron flow control spare parts and equipment. This procedure applies to equipment which will not be installed within two months of shipment from the Cameron manufacturing location.

7.1.2 Storage conditions

7.1.2.1 *Environmental Conditions*

Spare parts and equipment shall be installed in environmental conditions which meet the following:

(a) All storage shall be indoors.

(b) Storage temperature shall be between 3°C (38°F) and 50°C (122°F).

(c) Relative humidity shall be 85% maximum.

(d) Storage shall be in non-corrosive environment.

7.1.2.2 *Packaging*

Spare parts such as disc assemblies, bonnets, capscrews etc. may be removed from the packaging and stored on shelves.

NOTE: Metal to metal contact between adjacent parts and between the parts and the shelves, is not allowed.

Choke assemblies shall be stored in the original packaging for maximum protection against mechanical damage.

7.1.2.3 *Elastomer Storage*

All elastomers are to be stored in opaque boxes at ambient temperature in a clean dry environment away from electric motors and fluorescent lights.

Elastomer stock is to be rotated to ensure that shelf-life requirements of materials are not exceeded.

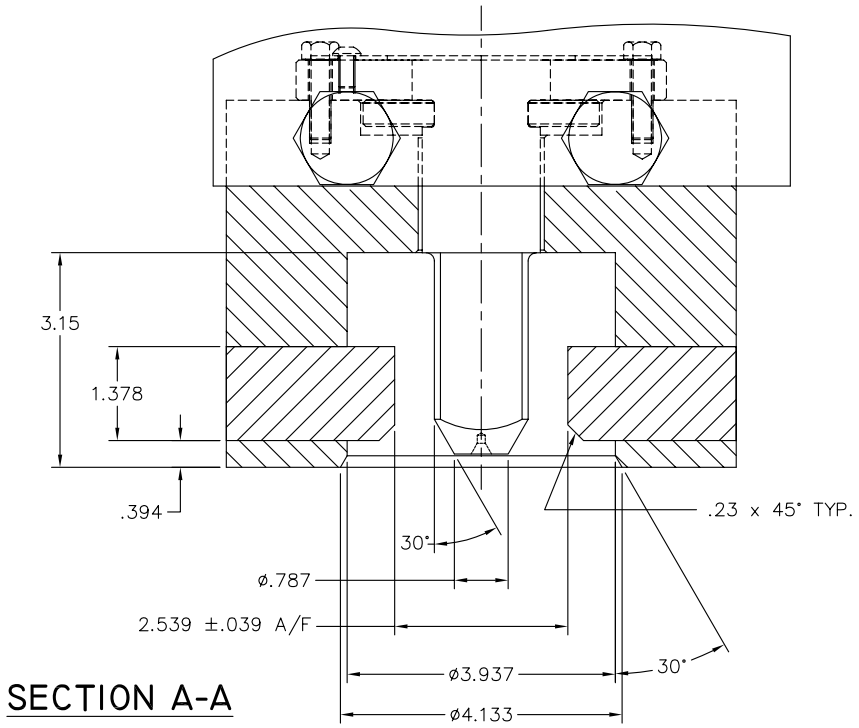
Information about cure dates shelf-life requirements and storage recommendations, is to remain with each shipment of elastomer materials until that shipments supply is exhausted.

7.1.3 Periodic review of equipment

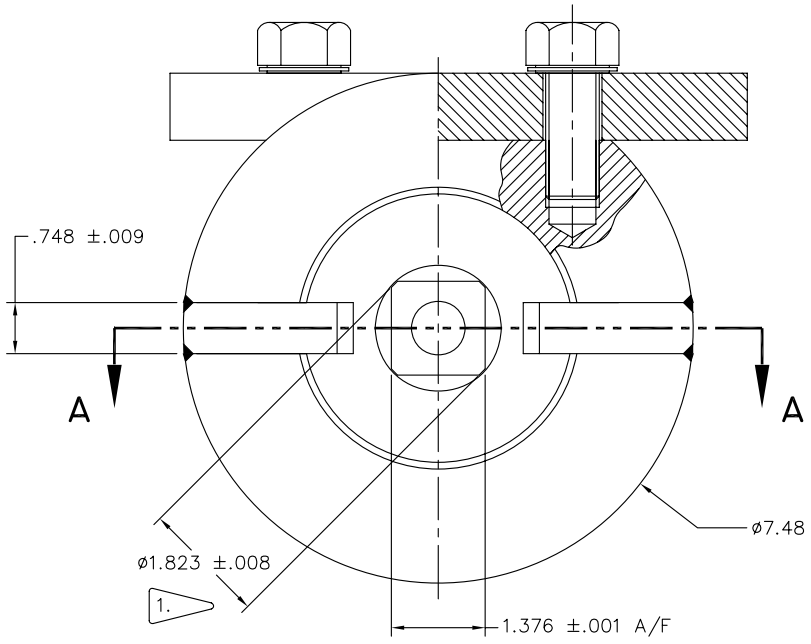
All spare parts and equipment stored in the original packing or on shelving shall be reviewed every six months for evidence of damage or surface corrosion. If surface corrosion is evident, then the parts should be cleaned (no mechanical cleaning allowed) to remove surface corrosion and re-coated with an approved rust preventative.

8.0
APPENDICES

Appendix A - Drawings as referenced within the IOM.
(10 Pages)



SECTION A-A



NOTE:

1. ACROSS CORNER DIMENSION SPECIFIED IN ISO/CD 13628-8 IS ø49.9/48.9mm (1.944 ±.019"). IT IS MODIFIED TO 1.823" DIMENSION AS REQUIRED BY CLAMP VENDOR FOR ASSEMBLY PURPOSES.

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES. BREAK ALL SHARP EDGES .01 – .03 R OR 45°.
INTERPRET DWG PER ANSI Y14.5 STANDARD. SEE B/M FOR MATERIAL AND SPECIAL REQUIREMENTS.
ITEM NUMBERS NOT APPEARING ON B/M DO NOT APPLY. RADII .05. T.I.R. .010.

A1 REV

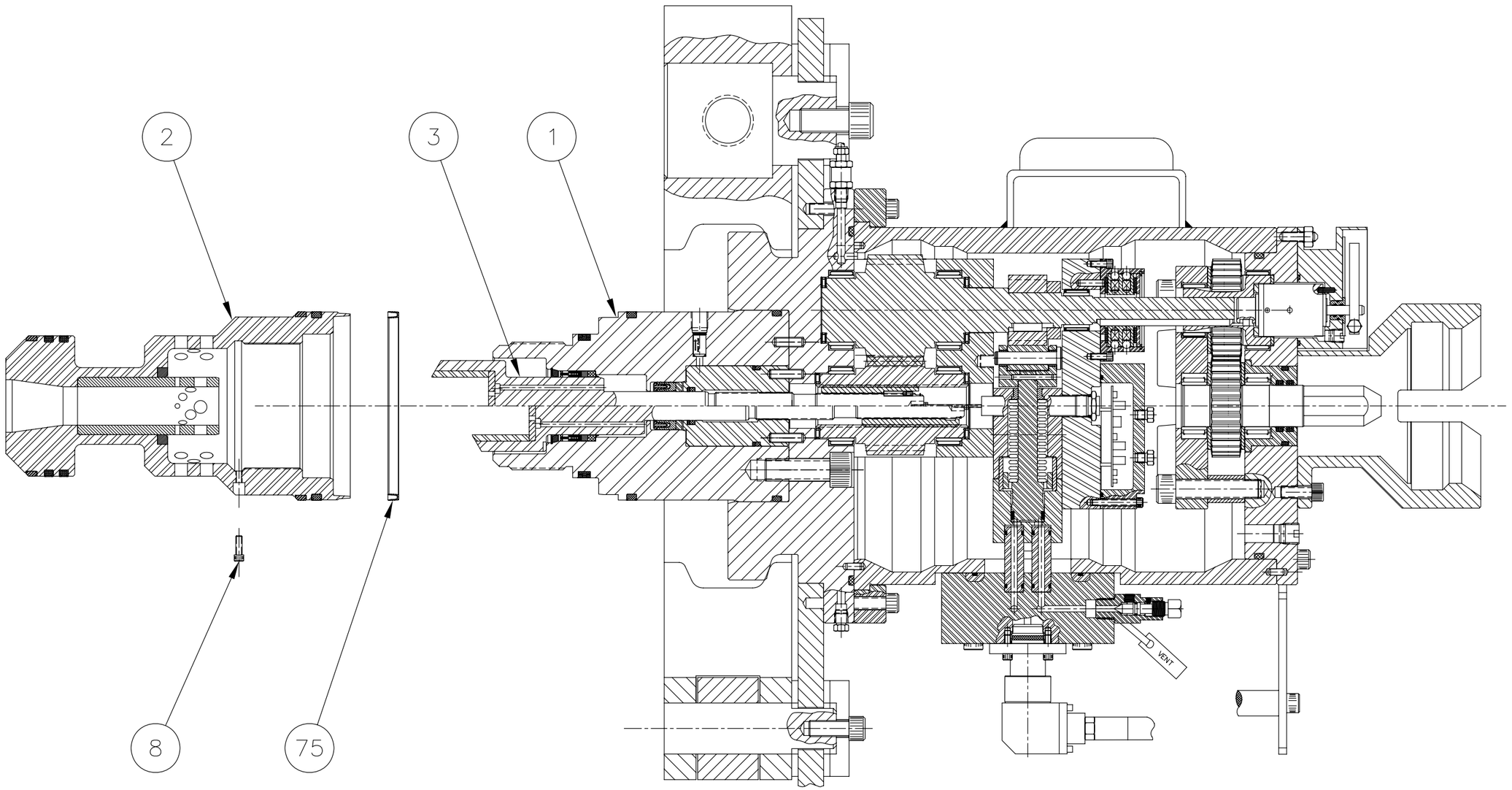
TOLERANCE UNLESS OTHERWISE SPECIFIED	.X ±.X; ANGLES ± .5°
	.XX ± .03; 125/ AA ON ALL MACHINED SURFACES
	.XXX ± .015
SURFACE TREATMENT	
MATERIAL & HEAT TREAT	
SUPERSEDES	
DO NOT SCALE	
DRAWN BY S. HALVEY	DATE 5/10/00
CHECKED R.Logan	DATE 20/10/00
APPROVED E.McHugh	DATE 20/10/00
DATED	
INITIAL USE B/M	

Cooper Cameron Corporation
Cameron Division
Cameron Willis

MODIFIED API 17H HIGH TORQUE CLAMP INTERFACE DETAIL

PLOT SCALE: FULL / CAD

SHEET 1 OF 1 | DWG. No. WSK-1949L



UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES. BREAK ALL SHARP EDGES .01 – .03 R OR 45°.
INTERPRET DWG PER ANSI Y14.5 STANDARD. SEE B/M FOR MATERIAL AND SPECIAL REQUIREMENTS.
ITEM NUMBERS NOT APPEARING ON B/M DO NOT APPLY. RADII .05. T.I.R. .010.

01
REV

PLOT SCALE .44

CAD

TOLERANCE UNLESS OTHERWISE SPECIFIED
.X ± .1
.XX ± .03
.XXX ± .015
ANGLES ± .5°
125 AA ON ALL MACHINED SURFACES

SURFACE TREATMENT

MATERIAL & HEAT TREAT

DO NOT SCALE

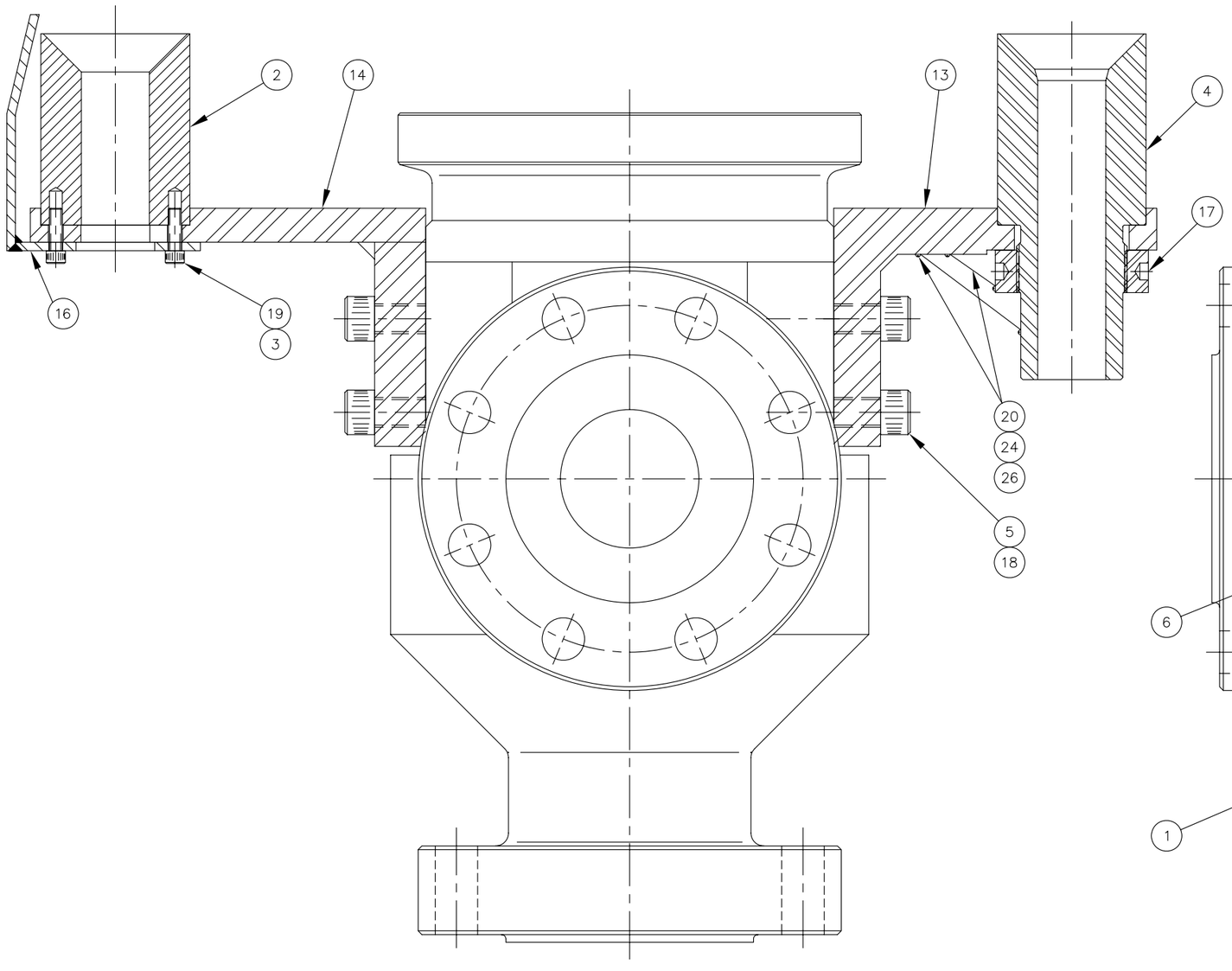
DRAWN BY	C. KEOGH	DATE 2/12/03
CHECKED	B. COLE	DATE 2/12/03
APPROVED	N. SHANMUGAM	DATE 2/12/03

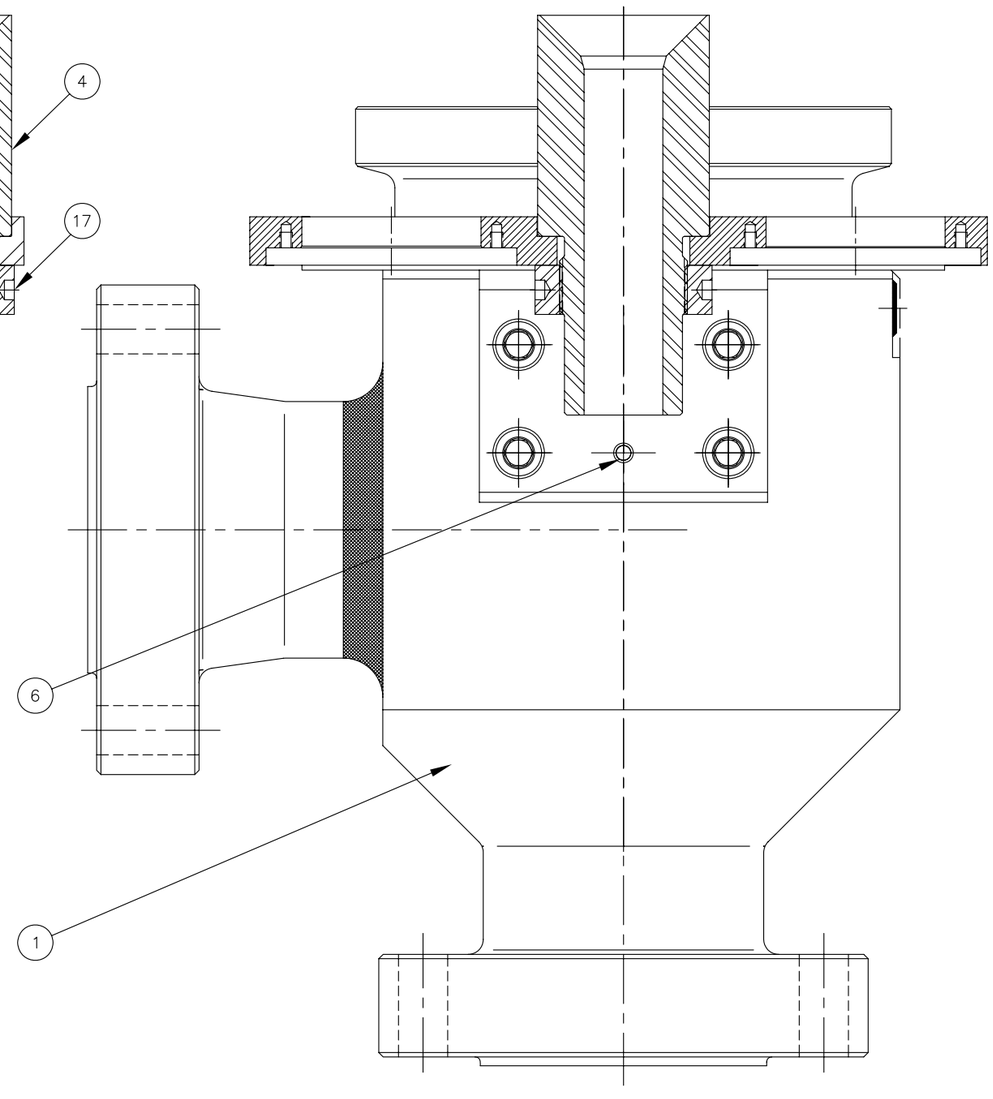
CAMERON WILLIS

Cooper Cameron Corporation
Cameron Division
Cameron Willis

EXPLODED DETAIL FOR INSTALLATION/ REMOVAL OF BONNET METAL SEAL

SUPERSEDES | DATED | INITIAL USE B/M | SHEET 1 OF 1 | DWG. No. WSK-2314L





UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES. BREAK ALL SHARP EDGES .01 – .03 R OR 45°.
INTERPRET DWG PER ANSI Y14.5 STANDARD. SEE B/M FOR MATERIAL AND SPECIAL REQUIREMENTS.
ITEM NUMBERS NOT APPEARING ON B/M DO NOT APPLY. RADII .05. T.I.R. .010.

01 REV

PLOT SCALE .5

CAD

TOLERANCE UNLESS OTHERWISE SPECIFIED
.X ± .1
.XX ± .03
.XXX ± .015
ANGLES ± .5°
125 AA ON ALL MACHINED SURFACES

SURFACE TREATMENT

MATERIAL & HEAT TREAT

DO NOT SCALE

DRAWN BY	S.HALVEY	DATE 27/10/06
CHECKED	N.FOX	DATE 27/10/06
APPROVED	N.SHANMUGAM	DATE 27/10/06

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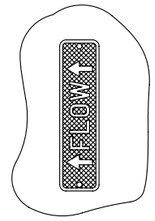
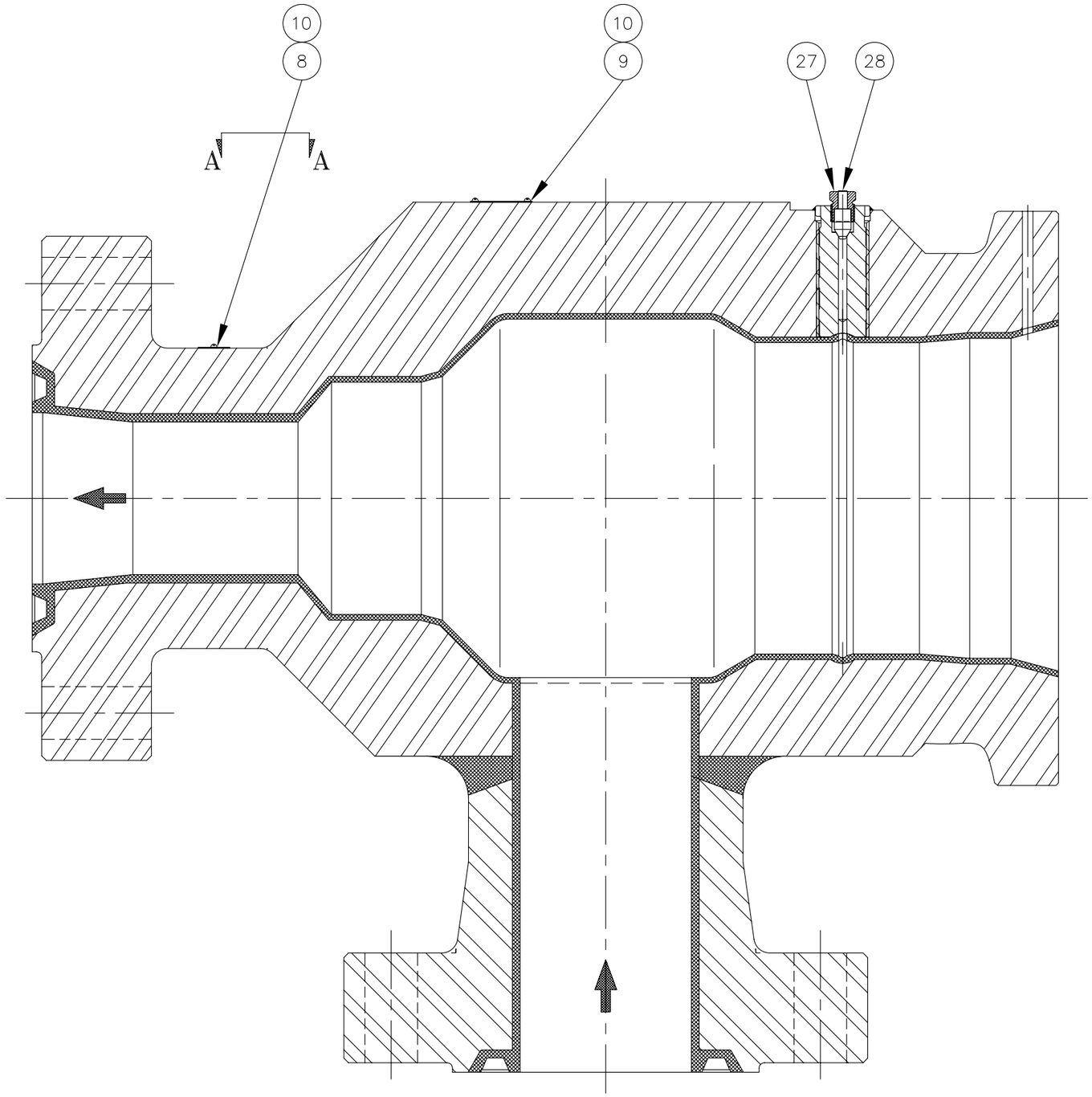
Cameron Division
Cameron Willis

ASSY. DETAIL, BODY ASSY. CC40SR, SUBSEA RETRIEVABLE INSERT CHOKE.

SUPERSEDES | DATED | INITIAL USE B/M 2259785-01 | SHEET 1 OF 2 | DWG. No. SK-079366-01



VIEW A–A



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INTERPRET DWG PER ANSI Y14.5 STANDARD. SEE B/M FOR MATERIAL AND SPECIAL REQUIREMENTS.
ITEM NUMBERS NOT APPEARING ON B/M DO NOT APPLY. RADII .05. T.I.R. .010.

01 REV

PLOT SCALE .5
CAD

TOLERANCE UNLESS OTHERWISE SPECIFIED
.X ± .1
.XX ± .03
.XXX ± .015
ANGLES ± .5°
125/ AA ON ALL MACHINED SURFACES

SURFACE TREATMENT
MATERIAL & HEAT TREAT

DO NOT SCALE

DRAWN BY	S.HALVEY	DATE 27/10/06
CHECKED	N.FOX	DATE 27/10/06
APPROVED	N.SHANMUGAM	DATE 27/10/06

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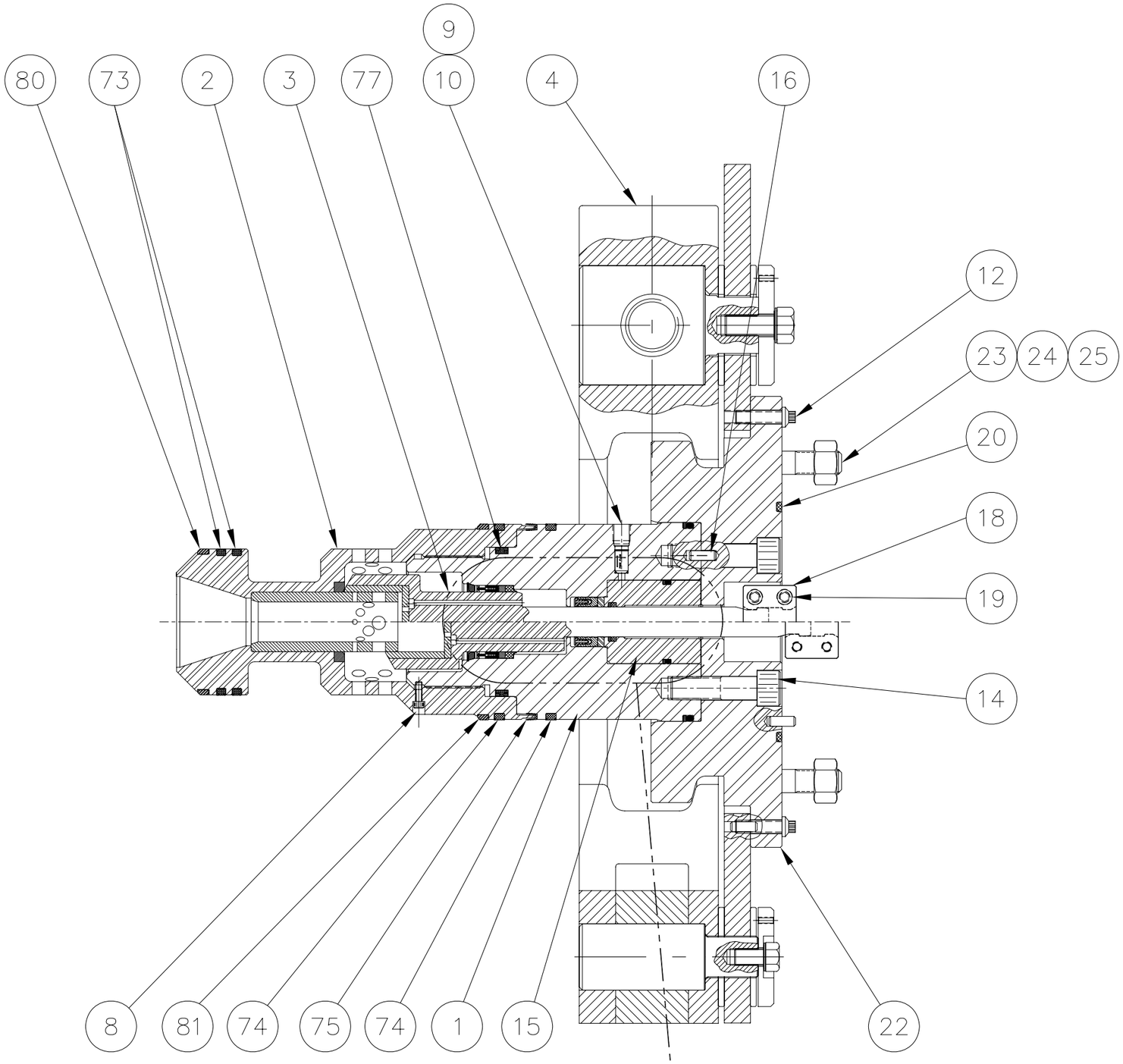
Cameron Division
Cameron Willis

ASSY. DETAIL, BODY ASSY. CC40SR, SUBSEA RETRIEVABLE INSERT CHOKE.

SUPERSEDES | DATED | INITIAL USE B/M 2259785-01 | SHEET 2 OF 2 | DWG. No. SK-079366-01



SEE DETAIL "C"

SECTION "A-A"

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES. BREAK ALL SHARP EDGES .01 – .03 R OR 45°.
INTERPRET DWG PER ANSI Y14.5 STANDARD. SEE B/M FOR MATERIAL AND SPECIAL REQUIREMENTS.
ITEM NUMBERS NOT APPEARING ON B/M DO NOT APPLY. RADII .05. T.I.R. .010.

REV 01

TOLERANCE UNLESS OTHERWISE SPECIFIED	
.X ± .1	ANGLES ± .5°
.XX ± .03	125 AA ON ALL MACHINED SURFACES
.XXX ± .015	
SURFACE TREATMENT	
MATERIAL & HEAT TREAT	
PLOT SCALE .44	
CAD	

DO NOT SCALE

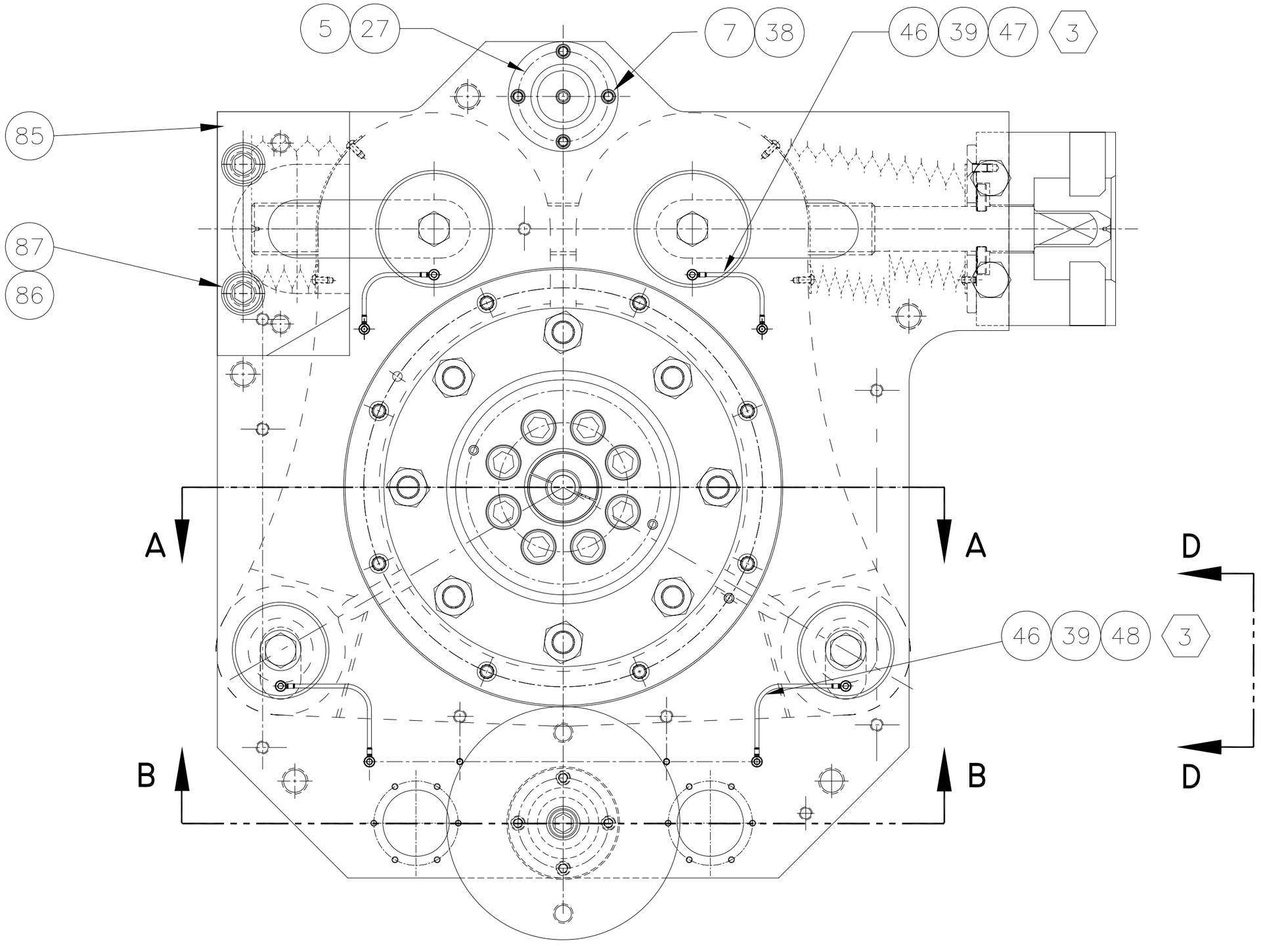
DRAWN BY	S.HALVEY	DATE 23/10/06
CHECKED	N.FOX	DATE 23/10/06
APPROVED	N.SHANMUGAM	DATE 1/11/06

CAMERON WILLIS

Cooper Cameron Corporation
Cameron Division
Cameron Willis

ASSY. DETAIL, CLAMP & TRIM, CC30SR, SUBSEA RETRIEVABLE INSERT CHOKE, W/AQUA-TORQ ACTUATOR.

SUPERSEDES | DATED | INITIAL USE B/M 2259786-01 | SHEET 1 OF 3 | DWG. No. SK-079326-01



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INTERPRET DWG PER ANSI Y14.5 STANDARD. SEE B/M FOR MATERIAL AND SPECIAL REQUIREMENTS.
ITEM NUMBERS NOT APPEARING ON B/M DO NOT APPLY. RADII .05. T.I.R. .010.

01 REV

PLOT SCALE	.50
	CAD

TOLERANCE UNLESS OTHERWISE SPECIFIED
.X ± .1 ANGLES ± .5°
.XX ± .03
.XXX ± .015
125 AA ON ALL MACHINED SURFACES

SURFACE TREATMENT
MATERIAL & HEAT TREAT
SUPERSEDES
DATED

DO NOT SCALE

DRAWN BY	S.HALVEY	DATE 23/10/06
CHECKED	N.FOX	DATE 23/10/06
APPROVED	N.SHANMUGAM	DATE 1/11/06

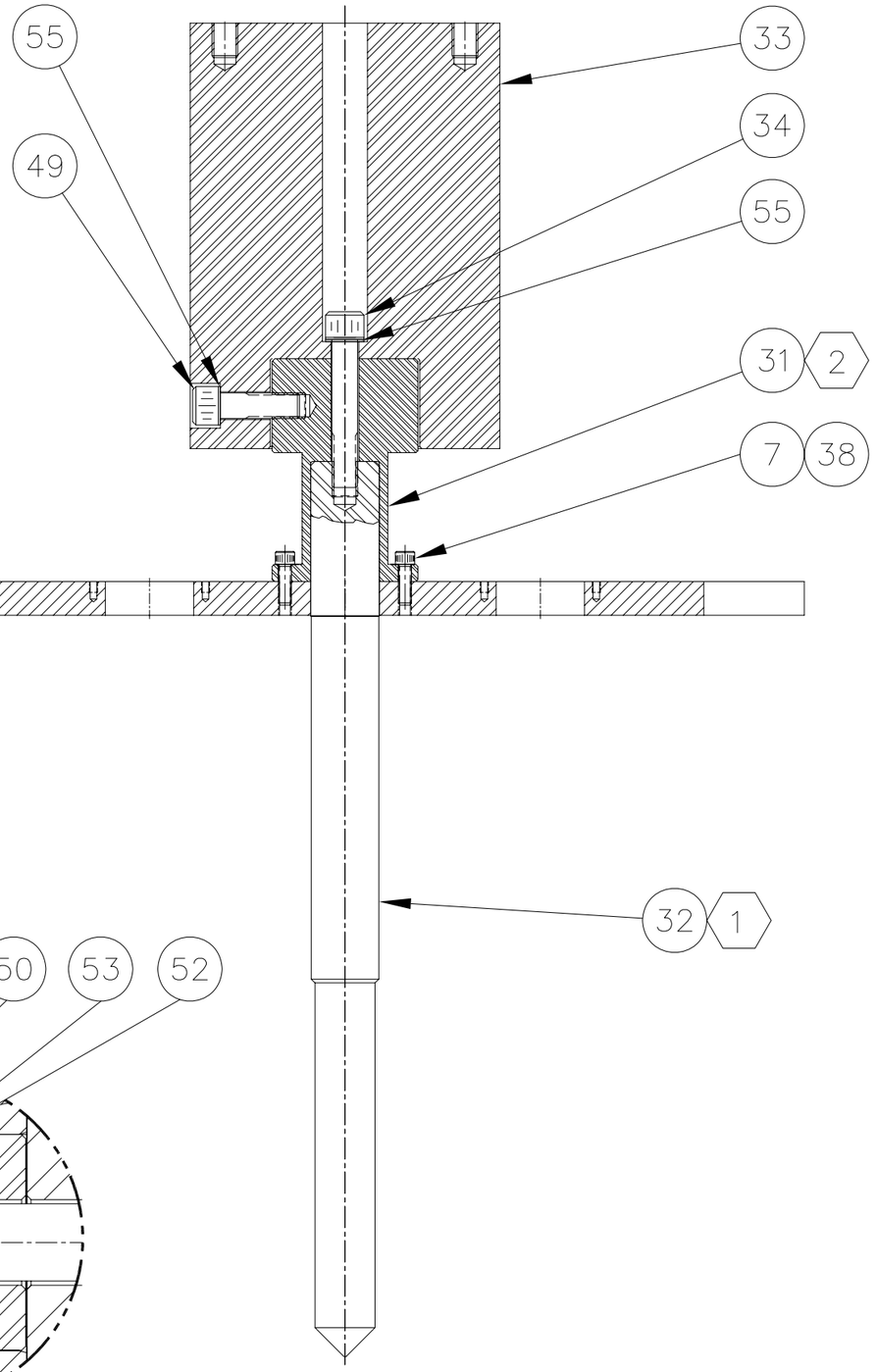
INITIAL USE B/M 2259786-01

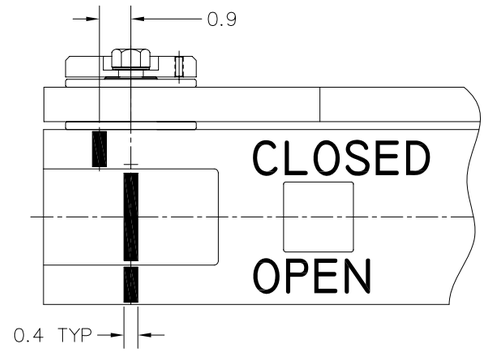
Cooper Cameron Corporation
Cameron Division
Cameron Willis

ASSY. DETAIL, CLAMP & TRIM, CC30SR, SUBSEA RETRIEVABLE INSERT CHOKE, W/AQUA-TORQ ACTUATOR.

SHEET 2 OF 3

DWG. No. SK-079326-01





VIEW "D-D"

(PARTIAL VIEW)
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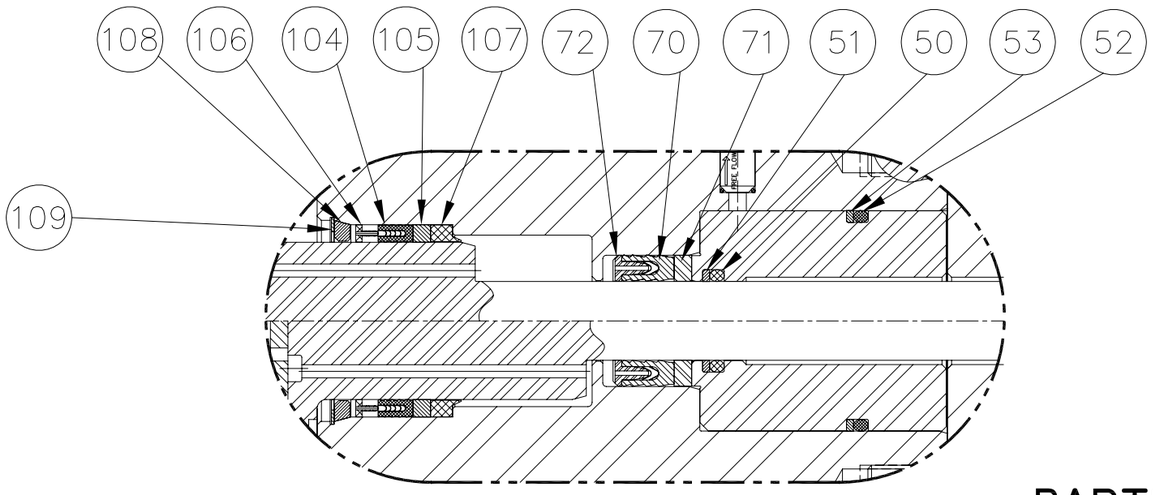
IN PERMANENT WATERPROOF BLACK INK.
MINIMUM TEXT HEIGHT 1"



DETAIL "C"

SCALE: 2:1

PARTIAL VIEW "B-B"

NOTES:

1. ITEM (27) (GUIDE PIN) NOT SHOWN, POSITIONED AT OPPOSITE SIDE OF CHOKE.
2. ITEM (5) (RETAINER) NOT SHOWN, POSITIONED AT OPPOSITE SIDE OF CHOKE.
3. ITEM (48), (39), (47) & (46) PROVIDE ELECTRICAL CONTINUITY BETWEEN THE CLAMP PLATE AND ITS MATING COMPONENTS.

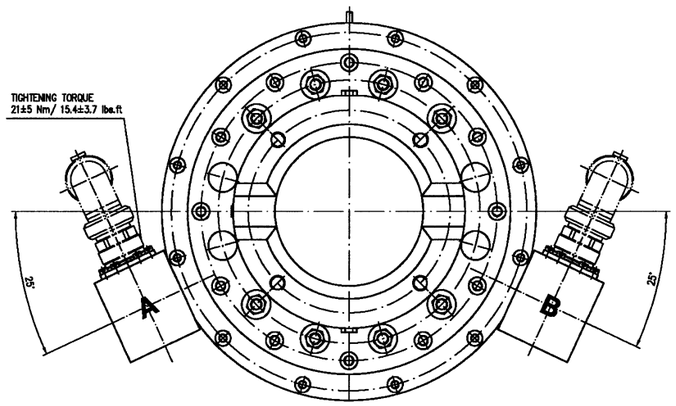
UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES. BREAK ALL SHARP EDGES .01 – .03 R OR 45°.
INTERPRET DWG PER ANSI Y14.5 STANDARD. SEE B/M FOR MATERIAL AND SPECIAL REQUIREMENTS.
ITEM NUMBERS NOT APPEARING ON B/M DO NOT APPLY. RADII .05. T.I.R. .010.

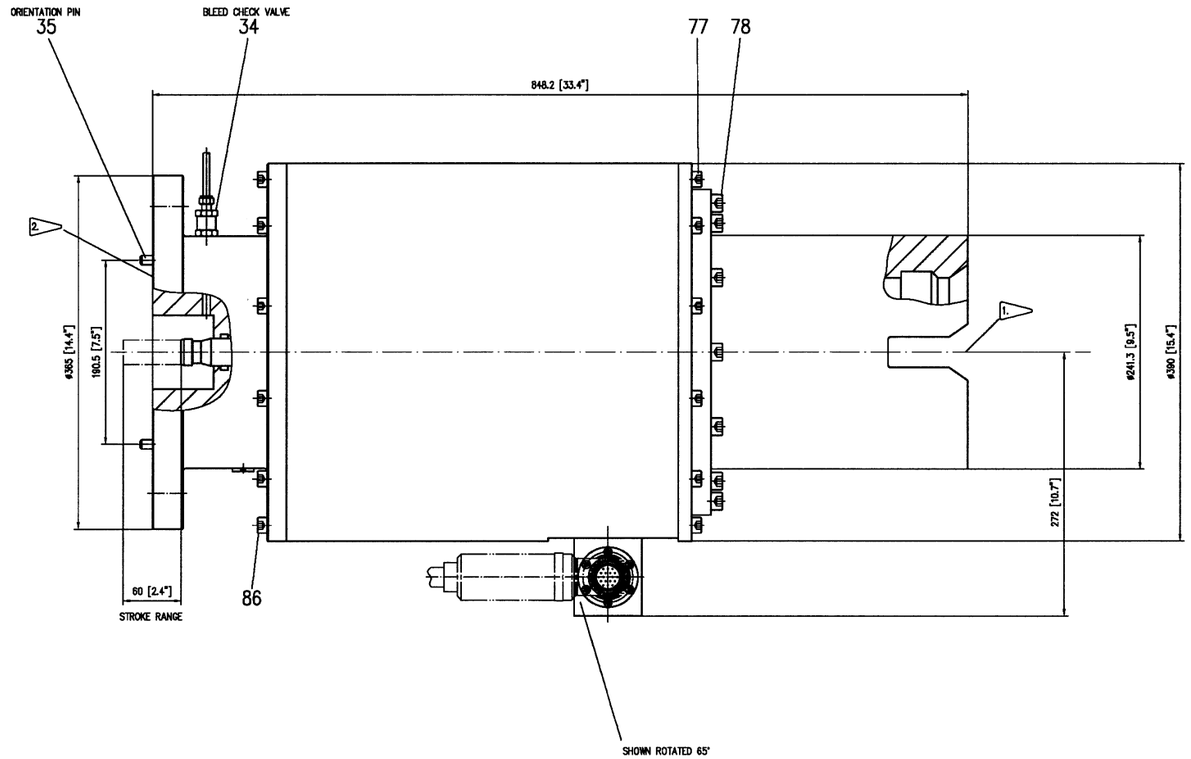
REV 01

TOLERANCE UNLESS OTHERWISE SPECIFIED	.X ± .1; .XX ± .03; .XXX ± .015; ANGLES ± .5°
SURFACE TREATMENT	125 AA ON ALL MACHINED SURFACES
MATERIAL & HEAT TREAT	
SUPERSEDES	DATED
PLOT SCALE	.44 / CAD
DO NOT SCALE	
DRAWN BY	S.HALVEY — DATE 23/10/06
CHECKED	N.FOX — DATE 23/10/06
APPROVED	N.SHANMUGAM — DATE 1/11/06
INITIAL USE B/M	2259786-01
SHEET	3 OF 3
DWG. No.	SK-079326-01

CAMERON WILLIS
Cooper Cameron Corporation
Cameron Division
Cameron Willis

ASSY. DETAIL, CLAMP & TRIM, CC30SR, SUBSEA RETRIEVABLE INSERT CHOKE, W/AQUA-TORQ ACTUATOR.





NOTE:

1. FOR SUBSEA CHOKES MODIFIED ROV BUCKET, ISO 13628-8 CLASS 4.
2. FLANGE FITS TO CLAMP AND TRIM CC 30 SR ASSY PN 2259786-01
3. WEIGHT IN AIR: 370 KG
   WEIGHT IN WATER: 300 KG
4. A= SYSTEM "A"
   B= SYSTEM "B"
5. SECURE ALL SCREWS WITH LOCTITE TYPE: 243 OR EQUIVALENT

Tightening Torque		
Pos	Nm	lbs.ft
77	30	22,2
78	50	37
86	30	22,2

REVISION DESCRIPTIONS:

APPROVED FOR CONSTRUCTION	12SEP07	1
ISSUED FOR CLIENT COMMENT	20AUG07	N/A
ISSUED FOR INTERNAL IDC	02AUG07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-03-527

CAD	DES BY: T. Hein	DATE: 01.03.2006 REV: 01
DO NOT SCALE	DRAWN: T. Hein	DATE: 01.03.2006
	ENGINEER: J. Donnehl	DATE: 19.08.2007
	APPROVED: M. Lehmkes	DATE: 19.08.2007

SURFACE TREATMENT

MATERIAL AND HEAT TREATMENT

TOLERANCES ACCORDING TO ISO 13 920

GENERAL DIMENSIONS WITHOUT TOLERANCE SPECIFIED ACCORDING TO ISO 20 768 mK

TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO ISO 20 768 mK

EST. WEIGHT: 370,000 KG | SUPERSEDES: | SCALE: 1:2

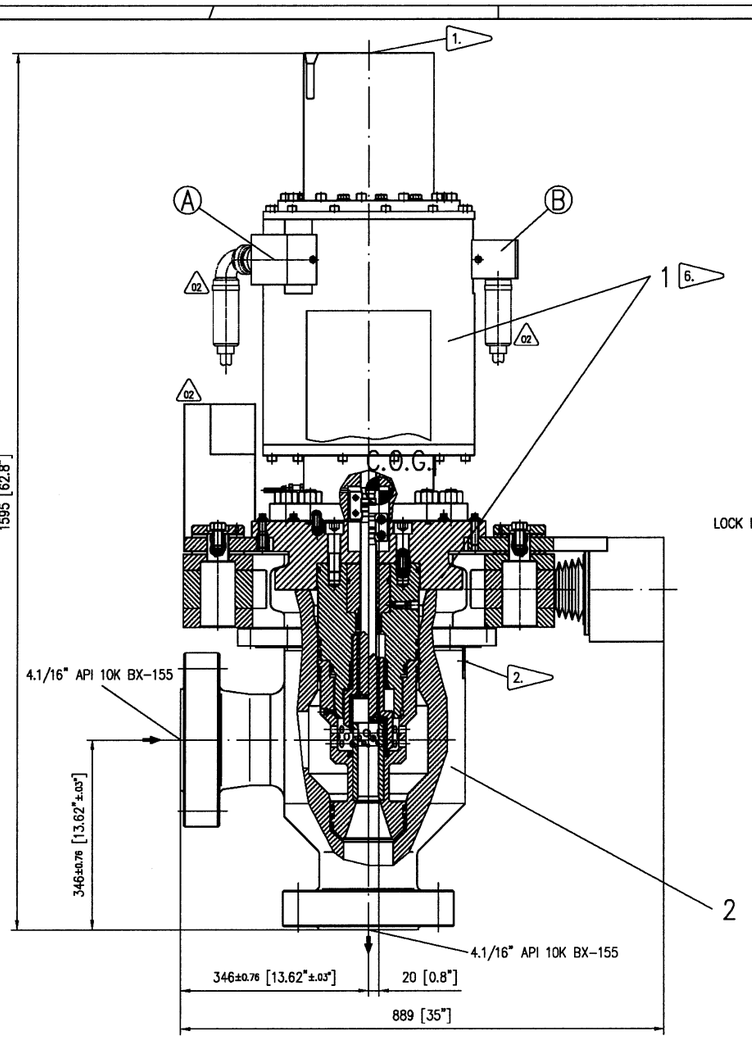
CAMERON

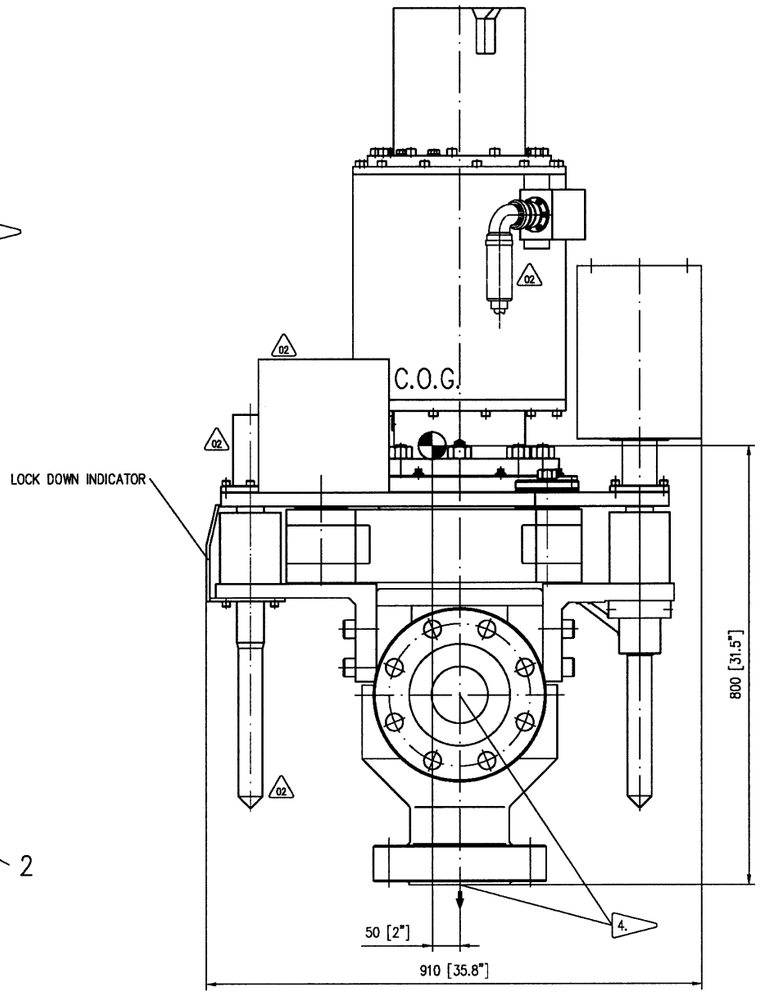
CAMERON GmbH
Lilienthalstrasse 1
29227 Celle, Germany

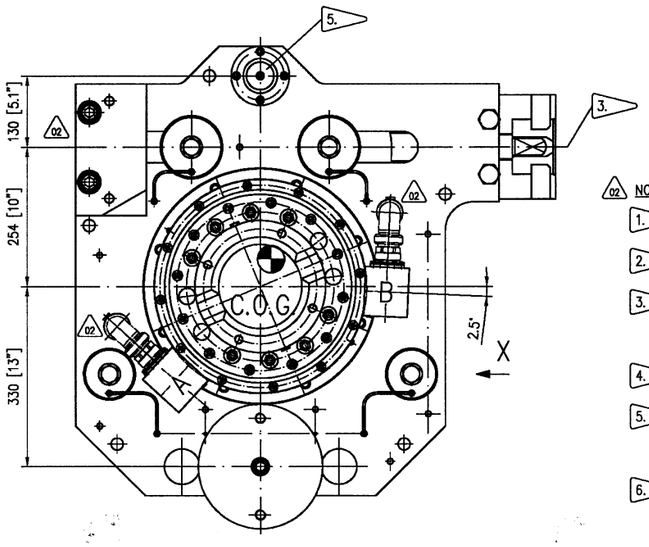
ELECTRIC SUBSEA CHOKE ACTUATOR

INTERNAL USE ONLY: 223350-28 | SHEET: 1 OF 1 | DRAWING NUMBER: SK-066350-28

10/5/2007 9:14:10 AM SAP-LOWEMX SK-066350-28_001_000_00_CURRENT_CCP100.TIF

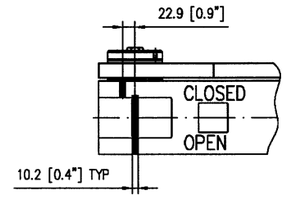






VIEW X

02 PARTIAL VIEW CLAMP INDICATOR



DETAILS TO BE STENCILED
IN PERMANENT WATERPROOF BLACK INK.
MINIMUM TEXT HEIGHT 1"

02 NOTE:

1. FOR SUBSEA CHOKES MODIFIED ROV BUCKET, ISO 13628-8, CLASS 4.
2. BONNET SEAL TEST PORT (AUTOCLAVE 3/8" MP, SF375CX20).
3. SINGLE BOLT HINGED CLAMP LOCK DOWN W/ISO 13628-8 HIGH TORQUE INTERFACE, 42 TURNS APPROX. TO OPEN, SETTING TORQUE 1280 FT. LBS, MAX. BREAK OUT TORQUE 1700 FT. LBS.
4. BORE SIZE 4.07".
5. CHOKE INSERT GUIDE PINS DESIGNED TO ACCOMMODATE 44,45 MM (1.75") MAXIMUM INSERT OFFSET IN ANY DIRECTION FROM THE TOP OF THE CHOKE LIFTING MANDREL (I.E. HIGHEST POINT OF THE CHOKE).
6. RETRIEVABLE PART: APPROX. WEIGHT IN AIR 1070 KG
   APPROX. WEIGHT IN WATER 917 KG

APPROX. WEIGHT IN AIR 1430 KG

APPROX. WEIGHT IN WATER 1225 KG

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

REASON FOR ISSUE	DATE	CLIENT REV.
APPROVED FOR CONSTRUCTION	10AUG07	1
ISSUED FOR CLIENT COMMENT	11APR07	N/A
ISSUED FOR INTERNAL IDC	21MAR07	N/A

Total Exploration & Production
Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-03-304

CAD | REV. BY: W. Dill | DATE: 11.04.2007 | REV.: 02

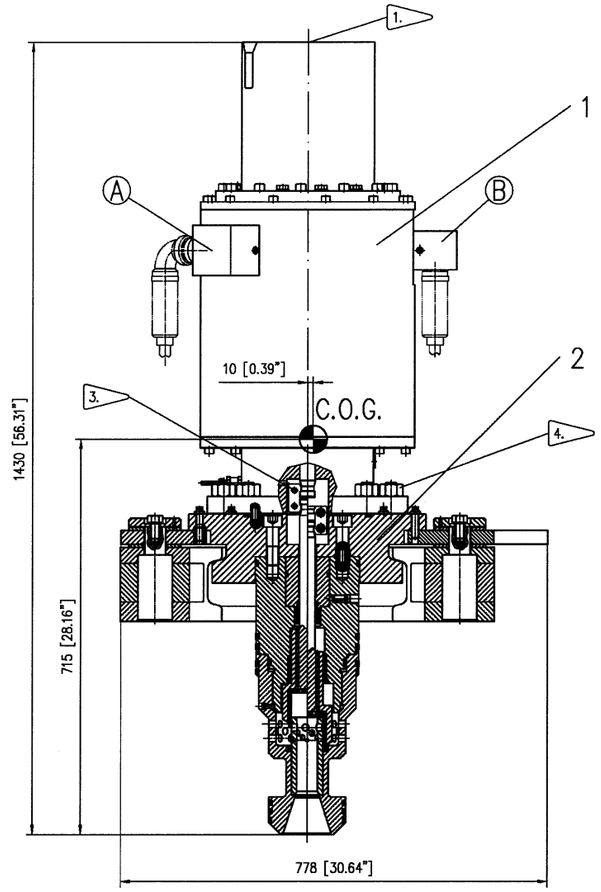
TOLERANCES ACCORDING TO DIN ISO 8015	SURFACE TREATMENT	DO NOT SCALE	
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	MATERIAL AND HEAT TREATMENT	DRAWN: T. Hein	DATE: 12.03.2007
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K		CHECKED: R. Wrede	DATE: 13.08.2007
EST. WEIGHT: 1430.000 KG	SUPERSEDES:	APPROVED: M. Lehmker	DATE: 13.08.2007
		SCALE: 1:5	

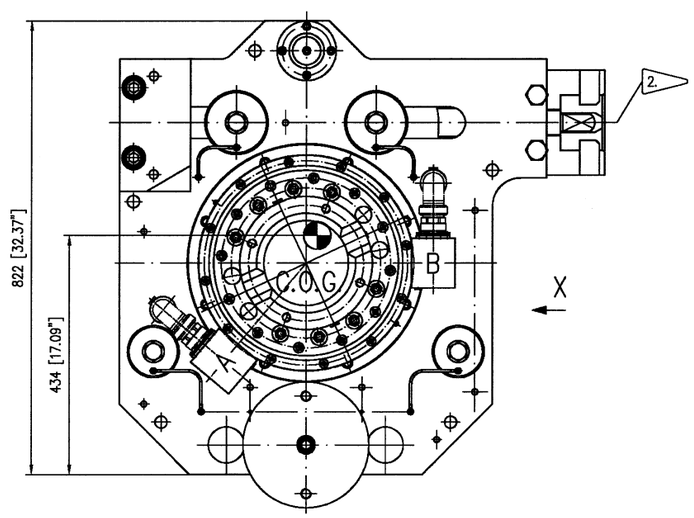
CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

TOP LEVEL ASSEMBLY DRAWING
OF COMBINED CHOKE AND DC ACTUATOR
BODY CC40SR, CLAMP & TRIM CC30SR

INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223446-01	1 OF 1	SK-066446-01

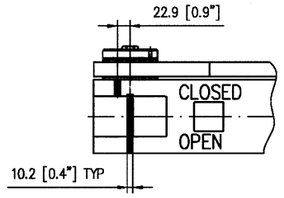
STATUS: APPROVED





VIEW X

PARTIAL VIEW CLAMP INDICATOR



DETAILS TO BE STENCILED
IN PERMANENT WATERPROOF BLACK INK.
MINIMUM TEXT HEIGHT 1"

APPROX. WEIGHT IN AIR: 1070 KG

APPROX. WEIGHT IN WATER: 917 KG

NOTE:

1. FOR SUBSEA CHOKES MODIFIED ROV BUCKET, ISO 13628-8, CLASS 4.
2. SINGLE BOLT HINGED CLAMP LOCK DOWN W/ISO 13628-8 HIGH TORQUE INTERFACE, 42 TURNS APPROX. TO OPEN, SETTING TORQUE 1280 FT. LBS, MAX. BREAK OUT TORQUE 1700 FT. LBS.
3. TIGHTENING TORQUE : 20 Nm (14 lbs.ft.) SECURE ALL SCREWS WITH LOCTITE TYPE: 243 OR EQUIVALENT 03
4. TIGHTENING TORQUE : 424 Nm (313 lbs.ft.)

REV. BY:	DATE:	REV.:
T. Hein	06.11.2007	03

SURFACE TREATMENT	DO NOT SCALE		
TOLERANCES ACCORDING TO DIN ISO 8015	DRAWN: T. Hein	DATE: 14.06.2007	CAMERON GmbH Lückenweg 1 29227 Celle, Germany
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	MATERIAL AND HEAT TREATMENT	CHECKED: G. Durand	DATE: 06.11.2007
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K		APPROVED: M. Lehmker	DATE: 06.11.2007
EST. WEIGHT: 1070.000 KG	SUPERSEDES:	SCALE: 1:5	

CHOKE INSERT ASSEMBLY
OF COMBINED CHOKE AND DC ACTUATOR
CLAMP & TRIM CC30SR

INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223446-01-01	1OF1	SK-066446-01-01

STATUS: APPROVED

Appendix B - Pre-submergence Checklist for subsea retrievable choke with clamp connector. Reference procedure number: X-175160-01.
(8 Pages)

Title: Pre-submergence Checklist for subsea Retrievable Choke with Clamp Connector	Procedure No: X-175160-01	
	Rev: B01	Date: 13/11/00
Prepared by: Eddie Mc Hugh	Approved by: Richard Logan	

The pre-submergence check is to be performed off-shore prior to a choke assembly or an insert assembly being deployed subsea. Recommend that reference is made to the choke's CD drawing in the IOM, as the WSK-1794L & WSK-1795L are generic drawings

Drawing Reference No.	**Choke Body Assembly Check-list – Ref: WSK-1794L**	
	Checklist Item	**Verified (Yes/No)**
1	Electrical continuity straps firmly attached between guide bushing, nut and mounting plates with a torque of 5 ft.lbs.	
2	If applicable, electrical jumper assembly positioned with dowel and capscrews in the mounting plate.	
3	If applicable, bleed plug is torqued 1 ¼ turns beyond finger tight in choke body. Ensure that plastic plug is not positioned.	
4	If applicable, bonnet seal test port is hard piped to hot-stab or has the port plugged with suitable plug.	
5	If applicable, dust caps removed from electrical connector	
6	If applicable, protective bungs removed from hydraulic couplers	
7	Hydraulic fittings show no signs of leakage per visual inspection	
8	Painted/Coated surfaces are free from blistering or cracks	
9	Choke body bore (if accessible) is free of debris and seal surfaces are free of scratches or scale	
10	If accessible, seal surfaces are lightly greased with Castrol LM grease or equivalent to allow easy installation of insert	
11	All external capscrews are securely tightened. Recommended torques are detailed per Table 1.0. The BOM in the choke data book/IOM will detail each of the capscrew sizes and materials.	
12	Insert lockdown indicator positioned such that the indicator arm is not contacting the insert.	
13	If insert positioned in body, line on the insert lockdown indicator shows insert to be properly positioned.	

Drawing Reference No.	Insert Assembly Check-list – Ref: WSK-1795L	
	Checklist Item	**Verified (Yes/No)**
14	If applicable, electrical continuity straps are attached firmly between hydraulic couplings (2 or 3 off) and clamp plate with a torque of 5 ft.lbs.	
15	Electrical continuity straps attached firmly between clamp hinge disks (4 off) and clamp plate with a torque of 5 ft.lbs.	
16	If applicable, electrical jumper assembly positioned with dowel and capscrews in clamp plate	
17	If applicable, electrical jumper assembly cable tied to protection plate post	
18	If applicable, the square drive hydraulic bleed plugs (2 or 3 off) are tightened ¼ turn beyond finger tight at hydraulic mounting block	
19	Clamp reading 'full open' if insert is stabbed out of body and 'full closed' if insert positioned in body	
20	Clamp open/close indications are secured in place with epoxy. The replacement epoxy if required can be supplied by Underwater Markers Scotland, ph + 44 845 6011731.	
21	If applicable, dust caps removed from electrical connector	
22	If applicable, protective bungs removed from hydraulic couplers	
23	If applicable, hydraulic fittings show no signs of visible leakage	
24	Painted/Coated surfaces are free of blistering or cracks	
25	If insert removed from choke body, seals on insert are free from scratches	
26	If insert removed from choke body, metal springs of S-seals are firmly held in S-seals elastomer.	
27	If insert removed from choke body, insert surfaces are lightly covered in Castrol LM grease or equivalent to allow easy installation of insert in body	
28	All external capscrews are securely tightened. Recommended torques are detailed per Table 1.0. The BOM in the choke data book/IOM will detail each of the capscrew sizes and materials.	
29	If applicable, exhaust pipe is positioned on actuator pressure relief valve	
30	Capscrews for balance weight are secured with thread lock and torqued to 190 ft.lbs.	
31	If applicable, hydraulic piping from hydraulic couplers to actuator correct per the interface drawing (CD drawing)	
33	Choke set at an opening position greater than 30% open	
34	Local position indicator pointer is securely tightened with a torque of 5 ft.lbs.	
35	Local position indicator face is secured in place with epoxy. The replacement epoxy if required can be supplied by Underwater Markers Scotland, ph + 44 845 6011731.	
36	Clamp bellows are fully intact	

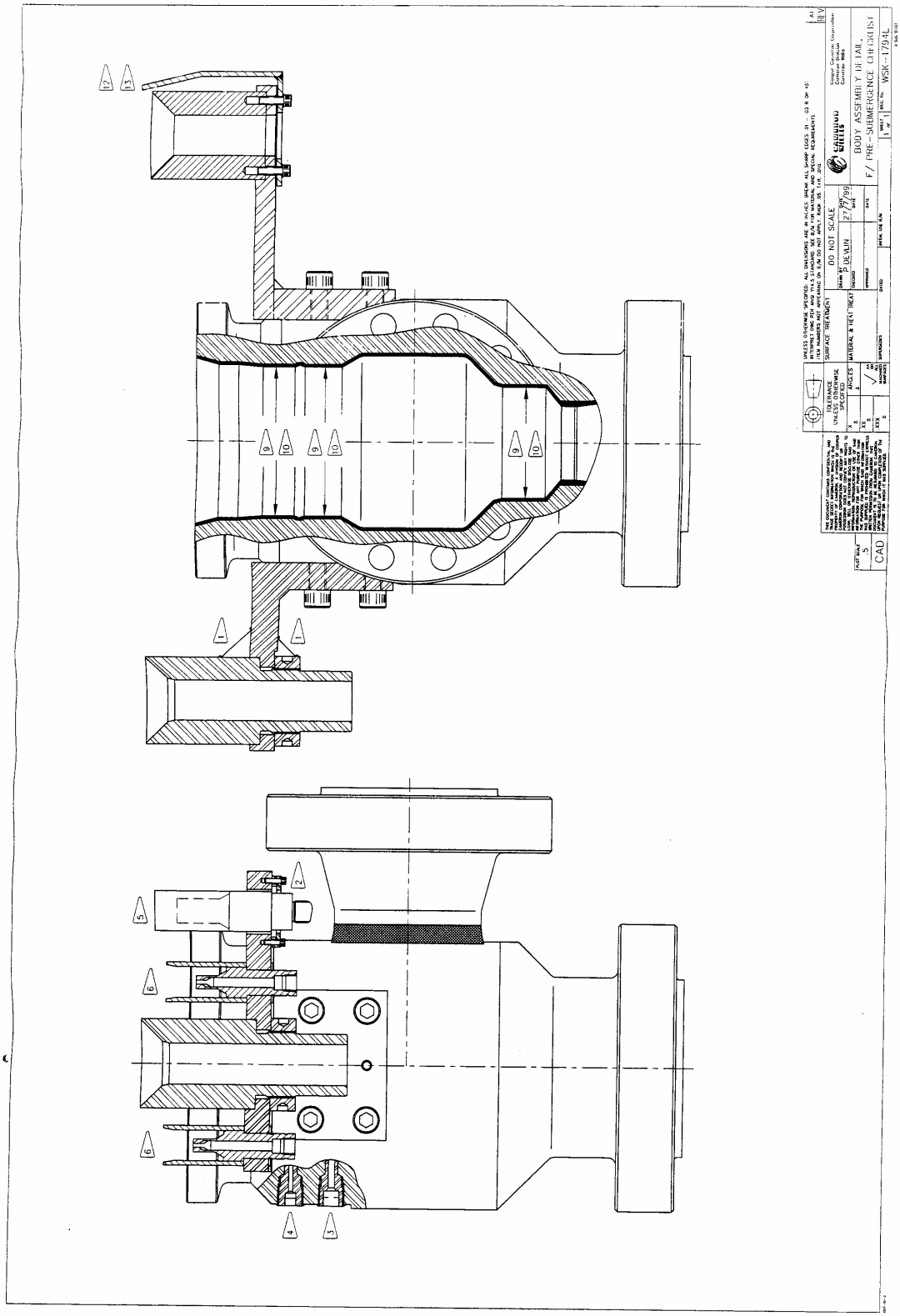
Service Technician: _____ Dated: _____

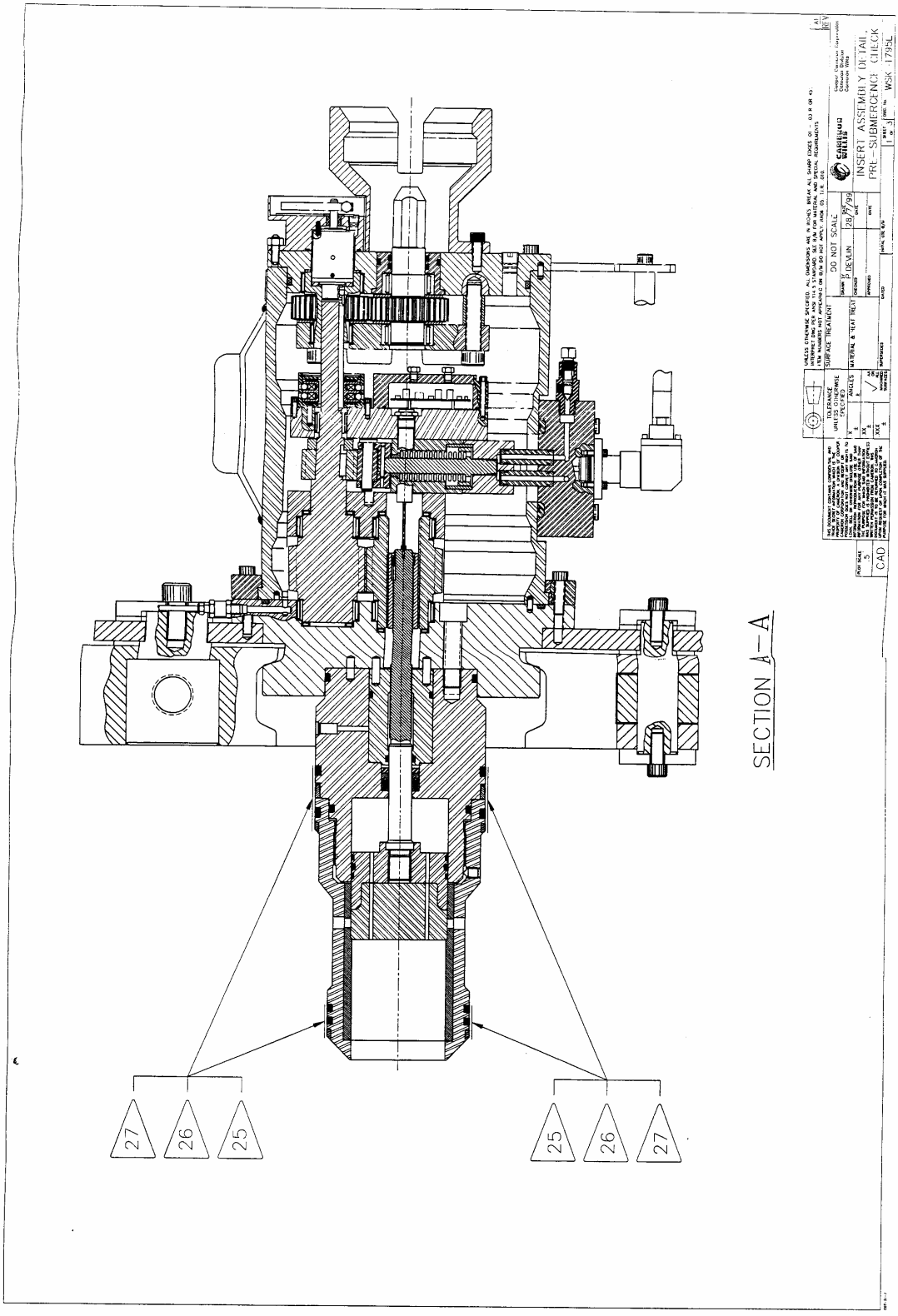
Customer Representative: _____ Dated: _____

Recommended Torques, (Ft.lbs) for Capscrews (Reference Cameron WWS-001028)

	ASTM A-320 GR-L7M /B7M (Style 4, 8, & C)	**ASTM A-320 GR-L7 & B7. A453 GR 660 (Style 4, 8, C)**
¼ - 20 UNC	4	6
5/16 – 18 UNC	10	13
3/8 – 16 UNC	16	21
7/16 – 14 UNC	28	37
½- 13 UNC	44	57
9/16 – 12 UNC	64	84
5/8 – 11 UNC	86	113
¾-10 UNC	150	197
7/8 – 9 UNC	239	313
1 – 8 UNC	361	473
1 1/8 – 7 UNC **1 1/8 – 8 UN**	508 522	667 684
1 ¼ - 7 UNC **1 ¼ - 8 UN**	709 726	930 951
1 3/8 – 8 UN	974	1278
1 ½ - 6 UNC **1 ½ - 8 UN**	1224 1277	1606 1672
1 5/8 – 8 UN	1635	2142
1 ¾ - 8 UN	2054	2691
1 7/8 – 8 UN	2538	3325
2 – 8 UN	3093	4052

Table 1.0


BODY ASSEMBLY DETAIL
F/ PRE-SUBMERGENCE CHECKLIST
WSK-179AL
DO NOT SCALE
CAD


SECTION A-A
27
26
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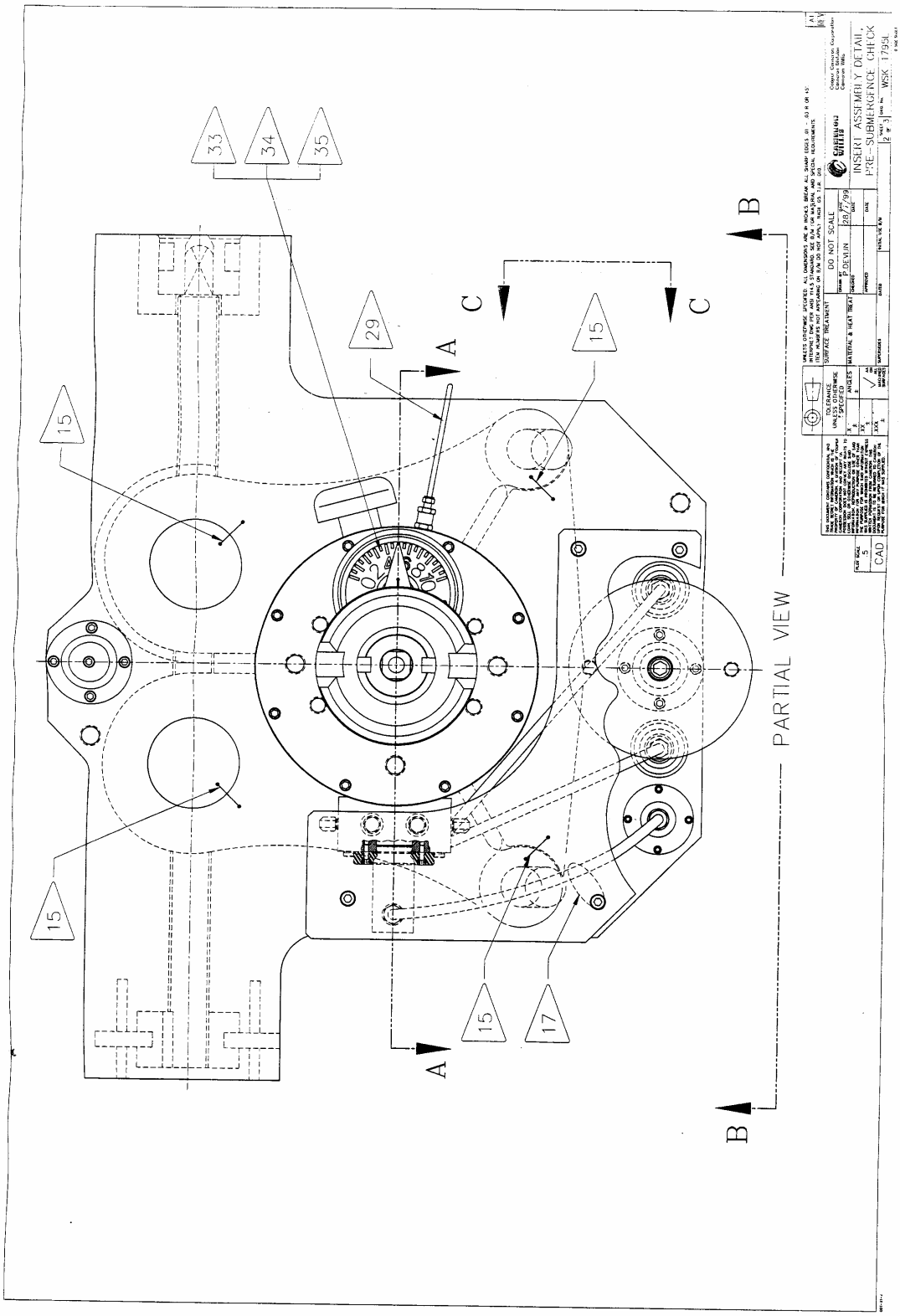
27
INSERT ASSEMBLY DETAIL
PRE-SUBMERGENCE CHECK
DO NOT SCALE


33
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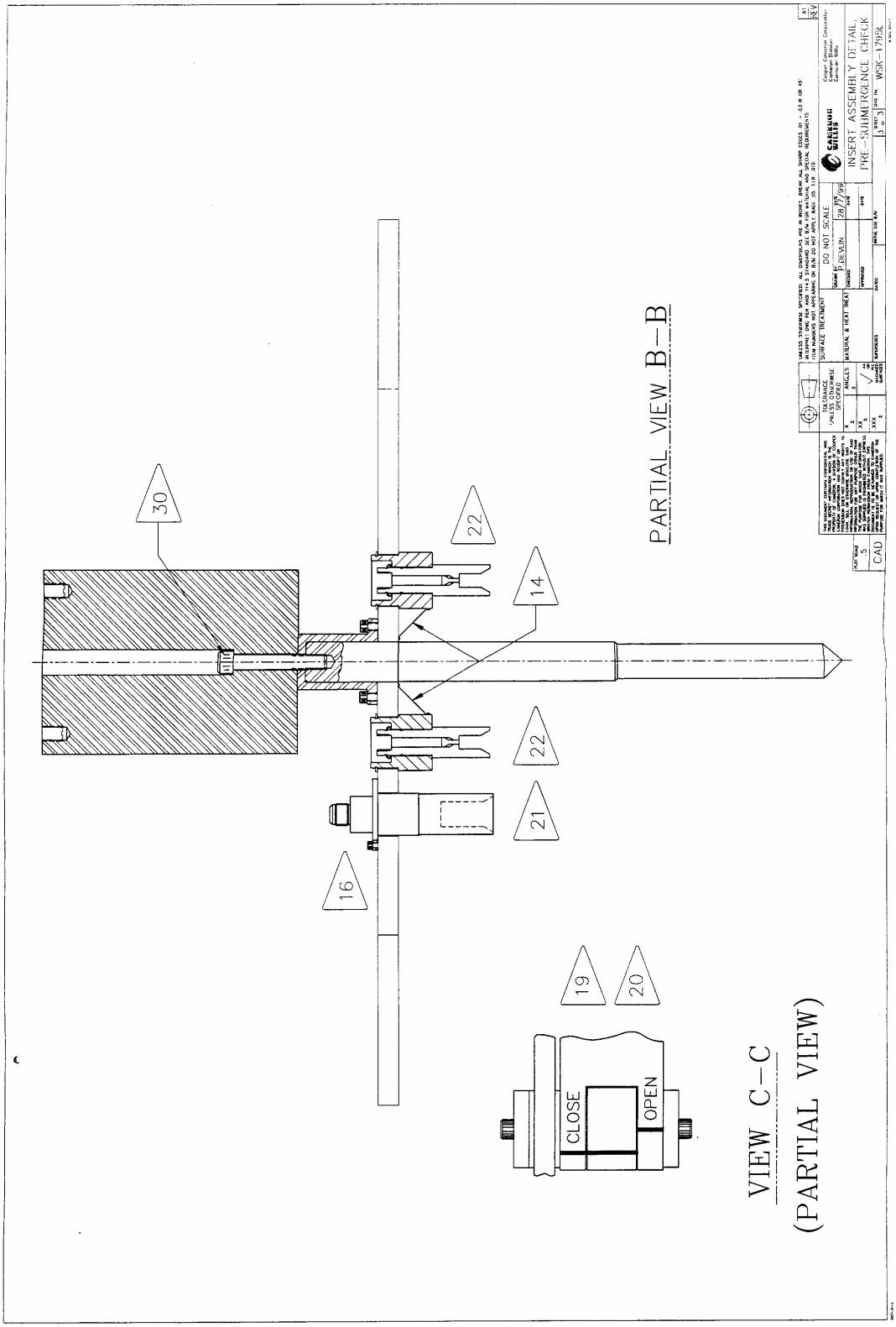
PARTIAL VIEW
INSERT ASSEMBLY DETAIL
PRE-SUBMERGENCE CHECK
DO NOT SCALE
F.DEVLIN
28/7/99
CAD


PARTIAL VIEW B–B
30
22
14
22
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16
19
20
CLOSE
OPEN
VIEW C–C
(PARTIAL VIEW)

APPROVAL RECORD SHEET

Prepared by: __Eddie Mc Hugh_____ Date: __13/11/'00_____

Approved by: _pp Stephen Chambers_ Date: __13/11/'00_____

Revision: B01 Issue Date: ___13/11/'00_____

Page No.	Paragraph No.	Details of Revision
		Items 1, 3, 10, 11, 12, 14, 15, 18, 20, 27, 28 34 & 35 revised. Added Table 1.0.

APPROVED BY:

Signed: ____D. Elliott____	Signed: ___B. Tallon___
Date: _____15/11/00_____	Date: ___15/11/00_____
Engineering Manager	Manuf. Eng. Supervisor

Appendix C – Safety data sheets for Kluebersynth GH 6-32 Oil. (4 Pages)

Material Safety Data Sheet
According to 91/155 EEC

Printing date 17.02.2004 Reviewed on 17.02.2004

1 Identification of the substance/preparation and of the company/ undertaking

· **Product details**

· **Trade name: Klübersynth GH 6- 32**

· **Article number:** 012157
· **Application of the substance / the preparation** Lubricating oil

· **Manufacturer/Supplier:**
KLÜBER LUBRICATION MÜNCHEN KG
Geisenhausenerstrasse 7
D-81379 München
Tel.: 0049 (0) 897876-0
Fax: 0049 (0) 897876-333
Notfallauskunft: 0049 (0) 897876-700

· **Further information obtainable from:** Material Compliance Management

2 Composition/information on ingredients

· **Chemical characterization**
· **Description:** polyalkylene glycol oil

· **Dangerous components:**		
Amine-neutralized phosphoric acid ester	C, N; R 22-34-51/53	≤ 2.5%

· **Additional information:** For the wording of the listed risk phrases refer to section 16.

3 Hazards identification

· **Hazard description:** Not applicable.
· **Information concerning particular hazards for human and environment:**
The product does not have to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.
· **Classification system:**
The classification is according to the latest editions of the EU-lists, and extended by company and literature data.

4 First-aid measures

· **After inhalation:** Supply fresh air; consult doctor in case of complaints.
· **After skin contact:** Wash off with soap and plenty of water.
· **After eye contact:**
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.

(Contd. on page 2)

Material Safety Data Sheet
According to 91/155 EEC

Printing date 17.02.2004 Reviewed on 17.02.2004

Trade name: Klübersynth GH 6- 32

(Contd. of page 1)

· **After swallowing:** If symptoms persist consult doctor.

5 Fire-fighting measures

· **Suitable extinguishing agents:**
Water haze
Foam
Fire-extinguishing powder
Carbon dioxide
· **For safety reasons unsuitable extinguishing agents:** Water with full jet
· **Protective equipment:** Wear fully protective suit.
· **Additional information** Cool endangered receptacles with water spray.

6 Accidental release measures

· **Person-related safety precautions:** Particular danger of slipping on leaked/spilled product.
· **Measures for environmental protection:**
Do not allow to enter sewers/ surface or ground water.
· **Measures for cleaning/collecting:**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Dispose of the material collected according to regulations.

7 Handling and storage

· **Handling:**
· **Information for safe handling:** Prevent formation of aerosols.
· **Information about fire - and explosion protection:** No special measures required.

· **Storage:**
· **Requirements to be met by storerooms and receptacles:**
Store in cool, dry conditions in well sealed receptacles.
· **Information about storage in one common storage facility:**
Store away from oxidizing agents.
Store away from foodstuffs.
· **Further information about storage conditions:** None.

8 Exposure controls/personal protection

· **Additional information about design of technical facilities:** No further data; see item 7.

· **Ingredients with limit values that require monitoring at the workplace:**
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.
· **Additional information:** The lists valid during the making were used as basis.

· **Personal protective equipment:**
· **General protective and hygienic measures:**
Do not inhale gases / fumes / aerosols.
Immediately remove all soiled and contaminated clothing
Avoid close or long term contact with the skin.
Be sure to clean skin thoroughly after work and before breaks.

(Contd. on page 3)

Material Safety Data Sheet
According to 91/155 EEC

Printing date 17.02.2004 Reviewed on 17.02.2004

Trade name: Klübersynth GH 6- 32

(Contd. of page 2)

· **Protection of hands:**
Preventive skin protection by use of skin-protecting agents is recommended.
· **Eye protection:** Goggles recommended during refilling
· **Body protection:** Protective work clothing

9 Physical and chemical properties

· **General Information**

Form:	Fluid
Colour:	Yellow
Odour:	Product specific

· **Change in condition**

Pour point	< -45°C (DIN ISO 3016)

· **Flash point:** > 220°C (DIN ISO 2592)

· **Danger of explosion:** Product does not present an explosion hazard.

· **Density at 20°C:** ~ 0.98 g/cm³ (DIN 51757)

· **Solubility in / Miscibility with water:** Partly miscible.

· **Viscosity:**

Kinematic at 20°C:	~ 32 mm²/s (DIN 51562)

10 Stability and reactivity

· **Thermal decomposition / conditions to be avoided:**
No decomposition if used and stored according to specifications.
· **Materials to be avoided:** oxidizing agents
· **Dangerous reactions** No dangerous reactions known.
· **Dangerous decomposition products:** none under normal use

11 Toxicological information

· **Additional toxicological information:**
Prolonged skin contact may cause skin irritation and/or dermatitis.

12 Ecological information

· **General notes:** Do not allow product to reach ground water, water course or sewage system.

13 Disposal considerations

· **Product:**
· **Recommendation** Can be incinerated in accordance with local and national regulations.

(Contd. on page 4)

Material Safety Data Sheet
According to 91/155 EEC

Printing date 17.02.2004 Reviewed on 17.02.2004

Trade name: Klübersynth GH 6- 32

(Contd. of page 3)

· **Waste disposal key:**
For this product no waste disposal key according the European Waste Catalogue (EWC) can be determined, as only the purpose of application defined by the user enables an allocation. The waste code number has to be determined in accordance with the local waste disposer.

· **Uncleaned packaging:**
· **Recommendation:**
Empty contaminated packagings thoroughly. They may be recycled after thorough and proper cleaning.

14 Transport information

· **Land transport ADR/RID (cross-border)**
· **ADR/RID class:** -

· **Maritime transport IMDG:**
· **IMDG Class:** -

· **Air transport ICAO-TI and IATA-DGR:**
· **ICAO/IATA Class:** -

· **Transport/Additional information:**
Not classified as dangerous according to the above specifications.

15 Regulatory information

· **Labelling according to EU guidelines:**
The product is not subject to classification according to the calculation methods of the "General Classification Guideline for Preparations of the EU" as issued in the latest valid version.

· **Special labelling of certain preparations:**
Safety data sheet available for professional user on request.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Relevant R-phrases**
22 Harmful if swallowed.
34 Causes burns.
51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

· **Department issuing MSDS:** Material Compliance Management
· **Contact:** Tel.: +49 (0) 897876-564

GENERAL PRESERVATION & STORAGE PROCEDURE

FOR

CAMERON CONTROLS EQUIPMENT

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Table of contents

1 Introduction

This document outlines the procedure for preservation and storage of a control system before and after use. This includes Production Control Systems, Workover Control Systems and Drilling Control Systems. The purpose of this procedure is to keep the equipment supplied by Cameron Celle in a proper shape during storage. It will be available for further operations without major refurbishment due to insufficient control during storage.

This document provides instructions to ensure preservation and protection of all typical control system equipment in order to prevent deterioration caused by corrosion, damage, influence of weather and foreign materials, during shipment, storage and installation.

2 Reference Procedures

X-065460-( )-( )	Protective Coating Procedure for Cameron Controls Equipment
X-065390-03	General Protection and Coating Procedure for Cameron Celle Controls Equipment
X-065390-03-00-01	Protection and Coating Procedure for Cameron Celle Controls Equipment
X-027055-01	Corrosion Inhibiting Coating of Machined Surfaces

3 General Storage Requirements for Environment

Before starting any activities for preservation & storage all functions need to be verified. It must be checked that maintenance and repair works have been performed by qualified service personnel and that the control system does not have any mechanical damages on framework, umbilicals, hoses and cables.

Clean and dry the equipment prior to storage and place it under cover (if available) in a clean and dry environment.

For outdoor storage use tarpaulin covers. Ensure that covers are correctly attached and check covers for any damage. Replace damaged covers.

Preferred ambient conditions for storage areas[*)]

Temperature range	:	0 to 40°C
Humidity range	:	0 to 50 % (excluding condensation and frost)

[*)] If above values are not available, humidity and temperature must be within project related specified range.

In areas with high ambient temperatures consider protection against UV light / direct sunlight to protect e.g. plastic materials or compensation systems (thermal expansion).

Atmosphere must be free from harmful substances which can effect resilient seals (e.g. high ozone level).

Store equipment and spare parts with sealing surface protection by protective devices and protect after inspection if necessary.

Consider special storage procedures for critical materials like hydraulic fluid, batteries, rubber goods etc.

Handling and transport of equipment must always be in accordance with the conform procedure, shown in the Operation and Maintenance Manual for the control system.

4 Cameron Controls Standard Hydraulic Control Fluids

This section outlines the Cameron Celle Controls standard hydraulic control fluids. If any other fluid is specified the appropriate data sheet must be considered for preparation and storage of the system.

4.1 Hydraulic Oils

The standard oil types for Cameron Celle Controls equipment are:

- SHELL TELLUS (different types)
- CASTROL BRAYCO MICRONIC 864

Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

Note: Further details for treatment of fluid before and during storage for the specific equipment are listed in section 5.

4.2 Water Based Fluid

The typical water based fluid types for Cameron Celle Controls equipment are delivered by **Mac Dermid CANNING (MARSTON BENTLEY) LTD.**:

- Oceanic HW 511
- Oceanic HW 525
- Oceanic HW 540
- Oceanic HW 443
- Oceanic HD 603 Water/Glycol with lubricant

A typical water based fluid supplied by **CASTROL**:

- TRANSAQUA HT or HT2

A typical water based fluid supplied by **CAMERON**:

- CAMERON 590 X Water / Glycol with lubricant

Note: Further details for treatment of water based fluid before and during storage are listed in the following table.

Water Based Fluid	Suitable Storage Fluid (>6 months)	Suitable Storage Fluid (>1 year)	Suitable Storage Fluid (>2 years)
Mac Dermid CANNING OCEANIC HW 525 Cameron PN 619011-36 OCEANIC HW 540 Cameron PN 619011-28 OCEANIC HW 443 Cameron PN 619011-41	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285
Mac Dermid CANNING Water based fluid with ERIFON HD 603 Cameron PN 619011-46 (Lubricant)	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285
	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	Composition Lubricant/Glycol/Water: 5 % Lubricant: PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	
CASTROL TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	TRANSAQUA HT Cameron PN 619011-53
CASTROL TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	TRANSAQUA HT2 Cameron PN 619011-84
CAMERON Fluid Cameron 590 X Cameron PN 619011-24 (Lubricant)	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 40 % Glycol PN 619011-10 55 % Demineralized Water	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285

5 Specific Equipment Preservation and Maintenance Requirements

Note: Preservation during storage shall be performed in accordance with the check lists shown in section 6.
Any damage occurring during the periodical checks must immediately be repaired and reported to the Maintenance Supervisor.

5.1 Instruments for Surface Containers and Frames

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

All moving parts are to be lubricated with Molycote 3402 or equivalent.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

5.2 Hydraulic Power Unit and Local Control Panel

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines, including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen precharge of each hydraulic accumulator down to 10 bar / 145 psi. This is for safety reasons and to keep e.g. bladder in a stable position.

Air accumulators must be vented and drained of water.

Open ends of piping must be sealed off by plugs or caps.

All moving parts including the push rod of the panel valves must be protected by Molycote 3402 or equivalent.

Operation panels must be protected by a protective cover or door.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anti-condensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect ventilation grills / air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof local control panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

All isolation valves (except drain valves) must be closed. 4/3-way panel valves must be moved to "CENTER" position. 3/2-way panel valves must be in "CLOSE" or "VENT" position.

5.2.1 Hydraulic Oil

For long term storage no fluid exchange is required to get conservation against corrosion if equipment is filled with clean hydraulic oil.

After usage or longer storage (>3 months) hydraulic reservoirs must be checked for cleanliness and water content. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

Note: Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

If the water content of the oil is too high, check the hydraulic fluid for bacterial contamination. Clean the system up if necessary by following instructions of supplier.

Hydraulic lines have to be flushed to customer required cleanliness level.

Note: Cleaning of the hydraulic lines of an empty system must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

5.2.2 Water Based Fluid

General

For long term storage (>6 months) a special fluid preparation is required to get conservation against corrosion of equipment.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Reservoirs must be checked for cleanliness.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluid should be within the system during long term storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions. The table in section 4.2 shows different possibilities for long term (>6 months) storage.

5.3 Remote Control Panel

Painting, frame and moving parts must be checked in accordance with section 5.1.

5.3.1 Electric Remote Control Panel

Cable connections are to be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Operation panel must be protected by a protective cover or door if available.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

Rack mounted equipment shipped separately from cabinets should be bagged with desiccant and tagged with shock fuses.

5.3.1.1 Control Panel for climatic controlled environment

Control panel for use in climatic controlled environment e.g. Master Control Station (MCS), Electric Power Unit (EPU), Remote Workstations etc.

Equipment should be stored in a warehouse in undamaged packaging under the following conditions excluding intensive dust and condensation of humidity.

Temperature -18 - +60°C

Humidity 20-90% RHNC

When packaging has to be opened e.g. for site receive tests it is recommended to use corrosion inhibitors (e.g. Cortec®VCI 110) for further preservation.

5.3.2 Pneumatic Remote Control Panel

Pneumatic connections are to be cleaned up and protected by non aggressive protective shield, protection against dust or mating protective cover if available. Check pneumatic jumper cable as well.

Air receivers must be vented and drained of water.

Operation panel front must be protected by a protective cover or door.

Acryl glass window panes on panels located in hazardous areas must be cleaned with wet cloth only due to electrostatic charge.

5.4 Hydraulic Umbilicals, Umbilical Jumpers & Steel Flying Leads

General Instructions

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the applicable hydraulic fluid.

All hydraulic connections must be cleaned from dirt by using cleaning solvents which do not harm the seals (see Operation and Maintenance Procedure).

The connection plate of the junction boxes must be protected by protective covers.

After cleaning mating protective caps or plugs must be mounted to the quick coupling or single connection.

Stainless steel junction boxes and plates must be covered with a thin film of non aggressive oil.

Painting, frame and moving parts must be checked in accordance with section 5.1.

The umbilical can be stored in a box or on a drum. The minimum bending radius for storage indicated by supplier may not be exceeded.

5.4.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The umbilical shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.4.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

All lines with poppets must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids and compositions (see table in section 4.2).

5.5 Electric Cables and Cable Jumpers

Contacts of electrical connectors must be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Check that cable minimum bending radius is kept for storage.

Cable materials have to be protected for storage to avoid mechanical impact and ageing impact caused by sunlight (UV).

5.6 Umbilical Reels

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cleaned piping must be sealed off by using protective plugs, caps or covers.

Parts for power transmission like gear, chain with sprockets etc. must be protected and lubricated.

Open gear drive with gear ring and cog	-	ANTI SEIZE (or equivalent)
Chain drive	-	ESSO CAZAR K2 (or equivalent)
Gear box for direct drive	-	See Operation and Maintenance Manual of gear box for specific oil type.

5.7 Uninterruptable Power Supply (UPS)

WARNING:

Hydrogen may discharge from batteries and cause explosion (depending from battery type). Sufficient ventilation is required.

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cable connections must be protected with non aggressive protective shield.

For storage of the UPS check the allowed temperature range in Operation and Maintenance Manual to avoid damage of sensitive parts like batteries etc.

Recharge batteries to full range. Deep discharge must be avoided.

Follow specific long term storage procedure for installed type of batteries.

Disconnection of batteries may be required.

Ensure that the UPS is tagged with a shock fuse indicator.

5.8 Subsea Valve Packages

Remark: Subsea valve packages are normally mounted to the subsea running tools (e.g. Lower Marine Riser Package), which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.8.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.8.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.9 Subsea Control Modules (direct / pilot hydraulic types)

Remark: This section is **not** to be applied for CAMTROL subsea control modules. Refer to the "CAMTROL Subsea Production Control Equipment" section.
Subsea Control Modules (SCM) are normally mounted to the subsea running tools which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool. Flushing and testing can be done with the appropriate flushing and testing unit.

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Hydraulic pressure from all lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

If applicable, cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

5.9.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.9.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.10 Hydraulic Flushing and Testing Units

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

Air receivers must be vented and drained of water.

Open connection ends must be sealed off by plugs or caps.

All moving parts must be protected by Molycote 3402 or equivalent.

Junction plates must be protected by an overall cover or individual caps and plugs.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anticondensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

5.10.1 Hydraulic Oil

Reservoirs must be checked for cleanliness and water content. Water content of hydraulic oil must be checked to be within the maximum allowed range. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.10.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.11 Running Tools for Subsea Modules

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines must be discharged.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Hydraulic lines are to be flushed to customer required cleanliness level.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.12 Hydraulic Cylinder (e.g. on SCM Test Stand)

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

Hydraulic cylinders are to be flushed to customer required cleanliness level. Ensure that the cavities are completely filled with hydraulic control fluid. Ensure that no air is left in the cylinders as remaining air might cause corrosion.

Painting must be checked in accordance with section 5.1.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Put piston of the cylinder in retract position. This ensures that the rod is protected inside the cylinder against corrosion or damage.

Grease the cylinder rod with silicon grease or equivalent non aggressive grease.

Store the cylinder in a dry indoor environment. Room temperature should not be below 37°F (3°C).

5.13 Float Type Accumulators

Note: Preservation has to be carried out when the float type accumulators are unused and storage will be longer than three (3) months.

<u>Disassembly of Accumulator</u>

Bleed the pressure from hydraulic fluid supply.

Ensure that the ¼" needle valve at the bottom of the accumulator is in the closed position.

Remove the ¼" NPT plug.

Open the ¼" needle valve at the bottom of the accumulator.

Ensure that the accumulator is depressurised.

Open the hammer union at the bottom of the accumulator.

Ensure that the floater is at the lower end of the accumulator.

Remove the plug at the end of the floater pipe.

Inspect the seals (floater pipe plug, hammer union).

Spray non aggressive anticorrosive lubricant into the accumulator to protect the inner surface of the accumulator.

Carefully move the accumulator in vertical position and ensure that the lubricant flows out of the accumulator.

Assembly of Accumulator

Grease the o-ring of the plug and fix the plug at the lower end of the floater pipe.

Grease the thread at the end of the accumulator bottle and connect the hammer union.

Close the ¼" needle valve at the bottom of the accumulator and install the ¼" plug.

Painting must be checked in accordance with section 5.1.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.14 Topside Umbilical Termination Unit / Assembly

Topside Umbilical Termination Units / Assemblies (TUTU / TUTA) will be treated like Hydraulic Power Units (HPU). The workload is reduced as the TUTU / TUTA does not contain motors, pumps and reservoirs.

5.15 Wire Rope

Grease the wire ropes with wire rope grease. Ommex or Kendal or equivalent wire rope grease can be used.

Store the wire ropes in a dry outdoor or indoor environment.

5.16 Load Cell

Protect the load cells by a thin film of non aggressive oil.

Store the load cells in a dry indoor environment. Room temperature should not be below 37°F (3°C).

6 Preservation Maintenance Check Lists

The following checklists must be used to get a controlled storage of the equipment with proper maintenance.

6.1 Hydraulic Power Unit and Local Control Panel (Main Control Unit)

Preservation Maintenance Check List	**Sheet: 1 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-65390-03-00-00 or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film; repair if necessary	Non aggressive oil
8.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Motors, Distribution Boxes, Relay Boxes, Subswitchboards, Junction Boxes**					
1.0			X		Inspect protection on cable connections; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0		X			Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check drain valves to be open	
6.0			X		Inspect fluid according to section 5.2.1 or 5.2.2	

6.2 Umbilical Reel with Umbilical

Preservation Maintenance Check List — **Sheet: 1 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check lines to be pressureless, drain valves to be open	
6.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.3 Electric Remote Control Panels

Preservation Maintenance Check List						**Sheet: 1 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A. General Inspection						
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, Vaseline or equivalent
4.0			X		Check pneumatic circuits to be depressurized (for purged system only)	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil

Preservation Maintenance Check List						**Sheet: 2 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.4 Pneumatic Remote Control Panels

Preservation Maintenance Check List — **Sheet: 1 of 1**

Description of Equipment: **Pneumatic Remote Control Panels**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on pneumatic hose connection, repair if necessary	Non aggressive protective shield with additional cover
4.0			X		Check pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
7.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
8.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
9.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
10.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
11.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.5 Hydraulic and Electrical Jumpers

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Hydraulic and Electrical Jumpers**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0	X				Check junction boxes and couplings for proper protection by covers, caps or plugs	
4.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield; acid free Vaseline or equivalent; protective caps
6.0			X		Check protection of electric cable against mechanical impact and ageing impact by sunlight	
7.0			X		Check that cable minimum bending radius is kept for storage	
8.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.6 Subsea Valve Package

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Valve Package**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
6.0			X		Check lines to be pressureless; drain valves to be open	
7.0			X		Inspect fluid according to section 5.8.1 or 5.8.2	

6.7 Subsea Control Module (direct / pilot hydraulic types)

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Control Module (not for CAMTROL SCM)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
6.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
7.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
8.0			X		Check lines to be pressureless; drain valves to be open	
9.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
10.0			X		Inspect fluid according to section 5.9.1 or 5.9.2	

6.8 Hydraulic Flushing and Testing Unit

Preservation Maintenance Check List						**Sheet: 1 of 3**
Description of Equipment:	**Hydraulic Flushing and Testing Unit**					
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
6.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List	**Sheet: 2 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C. Hydraulic Circuits						
1.0			X		3/2-way valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way valves to be in open centred position; function lines to be pressureless	
3.0			X		Check lines to be pressureless; drain valves to be open	
4.0			X		Inspect fluid according to section 5.10.1 or 5.10.2	

6.9 Running Tool for Subsea Module

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Running Tool for Subsea Module**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
6.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
7.0			X		Inspect fluid according to section 5.11	

7 CAMTROL Subsea Production Control Equipment

Note: Use the instructions in this section as check lists.

7.1 Subsea Control Module / SCM

Check on the bill of material if individual “Shipping, Transportation and Storage Guidelines” are available for the SCM, otherwise follow the instructions below:

Verify: _____

Store the SCM in the crate until it is required for use.

If it is necessary to gain access to the SCM, remove the top and sides of the crate, but leave the SCM on the shipping frame.

Visually inspect the SCM / packing before use and every **3 month** when it is not used.

Verify: _____

The storage environment must be free from harmful substances which can affect resilient seals (i.e. high Ozone level).

Verify: _____

The ambient temperature for storage must be within the range -10°C to 40°C to maintain the integrity of the pressure compensation system and ensure that no dielectric oil bleeds out.

Verify: _____

CAUTION:
If the loss of dielectric oil exceeds 3 Litre the SCM needs to be refilled in accordance to Cameron “Field refill procedure”. The lower reservoir of the shipping frame is seized to 3 Litre. If you are in doubt please contact Cameron Germany Engineering Department (Tel +49 (0)5141 8060).

7.2 Subsea Accumulator Module / SAM

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Any damage occurring during the periodical checks must immediately be reported and repaired by Cameron Controls.

Verify: _____

Drain the hydraulic pressure from the accumulators.

Verify: _____

Bleed nitrogen pre-charge from the accumulators. Leave 10 BAR residual pressure in the accumulator to prevent the bladder from collapsing.

Verify: _____

Close the two (2) Gas Valves on the HP Accumulators.

Verify: _____

Open ends of Accumulators must be sealed by plugs or protective caps off stainless steel on the gas side off the accumulators.

Verify: _____

Lubricate all moving parts, except the Hydraquad hydraulic connectors, by water-resistant grease.

Verify: _____

Painting, frame and moving parts must be checked for damage.

Verify: _____

Stainless Steel parts must be protected by a thin film of non aggressive oil (Pelox Protector or similar).

Verify: _____

7.3 Subsea Distribution Unit / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.3.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Set all valves to CLOSE position.

Verify: _____

Protect the mounting base of the SAM by a protective cover.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes

Verify: _____

7.3.2 Electrical Parts

Check that all ROV connectable fuses are installed.

Verify: _____

Check that all electrical connectors are protected by caps

Verify: _____

7.4 Umbilical Termination Assembly / UTA

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.4.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes.

Verify: _____

7.4.2 Electrical Parts

Check that all electrical connectors are protected by caps.

Verify: _____

7.5 Foundation Base & Mud Mate for UTA / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Foundation Base only: Verify the proper operation of the two (2) pile locks and confirm that they are in the unlocked position.

Verify: _____

Check the SDU locking mechanism by operating.

Verify: _____

Check the guide post locking mechanism by operating.

Verify: _____

Inspect all lift shackles for deformation and other damage.

Verify: _____

Check condition of all protection anodes.

Verify: _____

8 Handling Requirements for Special Materials

8.1 Rubber Goods

GENERAL

There is very little published information on the storage and care of rubber goods as used in the oil field. When we speak of rubber goods we include the synthetic packings of Nitrile Copolymers and Neoprene as well as natural rubber parts. Natural rubber parts have become relatively rare but the same things that are harmful to natural rubber are also harmful to the synthetics in varying degrees.

Generally speaking, light and air are bad for rubber goods. The exact chemical action is not fully understood and what has been written disagrees on the mechanism involved.

Ozone is known to be bad for rubber goods. Ozone (O_3) is a very active form of oxygen. As far as we know two principle sources contribute the ozone that reaches rubber goods. One is atmospheric ozone which is generated in the stratosphere carried downward by convection currents and eventually absorbed by organic matter. The other source is electrical discharges, such as lightning, high voltage corona, but more commonly, electrical machinery. Ozone attack is characterized by fairly deep cracks in the rubber parts.

Rubber is attacked by ordinary oxygen (O_2) much as steel rusts in the presence of oxygen. Oxidation is characterized by a hard skin which eventually crazes in a multitude of small cracks and may turn chalky or assume a bark-like appearance.

A strong direct light, especially sunlight, has deleterious effects on rubber goods. This is attributed to the ultraviolet content of the spectrum which accelerates cracking. Whatever the mechanism however, light, particularly sunlight, is undesirable. In extremely cold climates some rubber goods will become so brittle that upon dropping or rough handling they will shatter.

In very warm humid climates, particularly those found in some parts of the tropics, fungi and bacteria find their way to the rubber goods and attack the organic content. This is especially true on duck reinforced rubber parts. However, parts reinforced with synthetics will not be attacked in the reinforcement.

Heat also has a bad effect on rubber. This could be the result of sunlight or artificial or accidental heating of any type. Heat results in a gradual hardening of the part and if ozone or oxygen are present, will accelerate their action.

Any stretching or bending of rubber in storage will result in very accelerated ageing. By the term ageing, we mean the cumulative effects of all the above mentioned attacking agents over a period of time. Ozone attacks rubber preferentially at points of strain.

Rubber goods, both natural and synthetic, all possess some degree of susceptibility to various solvents including water, but especially the liquid hydro-carbons. These manifest themselves in various ways by either swell or shrinkage of the rubber goods with which they are in contact.

No precise figure can be given as a "storage life" of a part. This is dependent on all of the above conditions and also the size of the part, its material and function. Generally speaking, the greater the relative surface area is to the volume, the more susceptible a part is to being rendered useless by ageing. For example, a relatively bulky part such as a ram front packer might be expected to have a much longer useful shelf life than a thin large diameter o-ring type of seal such as used on the bonnet seals of preventers or the rings in 'X' bushing.

STORAGE

From the preceding section we can draw a few rules governing storage of rubber goods. Briefly put - a cool, dry, dark storage place would be the best. The ideal would be to store the packings in vacuum sealed containers. The following rules, however, should not be difficult to follow under the average storage conditions experienced throughout our operation.

- Keep the rubber storage area as dark as possible. Certainly not out of doors, and, if indoors, away from skylights or windows and with subdued or indirect artificial lighting.
- Select the coolest location possible and be sure that no heaters or stoves are near by and particularly that the direct blast from a space heater does not blow on the rubber parts.
- Be sure that no electrical machinery (motors, switch gear, or any high voltage equipment producing corona) is near the rubber goods and that drafts will not carry the atmosphere from electrical machinery to the area in which the rubber goods are stored.
- The practice of first in - first out is essential with rubber goods. There is a natural tendency to remove parts from the front of a bin and when stock is replenished to leave the parts that are in the back in place, in which case years might pass before these are finally pulled out for use.
- Store rubber goods in a relaxed position. For example, do NOT hang o-rings on nails. Where possible, do not keep assemblies in stock where the rubber goods are stretched in order to assemble them on the part. For example, o-rings on blanking plugs, tubing hangers and 'X' bushing. In some cases this is difficult as it is with the aforementioned 'X' bushings. On these, periodic inspection should be employed to detect any signs of ageing as quickly as possible.

  On parts, such as the 'X' bushing rings, where we know the rubber parts will be stretched in storage, the best age resistant compounds we can buy are used.
- Keep storage as dry as possible and remove any oil, gas, etc. of hydro-carbon nature that may accidentally get on the rubber.
- Do not store the rubber goods on top shelves near galvanized roofs. There are several reasons for this; one is that heat is passed through galvanized roofing and also there is some opinion that ozone may be generated in this area.
- If possible, store rubber goods in buildings of wooden construction and wooden shelves. Wood is believed to scavenger ozone quite effectively.
- If store for extended periods is unavoidable, sealed containers will aid considerably; impervious surface coverings such as "Sea-Peel" or waxing will help.

USABILITY CHECKS

No general rule can be drawn regarding usability. The final measure is whether or not the cumulative effects of ageing have affected the physical properties of the part to such an extent that it will no longer perform the function for which it is designed. Thus, a large heavy part might suffer the same total amount of ageing as a small, light, thin piece, and still be usable whereas the small part is rendered useless. In these cases some judgement must be used in deciding usability.

Prior to shipment or use out of stock, rubber goods should be examined to see that no "chalking" or "barking" (bark-like surface appearance) is present, that there is not a hard skin on the rubber and that there are no cracks. Sometimes cracks will be obvious, but it is wise to stretch or bend the part in question so that any incipient cracks or very thin cracks will reveal themselves. Where a part is suspect, a check of hardness should be run. In the event that the hardness runs 15 points higher than the nominal hardness of the part, it is considered non-usable. Hardness is affected by temperature and readings should be taken with the rubber part at 70°F – 100°F (21°C - 38°C).

8.2 Hydraulic Hoses

STORAGE

- Before placing hose in storage, it should be completely drained.
- Whenever feasible, store the hose in the original wooden shipping crate. This will provide some protection against the deteriorating effects of solvents, corrosive liquids, ozone and sunlight. Hose should be stored so that the coils are in a horizontal plane.
- Certain rodents and insects will damage the hose. Adequate protection from them should be provided.
- The ideal temperature for storing the hose ranges from 50°F (10°C) to 70°F (21°C) with a maximum limit of 100°F (38°C). If stored below 32°F (0°C), the hose will become stiff and would require warming before placed in service. The hose should not be stored near sources of heat, such as radiators, base heaters, etc., nor should the hose be stored under conditions of high or low humidity.
- To avoid the adverse effects of high ozone concentration, the hose should not be stored near electrical equipment that may generate ozone or be stored for any lengthy period in geographical areas of known high ozone concentration. Exposure to direct or reflected sunlight - even through windows - should also be avoided.

HANDLING

CAUTION: Care should be exercised to prevent mishandling. Crushing or kinking of the hose can cause severe damage to the reinforcement. If this occurs, remove hose from service.

- In order to minimize the danger of kinking, the hose preferably should be removed from its crate by hand, laid out in a straight line, then lifted by means of a catline attached near one end of the hose. If a catline is used to remove the hose from its crate, the crate should be rotated as the hose is removed. Recommended practice is to protect the hose in some manner when moving to a new location. It is considered bad practice to handle the hose with a winch, to hand the hose from a truck gin pole, or to place heavy pieces of equipment on the hose.

8.3 Electronic Goods and Tools containing Electronics

8.3.1 General Instructions

Rapid temperature changes must be excluded to avoid condensation of humidity and mechanical stress.

The packing should protect electronic goods against:

- Dust
- Humidity
- Electrostatic Charge
- Shock
- Direct Sunlight

Generally the original transport packing serves the above requirements best.

Normally antistatic bags, desiccant and anti-shock pads are applied to prevent damage.

Electronic goods should be stored in a warehouse secured against theft.

8.3.2 Fiberoptic Terminations

Optic Link Modules (OLM) should be capped. Caps have to be removed before installation.

8.3.3 Handling Procedure for CMOS Devices

Electrical environments such as overvoltages and electrostatic discharges damage CMOS devices and printed circuit cards containing the devices. Most CMOS devices have diode input protection circuits and gate protection structures to protect against such electrical environments.

In addition to the internal protection network, use the following steps to prevent the generation of severe electrical transient voltages during handling of CMOS devices.

- Read the manufacturer's equipment specification and data sheets before performing maintenance. Do not exceed recommended maximum voltage levels.
- Use grounding wrist straps which contact the skin.
- Ground all work surfaces.
- If lead-straightening or hand-soldering is necessary, provide ground straps for the equipment, and ground the soldering ties.
- Connect all unused inputs to an appropriate logic voltage level, either power or ground.
- Inspect test equipment for proper polarity of voltage before conduction parametric or functional testing.
- Inspect all power supplies used for testing to ensure there are no voltage transients present.
- Do not insert or remove devices from test sockets with power applied.
- Do not contact edge connectors which are wired directly to device inputs.
- If external connections to a printed circuit card address only an input of the integrated circuit, use a resistance of 10 K ohms or greater in series with the input. The resistance limits damage to the card if it is removed and contacts static generating materials.
- Connect all low impedance equipment such as pulse generators to inputs only after the device has power applied. Disconnect the equipment before power is removed.
- Do not allow nylon or other static generating materials to contact the devices.
- Store or transport the devices in materials that are antistatic. Do not insert the devices into plastic packing material, styrofoam, or plastic trays.

8.3.4 Lithium Manganese Dioxide Battery

Replacement of the Lithium Manganese Dioxide battery mounted in the subsea transmitter & battery module: The battery supports the AMF-System (Automatic Mode Function / Dead Man System) belonging to multiplex drilling control systems. Under normal operation conditions replacement is required **after each one-year period**. Battery storage conditions should be in a range of 23°F – 59°F (–5°C to 15°C).

9 Attachment

- Data Sheets of Protective Materials (if required)
- Data Sheets of Hydraulic Fluids (if required)

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Dual CANopen Press. TM Upstream (PPU)
Process Pressure Range: 0 to 400 bar
(Range: 0 to 690bar)
Output: CANopen Protocol / Fault
tolerant

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
0020	0020	04	X-076700-15-85	1.000	EA	FDS: dual CANopen Press & Temp. TM Functional Design Specification for dual Pressure and Temperature Transmitter Interface: 2 off 7-way GISMA Connectoren Protocol: CANopen Project: Total / K-5		
0080	0080	03	X-065415-87	1.000	EA	FDS: Crystals aging, screening and traceability Requirement for cystals which are used in products Cameron purchases from suppliers.		
0090	0090	03	QP-000160-27-02	1.000	EA	General QP for Control Systems, Transm. and Sand Monitor with API 6A Flanges. All Pressures, all temperature ratings, all material classes.		
0110	0190	04	SK-067200-24-03	1.000	EA	Dual Pressure Sensor, 25mm, CANopen Dual Pressure Sensor with 2 off GISMA receptacles FDS: X-076700-15-85 CameronDC Production System		
>>>B/M Category : Reference Call Outs								
0200	0170	02	X-065455-10	1.000	EA	BURN IN TEST PROCEDURE PRINTED CIRCUIT BOARDS CAMTROL		
0210	0200	01	X-076700-09-16	1.000	EA	HANDLING, STORAGE AND CLEANING OF DUPLEX AND SUPER DUPLEX STAINLESS STEEL		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Dual CANopen Press. TM Downstream (PPD)
Process Pressure Range: 0 to 400 bar
(Range: 0 to 690bar)
Output: CANopen Protocol / Fault
tolerant

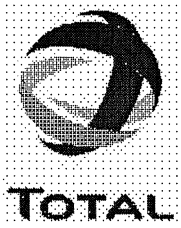
SORT ITEM INDI No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item							
0020 0020	04	X-076700-15-85	1.000	EA	FDS: dual CANopen Press & Temp. TM Functional Design Specification for dual Pressure and Temperature Transmitter Interface: 2 off 7-way GISMA Connectoren Protocol: CANopen Project: Total / K-5		
0080 0080	03	X-065415-87	1.000	EA	FDS: Crystals aging, screening and traceability Requirement for cystals which are used in products Cameron purchases from suppliers.		
0090 0090	03	QP-000160-27-02	1.000	EA	General QP for Control Systems, Transm. and Sand Monitor with API 6A Flanges. All Pressures, all temperature ratings, all material classes.		
0110 0200	04	SK-067200-24-03	1.000	EA	Dual Pressure Sensor, 25mm, CANopen Dual Pressure Sensor with 2 off GISMA receptacles FDS: X-076700-15-85 CameronDC Production System		
>>>B/M Category : Reference Call Outs							
0200 0170	02	X-065455-10	1.000	EA	BURN IN TEST PROCEDURE PRINTED CIRCUIT BOARDS CAMTROL		
0210 0190	01	X-076700-09-16	1.000	EA	HANDLING, STORAGE AND CLEANING OF DUPLEX AND SUPER DUPLEX STAINLESS STEEL		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Dual CANopen Annulus Press. TM 'A'
Process Pressure Range: 0 to 500 bar
(Pressure Range: 0 to 690bar)
Output: CANopen Protocol / Fault
tolerant

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
0020	0020	04	X-076700-15-85	1.000	EA	FDS: dual CANopen Press & Temp. TM Functional Design Specification for dual Pressure and Temperature Transmitter Interface: 2 off 7-way GISMA Connectoren Protocol: CANopen Project: Total / K-5		
0080	0080	03	X-065415-87	1.000	EA	FDS: Crystals aging, screening and traceability Requirement for cystals which are used in products Cameron purchases from suppliers.		
0090	0090	03	QP-000160-27-02	1.000	EA	General QP for Control Systems, Transm. and Sand Monitor with API 6A Flanges. All Pressures, all temperature ratings, all material classes.		
0110	0200	04	SK-067200-24-03	1.000	EA	Dual Pressure Sensor, 25mm, CANopen Dual Pressure Sensor with 2 off GISMA receptacles FDS: X-076700-15-85 CameronDC Production System		
>>>B/M Category : Reference Call Outs								
0200	0170	02	X-065455-10	1.000	EA	BURN IN TEST PROCEDURE PRINTED CIRCUIT BOARDS CAMTROL		
0210	0190	01	X-076700-09-16	1.000	EA	HANDLING, STORAGE AND CLEANING OF DUPLEX AND SUPER DUPLEX STAINLESS STEEL		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Dual CANopen Annulus Press. TM 'B'
Process Pressure Range: 0 to 500 bar
(Pressure Range: 0 to 690bar)
Output: CANopen Protocol / Fault tolerant

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
0020	1030	04	X-076700-15-85	1.000	EA	FDS: dual CANopen Press & Temp. TM Functional Design Specification for dual Pressure and Temperature Transmitter Interface: 2 off 7-way GISMA Connectoren Protocol: CANopen Project: Total / K-5		
0080	1050	03	QP-000160-27-02	1.000	EA	General QP for Control Systems, Transm. and Sand Monitor with API 6A Flanges. All Pressures, all temperature ratings, all material classes.		
0090	1080	03	X-065415-87	1.000	EA	FDS: Crystals aging, screening and traceability Requirement for cystals which are used in products Cameron purchases from suppliers.		
0110	1140	04	SK-067200-24-03	1.000	EA	Dual Pressure Sensor, 25mm, CANopen Dual Pressure Sensor with 2 off GISMA receptacles FDS: X-076700-15-85 CameronDC Production System		
>>>B/M Category : Reference Call Outs								
0200	1110	02	X-065455-10	1.000	EA	BURN IN TEST PROCEDURE PRINTED CIRCUIT BOARDS CAMTROL		
0210	1130	01	X-076700-09-16	1.000	EA	HANDLING, STORAGE AND CLEANING OF DUPLEX AND SUPER DUPLEX STAINLESS STEEL		



Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

11.10.2007	Approved for Construction	CorrOcean	J. Dannehl	S. Fischer
01.06.2007	Issued for Client Comments	CorrOcean	J. Dannehl	S. Fischer
19.04.2007	Issued for Internal IDC	CorrOcean	J. Dannehl	S. Fischer
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON

Document Title:

ASSY Dwg – Upstream/Downstream/Annulus Pressure Transmitter

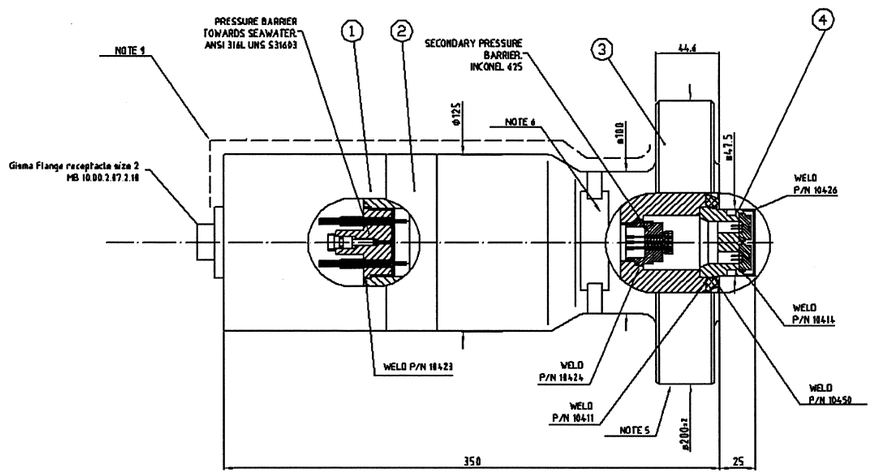
Customer Document Number:	**54NL92-W-03-511**	REV. 1
Cameron Document No.	SK-067200-24-03	REV. 04

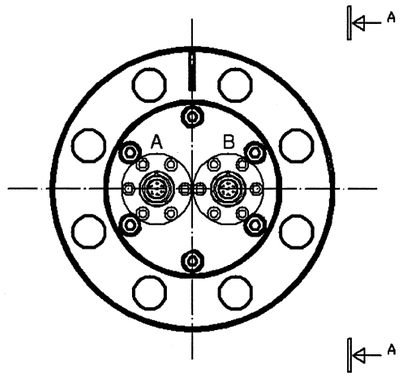
CAMERON REV FROM	03	TO	04
ITEM #	DRAWING ZONE	DESCRIPTION OF CHANGE	
01	11E	Note 11 changed	

CHECKED: J. Dannehl	DATE: 11.10.07	DRAWING NUMBER: SK-067208-24-03	REV.: 04
APPROVED: S. Fischer	DATE: 11.10.07	PART NUMBER: See table	

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

VIEW: A-A





NOTES:

1. MOUNTING ORIENTATION IS NOT CRITICAL TO SENSOR FUNCTIONALITY.
2. APPROXIMATE WEIGHT: 31Kg
3. BX 152 RING GASKET AND BOLTS/NUTS NOT IN CASA SCOPE OF SUPPLY.
4. INTEGRAL FLANGE TYPE: API SPEC. 6A, TYPE 6BX 2 1/16" 10,000 psi
5. MARKING ON INTEGRAL FLANGE:

   CORROCEAN SENSOR TYPE: SENCORR PP
   PART/SERIAL NO.: <SEE TABLE>
   DATE OF MANUFACTURE: (MONTH/YEAR)
   CAMERON PART NO./REVISION: <SEE TABLE>
   CAMERON ORDER NUMBER: TBA

   FL. TYPE: API 6A 6BX, SIZE: 2 1/16"
   RWP: 10,000 psi, PSL 3, PR 1
   RING GASKET: BX 152
   TEMP. RANGE: KU, MATERIAL CLASS: FF

6. MARKING ON TAG:

   CORROCEAN PP SENSOR
   PART/SERIAL NO:
   CANBUS ADDRESS:
   SOFTWARE REV:

7. WELD SPECIFICATION AND QUALIFICATION:
   P/N 10411, WPS: 10/2002, QPR: 8/2002
   P/N 10414, WPS: 35/2002, QPR: 24/2002
   P/N 10423, WPS: 13/2002, QPR: 11/2002
   P/N 10424, WPS: 9/2003, QPR: 7/2003
   P/N 10426, WPS: 41/2003, QPR: 23/2002
   P/N 10450, WPS: CORROCEAN NO. 02, QPR: R43-204

8. SENSOR PENETRATOR DETAILS:

Signal Description	Penetrator Pin No.	Channel
+24V supply	1	A
0V (GND)	2	A
Can H	3	A
Can L	4	A
+24V supply	5	B
0V (GND)	6	B
Can H	7	B
Can L	8	B

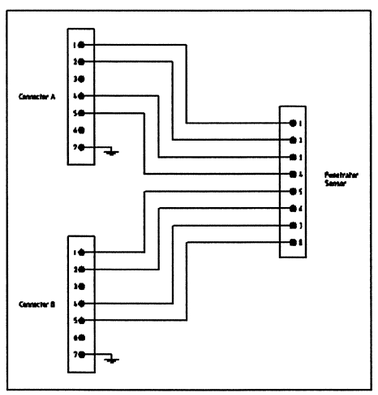
9. SENSOR P/N:

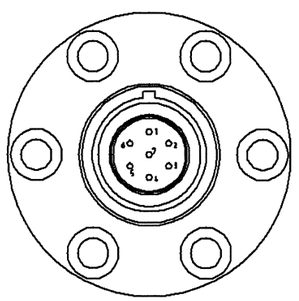
Cameron PN	Acronym	CASA P/N	Canbus address	Operating Pressure
2197093-01-20	PPU	22641-20	80	0-400 bar
2197093-01-22	PPD	22642-22	82	0-400 bar
2197093-01-24	APT 'A'	22642-24	84	0-500 bar
2197093-01-25	APT 'B'	22642-25	85	0-200 bar

10. COATING NOT REQUIRED

11. FOR TOTAL TAG NUMBERS LOOK AT CAMERON REFERENCE DOCUMENT SK-066001-88-04 / TOTAL No. 54NL92-W-03-530

Circuit drawing connector-penetrator:





CONNECTOR PINOUT (2:1)

Pos.	Qty.	Description	Material	CAS Part No.
4	1	PP PROBE	UNS N06625	-
3	1	INTEGRAL FLANGE API 6A 6BX 10,000 psi	ASTM A182-F51	-
2	1	PENETRATOR HOUSING	UNS S31803	-
1	1	TOP COVER W/ DUAL INTERFACE FLANGE RECEPTACLE, SIZE 2)	UNS S31803	-

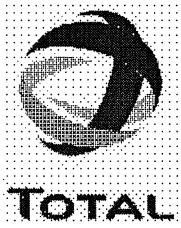
REV.	Symbol	No. of Places	Date	Reason for Issue	Design/Drawn	Checked by	Approved by
05	05	01	11.10.07	Note 11 changed	KW	GJ	MNP
04	04	01	11.10.07	Note 11 added	KW	GJ	MNP
03	03	11	04.06.07	Added Cameron approval	HdG	GJ	CP

Date: 25.05.07	Designer/Drawn: HdG	Checked: KNB	Approved for use: CP
Customer: CAMERON CONTROLS			
Package title			
Title: SENCORR PP SENSOR, 10,000 psi GENERAL ARRANGEMENT			
CASA Part No.: See table	Calculations	Next higher assy.	

CAD System: Mech Desk
Size: A1 | Scale: 1:2
CorrOcean ASA Trondheim Norway
Proj.No.-Orig.-Disc-Type -Seq.No.-(Sheet)
CASA dwg. no.: 18683-16959-1-XG-0023
Client dwg. no.:
Replaces
SHEET 1 OF 1 | Rev. 05

STATUS: Released REVISION : 02
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Dual CANopen Temp. TM Upstream (PTU)
Process Temperature Range: -60°C to 100°C
Output: CANopen Protocol / Fault tolerant

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
0020	0020	04	X-076700-15-85	1.000	EA	FDS: dual CANopen Press & Temp. TM Functional Design Specification for dual Pressure and Temperature Transmitter Interface: 2 off 7-way GISMA Connectoren Protocol: CANopen Project: Total / K-5		
0080	0080	03	X-065415-87	1.000	EA	FDS: Crystals aging, screening and traceability Requirement for cystals which are used in products Cameron purchases from suppliers.		
0090	0090	03	QP-000160-27-02	1.000	EA	General QP for Control Systems, Transm. and Sand Monitor with API 6A Flanges. All Pressures, all temperature ratings, all material classes.		
0110	0190	04	SK-067200-24-04	1.000	EA	Dual Temperature Sensor, 85mm, CANopen Dual Temperature Sensor with 2 off GISMA receptacles FDS: X-076700-15-85 CameronDC Production System		
>>>B/M Category : Reference Call Outs								
0200	0170	02	X-065455-10	1.000	EA	BURN IN TEST PROCEDURE PRINTED CIRCUIT BOARDS CAMTROL		
0210	0200	01	X-076700-09-16	1.000	EA	HANDLING, STORAGE AND CLEANING OF DUPLEX AND SUPER DUPLEX STAINLESS STEEL		



Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

11.10.2007	Approved for Construction	CorrOcean	J. Dannehl	S. Fischer
01.06.2007	Issued for Client Comments	CorrOcean	J. Dannehl	S. Fischer
19.04.2007	Issued for Internal IDC	CorrOcean	J. Dannehl	S. Fischer
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

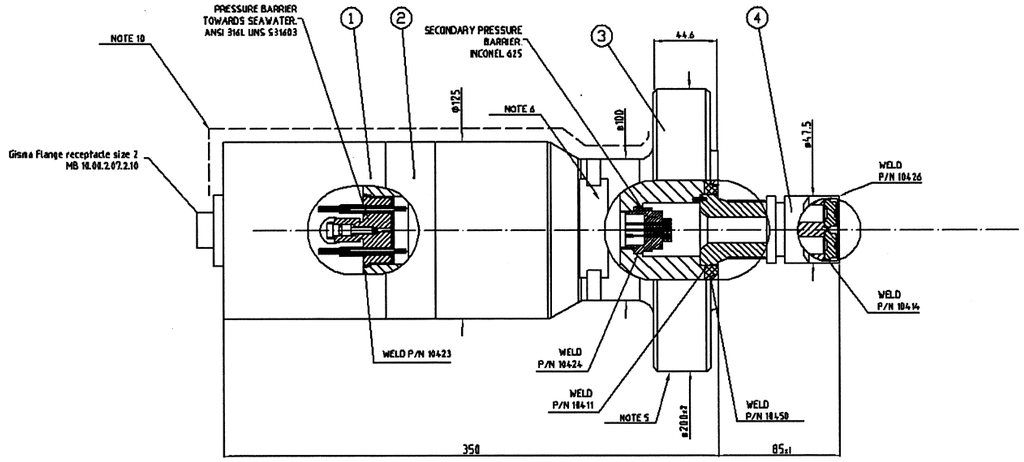
CAMERON	**Document Title:** **ASSY Dwg – Upstream Temperature Transmitter**		
	Customer Document Number:	**54NL92-W-03-331**	REV. N/A
	Cameron Document No.	SK-067200-24-04	REV. 04

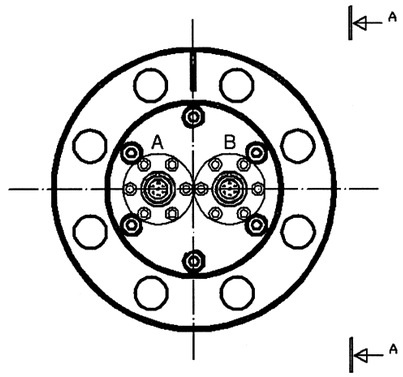
CAMERON REV FROM	03	TO	04
ITEM #	DRAWING ZONE	DESCRIPTION OF CHANGE	
1	11E	NOTE 11 ADDED	

CHECKED: J. Dannehl	DATE: 11.10.07	DRAWING NUMBER: SK-067280-24-04	REV.: 04
APPROVED: S. Fischer	DATE: 11.10.07	PART NUMBER: 2197093-01-21	

CAMERON
CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

VIEW: A-A





NOTES:

1. MOUNTING ORIENTATION IS NOT CRITICAL TO SENSOR FUNCTIONALITY.
2. APPROXIMATE WEIGHT: 31KG
3. BX 152 RING GASKET AND BOLTS/NUTS NOT IN CASA SCOPE OF SUPPLY.
4. INTEGRAL FLANGE TYPE: API SPEC. 6A, TYPE 6BX 2 1/16" 10,000 psi
5. MARKING ON INTEGRAL FLANGE:

CORROCEAN SENSOR TYPE: SENCORR TT
PART/SERIAL NO.: 22642-21
DATE OF MANUFACTURE: (MONTH/YEAR)
CAMERON PART NO./REVISION: 2197093-01-21
CAMERON ORDER NUMBER: TBA

FL. TYPE: API 6A 6BX, SIZE: 2 1/16"
RVP: 10,000 psi, PSL 3, PR 1
RING GASKET: BX 152
TEMP. RANGE: KU, MATERIAL CLASS: FF

6. MARKING ON TAG:

CORROCEAN TT SENSOR
PART/SERIAL NO.:
CANBUS ADDRESS:
SOFTWARE REV:

7. WELD SPECIFICATION AND QUALIFICATION:
P/N 10411, WPS: 10/2002, QPR: 9/2002
P/N 10414, WPS: 35/2002, QPR: 24/2002
P/N 10423, WPS: 13/2002, QPR: 11/2002
P/N 10424, WPS: 9/2003, QPR: 7/2003
P/N 10426, WPS: 41/2003, QPR: 23/2002
P/N 10450, WPS:CORROCEAN NO. 02, QPR: R43-204

8. SENSOR PENETRATOR DETAILS:

Signal Description	Penetrator Pin No.	Channel
+24V supply	1	A
0V (GND)	2	A
Can H	3	A
Can L	4	A
+24V supply	5	B
0V (GND)	6	B
Can H	7	B
Can L	8	B

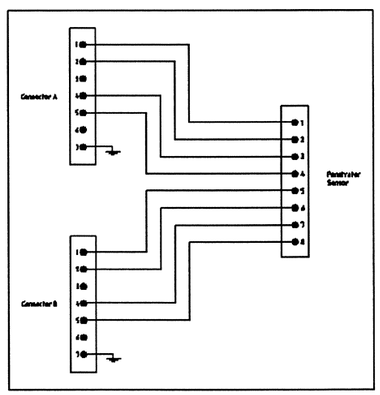
9. SENSOR P/N:

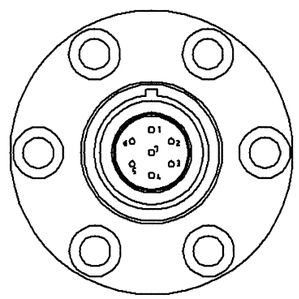
Cameron PN	Acronym	CASA P/N	Canbus address	Operational Temperature
2197093-01-21	PTU	22641-21	81	-60°C to +180°C

10. NO COATING REQUIRED

11. FOR TOTAL TAG NUMBERS LOOK AT CAMERON REFERENCE DOCUMENT SK-066001-88-04 / TOTAL No. 54NL92-W-03-530.

Circuit drawing connector-penetrator:





CONNECTOR PINOUT (2:1)

Pos.	Qty.	Description	Material	CAS Part No.
4	1	TT PROBE	UNS N06625	-
3	1	INTEGRAL FLANGE API 6A 6BX 10,000 psi	ASTM A182-F51	-
2	1	PENETRATOR HOUSING	UNS S31803	-
1	1	TOP COVER W/ DUAL INTERFACE FLANGE RECEPTACLE, SIZE 2	UNS S31803	-

REV.	Symbol	No. of Places	Date	Reason for Issue	Design/ Drawn	Checked by	Approved by
04	04	01	11.10.07	Note 11 added	KM	GJ	MNP
03	03	-	04.06.07	Included Cameron approval	HdG	GJ	CP

Date: 25.05.07 | Designer/Drawn: HdG | Checked: KNB | Approved for use: MNP

Customer: CAMERON CONTROLS

Package title:

CAD System: Mech Desk | Size: A1 | Scale: 1:2

CorrOcean ASA Trondheim Norway

Proj.No.-Orig.-Disc-Type -Seq.No.-(Sheet)

Title: SENCORR TT SENSOR, 10,000 psi
GENERAL ARRANGEMENT
DESIGN TEMPERATURE -60°C to +125°C

CASA dwg. no. 18683-16959-I-XG-0033

Client dwg. no.

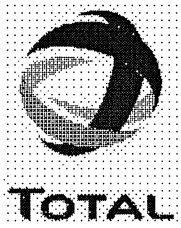
CASA Part No. 22642-21 | Calculations | Next higher assy. | Replaces | SHEET 1 OF 1 | Rev. 04

COOPER CAMERON CORPORATION HOUSTON, TEXAS

ENGINEERING BILL OF MATERIAL

STATUS: Released REVISION : 02
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Dual CANopen Temp. TM Downstream (PTD)
Process Temperature Range: -60°C to 100°C
Output: CANopen Protocol / Fault tolerant

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
0020	0020	04	X-076700-15-85	1.000	EA	FDS: dual CANopen Press & Temp. TM Functional Design Specification for dual Pressure and Temperature Transmitter Interface: 2 off 7-way GISMA Connectoren Protocol: CANopen Project: Total / K-5		
0080	0080	03	X-065415-87	1.000	EA	FDS: Crystals aging, screening and traceability Requirement for cystals which are used in products Cameron purchases from suppliers.		
0090	0090	03	QP-000160-27-02	1.000	EA	General QP for Control Systems, Transm. and Sand Monitor with API 6A Flanges. All Pressures, all temperature ratings, all material classes.		
0110	0200	05	SK-067200-24-05	1.000	EA	Dual Temperature Sensor, 185mm, CANopen Dual Temperature Sensor with 2 off GISMA receptacles FDS: X-076700-15-85 CameronDC Production System		
>>>B/M Category : Reference Call Outs								
0200	0170	02	X-065455-10	1.000	EA	BURN IN TEST PROCEDURE PRINTED CIRCUIT BOARDS CAMTROL		
0210	0190	01	X-076700-09-16	1.000	EA	HANDLING, STORAGE AND CLEANING OF DUPLEX AND SUPER DUPLEX STAINLESS STEEL		



Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

11.10.2007	Approved for Construction	CorrOcean	J. Dannehl	S. Fischer
01.06.2007	Issued for Client comments	CorrOcean	J. Dannehl	S. Fischer
20.04.2007	Issued for Internal IDC	CorrOcean	J. Dannehl	S. Fischer
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **ASSY Dwg – Downstream Temperature Transmitter**		
	Customer Document Number:	**54NL92-W-03-332**	REV. N/A
	Cameron Document No.	SK-067200-24-05	REV. 05

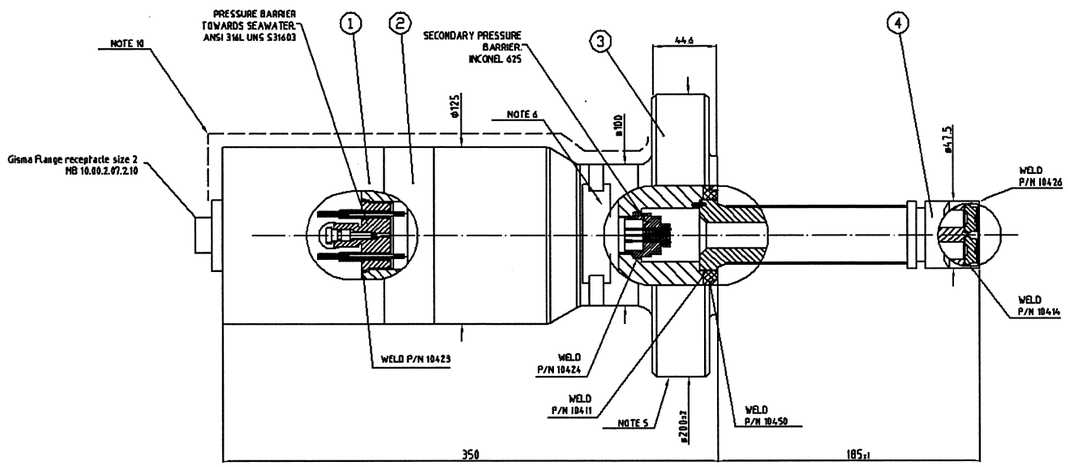
CAMERON REV FROM	04	TO	05

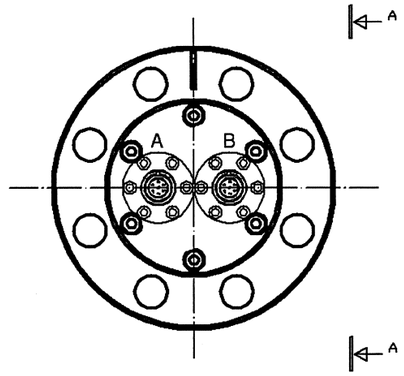
ITEM #	DRAWING ZONE	DESCRIPTION OF CHANGE
1	11E	Note 11 added

CHECKED:	DATE:	DRAWING NUMBER:	REV.:
J. Dannehl	11.10.07	SK-067208-24-05	05
APPROVED:	DATE:	PART NUMBER:	
S. Fischer	11.10.07	2197093-01-23	

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

VIEW: A-A





NOTES:

1. MOUNTING ORIENTATION IS NOT CRITICAL TO SENSOR FUNCTIONALITY.
2. APPROXIMATE WEIGHT: 31Kg
3. BX 152 RING GASKET AND BOLTS/NUTS NOT IN CASA SCOPE OF SUPPLY.
4. INTEGRAL FLANGE TYPE: API SPEC. 6A, TYPE 6BX 2 1/16" 10,000 psi
5. MARKING ON INTEGRAL FLANGE:

CORROCEAN SENSOR TYPE: SENCORR TT
PART/SERIAL NO.: 22642-23
DATE OF MANUFACTURE: (MONTH/YEAR)
CAMERON PART NO./REVISION: 2197093-01-23
CAMERON ORDER NUMBER: TBA

FL. TYPE: API 6A 6BX, SIZE: 2 1/16"
RWP: 10,000 psi, PSL 3, PR 1
RING GASKET: BX 152
TEMP. RANGE: KU, MATERIAL CLASS: FF

6. MARKING ON TAG:

CORROCEAN TT SENSOR
PART/SERIAL NO.:
CANBUS ADDRESS:
SOFTWARE REV:

7. WELD SPECIFICATION AND QUALIFICATION:
P/N 10411, WPS: 10/2003, QPR: 8/2002
P/N 10414, WPS: 35/2002, QPR: 24/2002
P/N 10423, WPS: 13/2002, QPR: 11/2002
P/N 10424, WPS: 9/2003, QPR: 7/2003
P/N 10426, WPS: 41/2003, QPR: 23/2002
P/N 10450, WPS:CORROCEAN NO. 02, QPR: R43-204

8. SENSOR PENETRATOR DETAILS:

Signal Description	Penetrator Pin No.	Channel
+24V supply	1	A
0V (GND)	2	A
Can H	3	A
Can L	4	A
+24V supply	5	B
0V (GND)	6	B
Can H	7	B
Can L	8	B

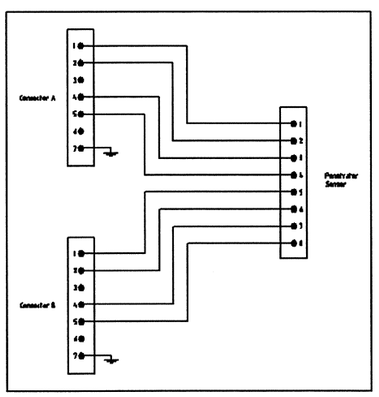
9. SENSOR P/N:

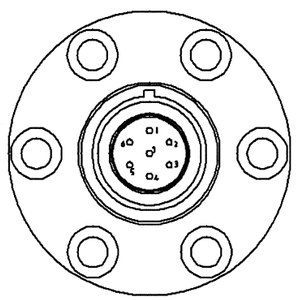
Cameron PN	Acronym	CASA P/N	Canbus address	Operating Temperature
2197093-01-23	PTD	22642-23	83	-60°C to +100°C

10. NO COATING REQUIRED

11. FOR TOTAL TAG NUMBERS LOOK AT CAMERON REFERENCE DOCUMENT SK-066001-88-04 / TOTAL No. 54NL92-V-03-530

Circuit drawing connector-penetrator:





CONNECTOR PINOUT (2:1)

Pos.	Qty.	Description	Material	CAS Part No.
4	1	TT PROBE	UNS N06625	-
3	1	INTEGRAL FLANGE API 6A 6BX 10,000 psi	ASTM A182-F51	-
2	1	PENETRATOR HOUSING	UNS S31803	-
1	1	TOP COVER W/ DUAL INTERFACE (FLANGE RECEPTACLE, SIZE 2)	UNS S31803	-

REV.	Symbol	No. of Pieces	Date	Reason for issue	Design / Drawn	Checked by	Approved by
04	04	01	11.10.07	Note 11 added	KM	GJ	MNP
03	03	-	04.06.07	Included Cameron approval	HdG	GJ	CP

Date: 25.05.07 | Designer/Drawn: HdG | Checked: KNB | Approved for use: CP

Customer: CAMERON CONTROLS

Package title

CAD System: Mech Desk | Size: A1 | Scale: 1:2

CorrOcean ASA Trondheim Norway

Proj.No.-Orig.-Disc-Type -Seq.No.-(Sheet)

Title: SENCORR TT SENSOR, 10,000 psi
GENERAL ARRANGEMENT
DESIGN TEMPERATURE -60°C to +125°C

CASA dwg. no.: 18683-16959-1-XG-0043

Client dwg. no.:

CASA Part No.	Calculations	Next higher assy.	Replaces	SHEET 1 OF 1	Rev.
22642-23					04

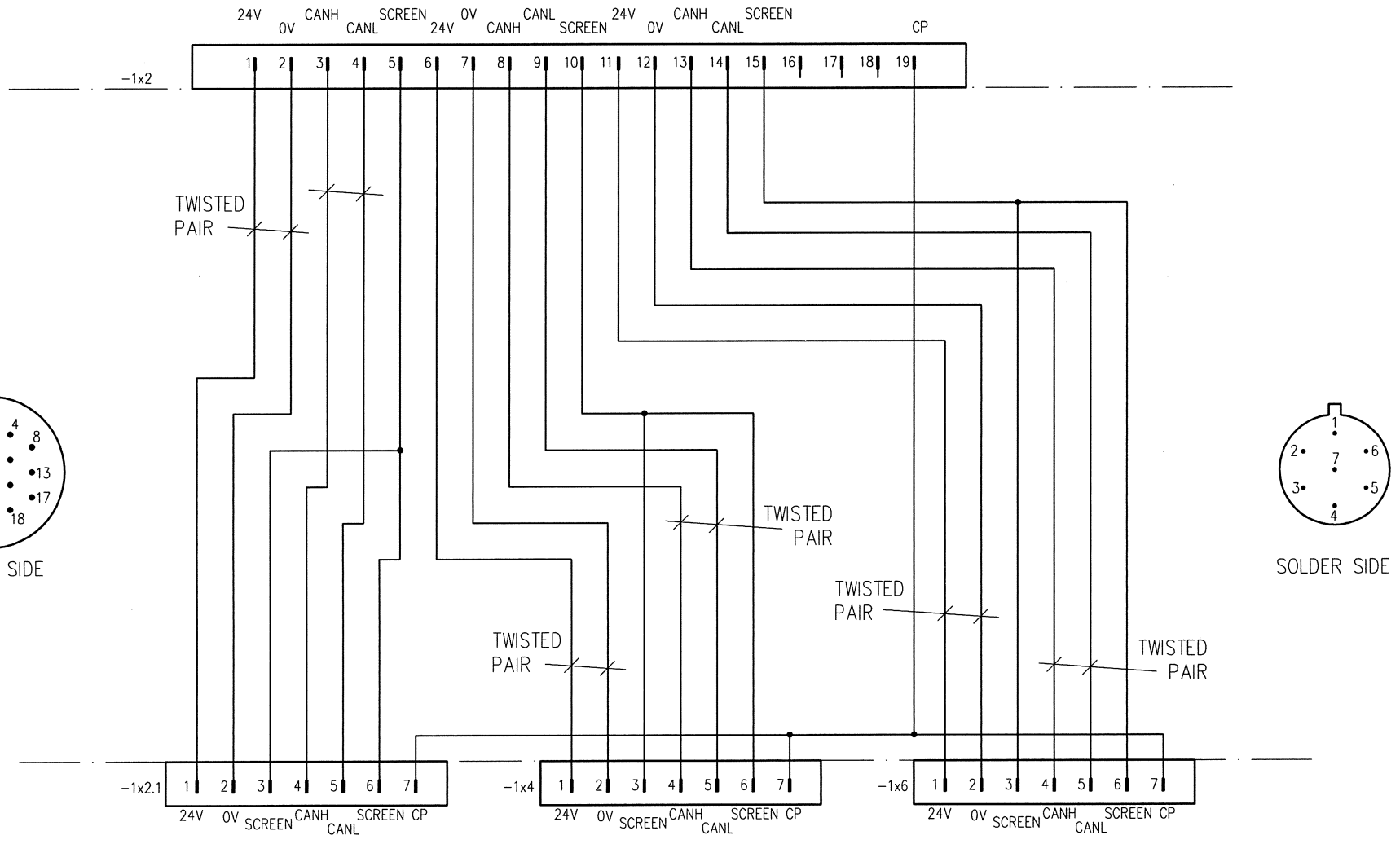
STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Subsea Sensor J-Box (with 4 Recept.)
Subsea Sensor Junction Box
Position 1: 19-way connector, series 10
Position 2,3 and 4: 7-way connector, series 10
Orientations: (Position/Orientation): 1/A,2/A,3/A,4/A

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	05	X-076700-16-67	1.000	EA	DS: Subsea Sensor J-Box (with 4 Recept.) Subsea Junction Box for use with 2197086-08-(XX) with 4 receptacles		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
970	0970	04	SK-067811-68-04	1.000	EA	CD: Subsea Sensor Junction Box Circuit Diagram DC-System		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Subsea Sensor J-Box (with 4 Recept.)
Subsea Sensor Junction Box
Position 1: 19-way connector, series 10
Position 2,3 and 4: 7-way connector, series 10
Orientations: (Position/Orientation):
1/C,2/C,3/C,4/C

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	05	X-076700-16-67	1.000	EA	DS: Subsea Sensor J-Box (with 4 Recept.) Subsea Junction Box for use with 2197086-08-(XX) with 4 receptacles		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
970	0970	04	SK-067811-68-04	1.000	EA	CD: Subsea Sensor Junction Box Circuit Diagram DC-System		

POS. 1 (19-WAY)



POS. 2 (7-WAY)

POS. 3 (7-WAY)

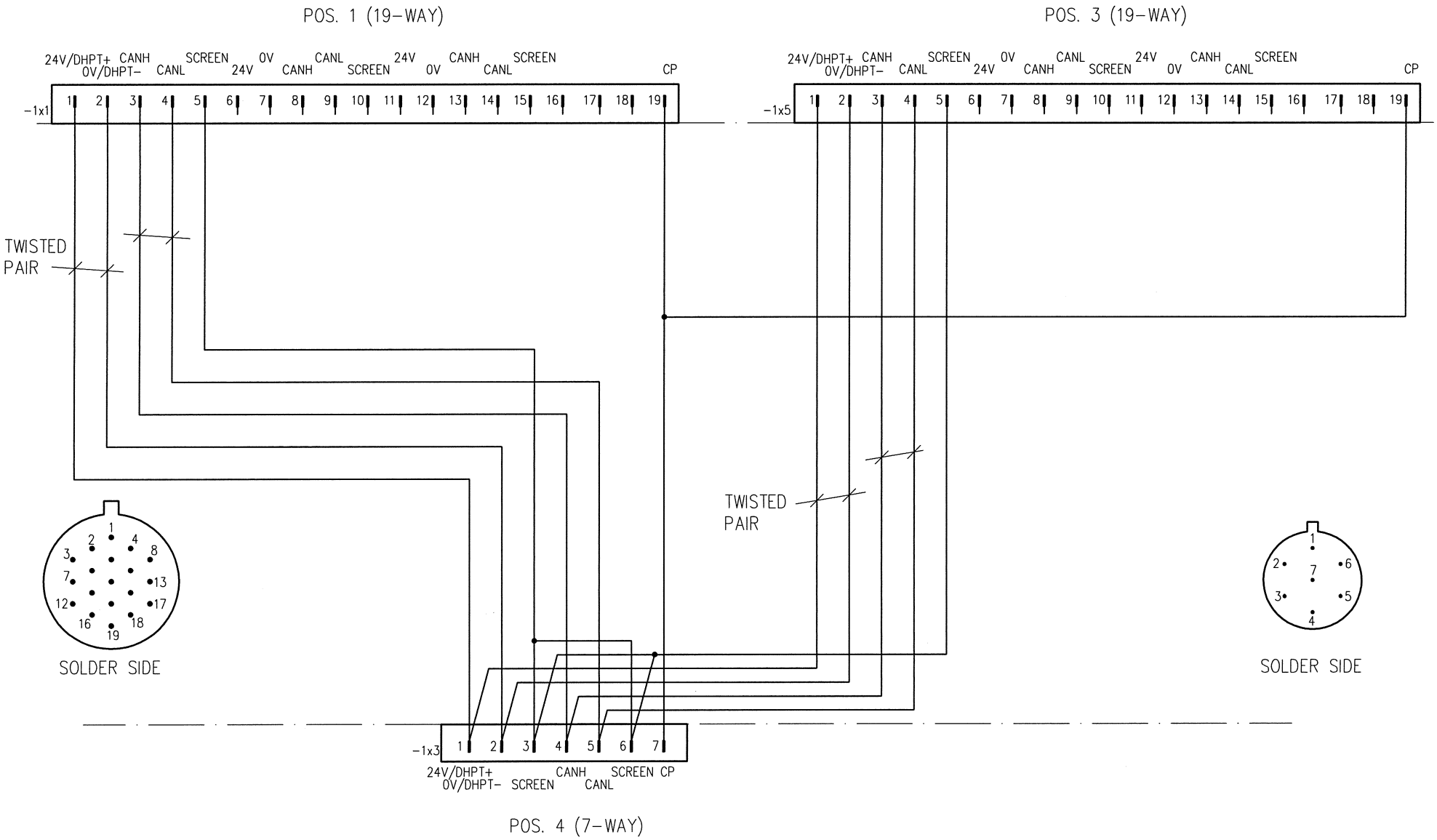
POS. 4 (7-WAY)

04	T. Hein	23.05.2007	J. Dannehl	23.05.2007	CAMERON GmbH Lückenweg 1 29227 Celle, Germany	Title: SUBSEA SENSOR JUNCTION BOX	DWG. NO. SK-067811-68-04
Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date			B.O.M. NO. 2197086-08
01	C. Schulze	23.10.2006	Initial Release				SHEET 1 of 1
Initial Rev.	Initial Author	Initial Date	Remark		Supersedes		STATUS: APPROVED

= + JUNCTION BOX

STATUS: Released REVISION : 03
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Subsea DHPT J-Box (with 3 Receptacles)
Subsea DHPT Junction Box
Position 1 and 3: 19-way connector, series 10
Position 4: 7-way connector, series 10
(Position/Orientation): 1/B,2/-,3/D,4/A

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
001	0910	04	X-076700-16-68	1.000	EA	DS: Subsea DHPT J-Box (with 3 Recept.) Subsea Junction Box for use with 2197086-09 with 3 Receptacles		
002	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
003	0960	05	SK-067811-69-04	1.000	EA	CD: Subsea DHPT Junction Box Circuit Diagram DC-System		

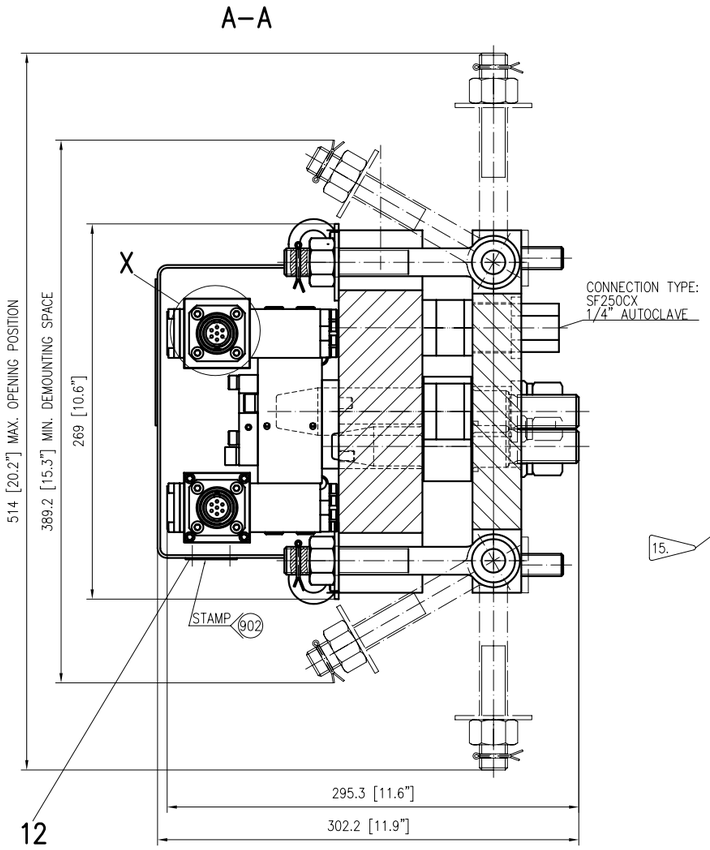


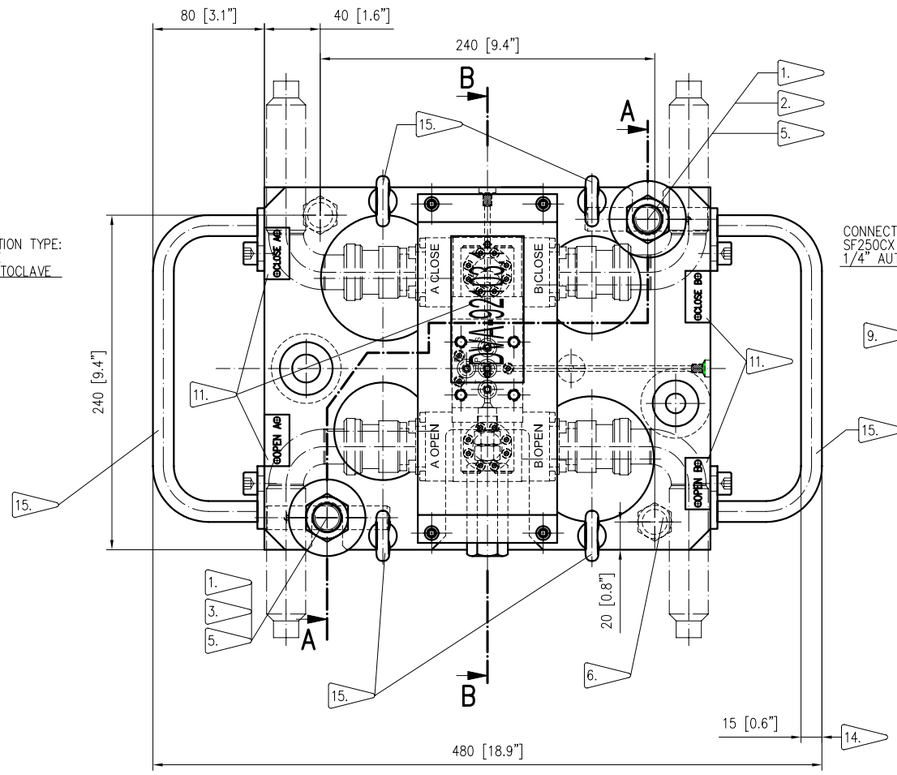
05	T. Hein	23.05.2007	J. Dannehl	23.05.2007	CAMERON GmbH Lückenweg 1 29227 Celle, Germany	Title: SUBSEA DHPT JUNCTION BOX	DWG. NO. SK-067811-69-04	= + JUNCTION BOX
Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date			B.O.M. NO. 2197086-09	SHEET 1 of 1
01	C. Schulze	26.10.2006	Initial Release					
Initial Rev.	Initial Author	Initial Date	Remark		Supersedes			STATUS: APPROVED

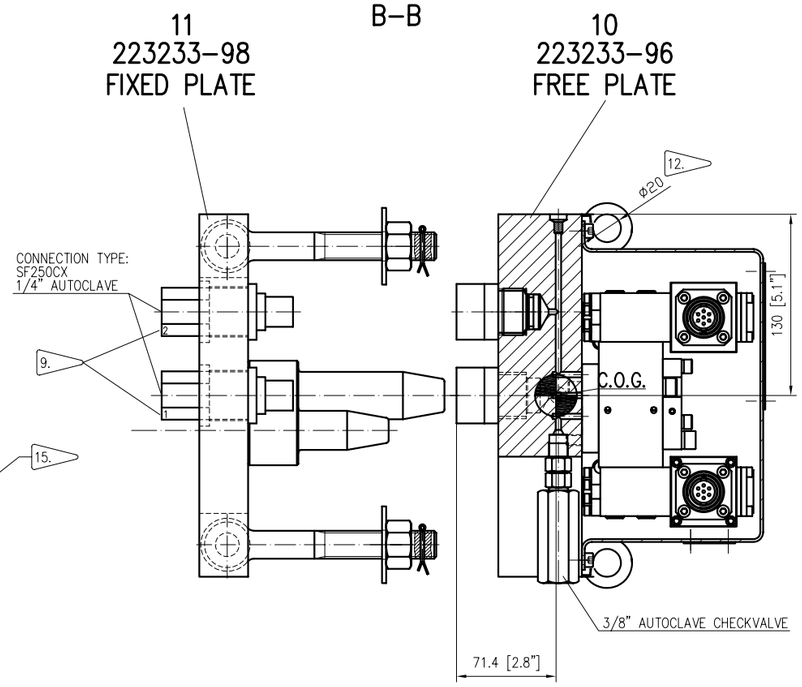
STATUS: Released REVISION : 11
DATE PRINTED : 09/09/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : 3/2 Way SCSSV Dump Valve, K5-F

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
010	0010	06	223233-96	1.000	EA	PILOTED VALVE ON DIVER-MATABLE PLATE FREE PLATE TOTAL K-5		
011	0011	05	223233-98	1.000	EA	PILOTED VALVE ON DIVER-MATABLE PLATE FIXED PLATE TOTAL K5-F		
012	0012	A01	619046-49-86	1.000	EA	TAG, 37 X 74 MM, METAL		
013	0160		714123	2.000	EA	COLLET GLAND ASSY, ANTI-VIBRATION 1/4 TBG, SST 316, 20,000 PSI MWP, COMPLETE ASSEMBLY- COLLET BODY, SLOTTED COLLET, & GLAND NUT		
>>>B/M Category : Engrg Spec/Document item								
	0110	08	X-065437-01-40	1.000	EA	Test Procedure and Record Sheet: 3/2 Way SCSSV Dump Valve Assembly (Free Plate) PN: 223233-96		
901	0060	08	SK-066293-20	1.000	EA	AS: 3/2 Way SCSSV Dump Valve, K5-F		
902	0070	25	D-000100-09-17	1.000	EA	PART IDENT: LOW STRESS STAMP, "ASSY", ASSY P/N, "REV" REV, "CAM" SAP PLANT NO, S/N ("CCV" MAY BE USED IN PLACE OF "CAM". SEE X-043764-01 FOR DETAILS)		
903	0080	01	QP-000160-05-06	1.000	EA	QP StabPlates, FixedPlates, LTC, STC		
904	0090	06	SP-003118-15	1.000	EA	TOTAL K5F Project Quality Plan		
905	0100	A02	X-008060	1.000	EA	VISUAL EXAMINATION INSPECTION METHOD		
907	0200	01	X-065467-02-28	1.000	EA	Installation & Retrieval Procedure DV K5F for SCSSV Dump Valve Project: TOTAL K5F		
>>>B/M Category : Optional item								
801	0110	01	2197088-17-19	4.000	EA	Gisma Sealing Cap Size 2		

SORT ITEM INDI No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
					for 10/2/7 Receptacle Longterm Protective Cover		





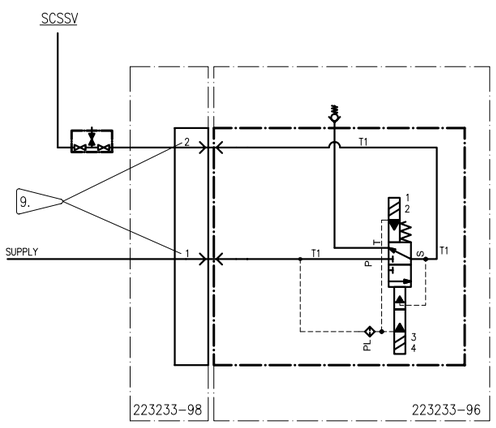


08
17.

!!! ATTENTION !!!
ALLWAYS THE FREE PLATE IS ON DECK FOR REWORK, PROTECT THE OPEN COUPLER–ENDS TO AVOID CONTAMINATION AND DAMAGE!

FLOWDIAGRAM REFERENCED IN SK–066233–96–01

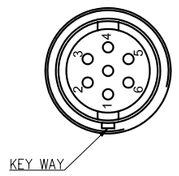
WORKING PRESSURE 690 BAR



NOTES:

1. SPANNER DIMENSION A/F= 30mm
2. TORQUE 85 Nm
3. TORQUE 85 Nm
4. WEIGHT DRY = 72 KG, WEIGHT WET = 60 KG
   FREE PLATE WEIGHT DRY = 40 KG, WEIGHT WET = 33 KG
   FIXED PLATE WEIGHT DRY = 32 KG, WEIGHT WET = 27 KG
5. SCREW THE NUTS ALTERNATING OVER THE SWINGBOLTS DOWN (KEEP THE PARALLELISM OF THE PLATES!)
6. SPANNER DIMENSION A/F= 24mm
7. REFERENCE FOR MOUNTING DETAILS IN SK–066233–98
8. ALL MANUFACTURER AND STANDARD PARTS 316 SSt
   VALVE BODY 316SSt AND MATERIAL IN THE VALVE ARE SEAWATER–RESISTANT
9. NUMBERING OF COUPLER, REFER TO FD SK–066233–96–01
10. !!!WARNING!!! SYSTEM MUST BE DEPRESSURIZED BEFORE REMOVING FREE PLATE. WORKING PRESSURE = 690 BAR
11. SEE TAGGING AND MARKING ASSY PN: 223250–01–45 IN BOM 223233–96
12. LIFTING INTERFACE ø20mm
13. TECHNICAL VALVE DATA:
    DUMP PRESSURE: 30–40 BAR
    MIN. WORKING PRESSURE: 60 BAR
    MAX. WORKING PRESSURE 690 BAR
14. HANDLE DIAMETER: ø15mm
15. DVA MAY BE SUSPENDED BY LIFTING BAG FROM EITHER PADEYES OR BY THE HANDLES, DEPENDING ON DIVER OPERATIONAL REQUIREMENTS
16. FOR FURTHER INFORMATION ABOUT THE VALVE SEE SPEC. X–076721–54–17
08 17. LABEL–TAG TO BE PLACED ON THE ASSEMBLY. INFORMATION TO AVOID CONTAMINATION.
18. FOR FURTHER INFORMATION SEE BILL OF MATERIAL.

DETAIL "X"



KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

A INTERNAL IDC

REASON FOR ISSUE	DATE	CLIENT REV.
REISSUED AS APPROVED FOR CONSTRUCTION	04APR08	4
REISSUED AS APPROVED FOR CONSTRUCTION	22NOV07	3
REISSUED AS APPROVED FOR CONSTRUCTION	30OCT07	2
APPROVED FOR CONSTRUCTION	18JUN07	1
ISSUED FOR CLIENT COMMENT	14MAR07	N/A
ISSUED FOR INTERNAL IDC	25JAN07	N/A

Total Exploration & Production
Netherlands K5 F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92–W–03–514

CAD | REV. BY: C. Reitz | DATE: 31.03.2008 | REV.: 08

SURFACE TREATMENT	DO NOT SCALE	
TOLERANCES ACCORDING TO DIN ISO 8015	DRAWN: C. Reitz	DATE: 17.01.2007
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	CHECKED: M. Khan	DATE: 31.03.2008
MATERIAL AND HEAT TREATMENT	APPROVED: C. Reitz	DATE: 03.04.2008
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K		
EST. WEIGHT: 72.000 KG	SUPERSEDES:	SCALE: 1:2

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

SCSSV DUMP VALVE ASSEMBLY

INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223293–20	1OF 1	SK–066293–20

STATUS: APPROVED

STATUS: Released REVISION : 03
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : DC ACTUATOR 2.1/16"

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
001	0001	01	222255-75	1.000	EA	HOUSING, 2.1/16" ACTUATOR		
002	0002	02	222255-78	1.000	EA	BODY FOR DAMPER 2.1/16" ACTUATOR		
003	0003	02	222261-34	1.000	EA	END CAP FOR 2.1/16" ACTUATOR		
004	0004	02	222226-28	1.000	EA	GUIDE SLEEVE FOR 2.1/16" ACTUATOR		
005	0005	02	222221-04	1.000	EA	BEARING CARRIER FOR 2.1/16" ACTUATOR		
006	0006	03	222216-01	1.000	EA	HOLLOW SHAFT FOR 2.1/16" ACTUATOR		
007	0007	02	222296-01-02	1.000	EA	LOAD FLANGE FOR 2.1/16" ACTUATOR		
008	0008	01	222226-29	1.000	EA	ACTUATION SLEEVE FOR 2.1/16" ACTUATOR		
009	0009	01	222296-01-03	1.000	EA	DISTANCE FLANGE FOR 2.1/16" ACTUATOR		
010	0010	01	222292-01	1.000	EA	SPROCKET, INTERNAL, M=1, Z=205, 2.1/16"		
011	0011	01	222255-77	1.000	EA	HOUSING FOR MOTOR, 2.1/16" ACTUATOR		
012	0012	03	222261-35	1.000	EA	END CAP FOR MOTOR HOUSING, 2.1/16"		
013	0013	01	222211-52	1.000	EA	DRIVE SHAFT FOR 2.1/16" ACTUATOR		
014	0014	02	222221-02	1.000	EA	LOWER CARRIER FOR THRUST BEARING,2.1/16"		
015	0015	01	222221-03	1.000	EA	UPPER CARRIER FOR THRUST BEARING,2.1/16"		
016	0016	01	222273-07	1.000	EA	THRUST PLATE, 2.1/16" ACTUATOR		
017	0017	03	222288-54	1.000	EA	STEM DIAMETER 32 MM FOR 2.1/16" ACTUATOR		
018	0018	01	222267-29	2.000	EA	SPLIT RETAINING RING, 2.1/16" ACTUATOR		
019	0019	01	222201-19	1.000	EA	STOP PIN FOR 2.1/16" ACTUATOR		
020	0020	01	222270-07	2.000	EA	LOCK RING 11.75"-6 TPI, 2.1/16" ACTUATOR		
021	0021	01	222270-06	1.000	EA	LOCK RING FOR 2.1/16" ACTUATOR		
022	0022	01	222700-31	1.000	EA	WRAP SPRING ID 96 FOR 2.1/16" ACTUATOR		
023	0023	01	222700-32	1.000	EA	WRAP SPRING ID 182 FOR 2.1/16" ACTUATOR		
024	0024	01	222274-67	1.000	EA	DISTANCE SLEEVE FOR 2.1/16"		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						ACTUATOR		
025	0025	01	222261-38	1.000	EA	END CAP FOR 2.1/16" ACTUATOR		
026	0026	01	222296-01-01	1.000	EA	COLLET HARMONIC DRIVE GEAR BOX, 2.1/16"		
027	0027	01	222261-36	1.000	EA	CAP FOR POSITION SENSOR,2.1/16" & 5.1/8"		
028	0028	01	222543-02	1.000	EA	PARALLEL KEY 10X8X32, 2.1/16" ACTUATOR		
029	0029	01	222273-08	1.000	EA	MOUNTING PLATE, 2.1/16" ACTUATOR		
030	0030	02	222244-59	2.000	EA	SOCKET, 2.1/16" ACTUATOR		
031	0031	01	222274-65	1.000	EA	DISTANCE SLEEVE DUAL REDUNDANT, 2.1/16"		
032	0032	01	222201-20	4.000	EA	PIN FOR WRAP SPRING, 2.1/16" ACTUATOR		
033	0033	02	222244-58	2.000	EA	BUSHING FOR GUIDING ROLLER, 2.1/16"		
034	0034	01	222450-24	2.000	EA	BRACKET FOR STEPPER MOTOR, 2.1/16"		
035	0035	01	222211-54	2.000	EA	PINION SHAFT, 2.1/16" ACTUATOR		
036	0036	01	222700-33	1.000	EA	REWINDER SPRING OD 49,5 MM, 2.1/16"		
037	0037	01	222211-53	1.000	EA	COUPLING ROD, 2.1/16" ACTUATOR		
038	0038	01	222274-66	2.000	EA	DISTANCE SLEEVE, 2.1/16" ACTUATOR		
039	0039	01	222273-06	2.000	EA	DISTANCE DISC, 2.1/16" ACTUATOR		
040	0040	02	222255-76	2.000	EA	HOLDER FOR DRIVING SPRING, 2.1/16"		
041	0041	01	222261-37	2.000	EA	CAP FOR COMPENSATOR, 2.1/16" ACTUATOR		
042	0042	02	222229-13	1.000	EA	PISTON FOR DAMPER, 2.1/16" ACTUATOR		
043	0043	01	222201-18	1.000	EA	PIN, 2.1/16" ACTUATOR		
044	0044	01	222267-30	1.000	EA	MOUNTING RING FOR DAMPER, 2.1/16"		
051	0051		619040-01-73	2.000	EA	BRUSHLESS MOTOR, BM-2701-A ACCORDING TO DRAWING NO. 124688 MOTOR SUPPLIED AS TWO SEPARATE COMPONENTS, ARMATURE ASSEMBLY AND FIELD ASSEMBLY. MOTOR LEADS: #18 AWG, TEFLON COATED, PER MIL-W-22759/11, 3 LEADS (BLACK, RED, WHITE) 18" (457 mm) min. LONG EACH.		
052	0052	01	222311-02	1.000	EA	GEAR BOX, 2.1/16" ACTUATOR		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						HFUC-32-160-2A-GR-SP		
053	0053	01	222288-55	1.000	EA	SPINDLE 39X5-75, 2.1/16" ACTUATOR		
054	0054	02	2197040-18-02	2.000	EA	Special Stepper Motor 6600-30 with Teflon Supply Wires and Shaft ar both Sides. Not painted		
055	0055		619012-02-87	2.000	EA	COMPENSATOR BLADDER, 0.7 L, NITRILE CONN.: M22x1.5 MALE X G 1/4" FEM. VOLUME: 0.7 LITRE GAS VALVE MATERIAL: AISI 316 BLADDER MATERIAL: NITRILE WITH GROOVE FOR O-RING SIZE 2-115.		
056	0056	06	223361-32	1.000	EA	SENSOR HOUSING, 2.1/16" ACTUATOR		
057	0057		619010-06-52	4.000	EA	TAPERED SHAFT HUB, DIA. 20 MM, STL WITH LOCK NUT FOR SHAFT DIA.: 20 mm BORING: 30 mm MATERIAL: STEEL		
058	0058	A02	2197006-03	1.000	EA	VALVE,CHECK 275 BAR,D=4,75MM,SST BORE DIA.DMR.4.75MM CRACKING PRESS.:5+/-3PSI CHECK VALVE,FREE FLOW REVERSE WORK.PRESS.:4000 PSI / 275 BAR LOHMRATE AT 15PSI D:MAX 100 LOHMS		
059	0059	A02	2197006-04	1.000	EA	VALVE,CHECK 275 BAR,D=4,75MM,SST BORE DIA.DMR.4.75MM CRACKING PRESS.:5+/-3PSI CHECK VALVE, FREE FLOW FORWARD WORK.PRESS.:4000 PSI / 275 BAR LOHMRATE AT 15PSI D:MAX 100 LOHMS		
060	0060		619010-06-51	2.000	EA	TRACK ROLLER, KRV 22, 22 X 36 mm OD X W: 22 X 36 mm THREAD: M10X1 MALE DYN. RADIAL LOAD: max. 5.7 KN		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						LIMITING SPEED: 3600 RPM WITHOUT SEAL RINGS AND ECCENTRIC.		
061	0061	02	222209-05	3.000	EA	PLUG 7/16"-20 UNF FOR VALVE ELECTRONIC MODULE		
062	0062		2707184-01	2.000	EA	PLUG, HEXAGON SOCKET, 7/16" -20-UNF, SST SAE 090109B; INC.O-RING (ISO 11926)		
063	0063		2707183-01	2.000	EA	PLUG, HEXAGON SOCKET, 3/4"-16UNF,SST SAE 090109B; INCL.O-RING(ISO 11926)		
064	0064		712439	4.000	EA	BEARING, BALL 12.MM ID X 28.MM OD X 8.MM W		
065	0065		619010-06-60-02	3.000	EA	DEEP GROOVE BALL BEARING SINGLE ROW DESIGNATION: 61828 ID X OD X W: 140 X 175 X 18 mm DYN. LOAD RATING: 39 KN LIMITING SPEED: 4500 RPM		
066	0066		619010-06-60-03	2.000	EA	DEEP GROOVE BALL BEARING SINGLE ROW DESIGNATION: 61834 ID X OD X W: 170 X 215 X 22 mm DYN. LOAD RATING: 61.8 KN LIMITING SPEED: 3600 RPM		
067	0067		619010-06-60-01	1.000	EA	DEEP GROOVE BALL BEARING SINGLE ROW DESIGNATION: 61904 ID X OD X W: 20 X 37 X 9 mm DYN. LOAD RATING: 6.37 KN LIMITING SPEED: 26000 RPM		
068	0068		619010-06-61	1.000	EA	NEEDLE ROLLER BEARING WITH FLANGE AND INNER RING DESIGNATION: NA4911 ID X OD X W: 55 X 80 X 25 mm DYN. LOAD RATING: 57.2 KN LIMITING SPEED: 7000 RPM		
069	0069		619953-19-03-04	2.000	EA	RETAINING RING, DIN 472, 28 MM, STL FOR BORE DIA.: 28 MM MATERIAL: SPRING STEEL		
070	0070		2707182-01	1.000	EA	BEARING, NEEDLE 14MM ID X 20MM OD X 12MM WIDTH		
071	0071		619010-06-63-02	1.000	EA	CYLINDRICAL ROLLER THRUST		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						BEARING DESIGNATION: 81122M ID X OD X W: 110 X 145 X 25 mm DYN. LOAD RATING: 163 KN LIMITING SPEED: 2200 RPM SOLID CAGE IN BRASS		
072	0072		619010-06-63-01	1.000	EA	CYLINDRICAL ROLLER THRUST BEARING DESIGNATION: 81211M ID X OD X W: 55 x 90 x 25 mm DYN. LOAD RATING: 122 KN LIMITING SPEED: 3600 RPM SOLID CAGE IN BRASS	Use the washer "GS".	
074	0074		2700057	1.000	EA	BEARING, AXIAL NEEDLE ROLLER AND CAGE ASSEMBLY 60MM BORE SERIES AXK		
075	0075		2700057-01	1.000	EA	shaft and housing locating washer TYPE: AS6085 ID X OD X W: 60 x 85 x 1 mm suitable for AXK to DIN 5405-3/ISO 303		
076	0076		619010-06-62	1.000	EA	SELF-ALIGNING BALL BEARING CYLINDRICAL AND TAPERED BORE DESIGNATION: 1201ETN9 ID X OD X W: 12 X 32 X 10 mm DYN. LOAD RATING: 6.24 KN LIMITING SPEED: 32000 RPM		
077	0077		2706212	4.000	EA	PLUG, HOLLOW HEX, 5/16"-24 UNF, SST SAE 090109B; INCL. O-RING; SIZE 2 THREAD: 5/16"-24UNF; MAT.: SST		
078	0078		619914-05-08-01	1.000	EA	PAR. KEY, DIN 6885, A6 X 6 X 20 TYPE A: ROUND HEAD ; MAT.: STEEL		
079	0079		619917-13-22-01	2.000	EA	PAR. PIN, DIN 7, DIA. 12 X 70, STL MATERIAL: STEEL		
080	0080		619989-04-06-01	5.000	EA	PIN, GROOVED, ISO 8742, 3 X 12, STL THIRD LENGTH CENTRE GROOVED DIA.: 3 X 12 MM LG. MATERIAL: STEEL		
081	0081	03	2197088-17-06	2.000	EA	SS Bulkhead Conn. Series 10/4, 19-pin, m Subsea Bulkhead Connector		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						Series 10/4, special type (LV439), 19-pin male contacts, wet mateable		
082	0082		619912-11-22	1.000	EA	PIN, SLOTTED, DIN 1481, 8 X 60, STL SPRING TYPE STRAIGHT PIN , SLOTTED MATERIAL: SPRING STEEL		
083	0083	01	2197088-17-09	1.000	EA	Penetrator Greene Tweed 8 pin for Position Indicator Housing		
084	0084		619917-06-13-01	1.000	EA	PAR. PIN, DIN 7, DIA. 2.5 X 24, STL MATERIAL: STEEL		
085	0085		619915-02-00-06	5.000	EA	RETAINING RING, DIN 471, 12 MM, STL FOR SHAFT DIA.: 12 MM MATERIAL: SPRING STEEL		
086	0086		619010-06-58-01	1.000	EA	RETAINING RING, TYPE SB 50, STL FOR BORE DIA.: 50 mm RING THICKNESS: 1.5 mm MATERIAL: SPRING STEEL		
087	0087		619953-26-04-04	1.000	EA	RETAINING RING, DIN 472, 37 MM, STL FOR BORE DIA.: 37 MM MATERIAL: SPRING STEEL		
088	0088		619915-06-00-06	4.000	EA	RETAINING RING, DIN 471, 20 MM, STL FOR SHAFT DIA.: 20 MM MATERIAL: SPRING STEEL		
089	0089		619010-06-59-01	1.000	EA	RETAINING RING, TYPE SW 55, STL FOR SHAFT DIA.: 55 mm RING THICKNESS: 1.5 mm MATERIAL: SPRING STEEL		
090	0090		619010-06-58-02	1.000	EA	RETAINING RING, TYPE SB 80, STL FOR BORE DIA.: 80 mm RING THICKNESS: 2.0 mm MATERIAL: SPRING STEEL		
091	0091		619010-06-59-03	1.000	EA	RETAINING RING, TYPE SW 170, STL FOR SHAFT DIA.: 170 mm RING THICKNESS: 2.5 mm MATERIAL: SPRING STEEL		
092	0092		619010-06-58-03	1.000	EA	RETAINING RING, TYPE SB 175, STL FOR BORE DIA.: 175 mm		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						RING THICKNESS: 2.5 mm MATERIAL: SPRING STEEL		
093	0093		619010-06-59-02	1.000	EA	RETAINING RING, TYPE SW 140, STL FOR SHAFT DIA.: 140 mm RING THICKNESS: 2.5 mm MATERIAL: SPRING STEEL		
094	0094		619027-02-78	3.000	EA	O-RING, SIZE-0.351" ID X 0.072" W THICKNESS: 0.072" MATARIAL: NBR HARDNESS: 90 SHORE		
095	0095		702645-37-31	1.000	EA	O RING, SIZE AS-568-373 8.975 ID X .210 W 90D /MS-1078 NITRILE PKG AND QUAL /CIW 702645		
096	0096		702645-37-71	4.000	EA	O RING, SIZE AS-568-377 9.975 ID X .210 W 90D /MS-1078 NITRILE PKG AND QUAL /CIW 702645		
097	0097		702645-13-81	8.000	EA	O RING, SIZE AS-568-138 2.112 ID X .103 W 90D /MS-1078 NITRILE PKG AND QUAL /CIW 702645		
098	0098		702645-15-11	2.000	EA	O RING, SIZE AS-568-151 2.987 ID X .103 W 90D /MS-1078 NITRILE PKG AND QUAL /CAM 702645		
099	0099		619027-03-97	1.000	EA	O RING, SIZE 5-052, 6.86 X 1.78 mm MATERIAL: NBR , 90 SHORE		
100	0100		702645-00-91	3.000	EA	O RING, SIZE AS-568-009 .208 ID X .070 W 90D /MS-1078 NITRILE PKG AND QUAL /CIW 702645		
101	0101		619027-03-43	2.000	EA	TURCON GLYD RING, 800 BAR, ID 32 MM INCL. O-RING ; ROD DIA.: 32 MM WORK. PRESS.: MAX. 800 BAR MATERIAL: TURCON T46 ; O-RING: NBR		
102	0102		619027-03-96	4.000	EA	WEAR RING FOR ROD DIA. 32 mm WITH ANGLE CUT GROOVE DIA. X WIDTH: 37 X 5.6 mm SPEED: MAX. 15 m/s TEMP.: -60°C / +200°C MATERIAL: TURCITE T47		
103	0103		619027-03-95	1.000	EA	TURCON GLYD RING, 800 BAR, OD 100 mm		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						INCL. O-RING in NBR FOR BORE DIA.: 100 mm NOM. PRESS.: MAX. 800 BAR MATERIAL: TURCON T46		
104	0104		702645-24-01	1.000	EA	O RING, SIZE AS-568-240 3.734 ID X .139 W 90D /MS-1078 NITRILE PKG AND QUAL /CIW 702645		
105	0105		619901-11-12-09	24.000	EA	SCREW, HEX, DIN 933, M6 X 16, SST MATERIAL: AISI 316 (1.4401)		
106	0106		619903-07-09-06	12.000	EA	SCREW, SOC, DIN 912, M5 X 12, SST MATERIAL: AISI 316 (1.4401)		
107	0107		619925-11-21-11	6.000	EA	SCREW, HEX, DIN 931, M6 X 90, SST MATERIAL: AISI 316 (1.4401)		
108	0108		619903-07-12-09	6.000	EA	SCREW, SOC, DIN 912, M5 X 25, STL MATERIAL: 8.8 EL. ZINC-PLATED		
109	0109		619903-07-11-03	12.000	EA	SCREW, SOC, DIN 912, M5 X 20, STL MATERIAL: STEEL 12.9		
110	0110		619903-09-11-03	8.000	EA	SCREW, SOC, DIN 912, M8 X 20, STL MATERIAL: STEEL 12.9		
111	0111		619903-07-10-09	26.000	EA	SCREW, SOC, DIN 912, M5 X 16, STL MATERIAL: 8.8 EL. ZINC-PLATED		
112	0112		619903-07-09-09	8.000	EA	SCREW, SOC, DIN 912, M5 X 12, STL MATERIAL: 8.8 EL. ZINC-PLATED		
113	0113		619903-09-14-09	12.000	EA	SCREW, SOC, DIN 912, M8 X 35, STL MATERIAL: 8.8 EL. ZINC-PLATED		
114	0114		619903-08-19-09	6.000	EA	SCREW, SOC, DIN 912, M6 X 60, STL MATERIAL: 8.8 EL. ZINC PLATED		
115	0115		619903-10-16-02	6.000	EA	SCREW, SOC, DIN 912, M10 X 45, STL MATERIAL: STEEL 10.9		
116	0116		619903-09-17-09	6.000	EA	SCREW, SOC, DIN 912, M8 X 50, STL MATERIAL: 8.8 EL. ZINC-PLATED		
117	0117		619903-10-12-09	12.000	EA	SCREW, SOC, DIN 912, M10 X		

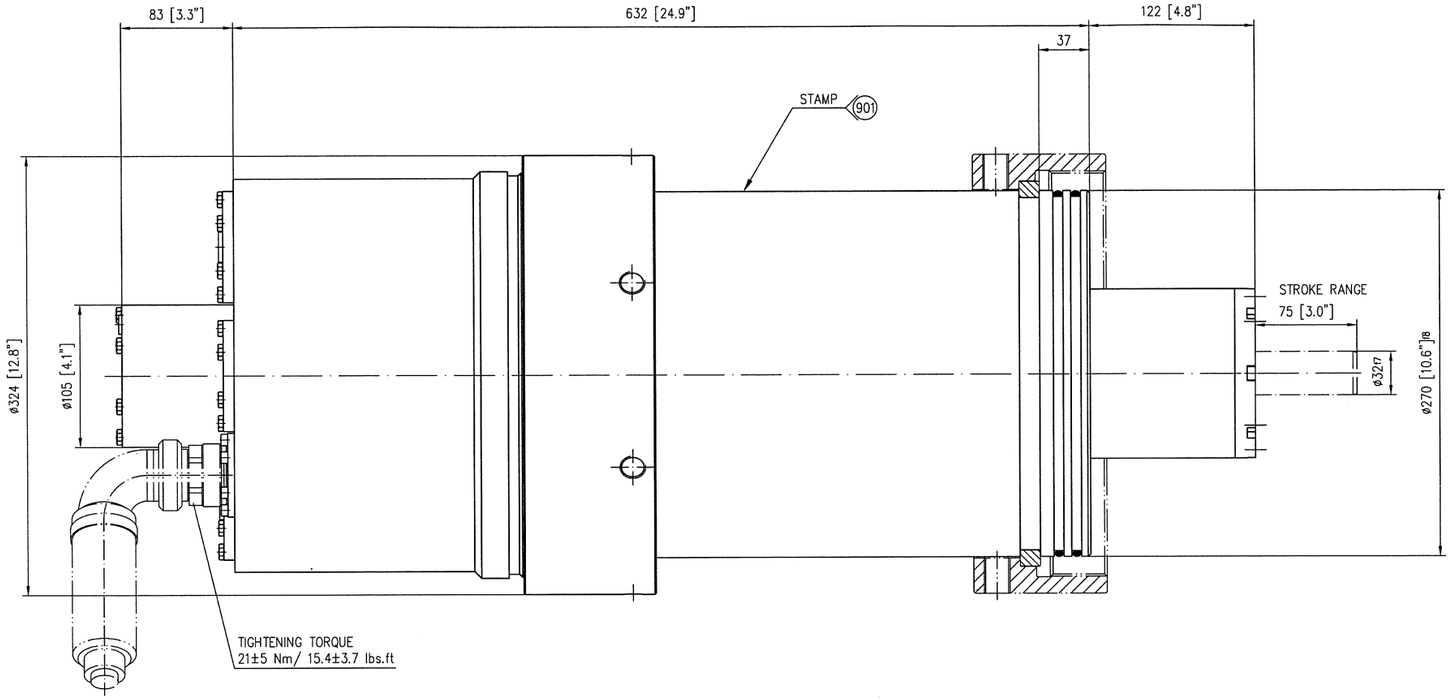
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						25, STL MATERIAL: 8.8 EL. ZINC-PLATED		
118	0118		619903-08-10-09	1.000	EA	SCREW, SOC, DIN 912, M6 X 16, STL MATERIAL: 8.8 EL. ZINC-PLATED		
119	0119		619903-07-07-09	1.000	EA	SCREW, SOC, DIN 912, M5 X 8, STL MATERIAL: 8.8 EL. ZINC-PLATED		
120	0120		619903-08-12-09	8.000	EA	SCREW, SOC, DIN 912, M6 X 25, STL MATERIAL: 8.8 EL. ZINC PLATED		
121	0121		619919-11-02-07	1.000	EA	WASHER, MEDIUM, DIN 125, B 6.4, STL TYPE B: WITH CHAMFER ; ID: 6.4 mm MAT.: STEEL 140 HV GALV. ZINC-PLAT.		
122	0122		619936-05-04-01	1.000	EA	WASHER, DIN 9021, 5.3 X 15 X 1.2 TYPE: A ; MAT.: AISI 316 (1.4401)		
123	0123		619988-07-02	18.000	EA	PLAIN WASHER, SMALL SERIES ID X OD X WT: 5.3 X 9.0 X 1.0 mm FOR BOLT SIZE: 5 mm MAT.: STEEL 140 HV EL. ZINC-PLATED		
124	0124		619903-11-12-02	1.000	EA	SCREW, SOC, DIN 912, M12 X 25, STL MATERIAL: STEEL 10.9		
125	0125		619910-16-08	4.000	EA	NUT, HEX, DIN 934, M8, STL MATERIAL: 8 EL. ZINC-PLATED		
126	0126		619923-07-07-02	1.000	EA	SCREW, SET, DIN 916, M4 X 6, SST MATERIAL: AISI 316 (1.4401)		
127	0127		702645-01-61	1.000	EA	O RING, SIZE AS-568-016 .614 ID X .070 W 90D /MS-1078 NITRILE PKG AND QUAL /CAMERON 702645		
128	0128		619006-01-52	2.000	EA	VALVE, THROTTLE CHECK ,1/4", 700 BAR CONN.: G 1/4" MALE ; W/O. HOUSING WORK. PRESS.: MAX. 700 BAR CRACK. PRESS.: 0.05...0.07 BAR HOLE DIA.: 0.4 mm MEDIUM: MINERAL OIL		

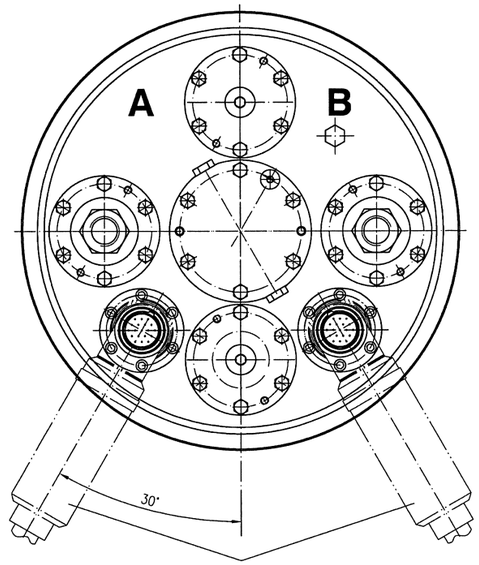
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						TEMP.: -40°C / +80°C FLOW RATE: 20 L/MIN ; MAT.: STEEL		
130	0130		702515-29-20-10	12.000	EA	SCREW, SOC HD SET .750-10 X .625 SST STL CUP POINT ANSI B18.3		
140	0140		619014-14-78	1.000	EA	PLUG, METRIC LEE, SHORT, 3 MM, SST BORE DIA.: 3 MM PROOF PRESS: CLASS 1 (H10) 980 BAR CLASS 2 (H9) 1130 BAR AND CLASS 3 (H7) 1370 BAR MATERIAL: SST		
141	0141		619923-09-10-01	1.000	EA	SCREW, SET, DIN 916, M6 X 12, STL HEX SOCKET SET SCREW WITH CUP POINT MATERIAL: 45 H (HARDNESS CLASS)		
150	0150	01	222226-36	1.000	EA	SLEEVE FOR SENSOR DC ACTUATOR		
151	0151	01	222244-67	1.000	EA	DISTANCE BUSHING OD 15 FOR SENSOR, DC ACTUATOR		
152	0152	01	222244-68	1.000	EA	DISTANCE BUSHING OD 18 FOR SENSOR, DC ACTUATOR		
153	0153		619010-06-57	2.000	EA	MAGNET RING , AXIAL MAGNETIZED OD X ID X H: 15 X 6 X 6 mm SURFACE: GALV. TIN PLATED MAGNET MATERIAL ACC. TO CODE 262/135.		
154	0154		619953-11-02-04	1.000	EA	RETAINING RING, DIN 472, 18 MM, STL FOR BORE DIA.: 18 MM MATERIAL: SPRING STEEL		
155	0155		702645-01-21	2.000	EA	O RING, SIZE AS-568-012 .364 ID X .070 W 90D /MS-1078 NITRILE PKG AND QUAL /CAMERON 702645		
156	0156		619979-03-03-08	6.000	EA	SCREW, CTK, DIN 7991, M5 X 10, SST HEX SOC COUNTERS. FLAT HD CAP SCREW MATERIAL: AISI 316 (1.4401)		
159	0159	01	223388-54-02	1.000	EA	MSDS 2" Actuator, ESS tested		
170	0170		619011-82	12.000	LI	SYNTHETIC GEAR AND HIGH TEMP. OIL		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						TYPE: KLUEBERSYNTH GH 6-32. KINEMATIC VISKOSITY: DIN 51 561, at 20°C: 88 cst, at 40°C: 32 cst AND at 100°C: 6.5 cst. DENSITY at 15°C: 984 kg/m3. FLASH POINT: > 220°C. POUR POINT: < -45°C. SERVICE TEMP. RANGE: -45°C / +160°C.		
180	0180		619084-27-01-01	1.000	ME	SHRINK TUBING, 1.5 - 0.5 mm, CLEAR SHRINK RATIO: 3:1. SHRINK RANGE: 1.5 - 0.5 mm. OPER. TEMP.: -40°C / +135°C. SHRINK TEMP.: +80°C / +120°C. MATERIAL: POLYOLEFINE.		
181	0181		619084-27-11-01	1.000	ME	SHRINK TUBING, 3.0 - 1.0 mm, CLEAR SHRINK RATIO: 3:1. SHRINK RANGE: 3.0 - 1.0 mm. OPER. TEMP.: -40°C / +135°C. SHRINK TEMP.: +80°C / +120°C. MATERIAL: POLYOLEFINE.		
182	0182		619084-27-21-01	1.000	ME	SHRINK TUBING, 6.0 - 2.0 mm, CLEAR SHRINK RATIO: 3:1. SHRINK RANGE: 6.0 - 2.0 mm. OPER. TEMP.: -40°C / +135°C. SHRINK TEMP.: +80°C / +120°C. MATERIAL: POLYOLEFINE.		
183	0183		619087-02-18-01	1.000	ME	CABLE, SPEC 55, 18 AWG, BLACK STRANDING: 19/0.25 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 1.52 mm. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
184	0184		619087-02-18-45	1.000	ME	CABLE, SPEC 55, 18 AWG, YE/GN STRANDING: 19/0.25 mm. NO. OF CONDUCTOR: 1.		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 1.52 mm. COLOUR: YELLOW / GREEN. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
185	0185		619087-02-19-01	1.000	ME	CABLE, SPEC 55, 26 AWG, BLACK STRANDING: 19/102 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 0.81 mm. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
186	0186		619087-02-19-02	1.000	ME	CABLE, SPEC 55, 26 AWG, RED STRANDING: 19/102 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 0.81 mm. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
187	0187		619087-02-19-04	1.000	ME	CABLE, SPEC 55, 26 AWG, YELLOW STRANDING: 19/102 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 0.81 mm. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
188	0188		619087-02-19-06	1.000	ME	CABLE, SPEC 55, 26 AWG, BLUE STRANDING: 19/102 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 0.81 mm. CONDUCTOR: TIN-PLATED		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
189	0189		619010-12-06	1.000	ME	SPIRAL WRAP, 6.4 MM ID, PTFE OPER. TEMP.: -60°C / +260°C MATERIAL: PTFE, NON-FLAMMABLE		
>>>B/M Category : Engrg Spec/Document item								
900	0900	03	SK-066350-24	1.000	EA	ELECTRIC SUBSEA GATE VALVE ACTUATOR 2.1/16" - 10000 PSI		
901	0901	03	SK-066350-24-04	1.000	EA	CIRCUIT DIAGRAM ELECTRIC SUBSEA ACTUATOR 2 1/16"		
905	0905	05	X-065472-96	1.000	EA	TP: 2" Electr. Valve Actuator Unit		
907	0907	08	QP-000160-01-18	1.000	EA	Main Quality Plan for DC Tree Systems		





FIXED POSITION

A = SYSTEM "A"
B = SYSTEM "B"

NOTE:
1. APPROXIMITY WEIGHT IN AIR 200 KG.
   APPROXIMITY WEIGHT IN WATER 157 KG.

KEY PLAN/LEGEND:

NOTES/HOLDS:

03

REVISION DESCRIPTIONS:

APPROVED FOR CONSTRUCTION	16MAY07	1
ISSUED FOR CLIENT COMMENT	12MAR07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-03-525

CAD	REV. BY: T. Hein	DATE: 07.03.2007	REV.: 03

TOLERANCES ACCORDING TO DIN ISO 8015	SURFACE TREATMENT	DO NOT SCALE	
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219		DRAWN: T. Hein	DATE: 19.12.2005
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K	MATERIAL AND HEAT TREATMENT	CHECKED: R. Wrede	DATE: 18.05.2007
		APPROVED: M. Lehmker	DATE: 18.05.2007
EST. WEIGHT: 200.000 KG	SUPERSEDES:	SCALE: 1:2	

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

ASSEMBLY DRAWING:
ELECTRIC SUBSEA GATE VALVE
ACTUATOR 2.1/16" - 10000 PSI

INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223350-24	1OF1	SK-066350-24

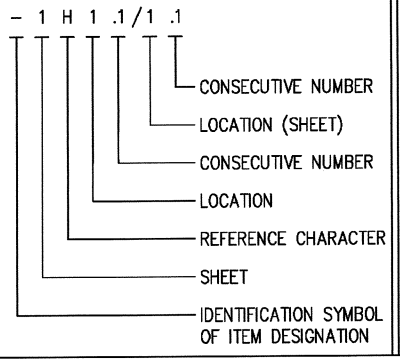
STATUS: APPROVED

SHEET	DESIGNATION
1	INDEX/ NOTES
2	WIRING DETAILS
3	CONNECTOR DETAILS

CABLE NO.	TERMINAL
———	———

TERMINAL TYPE	TERMINALS
———	———

ITEM DESIGNATION/CROSS-REFERENCES



LIST OF REFERENCE CHARACTERS (IN ACCORDANCE WITH IEC 61346-1)

A	AMPLIFIER; SPS COMPONENT
B	CONVERTER
C	CAPACITOR
E	MISCELLANEOUS
F	FUSE; MOTOR PROTECTION
H	LAMP; HORN
K	RELAY
M	MOTOR
P	MEASURING INSTRUMENT
Q	MOTOR-, POWER PROTECTION SWITCH
R	RESISTOR
S	SWITCH
T	TRANSFORMER
U	MODULATOR
V	DIODE
W	CABLES
X	TERMINAL
Y	VALVE

STANDARDS:

-ALL INSTALLATION SHALL BE IN ACCORDANCE WITH VDE 0100.
-ALL ELECTRIC SYMBOLS SHALL BE IN ACCORDANCE WITH IEC 617.

NOTES:

-SIGNAL LINES TO BE TWISTED
-POWER LINES TO BE TWISTED

REMARKS:

-X1 TERMINALS
LINE OF DEMARCATION
SCREEN/ARMOUR
SCREEN/ARMOUR INSULATED
FOR INFORMATION

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	T. Hein	14.05.2007	J. Dannehl	15.05.2007
01	T. Hein	20.11.2006	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

Supersedes

CAMERON
CAMERON GmbH
Lückenweg 1
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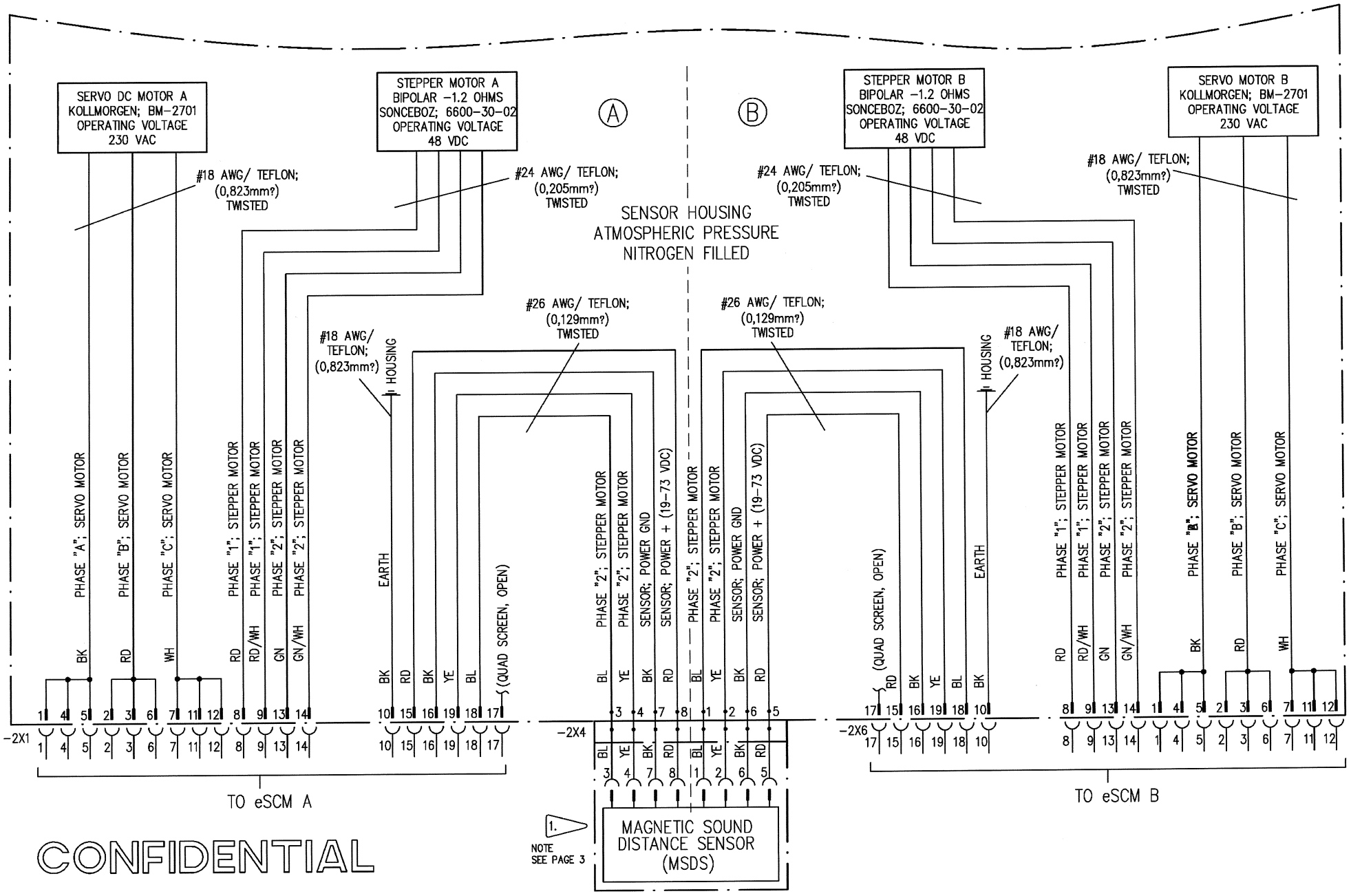
Title
CIRCUIT DIAGRAM
ELECTRIC SUBSEA ACTUATOR 2.1/16"

DWG. NO. SK-066350-24-04
B.O.M. NO. 223350-24
SHEET 1 of 3

= TOTAL-K5F
+ ACTUATOR

STATUS: APPROVED



CONFIDENTIAL

Revision	Author	Date	Approver	Appr. Date
03	T. Hein	14.05.2007	J. Dannehl	15.05.2007
01	T. Hein	22.11.2006	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Supersedes

Title
CIRCUIT DIAGRAM
ELECTRIC SUBSEA ACTUATOR 2.1/16"

DWG. NO.
SK-066350-24-04

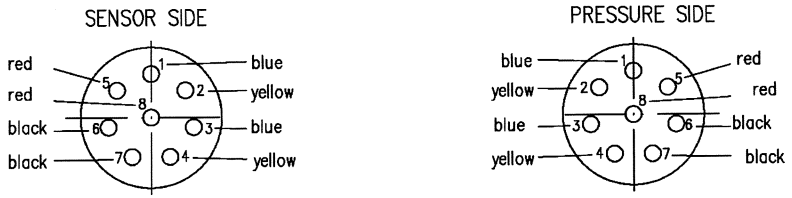
B.O.M. NO.
223350-24

= TOTAL-K5F
+ ACTUATOR

SHEET
2 of 3

STATUS: APPROVED

SENSOR PENETRATOR (8-PIN)

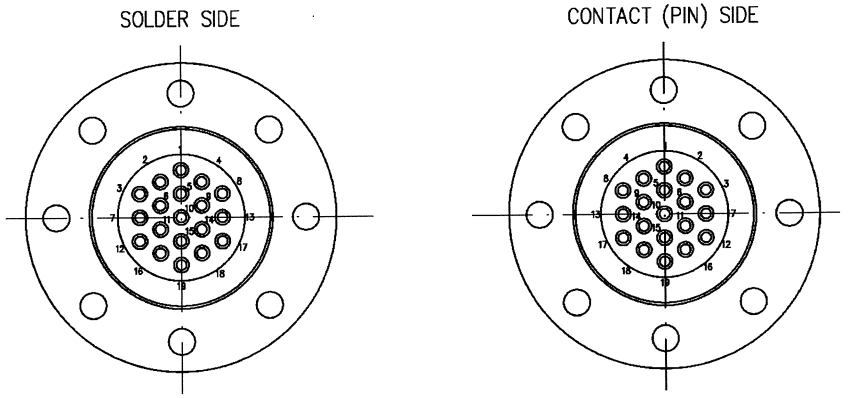


NOTE:

1. VIEW FROM CABLE SITE

A			B
8 RED (RD) +48V S1	7 BLACK (BK) GND S1	6 BLACK (BK) GND S2	5 RED (RD) +48V S2
4 YELLOW (YE) CAN H1 RS485 A1	3 BLUE (BL) CAN L1 RS485 B1	2 YELLOW (YE) CAN H2 RS485 A2	1 BLUE (BL) CAN L2 RS485 B2

GISMA CONNECTOR BR10/4/19



CONFIDENTIAL

Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	T. Hein	14.05.2007	J. Dannehl	15.05.2007
01	T. Hein	30.11.2006	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Supersedes

Title: CIRCUIT DIAGRAM ELECTRIC SUBSEA ACTUATOR 2.1/16"

DWG. NO. SK-066350-24-04

B.O.M. NO. 223350-24

= TOTAL-K5F
+ ACTUATOR

SHEET 3 of 3

STATUS: APPROVED

STATUS: Released REVISION : 04
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : DC ACTUATOR 5.1/8"

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
001	0001	01	222255-79	1.000	EA	LOWER HOUSING, 5.1/8" ACTUATOR		
002	0002	02	222255-82	1.000	EA	BODY FOR DAMPER, 5.1/8" ACTUATOR		
003	0003	01	222261-40	1.000	EA	END CAP, 5.1/8" ACTUATOR		
004	0004	01	222270-09	1.000	EA	LOCKRING 15.5"-6 TPI, 5.1/8" ACTUATOR		
005	0005	01	222221-07	1.000	EA	BEARING CARRIER, 5.1/8" ACTUATOR		
006	0006	02	222216-02	1.000	EA	HOLLOW SHAFT, 5.1/8" ACTUATOR		
007	0007	02	222296-01-04	1.000	EA	LOAD FLANGE, 5.1/8" ACTUATOR		
008	0008	01	222226-31	1.000	EA	ACTUATING SLEEVE, 5.1/8" ACTUATOR		
009	0009	02	222226-30	1.000	EA	GUIDE SLEEVE, 5.1/8" ACTUATOR		
010	0010	01	222292-02	1.000	EA	SPROCKET, INTERNAL, M=1, Z=268, 5.1/8"		
011	0011	02	222255-81	1.000	EA	HOUSING FOR MOTOR, 5.1/8" ACTUATOR		
012	0012	01	222261-41	1.000	EA	END CAP FOR MOTOR HOUSING, 5.1/8"		
013	0013	01	222211-55	1.000	EA	DRIVE SHAFT, 5.1/8" ACTUATOR		
014	0014	01	222221-05	1.000	EA	LOWER CARRIER FOR THRUST BEARING, 5.1/8"		
015	0015	01	222221-06	1.000	EA	UPPER CARRIER FOR THRUST BEARING, 5.1/8"		
016	0016	02	222273-12	1.000	EA	THRUST PLATE, 5.1/8" ACTUATOR		
017	0017	03	222288-56	1.000	EA	STEM OD 70 MM, 5.1/8" ACTUATOR		
018	0018	01	222267-32	2.000	EA	SPLIT RETAINING RING, 5.1/8" ACTUATOR		
019	0019	01	222201-21	5.000	EA	STOP PIN, 5.1/8" ACTUATOR		
020	0020	02	222255-94	1.000	EA	UPPER HOUSING, 5.1/8" ACTUATOR		
021	0021	02	222261-43	1.000	EA	END CAP FOR DAMPER, 5.1/8" ACTUATOR		
022	0022	01	222700-34	1.000	EA	WRAP SPRING ID 168 MM, 5.1/8" ACTUATOR		
023	0023	01	222700-35	1.000	EA	WRAP SPRING ID 266 MM, 5.1/8" ACTUATOR		
024	0024	01	222274-69	1.000	EA	DISTANCE SLEEVE ID 124X54 MM, 5.1/8"		
025	0025	01	222244-60	2.000	EA	SOCKET, 5.1/8" ACTUATOR		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
026	0026	01	222296-01-05	1.000	EA	COLLET F.HARMONIC DRIVE GEAR BOX, 5.1/8"		
027	0027	01	222450-25	2.000	EA	BRACKET FOR STEPPER MOTOR, 5.1/8"		
028	0028	01	222543-03	2.000	EA	PARALLEL KEY 20X12X50, 5.1/8" ACTUATOR		
029	0029	03	222229-14	1.000	EA	PISTON FOR DAMPER, 5.1/8" ACTUATOR		
030	0030	01	222211-57	1.000	EA	COUPLING ROD FAIL SAFE CL. DEV., 5.1/8"		
031	0031	01	222211-56	2.000	EA	COUPLING DUAL REDUNDANT, 5.1/8" ACTUATOR		
032	0032	01	222255-80	2.000	EA	HOLDER FOR DRIVING SPRING, 5.1/8"		
033	0033	02	222244-61	2.000	EA	BUSHING F. GUIDE ROLLER, 5.1/8" ACTUATOR		
034	0034	01	222261-42	2.000	EA	CAP FOR COMPENSATOR, 5.1/8" ACTUATOR		
035	0035	01	222261-36	1.000	EA	CAP FOR POSITION SENSOR,2.1/16" & 5.1/8"		
036	0036	01	222700-36	1.000	EA	REWINDER SPRING OD 69.5 MM, 5.1/8"		
037	0037	01	222273-11	2.000	EA	DISTANCE DISC, 5.1/8" ACTUATOR		
038	0038	01	222273-10	2.000	EA	DISTANCE PIECE, 5.1/8" ACTUATOR		
039	0039	01	222211-58	2.000	EA	PINION SHAFT FAIL SAFE CL. DEV., 5.1/8"		
040	0040	01	222267-42	1.000	EA	DISTANCE RING, 5.1/8" ACTUATOR		
041	0041	01	222274-71	1.000	EA	DISTANCE SLEEVE ID 200.2X12.5 MM, 5.1/8"		
042	0042	01	222274-70	1.000	EA	DISTANCE SLEEVE ID 240.2X65 MM, 5.1/8"		
043	0043	01	222267-33	1.000	EA	MOUNTING RING FOR DAMPER, 5.1/8"		
051	0051		619040-01-74	2.000	EA	BRUSHLESS MOTOR, BM-3221-A ACCORDING TO DRAWING NO. 124587 MOTOR SUPPLIED AS TWO SEPARATE COMPONENTS, ARMATURE ASSEMBLY AND FIELD ASSEMBLY. MOTOR LEADS: #14 AWG, TEFLON COATED, PER MIL-W-22759/11, 3 LEADS (BLACK, RED, WHITE) 24" (610 mm) min. LONG EACH.		
052	0052	01	222311-03	1.000	EA	GEAR BOX, 5.1/8" ACTUATOR HFUC-65-160-2A-GR-SP		
053	0053	01	222288-57	1.000	EA	SPINDLE 75X10-160, 5.1/8"		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						ACTUATOR		
054	0054	02	2197040-18-03	2.000	EA	Special Stepper Motor 6630-37 with Teflon Supply Wires and Shaft ar both Sides. Not painted		
055	0055	06	223361-33	1.000	EA	SENSOR HOUSING, 5.1/8" ACTUATOR		
056	0056		619012-02-88	2.000	EA	COMPENSATOR BLADDER, 2.5 L, NITRILE CONN.: M22X1.5 MALE X G 1/4" FEM. VOLUME: 2.5 LITRE GAS VALVE MATERIAL: AISI 316 BLADDER MATERIAL: NITRILE WITH GROOVE FOR O-RING SIZE 2-115.		
057	0057	A02	2197006-04	1.000	EA	VALVE,CHECK 275 BAR,D=4,75MM,SST BORE DIA.DMR.4.75MM CRACKING PRESS.:5+/-3PSI CHECK VALVE, FREE FLOW FORWARD WORK.PRESS.:4000 PSI / 275 BAR LOHMRATE AT 15PSI D:MAX 100 LOHMS		
058	0058	A02	2197006-03	1.000	EA	VALVE,CHECK 275 BAR,D=4,75MM,SST BORE DIA.DMR.4.75MM CRACKING PRESS.:5+/-3PSI CHECK VALVE,FREE FLOW REVERSE WORK.PRESS.:4000 PSI / 275 BAR LOHMRATE AT 15PSI D:MAX 100 LOHMS		
059	0059		619010-06-70	2.000	EA	CONE CLAMPING, SELF CENTERING FOR SHAFT DIA.: 36 mm BORING: 45 mm		
060	0060		619010-06-51-02	2.000	EA	TRACK ROLLER, KRV 35, 35 X 52 mm OD X W: 35 X 52 mm THREAD: M16X1.5 MALE DYN. RADIAL LOAD: MAX. 14.6 KN LIMITING SPEED: 2600 RPM WITHOUT SEAL RINGS AND ECCENTRIC.		
061	0061	03	2197088-17-06	2.000	EA	SS Bulkhead Conn. Series		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						10/4, 19-pin, m Subsea Bulkhead Connector Series 10/4, special type (LV439), 19-pin male contacts, wet mateable		
062	0062	02	222209-05	3.000	EA	PLUG 7/16"-20 UNF FOR VALVE ELECTRONIC MODULE		
063	0063		2707184-01	2.000	EA	PLUG, HEXAGON SOCKET, 7/16"-20-UNF, SST SAE 090109B; INC.O-RING (ISO 11926)		
064	0064		2707183-01	4.000	EA	PLUG, HEXAGON SOCKET, 3/4"-16UNF,SST SAE 090109B; INCL.O-RING(ISO 11926)		
065	0065		619010-06-60-06	1.000	EA	DEEP GROOVE BALL BEARING SINGLE ROW DESIGNATION: 6206 ID X OD X W: 30 x 62 x 16 mm DYN. LOAD RATING: 20.3 KN LIMITING SPEED: 15000 RPM		
066	0066		619010-06-60-05	4.000	EA	DEEP GROOVE BALL BEARING SINGLE ROW DESIGNATION: 6201 ID X OD X W: 12 x 32 x 10 mm DYN. LOAD RATING: 7.28 KN LIMITING SPEED: 32000 RPM		
067	0067		619010-06-60-11	2.000	EA	DEEP GROOVE BALL BEARING SINGLE ROW DESIGNATION: 61848 ID X OD X W: 240 x 300 x 28 mm DYN. LOAD RATING: 108 KN LIMITING SPEED: 2600 RPM		
068	0068		619010-06-60-09	2.000	EA	DEEP GROOVE BALL BEARING SINGLE ROW DESIGNATION: 61840 ID X OD X W: 200 x 250 x 24 mm DYN. LOAD RATING: 76.1 KN LIMITING SPEED: 3200 RPM		
069	0069		619010-06-60-10	1.000	EA	DEEP GROOVE BALL BEARING SINGLE ROW DESIGNATION: 61844 ID X OD X W: 220 x 270 x 24 mm DYN. LOAD RATING: 78 KN LIMITING SPEED: 2800 RPM		
070	0070		619010-06-67-01	1.000	EA	NEEDLE ROLLER BEARING		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						WITH FLANGE, WITHOUT INNER RING DESIGNATION: NK30/30TN ID X OD X W: 30 X 40 X 30 mm DYN. LOAD RATING: 39.1 KN LIMITING SPEED: 15000 RPM		
071	0071		619010-06-63-06	1.000	EA	CYLINDRICAL ROLLER THRUST BEARING DESIGNATION: 81236M ID X OD X W: 180 x 250 x 56 mm DYN. LOAD RATING: 550 KN LIMITING SPEED: 1100 RPM SOLID CAGE IN BRASS		
072	0072		619010-06-63-05	1.000	EA	CYLINDRICAL ROLLER THRUST BEARING DESIGNATION: 87415M ID X OD X W: 75 x 160 x 38 mm DYN. LOAD RATING: KN LIMITING SPEED: RPM SOLID CAGE IN BRASS	Use the washer "GS".	
074	0074		619010-06-65-02	1.000	EA	NEEDLE ROLLER THRUST BEARING DESIGNATION: AXK120155 ID X OD X W: 120 X 155 X 4 mm DYN. LOAD RATING: 86.5 KN LIMITING SPEED: 2600 RPM		
075	0075		619010-06-66-02	1.000	EA	THRUST WASHER DESIGNATION: AS120155 ID X OD X W: 120 X 155 X 1 mm		
077	0077		619010-06-68-01	1.000	EA	NEEDLE ROLLER BEARING WITH FLANGE AND INNER RING DESIGNATION: NA4922 ID X OD X W: 110 x 150 x 40 mm DYN. LOAD RATING: 130 KN LIMITING SPEED: 3600 RPM		
078	0078		619010-06-62	1.000	EA	SELF-ALIGNING BALL BEARING CYLINDRICAL AND TAPERED BORE DESIGNATION: 1201ETN9 ID X OD X W: 12 X 32 X 10 mm DYN. LOAD RATING: 6.24 KN LIMITING SPEED: 32000 RPM		
079	0079		2707183-01	2.000	EA	PLUG, HEXAGON SOCKET, 3/4"-16UNF,SST SAE 090109B; INCL.O-RING(ISO 11926)		
080	0080		619915-12-00-06	1.000	EA	RETAINING RING, DIN 471, 30 MM, STL		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						FOR SHAFT DIA.: 30 MM MATERIAL: SPRING STEEL		
081	0081		619953-39-06-04	1.000	EA	RETAINING RING, DIN 472, 62 MM, STL FOR BORE DIA.: 62 MM MATERIAL: SPRING STEEL		
082	0082		619915-13-00-06	1.000	EA	RETAINING RING, DIN 471, 32 MM, STL FOR SHAFT DIA.: 32 MM MATERIAL: SPRING STEEL		
083	0083		619010-06-59-07	1.000	EA	RETAINING RING, TYPE SW 110, STL FOR SHAFT DIA.: 110 mm RING THICKNESS: 2.5 mm MATERIAL: SPRING STEEL		
084	0084		619010-06-58-08	1.000	EA	RETAINING RING, TYPE SB 150, STL FOR BORE DIA.: 150 mm RING THICKNESS: 2.5 mm MATERIAL: SPRING STEEL		
085	0085		619010-06-58-09	1.000	EA	RETAINING RING, TYPE SB 250, STL FOR BORE DIA.: 250 mm RING THICKNESS: 3.0 mm MATERIAL: SPRING STEEL		
086	0086		619010-06-59-08	1.000	EA	RETAINING RING, TYPE SW 200, STL FOR SHAFT DIA.: 200 mm RING THICKNESS: 3.0 mm MATERIAL: SPRING STEEL		
087	0087		619010-06-59-09	1.000	EA	RETAINING RING, TYPE SW 240, STL FOR SHAFT DIA.: 240 mm RING THICKNESS: 3.0 mm MATERIAL: SPRING STEEL		
088	0088		619915-02-00-06	2.000	EA	RETAINING RING, DIN 471, 12 MM, STL FOR SHAFT DIA.: 12 MM MATERIAL: SPRING STEEL		
089	0089		619953-22-03-04	4.000	EA	RETAINING RING, DIN 472, 32 MM, STL FOR BORE DIA.: 32 MM MATERIAL: SPRING STEEL		
090	0090		619010-06-58-06	1.000	EA	RETAINING RING, TYPE SB 70, STL FOR BORE DIA.: 70 mm RING THICKNESS: 1.5 mm MATERIAL: SPRING STEEL		
091	0091		619010-06-55-02	1.000	EA	LOCK NUT, PRECISION, M50X1.5, STL TYPE: PRECISKO, DRS 50X1.5		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						WITH RADIAL SET SCREW MATERIAL: STEEL BRONZED		
094	0094		619987-11-10-01	2.000	EA	COILED SPRING PIN (SPIRAL PIN) OD X L: 8 X 20 mm MATERIAL: SPRING STEEL		
095	0095		619989-05-08-01	5.000	EA	PIN, GROOVED, ISO 8742, 4 X 16, STL THIRD LENGTH CENTRE GROOVED DIA.: 4 X 16 MM LG. MATERIAL: STEEL		
096	0096		619917-13-22-01	2.000	EA	PAR. PIN, DIN 7, DIA. 12 X 70, STL MATERIAL: STEEL		
097	0097		619917-07-14-01	1.000	EA	PAR. PIN, DIN 7, DIA. 3 X 28, STL MATERIAL: STEEL		
098	0098		619914-07-13-01	1.000	EA	PAR. KEY, DIN 6885, A10 X 8 X 36 TYPE A: ROUND HEAD ; MAT.: STEEL		
100	0100	01	2197088-17-09	1.000	EA	Penetrator Greene Tweed 8 pin for Position Indicator Housing		
101	0101		702645-37-51	1.000	EA	O RING, SIZE AS-568-375 9.475 ID X .210 W 90D /MS-1078 NITRILE PKG AND QUAL /CIW 702645		
102	0102		702645-38-31	3.000	EA	O RING, SIZE AS-568-383 13.975 ID X .210 W 90D /MS-1078 NITRILE PKG AND QUAL /CIW 702645		
103	0103		702645-15-41	4.000	EA	O RING, SIZE AS-568-154 3.737 ID X .103 W 90D /MS-001078 NITRILE PKG AND QUAL /COT 702645		
105	0105		702645-15-11	6.000	EA	O RING, SIZE AS-568-151 2.987 ID X .103 W 90D /MS-1078 NITRILE PKG AND QUAL /CAM 702645		
106	0106		619027-03-44	2.000	EA	TURCON GLYD RING, 800 BAR, ID 70 MM INCL. O-RING ; ROD DIA.: 70 MM WORK. PRESS.: MAX. 800 BAR MATERIAL: TURCON T46 ; O-RING: NBR		
107	0107		619027-04-01	4.000	EA	WEAR RING FOR ROD DIA. 70 mm WITH ANGLE CUT		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						GROOVE DIA. X WIDTH: 75 X 9.7 mm SPEED: MAX. 15 m/s TEMP.: -60°C / +200°C MATERIAL: TURCITE T47		
108	0108		702645-38-01	1.000	EA	O RING, SIZE AS-568-380 11.475 ID X .210 W 90D /MS-1078 NITRILE PKG AND QUAL /CIW 702645		
109	0109		619903-10-18-09	2.000	EA	SCREW, SOC, DIN 912, M10 X 55, STL MATERIAL: 8.8 EL. ZINC-PLATED		
110	0110		619901-11-12-09	12.000	EA	SCREW, HEX, DIN 933, M6 X 16, SST MATERIAL: AISI 316 (1.4401)		
111	0111		619925-11-09-11	12.000	EA	SCREW, HEX, DIN 931, M6 X 30, SST MATERIAL: AISI 316 (1.4401)		
112	0112		619925-11-21-11	6.000	EA	SCREW, HEX, DIN 931, M6 X 90, SST MATERIAL: AISI 316 (1.4401)		
113	0113		619903-07-09-04	12.000	EA	SCREW, SOC, DIN 912, M5 X 12, SST MATERIAL: AISI 304 (1.4301)		
114	0114		619903-08-11-09	6.000	EA	SCREW, SOC, DIN 912, M6 X 20, STL MATERIAL: 8.8 EL. ZINC-PLATED		
115	0115		619903-10-19-03	10.000	EA	SCREW, SOC, DIN 912, M10 X 60, STL MATERIAL: STEEL 12.9		
116	0116		619903-13-16-03	8.000	EA	SCREW, SOC, DIN 912, M16 X 45, STL MATERIAL: STEEL 12.9		
117	0117		619903-07-09-09	8.000	EA	SCREW, SOC, DIN 912, M5 X 12, STL MATERIAL: 8.8 EL. ZINC-PLATED		
118	0118		619903-08-18-09	6.000	EA	SCREW, SOC, DIN 912, M6 X 55, STL MATERIAL: 8.8 EL. ZINC PLATED		
119	0119		619901-11-16-07	14.000	EA	SCREW, HEX, DIN 933, M6 X 25, STL MATERIAL: 8.8 EL. ZINC-PLATED		
120	0120		619903-11-11-09	1.000	EA	SCREW, SOC, DIN 912, M12 X 20, STL MATERIAL: 8.8 EL. ZINC-PLATED		

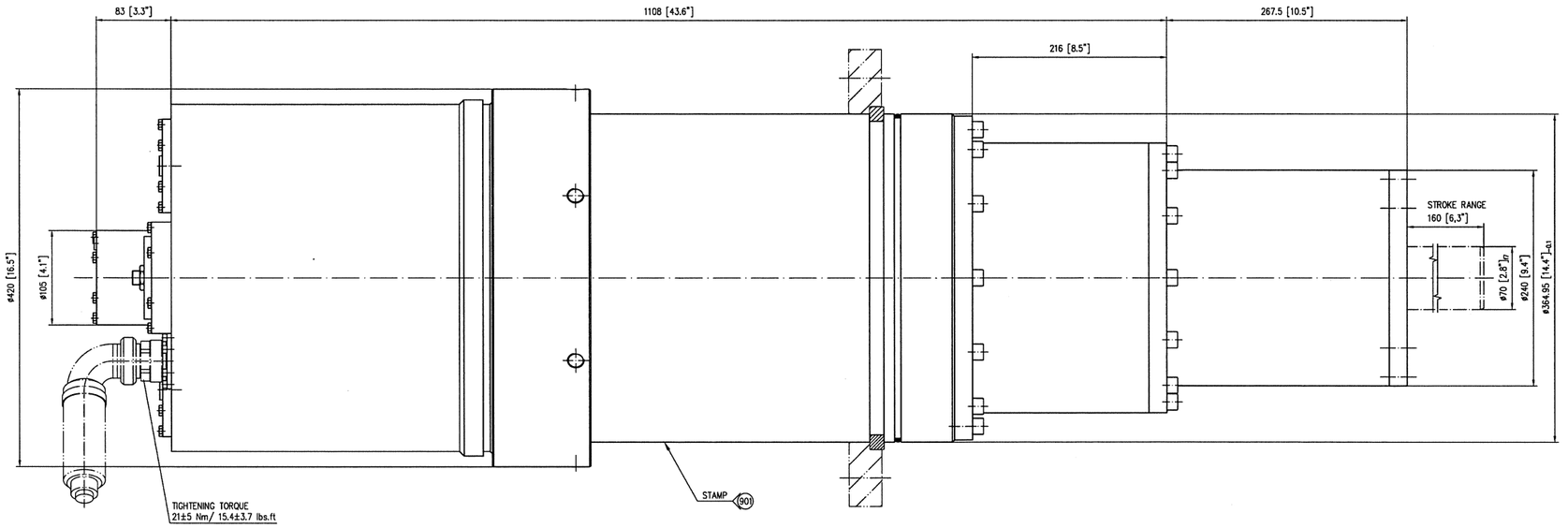
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
121	0121		619903-11-17-02	12.000	EA	SCREW, SOC, DIN 912, M12 X 50, STL MATERIAL: STEEL 10.9		
122	0122		619903-11-14-09	24.000	EA	SCREW, SOC, DIN 912, M12 X 35, STL MATERIAL: 8.8 EL. ZINC-PLATED		
123	0123		619923-09-08-01	4.000	EA	SCREW, SET, DIN 916, M6 X 8, STL MATERIAL: 45 H (HARDNESS CLASS)		
124	0124		619903-09-10-29	1.000	EA	SCREW, SOC, DIN 912, M8 X 18, STL MATERIAL: 8.8 EL. ZINC-PLATED		
125	0125		619903-07-07-09	1.000	EA	SCREW, SOC, DIN 912, M5 X 8, STL MATERIAL: 8.8 EL. ZINC-PLATED		
126	0126		702515-29-20-10	6.000	EA	SCREW, SOC HD SET .750-10 X .625 SST STL CUP POINT ANSI B18.3		
127	0127		619903-10-20-09	12.000	EA	SCREW, SOC, DIN 912, M10 X 65, STL MATERIAL: 8.8 EL. ZINC-PLATED		
128	0128		619919-13-02-07	1.000	EA	WASHER, MEDIUM, DIN 125, B 8.4, STL TYPE B: WITH CHAMFER ; ID: 8.4 mm MAT.: STEEL 140 HV GALV. ZINC-PLAT.		
129	0129		619936-05-06-02	1.000	EA	WASHER, DIN 9021, 5.3 X 15 X 1.2 TYPE: B MATERIAL: STEEL EL. ZINC-PLATED		
130	0130		619910-16-08	5.000	EA	NUT, HEX, DIN 934, M8, STL MATERIAL: 8 EL. ZINC-PLATED		
131	0131		619919-14-02-07	10.000	EA	WASHER, MEDIUM, DIN 125, B 10.5,STL TYPE B: WITH CHAMFER ; ID: 10.5 mm MAT.: STEEL 140 HV GALV. ZINC-PLAT.		
132	0132		619027-02-78	3.000	EA	O-RING, SIZE-0.351" ID X 0.072" W THICKNESS: 0.072" MATARIAL: NBR HARDNESS: 90 SHORE		

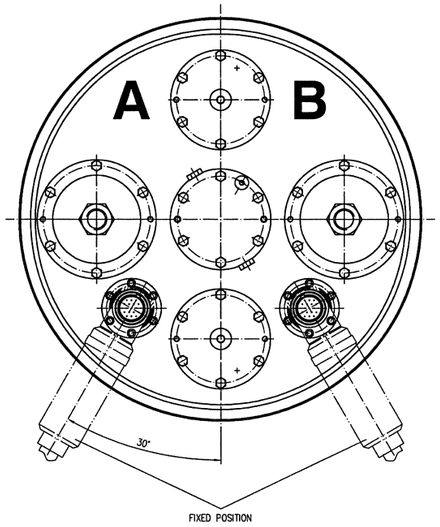
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
133	0133		702645-00-91	3.000	EA	O RING, SIZE AS-568-009 .208 ID X .070 W 90D /MS-1078 NITRILE PKG AND QUAL /CIW 702645		
134	0134		702645-36-71	1.000	EA	O RING, SIZE AS-568-367 7.475 ID X .210 W 90D /MS-1078 NITRILE PKG AND QUAL /COT 702645		
135	0135		702645-21-81	1.000	EA	O RING, SIZE AS-568-218 1.234 ID X .139 W 90D /MS-1078 NITRILE PKG AND QUAL /CIW 702645		
136	0136		619027-04-03	1.000	EA	TURCON GLYD RING, 800 BAR, OD 200 mm INCL. O-RING in NBR FOR BORE DIA.: 200 mm NOM. PRESS.: MAX. 800 BAR MATERIAL: TURCON T46		
137	0137		619006-01-53	2.000	EA	VALVE, THROTTLE CHECK ,1/4", 700 BAR CONN.: G 1/4" MALE ; W/O. HOUSING WORK. PRESS.: MAX. 700 BAR CRACK. PRESS.: 0.05...0.07 BAR HOLE DIA.: 1.0 mm MEDIUM: MINERAL OIL TEMP.: -40°C / +80°C FLOW RATE: 20 L/MIN ; MAT.: STEEL		
138	0138		619903-10-15-09	8.000	EA	SCREW, SOC, DIN 912, M10 X 40, STL MATERIAL: 8.8 EL. ZINC-PLATED		
139	0139		619923-09-10-02	1.000	EA	SCREW, SET, DIN 916, M6 X 12, SST HEX SOCKET SET SCREW WITH CUP POINT MATERIAL: AISI 316 (1.4401)		
140	0140		619014-14-78	1.000	EA	PLUG, METRIC LEE, SHORT, 3 MM, SST BORE DIA.: 3 MM PROOF PRESS: CLASS 1 (H10) 980 BAR CLASS 2 (H9) 1130 BAR AND CLASS 3 (H7) 1370 BAR MATERIAL: SST		
150	0150	01	222226-36	1.000	EA	SLEEVE FOR SENSOR DC ACTUATOR		
151	0151	01	222244-67	1.000	EA	DISTANCE BUSHING OD 15 FOR SENSOR,		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						DC ACTUATOR		
152	0152	01	222244-68	1.000	EA	DISTANCE BUSHING OD 18 FOR SENSOR, DC ACTUATOR		
153	0153		619010-06-57	2.000	EA	MAGNET RING , AXIAL MAGNETIZED OD X ID X H: 15 X 6 X 6 mm SURFACE: GALV. TIN PLATED MAGNET MATERIAL ACC. TO CODE 262/135.		
154	0154		619953-11-02-04	1.000	EA	RETAINING RING, DIN 472, 18 MM, STL FOR BORE DIA.: 18 MM MATERIAL: SPRING STEEL		
155	0155		702645-01-21	2.000	EA	O RING, SIZE AS-568-012 .364 ID X .070 W 90D /MS-1078 NITRILE PKG AND QUAL /CAMERON 702645		
156	0156		619979-03-03-08	6.000	EA	SCREW, CTK, DIN 7991, M5 X 10, SST HEX SOC COUNTERS. FLAT HD CAP SCREW MATERIAL: AISI 316 (1.4401)		
159	0159	01	223388-54-03	1.000	EA	MSDS 5" Actuator, ESS tested		
170	0170		619011-82	50.000	LI	SYNTHETIC GEAR AND HIGH TEMP. OIL TYPE: KLUEBERSYNTH GH 6-32. KINEMATIC VISKOSITY: DIN 51 561, at 20°C: 88 cst, at 40°C: 32 cst AND at 100°C: 6.5 cst. DENSITY at 15°C: 984 kg/m3. FLASH POINT: > 220°C. POUR POINT: < -45°C. SERVICE TEMP. RANGE: -45°C / +160°C.		
180	0180		619084-27-01-01	1.000	ME	SHRINK TUBING, 1.5 - 0.5 mm, CLEAR SHRINK RATIO: 3:1. SHRINK RANGE: 1.5 - 0.5 mm. OPER. TEMP.: -40°C / +135°C. SHRINK TEMP.: +80°C / +120°C. MATERIAL: POLYOLEFINE.		
181	0181		619084-27-11-01	1.000	ME	SHRINK TUBING, 3.0 - 1.0 mm, CLEAR SHRINK RATIO: 3:1. SHRINK RANGE: 3.0 - 1.0 mm. OPER. TEMP.: -40°C / +135°C. SHRINK TEMP.: +80°C /		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						+120°C. MATERIAL: POLYOLEFINE.		
182	0182		619084-27-21-01	1.000	ME	SHRINK TUBING, 6.0 - 2.0 mm, CLEAR SHRINK RATIO: 3:1. SHRINK RANGE: 6.0 - 2.0 mm. OPER. TEMP.: -40°C / +135°C. SHRINK TEMP.: +80°C / +120°C. MATERIAL: POLYOLEFINE.		
183	0183		619087-02-18-01	1.000	ME	CABLE, SPEC 55, 18 AWG, BLACK STRANDING: 19/0.25 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 1.52 mm. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
184	0184		619087-02-18-45	1.000	ME	CABLE, SPEC 55, 18 AWG, YE/GN STRANDING: 19/0.25 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 1.52 mm. COLOUR: YELLOW / GREEN. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
185	0185		619087-02-19-01	1.000	ME	CABLE, SPEC 55, 26 AWG, BLACK STRANDING: 19/102 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 0.81 mm. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
186	0186		619087-02-19-02	1.000	ME	CABLE, SPEC 55, 26 AWG, RED STRANDING: 19/102 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V.		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						TEMP.: -60°C / +200°C. AD: 0.81 mm. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
187	0187		619087-02-19-04	1.000	ME	CABLE, SPEC 55, 26 AWG, YELLOW STRANDING: 19/102 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 0.81 mm. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
188	0188		619087-02-19-06	1.000	ME	CABLE, SPEC 55, 26 AWG, BLUE STRANDING: 19/102 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 0.81 mm. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
189	0189		619010-12-06	1.000	ME	SPIRAL WRAP, 6.4 MM ID, PTFE OPER. TEMP.: -60°C / +260°C MATERIAL: PTFE, NON-FLAMMABLE		
>>>B/M Category : Engrg Spec/Document item								
900	0900	03	SK-066350-26	1.000	EA	ELECTRIC SUBSEA ACTUATOR, 5.1/8" - 10000 PSI REDUNDANT		
901	0901	03	SK-066350-26-04	1.000	EA	CIRCUIT DIAGRAM ELECTRIC SUBSEA ACTUATOR 5 1/8"		
905	0905	04	X-065472-95	1.000	EA	TP: 5" Electr. Valve Actuator Unit		
907	0907	08	QP-000160-01-18	1.000	EA	Main Quality Plan for DC Tree Systems		





03

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

APPROVED FOR CONSTRUCTION	16MAY07	1
ISSUED FOR CLIENT COMMENT	12MAR07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production
Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-03-524

CAD	REV. BY: T. Hein	DATE: 07.03.2007	REV: 03

A = SYSTEM "A"
B = SYSTEM "B"

NOTE:
1. APPROXIMITY WEIGHT IN AIR 660 KG.
   APPROXIMITY WEIGHT IN WATER 530 KG.

TOLERANCES ACCORDING TO DIN ISO 8015	SURFACE TREATMENT: DO NOT SCALE	DRAWN: T. Hein	DATE: 01.02.2006
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	MATERIAL AND HEAT TREATMENT: -	CHECKED: R. Wrede	DATE: 18.05.2007
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K		APPROVED: M. Lehmker	DATE: 18.05.2007
EST. WEIGHT: 660.000 KG	SUPERSEDES: -	SCALE: 1:2	

CAMERON
CAMERON GmbH
Lückerweg 1
29227 Celle, Germany

ASSEMBLY DRAWING:
ELECTRIC SUBSEA ACTUATOR
5.1/8" – 10000 PSI, REDUNDANT

INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223350-26	1 OF 1	SK-066350-26

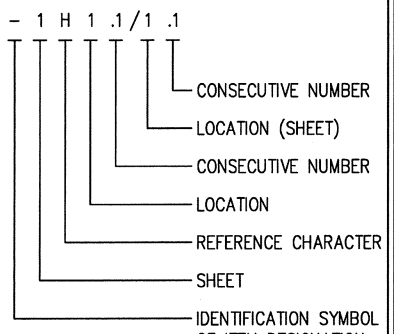
STATUS: APPROVED

SHEET	DESIGNATION
1	INDEX/ NOTES
2	WIRING DETAILS
3	CONNECTOR DETAILS

CABLE NO.	TERMINAL
———	———

TERMINAL TYPE	TERMINALS
———	———

ITEM DESIGNATION/CROSS-REFERENCES



LIST OF REFERENCE CHARACTERS (IN ACCORDANCE WITH IEC 61346-1)

- A → AMPLIFIER; SPS COMPONENT
- B → CONVERTER
- C → CAPACITOR
- E → MISCELLANEOUS
- F → FUSE; MOTOR PROTECTION
- H → LAMP; HORN
- K → RELAY
- M → MOTOR
- P → MEASURING INSTRUMENT
- Q → MOTOR-, POWER PROTECTION SWITCH
- R → RESISTOR
- S → SWITCH
- T → TRANSFORMER
- U → MODULATOR
- V → DIODE
- W → CABLES
- X → TERMINAL
- Y → VALVE

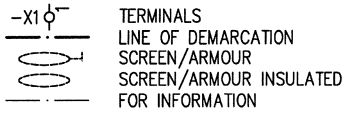
STANDARDS:

-ALL INSTALLATION SHALL BE IN ACCORDANCE WITH VDE 0100.
-ALL ELECTRIC SYMBOLS SHALL BE IN ACCORDANCE WITH IEC 617.

NOTES:

-SIGNAL LINES TO BE TWISTED
-POWER LINES TO BE TWISTED

REMARKS:



Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
03	T. Hein	14.05.2007	J. Dannehl	15.05.2007
01	T. Hein	20.11.2006	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

Supersedes

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Title

CIRCUIT DIAGRAM
ELECTRIC SUBSEA ACTUATOR 5.1/8"

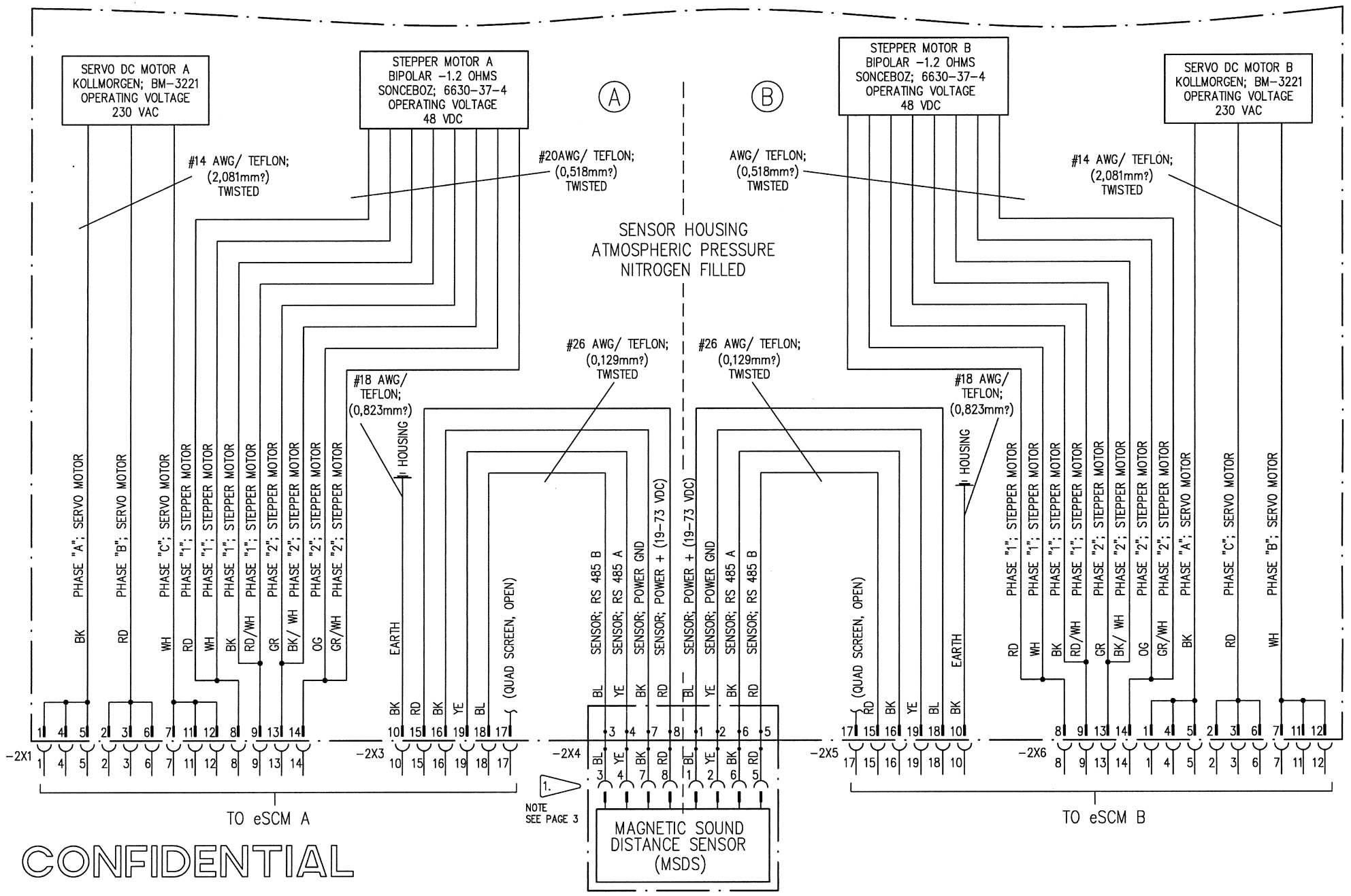
DWG. NO. SK-066350-26-04

B.O.M. NO. 223350-26

= TOTAL-K5F
+ ACTUATOR

SHEET 1 of 3

STATUS: APPROVED



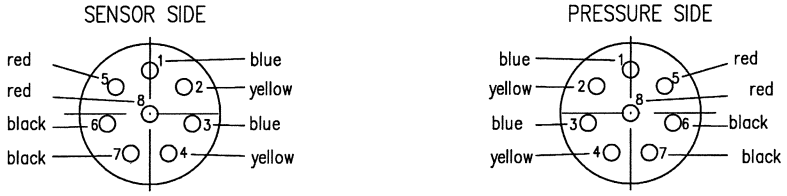
CONFIDENTIAL

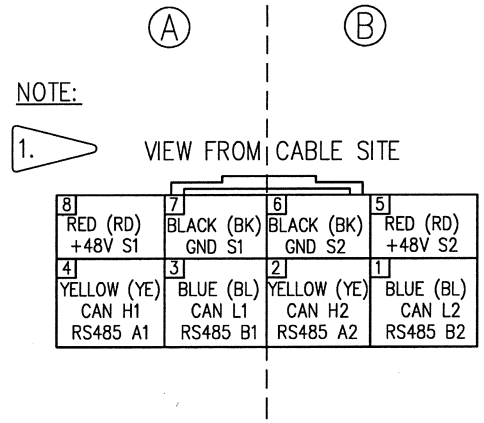
03	T. Hein	14.05.2007	J. Dannehl	15.05.2007	CAMERON	CAMERON GmbH Lückenweg 1 29227 Celle, Germany	Title: CIRCUIT DIAGRAM ELECTRIC SUBSEA ACTUATOR 5.1/8"
Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date			DWG. NO. SK-066350-26-04
01	T. Hein	22.11.2006	Initial Release				B.O.M. NO. 223350-26
Initial Rev.	Initial Author	Initial Date	Remark		Supersedes		SHEET 2 of 3

= TOTAL-K5F
+ ACTUATOR

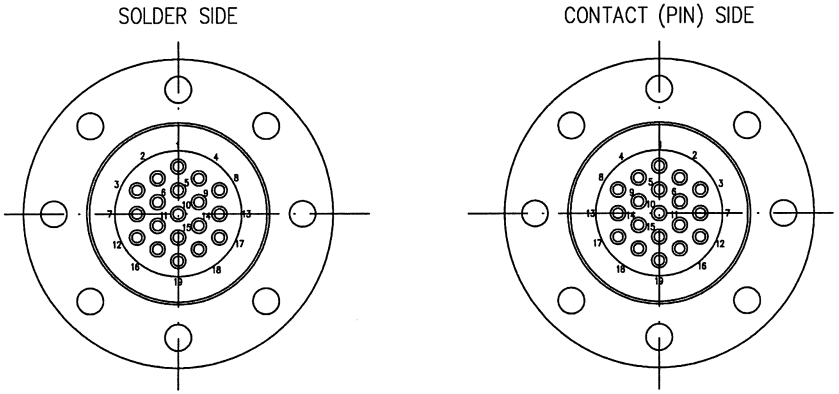
STATUS: APPROVED

SENSOR PENETRATOR (8-PIN)





GISMA CONNECTOR BR10/4/19



CONFIDENTIAL

03	T. Hein	14.05.2007	J. Dannehl	15.05.2007	CAMERON GmbH Lückenweg 1 29227 Celle, Germany	Title: CIRCUIT DIAGRAM ELECTRIC SUBSEA ACTUATOR 5.1/8"	DWG. NO. SK-066350-26-04	= TOTAL-K5F
Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date				+ ACTUATOR
01	T. Hein	30.11.2006	Initial Release				B.O.M. NO. 223350-26	SHEET 3 of 3
Initial Rev.	Initial Author	Initial Date	Remark		Supersedes			STATUS: APPROVED

STATUS: Released REVISION : 04
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : DC ACTUATOR 3/4"

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
001	0001	01	222255-83	1.000	EA	HOUSING, 3/4" ACTUATOR		
002	0002	02	222255-86	1.000	EA	BODY FOR DAMPER, 3/4" ACTUATOR		
003	0003	02	222261-44	1.000	EA	END CAP, 3/4" ACTUATOR		
004	0004	01	222226-32	1.000	EA	GUIDE SLEEVE, 3/4" ACTUATOR		
005	0005	02	222221-08	1.000	EA	BEARING CARRIER, 3/4" ACTUATOR		
006	0006	02	222216-03	1.000	EA	HOLLOW SHAFT, 3/4" ACTUATOR		
007	0007	02	222296-01-06	1.000	EA	LOAD FLANGE, 3/4" ACTUATOR		
008	0008	01	222226-33	1.000	EA	ACTUATING SLEEVE, 3/4" ACTUATOR		
009	0009	01	222296-01-07	1.000	EA	DISTANCE FLANGE, 3/4" ACTUATOR		
010	0010	01	222292-03	1.000	EA	SPROCKET INTERNAL, M=0.5, Z=242, 3/4"		
011	0011	03	222255-84	1.000	EA	HOUSING FOR MOTOR, 3/4" ACTUATOR		
012	0012	01	222261-45	1.000	EA	END CAP FOR MOTOR HOUSING, 3/4" ACTUATOR		
013	0013	01	222211-59	1.000	EA	DRIVE SHAFT, 3/4" ACTUATOR		
014	0014	01	222221-09	1.000	EA	LOWER CARRIER FOR THRUST BEARING, 3/4"		
015	0015	01	222221-10	1.000	EA	UPPER CARRIER FOR THRUST BEARING, 3/4"		
016	0016	01	222267-34	1.000	EA	TOLERANCE COMPENSATION RING, 3/4" ACT.		
017	0017	02	222288-58	1.000	EA	STEM OD 20 MM, 3/4" ACTUATOR		
018	0018	01	222267-35	1.000	EA	SPLIT RETAINER RING, 3/4" ACTUATOR		
019	0019	01	222274-72	1.000	EA	DISTANCE SLEEVE OD 98 MM, 3/4" ACTUATOR		
020	0020	02	222270-10	1.000	EA	LOCK RING 6.625" STUB ACME,3/4" ACTUATOR AND SPRING MODULE		
021	0021	01	222274-73	1.000	EA	DISTANCE SLEEVE OD 81 MM, 3/4" ACTUATOR		
022	0022	01	222261-46	1.000	EA	END CAP FOR POSITION SENSOR, 3/4" ACT.		
023	0023	01	222700-37	1.000	EA	WRAP SPRING ID 101 MM, 3/4" ACTUATOR		
024	0024	02	222700-38	1.000	EA	WRAP SPRING ID 57 MM, 3/4" ACTUATOR		
025	0025	01	222543-04	1.000	EA	PARALLEL KEY A 6X6X32, 3/4" ACTUATOR		
026	0026	01	222274-74	8.000	EA	FASTENING SLEEVE, 3/4"		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						ACTUATOR		
027	0027	01	222261-47	2.000	EA	CAP FOR COMPENSATOR, 3/4" ACTUATOR		
028	0028	01	222211-60	2.000	EA	PINION SHAFT, 3/4" ACTUATOR		
029	0029	01	222211-61	2.000	EA	COUPLING ROD, LONG, 3/4" ACTUATOR		
030	0030	02	222274-75	2.000	EA	DISTANCE SLEEVE OD 10 MM, 3/4" ACTUATOR		
031	0031	01	222296-01-08	2.000	EA	ADAPTER FLANGE, STEPPER MOTOR, 3/4" ACT.		
032	0032	01	222255-85	2.000	EA	HOLDER FOR REWINDER SPRING, 3/4" ACT.		
033	0033	01	222244-62	2.000	EA	SOCKET, 3/4" ACTUATOR		
034	0034	01	222211-62	1.000	EA	COUPLING ROD, SHORT, 3/4" ACTUATOR		
035	0035	01	222273-13	2.000	EA	DISTANCE DISC, 3/4" ACTUATOR		
036	0036	01	222296-01-09	1.000	EA	COLLET FOR GEAR BOX, 3/4" ACTUATOR		
037	0037	01	222201-23	4.000	EA	PIN FOR WRAP SPRING, 3/4" ACTUATOR		
038	0038	02	222244-63	2.000	EA	BUSHING FOR GUIDE ROLLER, 3/4" ACTUATOR		
039	0039	01	222274-76	1.000	EA	DISTANCE SLEEVE OD 65 MM, 3/4" ACTUATOR		
040	0040	01	222700-39	1.000	EA	REWINDER SPRING OD 31.5 MM,3/4" ACTUATOR		
041	0041	05	222229-15	1.000	EA	PISTON FOR DAMPER, 3/4" ACTUATOR		
042	0042		2707181-01	1.000	EA	BEARING, BALL, SINGLE ROW DEEP GROOVE 8MM ID X 22MM OD X 7MM WIDTH		
043	0043		619010-06-60-04	4.000	EA	DEEP GROOVE BALL BEARING SINGLE ROW DESIGNATION: 619/7 ID X OD X W: 7 X 17 X 5 mm DYN. LOAD RATING: 1.48 KN LIMITING SPEED: 56000 RPM		
044	0044		619010-06-60-08	2.000	EA	DEEP GROOVE BALL BEARING SINGLE ROW DESIGNATION: 61818 ID X OD X W: 90 x 115 x 13 mm DYN. LOAD RATING: 19.5 KN LIMITING SPEED: 7000 RPM		
045	0045		619010-06-60-07	3.000	EA	DEEP GROOVE BALL BEARING SINGLE ROW DESIGNATION: 61815 ID X OD X W: 75 x 95 x 10 mm DYN. LOAD RATING: 12.7 KN LIMITING SPEED: 8500 RPM		
046	0046		619010-06-64-02	1.000	EA	DRAWN CUP NEEDLE ROLLER		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						BEARING DESIGNATION: HK4516 ID X OD X W: 45 x 52 x 16 mm DYN. LOAD RATING: 20.5 KN LIMITING SPEED: 6300 RPM		
047	0047		619010-06-64-01	1.000	EA	DRAWN CUP NEEDLE ROLLER BEARING DESIGNATION: HK0810 ID X OD X W: 8 X 12 X 10 mm DYN. LOAD RATING: 3.69 KN LIMITING SPEED: 22000 RPM		
048	0048		619010-06-63-03	1.000	EA	CYLINDRICAL ROLLER THRUST BEARING DESIGNATION: 81107M ID X OD X W: 35 x 52 x 12 mm DYN. LOAD RATING: 29 KN LIMITING SPEED: 5600 RPM SOLID CAGE IN BRASS	Use the washer "GS".	
050	0050		619010-06-65-01	1.000	EA	NEEDLE ROLLER THRUST BEARING DESIGNATION: AXK3552 ID X OD X W: 35 X 52 X 2 mm DYN. LOAD RATING: 16.6 KN LIMITING SPEED: 6300 RPM		
051	0051		619010-06-66-01	1.000	EA	THRUST WASHER DESIGNATION: AS3552 ID X OD X W: 35 X 52 X 1 mm		
052	0052		619010-06-63-04	1.000	EA	CYLINDRICAL ROLLER THRUST BEARING DESIGNATION: 81114M ID X OD X W: 70 x 95 x 18 mm DYN. LOAD RATING: 86.5 KN LIMITING SPEED: 3400 RPM SOLID CAGE IN BRASS		
053	0053		619010-06-51-01	2.000	EA	TRACK ROLLER, KRV 16, 16 X 28 mm OD X W: 16 X 28 mm THREAD: M6X1 MALE DYN. RADIAL LOAD: max. 4.05 KN LIMITING SPEED: 4300 RPM WITHOUT SEAL RINGS AND ECCENTRIC.		
054	0054		619953-15-02-04	2.000	EA	RETAINING RING, DIN 472, 22 MM, STL FOR BORE DIA.: 22 MM MATERIAL: SPRING STEEL		
055	0055		619915-00-08-06	1.000	EA	RETAINING RING, DIN 471, 8 MM, STL FOR SHAFT DIA.: 8 MM MATERIAL: SPRING STEEL		
056	0056		619915-02-00-06	1.000	EA	RETAINING RING, DIN 471, 12		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						MM, STL FOR SHAFT DIA.: 12 MM MATERIAL: SPRING STEEL		
057	0057		619010-06-58-04	1.000	EA	RETAINING RING, TYPE SB 12, STL FOR BORE DIA.: 12 mm RING THICKNESS: 1.0 mm MATERIAL: SPRING STEEL		
058	0058		619010-06-59-04	4.000	EA	RETAINING RING, TYPE SW 7, STL FOR SHAFT DIA.: 7 mm RING THICKNESS: 0.7 mm MATERIAL: SPRING STEEL		
059	0059		619010-06-58-05	2.000	EA	RETAINING RING, TYPE SB 52, STL FOR BORE DIA.: 52 mm RING THICKNESS: 1.5 mm MATERIAL: SPRING STEEL		
060	0060		619010-06-59-06	1.000	EA	RETAINING RING, TYPE SW 90, STL FOR SHAFT DIA.: 90 mm RING THICKNESS: 2.5 mm MATERIAL: SPRING STEEL		
061	0061		619010-06-58-07	1.000	EA	RETAINING RING, TYPE SB 95, STL FOR BORE DIA.: 95 mm RING THICKNESS: 2.5 mm MATERIAL: SPRING STEEL		
062	0062		619010-06-59-05	1.000	EA	RETAINING RING, TYPE SW 75, STL FOR SHAFT DIA.: 75 mm RING THICKNESS: 2.0 mm MATERIAL: SPRING STEEL		
063	0063		619953-34-16-04	1.000	EA	RETAINING RING, DIN 472, 53 MM, STL FOR BORE DIA.: 53 MM MATERIAL: SPRING STEEL		
064	0064		619953-22-03-04	1.000	EA	RETAINING RING, DIN 472, 32 MM, STL FOR BORE DIA.: 32 MM MATERIAL: SPRING STEEL		
065	0065		619010-06-58-10	2.000	EA	RETAINING RING, TYPE SB 17, STL FOR BORE DIA.: 17 mm RING THICKNESS: 1.2 mm MATERIAL: SPRING STEEL		
066	0066		619040-01-75	2.000	EA	BRUSHLESS MOTOR, BM-1510-A ACCORDING TO DRAWING NO. 125053 MOTOR SUPPLIED AS TWO SEPARATE		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						COMPONENTS, ARMATURE ASSEMBLY AND FIELD ASSEMBLY. MOTOR LEADS: #20 AWG, TEFLON COATED, PER MIL-W-22759/11, 3 LEADS (BLACK, RED, WHITE) 24" (610 mm) min. LONG EACH.		
067	0067	03	2197040-18-01	2.000	EA	Special Stepper Motor 6540-18 with Teflon Supply Wires and Shaft ar both Sides. Not painted		
068	0068	01	222288-59	1.000	EA	SPINDLE, 25X5-30, 3/4" ACTUATOR		
069	0069	01	222311-01	1.000	EA	GEAR BOX, 3/4" ACTUATOR HFUC-20-160-2A-GR-SP		
070	0070		619012-02-86	2.000	EA	COMPENSATOR BLADDER, 0.2 L, NITRILE CONN.: 5/8" UNF MALE X G 1/8" FEM. VOLUME: 0.2 LITRE GAS VALVE MATERIAL: AISI 316 BLADDER MATERIAL: NITRILE WITH GROOVE FOR O-RING SIZE 6-129.		
071	0071	03	2197088-17-06	2.000	EA	SS Bulkhead Conn. Series 10/4, 19-pin, m Subsea Bulkhead Connector Series 10/4, special type (LV439), 19-pin male contacts, wet mateable		
072	0072	01	2197088-17-09	1.000	EA	Penetrator Greene Tweed 8 pin for Position Indicator Housing		
073	0073		619989-02-05-01	5.000	EA	PIN, GROOVED, ISO 8742, 2 X 10, STL THIRD LENGTH CENTRE GROOVED DIA.: 2 X 10 MM LG. MATERIAL: STEEL		
074	0074		619917-10-17-01	2.000	EA	PAR. PIN, DIN 7, DIA. 6 X 40, STL MATERIAL: STEEL		
075	0075		619914-03-07-01	1.000	EA	PAR. KEY, DIN 6885, A4 X 4 X 18 TYPE A: ROUND HEAD ; MAT.: STEEL		
076	0076		2706212	5.000	EA	PLUG, HOLLOW HEX, 5/16"-24 UNF, SST SAE 090109B; INCL. O-RING;		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						SIZE 2 THREAD: 5/16"-24UNF; MAT.: SST		
077	0077	02	222209-05	2.000	EA	PLUG 7/16"-20 UNF FOR VALVE ELECTRONIC MODULE		
078	0078		702515-25-20-08	6.000	EA	SCREW, SOC HD SET .500-13 X .500 SST CUP PT ANSI B18.3		
079	0079		619903-09-11-09	12.000	EA	SCREW, SOC, DIN 912, M8 X 20, STL MATERIAL: 8.8 EL. ZINC-PLATED		
080	0080		619903-06-13-09	6.000	EA	SCREW, SOC, DIN 912, M4 X 30, STL MATERIAL: 8.8 EL. ZINC-PLATED		
081	0081		619903-06-15-09	6.000	EA	SCREW, SOC, DIN 912, M4 X 40, STL MATERIAL: 8.8 EL. ZINC-PLATED		
082	0082		619903-08-11-09	20.000	EA	SCREW, SOC, DIN 912, M6 X 20, STL MATERIAL: 8.8 EL. ZINC-PLATED		
083	0083		619903-05-09-09	12.000	EA	SCREW, SOC, DIN 912, M3 X 12, STL MATERIAL: 8.8 EL. ZINC-PLATED		
084	0084		619903-05-12-09	12.000	EA	SCREW, SOC, DIN 912, M3 X 25, STL MATERIAL: 8.8 EL. ZINC-PLATED		
085	0085		619903-07-09-06	12.000	EA	SCREW, SOC, DIN 912, M5 X 12, SST MATERIAL: AISI 316 (1.4401)		
086	0086		619903-07-12-06	8.000	EA	SCREW, SOC, DIN 912, M5 X 25, SST MATERIAL: AISI 316 (1.4401)		
087	0087		619903-07-17-06	4.000	EA	SCREW, SOC, DIN 912, M5 X 50, SST MATERIAL: AISI 316 (1.4401)		
088	0088		619903-07-11-26	8.000	EA	SCREW, SOC, DIN 912, M5 X 22, SST MATERIAL: AISI 316 (1.4401)		
089	0089		619903-06-07-09	1.000	EA	SCREW, SOC, DIN 912, M4 X 8, STL MATERIAL: 8.8 EL. ZINC-PLATED		
090	0090		619903-08-07-09	1.000	EA	SCREW, SOC, DIN 912, M6 X 8, STL		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						MATERIAL: 8.8 EL. ZINC-PLATED		
091	0091		619903-05-07-09	8.000	EA	SCREW, SOC, DIN 912, M3 X 8, STL MATERIAL: 8.8 EL. ZINC-PLATED		
092	0092		619910-12-08	4.000	EA	NUT, HEX, DIN 934, M4, STL MATERIAL: 8 EL. ZINC-PLATED		
093	0093		619919-09-02-07	1.000	EA	WASHER, MEDIUM, DIN 125, B 4.3, STL TYPE B: WITH CHAMFER ; ID: 4.3 mm MAT.: STEEL 140 HV GALV. ZINC-PLAT.		
094	0094		619988-04-02	24.000	EA	PLAIN WASHER, SMALL SERIES ID X OD X WT: 3.2 x 6.0 x 0.5 mm FOR BOLT SIZE: 3 mm MAT.: STEEL 140 HV EL. ZINC-PLATED		
095	0095		619903-07-06-09	1.000	EA	SCREW, SOC, DIN 912, M5 X 6, STL MATERIAL: 8.8 EL. ZINC-PLATED		
096	0096		619936-05-04-01	1.000	EA	WASHER, DIN 9021, 5.3 X 15 X 1.2 TYPE: A ; MAT.: AISI 316 (1.4401)		
097	0097		619027-03-98	2.000	EA	TURCON GLYD RING, 800 BAR, ID 20 MM INCL. O-RING ; ROD DIA.: 20 MM WORK. PRESS.: MAX. 800 BAR MATERIAL: TURCON T46 ; O-RING: NBR		
098	0098		619027-03-99	4.000	EA	WEAR RING FOR ROD DIA. 20 mm WITH ANGLE CUT GROOVE DIA. X WIDTH: 23.1 X 4.0 mm SPEED: MAX. 15 m/s TEMP.: -60°C / +200°C MATERIAL: TURCITE T47		
099	0099		702645-24-31	1.000	EA	O RING, SIZE AS-568-243 4.109 ID X .139 W 90D /MS-1078 NITRILE PKG AND QUAL /CIW 702645		
100	0100		702645-25-51	3.000	EA	O RING, SIZE AS-568-255 5.609 ID X .139 W 90D /MS-1078 NITRILE PKG AND QUAL /CIW 702645		
101	0101		702645-03-01	8.000	EA	O RING, SIZE AS-568-030		

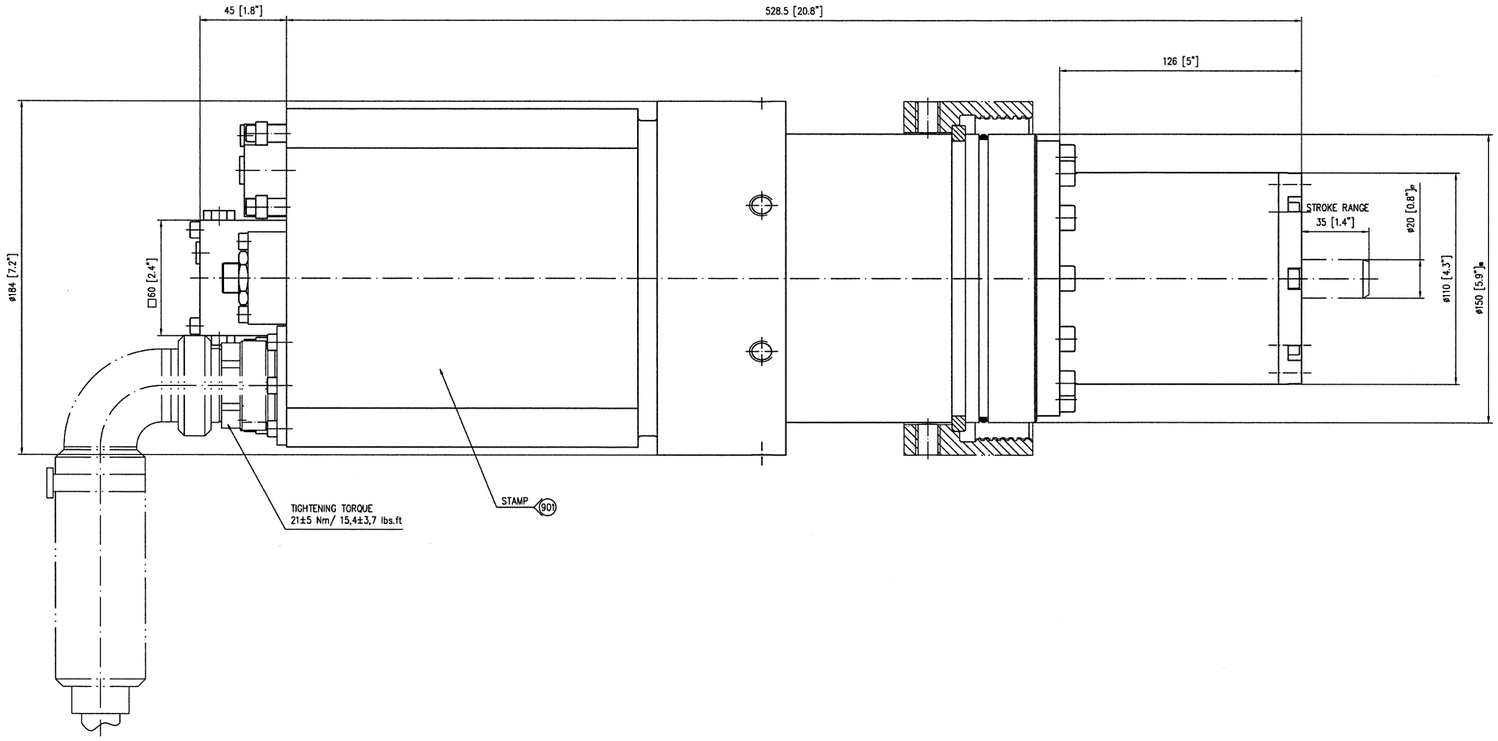
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						1.614 ID X .070 W 90D /MS-1078 NITRILE PKG AND QUAL /COT 702645		
102	0102		702645-03-41	2.000	EA	O RING, SIZE AS-568-034 2.114 ID X .070 W 90D /MS-1078 NITRILE PKG AND QUAL /CAMERON 702645		
103	0103		619010-06-69	4.000	EA	SHAFTLOC SLEEVE, SINGLE-ENDED FOR SHAFT DIA.: 0.5" BORING: 0.375" MATERIAL: SST 416		
104	0104		619917-06-12-01	1.000	EA	PAR. PIN, DIN 7, DIA. 2.5 X 20, STL MATERIAL: STEEL		
105	0105		619903-05-09-03	12.000	EA	SCREW, SOC, DIN 912, M3 X 12, STL MATERIAL: STEEL 12.9		
106	0106		619903-07-10-03	8.000	EA	SCREW, SOC, DIN 912, M5 X 16, STL MATERIAL: STEEL 12.9		
107	0107		2707184-01	4.000	EA	PLUG, HEXAGON SOCKET, 7/16" -20-UNF, SST SAE 090109B; INC.O-RING (ISO 11926)		
108	0108		619910-10-18	4.000	EA	NUT, HEX, DIN 934, M3, STL MATERIAL: 8 EL. ZINC-PLATED		
109	0109	A02	2197006-03	1.000	EA	VALVE,CHECK 275 BAR,D=4,75MM,SST BORE DIA.DMR.4.75MM CRACKING PRESS.:5+/-3PSI CHECK VALVE,FREE FLOW REVERSE WORK.PRESS.:4000 PSI / 275 BAR LOHMRATE AT 15PSI D:MAX 100 LOHMS		
110	0110	A02	2197006-04	2.000	EA	VALVE,CHECK 275 BAR,D=4,75MM,SST BORE DIA.DMR.4.75MM CRACKING PRESS.:5+/-3PSI CHECK VALVE, FREE FLOW FORWARD WORK.PRESS.:4000 PSI / 275 BAR LOHMRATE AT 15PSI D:MAX 100 LOHMS		
111	0111	06	223361-31	1.000	EA	SENSOR HOUSING, 3/4" ACTUATOR		
112	0112		619027-02-78	2.000	EA	O-RING, SIZE-0.351" ID X 0.072" W		

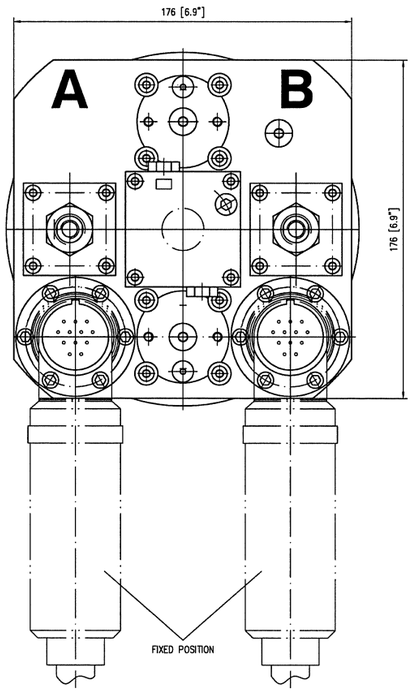
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						THICKNESS: 0.072" MATARIAL: NBR HARDNESS: 90 SHORE		
113	0113		702645-00-91	2.000	EA	O RING, SIZE AS-568-009 .208 ID X .070 W 90D /MS-1078 NITRILE PKG AND QUAL /CIW 702645		
114	0114		702645-23-41	1.000	EA	O RING, SIZE AS-568-234 2.984 ID X .139 W 90D /MS-1078 NITRILE PKG AND QUAL /CIW 702645		
115	0115	01	222273-14	1.000	EA	THRUST PLATE, 3/4" ACTUATOR		
116	0116		619001-01-74	1.000	EA	RESTRICTOR, LOHM RATE 7330, +/-5% PASSAGE SIZE: min. 0.026" BODY MATERIAL: 304L CRES		
117	0117	02	222261-48	1.000	EA	END CAP, 3/4" ACTUATOR		
118	0118	01	222267-36	1.000	EA	MOUNTING RING FOR DAMPER, 3/4" ACTUATOR		
119	0119		702645-01-01	1.000	EA	O RING, SIZE AS-568-010 .239 ID X .070 W 90D /MS-1078 NITRILE PKG AND QUAL /CAMERON 702645		
120	0120		619027-04-02	1.000	EA	TURCON GLYD RING, 800 BAR, OD 80 mm INCL. O-RING in NBR FOR BORE DIA.: 80 mm NOM. PRESS.: MAX. 800 BAR MATERIAL: TURCON T46		
121	0121		619010-06-55-01	1.000	EA	LOCK NUT, PRECISION, M12X1, STL TYPE: PRECISKO, DRS 12X1 WITH RADIAL SET SCREW MATERIAL: STEEL BRONZED		
122	0122		619903-06-08-09	6.000	EA	SCREW, SOC, DIN 912, M4 X 10, SST MATERIAL: 8.8 EL. ZINC-PLATED		
123	0123		619923-06-05-02	1.000	EA	SCREW, SET, DIN 916, M3 X 4, SST MATERIAL: AISI 316 (1.4401)		
141	0141		619923-08-09-01	1.000	EA	SCREW, SET, DIN 916, M5 X 10, STL MATERIAL: 45 H (HARDNESS CLASS)		
150	0130	01	222226-36	1.000	EA	SLEEVE FOR SENSOR DC ACTUATOR		
151	0131	01	222244-67	1.000	EA	DISTANCE BUSHING OD 15 FOR SENSOR, DC ACTUATOR		
152	0132	01	222244-68	1.000	EA	DISTANCE BUSHING OD 18 FOR		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						SENSOR, DC ACTUATOR		
153	0133		619010-06-57	2.000	EA	MAGNET RING , AXIAL MAGNETIZED OD X ID X H: 15 X 6 X 6 mm SURFACE: GALV. TIN PLATED MAGNET MATERIAL ACC. TO CODE 262/135.		
154	0134		619953-11-02-04	1.000	EA	RETAINING RING, DIN 472, 18 MM, STL FOR BORE DIA.: 18 MM MATERIAL: SPRING STEEL		
155	0135		702645-01-21	2.000	EA	O RING, SIZE AS-568-012 .364 ID X .070 W 90D /MS-1078 NITRILE PKG AND QUAL /CAMERON 702645		
156	0136		619979-03-03-08	6.000	EA	SCREW, CTK, DIN 7991, M5 X 10, SST HEX SOC COUNTERS. FLAT HD CAP SCREW MATERIAL: AISI 316 (1.4401)		
159	0139	01	223388-54-01	1.000	EA	MSDS 3/4" Actuator, ESS tested		
170	0150		619011-82	2.000	LI	SYNTHETIC GEAR AND HIGH TEMP. OIL TYPE: KLUEBERSYNTH GH 6-32. KINEMATIC VISKOSITY: DIN 51 561, at 20°C: 88 cst, at 40°C: 32 cst AND at 100°C: 6.5 cst. DENSITY at 15°C: 984 kg/m3. FLASH POINT: > 220°C. POUR POINT: < -45°C. SERVICE TEMP. RANGE: -45°C / +160°C.		
180	0180		619084-27-01-01	1.000	ME	SHRINK TUBING, 1.5 - 0.5 mm, CLEAR SHRINK RATIO: 3:1. SHRINK RANGE: 1.5 - 0.5 mm. OPER. TEMP.: -40°C / +135°C. SHRINK TEMP.: +80°C / +120°C. MATERIAL: POLYOLEFINE.		
181	0181		619084-27-11-01	1.000	ME	SHRINK TUBING, 3.0 - 1.0 mm, CLEAR SHRINK RATIO: 3:1. SHRINK RANGE: 3.0 - 1.0 mm. OPER. TEMP.: -40°C / +135°C. SHRINK TEMP.: +80°C / +120°C.		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						MATERIAL: POLYOLEFINE.		
182	0182		619084-27-21-01	1.000	ME	SHRINK TUBING, 6.0 - 2.0 mm, CLEAR SHRINK RATIO: 3:1. SHRINK RANGE: 6.0 - 2.0 mm. OPER. TEMP.: -40°C / +135°C. SHRINK TEMP.: +80°C / +120°C.		
						MATERIAL: POLYOLEFINE.		
183	0183		619087-02-18-01	1.000	ME	CABLE, SPEC 55, 18 AWG, BLACK STRANDING: 19/0.25 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 1.52 mm. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
184	0184		619087-02-18-45	1.000	ME	CABLE, SPEC 55, 18 AWG, YE/GN STRANDING: 19/0.25 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 1.52 mm. COLOUR: YELLOW / GREEN. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
185	0185		619087-02-19-01	1.000	ME	CABLE, SPEC 55, 26 AWG, BLACK STRANDING: 19/102 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 0.81 mm. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
186	0186		619087-02-19-02	1.000	ME	CABLE, SPEC 55, 26 AWG, RED STRANDING: 19/102 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C.		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						AD: 0.81 mm. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
187	0187		619087-02-19-04	1.000	ME	CABLE, SPEC 55, 26 AWG, YELLOW STRANDING: 19/102 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 0.81 mm. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
188	0188		619087-02-19-06	1.000	ME	CABLE, SPEC 55, 26 AWG, BLUE STRANDING: 19/102 mm. NO. OF CONDUCTOR: 1. NOM. VOLT.: 600 V. TEMP.: -60°C / +200°C. AD: 0.81 mm. CONDUCTOR: TIN-PLATED COPPER. ROUND BRAID SCREENED AND JACKETED CABLE. APPROBATION: UL STYLE 3467		
189	0189		619010-12-06	1.000	ME	SPIRAL WRAP, 6.4 MM ID, PTFE OPER. TEMP.: -60°C / +260°C MATERIAL: PTFE, NON-FLAMMABLE		
>>>B/M Category : Engrg Spec/Document item								
900	0900	03	SK-066350-27	1.000	EA	ELECTRIC SUBSEA ACTUATOR 3/4" - 15000 PSI, REDUNDANT		
901	0901	04	SK-066350-27-04	1.000	EA	CIRCUIT DIAGRAM SUBSEA ACTUATOR 3/4"		
905	0905	04	X-065472-97	1.000	EA	TP: 3/4" Electr. Valve Actuator Unit		
907	0907	08	QP-000160-01-18	1.000	EA	Main Quality Plan for DC Tree Systems		
910	0910	02	X-065467-02-37	1.000	EA	Installation Procedure DC Actuator Project: General		
>>>B/M Category : Optional item								
920	0920	01	222270-18	1.000	EA	SHIM RING ID 150.2 X 2 3/4" ACTUATOR - SPRING MODULE		





03

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

APPROVED FOR CONSTRUCTION	15MAY07	1
ISSUED FOR CLIENT COMMENT	12MAR07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production
Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-03-526

A = SYSTEM "A"
B = SYSTEM "B"

NOTE:
1. APPROXIMITY WEIGHT IN AIR 65 KG.
   APPROXIMITY WEIGHT IN WATER 55 KG.

REV. BY: T. Hein	DATE: 07.03.2007	REV: 03	
CAD	DO NOT SCALE	SURFACE TREATMENT	
TOLERANCES ACCORDING TO DIN ISO 8015	DRAWN: T. Hein	DATE: 07.02.2006	CAMERON GmbH Lückenweg 1 29227 Celle, Germany
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	CHECKED: R. Gabel	DATE: 15.05.2007	ASSEMBLY DRAWING: ELECTRIC SUBSEA ACTUATOR 3/4" - 15000 PSI, REDUNDANT
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K	APPROVED: M. Lehmker	DATE: 15.05.2007	MATERIAL AND HEAT TREATMENT
EST. WEIGHT: 65.000 KG	SUPERSEDES:	SCALE: 1:1	
INITIAL USE NOW: 223350-27	SHEET: 1 OF 1	DRAWING NUMBER: SK-066350-27	

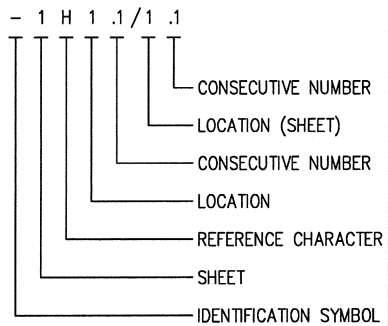
STATUS: APPROVED

SHEET	DESIGNATION
1	INDEX/ NOTES
2	WIRING DETAILS
3	CONNECTOR DETAILS

CABLE NO.	TERMINAL
—	—

TERMINAL TYPE	TERMINALS
—	—

ITEM DESIGNATION/CROSS-REFERENCES



LIST OF REFERENCE CHARACTERS (IN ACCORDANCE WITH IEC 61346-1)

A	AMPLIFIER; SPS COMPONENT
B	CONVERTER
C	CAPACITOR
E	MISCELLANEOUS
F	FUSE; MOTOR PROTECTION
H	LAMP; HORN
K	RELAY
M	MOTOR
P	MEASURING INSTRUMENT
Q	MOTOR-, POWER PROTECTION SWITCH
R	RESISTOR
S	SWITCH
T	TRANSFORMER
U	MODULATOR
V	DIODE
W	CABLES
X	TERMINAL
Y	VALVE

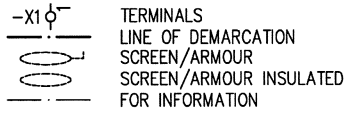
STANDARDS:

-ALL INSTALLATION SHALL BE IN ACCORDANCE WITH VDE 0100.
-ALL ELECTRIC SYMBOLS SHALL BE IN ACCORDANCE WITH IEC 617.

NOTES:

-SIGNAL LINES TO BE TWISTED
-POWER LINES TO BE TWISTED

REMARKS:



Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date
04	T. Hein	14.05.2007	J. Dannehl	15.05.2007
01	T. Hein	20.11.2006	Initial Release	
Initial Rev.	Initial Author	Initial Date	Remark	

Supersedes

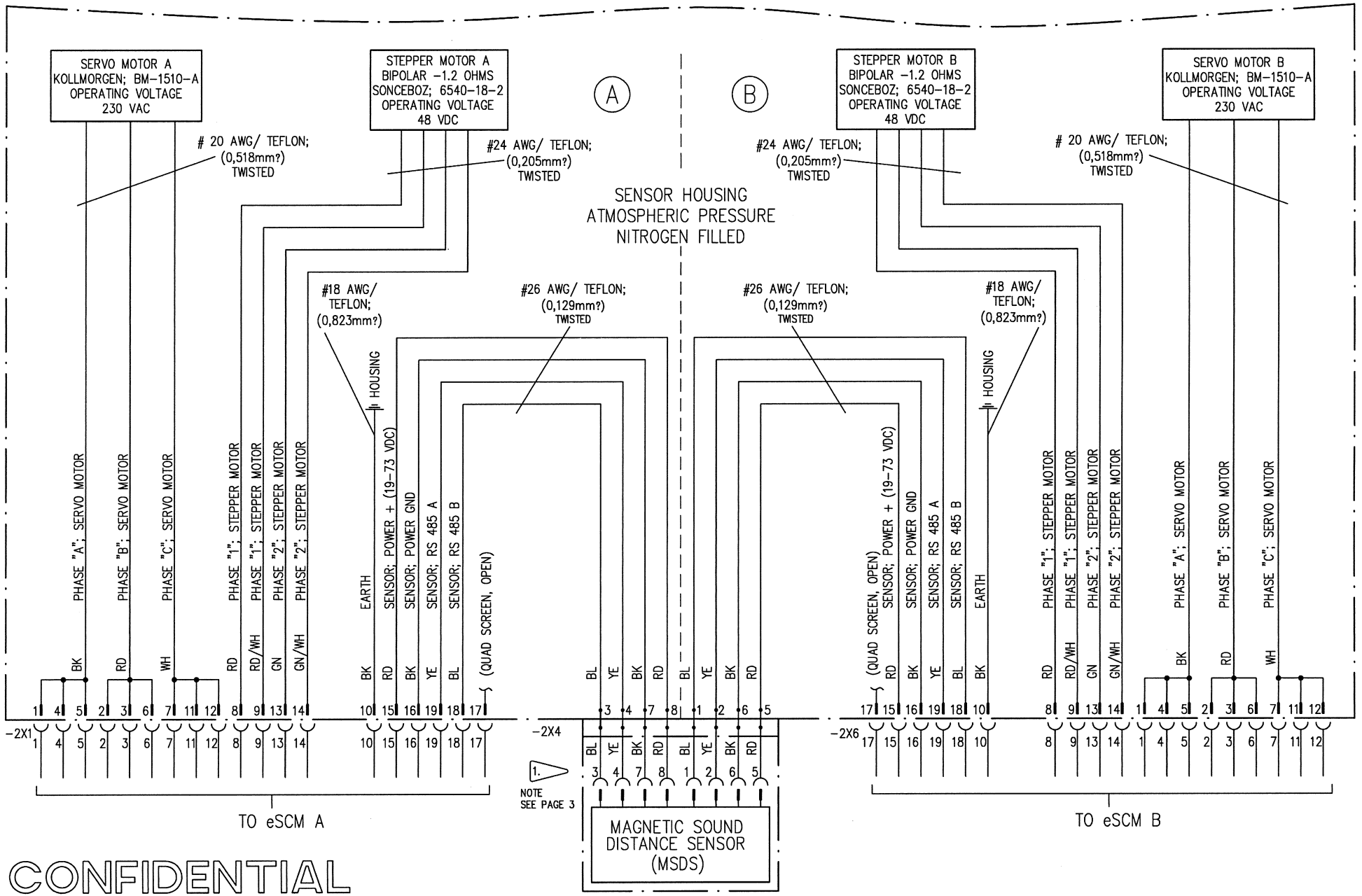
CAMERON
CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

Title
CIRCUIT DIAGRAM
ELECTRIC SUBSEA ACTUATOR 3/4"

DWG. NO. SK-066350-27-04
B.O.M. NO. 223350-27
SHEET 1 of 3

= TOTAL-K5F
+ ACTUATOR

STATUS: APPROVED



CONFIDENTIAL

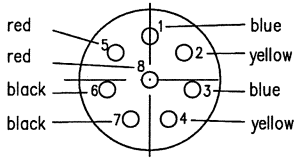
04	T. Hein	14.05.2007	J. Dannehl	15.05.2007	CAMERON	CAMERON GmbH Lückenweg 1 29227 Celle, Germany	Title: CIRCUIT DIAGRAM ELECTRIC SUBSEA ACTUATOR 3/4"
Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date			DWG. NO. SK-066350-27-04
01	T. Hein	21.11.2006	Initial Release				B.O.M. NO. 223350-27
Initial Rev.	Initial Author	Initial Date	Remark		Supersedes		SHEET 2 of 3

= TOTAL-K5F
+ ACTUATOR

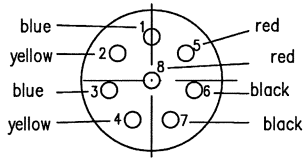
STATUS: APPROVED

SENSOR PENETRATOR (8-PIN)

SENSOR SIDE

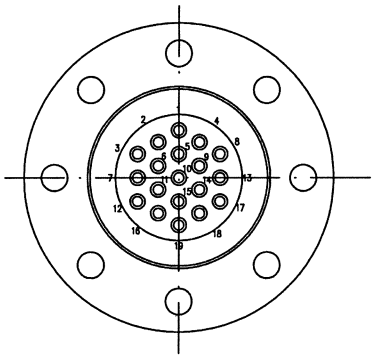


PRESSURE SIDE

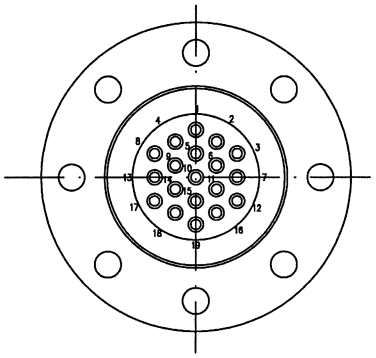


GISMA CONNECTOR BR10/4/19

SOLDER SIDE



CONTACT (PIN) SIDE



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NOTE:

1. VIEW FROM CABLE SITE

8	7	6	5
RED (RD) +48V S1	BLACK (BK) GND S1	BLACK (BK) GND S2	RED (RD) +48V S2
4	**3**	**2**	**1**
YELLOW (YE) CAN H1 RS485 A1	BLUE (BL) CAN L1 RS485 B1	YELLOW (YE) CAN H2 RS485 A2	BLUE (BL) CAN L2 RS485 B2

CONFIDENTIAL

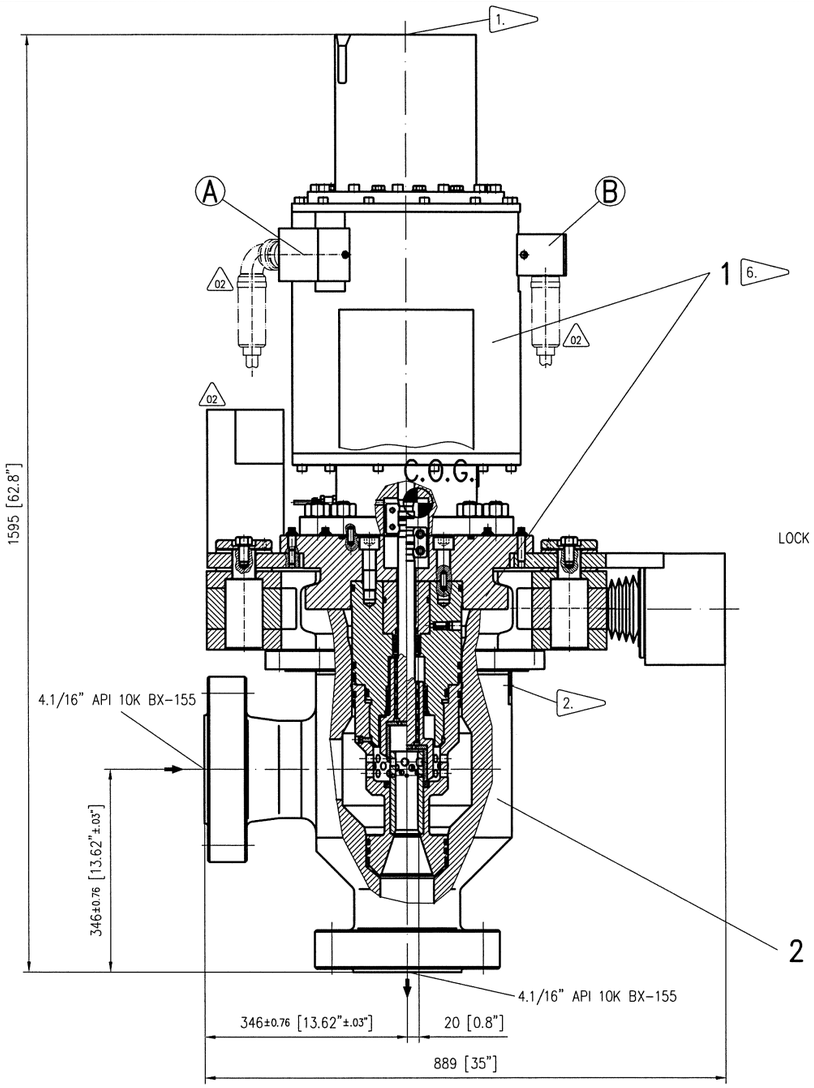
04	T. Hein	14.05.2007	J. Dannehl	15.05.2007	CAMERON	CAMERON GmbH Lückenweg 1 29227 Celle, Germany	Title: CIRCUIT DIAGRAM ELECTRIC SUBSEA ACTUATOR 3/4"
Revision	Rev. Author	Rev. Date	Rev. Approver	Rev. Appr. Date			DWG. NO. SK-066350-27-04
01	T. Hein	28.11.2006	Initial Release				B.O.M. NO. 223350-27
Initial Rev.	Initial Author	Initial Date	Remark		Supersedes		SHEET 3 of 3

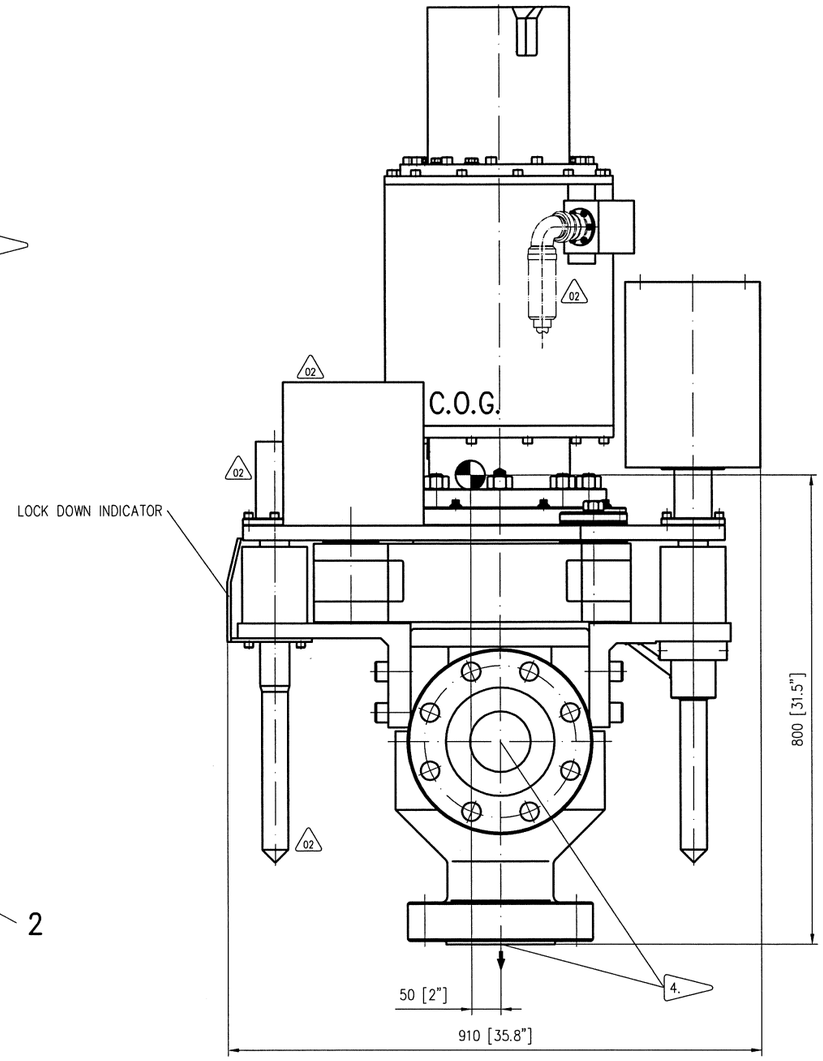
= TOTAL-K5F
+ ACTUATOR

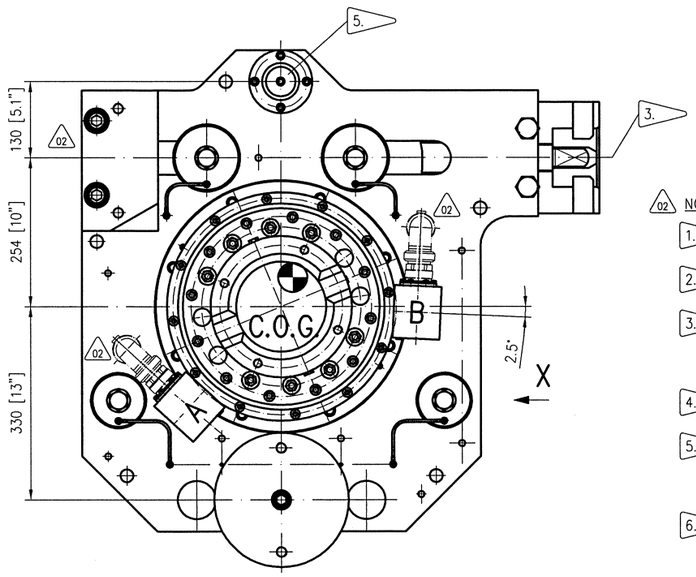
STATUS: APPROVED

STATUS: Released REVISION : 02
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Choke Top Level Assy for Prd.-Choke

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
010	0010	03	223446-01-01	1.000	EA	CHOKE INSERT ASSEMBLY OF COMBINED CHOKE AND DC ACTUATOR CLAMP & TRIM CC30SR		
020	0020	03	2259785-01	1.000	EA	BODY ASSY, CC40SR CAMERON DC ELECTRIC CHOKE 4 1/16" API 10K BX-155 IN/OUT. "A" = "B" = 13.62" +/- .03". F22 W/625 CLADDING. API 6A 19TH ED / API 17D 1ST ED / ISO 10423 / ISO 13628-4 PSL 3G, PR2, M/C 'HH-NL', T/R '-50°F to 250°F'. NOM SIZE 4-1/16" X 232/64THS MAX ORIFICE. MWP: 10,000 PSI.		
>>>B/M Category : Engrg Spec/Document item								
900	0900	02	SK-066446-01	1.000	EA	AS : CHOKE TOP LEVEL ASSEMBLY DRAWING		
905	0905	03	X-065437-01-84	1.000	EA	FAT DC Choke Actuator & Choke K5-F Factory Acceptance Test Combined Actuator & Choke Insert & Choke Body Project: TOTAL K5-F		
907	0907	08	QP-000160-01-18	1.000	EA	Main Quality Plan for DC Tree Systems		







02 NOTE:

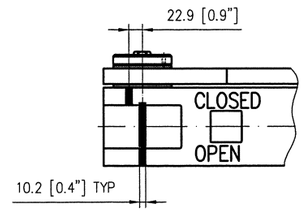
1. FOR SUBSEA CHOKES MODIFIED ROV BUCKET, ISO 13628-8, CLASS 4.
2. BONNET SEAL TEST PORT (AUTOCLAVE 3/8" MP, SF375CX20).
3. SINGLE BOLT HINGED CLAMP LOCK DOWN W/ISO 13628-8 HIGH TORQUE INTERFACE, 42 TURNS APPROX. TO OPEN, SETTING TORQUE 1280 FT. LBS, MAX. BREAK OUT TORQUE 1700 FT. LBS.
4. BORE SIZE 4.07".
5. CHOKE INSERT GUIDE PINS DESIGNED TO ACCOMMODATE 44,45 MM (1.75") MAXIMUM INSERT OFFSET IN ANY DIRECTION FROM THE TOP OF THE CHOKE LIFTING MANDREL (I.E. HIGHEST POINT OF THE CHOKE).
6. RETRIEVABLE PART: APPROX. WEIGHT IN AIR 1070 KG
   APPROX. WEIGHT IN WATER 917 KG

APPROX. WEIGHT IN AIR 1430 KG

APPROX. WEIGHT IN WATER 1225 KG

VIEW X

02 PARTIAL VIEW CLAMP INDICATOR



DETAILS TO BE STENCILED
IN PERMANENT WATERPROOF BLACK INK.
MINIMUM TEXT HEIGHT 1"

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

APPROVED FOR CONSTRUCTION	10AUG07	1
ISSUED FOR CLIENT COMMENT	11APR07	N/A
ISSUED FOR INTERNAL IDC	21MAR07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-03-304

CAD

REV. BY: W. Dill | DATE: 11.04.2007 | REV.: 02

TOLERANCES ACCORDING TO DIN ISO 8015	SURFACE TREATMENT	DO NOT SCALE	
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	MATERIAL AND HEAT TREATMENT	DRAWN: T. Hein	DATE: 12.03.2007
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K		CHECKED: R. Wrede	DATE: 13.08.2007
		APPROVED: M. Lehmker	DATE: 13.08.2007
EST. WEIGHT: 1430.000 KG	SUPERSEDES:	SCALE: 1:5	

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

TOP LEVEL ASSEMBLY DRAWING
OF COMBINED CHOKE AND DC ACTUATOR
BODY CC40SR, CLAMP & TRIM CC30SR

INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223446-01	1 OF 1	SK-066446-01

STATUS: APPROVED

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 2, Section 4

ANODE & CATHODE PACKAGE

CONTENTS

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K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 2, Section 4
ANODE & CATHODE PACKAGE

DESCRIPTION, INSTALLATION, OPERATION & MAINTENANCE

CONTENTS

Total
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Volume 2, Section 4
ANODE & CATHODE PACKAGE

PARTS LISTS & DRAWINGS

CONTENTS

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

31 MAR 2009	As Built	A. Weilandt	T. Appel	A. Weilandt
06 AUG 2007	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
02 MAY 2007	Issued for Client Comment	A. Weilandt	S. Horne	
12 OCT 2006	Issued for Internal IDC	A. Weilandt	D.Coonrod	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approver**

CAMERON	**Document Title:** **Subsea and Topsides Functional Requirement Specification**		
PAGE 1 OF 34	**Customer Document Number:**	54NL92-W-0S-502	REV. 2
	Cameron Document No.	X-076721-87	REV. 02

TABLE OF CONTENTS

1 Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
A	12OCT06	Initial release Celle	- - -
B	02MAY07	Section 7.5.6.1: Use of Swagelok added for LP lines and added the need for metric size on all LP tubing Section 8.4: cable entry changed from top to bottom Section 9.2: List of Total Tag Numbers added Section 9.1.1.2: Colour for topside equipment changed from RAL5015 to RAL7035 (light grey) 10.8 & 10.9: updated description as per current design of anode and cathode package 10.10: complete section added for Anode Umbilical Assembly	Comments from internal IDC
01	06AUG07	Section 10.8: Anode Package Foundation Base added	Updated to Approved for Construction
02	31MAR09	Minor cosmetic Customer Comments implemented	Update to “As Built”

2 Introduction

This document is written to consolidate the technical requirements for the subsea control system intended to be used on the TOTAL K5F Project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

It will be submitted for approval early on in the project cycle and upon approval will be used for the design of the system.

Referenced client specifications within this document also need to be considered for the design.

3 Scope of this document

The scope of this document is to define the functional requirements for the subsea control system intended to be used on the TOTAL K5F Project.

Technical requirements relate but shall not be limited to:

- Design basis data
- Functional requirements

The Intervention & Workover Control System (IWOCS) shall **NOT** be covered by this document.

4 Abbreviations & Definitions

4.1 Abbreviations

AIV	Annulus Isolation Valve
AMV	Annulus Master Valve
APTA	Annulus Pressure Transmitter A
APTB	Annulus Pressure Transmitter B
BAIV	B Annulus Isolation Valve
CI	Corrosion Inhibitor
CIV	Chemical Injection Valve
CP	Cathodic Protection
CR	Control Room
DCS	Distributed Control System
DHSV	Downhole Safety Valve
DHPT	Downhole Pressure Temperature Transmitter
EPCU	Electrical Power and Communication Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
HPU	Hydraulic Power Unit
ICSS	Integrated Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
KHI	Kinetic Hydrate Inhibitor
LPMV	Lower Production Master Valve
MEOH	Methanol
PCS	Process Control System
PPD	Production Pressure Downstream
PPU	Production Pressure Upstream
PSV	Production Swab Valve
PTD	Production Temperature Downstream
PTU	Production Temperature Upstream
PWV	Production Wing Valve
PRCM	Power Regulation and Communication Module
SCSSV	Surface Controlled Subsurface Safety Valve
SSS	Safety Shutdown System
TUTU	Topside Umbilical Termination Unit
UPMV	Upper Production Master Valve
UPS	Uninterruptible Power Supply
UTA	Umbilical Termination Assembly
WH	Wellhead
XOV	Crossover Valve

4.2 Definitions

COMPANY	Total E&P Nederland B.V. (TEPNL)
CONTRACTOR	Cooper Cameron UK Ltd.

5 References

5.1 Cameron documents

Following documents **MUST** be considered during the design phase.

Description	Number
Subsea Production Control System Interconnection Diagram	SK-066001-88-04
K5F Field Development Project Contract	4600000416
Bill Of Material – Subsea Production Control System	223001-88
Project Quality Specification	SP-003118-15

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Design of cathodic protection of offshore structures	GS GR COR 100
External protection of off-shore and coastal structures and equipment by painting	GS EP COR 350
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Minimum CONTRACTOR document requirements	GS EP ELE 091
Electrical cables	GS EP ELE 161
Cable trays/ladders	GS EP ELE 311
Precommissioning and commissioning specification	GS EP EXP 101
Precommissioning and commissioning technical preparation	GS EP EXP 103
Precommissioning execution	GS EP EXP 105
Commissioning execution	GS EP EXP 107
Operations preparation during project – Maintenance and inspection documentation	GS EP EXP 203
Requirements for contractor quality management	GS EP PJC 501
Requirements for contractor critically rating of a unit	GS EP PJC 502
Requirements for contractor quality control	GS EP PJC 503
Valves	GS EP PVV 142
Welding of duplex and superduplex stainless steel	GS EP PVV 614
Area classification	GS EP SAF 216

Description	Number
Completed wells safety systems and safety rules	GS EP SAF 226
Impacted area, restricted area and fire zones	GS EP SAF 253
Emergency shut-down and emergency de-pressurisation (ESD & EDP)	GS EP SAF 261
Design philosophy and requirements for subsea stations	GS EP SPS 001
Subsea ball valves	GS EP SPS 005
Service valves in subsea stations	GS EP SPS 006
Tie-in systems	GS EP SPS 007
Corrosion protection of subsea stations	GS EP SPS 009
Preservation requirements for subsea package	GS EP SPS 010
Mechanical completion of subsea stations	GS EP SPS 011
Documentation requirements for subsea stations	GS EP SPS 012
Wellhead and guidance systems	GS EP SPS 013
Subsea gate valves and actuators in subsea Xmas-tree systems	GS EP SPS 015
Subsea insert chokes and associated running and retrieval tools	GS EP SPS 016
Subsea production control system	GS EP SPS 019
Subsea control unit functional requirements	GS EP SPS 020
Subsea mateable electrical/optical connectors	GS EP SPS 021
Environmental testing of subsea electronics	GS EP SPS 022
Cleaning and flushing of hydraulic systems	GS EP SPS 023
Subsea mechanical quarter turn actuator (manually operated gearbox)	GS EP SPS 024
Subsea hydraulic spring return quarter turn actuators	GS EP SPS 025
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Static 230Vac power supply units for on- and offshore installations	NL00-U-6S-037
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Typical cable tray details (offshore)	NL00-U-64-044
Elec. Cable colour seq. (onsh. + offsh.)	NL00-U-64-045
Protection and Instrument Earth. Det. (onsh. + offsh.)	NL00-U-64-046
Presentation of engineering and final documentation	NL00-Z-0S-002

Description	Number
Microstation Version 5.0: User Definable Attributes	NL00-Z-0S-005
Codification & Numbering of New Technical Documents for Offshore Installations	NL00-Z-0S-006
Instrumentation/piping interface standards	NL00-Z-4S-042
Actuators and control systems for hydraulically operated control valves	NL00-Z-7S-041
Actuators and control system for hydraulically operated ball valves	NL00-Z-7S-043
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
Codification of instrumentation links & equipment	NL00-Z-7S-077
Electrical/instrument interface diagram typicals for normally unmanned offshore installations	NL00-Z-71-002
Loop diagrams typicals	NL00-Z-71-003
Instrumentation - process hook-up typicals	NL00-Z-74-011
Hydraulic hook-up typicals	NL00-Z-74-021
Mounting typicals	NL00-Z-74-031
Instrument name plate detail	NL00-Z-74-055
Completion dossier guidelines	CS-3-OPE-EC-701 (EDMP-40657)
K5F MCS – K6CC SSS/PCS Interface	EDMP #59401

Any agreed deviations from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

Any clarifications from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

In case of conflict between documents the following order of priority shall be applied:

1) Local and international rules and regulations
2) Company Safety Specifications (GS EP SAF)
3) Project Specifications
4) Company Standards (NL00)
5) Company General Specifications

5.3 Codes, standards and regulations

Following codes, standards and regulations shall be considered during the design phase.

Description	Number
Design and operation of sub sea production systems	ISO 13628
Design & Operation Of Subsea Production Control Systems	ISO 13628-6
Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluids	SAE AS4059

Description	Number
EMC Directive	89/336-EEC
Process measurement control functions and instrumentation Symbolic representation	ISO 3511
Quality management and quality assurance standards - Part 3:Guidelines for the application of ISO 9001 to the development, supply and maintenance of software	ISO 9000-3

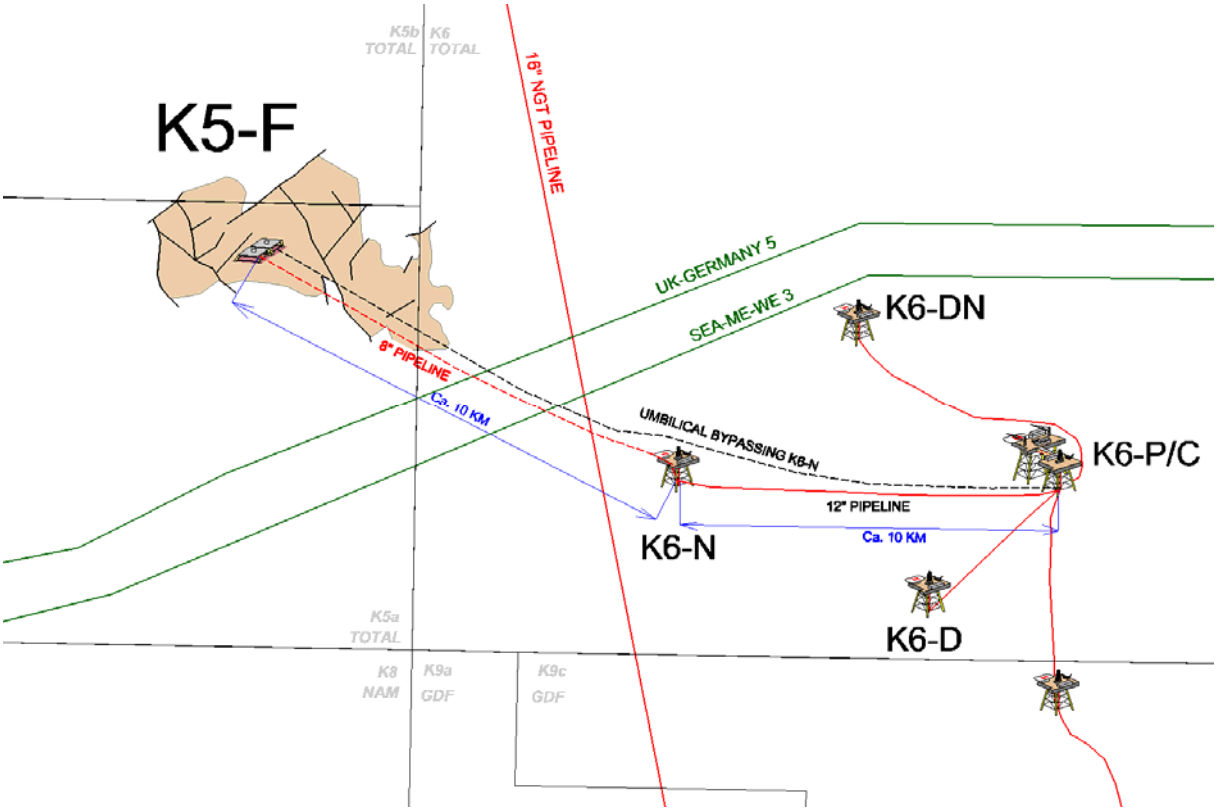
5.4 CE marking

CE marking **will** be required for the K5F project.

6 Project Overview

The K5F is a gas field located 10 km NW of the existing satellite platform K6N and 20km NW of the K6 Central Complex, all operated by TEPNL.

In the first phase, K5F will be developed with two wells. In order to be able to increase the reserves recovery in the future a third well might be connected in the future on the Subsea Protection Structure and it is also possible to connect a fourth future satellite well.



7 Design basis

The following sections are describing the systems information particularly relevant to the design of the Production Control System:

7.1 Field data

Present Number of Production Wells	Two plus two future wells
Design Life	20 years

7.2 Environmental conditions

7.2.1 Climatic data

Parameter		Data
Ambient Temperature (Outdoors)	Minimum Air Temperature	- 16°C
	Maximum Air Temperature	+ 40°C
Ambient Temperature (Indoors)	Minimum Air Temperature	-5°C
	Maximum Air Temperature	+ 40°C

7.2.2 Subsea Design Information

Parameter	Data
Water Depth	37 metres
Temperature	+4°C to +9.5°C
Seawater density	1025 kg/m³
Seawater Electrical Resistivity	0.3 OhmMeter
Wellhead Shut-in Pressure	350 barg

7.2.3 Hazardous Area Classification

The HPU and the TUTU shall be specified for hazardous area Zone 1, Gas Group IIB, Temperature Class T3, on the Platform deck.

7.2.4 Local equipment room

The platform local electrical switch room shall be used to accommodate the MCS and the ECPU cabinets. The maximum temperature during normal conditions within the LER shall be limited to 25 °C, but all of the equipment shall be able to operate as long as the room temperature does not exceed 40°C.

7.2.5 Hydraulic system pressures for the SCSSV line

The subsea production control system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
HP Hydraulics	627 barg	690 barg	1035 barg
Return Lines	< 207 barg	207 barg	N/A
Reservoir Fill Lines	<10 barg	10 barg	15 barg

NOTE: The design pressures shown above shall be used for specification of the HP hydraulic system relief valves and these shall release at the shown design pressures.

The return lines of the HPU are piped directly to the return reservoir and open to atmosphere. Pressure testing of these lines is neither necessary nor possible.

7.2.6 Chemical system pressure requirements

The chemical injection system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
Methanol Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Corrosion Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Kinetic Hydrate Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg

7.2.7 List of chemicals

The following chemicals are considered to be used for chemical injection for the K5F project:

- Methanol (MEOH)
- Corrosion Inhibitor (CI)
- Kinetic Hydrate Inhibitor (KHI)

7.3 Design life

The design life of the Subsea equipment shall be equal to the service life of the field.

The Subsea and related topside facilities shall be designed for a minimum design life of **20 years**.

7.4 Utilities

7.4.1 Platform utilities

The subsea production control system shall be designed to operate from the platform power and utilities as follows:

Electrical Supply (ECPU)	400VAC , 3 phase, 50 Hz ± 2% from UPS (floating), redundant
Electrical Supply (MCS)	230VAC 50 Hz ± 2%,from UPS (floating), redundant
Electrical supply (HPU PLC Cabinet)	230VAC 50 Hz ± 2% from UPS (floating)
Electrical supply (HPU Lighting)	230VAC 50 Hz from MCC
Electrical supply (HPU Motors)	380VAC 3ph 50 Hz, floating (3 wires) from MCC
Electrical supply (Motor heaters)	230VAC 50 Hz from MCC (if applicable)
Electrical supply (ESD solenoids)	24 V DC when healthy, 0V on ESD

7.5 Hydraulic systems

7.5.1 Sealing systems

Hydraulic couplers with primary metal seals are preferred for permanently installed Subsea equipment. Where possible, secondary, non-metallic seals should be considered as back-up for primary metal-to-metal seals. Hydraulic and chemical couplers within removable assemblies like single diver mate able hydraulic/chemical couplings shall have non-metallic primary seals and non-metallic back-up seals.

7.5.2 Hydraulic distribution

The subsea production control system high pressure (HP) hydraulic supplies shall be single from the HPU pumps. The hydraulic system shall be open utilising a water based control fluid.

7.5.3 Hydraulic fluid

The hydraulic system shall use Castrol Transaqua HT water based control fluid.

7.5.4 Fluid cleanliness

The production control system hydraulic control fluid shall be water based. All production control system hydraulic equipment shall be delivered with fluid cleanliness levels of SAE AS4059 class 6 or better. All methanol and chemical lines and equipment shall be delivered with fluid cleanliness level of SAE AS4059 class 12 or better.

Protective caps shall be provisioned for all hydraulic couplings to avoid accidental contamination. Assembly of hydraulic components shall take place in areas where the environment is controlled. The objective shall be to “assemble clean to keep clean” such that subsequent flushing operations are simplified.

Cleaning methods used for sub-assemblies shall include shop air flushing, solvent cleaning, pipe cleaning and ultrasonic bathing as appropriate. Cleaning of major assemblies shall in general be confined to flushing with control fluid of known cleanliness. As far as is practical, designs shall take due note of the subsequent flushing requirements e.g. avoiding blind holes, avoiding welding or grinding on assembled components and ensuring that systems allow turbulent flow for flushing.

All hoses and flying leads intended for chemical service (Methanol, Corrosion Inhibitor and Kinetic Hydrate Inhibitor) should be supplied filled with either control fluid or a suitable fluid compatible with the chemicals to be used.

7.5.5 Tubing

All hydraulic tubing and fittings shall be sized for efficient operation of the system with due regard to design pressures and minimising pressure drops within the system.

- For the topside equipment minimum seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the subsea equipment seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the UTA, the Methanol tubing has to be super duplex.

The tubing of the hydraulic circuits shall be accurately cut and bent using standard tube cutters and tube benders to fitting manufacturer’s recommendation. No burrs shall be allowed and each section of the tubing shall be cleaned and blown dry before assembly to ensure that no contamination is permitted to enter the control components.

All hydraulic tubing together with the associated fittings shall be capable of withstanding the application of a 1.5 times design pressure test for 15 minutes without any deformation or other damage.

7.5.6 Threaded connection systems

All threaded fittings for equipment used subsea shall withstand external ambient pressure at the design depth.

7.5.6.1 Topside equipment

For all circuits Autoclave MP Piping and fittings shall be used, except return lines where Swagelok can be used. All non Autoclave lines need to be in metric size.

7.5.6.2 Permanent subsea equipment

Ferrulok tube end reducers are to be welded to the back of hydraulic couplers, etc., where practical, rather than pipe threaded connections.

High-pressure ports requiring threaded fittings, such as valve actuator ports shall be SAE thread with 37-degree bottom taper conforming to SAE standard J514. Autoclave anti-vibration type fittings shall also be acceptable.

National Pipe Thread (NPT) fittings or any other thread seal type fitting shall **NOT** be used without specific approval from the project.

Fitting assembly torque shall be independently verified and sealed/secured to identify, that fittings have been properly made-up and inspected.

7.5.6.3 Thread sealants

Where taper threads are permitted for use, they shall be sealed using Loctite 572 fluid applied in accordance with the manufacturer's instructions. No other thread sealant shall be used. Teflon tape is **NOT** permitted for use on any equipment used with this system.

7.5.7 Welded connection systems

All couplers, whether in hydraulic or chemical services shall be butt-welded, except were otherwise specified within this document. All couplers shall be fitted with seals from identical compounds. All hydraulic or chemical service valves and fittings shall be butt welded.

- Connections shall be welded to the extent practical
- Autogenously welding shall be acceptable on 316L materials
- Liquid penetrate testing shall be performed on all tubing welds

Note: all welding has to be performed in accordance to approved Cameron welding specification.

8 Electric Systems

8.1 Terminal Type

Screw type terminals shall be used on all topside equipment.

8.2 Instrument Type

For the use in hazardous area EEx-d type instruments shall be used.

8.3 Electrical Motor Type

For the use in hazardous area EEx-d type electrical motors shall be used.

8.4 Cable entry for cabinets located in the Control Room

All cabinets located in the control room shall be designed to allow bottom cable entry only.

9 Functional Requirements

9.1 Coating & protection systems

9.1.1 Coating systems

All equipment manufactured from Carbon steels shall be protected with an approved coating system suitable for the design life of the equipment.

9.1.1.1 Subsea painting

Painting of all subsea components manufactured from Carbon steels shall be done in accordance to the approved paint specification A-020025-01

9.1.1.2 Painting of topside equipment for outside installation

Painting of all topside components located outside shall be done in accordance to the approved paint specification X-065460-04-04

- Top colour for surface equipment shall be light grey (RAL 7035).
- SST framework and parts shall normally NOT be painted, if not separately specified.

9.1.1.3 Painting of topside equipment for inside installation

Paint colour for MCS or EPU cabinet housings shall be light grey (RAL 7035).

9.1.2 Cathodic protection

9.1.2.1 General

The primary corrosion protection system for the control system Subsea equipment shall be via materials selection and suitable paint coatings.

A cathodic protection system using sacrificial anodes shall be utilised to protect the ‘bare steel’ components and to protect uncoated areas of any other control system hardware, i.e. such as those items not protected by the host equipment. Special attention shall be given to SST screws and bolts. All items to be protected shall be electrically connected using stranded, flexible SST 316 earthing braids of a suitable cross sectional area.

9.1.2.2 Calculations

Suitable CP calculations shall be carried out in accordance with the standard applicable for control system hardware i.e. not tree mounted equipment (this shall be part of the Subsea tree CP system). The CP system shall be designed to be capable of protecting the control system for the 20-year design life of the equipment.

9.1.2.3 Construction

The following principles shall be adhered when designing equipment for the subsea control system:

- All equipment metalwork shall be welded (or bolted) onto the equipment main structure to ensure any static potential build up is avoided by continuous drain to earth.
- All metallic items shall have earth continuity by physical connection i.e. metallic fastenings, clamps or earth straps. This shall include all valves, tubing, components, tubing clamps etc.

Electrical connectors may remain isolated from the structure provided suitable materials are chosen for their construction.

- When stainless steel fasteners are used in the construction of subsea structures or equipment, they shall be suitably earth bonded using earth straps. Carbon steel fasteners may alternatively be used.
- Anodes mounted on equipment sub-structures shall be manufactured from material identical and from the same batch as those fitted to the main structure.
- The anodes shall comply with the Cameron material specification MS-011310-01.
- The minimum distance from hydraulic tubing to anodes shall be 80 mm. If unavoidable it is acceptable to have a distance of less than 80 mm for some cases.
- Earthing conductors shall be of corrosion resistant material and shall be securely fastened and protected where necessary against damage and electrolytic corrosion. Where earth-bonding straps are used, conductive paste shall be smeared on contact surfaces (not threads) to ensure a lasting low resistance contact. Where the metallic composition of equipment requiring earth bonding differs from the main structure, care shall be taken in the selection of the bonding strap material to minimise possible ill effects of different contact potentials.
- Connections shall be secured using star-type shake proof washers such that they cannot work loose under vibration.

9.2 Project specific Tag Numbers

This is a list of Tag numbers to be used for K5F equipment. All units and components on this list need to be marked with these numbers as per Total Spec. NL00-Z-74-055.

Instruments	Equipment	Description	Comments
	NN-82201	TUTU	
	NN-82202	HPU	
	NN-82203	HPU PLC	
	NN-81203	MCS	
	NN-81204-1	EPCU 1	
	NN-81204-2	EPCU 2	
	NN-81204-3	EPCU 3	
	NN-81204-4	EPCU 4	
	SA-92100A	Anode Package A	
	SA-92100B	Anode Package B	
	UTA-92100	UTA	
	UTA-92101	IUTA	FUTURE
	UTA-92102	IUTA	FUTURE
	PRCM-92100.1A	PRCM A well 1	
	PRCM-92100.1B	PRCM B well 1	
	SC-92100.1A	Cathode A well 1	
	SC-92100.1B	Cathode B well 1	
	ESCM-92100.1A	ESCM A well 1	
	ESCM-92100.1B	ESCM B well 1	
	DVA-92103.1	Dump valve assembly well 1	
	DHSV-92103.1	Downhole safety valve well 1	

	PRCM-92100.2A	PRCM A well 2	
	PRCM-92100.2B	PRCM B well 2	
	SC-92100.2A	Cathode A well 2	
	SC-92100.2B	Cathode B well 2	
	ESCM-92100.2A	ESCM A well 2	
	ESCM-92100.2B	ESCM B well 2	
	DVA-92103.2	Dump valve assembly well 2	
	DHSV-92103.2	Downhole safety valve well 2	
	PRCM-92100.3A	PRCM A well 3	
	PRCM-92100.3B	PRCM B well 3	
	SC-92100.3A	Cathode A well 3	
	SC-92100.3B	Cathode B well 3	
	ESCM-92100.3A	ESCM A well 3	
	ESCM-92100.3B	ESCM B well 3	
	DVA-92103.3	Dump valve assembly well 3	
	DHSV-92103.3	Downhole safety valve well 3	
	PRCM-92100.4A	PRCM A well 4	
	PRCM-92100.4B	PRCM B well 4	
	SC-92100.4A	Cathode A well 4	
	SC-92100.4B	Cathode B well 4	
	ESCM-92100.4A	ESCM A well 4	
	ESCM-92100.4B	ESCM B well 4	
	DVA-92103.4	Dump valve assembly well 4	
	DHSV-92103.4	Downhole safety valve well 4	
	HP-92100.1	HP Jumper UTA to tree 1	
	MEOH-92100.1	MeOH Jumper UTA to tree 1	
	KHI-92100.1	KHI Jumper UTA to tree 1	
	CI-92100.1	CI Jumper UTA to tree 1	
	COAX-92100.1A	Coax Jumper UTA to PRCM A tree 1	
	COAX-92100.1B	Coax Jumper UTA to PRCM B tree 1	
	PC-92100.1A	P/C Jumper PRCM A to ESCM A tree 1	
	PC-92100.1B	P/C Jumper PRCM B to ESCM B tree 1	
	HP-92100.2	HP Jumper UTA to tree 2	
	MEOH-92100.2	MeOH Jumper UTA to tree 2	
	KHI-92100.2	KHI Jumper UTA to tree 2	
	CI-92100.2	CI Jumper UTA to tree 2	
	COAX-92100.2A	Coax Jumper UTA to PRCM A tree 2	
	COAX-92100.2B	Coax Jumper UTA to PRCM B tree 2	
	PC-92100.2A	P/C Jumper PRCM A to ESCM A tree 2	
	PC-92100.2B	P/C Jumper PRCM B to ESCM B tree 2	
	HP-92100.3	HP Jumper UTA to tree 3	FUTURE
	MEOH-92100.3	MeOH Jumper UTA to tree 3	FUTURE
	KHI-92100.3	KHI Jumper UTA to tree 3	FUTURE

	CI-92100.3	CI Jumper UTA to tree 3	FUTURE
	COAX-92100.3A	Coax Jumper UTA to PRCM A tree 3	FUTURE
	COAX-92100.3B	Coax Jumper UTA to PRCM B tree 3	FUTURE
	PC-92100.3A	P/C Jumper PRCM A to ESCM A tree 3	FUTURE
	PC-92100.3B	P/C Jumper PRCM B to ESCM B tree 3	FUTURE
PCV-92101.1		Production Choke valve well K5F-1	
PWV-92101.1		Production Wing Valve well K5F-1	
UPMV-92102.1		Upper Production Master Valve well K5F-1	
DHSV-92103.1		Down Hole Safety Valve well K5F-1	
AMV-92103.1		Annulus Master Valve well K5F-1	
BAIV-92100.1		B Annulus Isolation Valve well K5F-1	
XOV-92101.1		Crossover Valve well K5F-1	
CIV-92101.1		Chemical Injection Valve well K5F-1	
CIV-92102.1		Chemical Injection Valve well K5F-1	
CIV-92103.1		Chemical Injection Valve well K5F-1	
XEV-92103.1		HP Dump Valve (solenoid) well K5F-1	
PPU-92101.1		Production Pressure Upstream well K5F-1	
PPD-92111.1		Production Pressure Downstream well K5F-1	
APTA-92103.1		Annulus Pressure Transmitter A well K5F-1	
APTB-92105.1		Annulus Pressure transmitter B well K5F-1	
PTD-92101.1		Production Temperature Downstream well K5F-1	
PTU-92104.1		Production Temperature Upstream well K5F-1	
PT-92104.1		Downhole Pressure Transmitter	
TT-92-103.1		Downhole Temperature Transmitter	
PCV-92101.2		Production Choke valve well K5F-2	
PWV-92101.2		Production Wing Valve well K5F-2	
UPMV-92102.2		Upper Production Master Valve well K5F-2	
DHSV-92103.2		Down Hole Safety Valve well K5F-2	
AMV-92103.2		Annulus Master Valve well K5F-2	
BAIV-92100.2		B Annulus Isolation Valve well K5F-2	
XOV-92101.2		Crossover Valve well K5F-2	
CIV-92101.2		Chemical Injection Valve well K5F-2	
CIV-92102.2		Chemical Injection Valve well K5F-2	
CIV-92103.2		Chemical Injection Valve well K5F-2	
XEV-92103.2		HP Dump Valve (solenoid) well K5F-2	
PPU-92101.2		Production Pressure Upstream well K5F-2	
PPD-92111.2		Production Pressure Downstream well K5F-2	
APTA-92103.2		Annulus Pressure Transmitter A well K5F-2	
APTB-92105.2		Annulus Pressure transmitter B well K5F-2	
PTD-92101.2		Production Temperature Downstream well K5F-2	
PTU-92104.2		Production Temperature Upstream well K5F-2	
PT-92104.2		Downhole Pressure Transmitter	
TT-92103.2		Downhole Temperature Transmitter	
PCV-92101.3		Production Choke valve well K5F-3	FUTURE
PWV-92101.3		Production Wing Valve well K5F-3	FUTURE
UPMV-92102.3		Upper Production Master Valve well K5F-3	FUTURE

DHSV-92103.3		Down Hole Safety Valve well K5F-3	FUTURE
AMV-92103.3		Annulus Master Valve well K5F-3	FUTURE
BAIV-92100.3		B Annulus Isolation Valve well K5F-3	FUTURE
XOV-92101.3		Crossover Valve well K5F-3	FUTURE
CIV-92101.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92102.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92103.3		Chemical Injection Valve well K5F-3	FUTURE
XEV-92103.3		HP Dump Valve (solenoid) well K5F-3	FUTURE
PPU-92101.3		Production Pressure Upstream well K5F-3	FUTURE
PPD-92111.3		Production Pressure Downstream well K5F-3	FUTURE
APTA-92103.3		Annulus Pressure Transmitter A well K5F-3	FUTURE
APTB-92105.3		Annulus Pressure transmitter B well K5F-3	FUTURE
PTD-92101.3		Production Temperature Downstream well K5F-3	FUTURE
PTU-92104.3		Production Temperature Upstream well K5F-3	FUTURE
PT-92104.3		Downhole Pressure Transmitter	FUTURE
TT-92103.3		Downhole Temperature Transmitter	FUTURE
PCV-92101.4		Production Choke valve well K5F-4	FUTURE
PWV-92101.4		Production Wing Valve well K5F-4	FUTURE
UPMV-92102.4		Upper Production Master Valve well K5F-4	FUTURE
DHSV-92103.4		Down Hole Safety Valve well K5F-4	FUTURE
AMV-92103.4		Annulus Master Valve well K5F-4	FUTURE
BAIV-92100.4		B Annulus Isolation Valve well K5F-4	FUTURE
XOV-92101.4		Crossover Valve well K5F-4	FUTURE
CIV-92101.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92102.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92103.4		Chemical Injection Valve well K5F-4	FUTURE
XEV-92103.4		HP Dump Valve (solenoid) well K5F-4	FUTURE
PPU-92101.4		Production Pressure Upstream well K5F-4	FUTURE
PPD-92111.4		Production Pressure Downstream well K5F-4	FUTURE
APTA-92103.4		Annulus Pressure Transmitter A well K5F-4	FUTURE
APTB-92105.4		Annulus Pressure transmitter B well K5F-4	FUTURE
PTD-92101.4		Production Temperature Downstream well K5F-4	FUTURE
PTU-92104.4		Production Temperature Upstream well K5F-4	FUTURE
PT-92104.4		Downhole Pressure Transmitter	FUTURE
TT-92103.4		Downhole Temperature Transmitter	FUTURE

9.3 Special Requirements

All warning and emergency signs need to be English **and** Dutch language as per NL00-U-6S-061.

10 Equipment Requirement Specification

10.1 Master Control Station (MCS)

The redundant MCS will be the communication interface between the ICSS and the K5F electrical Subsea Control Modules (ESCM). The MCS will be located in the electrical switch room of the K6P Platform (safe area) and will be powered from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-01 Supplemental Requirements Specification for MCS Hardware

X-076721-87-02 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Control and Management

X-076721-87-03 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Process Interlocks and Shutdowns

X-076721-87-12 Supplemental Requirements Specification for MCS/ICSS Control Interface

10.2 Electrical Power and Control Unit (EPCU)

The EPCU is a redundant electrical power and communication unit for high voltage DC power supply and communication to the subsea installed ESCM's. The EPCU will be located in the electrical switch room of the K6P Platform (safe area) and will receive separate power supply for channel A and B from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-04 Supplemental Requirements Specification for EPCU

10.3 Hydraulic Power Unit (HPU)

A dedicated Hydraulic Power Unit (HPU) will be installed on the K6C platform to provide clean hydraulic HP power for the control of the K5F Downhole Safety Valves (DHSV). The HPU will be controlled from a remote PLC located in a safe area and will be monitored by the MCS/ICSS.

Design Pressure = 690 bar

Hydraulic Fluid = Castrol Transaqua HT

Refer to the following documents for detailed technical requirements:

X-076721-87-05 Supplemental Requirements Specification for HPU

10.4 Topside Umbilical Termination Unit (TUTU)

The Topside Umbilical Termination Unit (TUTU) shall terminate the main electro/hydraulic/chemical umbilical lines and provide the interface to the K6C platform equipment. It will only provide a hardware interface without any block/bleed-valves and/or Pressure gauges for testing or maintenance work. All tubing and couplers need to be supplied by others. The electrical cables shall be terminated in separately mounted explosion proof Junction Boxes or with moulded splice connections.

Refer to the following documents for detailed technical requirements:

X-076721-87-06 Supplemental Requirements Specification for TUTU

10.5 Umbilical Termination Assembly (UTA)

The Umbilical Termination Assembly (UTA) shall be a robust construction to provide interfaces with the umbilical and shall allow to suitably terminating all functions. The UTA shall be setup for the hydraulic connection of the two trees currently in the scope of supply and the two future trees.

Refer to the following documents for detailed technical requirements:

X-076721-87-07 Supplemental Requirements Specification for UTA

10.6 Power Regulation and Control Module (PRCM)

The Power Regulation and Communication Module (PRCM) regulate the power to the ESCM and provide communication to the ESCM. It also provides the connection to the external cathode package.

The PRCM shall be diver recoverable by using a special change out tool and shall be connected to a mounting base.

10.7 Electric Subsea Control Module (eSCM)

The eSCM controls various electric actuators on the tree/wellhead and acquires data from the subsea instrumentation for the transmission to the surface.

The following functions need to be controlled by the eSCM:

No.	Function	Actuator Size	Location	Note
1	CIV 1	¾”	Tree	
2	CIV 2	¾”	Tree	
3	CIV 3	¾”	Tree	
4	BAIV	¾”	Wellhead	
5	AMV	2”	Wellhead	
6	XOV 1	2”	Tree	
7	UPMV	5”	Tree	
8	PWV	5”	Tree	
9	PCV	N/A	Tree	
10	SCSSV Open	N/A	Tree	
11	SCSSV Close	N/A	Tree	

The following tree sensors need to be monitored by the eSCM:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

10.8 Anode Package / Anode Package Foundation Base

There are two separate Anode Packages for the A and the B channel of the system. The Anode Package shall be a robust frame construction for two separate and diver retrievable Anodes. The Anode package requires two separate electrical connectors for each anode for the connection via a flying lead to the anode umbilical assembly. The Anode Packages need to be clearly marked with “A” and “B”. The painted steel frame is protected by FRP grating on all four sides and on top to prevent damages caused by dropped objects. The two anode packages for the channels A and B will be placed on a further support frame to minimize the required installation effort. Both Anode Packages will be located on a Foundation Base.

10.9 Cathode Package

There are four separate Cathode Packages for the A and B channel of each tree. The Cathode Packages will be connected to the respective PRCM on the Subsea Protection Structure via an electrical flying lead. The Cathode Packages are diver installable and will be hooked into the outside plates of the Subsea Protection Structure. The Cathode Package contains the cathode itself and a frame with FRP grating on top to provide mechanical protection.

10.10 Anode Umbilical Assembly

The complete Anode Umbilical Assembly includes the following items:

- an approx. 100m long umbilical with an overall armour and four separate armoured 2,5mm² cores
- a pulling head assembly with 100mm diameter
- a hang-off assembly
- bend restrictor assembly at the Subsea end of the umbilical incl. clamping surface to fix the umbilical
- 4 pigtails, each 6m long, at the end of the umbilical

10.11 Electrical Flying Leads

The electrical flying leads shall comprise a cable moulded to the subsea connectors at both ends. The colour of these cables shall be black with a marking by means of approx. 30cm long heat shrinks at both ends. System A will be marked “blue” and System B “yellow”. These flying leads shall be designed for diver make up only.

10.12 Tree/Wellhead Pressure and Temperature Sensors

The following Pressure and Temperature Sensors are located on the Tree and the Wellhead:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

These sensors shall meet the following requirements:

- Field proven design
- The sensors shall be suitable for the intended subsea service
- Redundant with separate interconnection cables for the A and B channel
- Diver retrievable sensors
- With block-bleed-block assemblies on the pressure sensors
- Minimum accuracy of:
    - +/- 0.03% x full scale accuracy and a drift of 0.2%/year for the pressure sensors
    - +/- 0.3°C accuracy and a drift of 0.2°C/year for the temperature sensors

10.13 SCSSV Dump Valve Assembly

A 3/2 way valve shall be located on the tree for the operation of the SCSSV. The operation of this valve will be direct hydraulic by use of Transaqua HT fluid from a dedicated HPU through a single HP supply line in the main umbilical. The valve shall be designed for the design pressure of the SCSSV system and shall be activated by the ESCM. This assembly will consist of a fixed plate which will be located on the tree and a free plate with the dump valve on which is diver retrievable. Both plates will be connected via quick couplers without the use of poppets. The tree tubing will be connected to the fixed plate by using Autoclave anti-vibration couplers.

11 Quality requirements

A Quality Plan to be used for the project shall be created. For the Project Quality Specification see section 5.1 of this document.

11.1 CE Marking

The topside hardware and software is to be supplied with a CE declaration of conformity, which confirms compliance with all relevant directives.

12 Handling/Installation/Intervention & Shipping

Project shall provide detailed installation and intervention recommendations, and step-by-step project specific procedures, for review as part of the project-engineering phase.

All separately installable and retrievable items shall be provided with suitable lifting points and be generally designed to allow a smooth, simple and quick installation/retrieval process to be performed by divers. This shall include the following items:

- Electric Subsea Control Module (eSCM)
- Power Regulation & Communication Module (PRCM)
- Electrical flying leads between
  - Tree/Wellhead located junction boxes and sensors
  - UTA and PRCM
  - PRCM and ESCM
  - PRCM and Cathode Package

  Tree and Wellhead Pressure and Temperature Sensors
- SCSSV Dump Valve Assembly
- Anode Umbilical Assembly

All subsea assemblies shall be designed to withstand an abandonment period of 6 month sub sea, located where required but not connected to its services (hydraulic, chemical, electrical, ..)

12.1 Use of guidelines

All Subsea equipment (trees, choke inserts, jumpers, control modules, etc.) shall be designed for installation and retrieval by divers with the use of guidelines.

12.2 Lifting / Handling

All equipment shall be designed for safe handling and transportation, both onshore and offshore. All lifting points on all equipment handled offshore shall be:

- Physically load tested to rated weight
- Designed for loads as defined in API 17D and API RP 17G.
- Any welding and associated NDE, which is required for lifting apparatus shall be in compliance with API 17D and API RP 17G.
- All lifting points on all equipment, both purchased and rented; to be handled offshore shall be tested and labelled in accordance with API 17D and API RP 17G.
- All shipped equipment assemblies shall be labelled with their weight.
- Slings and rigging shall be provided for items that require lifting.

12.3 Connection of flying leads

The Subsea hydraulic and electrical flying leads shall be designed to be installed by the use of divers.

Following installation of the Xmas tree, the diver (after removing the LTC from the remote stab or connector) shall pick up the remote end connection and install it to the UTA or Wellhead.

The process shall be similar for the electrical connector.

For recovery the procedure shall be reversed.

12.4 ROV Interfaces

All ROV and diver interfaces shall be designed in accordance with ISO 13628-8.

12.5 ROV Marking of Subsea Stations

Marking of subsea station shall be in accordance with ISO 13628-1 and the following requirements:

- Letter size shall be 50mm

13 Testing

Each item of deliverable equipment shall be tested in accordance with a project approved and CAMERON supplied acceptance test procedure to verify the following as a minimum:

- Functionality
- Internal pressure testing
- External pressure testing
- Control fluid cleanliness to SAE AS4059

CAMERON shall provide written step-by-step procedures for these tests to be provided to COMPANY.

A Control System Integration Test shall be performed in accordance with a COMPANY approved procedure to demonstrate that all of the individual items of equipment function correctly as a system.

The testing programme for the Subsea Production Control System shall be undertaken in the stages detailed as follows:

- Factory Acceptance Test for single units (FAT's)
- System Factory Integration Testing (FIT)
- Tree EFAT
- System Integration Testing (SIT)
- Platform Commissioning
- Offshore Pre-submergence Testing/Deck Testing
- System Commissioning

13.1 Factory Acceptance Test (FAT)

Each deliverable item shall be subjected to a Factory Acceptance Test (FAT). The purpose of this FAT shall be to demonstrate the item is suitable for the intended purpose and functions correctly. FAT tests shall include hydrostatic proof pressure testing to 1.5 times the design pressure of the Subsea control system.

All FAT procedures shall be step-by-step and submitted for review and approval prior to testing commencing.

All critical equipment components shall be subjected to sub-assembly tests during the assembly phase of manufacture and to carry out these tests, the necessary equipment and fittings are specialised in-house equipment and are not project deliverable.

Each item of equipment shall be subject to an in-house FAT in accordance to an approved standard procedure document to demonstrate these meet the specified operational and functional requirements.

The tests shall include interface connections and mechanical alignment tests to verify design and manufacturing limit tolerance effects, component inter-changeability, together with hydraulic fluid system flushing and / or cleanliness checks as necessary to ensure the system meets SAE AS4059. The hydraulic tubing and piping pressure lines shall be hydrostatic pressure tested to 1,5 times the design pressure.

The test equipment shall be determined by the proposed testing programme, however in the event of additional testing or if testing in other locations is required, the quantity of test equipment detailed shall be subject to review.

Testing of fabricated items shall also include continuity testing of bolting.

Testing on subsea assemblies shall include continuity testing and earthing testing.

The maximum value for the resistance measured shall be 0.1 Ohm.

13.1.1 Environmental Stress Screening (ESS)

Modules or subassemblies containing electrical equipment and/or electronic equipment, which are intended for permanent subsea installation shall comply with section 4 of the Total specification GS EP SPS 022 “Environmental testing of Subsea Electronics”.

13.2 Factory Integration Test (FIT)

A System Factory Integration Test (FIT) shall be conducted to verify the correct interfacing and inter-working of all items of the subsea production control system equipment. External interfaces, for example Xmas tree valves & sensors, umbilical cables, DCS, MCC & ESD systems etc. shall be simulated for the purpose of the test. The testing shall be designed to verify the functional and operational integrity of the subsea production control system.

13.3 Xmas Tree/SCM system integration test (Tree eFAT)

A Xmas Tree/SCM System Integration Test shall be conducted for the Xmas tree, following completion of the Xmas tree FAT within the factory.

14 Special packing/shipping procedures/Instructions

For deliverables consisting of a main assembly with additional loose items (Lifting Slings, Test Hoses/Cables, Fill Lance, Pre-Charge Kit, Fluid in Barrels etc.), separate packing/shipping procedures/instructions with included component check-lists shall be provided.

The same shall apply for deliverables that can not be shipped as complete units, as transportation could result in damage of internal components.

These procedures/instructions should be part of the BOM from the related parts.

For all units which include any fluids or substances, COSHH sheets (Control of Substances Hazardous to Health) shall be delivered with the unit. These COSHH sheets shall be available early in the process for supply to the client.

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

26JUL07	Issued Approved for construction	J. Grochowski	G. Durand	A. Weilandt
11JUL07	Issued for Client Comment	J. Grochowski	G. Durand	A. Weilandt
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Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Installation, Retrieval & Maintenance Procedure For Subsea Anode Package Assembly (SAPA) And SAPA Foundation Base (SAPAFB)**

PAGE 1 OF 11	**Customer Document Number:**	54NL92-W-0P-536	REV. 1
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A	22MAI07		Initial Release
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Table of Contents

1 Abbreviations

BOM	Bill Of Material
CAM	CAMERON
EPCU	Electrical Power & Communication Unit
FAT	Factory Acceptance Test
FB	SAPAFB
LTC	Long Term Cover
MCS	Master Control Station
N/A	Not applicable
PCS	Production Control System
PN	Part Number
SAPA	Subsea Anode Package Assembly
SAPAFB	Subsea Anode Package Assembly Foundation Base

2 Scope

This document covers the requirements for the installation, retrieval & maintenance of the CAMERON SAPA and SAPAFB within the K5F project.

3 Reference Documents / Drawings

Description	CAM Doc. No.
Bill of Material (BOM): SAPA	223170-49
Assembly Drawing: SAPA	SK-066170-49 (54NL92-W-03-505)
Bill of Material: SAPAFB	223211-01
Assembly Drawing: SAPAFB	SK-066211-01 (54NL92-W-63-504)
Anode Umbilical Assembly Drawing	SK-066406-02 (54NL92-W-03-542)

4 Required Equipment

4.1 Equipment for Subsea Installation

2 off SAPA (A&B)
1 off SAPAFB
1 off Subsea Lifting Set for SAPAFB or SAPA as applicable
1 off adjustable spanner (to remove top cover grating)

4.2 Equipment for Surface Installation

Wire rope slings PN 2197010-07-60 for SAPA

5 Safety / Warnings

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

All personnel must acquaint themselves fully and strictly adhere to all company sites' HEALTH AND SAFETY AT WORK REGULATIONS, together with other specific requirements detailed in this procedure.

All work is to be carried out within either a dedicated test bay area with authorised personnel entry points, or an area adequately protected from unauthorised access with a visible cordoned zone and adequately displayed warning signs detailing the test type and associated hazards.

The lifting and handling of the equipment must be carried out with extreme caution and with regard to the safety regulations.

All personnel in contact with the hydraulic fluid must wear suitable protective clothing and gloves if required, regarding all the necessary precautions detailed on the fluid data sheets.

For work, which includes the use of pressurised fluid, compressed gas and/or electrical voltage, all necessary suitable and adequate precautions must be taken prior beginning of work.

All personal working on the equipment must have the required experience, training and qualifications.

ENSURE THAT NO ELECTRICAL POWER IS APPLIED TO ANY OF THE CONNECTIONS IF CONNECTIONS ARE MADE – UP OR DISCONNECTED.

6 System Description

The two (2) SAPA (A&B) feed back the electric current via the seawater from the cathodes. The applied voltage will be approx. 3000V DC during system operation. The two (2) SAPA will be mounted on the SAPAFB for deployment.

7 Lifting of a SAPA Module on Surface

Note: All offshore operations to comply with appropriate Permit to Work system.

Lifting weight: approx. 1,5 t in air

Do not use the supplied wire rope slings for subsea deployment. The slings PN 2197010-07-60 are for surface handling of one (1) SAPA only.

Visually inspect the package for damage before and after lifting.

Verify:_____

Refer the four (4) lift points at the edges of the SAPA. Attach wire rope slings for four (4) point lifting.

Verify:_____

Lift the SAPA a few centimetres off the ground and check that safe lifting is possible.

Verify:_____

Lift and set down the SAPA carefully to prevent the plastic corners and other plastic parts from damage.

Verify:_____

8 Subsea Installation and Retrieval

8.1 General Requirements for Installation and Retrieval

DANGER!

Risk of electric shock for diver. Switch off electric power for the correct SAPA at EPCU before disconnection / connection. Secure electric power against turning on. Refer to tagging and never confuse SAPA modules subsea.

Refer to drawing "General Arrangement PCS" for cable interconnection of SAPA modules. Cables are colour coded.

SAPA module lifting weight: Approx. 1,1 t in water.

Lifting weight of SAPAFB with 2 SAPA modules: Approx. 5,2 t in air.
Lifting weight of SAPAFB with 2 SAPA modules: Approx. 4,2 t in water.

8.2 Subsea Installation of SAPAFB together with two (2) off SAPA

Note: It is expected that 2 off SAPA modules will be deployed on its SAPAFB

Visually inspect the SAPA modules for damage. Pay attention for all plastic parts.

Verify:_____

Check that all gratings are in place and tagging is not mixed between A & B modules.

Verify:_____

Ensure that all subsea electric power supply is switched OFF.

Verify:_____

Check that the 2 SAPA are correctly locked on the SAPAFB (with 4 pins screwed to SAPAFB and entering 2 of each SAPA pad eyes).

Verify:_____

Check that the subsea lifting slings are correctly connected to the SAPAFB. .

Verify:_____

Ensure that the route to the subsea destination point is cleared. The seabed must be free of rocks / debris.

Verify:_____

Maximum deployment speed has to be advised:

Maximum Deployment Speed
0.3 m/s

Deploy the SAPAFB to seabed.

Verify:_____

Disconnect and retrieve the subsea lifting set.

Verify:_____

Secure Anode umbilical flange against pulling to the SAPAFB frame according to assembly drawing SK-066211-01.

Verify:_____

Remove top cover grating from SAPA A.

Verify:_____

Connect cable (Tree - PRCM) 1 and (Tree - PRCM) 2 at SAPA A referring to cable colour coding defined in SK-066406-02.

Verify:_____

Reinstall top cover grating on SAPA A.

Verify:_____

Repeat these operations for SAPA B.

Verify:_____

8.3 Retrieval of a single SAPA Module

Switch off the EPCU power supply of the **correct** SAPA that will be removed.

Verify:_____

Prepare a subsea lifting set for the SAPA.

Verify:_____

Prior to any disconnection ensure that a replacement SAPA is prepared for immediate installation with the correct tagging (A or B) and gratings in place.

Verify:_____

Ensure that the route to the SAPAFB is clear.

Verify:_____

Maximum deployment speed has to be advised:

Maximum Deployment Speed
0.3 m/s

Verify:_____

DANGER!

Risk of electric shock for diver. Never access a SAPA that is under live electric power condition.

Refer to tagging and never confuse SAPA modules subsea.

Refer to:
- SAPAFB Assembly Drawing, SK-066211-01.

Identify the correct SAPA and remove top cover grating.

Verify:_____

Remove the electric power cable from the SAPA.

Verify:_____

Reinstall top cover grating.

Verify:_____

Unlock the SAPA from SAPAFB and connect the subsea lifting set to the two (2) edges of the SAPA.

Verify:_____

Retrieve the SAPA and secure it on deck.

Verify:_____

WARNING!
The SAPA connection cables are not to be left uncovered indefinitely. Deploy either a cover or a replacement SAPA within 48 hours of SAPA removal.

8.4 Subsea Installation of a single SAPA Module

Visually inspect the SAPA module for damage. Pay attention for all plastic parts.

Verify:_____

Check that all gratings are in place and tagging is correct (A or B).

Verify:_____

Ensure that the correct (A or B) subsea electric power supply is still switched OFF.

Verify:_____

Check that the subsea lifting slings are correctly connected to the four (4) edges of the SAPA.

Verify:_____

Ensure that the route to the subsea destination point is cleared. The SAPAFB must be free of debris.

Verify:_____

Maximum deployment speed has to be advised:

Maximum Deployment Speed
0.3 m/s

Deploy the SAPA to SAPAFB.

Verify:_____

Disconnect and retrieve the subsea lifting set.

Verify:_____

Ensure that the SAPA is locked on the SAPAFB (with 2 pins screwed to SAPAFB and entering 2 of each SAPA pad eyes).

Verify:_____

Remove top cover grating from SAPA.

Verify:_____

Connect cables (Tree - PRCM) 1 and (Tree- PRCM) 2 at SAPA referring to cable colour coding defined in SK-066406-02.

Verify:_____

Reinstall top cover grating on SAPA.

Verify:_____

9 Maintenance & Repair

The SAPA will be free of maintenance for more then 10 years. An alarm will be indicated on MCS if wear is occurring on SAPA. If repair work is required send SAPA back to:

CAMERON GmbH
Lueckenweg 1
29227 Celle
Germany

Phone: +49 5141 806 0
Fax: +49 5141 806 333

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

19.09.2007	Issued Approved for Con.	J. Grochowski	R. Wrede	G. Durand
21.08.2007	Issued for Client Comm.	J. Grochowski	R. Wrede	J. Dannehl
12.06.2007	Issued for internal IDC	J. Grochowski	R. Wrede	A. Weilandt
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Installation, Retrieval & Maintenance Procedure For Subsea Cathode Package Assembly (SCPA)**		
PAGE 1 OF 10	**Customer Document Number:**	54NL92-W-0P-580	REV. 1
	Cameron Document No.	X-065467-02-12	REV. 01

Document Revision History

Rev	Date	Description of change	Reason for change
A	22. May 2007		Initial Release
B	21. August 2007	Comments included	Internal review
01	19. September 2007	Power supply explained	released

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1 Abbreviations

BOM	Bill Of Material
CAM	CAMERON
EPCU	Electrical Power & Communication Unit
FAT	Factory Acceptance Test
FB	Foundation Base
LTC	Long Term Cover
MCS	Master Control Station
N/A	Not applicable
PCS	Production Control System
PN	Part Number
SAPA	Subsea Anode Package Assembly
SCPA	Subsea Cathode Package Assembly
SPS	Subsea Protection Structure

2 Scope

This document covers the requirements for the Installation, Retrieval & Maintenance of the CAMERON Subsea Cathode Packages (SCPA) within the K5F project. It is applicable for:

- Part Number 223170-50

3 Reference Documents / Drawings

Description	CAM Doc. No.	CAM Doc. No.
Bill of Material (BOM) SCPA	223170-50	N/A
Assembly Drawing SCPA	SK-066170-50	N/A
Interconnection Diagram Production Control System	SK-066001-88-04	54NL92-W-03-530
Generic Installation Procedure for GISMA E-Connectors	X-065467-02-19	N/A

4 Required Equipment

1 off adjustable spanner 20-30mm (to remove / install E-connector with 26mm AF)
For retrieval only: Tool to loosen 50mm AF plastic nuts

5 Safety / Warnings

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

All personnel must acquaint themselves fully and strictly adhere to all company sites' HEALTH AND SAFETY AT WORK REGULATIONS, together with other specific requirements detailed in this procedure.

All work is to be carried out within either a dedicated test bay area with authorised personnel entry points, or an area adequately protected from unauthorised access with a visible cordoned zone and adequately displayed warning signs detailing the test type and associated hazards.

The lifting and handling of the equipment must be carried out with extreme caution and with regard to the safety regulations.

All personnel in contact with the hydraulic fluid must wear suitable protective clothing and gloves if required, regarding all the necessary precautions detailed on the fluid data sheets.

For work, which includes the use of pressurised fluid, compressed gas and/or electrical voltage, all necessary suitable and adequate precautions must be taken prior beginning of work.

All personal working on the equipment must have the required experience, training and qualifications.

ENSURE THAT NO ELECTRICAL POWER IS APPLIED TO ANY OF THE CONNECTIONS IF CONNECTIONS ARE MADE – UP OR DISCONNECTED.

6 System Description

The four (4) cathode packages feed back the electric current via the seawater to the anodes. The voltage applied topside will be approx. 4000V DC during system operation. The four (4) SCPA will be mounted subsea on the Subsea Protection Structure (SPS).

7 Handling of a SCPA Module

Note: All offshore operations to comply with appropriate Permit to Work system.

The SCPA should be handled with 2 persons as a minimum.

SCPA weight: approx. 55 kg in air

Visually inspect the package for damage before and after handling.

Verify:_____

8 Subsea Installation and Retrieval

8.1 General Requirements for Installation and Retrieval

DANGER!

Risk of electric shock for diver. Switch off electric power for all SCPA at EPCU before disconnection / connection. Secure electric power against turning on. Refer to tagging and never confuse SCPA modules subsea.

Refer to drawing "Interconnection Diagram PCS" for cable interconnection of SCPA modules. Cables will be colour coded.

- **The A cables are blue**
- **The B cables are yellow**

Figure: Subsea Protection Structure (SPS), SCPA area in centre

8.2 Subsea Installation of a single SCPA Module

Visually inspect the SCPA module for damage. Pay attention for all plastic parts. Check that the correct tag number (1A, 1B, 2A or 2B) is available.

Verify:_____

Ensure that all subsea electric power supply is correctly switched OFF at the EPCU.

Verify:_____

Check that a tooling basket is prepared for the SCPA.

Verify:_____

Ensure that the route to the Subsea Protection Structure is cleared.

Verify:_____

Deploy the SCPA to SPS.

Verify:_____

Figure: View from inside Subsea Protection Structure to 4 off SCPA mounting areas

Install the SCPA at Subsea Protection Structure by four (4) nuts and connect the electric power cable:

- Orientate and mount the SPCA from outside SPS.
- Install tag and carefully tighten nuts (50mm AF) by hand from inside SPS.
- Check the tag and connect the correct cable (Torque 5-30 Nm).

Verify:_____

Secure cable against pulling if applicable.

Verify:_____

8.3 Retrieval of a single SCPA Module

Ensure that all subsea electric power supply is correctly switched OFF at the EPCU.

Verify:_____

Prepare a tooling basket for the SCPA.

Verify:_____

Prior to any disconnection ensure that a replacement SCPA is prepared for immediate installation with grating in place.

Verify:_____

Ensure that the route to the Subsea Protection Structure is clear.

Verify:_____

DANGER!

Risk of electric shock for diver. Never access a SCPA that is under live electric power condition.

Refer to tagging and never confuse SCPA modules subsea.

Refer also to drawing “Interconnection Diagram PCS”:
Identify the correct SCPA.

Verify:_____

Remove the electric power cable and four (4) nuts (50mm AF) from the SCPA rear side.
Ensure the tag is not lost.

Verify:_____

Retrieve the SCPA and secure it on deck.

Verify:_____

WARNING!
The SCPA connection cables are not to be left uncovered indefinitely. Deploy either a cover or a replacement SCPA within 48 hours of SCPA removal.

- **Long Term Cover male PN 2197088-17-24**

9 Maintenance & Repair

An alarm will be indicated on MCS if wear is occurring on SCPA or SAPA. If repair work is required send SCPA back to:

CAMERON GmbH
Lueckenweg 1
29227 Celle
Germany

Phone: +49 5141 806 0
Fax: +49 5141 806 333

GENERAL PRESERVATION & STORAGE PROCEDURE

FOR

CAMERON CONTROLS EQUIPMENT

07	12. March 2008	J. Grochowski	K. Yahosseini	J. Grochowski
06	14. March 2007	J. Grochowski	B. Müller	J. Grochowski
05	12. May 2006	J. Grochowski	F. Duensing	J. Grochowski
04	18. July 2005	J. Grochowski	F. Duensing	J. Gronstedt
03	6. January 2005	J. Grochowski	A. Kamp	T. Loi
02	14. May 2004	H. Mohwinkel	M. Lehmker	A. Voges
01	27. August 2002	J. Grochowski	K. Seidel	K. Yahosseini
Cameron Rev	**Date**	**Prepared by**	**Checked by**	**Approved by**

Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
D 07	02. April 02	Document layout revised Document Revision Status sheet added	
01	27. Aug 02	CAMTROL equipment added	Request from project
02	14. May 04	Chapter 3: tarpaulin cover usage for outdoor storage added; Chapter 4.2: Storage fluid (for storage of 1 to 2 years) Castrol Anvol changed to Transaqua HT; Chapter 5.3.1.1 added	Requested by project
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04	18. July 05	Comments included	Required by D. Coonrod
05	12. May 06	TUTA requirements included	Required by project
06	14. Mar 07	Umbilical poppet requirement included	Required by project
07	12. Mar 08	Comments included	Required by project

Table of contents

1 Introduction

This document outlines the procedure for preservation and storage of a control system before and after use. This includes Production Control Systems, Workover Control Systems and Drilling Control Systems. The purpose of this procedure is to keep the equipment supplied by Cameron Celle in a proper shape during storage. It will be available for further operations without major refurbishment due to insufficient control during storage.

This document provides instructions to ensure preservation and protection of all typical control system equipment in order to prevent deterioration caused by corrosion, damage, influence of weather and foreign materials, during shipment, storage and installation.

2 Reference Procedures

X-065460-( )-( )	Protective Coating Procedure for Cameron Controls Equipment
X-065390-03	General Protection and Coating Procedure for Cameron Celle Controls Equipment
X-065390-03-00-01	Protection and Coating Procedure for Cameron Celle Controls Equipment
X-027055-01	Corrosion Inhibiting Coating of Machined Surfaces

3 General Storage Requirements for Environment

Before starting any activities for preservation & storage all functions need to be verified. It must be checked that maintenance and repair works have been performed by qualified service personnel and that the control system does not have any mechanical damages on framework, umbilicals, hoses and cables.

Clean and dry the equipment prior to storage and place it under cover (if available) in a clean and dry environment.

For outdoor storage use tarpaulin covers. Ensure that covers are correctly attached and check covers for any damage. Replace damaged covers.

Preferred ambient conditions for storage areas[*)]

Temperature range	:	0 to 40°C
Humidity range	:	0 to 50 % (excluding condensation and frost)

[*)] If above values are not available, humidity and temperature must be within project related specified range.

In areas with high ambient temperatures consider protection against UV light / direct sunlight to protect e.g. plastic materials or compensation systems (thermal expansion).

Atmosphere must be free from harmful substances which can effect resilient seals (e.g. high ozone level).

Store equipment and spare parts with sealing surface protection by protective devices and protect after inspection if necessary.

Consider special storage procedures for critical materials like hydraulic fluid, batteries, rubber goods etc.

Handling and transport of equipment must always be in accordance with the conform procedure, shown in the Operation and Maintenance Manual for the control system.

4 Cameron Controls Standard Hydraulic Control Fluids

This section outlines the Cameron Celle Controls standard hydraulic control fluids. If any other fluid is specified the appropriate data sheet must be considered for preparation and storage of the system.

4.1 Hydraulic Oils

The standard oil types for Cameron Celle Controls equipment are:

- SHELL TELLUS (different types)
- CASTROL BRAYCO MICRONIC 864

Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

Note: Further details for treatment of fluid before and during storage for the specific equipment are listed in section 5.

4.2 Water Based Fluid

The typical water based fluid types for Cameron Celle Controls equipment are delivered by **Mac Dermid CANNING (MARSTON BENTLEY) LTD.**:

- Oceanic HW 511
- Oceanic HW 525
- Oceanic HW 540
- Oceanic HW 443
- Oceanic HD 603 Water/Glycol with lubricant

A typical water based fluid supplied by **CASTROL**:

- TRANSAQUA HT or HT2

A typical water based fluid supplied by **CAMERON**:

- CAMERON 590 X Water / Glycol with lubricant

Note: Further details for treatment of water based fluid before and during storage are listed in the following table.

Water Based Fluid	Suitable Storage Fluid (>6 months)	Suitable Storage Fluid (>1 year)	Suitable Storage Fluid (>2 years)
Mac Dermid CANNING OCEANIC HW 525 Cameron PN 619011-36 OCEANIC HW 540 Cameron PN 619011-28 OCEANIC HW 443 Cameron PN 619011-41	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285
Mac Dermid CANNING Water based fluid with ERIFON HD 603 Cameron PN 619011-46 (Lubricant)	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285
	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	Composition Lubricant/Glycol/Water: 5 % Lubricant: PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	
CASTROL TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	TRANSAQUA HT Cameron PN 619011-53
CASTROL TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	TRANSAQUA HT2 Cameron PN 619011-84
CAMERON Fluid Cameron 590 X Cameron PN 619011-24 (Lubricant)	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 40 % Glycol PN 619011-10 55 % Demineralized Water	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285

5 Specific Equipment Preservation and Maintenance Requirements

Note: Preservation during storage shall be performed in accordance with the check lists shown in section 6.
Any damage occurring during the periodical checks must immediately be repaired and reported to the Maintenance Supervisor.

5.1 Instruments for Surface Containers and Frames

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

All moving parts are to be lubricated with Molycote 3402 or equivalent.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

5.2 Hydraulic Power Unit and Local Control Panel

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines, including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen precharge of each hydraulic accumulator down to 10 bar / 145 psi. This is for safety reasons and to keep e.g. bladder in a stable position.

Air accumulators must be vented and drained of water.

Open ends of piping must be sealed off by plugs or caps.

All moving parts including the push rod of the panel valves must be protected by Molycote 3402 or equivalent.

Operation panels must be protected by a protective cover or door.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anti-condensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect ventilation grills / air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof local control panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

All isolation valves (except drain valves) must be closed. 4/3-way panel valves must be moved to "CENTER" position. 3/2-way panel valves must be in "CLOSE" or "VENT" position.

5.2.1 Hydraulic Oil

For long term storage no fluid exchange is required to get conservation against corrosion if equipment is filled with clean hydraulic oil.

After usage or longer storage (>3 months) hydraulic reservoirs must be checked for cleanliness and water content. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

Note: Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

If the water content of the oil is too high, check the hydraulic fluid for bacterial contamination. Clean the system up if necessary by following instructions of supplier.

Hydraulic lines have to be flushed to customer required cleanliness level.

Note: Cleaning of the hydraulic lines of an empty system must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

5.2.2 Water Based Fluid

General

For long term storage (>6 months) a special fluid preparation is required to get conservation against corrosion of equipment.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Reservoirs must be checked for cleanliness.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluid should be within the system during long term storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions. The table in section 4.2 shows different possibilities for long term (>6 months) storage.

5.3 Remote Control Panel

Painting, frame and moving parts must be checked in accordance with section 5.1.

5.3.1 Electric Remote Control Panel

Cable connections are to be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Operation panel must be protected by a protective cover or door if available.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

Rack mounted equipment shipped separately from cabinets should be bagged with desiccant and tagged with shock fuses.

5.3.1.1 Control Panel for climatic controlled environment

Control panel for use in climatic controlled environment e.g. Master Control Station (MCS), Electric Power Unit (EPU), Remote Workstations etc.

Equipment should be stored in a warehouse in undamaged packaging under the following conditions excluding intensive dust and condensation of humidity.

Temperature -18 - +60°C

Humidity 20-90% RHNC

When packaging has to be opened e.g. for site receive tests it is recommended to use corrosion inhibitors (e.g. Cortec®VCI 110) for further preservation.

5.3.2 Pneumatic Remote Control Panel

Pneumatic connections are to be cleaned up and protected by non aggressive protective shield, protection against dust or mating protective cover if available. Check pneumatic jumper cable as well.

Air receivers must be vented and drained of water.

Operation panel front must be protected by a protective cover or door.

Acryl glass window panes on panels located in hazardous areas must be cleaned with wet cloth only due to electrostatic charge.

5.4 Hydraulic Umbilicals, Umbilical Jumpers & Steel Flying Leads

General Instructions

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the applicable hydraulic fluid.

All hydraulic connections must be cleaned from dirt by using cleaning solvents which do not harm the seals (see Operation and Maintenance Procedure).

The connection plate of the junction boxes must be protected by protective covers.

After cleaning mating protective caps or plugs must be mounted to the quick coupling or single connection.

Stainless steel junction boxes and plates must be covered with a thin film of non aggressive oil.

Painting, frame and moving parts must be checked in accordance with section 5.1.

The umbilical can be stored in a box or on a drum. The minimum bending radius for storage indicated by supplier may not be exceeded.

5.4.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The umbilical shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.4.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

All lines with poppets must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids and compositions (see table in section 4.2).

5.5 Electric Cables and Cable Jumpers

Contacts of electrical connectors must be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Check that cable minimum bending radius is kept for storage.

Cable materials have to be protected for storage to avoid mechanical impact and ageing impact caused by sunlight (UV).

5.6 Umbilical Reels

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cleaned piping must be sealed off by using protective plugs, caps or covers.

Parts for power transmission like gear, chain with sprockets etc. must be protected and lubricated.

Open gear drive with gear ring and cog	-	ANTI SEIZE (or equivalent)
Chain drive	-	ESSO CAZAR K2 (or equivalent)
Gear box for direct drive	-	See Operation and Maintenance Manual of gear box for specific oil type.

5.7 Uninterruptable Power Supply (UPS)

WARNING:

Hydrogen may discharge from batteries and cause explosion (depending from battery type). Sufficient ventilation is required.

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cable connections must be protected with non aggressive protective shield.

For storage of the UPS check the allowed temperature range in Operation and Maintenance Manual to avoid damage of sensitive parts like batteries etc.

Recharge batteries to full range. Deep discharge must be avoided.

Follow specific long term storage procedure for installed type of batteries.

Disconnection of batteries may be required.

Ensure that the UPS is tagged with a shock fuse indicator.

5.8 Subsea Valve Packages

Remark: Subsea valve packages are normally mounted to the subsea running tools (e.g. Lower Marine Riser Package), which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.8.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.8.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.9 Subsea Control Modules (direct / pilot hydraulic types)

Remark: This section is **not** to be applied for CAMTROL subsea control modules. Refer to the "CAMTROL Subsea Production Control Equipment" section.
Subsea Control Modules (SCM) are normally mounted to the subsea running tools which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool. Flushing and testing can be done with the appropriate flushing and testing unit.

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Hydraulic pressure from all lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

If applicable, cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

5.9.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.9.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.10 Hydraulic Flushing and Testing Units

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

Air receivers must be vented and drained of water.

Open connection ends must be sealed off by plugs or caps.

All moving parts must be protected by Molycote 3402 or equivalent.

Junction plates must be protected by an overall cover or individual caps and plugs.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anticondensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

5.10.1 Hydraulic Oil

Reservoirs must be checked for cleanliness and water content. Water content of hydraulic oil must be checked to be within the maximum allowed range. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.10.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.11 Running Tools for Subsea Modules

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines must be discharged.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Hydraulic lines are to be flushed to customer required cleanliness level.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.12 Hydraulic Cylinder (e.g. on SCM Test Stand)

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

Hydraulic cylinders are to be flushed to customer required cleanliness level. Ensure that the cavities are completely filled with hydraulic control fluid. Ensure that no air is left in the cylinders as remaining air might cause corrosion.

Painting must be checked in accordance with section 5.1.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Put piston of the cylinder in retract position. This ensures that the rod is protected inside the cylinder against corrosion or damage.

Grease the cylinder rod with silicon grease or equivalent non aggressive grease.

Store the cylinder in a dry indoor environment. Room temperature should not be below 37°F (3°C).

5.13 Float Type Accumulators

Note: Preservation has to be carried out when the float type accumulators are unused and storage will be longer than three (3) months.

<u>Disassembly of Accumulator</u>

Bleed the pressure from hydraulic fluid supply.

Ensure that the ¼" needle valve at the bottom of the accumulator is in the closed position.

Remove the ¼" NPT plug.

Open the ¼" needle valve at the bottom of the accumulator.

Ensure that the accumulator is depressurised.

Open the hammer union at the bottom of the accumulator.

Ensure that the floater is at the lower end of the accumulator.

Remove the plug at the end of the floater pipe.

Inspect the seals (floater pipe plug, hammer union).

Spray non aggressive anticorrosive lubricant into the accumulator to protect the inner surface of the accumulator.

Carefully move the accumulator in vertical position and ensure that the lubricant flows out of the accumulator.

Assembly of Accumulator

Grease the o-ring of the plug and fix the plug at the lower end of the floater pipe.

Grease the thread at the end of the accumulator bottle and connect the hammer union.

Close the ¼" needle valve at the bottom of the accumulator and install the ¼" plug.

Painting must be checked in accordance with section 5.1.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.14 Topside Umbilical Termination Unit / Assembly

Topside Umbilical Termination Units / Assemblies (TUTU / TUTA) will be treated like Hydraulic Power Units (HPU). The workload is reduced as the TUTU / TUTA does not contain motors, pumps and reservoirs.

5.15 Wire Rope

Grease the wire ropes with wire rope grease. Ommex or Kendal or equivalent wire rope grease can be used.

Store the wire ropes in a dry outdoor or indoor environment.

5.16 Load Cell

Protect the load cells by a thin film of non aggressive oil.

Store the load cells in a dry indoor environment. Room temperature should not be below 37°F (3°C).

6 Preservation Maintenance Check Lists

The following checklists must be used to get a controlled storage of the equipment with proper maintenance.

6.1 Hydraulic Power Unit and Local Control Panel (Main Control Unit)

Preservation Maintenance Check List	**Sheet: 1 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-65390-03-00-00 or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film; repair if necessary	Non aggressive oil
8.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Motors, Distribution Boxes, Relay Boxes, Subswitchboards, Junction Boxes**					
1.0			X		Inspect protection on cable connections; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0		X			Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check drain valves to be open	
6.0			X		Inspect fluid according to section 5.2.1 or 5.2.2	

6.2 Umbilical Reel with Umbilical

Preservation Maintenance Check List — **Sheet: 1 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check lines to be pressureless, drain valves to be open	
6.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.3 Electric Remote Control Panels

Preservation Maintenance Check List						**Sheet: 1 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A. General Inspection						
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, Vaseline or equivalent
4.0			X		Check pneumatic circuits to be depressurized (for purged system only)	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil

Preservation Maintenance Check List						**Sheet: 2 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.4 Pneumatic Remote Control Panels

Preservation Maintenance Check List — **Sheet: 1 of 1**

Description of Equipment: **Pneumatic Remote Control Panels**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on pneumatic hose connection, repair if necessary	Non aggressive protective shield with additional cover
4.0			X		Check pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
7.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
8.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
9.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
10.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
11.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.5 Hydraulic and Electrical Jumpers

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Hydraulic and Electrical Jumpers**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0	X				Check junction boxes and couplings for proper protection by covers, caps or plugs	
4.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield; acid free Vaseline or equivalent; protective caps
6.0			X		Check protection of electric cable against mechanical impact and ageing impact by sunlight	
7.0			X		Check that cable minimum bending radius is kept for storage	
8.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.6 Subsea Valve Package

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Valve Package**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
6.0			X		Check lines to be pressureless; drain valves to be open	
7.0			X		Inspect fluid according to section 5.8.1 or 5.8.2	

6.7 Subsea Control Module (direct / pilot hydraulic types)

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Control Module (not for CAMTROL SCM)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
6.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
7.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
8.0			X		Check lines to be pressureless; drain valves to be open	
9.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
10.0			X		Inspect fluid according to section 5.9.1 or 5.9.2	

6.8 Hydraulic Flushing and Testing Unit

Preservation Maintenance Check List						**Sheet: 1 of 3**
Description of Equipment:	**Hydraulic Flushing and Testing Unit**					
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
6.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List	**Sheet: 2 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C. Hydraulic Circuits						
1.0			X		3/2-way valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way valves to be in open centred position; function lines to be pressureless	
3.0			X		Check lines to be pressureless; drain valves to be open	
4.0			X		Inspect fluid according to section 5.10.1 or 5.10.2	

6.9 Running Tool for Subsea Module

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Running Tool for Subsea Module**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
6.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
7.0			X		Inspect fluid according to section 5.11	

7 CAMTROL Subsea Production Control Equipment

Note: Use the instructions in this section as check lists.

7.1 Subsea Control Module / SCM

Check on the bill of material if individual “Shipping, Transportation and Storage Guidelines” are available for the SCM, otherwise follow the instructions below:

Verify: _____

Store the SCM in the crate until it is required for use.

If it is necessary to gain access to the SCM, remove the top and sides of the crate, but leave the SCM on the shipping frame.

Visually inspect the SCM / packing before use and every **3 month** when it is not used.

Verify: _____

The storage environment must be free from harmful substances which can affect resilient seals (i.e. high Ozone level).

Verify: _____

The ambient temperature for storage must be within the range -10°C to 40°C to maintain the integrity of the pressure compensation system and ensure that no dielectric oil bleeds out.

Verify: _____

CAUTION:
If the loss of dielectric oil exceeds 3 Litre the SCM needs to be refilled in accordance to Cameron “Field refill procedure”. The lower reservoir of the shipping frame is seized to 3 Litre. If you are in doubt please contact Cameron Germany Engineering Department (Tel +49 (0)5141 8060).

7.2 Subsea Accumulator Module / SAM

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Any damage occurring during the periodical checks must immediately be reported and repaired by Cameron Controls.

Verify: _____

Drain the hydraulic pressure from the accumulators.

Verify: _____

Bleed nitrogen pre-charge from the accumulators. Leave 10 BAR residual pressure in the accumulator to prevent the bladder from collapsing.

Verify: _____

Close the two (2) Gas Valves on the HP Accumulators.

Verify: _____

Open ends of Accumulators must be sealed by plugs or protective caps off stainless steel on the gas side off the accumulators.

Verify: _____

Lubricate all moving parts, except the Hydraquad hydraulic connectors, by water-resistant grease.

Verify: _____

Painting, frame and moving parts must be checked for damage.

Verify: _____

Stainless Steel parts must be protected by a thin film of non aggressive oil (Pelox Protector or similar).

Verify: _____

7.3 Subsea Distribution Unit / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.3.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Set all valves to CLOSE position.

Verify: _____

Protect the mounting base of the SAM by a protective cover.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes

Verify: _____

7.3.2 Electrical Parts

Check that all ROV connectable fuses are installed.

Verify: _____

Check that all electrical connectors are protected by caps

Verify: _____

7.4 Umbilical Termination Assembly / UTA

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.4.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes.

Verify: _____

7.4.2 Electrical Parts

Check that all electrical connectors are protected by caps.

Verify: _____

7.5 Foundation Base & Mud Mate for UTA / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Foundation Base only: Verify the proper operation of the two (2) pile locks and confirm that they are in the unlocked position.

Verify: _____

Check the SDU locking mechanism by operating.

Verify: _____

Check the guide post locking mechanism by operating.

Verify: _____

Inspect all lift shackles for deformation and other damage.

Verify: _____

Check condition of all protection anodes.

Verify: _____

8 Handling Requirements for Special Materials

8.1 Rubber Goods

GENERAL

There is very little published information on the storage and care of rubber goods as used in the oil field. When we speak of rubber goods we include the synthetic packings of Nitrile Copolymers and Neoprene as well as natural rubber parts. Natural rubber parts have become relatively rare but the same things that are harmful to natural rubber are also harmful to the synthetics in varying degrees.

Generally speaking, light and air are bad for rubber goods. The exact chemical action is not fully understood and what has been written disagrees on the mechanism involved.

Ozone is known to be bad for rubber goods. Ozone (O_3) is a very active form of oxygen. As far as we know two principle sources contribute the ozone that reaches rubber goods. One is atmospheric ozone which is generated in the stratosphere carried downward by convection currents and eventually absorbed by organic matter. The other source is electrical discharges, such as lightning, high voltage corona, but more commonly, electrical machinery. Ozone attack is characterized by fairly deep cracks in the rubber parts.

Rubber is attacked by ordinary oxygen (O_2) much as steel rusts in the presence of oxygen. Oxidation is characterized by a hard skin which eventually crazes in a multitude of small cracks and may turn chalky or assume a bark-like appearance.

A strong direct light, especially sunlight, has deleterious effects on rubber goods. This is attributed to the ultraviolet content of the spectrum which accelerates cracking. Whatever the mechanism however, light, particularly sunlight, is undesirable. In extremely cold climates some rubber goods will become so brittle that upon dropping or rough handling they will shatter.

In very warm humid climates, particularly those found in some parts of the tropics, fungi and bacteria find their way to the rubber goods and attack the organic content. This is especially true on duck reinforced rubber parts. However, parts reinforced with synthetics will not be attacked in the reinforcement.

Heat also has a bad effect on rubber. This could be the result of sunlight or artificial or accidental heating of any type. Heat results in a gradual hardening of the part and if ozone or oxygen are present, will accelerate their action.

Any stretching or bending of rubber in storage will result in very accelerated ageing. By the term ageing, we mean the cumulative effects of all the above mentioned attacking agents over a period of time. Ozone attacks rubber preferentially at points of strain.

Rubber goods, both natural and synthetic, all possess some degree of susceptibility to various solvents including water, but especially the liquid hydro-carbons. These manifest themselves in various ways by either swell or shrinkage of the rubber goods with which they are in contact.

No precise figure can be given as a "storage life" of a part. This is dependent on all of the above conditions and also the size of the part, its material and function. Generally speaking, the greater the relative surface area is to the volume, the more susceptible a part is to being rendered useless by ageing. For example, a relatively bulky part such as a ram front packer might be expected to have a much longer useful shelf life than a thin large diameter o-ring type of seal such as used on the bonnet seals of preventers or the rings in 'X' bushing.

STORAGE

From the preceding section we can draw a few rules governing storage of rubber goods. Briefly put - a cool, dry, dark storage place would be the best. The ideal would be to store the packings in vacuum sealed containers. The following rules, however, should not be difficult to follow under the average storage conditions experienced throughout our operation.

- Keep the rubber storage area as dark as possible. Certainly not out of doors, and, if indoors, away from skylights or windows and with subdued or indirect artificial lighting.
- Select the coolest location possible and be sure that no heaters or stoves are near by and particularly that the direct blast from a space heater does not blow on the rubber parts.
- Be sure that no electrical machinery (motors, switch gear, or any high voltage equipment producing corona) is near the rubber goods and that drafts will not carry the atmosphere from electrical machinery to the area in which the rubber goods are stored.
- The practice of first in - first out is essential with rubber goods. There is a natural tendency to remove parts from the front of a bin and when stock is replenished to leave the parts that are in the back in place, in which case years might pass before these are finally pulled out for use.
- Store rubber goods in a relaxed position. For example, do NOT hang o-rings on nails. Where possible, do not keep assemblies in stock where the rubber goods are stretched in order to assemble them on the part. For example, o-rings on blanking plugs, tubing hangers and 'X' bushing. In some cases this is difficult as it is with the aforementioned 'X' bushings. On these, periodic inspection should be employed to detect any signs of ageing as quickly as possible.

  On parts, such as the 'X' bushing rings, where we know the rubber parts will be stretched in storage, the best age resistant compounds we can buy are used.
- Keep storage as dry as possible and remove any oil, gas, etc. of hydro-carbon nature that may accidentally get on the rubber.
- Do not store the rubber goods on top shelves near galvanized roofs. There are several reasons for this; one is that heat is passed through galvanized roofing and also there is some opinion that ozone may be generated in this area.
- If possible, store rubber goods in buildings of wooden construction and wooden shelves. Wood is believed to scavenger ozone quite effectively.
- If store for extended periods is unavoidable, sealed containers will aid considerably; impervious surface coverings such as "Sea-Peel" or waxing will help.

USABILITY CHECKS

No general rule can be drawn regarding usability. The final measure is whether or not the cumulative effects of ageing have affected the physical properties of the part to such an extent that it will no longer perform the function for which it is designed. Thus, a large heavy part might suffer the same total amount of ageing as a small, light, thin piece, and still be usable whereas the small part is rendered useless. In these cases some judgement must be used in deciding usability.

Prior to shipment or use out of stock, rubber goods should be examined to see that no "chalking" or "barking" (bark-like surface appearance) is present, that there is not a hard skin on the rubber and that there are no cracks. Sometimes cracks will be obvious, but it is wise to stretch or bend the part in question so that any incipient cracks or very thin cracks will reveal themselves. Where a part is suspect, a check of hardness should be run. In the event that the hardness runs 15 points higher than the nominal hardness of the part, it is considered non-usable. Hardness is affected by temperature and readings should be taken with the rubber part at 70°F – 100°F (21°C - 38°C).

8.2 Hydraulic Hoses

STORAGE

- Before placing hose in storage, it should be completely drained.
- Whenever feasible, store the hose in the original wooden shipping crate. This will provide some protection against the deteriorating effects of solvents, corrosive liquids, ozone and sunlight. Hose should be stored so that the coils are in a horizontal plane.
- Certain rodents and insects will damage the hose. Adequate protection from them should be provided.
- The ideal temperature for storing the hose ranges from 50°F (10°C) to 70°F (21°C) with a maximum limit of 100°F (38°C). If stored below 32°F (0°C), the hose will become stiff and would require warming before placed in service. The hose should not be stored near sources of heat, such as radiators, base heaters, etc., nor should the hose be stored under conditions of high or low humidity.
- To avoid the adverse effects of high ozone concentration, the hose should not be stored near electrical equipment that may generate ozone or be stored for any lengthy period in geographical areas of known high ozone concentration. Exposure to direct or reflected sunlight - even through windows - should also be avoided.

HANDLING

CAUTION: Care should be exercised to prevent mishandling. Crushing or kinking of the hose can cause severe damage to the reinforcement. If this occurs, remove hose from service.

- In order to minimize the danger of kinking, the hose preferably should be removed from its crate by hand, laid out in a straight line, then lifted by means of a catline attached near one end of the hose. If a catline is used to remove the hose from its crate, the crate should be rotated as the hose is removed. Recommended practice is to protect the hose in some manner when moving to a new location. It is considered bad practice to handle the hose with a winch, to hand the hose from a truck gin pole, or to place heavy pieces of equipment on the hose.

8.3 Electronic Goods and Tools containing Electronics

8.3.1 General Instructions

Rapid temperature changes must be excluded to avoid condensation of humidity and mechanical stress.

The packing should protect electronic goods against:

- Dust
- Humidity
- Electrostatic Charge
- Shock
- Direct Sunlight

Generally the original transport packing serves the above requirements best.

Normally antistatic bags, desiccant and anti-shock pads are applied to prevent damage.

Electronic goods should be stored in a warehouse secured against theft.

8.3.2 Fiberoptic Terminations

Optic Link Modules (OLM) should be capped. Caps have to be removed before installation.

8.3.3 Handling Procedure for CMOS Devices

Electrical environments such as overvoltages and electrostatic discharges damage CMOS devices and printed circuit cards containing the devices. Most CMOS devices have diode input protection circuits and gate protection structures to protect against such electrical environments.

In addition to the internal protection network, use the following steps to prevent the generation of severe electrical transient voltages during handling of CMOS devices.

- Read the manufacturer's equipment specification and data sheets before performing maintenance. Do not exceed recommended maximum voltage levels.
- Use grounding wrist straps which contact the skin.
- Ground all work surfaces.
- If lead-straightening or hand-soldering is necessary, provide ground straps for the equipment, and ground the soldering ties.
- Connect all unused inputs to an appropriate logic voltage level, either power or ground.
- Inspect test equipment for proper polarity of voltage before conduction parametric or functional testing.
- Inspect all power supplies used for testing to ensure there are no voltage transients present.
- Do not insert or remove devices from test sockets with power applied.
- Do not contact edge connectors which are wired directly to device inputs.
- If external connections to a printed circuit card address only an input of the integrated circuit, use a resistance of 10 K ohms or greater in series with the input. The resistance limits damage to the card if it is removed and contacts static generating materials.
- Connect all low impedance equipment such as pulse generators to inputs only after the device has power applied. Disconnect the equipment before power is removed.
- Do not allow nylon or other static generating materials to contact the devices.
- Store or transport the devices in materials that are antistatic. Do not insert the devices into plastic packing material, styrofoam, or plastic trays.

8.3.4 Lithium Manganese Dioxide Battery

Replacement of the Lithium Manganese Dioxide battery mounted in the subsea transmitter & battery module: The battery supports the AMF-System (Automatic Mode Function / Dead Man System) belonging to multiplex drilling control systems. Under normal operation conditions replacement is required **after each one-year period**. Battery storage conditions should be in a range of 23°F – 59°F (–5°C to 15°C).

9 Attachment

- Data Sheets of Protective Materials (if required)
- Data Sheets of Hydraulic Fluids (if required)

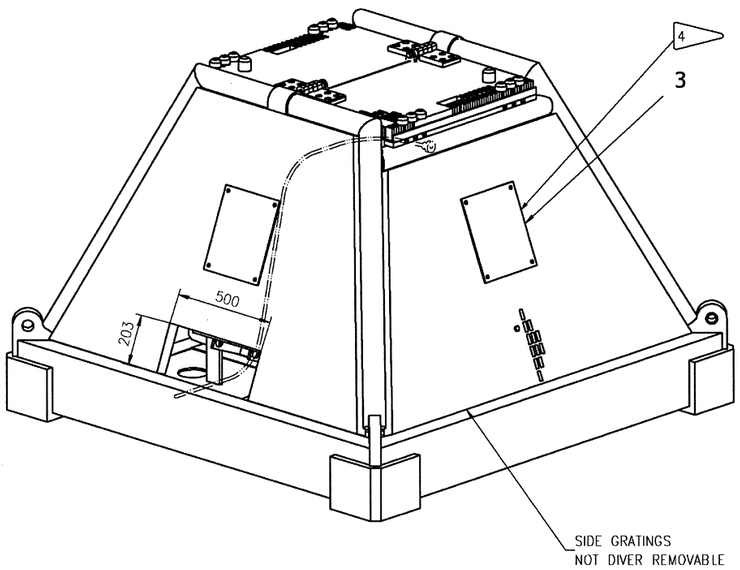
STATUS: Released REVISION : 05
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SAPA, K5-F

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
001	0001	01	222274-98	4.000	EA	PLASTIC PROTECTION FOOT		
002	0002	05	222416-70	1.000	EA	K5F SAPA FRAME		
003	0003	01	222513-88	4.000	EA	TAG PLATE		
004	0004	01	222720-13	2.000	EA	GUIDE BEAM		
005	0005	02	222720-14	2.000	EA	HOLDER BEAM TOP		
006	0006	01	222720-15	2.000	EA	HOLDER BEAM BOTTOM		
007	0007	01	222720-20	2.000	EA	GUIDE BEAM		
008	0008	02	2197999-43	2.000	EA	ANODE & WELDED CONNECTOR SUPPLIER FOR THE COMPLETE ASSEMBLY: HANS-HERMANN PAREIDT KUPFERSCHMIEDE GMBH D-30982 PATTENSEN		
010	0010	01	2197010-07-60	1.000	EA	LIFTING SET: 4 LEGS- 14T-2500 MM		
011	0011	02	223450-28	1.000	EA	TAGGING & MARK. ANODE PACKAGE TOTAL K5F		
012	0012		2731660-01	1.000	EA	FIBREGRATE HLC (HIGH LOAD CAPACITY) MOLDED 2" DEEP X 1" X 2" GRID. 6' WIDE X 4' SPAN. VINYLESTER RESIN, WITH ALUMINIUM OXIDE GRIT TOP SURFACE. COLOUR YELLOW.		
013	0013		619901-15-26-15	40.000	EA	SCREW, HEX, DIN 933, M12 X 70, PLASTIC		
014	0014		619901-15-30-15	12.000	EA	SCREW, HEX, DIN 933, M12 X 90, PLASTIC		
015	0015		619910-18-19	104.000	EA	NUT, HEX, DIN 934, M12, PLASTIC		
016	0016		619919-15-02-13	184.000	EA	WASHER, MEDIUM, DIN 125, B 13, PLASTIC TYPE B: WITH CHAMFER ; ID: 13 MM		
017	0017		619010-03-19-02	4.000	EA	BUSH, DIN 1850 TYPE S, 35 X 45 X 50 ID x OD x W: 35 x 45 x 50 mm MATERIAL: POLYAMIDE 6 (PA 6)		
020	0020		619907-12-14-15	18.000	EA	SCREW, FLAT, DIN 963, M6 X 25, PLASTIC		
021	0021		619910-14-19	18.000	EA	NUT, HEX, DIN 934, M6, PLASTIC		
022	0022		619919-11-02-13	18.000	EA	WASHER, MEDIUM, DIN 125, B 6.4, PLASTIC		

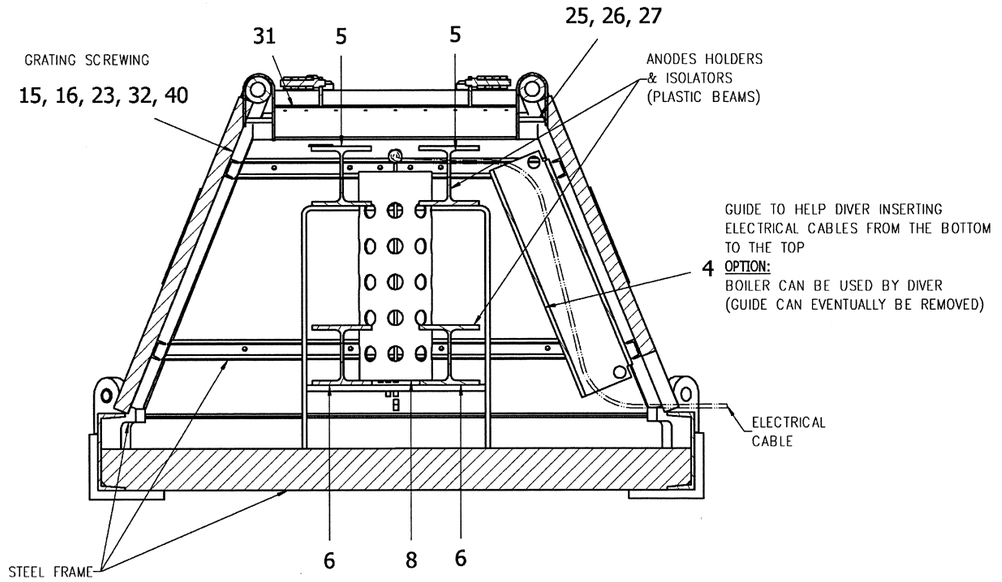
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						TYPE B: WITH CHAMFER ; ID: 6.4 MM		
023	0023		619907-15-23-15	48.000	EA	SCREW, FLAT, DIN 963, M12 X 70, PLASTIC		
024	0024		619907-15-25-15	16.000	EA	SCREW, FLAT, DIN 963, M12 X 90, PLASTIC		
025	0025		619901-17-36-15	4.000	EA	SCREW, HEX, DIN 933, M16 X 140, PLASTIC		
026	0026		619910-20-19	8.000	EA	NUT, HEX, DIN 934, M16, PLASTIC		
027	0027		619919-17-02-13	4.000	EA	WASHER, MEDIUM, DIN 125, B 17, PLASTIC TYPE B: WITH CHAMFER ; ID: 17 MM		
030	0030	01	222208-01	2.000	EA	STOPPER FOR FIBREGRATE HLC		
031	0031	01	222208-03	1.000	EA	HOLDER FOR FIBREGRATE HLC		
032	0032	01	222208-04	48.000	EA	HOLDER FOR FIBREGRATE GRP		
033	0033	03	222500-04-17	1.000	EA	PLATES FOR FIBREGRATE HLC		
034	0034	01	222725-43	2.000	EA	HINGE FOR FIBREGRATE HLC		
035	0035	01	222275-21	12.000	EA	NUT FOR FIBREGRATE HLC		
040	0040		619025-01-10	2.000	EA	GRATING, 4047 X 1007 X 38 MM, GRP GRID SIZE: 40 X 40 MM. MATERIAL: GRP. COLOUR: LIGHT GREY (RAL 7035). FIRE-RETARDANT, SELF-EXTINGUISHING. ANTI-SKID CONCAVE MENISCUS. WEIGHT: 19.8 kg/m2.		
>>>B/M Category : Engrg Spec/Document item								
100	0100	05	SK-066170-49	1.000	EA	AS: K5F Subsea Anode Package Ass. (SAPA)		
101	0101	01	QP-000160-01-28	1.000	EA	QP Anode/Cathode Package DC-Tree System		
102	0102	01	X-065437-01-15	1.000	EA	FAT: SAPA, K5F		
103	0103	01	X-065467-02-11	1.000	EA	IP: SAPA Subsea, K5-F Installation, Retrieval & Maintenance Procedure for Subsea Anode Packages Project: TOTAL K5-F		
110	0110	01	X-076709-03-77	1.000	EA	PACKING INSP. REC. K5F ANODE PACKAGE		
111	0111	07	X-065429	1.000	EA	GENERAL PRESERVATION AND STORAGE PROCEDURE FOR CAMERON CONTROLS EQUIPMENT		
>>>B/M Category : Expendable item								
130	0130		619011-69	3.000	EA	ADHESIVE AND SEALANT, Flex 310 M		

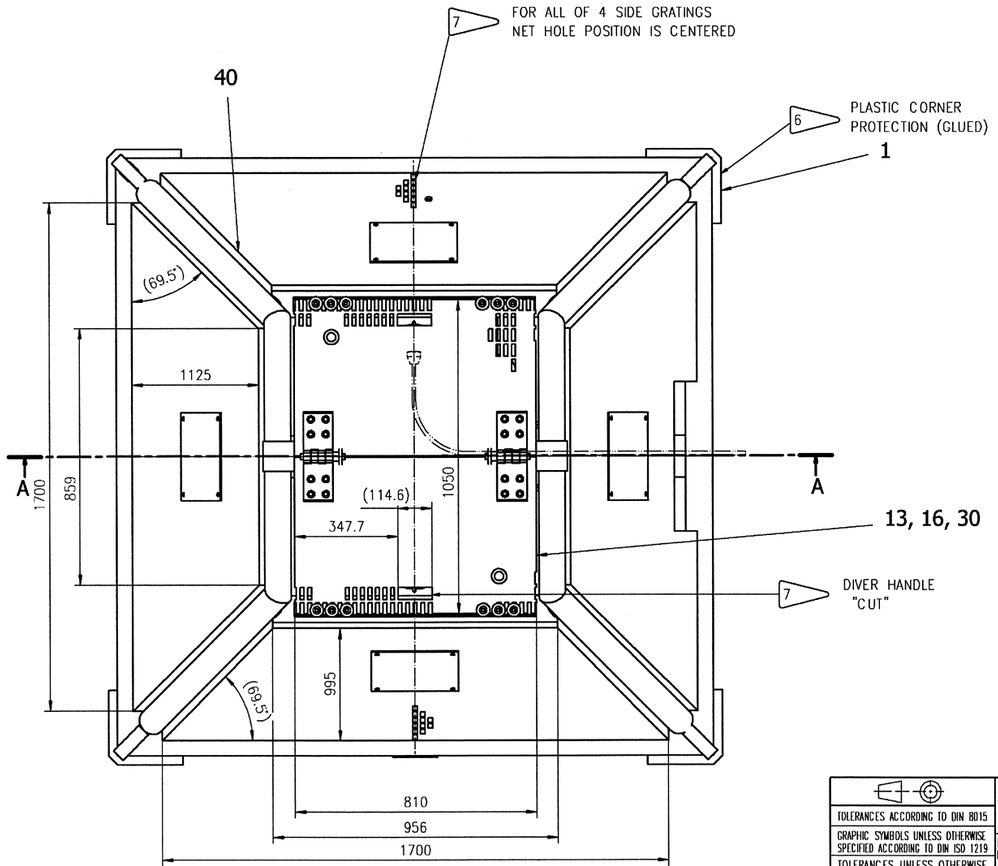
SORT ITEM INDI No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
					1-COMPONENT ADHESIVE AND SEALANT TYPE: WEICON Flex 310 M CHEM. BASE: 1-PART POP POLYMER CONSISTENCY: PASTY , NON-FLOW TEMP. RESISTANT: -40°C / +90°C COLOUR: BLACK VOLUME: 310 ml / PE-CARTRIDGE ELASTIC, HIGHLY ADHESIVE, SANDABLE, OVERPAINTABLE, FREE OF ISOCYANATE AND SOLVENTS, METAL-TO-METAL BONDING...		
>>>B/M Category : Reference Call Outs							
1000 1000	08	A-020025	1.000	EA	Total L4G and K5F Paint Spec. - WITNESS This specification controls the Total witness requirements The test sample adhesion testing. Personnel qualification.		

VIEW WITH TOP PLATE

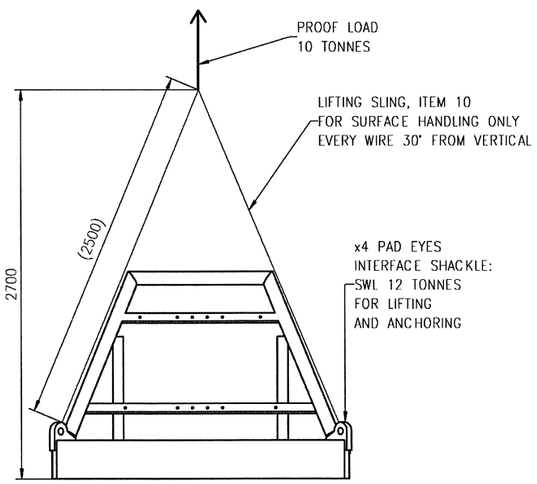


A-A





FRAME PROOF LOAD TESTING (1 : 20)



NOTES:

1. WEIGHT ALL EQUIPED IN AIR: 1500 KG
   WEIGHT ALL EQUIPED IN WATER: 1100 KG
2. COATING:
   STRUCTURAL PARTS COLOR: YELLOW
   EXCEPTION: PAD EYES: ORANGE RAL 2004
3. BOLTING: ALL IS HM12 PLASTIC BOLT, TORQUE: 8Nm
4. IDENTIFICATION ON DIVER IDENTIFICATION TAG PLATE
   LETTER "A" PAINTED FOR PACKAGE A
   LETTER "B" PAINTED FOR PACKAGE B
   LETTER HEIGHT: 200 MM
   LETTER COLOR: BLACK
   TAG PLATE COLOR: YELLOW
5. BOTH PACKAGES, A & B HAVE THE SAME P/N
6. GLUING
   - ENSURE BOTH PARTS ARE CLEANED
   - GLUE DIRECT ON FRAME COATING
   - USE GLUE BOM ITEM 18
7. GRATINGS CUT RECOMMANDATIONS
   ALL CUT EDGES OF THE GRATINGS TO BE SEALED WITH POLYARETHANE LACQUER (PUR)
8. GRATING:
   THICK: 50,8 – NET: 25,4 x 50,8 – HOLE: 13 x 40 MM
9.

TABLE OF TAG NUMBERS	
SAPA	TAG NUMBER
A	SA-92100A
B	SA-92100B

FOR INFORMATION:

CORROSION PROTECTION STRATEGY

1. FRAME
   - NO SACRIFICIAL ANODE (R&D REQUIREMENT)
   - FRAME BEAM WALL THICKNESS OVERSIZED
2. BOLTING MATERIAL: PLASTIC (ANTI CORROSION)
3. COATING PROTECTION WITH PLASTIC FOOTS AND BUSHINGS IN PAD EYES

DIVER OPERATIONS FOR CABLE CONNECTION

1. REMOVE TOP GRATING
2. INSERT THE CABLE FROM THE BOTTOM THROUGH THE SMALL SKID
3. CONNECT CABLE TO ANODE
4. RE-INSTALL TOP GRATING

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

REISSUED AS APPROVED FOR CONSTRUCTION	17JAN08	2
APPROVED FOR CONSTRUCTION	04JUN07	1
ISSUED FOR CLIENT COMMENT	03AVR07	N/A
RE-ISSUED FOR INTERNAL IDC	26MAR07	N/A
ISSUED FOR INTERNAL IDC	06MAR07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-03-505

CAD

REV. BY: W. Dill | DATE: 28.02.2008 | REV.: 05

SURFACE TREATMENT: DO NOT SCALE

MATERIAL AND HEAT TREATMENT:

DRAWN: G. Durand	DATE: 05.04.2007
CHECKED: J. Lohrer	DATE: 28.02.2008
APPROVED: M. Lehmker	DATE: 28.02.2008

TOLERANCES ACCORDING TO DIN 8015

GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219

TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

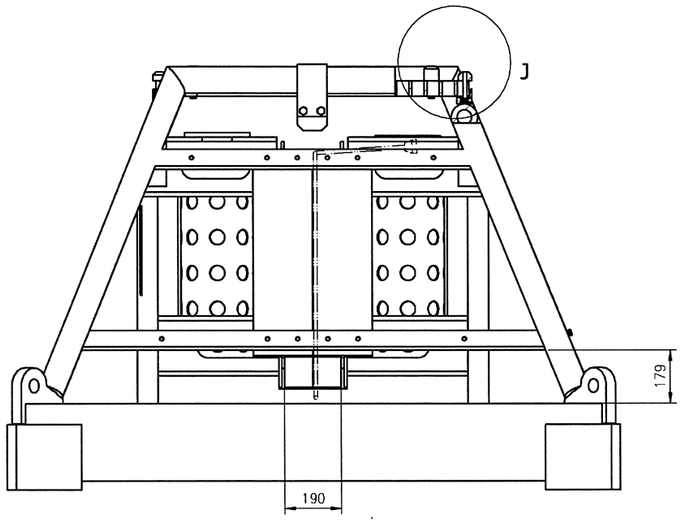
EST. WEIGHT: 1500 KG | SUPERSEDES: | SCALE: 1:10

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

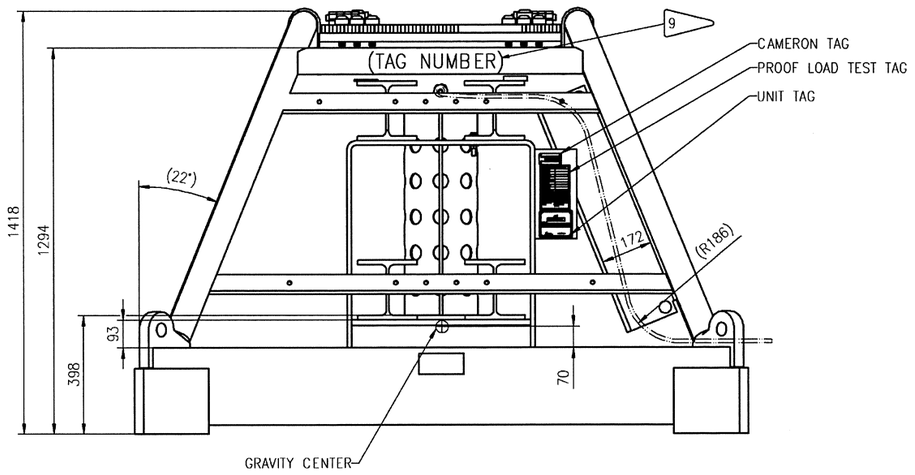
SUBSEA ANODE PACKAGE ASSEMBLY (SAPA)
ASSEMBLY DRAWING

INITIAL USE BOM: 223170-49 | SHEET: 1 OF 2 | DRAWING NUMBER: SK-066170-49

VIEW WITHOUT "SIDE" GRATING

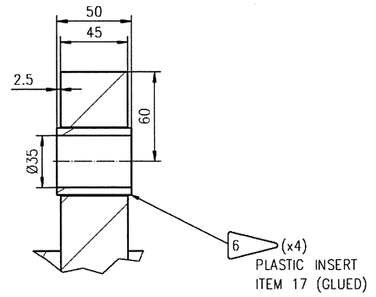


VIEW WITHOUT "SIDE" GRATING

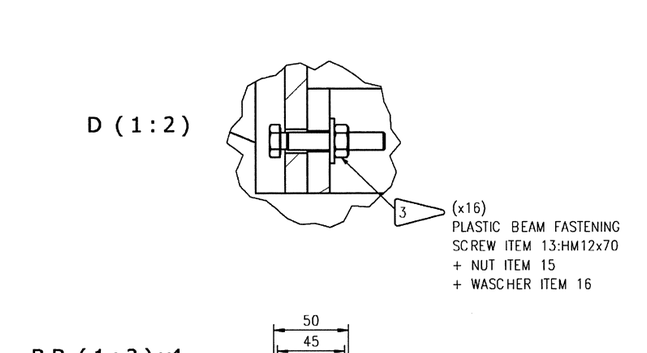


D (1 : 2)

B-B (1 : 2) x4

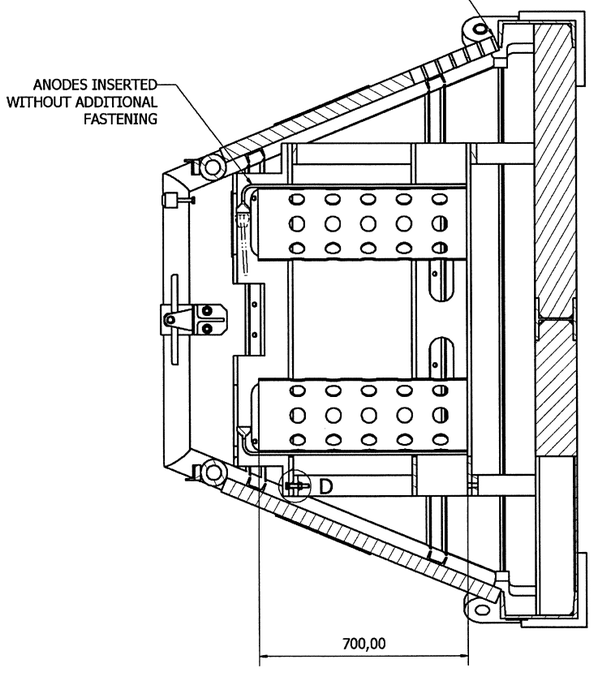


J (1 : 2)



"VERTICAL" NET CUT POSITION FOR ALL 4 SIDE GRATINGS

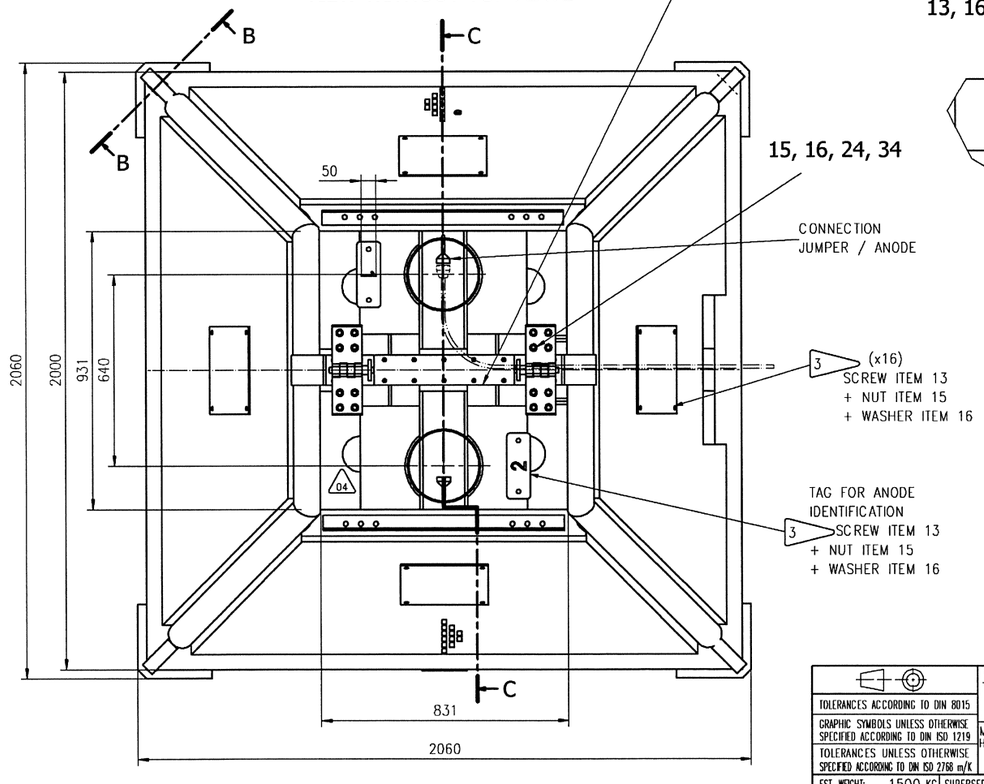
C-C (1 : 10)



20, 21, 22, 33

VIEW WITHOUT TOP PLATE

15, 16, 24, 34



Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W03-505 | CLIENT REV.: 1

CAD	REV. BY: W. Dill	DATE: 28.02.2008	REV.: 05
SURFACE TREATMENT	DO NOT SCALE	DRAWN: G. Durand	DATE: 05.04.2007
TOLERANCES ACCORDING TO DIN 8015		CHECKED: J. Lohrer	DATE: 28.02.2008
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	MATERIAL AND HEAT TREATMENT	APPROVED: M. Lehmker	DATE: 28.02.2008
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K			
EST. WEIGHT: 1500 KG	SUPERSEDES:	SCALE: 1:10	

CAMERON GmbH, Lückenweg 1, 29227 Celle, Germany

SUBSEA ANODE PACKAGE ASSEMBLY (SAPA) ASSEMBLY DRAWING

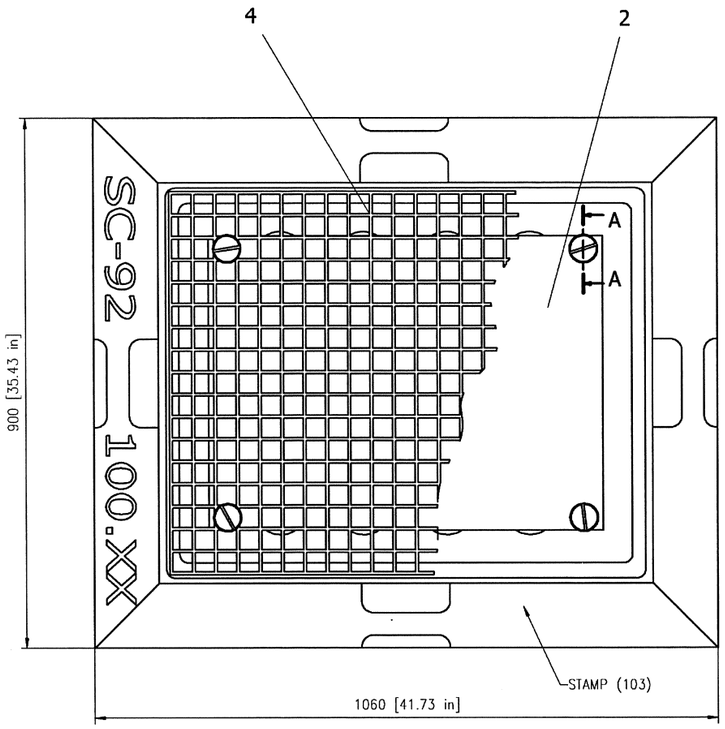
INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223170-49	2 OF 2	SK-066170-49

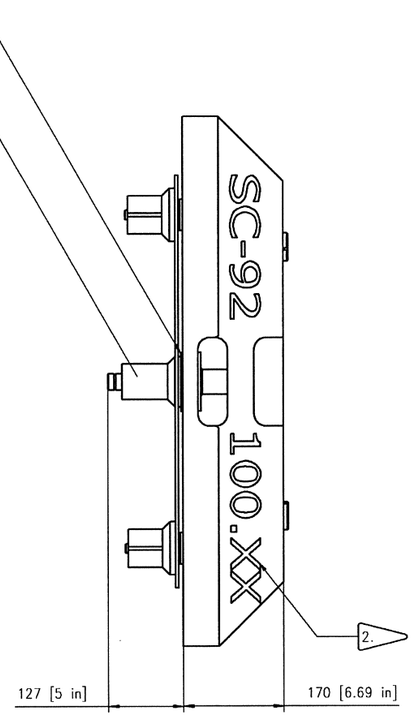
STATUS: Released

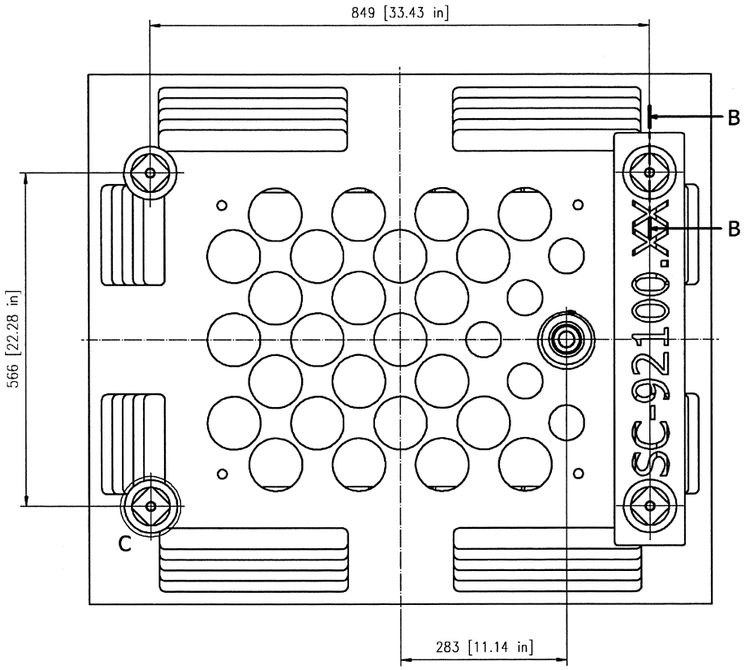
STATUS: Released REVISION : 02
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SUBSEA CATHODE PACKAGE ASSEMBLY
SCPA, TOTAL K5-F DC

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
001	0010	02	222416-83	1.000	EA	CATHODE FRAME FOR CATHODE PACKAGE MATERIAL OBOMODULAN 652 SUPPLIER OBO WERKE		
002	0020	04	2197999-41	1.000	EA	CATHODE WITH CONNECTION FOR RECEPTACLE SUPPLIER FOR THE COMPLET ASSEMBLY: HHP - HANS HERMANN PAREIDT KUPFERSCHMIEDE GMBH D-30982 PATTENSEN		
003	0030	01	222244-85	8.000	EA	BUSHING FOR CATHODE PACKAGE MATERIAL PE-HD 300 (BLACK)		
004	0040	02	2197010-08-12	1.000	EA	GLASS-FIBRE REINFORCED GRATING FOR TOTAL K5F CATHODE PACKAGE DIMENSION: 803 X 651 X 38MM GRID SIZE: 38 X 38MM		
005	0050	01	222205-30	4.000	EA	PE-BOLT FOR CATHODE PACKAGE MATERIAL PE-HD 300 (BLACK)		
006	0060	02	222275-19	4.000	EA	LOCK NUT FOR CATHODE PACKAGE MATERIAL PE-HD 300 (BLACK)		
007	0070	01	222275-20	4.000	EA	NUT M16 FOR CATHODE PACKAGE MATERIAL PE-HD 300 (BLACK)		
008	0080	01	222288-62	4.000	EA	THREAD ROD M16 FOR CATHODE PACKAGE		
009	0090		619027-01-62	4.000	EA	O-RING, 14.48 mm ID X 2.69 mm W SIZE: 5-239; MATERIAL: EPDM		
010	0100	01	222226-38	1.000	EA	PE-SLEEVE FOR CATHODE PACKAGE MATERIAL PE-HD 300 (BLACK)		
011	0110		619915-37-00-01	1.000	EA	RETAINING RING, DIN 471, 85 MM, SST FOR SHAFT DIA.: 85 MM MATERIAL: AISI 420 (1.4034/1.4122)		
012	0120	01	223451-67	1.000	EA	TAGGING AND MARKING ASSEMBLY FOR SUBSEA CATHODE PACKAGE SCPA P/N 223170-50 TOTAL K5F DC		
>>>B/M Category : Engrg Spec/Document item								
100	1000	01	SK-066170-50	1.000	EA	ASSY: CATHODE PACKAGE		

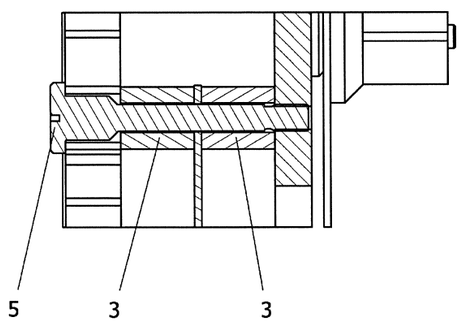
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						SUBSEA TOTAL K5		
102	1020	01	QP-000160-01-28	1.000	EA	QP Anode/Cathode Package DC-Tree System		
103	1030	16	D-000100-12-17	1.000	EA	PART IDENT: LOW STRESS STAMP, ETCH, OR VIBRATORY PENCIL "ASSY", ASSY P/N, "REV" REV, "CAM" SAP PLANT NO, S/N ("CCV" MAY BE USED IN PLACE OF "CAM". SEE X-043764-01 FOR DETAILS)		
104	1040	01	X-065437-01-17	1.000	EA	FAT: SCPA, K5F		
105	1050	01	X-065467-02-12	1.000	EA	IP: SCPA Subsea, K5F Installation, Retrieval & Maintenance Procedure for Subsea Cathode Package Assembly Project: TOTAL K5-F		
>>>B/M Category : Optional item								
900	1060	01	223170-50-00-99	1.000	EA	RECOMMENDED SPARE PART LIST FOR SUBSEA CATHODE PACKAGE ASSEMPLY TOTAL K5-F		
>>>B/M Category : Reference Call Outs								
1000	1070	08	A-020025	1.000	EA	Total L4G and K5F Paint Spec. - WITNESS This specification controls the Total witness requirements The test sample adhesion testing. Personnel qualification.		



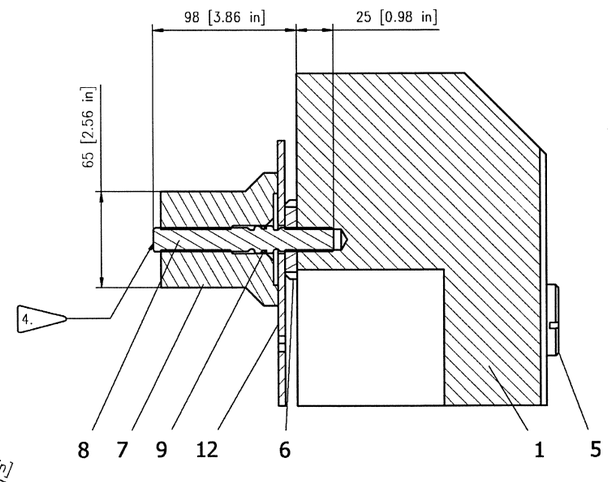




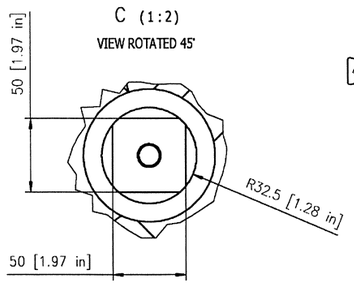
A–A (1:2)

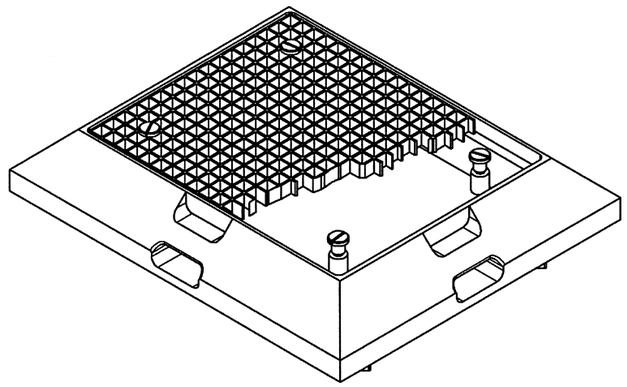


B–B (1:2)



C (1:2)
VIEW ROTATED 45°





TIGHTENING TORQUE		
POS.	NM	LBF.FT
5	7,5	5,6
6	6,5	4,8
7	9	6,7

NOTE:

1. FOR FURTHER INFORMATION SEE BILL OF MATERIAL
2. FOR ALLOCATION OF IDENTIFICATION LETTERING SEE TABLE BELOW
3. WEIGHT IN AIR: 65KG
   WEIGHT IN WATER: 10KG
4. ENSURE THAT THE THREADED BOLT IS SCREWED IN 25MM +/–0,5MM AND SECURED WITH LOCK NUT (ITEM 6)

SERIAL–NO.	TAGGING	COLOR	SIZE / TYPE
–01	SC–92100.1A	BLACK	60MM / ARIAL
–02	SC–92100.1B	BLACK	60MM / ARIAL
–03	SC–92100.2A	BLACK	60MM / ARIAL
–04	SC–92100.2B	BLACK	60MM / ARIAL

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

APPROVED FOR CONSTRUCTION	28 SEP 07	1
ISSUED FOR CLIENT COMMENT	01 AUG 07	N/A
RE–ISSUED FOR INTERNAL IDC	03 JUL 07	N/A
ISSUED FOR INTERNAL IDC	29 JUN 07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92–W–03–540

CAD | REV. BY: | DATE: | REV.: 1

SURFACE TREATMENT

MATERIAL AND HEAT TREATMENT

TOLERANCES ACCORDING TO DIN 8015

GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219

TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

EST. WEIGHT: 65 KG | SUPERSEDES:

DO NOT SCALE

DRAWN: I. Karras	DATE: 06.06.2007
CHECKED: T. Moeller	DATE: 02.08.2007
APPROVED: R. Wrede	DATE: 03.08.2007

SCALE: 1:5

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

CATHODE PACKAGE
SUBSEA MOUNTABLE VERSION
ASSEMBLY DRAWING

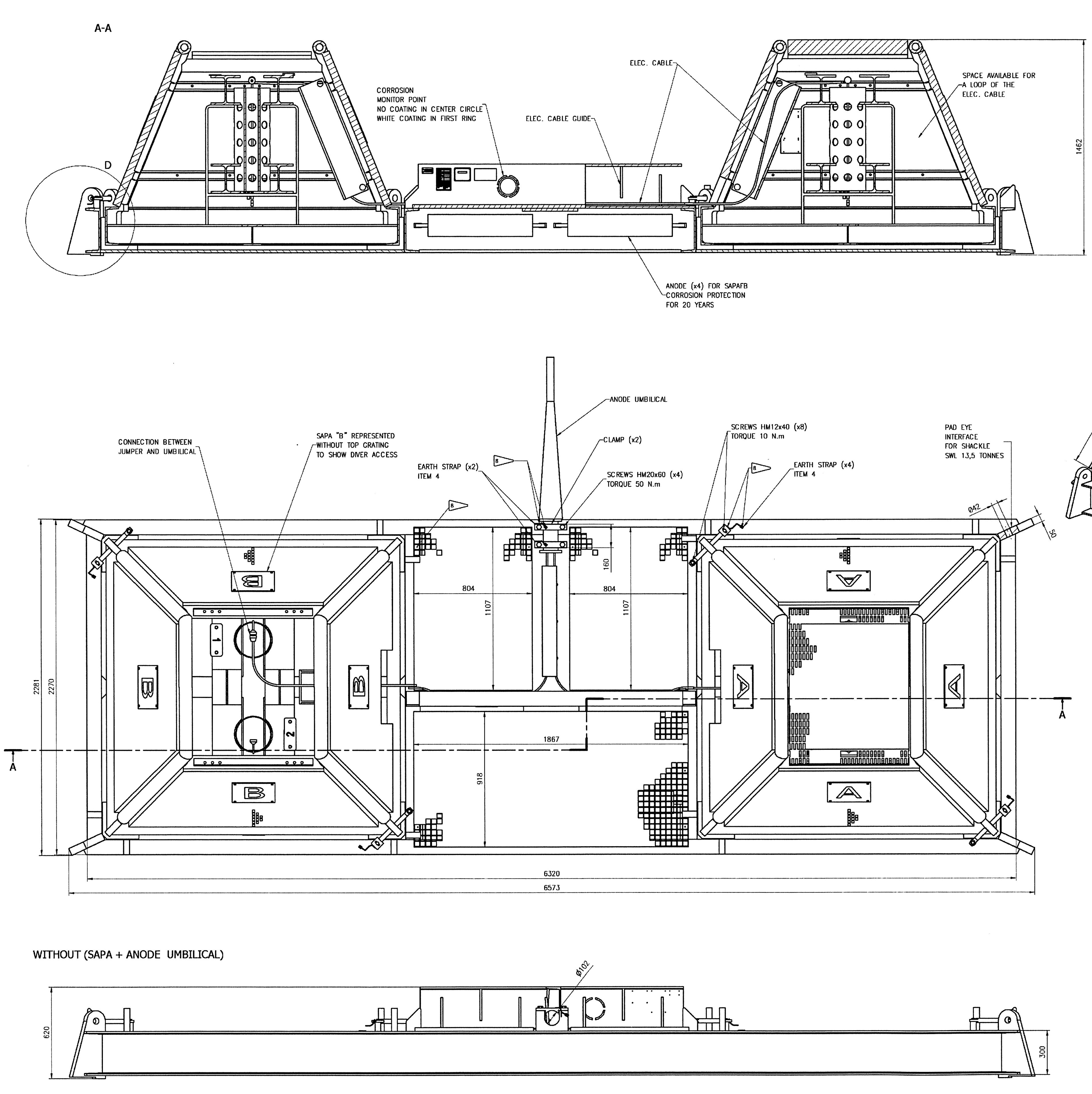
INITIAL USE BOM: 223170–50 | SHEET: 1 OF 1 | DRAWING NUMBER: SK–066170–50

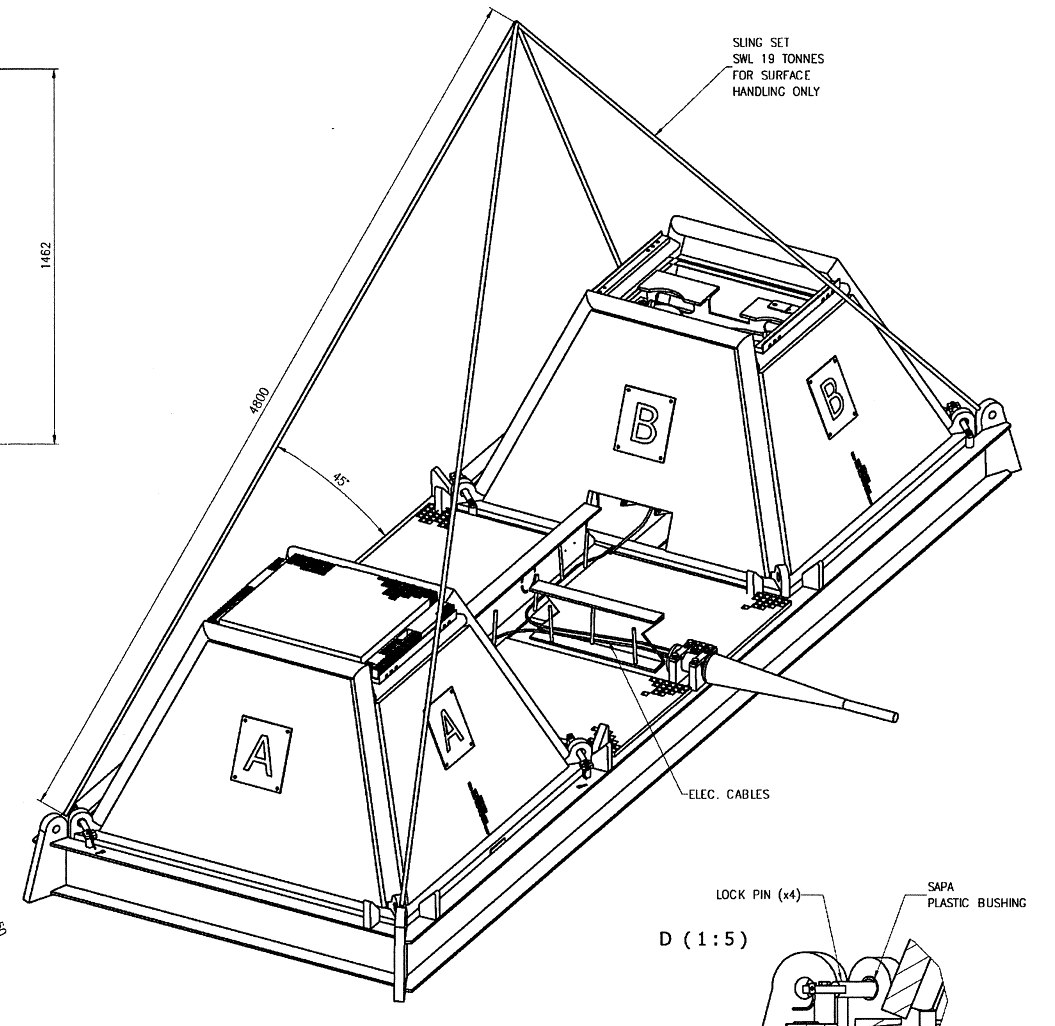
SIZE: A1

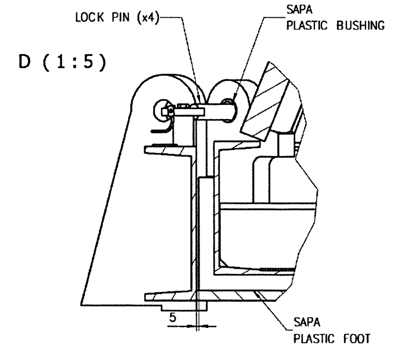
STATUS: Released REVISION : 02
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SAPA Anode, K5-F

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
1	0001	02	222416-81	1.000	EA	K5F SAPA FOUNDATION BASE FRAME		
10	0010		619025-03	24.000	EA	M-CLIP FOR GRATE, 50 x 20 mm, SST 316 WITH 7 mm HOLE FOR M6 SCREW.		
11	0011		619901-11-18-09	36.000	EA	SCREW, HEX, DIN 933, M6 X 30, SST MATERIAL: AISI 316 (1.4401)	FIX GRATING	
12	0012		619954-01-13-03	12.000	EA	WASHER, DIN 6798, TYPE A, 6.4 ID SERRATED LOCK WASHER EXTERNAL TOOTH MATERIAL: AISI 316 (1.4401)		
13	0013		619901-11-14-09	12.000	EA	SCREW, HEX, DIN 933, M6 X 20, SST MATERIAL: AISI 316 (1.4401)	FIX EARTH STRAP	
2	0002		619025-01-09	2.000	EA	GRATING, 1220 X 3660 X 25, GRP GRID SIZE: 38 X 38 MM TEMP.: -100°C / +180°C MATERIAL: GRP ; COLOUR: GREY FIRE-RESISTANT, SELF-EXINGUISHING ANTI-SKID CONCAVE MENISCUS FASTENING: 619025-03		
3	0003	G01	619046-20-61-51	1.000	EA	TAG: "CONTROL UNIT" (90X110) BLANK, 1.4301 COLOUR OF WRITING: BLACK		
4	0004	B02	222704-04	6.000	EA	EARTH STRAP, 450 MM LG. M6 MATERIAL - 316 SST DIA. 3MM WIRE ROPE WELDED WITH TWO END TAPS AND TWO HOLES FOR M6 REPLACE: 2197088-33		
>>>B/M Category : Engrg Spec/Document item								
100	0100	01	SK-066211-01	1.000	EA	AS: K5F SAPA FOUNDATION BASE (SAPAFB)		
102	0102	01	QP-000160-01	1.000	EA	CONTROL SYSTEMS ASSEMBLED EQUIPMENT :ALL PRESSURES, ALL TEMPERATURE RATINGS, ALL LOCATIONS		
110	0110	01	X-076709-03-94	1.000	EA	PACKING INSPECTION RECORD K5F SAPAFB		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
111	0111	07	X-065429	1.000	EA	GENERAL PRESERVATION AND STORAGE PROCEDURE FOR CAMERON CONTROLS EQUIPMENT		
>>>B/M Category : Optional item								
1001	1001	02	2197010-08-13	1.000	EA	LIFTING SET -4 LEG - 19T-5000 MM SHACKLE SWL 13,5T	SLING SET INCLUDED IN FRAME BOM	
>>>B/M Category : Reference Call Outs								
1000	1000	07	A-020025-01	1.000	EA	Total L4G Polyamide Paint system-Witness Polyamide epoxy paint system to be used for surface temperatures up to 65.C		







NOTE:

1. IN THIS DRAWING, SAPA + ANODE UMBILICAL ARE REPRESENTED FOR INFORMATION THEY ARE NOT PART OF THE PN 223211-01

2. WEIGHT
IN AIR:
- SAPA (NO CONCRETE IN THIS DESIGN): 1500 KG
- SAPAFB: 2200 KG
- (x2)SAPA + SAPAFB: 5200 KG

IN WATER:
- SAPA: 1100 KG
- SAPAFB: 2000 KG
- (x2)SAPA + SAPAFB: 4200 KG

(x2)SAPA + SAPAFB WEIGHT PER SQUARE METER ON SEA FLOOR: 400 KG/M²

3. ESTIMATION OF THE DRAG FORCE (Fdrag)
$Fdrag = 0{,}5 \times Cv \times S \times q \times V^2 = 5000$ N

Cv: "HYDRODYN. COEFF." - BIGGER VALUE POSSIBLE: 2
q: WATER DENSITY: 1025 KG/M3
S: BIGGER SIDE PROJECTED SURFACE: 6 M^2
V: CURRENT FOR AVERAGE BIGGER WAVE OF 20 YEARS: 0,9 M/S

4. SAPAFB FRAME PROOF TEST LOAD: 18 TONNES

5. COATING
- EVERYTHING YELLOW
- EXCEPTION 1: PAD EYE, LOCK PIN, ELEC. CABLE GUIDE=> ORANGE RAL2004
- EXCEPTION 2: CLAMP=> UNCOATED

6. REGARDING CATHODIC PROTECTION
- SAPA AND SAPAFB ELECTRICALLY ISOLATED BECAUSE OF PLASTIC FOOT AT CORNERS AND BUSHING IN PAD EYE
- USE OF EARTH STRAP TO CONNECT: CLAMP, LOCK PIN
- ANODE UMBILICAL FLANGE CONNECTION WITH UNCOATED CLAMP

7. ELEC. CABLE STATIC MBR: 180 MM

(B) SCREW M6, SEE BOM ITEM 11, 13
TORQUE: 6 N.m

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

REASON FOR ISSUE	DATE	CLIENT REV.
APPROVED FOR CONSTRUCTION	13AUG07	1
ISSUED FOR CLIENT COMMENT	06JUL07	N/A
ISSUED FOR INTERNAL IDC	26JUN07	N/A

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-63-504

CAD | REV. BY: | DATE: | REV.: 1

	SURFACE TREATMENT	DO NOT SCALE	
TOLERANCES ACCORDING TO DIN 8015		DRAWN: G. Durand	DATE: 26.06.2007
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	MATERIAL AND HEAT TREATMENT	CHECKED: R. Wrede	DATE: 04.09.2007
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K		APPROVED: G. Durand	DATE: 04.09.2007
EST. WEIGHT: 2200 KG	SUPERSEDES:		SCALE: 1:10

CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

SAPA FOUNDATION BASE (SAPAFB)
ASSEMBLY DRAWING

INITIAL USE BOM	SHEET	DRAWING NUMBER
223211-01	1 OF 1	SK-066211-01

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 2, Section 5

UMBILICAL TERMINATION ASSEMBLY (UTA)

CONTENTS

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 2, Section 5
UMBILICAL TERMINATION ASSEMBLY (UTA)

DESCRIPTION, INSTALLATION, OPERATION & MAINTENANCE

CONTENTS

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 2, Section 5
UMBILICAL TERMINATION ASSEMBLY (UTA)

PARTS LISTS & DRAWINGS

CONTENTS

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

31 MAR 2009	As Built	A. Weilandt	T. Appel	A. Weilandt
06 AUG 2007	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
02 MAY 2007	Issued for Client Comment	A. Weilandt	S. Horne	
12 OCT 2006	Issued for Internal IDC	A. Weilandt	D.Coonrod	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approver**

CAMERON	**Document Title:** **Subsea and Topsides Functional Requirement Specification**		
PAGE 1 OF 34	**Customer Document Number:**	54NL92-W-0S-502	REV. 2
	Cameron Document No.	X-076721-87	REV. 02

TABLE OF CONTENTS

1 Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
A	12OCT06	Initial release Celle	- - -
B	02MAY07	Section 7.5.6.1: Use of Swagelok added for LP lines and added the need for metric size on all LP tubing Section 8.4: cable entry changed from top to bottom Section 9.2: List of Total Tag Numbers added Section 9.1.1.2: Colour for topside equipment changed from RAL5015 to RAL7035 (light grey) 10.8 & 10.9: updated description as per current design of anode and cathode package 10.10: complete section added for Anode Umbilical Assembly	Comments from internal IDC
01	06AUG07	Section 10.8: Anode Package Foundation Base added	Updated to Approved for Construction
02	31MAR09	Minor cosmetic Customer Comments implemented	Update to “As Built”

2 Introduction

This document is written to consolidate the technical requirements for the subsea control system intended to be used on the TOTAL K5F Project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

It will be submitted for approval early on in the project cycle and upon approval will be used for the design of the system.

Referenced client specifications within this document also need to be considered for the design.

3 Scope of this document

The scope of this document is to define the functional requirements for the subsea control system intended to be used on the TOTAL K5F Project.

Technical requirements relate but shall not be limited to:

- Design basis data
- Functional requirements

The Intervention & Workover Control System (IWOCS) shall **NOT** be covered by this document.

4 Abbreviations & Definitions

4.1 Abbreviations

AIV	Annulus Isolation Valve
AMV	Annulus Master Valve
APTA	Annulus Pressure Transmitter A
APTB	Annulus Pressure Transmitter B
BAIV	B Annulus Isolation Valve
CI	Corrosion Inhibitor
CIV	Chemical Injection Valve
CP	Cathodic Protection
CR	Control Room
DCS	Distributed Control System
DHSV	Downhole Safety Valve
DHPT	Downhole Pressure Temperature Transmitter
EPCU	Electrical Power and Communication Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
HPU	Hydraulic Power Unit
ICSS	Integrated Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
KHI	Kinetic Hydrate Inhibitor
LPMV	Lower Production Master Valve
MEOH	Methanol
PCS	Process Control System
PPD	Production Pressure Downstream
PPU	Production Pressure Upstream
PSV	Production Swab Valve
PTD	Production Temperature Downstream
PTU	Production Temperature Upstream
PWV	Production Wing Valve
PRCM	Power Regulation and Communication Module
SCSSV	Surface Controlled Subsurface Safety Valve
SSS	Safety Shutdown System
TUTU	Topside Umbilical Termination Unit
UPMV	Upper Production Master Valve
UPS	Uninterruptible Power Supply
UTA	Umbilical Termination Assembly
WH	Wellhead
XOV	Crossover Valve

4.2 Definitions

COMPANY	Total E&P Nederland B.V. (TEPNL)
CONTRACTOR	Cooper Cameron UK Ltd.

5 References

5.1 Cameron documents

Following documents **MUST** be considered during the design phase.

Description	Number
Subsea Production Control System Interconnection Diagram	SK-066001-88-04
K5F Field Development Project Contract	4600000416
Bill Of Material – Subsea Production Control System	223001-88
Project Quality Specification	SP-003118-15

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Design of cathodic protection of offshore structures	GS GR COR 100
External protection of off-shore and coastal structures and equipment by painting	GS EP COR 350
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Minimum CONTRACTOR document requirements	GS EP ELE 091
Electrical cables	GS EP ELE 161
Cable trays/ladders	GS EP ELE 311
Precommissioning and commissioning specification	GS EP EXP 101
Precommissioning and commissioning technical preparation	GS EP EXP 103
Precommissioning execution	GS EP EXP 105
Commissioning execution	GS EP EXP 107
Operations preparation during project – Maintenance and inspection documentation	GS EP EXP 203
Requirements for contractor quality management	GS EP PJC 501
Requirements for contractor critically rating of a unit	GS EP PJC 502
Requirements for contractor quality control	GS EP PJC 503
Valves	GS EP PVV 142
Welding of duplex and superduplex stainless steel	GS EP PVV 614
Area classification	GS EP SAF 216

Description	Number
Completed wells safety systems and safety rules	GS EP SAF 226
Impacted area, restricted area and fire zones	GS EP SAF 253
Emergency shut-down and emergency de-pressurisation (ESD & EDP)	GS EP SAF 261
Design philosophy and requirements for subsea stations	GS EP SPS 001
Subsea ball valves	GS EP SPS 005
Service valves in subsea stations	GS EP SPS 006
Tie-in systems	GS EP SPS 007
Corrosion protection of subsea stations	GS EP SPS 009
Preservation requirements for subsea package	GS EP SPS 010
Mechanical completion of subsea stations	GS EP SPS 011
Documentation requirements for subsea stations	GS EP SPS 012
Wellhead and guidance systems	GS EP SPS 013
Subsea gate valves and actuators in subsea Xmas-tree systems	GS EP SPS 015
Subsea insert chokes and associated running and retrieval tools	GS EP SPS 016
Subsea production control system	GS EP SPS 019
Subsea control unit functional requirements	GS EP SPS 020
Subsea mateable electrical/optical connectors	GS EP SPS 021
Environmental testing of subsea electronics	GS EP SPS 022
Cleaning and flushing of hydraulic systems	GS EP SPS 023
Subsea mechanical quarter turn actuator (manually operated gearbox)	GS EP SPS 024
Subsea hydraulic spring return quarter turn actuators	GS EP SPS 025
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Static 230Vac power supply units for on- and offshore installations	NL00-U-6S-037
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Typical cable tray details (offshore)	NL00-U-64-044
Elec. Cable colour seq. (onsh. + offsh.)	NL00-U-64-045
Protection and Instrument Earth. Det. (onsh. + offsh.)	NL00-U-64-046
Presentation of engineering and final documentation	NL00-Z-0S-002

Description	Number
Microstation Version 5.0: User Definable Attributes	NL00-Z-0S-005
Codification & Numbering of New Technical Documents for Offshore Installations	NL00-Z-0S-006
Instrumentation/piping interface standards	NL00-Z-4S-042
Actuators and control systems for hydraulically operated control valves	NL00-Z-7S-041
Actuators and control system for hydraulically operated ball valves	NL00-Z-7S-043
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
Codification of instrumentation links & equipment	NL00-Z-7S-077
Electrical/instrument interface diagram typicals for normally unmanned offshore installations	NL00-Z-71-002
Loop diagrams typicals	NL00-Z-71-003
Instrumentation - process hook-up typicals	NL00-Z-74-011
Hydraulic hook-up typicals	NL00-Z-74-021
Mounting typicals	NL00-Z-74-031
Instrument name plate detail	NL00-Z-74-055
Completion dossier guidelines	CS-3-OPE-EC-701 (EDMP-40657)
K5F MCS – K6CC SSS/PCS Interface	EDMP #59401

Any agreed deviations from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

Any clarifications from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

In case of conflict between documents the following order of priority shall be applied:

1) Local and international rules and regulations
2) Company Safety Specifications (GS EP SAF)
3) Project Specifications
4) Company Standards (NL00)
5) Company General Specifications

5.3 Codes, standards and regulations

Following codes, standards and regulations shall be considered during the design phase.

Description	Number
Design and operation of sub sea production systems	ISO 13628
Design & Operation Of Subsea Production Control Systems	ISO 13628-6
Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluids	SAE AS4059

Description	Number
EMC Directive	89/336-EEC
Process measurement control functions and instrumentation Symbolic representation	ISO 3511
Quality management and quality assurance standards - Part 3:Guidelines for the application of ISO 9001 to the development, supply and maintenance of software	ISO 9000-3

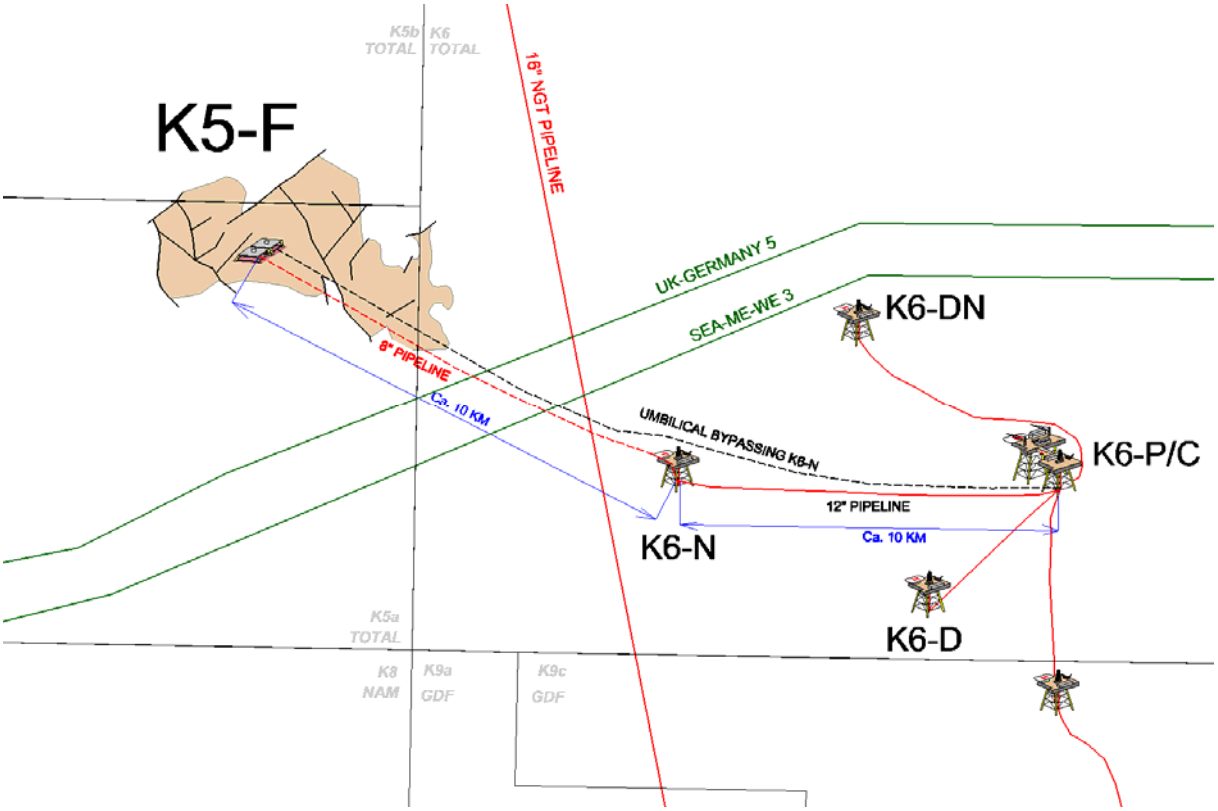
5.4 CE marking

CE marking **will** be required for the K5F project.

6 Project Overview

The K5F is a gas field located 10 km NW of the existing satellite platform K6N and 20km NW of the K6 Central Complex, all operated by TEPNL.

In the first phase, K5F will be developed with two wells. In order to be able to increase the reserves recovery in the future a third well might be connected in the future on the Subsea Protection Structure and it is also possible to connect a fourth future satellite well.



7 Design basis

The following sections are describing the systems information particularly relevant to the design of the Production Control System:

7.1 Field data

Present Number of Production Wells	Two plus two future wells
Design Life	20 years

7.2 Environmental conditions

7.2.1 Climatic data

Parameter		Data
Ambient Temperature (Outdoors)	Minimum Air Temperature	- 16°C
	Maximum Air Temperature	+ 40°C
Ambient Temperature (Indoors)	Minimum Air Temperature	-5°C
	Maximum Air Temperature	+ 40°C

7.2.2 Subsea Design Information

Parameter	Data
Water Depth	37 metres
Temperature	+4°C to +9.5°C
Seawater density	1025 kg/m³
Seawater Electrical Resistivity	0.3 OhmMeter
Wellhead Shut-in Pressure	350 barg

7.2.3 Hazardous Area Classification

The HPU and the TUTU shall be specified for hazardous area Zone 1, Gas Group IIB, Temperature Class T3, on the Platform deck.

7.2.4 Local equipment room

The platform local electrical switch room shall be used to accommodate the MCS and the ECPU cabinets. The maximum temperature during normal conditions within the LER shall be limited to 25 °C, but all of the equipment shall be able to operate as long as the room temperature does not exceed 40°C.

7.2.5 Hydraulic system pressures for the SCSSV line

The subsea production control system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
HP Hydraulics	627 barg	690 barg	1035 barg
Return Lines	< 207 barg	207 barg	N/A
Reservoir Fill Lines	<10 barg	10 barg	15 barg

NOTE: The design pressures shown above shall be used for specification of the HP hydraulic system relief valves and these shall release at the shown design pressures.

The return lines of the HPU are piped directly to the return reservoir and open to atmosphere. Pressure testing of these lines is neither necessary nor possible.

7.2.6 Chemical system pressure requirements

The chemical injection system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
Methanol Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Corrosion Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Kinetic Hydrate Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg

7.2.7 List of chemicals

The following chemicals are considered to be used for chemical injection for the K5F project:

- Methanol (MEOH)
- Corrosion Inhibitor (CI)
- Kinetic Hydrate Inhibitor (KHI)

7.3 Design life

The design life of the Subsea equipment shall be equal to the service life of the field.

The Subsea and related topside facilities shall be designed for a minimum design life of **20 years**.

7.4 Utilities

7.4.1 Platform utilities

The subsea production control system shall be designed to operate from the platform power and utilities as follows:

Electrical Supply (ECPU)	400VAC , 3 phase, 50 Hz ± 2% from UPS (floating), redundant
Electrical Supply (MCS)	230VAC 50 Hz ± 2%,from UPS (floating), redundant
Electrical supply (HPU PLC Cabinet)	230VAC 50 Hz ± 2% from UPS (floating)
Electrical supply (HPU Lighting)	230VAC 50 Hz from MCC
Electrical supply (HPU Motors)	380VAC 3ph 50 Hz, floating (3 wires) from MCC
Electrical supply (Motor heaters)	230VAC 50 Hz from MCC (if applicable)
Electrical supply (ESD solenoids)	24 V DC when healthy, 0V on ESD

7.5 Hydraulic systems

7.5.1 Sealing systems

Hydraulic couplers with primary metal seals are preferred for permanently installed Subsea equipment. Where possible, secondary, non-metallic seals should be considered as back-up for primary metal-to-metal seals. Hydraulic and chemical couplers within removable assemblies like single diver mate able hydraulic/chemical couplings shall have non-metallic primary seals and non-metallic back-up seals.

7.5.2 Hydraulic distribution

The subsea production control system high pressure (HP) hydraulic supplies shall be single from the HPU pumps. The hydraulic system shall be open utilising a water based control fluid.

7.5.3 Hydraulic fluid

The hydraulic system shall use Castrol Transaqua HT water based control fluid.

7.5.4 Fluid cleanliness

The production control system hydraulic control fluid shall be water based. All production control system hydraulic equipment shall be delivered with fluid cleanliness levels of SAE AS4059 class 6 or better. All methanol and chemical lines and equipment shall be delivered with fluid cleanliness level of SAE AS4059 class 12 or better.

Protective caps shall be provisioned for all hydraulic couplings to avoid accidental contamination. Assembly of hydraulic components shall take place in areas where the environment is controlled. The objective shall be to “assemble clean to keep clean” such that subsequent flushing operations are simplified.

Cleaning methods used for sub-assemblies shall include shop air flushing, solvent cleaning, pipe cleaning and ultrasonic bathing as appropriate. Cleaning of major assemblies shall in general be confined to flushing with control fluid of known cleanliness. As far as is practical, designs shall take due note of the subsequent flushing requirements e.g. avoiding blind holes, avoiding welding or grinding on assembled components and ensuring that systems allow turbulent flow for flushing.

All hoses and flying leads intended for chemical service (Methanol, Corrosion Inhibitor and Kinetic Hydrate Inhibitor) should be supplied filled with either control fluid or a suitable fluid compatible with the chemicals to be used.

7.5.5 Tubing

All hydraulic tubing and fittings shall be sized for efficient operation of the system with due regard to design pressures and minimising pressure drops within the system.

- For the topside equipment minimum seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the subsea equipment seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the UTA, the Methanol tubing has to be super duplex.

The tubing of the hydraulic circuits shall be accurately cut and bent using standard tube cutters and tube benders to fitting manufacturer’s recommendation. No burrs shall be allowed and each section of the tubing shall be cleaned and blown dry before assembly to ensure that no contamination is permitted to enter the control components.

All hydraulic tubing together with the associated fittings shall be capable of withstanding the application of a 1.5 times design pressure test for 15 minutes without any deformation or other damage.

7.5.6 Threaded connection systems

All threaded fittings for equipment used subsea shall withstand external ambient pressure at the design depth.

7.5.6.1 Topside equipment

For all circuits Autoclave MP Piping and fittings shall be used, except return lines where Swagelok can be used. All non Autoclave lines need to be in metric size.

7.5.6.2 Permanent subsea equipment

Ferrulok tube end reducers are to be welded to the back of hydraulic couplers, etc., where practical, rather than pipe threaded connections.

High-pressure ports requiring threaded fittings, such as valve actuator ports shall be SAE thread with 37-degree bottom taper conforming to SAE standard J514. Autoclave anti-vibration type fittings shall also be acceptable.

National Pipe Thread (NPT) fittings or any other thread seal type fitting shall **NOT** be used without specific approval from the project.

Fitting assembly torque shall be independently verified and sealed/secured to identify, that fittings have been properly made-up and inspected.

7.5.6.3 Thread sealants

Where taper threads are permitted for use, they shall be sealed using Loctite 572 fluid applied in accordance with the manufacturer's instructions. No other thread sealant shall be used. Teflon tape is **NOT** permitted for use on any equipment used with this system.

7.5.7 Welded connection systems

All couplers, whether in hydraulic or chemical services shall be butt-welded, except were otherwise specified within this document. All couplers shall be fitted with seals from identical compounds. All hydraulic or chemical service valves and fittings shall be butt welded.

- Connections shall be welded to the extent practical
- Autogenously welding shall be acceptable on 316L materials
- Liquid penetrate testing shall be performed on all tubing welds

Note: all welding has to be performed in accordance to approved Cameron welding specification.

8 Electric Systems

8.1 Terminal Type

Screw type terminals shall be used on all topside equipment.

8.2 Instrument Type

For the use in hazardous area EEx-d type instruments shall be used.

8.3 Electrical Motor Type

For the use in hazardous area EEx-d type electrical motors shall be used.

8.4 Cable entry for cabinets located in the Control Room

All cabinets located in the control room shall be designed to allow bottom cable entry only.

9 Functional Requirements

9.1 Coating & protection systems

9.1.1 Coating systems

All equipment manufactured from Carbon steels shall be protected with an approved coating system suitable for the design life of the equipment.

9.1.1.1 Subsea painting

Painting of all subsea components manufactured from Carbon steels shall be done in accordance to the approved paint specification A-020025-01

9.1.1.2 Painting of topside equipment for outside installation

Painting of all topside components located outside shall be done in accordance to the approved paint specification X-065460-04-04

- Top colour for surface equipment shall be light grey (RAL 7035).
- SST framework and parts shall normally NOT be painted, if not separately specified.

9.1.1.3 Painting of topside equipment for inside installation

Paint colour for MCS or EPU cabinet housings shall be light grey (RAL 7035).

9.1.2 Cathodic protection

9.1.2.1 General

The primary corrosion protection system for the control system Subsea equipment shall be via materials selection and suitable paint coatings.

A cathodic protection system using sacrificial anodes shall be utilised to protect the ‘bare steel’ components and to protect uncoated areas of any other control system hardware, i.e. such as those items not protected by the host equipment. Special attention shall be given to SST screws and bolts. All items to be protected shall be electrically connected using stranded, flexible SST 316 earthing braids of a suitable cross sectional area.

9.1.2.2 Calculations

Suitable CP calculations shall be carried out in accordance with the standard applicable for control system hardware i.e. not tree mounted equipment (this shall be part of the Subsea tree CP system). The CP system shall be designed to be capable of protecting the control system for the 20-year design life of the equipment.

9.1.2.3 Construction

The following principles shall be adhered when designing equipment for the subsea control system:

- All equipment metalwork shall be welded (or bolted) onto the equipment main structure to ensure any static potential build up is avoided by continuous drain to earth.
- All metallic items shall have earth continuity by physical connection i.e. metallic fastenings, clamps or earth straps. This shall include all valves, tubing, components, tubing clamps etc.

Electrical connectors may remain isolated from the structure provided suitable materials are chosen for their construction.

- When stainless steel fasteners are used in the construction of subsea structures or equipment, they shall be suitably earth bonded using earth straps. Carbon steel fasteners may alternatively be used.
- Anodes mounted on equipment sub-structures shall be manufactured from material identical and from the same batch as those fitted to the main structure.
- The anodes shall comply with the Cameron material specification MS-011310-01.
- The minimum distance from hydraulic tubing to anodes shall be 80 mm. If unavoidable it is acceptable to have a distance of less than 80 mm for some cases.
- Earthing conductors shall be of corrosion resistant material and shall be securely fastened and protected where necessary against damage and electrolytic corrosion. Where earth-bonding straps are used, conductive paste shall be smeared on contact surfaces (not threads) to ensure a lasting low resistance contact. Where the metallic composition of equipment requiring earth bonding differs from the main structure, care shall be taken in the selection of the bonding strap material to minimise possible ill effects of different contact potentials.
- Connections shall be secured using star-type shake proof washers such that they cannot work loose under vibration.

9.2 Project specific Tag Numbers

This is a list of Tag numbers to be used for K5F equipment. All units and components on this list need to be marked with these numbers as per Total Spec. NL00-Z-74-055.

Instruments	Equipment	Description	Comments
	NN-82201	TUTU	
	NN-82202	HPU	
	NN-82203	HPU PLC	
	NN-81203	MCS	
	NN-81204-1	EPCU 1	
	NN-81204-2	EPCU 2	
	NN-81204-3	EPCU 3	
	NN-81204-4	EPCU 4	
	SA-92100A	Anode Package A	
	SA-92100B	Anode Package B	
	UTA-92100	UTA	
	UTA-92101	IUTA	FUTURE
	UTA-92102	IUTA	FUTURE
	PRCM-92100.1A	PRCM A well 1	
	PRCM-92100.1B	PRCM B well 1	
	SC-92100.1A	Cathode A well 1	
	SC-92100.1B	Cathode B well 1	
	ESCM-92100.1A	ESCM A well 1	
	ESCM-92100.1B	ESCM B well 1	
	DVA-92103.1	Dump valve assembly well 1	
	DHSV-92103.1	Downhole safety valve well 1	

	PRCM-92100.2A	PRCM A well 2	
	PRCM-92100.2B	PRCM B well 2	
	SC-92100.2A	Cathode A well 2	
	SC-92100.2B	Cathode B well 2	
	ESCM-92100.2A	ESCM A well 2	
	ESCM-92100.2B	ESCM B well 2	
	DVA-92103.2	Dump valve assembly well 2	
	DHSV-92103.2	Downhole safety valve well 2	
	PRCM-92100.3A	PRCM A well 3	
	PRCM-92100.3B	PRCM B well 3	
	SC-92100.3A	Cathode A well 3	
	SC-92100.3B	Cathode B well 3	
	ESCM-92100.3A	ESCM A well 3	
	ESCM-92100.3B	ESCM B well 3	
	DVA-92103.3	Dump valve assembly well 3	
	DHSV-92103.3	Downhole safety valve well 3	
	PRCM-92100.4A	PRCM A well 4	
	PRCM-92100.4B	PRCM B well 4	
	SC-92100.4A	Cathode A well 4	
	SC-92100.4B	Cathode B well 4	
	ESCM-92100.4A	ESCM A well 4	
	ESCM-92100.4B	ESCM B well 4	
	DVA-92103.4	Dump valve assembly well 4	
	DHSV-92103.4	Downhole safety valve well 4	
	HP-92100.1	HP Jumper UTA to tree 1	
	MEOH-92100.1	MeOH Jumper UTA to tree 1	
	KHI-92100.1	KHI Jumper UTA to tree 1	
	CI-92100.1	CI Jumper UTA to tree 1	
	COAX-92100.1A	Coax Jumper UTA to PRCM A tree 1	
	COAX-92100.1B	Coax Jumper UTA to PRCM B tree 1	
	PC-92100.1A	P/C Jumper PRCM A to ESCM A tree 1	
	PC-92100.1B	P/C Jumper PRCM B to ESCM B tree 1	
	HP-92100.2	HP Jumper UTA to tree 2	
	MEOH-92100.2	MeOH Jumper UTA to tree 2	
	KHI-92100.2	KHI Jumper UTA to tree 2	
	CI-92100.2	CI Jumper UTA to tree 2	
	COAX-92100.2A	Coax Jumper UTA to PRCM A tree 2	
	COAX-92100.2B	Coax Jumper UTA to PRCM B tree 2	
	PC-92100.2A	P/C Jumper PRCM A to ESCM A tree 2	
	PC-92100.2B	P/C Jumper PRCM B to ESCM B tree 2	
	HP-92100.3	HP Jumper UTA to tree 3	FUTURE
	MEOH-92100.3	MeOH Jumper UTA to tree 3	FUTURE
	KHI-92100.3	KHI Jumper UTA to tree 3	FUTURE

	CI-92100.3	CI Jumper UTA to tree 3	FUTURE
	COAX-92100.3A	Coax Jumper UTA to PRCM A tree 3	FUTURE
	COAX-92100.3B	Coax Jumper UTA to PRCM B tree 3	FUTURE
	PC-92100.3A	P/C Jumper PRCM A to ESCM A tree 3	FUTURE
	PC-92100.3B	P/C Jumper PRCM B to ESCM B tree 3	FUTURE
PCV-92101.1		Production Choke valve well K5F-1	
PWV-92101.1		Production Wing Valve well K5F-1	
UPMV-92102.1		Upper Production Master Valve well K5F-1	
DHSV-92103.1		Down Hole Safety Valve well K5F-1	
AMV-92103.1		Annulus Master Valve well K5F-1	
BAIV-92100.1		B Annulus Isolation Valve well K5F-1	
XOV-92101.1		Crossover Valve well K5F-1	
CIV-92101.1		Chemical Injection Valve well K5F-1	
CIV-92102.1		Chemical Injection Valve well K5F-1	
CIV-92103.1		Chemical Injection Valve well K5F-1	
XEV-92103.1		HP Dump Valve (solenoid) well K5F-1	
PPU-92101.1		Production Pressure Upstream well K5F-1	
PPD-92111.1		Production Pressure Downstream well K5F-1	
APTA-92103.1		Annulus Pressure Transmitter A well K5F-1	
APTB-92105.1		Annulus Pressure transmitter B well K5F-1	
PTD-92101.1		Production Temperature Downstream well K5F-1	
PTU-92104.1		Production Temperature Upstream well K5F-1	
PT-92104.1		Downhole Pressure Transmitter	
TT-92-103.1		Downhole Temperature Transmitter	
PCV-92101.2		Production Choke valve well K5F-2	
PWV-92101.2		Production Wing Valve well K5F-2	
UPMV-92102.2		Upper Production Master Valve well K5F-2	
DHSV-92103.2		Down Hole Safety Valve well K5F-2	
AMV-92103.2		Annulus Master Valve well K5F-2	
BAIV-92100.2		B Annulus Isolation Valve well K5F-2	
XOV-92101.2		Crossover Valve well K5F-2	
CIV-92101.2		Chemical Injection Valve well K5F-2	
CIV-92102.2		Chemical Injection Valve well K5F-2	
CIV-92103.2		Chemical Injection Valve well K5F-2	
XEV-92103.2		HP Dump Valve (solenoid) well K5F-2	
PPU-92101.2		Production Pressure Upstream well K5F-2	
PPD-92111.2		Production Pressure Downstream well K5F-2	
APTA-92103.2		Annulus Pressure Transmitter A well K5F-2	
APTB-92105.2		Annulus Pressure transmitter B well K5F-2	
PTD-92101.2		Production Temperature Downstream well K5F-2	
PTU-92104.2		Production Temperature Upstream well K5F-2	
PT-92104.2		Downhole Pressure Transmitter	
TT-92103.2		Downhole Temperature Transmitter	
PCV-92101.3		Production Choke valve well K5F-3	FUTURE
PWV-92101.3		Production Wing Valve well K5F-3	FUTURE
UPMV-92102.3		Upper Production Master Valve well K5F-3	FUTURE

DHSV-92103.3		Down Hole Safety Valve well K5F-3	FUTURE
AMV-92103.3		Annulus Master Valve well K5F-3	FUTURE
BAIV-92100.3		B Annulus Isolation Valve well K5F-3	FUTURE
XOV-92101.3		Crossover Valve well K5F-3	FUTURE
CIV-92101.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92102.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92103.3		Chemical Injection Valve well K5F-3	FUTURE
XEV-92103.3		HP Dump Valve (solenoid) well K5F-3	FUTURE
PPU-92101.3		Production Pressure Upstream well K5F-3	FUTURE
PPD-92111.3		Production Pressure Downstream well K5F-3	FUTURE
APTA-92103.3		Annulus Pressure Transmitter A well K5F-3	FUTURE
APTB-92105.3		Annulus Pressure transmitter B well K5F-3	FUTURE
PTD-92101.3		Production Temperature Downstream well K5F-3	FUTURE
PTU-92104.3		Production Temperature Upstream well K5F-3	FUTURE
PT-92104.3		Downhole Pressure Transmitter	FUTURE
TT-92103.3		Downhole Temperature Transmitter	FUTURE
PCV-92101.4		Production Choke valve well K5F-4	FUTURE
PWV-92101.4		Production Wing Valve well K5F-4	FUTURE
UPMV-92102.4		Upper Production Master Valve well K5F-4	FUTURE
DHSV-92103.4		Down Hole Safety Valve well K5F-4	FUTURE
AMV-92103.4		Annulus Master Valve well K5F-4	FUTURE
BAIV-92100.4		B Annulus Isolation Valve well K5F-4	FUTURE
XOV-92101.4		Crossover Valve well K5F-4	FUTURE
CIV-92101.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92102.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92103.4		Chemical Injection Valve well K5F-4	FUTURE
XEV-92103.4		HP Dump Valve (solenoid) well K5F-4	FUTURE
PPU-92101.4		Production Pressure Upstream well K5F-4	FUTURE
PPD-92111.4		Production Pressure Downstream well K5F-4	FUTURE
APTA-92103.4		Annulus Pressure Transmitter A well K5F-4	FUTURE
APTB-92105.4		Annulus Pressure transmitter B well K5F-4	FUTURE
PTD-92101.4		Production Temperature Downstream well K5F-4	FUTURE
PTU-92104.4		Production Temperature Upstream well K5F-4	FUTURE
PT-92104.4		Downhole Pressure Transmitter	FUTURE
TT-92103.4		Downhole Temperature Transmitter	FUTURE

9.3 Special Requirements

All warning and emergency signs need to be English **and** Dutch language as per NL00-U-6S-061.

10 Equipment Requirement Specification

10.1 Master Control Station (MCS)

The redundant MCS will be the communication interface between the ICSS and the K5F electrical Subsea Control Modules (ESCM). The MCS will be located in the electrical switch room of the K6P Platform (safe area) and will be powered from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-01 Supplemental Requirements Specification for MCS Hardware

X-076721-87-02 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Control and Management

X-076721-87-03 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Process Interlocks and Shutdowns

X-076721-87-12 Supplemental Requirements Specification for MCS/ICSS Control Interface

10.2 Electrical Power and Control Unit (EPCU)

The EPCU is a redundant electrical power and communication unit for high voltage DC power supply and communication to the subsea installed ESCM's. The EPCU will be located in the electrical switch room of the K6P Platform (safe area) and will receive separate power supply for channel A and B from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-04 Supplemental Requirements Specification for EPCU

10.3 Hydraulic Power Unit (HPU)

A dedicated Hydraulic Power Unit (HPU) will be installed on the K6C platform to provide clean hydraulic HP power for the control of the K5F Downhole Safety Valves (DHSV). The HPU will be controlled from a remote PLC located in a safe area and will be monitored by the MCS/ICSS.

Design Pressure = 690 bar

Hydraulic Fluid = Castrol Transaqua HT

Refer to the following documents for detailed technical requirements:

X-076721-87-05 Supplemental Requirements Specification for HPU

10.4 Topside Umbilical Termination Unit (TUTU)

The Topside Umbilical Termination Unit (TUTU) shall terminate the main electro/hydraulic/chemical umbilical lines and provide the interface to the K6C platform equipment. It will only provide a hardware interface without any block/bleed-valves and/or Pressure gauges for testing or maintenance work. All tubing and couplers need to be supplied by others. The electrical cables shall be terminated in separately mounted explosion proof Junction Boxes or with moulded splice connections.

Refer to the following documents for detailed technical requirements:

X-076721-87-06 Supplemental Requirements Specification for TUTU

10.5 Umbilical Termination Assembly (UTA)

The Umbilical Termination Assembly (UTA) shall be a robust construction to provide interfaces with the umbilical and shall allow to suitably terminating all functions. The UTA shall be setup for the hydraulic connection of the two trees currently in the scope of supply and the two future trees.

Refer to the following documents for detailed technical requirements:

X-076721-87-07 Supplemental Requirements Specification for UTA

10.6 Power Regulation and Control Module (PRCM)

The Power Regulation and Communication Module (PRCM) regulate the power to the ESCM and provide communication to the ESCM. It also provides the connection to the external cathode package.

The PRCM shall be diver recoverable by using a special change out tool and shall be connected to a mounting base.

10.7 Electric Subsea Control Module (eSCM)

The eSCM controls various electric actuators on the tree/wellhead and acquires data from the subsea instrumentation for the transmission to the surface.

The following functions need to be controlled by the eSCM:

No.	Function	Actuator Size	Location	Note
1	CIV 1	¾”	Tree	
2	CIV 2	¾”	Tree	
3	CIV 3	¾”	Tree	
4	BAIV	¾”	Wellhead	
5	AMV	2”	Wellhead	
6	XOV 1	2”	Tree	
7	UPMV	5”	Tree	
8	PWV	5”	Tree	
9	PCV	N/A	Tree	
10	SCSSV Open	N/A	Tree	
11	SCSSV Close	N/A	Tree	

The following tree sensors need to be monitored by the eSCM:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

10.8 Anode Package / Anode Package Foundation Base

There are two separate Anode Packages for the A and the B channel of the system. The Anode Package shall be a robust frame construction for two separate and diver retrievable Anodes. The Anode package requires two separate electrical connectors for each anode for the connection via a flying lead to the anode umbilical assembly. The Anode Packages need to be clearly marked with “A” and “B”. The painted steel frame is protected by FRP grating on all four sides and on top to prevent damages caused by dropped objects. The two anode packages for the channels A and B will be placed on a further support frame to minimize the required installation effort. Both Anode Packages will be located on a Foundation Base.

10.9 Cathode Package

There are four separate Cathode Packages for the A and B channel of each tree. The Cathode Packages will be connected to the respective PRCM on the Subsea Protection Structure via an electrical flying lead. The Cathode Packages are diver installable and will be hooked into the outside plates of the Subsea Protection Structure. The Cathode Package contains the cathode itself and a frame with FRP grating on top to provide mechanical protection.

10.10 Anode Umbilical Assembly

The complete Anode Umbilical Assembly includes the following items:

- an approx. 100m long umbilical with an overall armour and four separate armoured 2,5mm² cores
- a pulling head assembly with 100mm diameter
- a hang-off assembly
- bend restrictor assembly at the Subsea end of the umbilical incl. clamping surface to fix the umbilical
- 4 pigtails, each 6m long, at the end of the umbilical

10.11 Electrical Flying Leads

The electrical flying leads shall comprise a cable moulded to the subsea connectors at both ends. The colour of these cables shall be black with a marking by means of approx. 30cm long heat shrinks at both ends. System A will be marked “blue” and System B “yellow”. These flying leads shall be designed for diver make up only.

10.12 Tree/Wellhead Pressure and Temperature Sensors

The following Pressure and Temperature Sensors are located on the Tree and the Wellhead:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

These sensors shall meet the following requirements:

- Field proven design
- The sensors shall be suitable for the intended subsea service
- Redundant with separate interconnection cables for the A and B channel
- Diver retrievable sensors
- With block-bleed-block assemblies on the pressure sensors
- Minimum accuracy of:
    - +/- 0.03% x full scale accuracy and a drift of 0.2%/year for the pressure sensors
    - +/- 0.3°C accuracy and a drift of 0.2°C/year for the temperature sensors

10.13 SCSSV Dump Valve Assembly

A 3/2 way valve shall be located on the tree for the operation of the SCSSV. The operation of this valve will be direct hydraulic by use of Transaqua HT fluid from a dedicated HPU through a single HP supply line in the main umbilical. The valve shall be designed for the design pressure of the SCSSV system and shall be activated by the ESCM. This assembly will consist of a fixed plate which will be located on the tree and a free plate with the dump valve on which is diver retrievable. Both plates will be connected via quick couplers without the use of poppets. The tree tubing will be connected to the fixed plate by using Autoclave anti-vibration couplers.

11 Quality requirements

A Quality Plan to be used for the project shall be created. For the Project Quality Specification see section 5.1 of this document.

11.1 CE Marking

The topside hardware and software is to be supplied with a CE declaration of conformity, which confirms compliance with all relevant directives.

12 Handling/Installation/Intervention & Shipping

Project shall provide detailed installation and intervention recommendations, and step-by-step project specific procedures, for review as part of the project-engineering phase.

All separately installable and retrievable items shall be provided with suitable lifting points and be generally designed to allow a smooth, simple and quick installation/retrieval process to be performed by divers. This shall include the following items:

- Electric Subsea Control Module (eSCM)
- Power Regulation & Communication Module (PRCM)
- Electrical flying leads between
  - Tree/Wellhead located junction boxes and sensors
  - UTA and PRCM
  - PRCM and ESCM
  - PRCM and Cathode Package

  Tree and Wellhead Pressure and Temperature Sensors
- SCSSV Dump Valve Assembly
- Anode Umbilical Assembly

All subsea assemblies shall be designed to withstand an abandonment period of 6 month sub sea, located where required but not connected to its services (hydraulic, chemical, electrical, ..)

12.1 Use of guidelines

All Subsea equipment (trees, choke inserts, jumpers, control modules, etc.) shall be designed for installation and retrieval by divers with the use of guidelines.

12.2 Lifting / Handling

All equipment shall be designed for safe handling and transportation, both onshore and offshore. All lifting points on all equipment handled offshore shall be:

- Physically load tested to rated weight
- Designed for loads as defined in API 17D and API RP 17G.
- Any welding and associated NDE, which is required for lifting apparatus shall be in compliance with API 17D and API RP 17G.
- All lifting points on all equipment, both purchased and rented; to be handled offshore shall be tested and labelled in accordance with API 17D and API RP 17G.
- All shipped equipment assemblies shall be labelled with their weight.
- Slings and rigging shall be provided for items that require lifting.

12.3 Connection of flying leads

The Subsea hydraulic and electrical flying leads shall be designed to be installed by the use of divers.

Following installation of the Xmas tree, the diver (after removing the LTC from the remote stab or connector) shall pick up the remote end connection and install it to the UTA or Wellhead.

The process shall be similar for the electrical connector.

For recovery the procedure shall be reversed.

12.4 ROV Interfaces

All ROV and diver interfaces shall be designed in accordance with ISO 13628-8.

12.5 ROV Marking of Subsea Stations

Marking of subsea station shall be in accordance with ISO 13628-1 and the following requirements:

- Letter size shall be 50mm

13 Testing

Each item of deliverable equipment shall be tested in accordance with a project approved and CAMERON supplied acceptance test procedure to verify the following as a minimum:

- Functionality
- Internal pressure testing
- External pressure testing
- Control fluid cleanliness to SAE AS4059

CAMERON shall provide written step-by-step procedures for these tests to be provided to COMPANY.

A Control System Integration Test shall be performed in accordance with a COMPANY approved procedure to demonstrate that all of the individual items of equipment function correctly as a system.

The testing programme for the Subsea Production Control System shall be undertaken in the stages detailed as follows:

- Factory Acceptance Test for single units (FAT's)
- System Factory Integration Testing (FIT)
- Tree EFAT
- System Integration Testing (SIT)
- Platform Commissioning
- Offshore Pre-submergence Testing/Deck Testing
- System Commissioning

13.1 Factory Acceptance Test (FAT)

Each deliverable item shall be subjected to a Factory Acceptance Test (FAT). The purpose of this FAT shall be to demonstrate the item is suitable for the intended purpose and functions correctly. FAT tests shall include hydrostatic proof pressure testing to 1.5 times the design pressure of the Subsea control system.

All FAT procedures shall be step-by-step and submitted for review and approval prior to testing commencing.

All critical equipment components shall be subjected to sub-assembly tests during the assembly phase of manufacture and to carry out these tests, the necessary equipment and fittings are specialised in-house equipment and are not project deliverable.

Each item of equipment shall be subject to an in-house FAT in accordance to an approved standard procedure document to demonstrate these meet the specified operational and functional requirements.

The tests shall include interface connections and mechanical alignment tests to verify design and manufacturing limit tolerance effects, component inter-changeability, together with hydraulic fluid system flushing and / or cleanliness checks as necessary to ensure the system meets SAE AS4059. The hydraulic tubing and piping pressure lines shall be hydrostatic pressure tested to 1,5 times the design pressure.

The test equipment shall be determined by the proposed testing programme, however in the event of additional testing or if testing in other locations is required, the quantity of test equipment detailed shall be subject to review.

Testing of fabricated items shall also include continuity testing of bolting.

Testing on subsea assemblies shall include continuity testing and earthing testing.

The maximum value for the resistance measured shall be 0.1 Ohm.

13.1.1 Environmental Stress Screening (ESS)

Modules or subassemblies containing electrical equipment and/or electronic equipment, which are intended for permanent subsea installation shall comply with section 4 of the Total specification GS EP SPS 022 “Environmental testing of Subsea Electronics”.

13.2 Factory Integration Test (FIT)

A System Factory Integration Test (FIT) shall be conducted to verify the correct interfacing and inter-working of all items of the subsea production control system equipment. External interfaces, for example Xmas tree valves & sensors, umbilical cables, DCS, MCC & ESD systems etc. shall be simulated for the purpose of the test. The testing shall be designed to verify the functional and operational integrity of the subsea production control system.

13.3 Xmas Tree/SCM system integration test (Tree eFAT)

A Xmas Tree/SCM System Integration Test shall be conducted for the Xmas tree, following completion of the Xmas tree FAT within the factory.

14 Special packing/shipping procedures/Instructions

For deliverables consisting of a main assembly with additional loose items (Lifting Slings, Test Hoses/Cables, Fill Lance, Pre-Charge Kit, Fluid in Barrels etc.), separate packing/shipping procedures/instructions with included component check-lists shall be provided.

The same shall apply for deliverables that can not be shipped as complete units, as transportation could result in damage of internal components.

These procedures/instructions should be part of the BOM from the related parts.

For all units which include any fluids or substances, COSHH sheets (Control of Substances Hazardous to Health) shall be delivered with the unit. These COSHH sheets shall be available early in the process for supply to the client.

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

10NOV08	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
07MAY08	Issued for Client Comment	A. Weilandt	S. Horne	
07MAY08	Issued for Internal IDC	A. Weilandt	S. Horne	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Supplemental Requirements Specification for UTA**		
PAGE 1 OF 8	**Customer Document Number:**	54NL92-W-0S-513	REV. 1
	Cameron Document No.	X-076721-87-07	REV. 01

1 INTRODUCTION

This document is written to consolidate the technical requirements for the Umbilical Termination Assembly (UTA) intended to be used on the Total K5F project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

Referenced client specifications within this document shall also be considered for the design.

2 SCOPE OF THIS DOCUMENT

The scope of this document is to define the technical requirements for the UTA intended to be used on the Total K5F Subsea Control System.

Technical requirements include but shall not be limited to:

- Industry, Cameron, and project specific requirements
- Design basis data
- Functional requirements
- Equipment specific requirements
- Test Requirements
- Documentation
- Quality

3 Document revision status / record

Table 3-1 – Amendments

Date	Rev.	Description	Author
07MAY08	A	Initial Release	A. Weilandt
07MAY08	B	Issued for Client Comment	A. Weilandt
10NOV08	01	Approved for Construction	A. Weilandt

4 ABBREVIATIONS & DEFINITIONS

For abbreviations and definitions used within the Total K5F Project see related documents referenced within section 5.1 of this document.

Abbreviations and Acronyms that are specific to this document alone, for readability purposes are listed in this section:

Table 4-1 – Abbreviation/Acronym

Abbreviation/Acronym	Description
CI	Corrosion Inhibitor
DP	Design Pressure
FAT	Factory Acceptance Test
HP	High Pressure
HPU	Hydraulic Power Unit
KHI	Kynetic Hydrate Inhibitor
MEOH	Methanol
SCSSV	Surface Controlled Sub-Surface Safety Valve
SST	Stainless Steel
TBD	To be determined
MWP	Maximum Working Pressure

5 References

5.1 Cameron Reference Documents

This section defines the supporting Cameron documents to be used for evaluations against overall project requirements.

Table 5-1 – Cameron Reference Documents

Number	Description
4600000416	Contract K5F Field Development Project
223001-88	Bill Of Material – Subsea Production Control System
SP-003118-15	Project Quality Specification
X-076721-87	Subsea and Topside Functional Requirement Specification
X-296979-01	Project General Design Basis

5.2 Customer Reference Documents

This section defines the supporting customer documents to be used for evaluations against overall project requirements.

Table 5-2 – Customer Reference Documents

Description	Number
Total “Design basis for K5F project”	EDMP #32611
External protection of offshore and coastal structures/equipment by painting	GS EP COR 350
Design of earthing and bonding systems	GS EP ELE 031
Electrical cables	GS EP ELE 161
Subsea production control system	GS EP SPS 019
Cleaning and flushing of hydraulic systems	GS EP SPS 023
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401

5.3 Industry Reference Documents

This section defines supporting industry and regulatory documents to be used for evaluations against overall project requirements.

Table 5-3 – Industry Reference Documents

Number	Description
API Spec. 17D	Specification for Subsea Wellhead and Christmas Tree Equipment
ANSI/AWS D1.1	Structural Steel Welding Code
ANSI/AWS D1.6	Structural Welding Code – Stainless Steel
ISO 13628-6 (Comparable to API Spec.17F)	Design and Operation of Subsea Production Systems – Subsea Production Control Systems
ISO 9000	Quality Management Systems – Fundamentals and Vocabulary
ISO 9001	Quality Management Systems – Requirements
SAE AS4059	Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluid

6 Scope of Supply

The scope of supply for the UTA shall consist of the following:

6.1 UTA Equipment

The scope for the UTA equipment shall consist of the following main items:

- UTA frame with internal tubing, electrical and hydraulic couplers, removable protection cover
- Sling set for surface handling (not for subsea installation)
- Pulling shackle

6.2 Deliverable Documentation

The deliverable documentation for the UTA shall consist of the following as a minimum:

6.2.1 Engineering Documentation Requirements

- Assembly Drawing
- Flow Diagram
- Circuit Diagram
- Factory Acceptance Test Procedure

6.2.2 Quality Documentation Requirements

- Factory acceptance test records
- Hydrostatic pressure test records
- Flushing test records

7 UTA Design Specifications

7.1 Equipment Design Requirements

Design requirements for the UTA are defined as follows:

Feature	Design Requirement	Comments
Maximum (not to exceed) Dimensions	Length: approx. 2100mm incl. removable cover Octagonal shape with approx. 1190mm distance across flats	
Maximum (Not to exceed) Weights	2100 kg (in Air) 1800 kg (in Water)	
Service Life	20 years	
Pressures	HP: 690 bar DP / 627 bar MWP CI/KHI/MEOH: 448 bar DP / 403 bar MWP	
Fluid	HP: Castrol Transaqua HT/HT2 CI, KHI and MEOH	
Cleanliness Requirement	Minimum SAE AS4059, Class 6	Periodic operation at SAE AS4059, Class 10 allowed.
Hydraulic Tubing	Super Duplex Tube to be used	
Inlet Connection	HP: JIC 6 male 9/16”-18UNF Spare: JIC 8 male ¾” – 16UNF KHI A: JIC 8 male ¾” – 16UNF KHI B: JIC 8 male ¾” – 16UNF CI A: JIC 8 male ¾” – 16UNF CI B: JIC 8 male ¾” – 16UNF MEOH: welded connection on ¾”ID / 0,122” WT pipe	Umbilical connection
Outlet Connection	HP: 3/8” male diver coupler Spare: 3/8” male diver coupler KHI A: 3/8” male diver coupler KHI B: 3/8” male diver coupler CI A: 3/8” male diver coupler CI B: 3/8” male diver coupler MEOH: 3/4” male diver coupler	Via couplers to the Trees
Painting	RAL1004 (yellow), except the pad eyes and handles which are RAL2004 (orange)	
Marking	Hydraulic Coupler outlets for each tree to be tagged as follows: HP, SP, MEOH, KHI, CI Electrical Coax connectors to be marked as follows: PRC1A, PRC1B, PRC2A, PRC2B	

7.2 Equipment Manufacturing Requirements

The tubing of the hydraulic circuits shall be accurately cut and bent using standard tube cutters and tube benders. No burrs shall be allowed and each section of the tubing shall be cleaned and blown dry before assembly to ensure that no contamination (dirt) could enter into the control components.

NOTE:
PTFE tape shall not be used on any part of the hydraulic system.

The skid shall, upon completion of fabrication, have all weld scale removed.

7.3 FAT Test Procedure

The UTA shall undergo a factory acceptance test (FAT) comprising of the following as a **minimum**:

- Flushing and Fluid cleanliness check
- Hydrostatic Pressure Test
- Function Test
- Interface Check
- Cathodic Protection Continuity check
- Weighing
- Final inspection

Site Received Test Procedure

for

Visual Inspection and Verification of Completeness of

Cameron Supplied Equipment

02	13. December 2006	J. Grochowski	H. Mohwinkel	J. Grochowski
01	4. March 2004	H. Mohwinkel	S. Holyfield	S. Brzeczek
Cameron Rev	**Date**	**Prepared by**	**Checked by**	**Approved by**

Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
01	04.03.2004	Initial release Celle	
02	13.12.2006	Photo taking included	Required by engineering

Table of contents

1. Introduction

1.1. Scope

This document provides the procedure for inspecting equipment supplied by CAMERON to a remote site. The aim is to visually check the equipment when it arrives on site, and to verify against the packing list that the equipment is complete.

1.2. Safety Warning

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

The lifting and handling of the equipment must be carried out with extreme caution and with regard to the safety regulations.

All personnel working on the equipment must have the required experience, training and qualifications.

1.3. Equipment Description

Record the equipment to be inspected.

Equipment	Cameron Part Number

2. Visual Inspection

Note: Unpack equipment only when it can be repacked adequately. Ensure not to damage special packing (e.g. vacuum packing, shrink-packs, etc.).

Unpack equipment carefully.

Verify: _____

Inspect the equipment thoroughly for any damage that may have occurred during transportation (e.g. missing protective caps / covers, paint damage, dents, broken hinges, broken gauges, broken glass, cut cables, bent pins). Record any damage.

Verify: _____

Equipment	Cameron Part Number	Damage description

Verify: _____

3. Verification against Packing Inspection Record

Check if a packing inspection record is available.
Record packing inspection record document number: _____

Check against packing inspection record that all items are included.

Verify: _____

4. Photos

Take photos from all sides of the equipment. If damage was detected take detail photos. Attach clearly labelled photos to the procedure.

Verify: _____

Repack, store and secure equipment adequately.

Verify: _____

5. SRT Certificate

Unit inspected : _____

Cameron P/N : _____

The inspection was witnessed and the results were accepted by:

Signature: _____ Client Representative

Block Letters: _____ (if applicable)

Date: _____

Signature: _____ Cameron Representative

Block Letters: _____

Date: _____

Signature: _____ Third Party Representative

Block Letters: _____ (if applicable)

Date: _____

Handling Procedure

for

Umbilical Termination Assembly

P/N 223398-99

TOTAL / K5-F

Supplier:
CAMERON GmbH
Lueckenweg 1
29227 Celle
Germany
Phone: +49 5141 806 0
Fax: +49 5141 806 333

01	3. April 2007	J. Grochowski	G. Durand	R. Wrede
CAM Rev	**Date**	**Prepared by**	**Checked by**	**Approved by**

Document Revision History

Rev	Date	Description of change	Reason for change
01	3. April 2007		Initial Release

Table of Contents

1 Abbreviations

PN Part Number
SST Stainless Steel
UTA Umbilical Termination Assembly

2 Equipment Description

The UTA is part of the subsea distribution system for electric power and hydraulic pressurised fluid in the production control umbilical. It will be located subsea on a manifold and connectors are designed to be made by diver.

3 Reference Documents / Drawings

Description	Cameron Doc. No.
Bill of Material UTA	223398-99
Assembly Drawing UTA	SK-066398-99
Flow Diagram UTA	SK-066398-99-01
Field Termination Diagram UTA	SK-066398-99-42
Circuit Diagram UTA	SK-066398-99-04

4 Lifting of the UTA on Surface

Lifting slings for surface handling only: PN 2197010-06-75

Lifting weight without umbilical: approx. 2000 kg
For exact weight refer to data plate

Visually inspect the package for damage before and after lifting. Check that protective covers are in place.

Verify: _____

Apply four (4) point lifting to the frame.

Verify: _____

Ensure that wooden beams are available to set down the lifted UTA. Never set the UTA on ground, otherwise painting will be damaged.

Verify: _____

Lift the UTA carefully.

Verify: _____

Secure the UTA when it is not used.

Verify: _____

5 Protective Covers

Two (2) half covers are mounted over the hydraulic and electric connectors. Each hydraulic (20 off) and electric (4 off) connector has to be protected by a long term protective cover.

Protective Covers have to be in place until the unit is connected subsea.
Connections that are not in use need to be protected by long term protective cover.
Protective Covers that are removed should be retrieved and stored.

List of protective covers:

Equipment	Quantity
Cap for ¾" coupler 316 SST PN 2197024-90-04	4
Cap for 3/8" coupler 316 SST PN 2197024-90	16
Coax Electric Long Term Cover PN 2197088-17-11	4

GENERAL PRESERVATION & STORAGE PROCEDURE

FOR

CAMERON CONTROLS EQUIPMENT

07	12. March 2008	J. Grochowski	K. Yahosseini	J. Grochowski
06	14. March 2007	J. Grochowski	B. Müller	J. Grochowski
05	12. May 2006	J. Grochowski	F. Duensing	J. Grochowski
04	18. July 2005	J. Grochowski	F. Duensing	J. Gronstedt
03	6. January 2005	J. Grochowski	A. Kamp	T. Loi
02	14. May 2004	H. Mohwinkel	M. Lehmker	A. Voges
01	27. August 2002	J. Grochowski	K. Seidel	K. Yahosseini
Cameron Rev	**Date**	**Prepared by**	**Checked by**	**Approved by**

Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
D 07	02. April 02	Document layout revised Document Revision Status sheet added	
01	27. Aug 02	CAMTROL equipment added	Request from project
02	14. May 04	Chapter 3: tarpaulin cover usage for outdoor storage added; Chapter 4.2: Storage fluid (for storage of 1 to 2 years) Castrol Anvol changed to Transaqua HT; Chapter 5.3.1.1 added	Requested by project
03	6. Jan 05	No content change	SAP upload
04	18. July 05	Comments included	Required by D. Coonrod
05	12. May 06	TUTA requirements included	Required by project
06	14. Mar 07	Umbilical poppet requirement included	Required by project
07	12. Mar 08	Comments included	Required by project

Table of contents

1 Introduction

This document outlines the procedure for preservation and storage of a control system before and after use. This includes Production Control Systems, Workover Control Systems and Drilling Control Systems. The purpose of this procedure is to keep the equipment supplied by Cameron Celle in a proper shape during storage. It will be available for further operations without major refurbishment due to insufficient control during storage.

This document provides instructions to ensure preservation and protection of all typical control system equipment in order to prevent deterioration caused by corrosion, damage, influence of weather and foreign materials, during shipment, storage and installation.

2 Reference Procedures

X-065460-( )-( )	Protective Coating Procedure for Cameron Controls Equipment
X-065390-03	General Protection and Coating Procedure for Cameron Celle Controls Equipment
X-065390-03-00-01	Protection and Coating Procedure for Cameron Celle Controls Equipment
X-027055-01	Corrosion Inhibiting Coating of Machined Surfaces

3 General Storage Requirements for Environment

Before starting any activities for preservation & storage all functions need to be verified. It must be checked that maintenance and repair works have been performed by qualified service personnel and that the control system does not have any mechanical damages on framework, umbilicals, hoses and cables.

Clean and dry the equipment prior to storage and place it under cover (if available) in a clean and dry environment.

For outdoor storage use tarpaulin covers. Ensure that covers are correctly attached and check covers for any damage. Replace damaged covers.

Preferred ambient conditions for storage areas[*)]

Temperature range	:	0 to 40°C
Humidity range	:	0 to 50 % (excluding condensation and frost)

[*)] If above values are not available, humidity and temperature must be within project related specified range.

In areas with high ambient temperatures consider protection against UV light / direct sunlight to protect e.g. plastic materials or compensation systems (thermal expansion).

Atmosphere must be free from harmful substances which can effect resilient seals (e.g. high ozone level).

Store equipment and spare parts with sealing surface protection by protective devices and protect after inspection if necessary.

Consider special storage procedures for critical materials like hydraulic fluid, batteries, rubber goods etc.

Handling and transport of equipment must always be in accordance with the conform procedure, shown in the Operation and Maintenance Manual for the control system.

4 Cameron Controls Standard Hydraulic Control Fluids

This section outlines the Cameron Celle Controls standard hydraulic control fluids. If any other fluid is specified the appropriate data sheet must be considered for preparation and storage of the system.

4.1 Hydraulic Oils

The standard oil types for Cameron Celle Controls equipment are:

- SHELL TELLUS (different types)
- CASTROL BRAYCO MICRONIC 864

Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

Note: Further details for treatment of fluid before and during storage for the specific equipment are listed in section 5.

4.2 Water Based Fluid

The typical water based fluid types for Cameron Celle Controls equipment are delivered by **Mac Dermid CANNING (MARSTON BENTLEY) LTD.**:

- Oceanic HW 511
- Oceanic HW 525
- Oceanic HW 540
- Oceanic HW 443
- Oceanic HD 603 Water/Glycol with lubricant

A typical water based fluid supplied by **CASTROL**:

- TRANSAQUA HT or HT2

A typical water based fluid supplied by **CAMERON**:

- CAMERON 590 X Water / Glycol with lubricant

Note: Further details for treatment of water based fluid before and during storage are listed in the following table.

Water Based Fluid	Suitable Storage Fluid (>6 months)	Suitable Storage Fluid (>1 year)	Suitable Storage Fluid (>2 years)
Mac Dermid CANNING OCEANIC HW 525 Cameron PN 619011-36 OCEANIC HW 540 Cameron PN 619011-28 OCEANIC HW 443 Cameron PN 619011-41	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285
Mac Dermid CANNING Water based fluid with ERIFON HD 603 Cameron PN 619011-46 (Lubricant)	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285
	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	Composition Lubricant/Glycol/Water: 5 % Lubricant: PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	
CASTROL TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	TRANSAQUA HT Cameron PN 619011-53
CASTROL TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	TRANSAQUA HT2 Cameron PN 619011-84
CAMERON Fluid Cameron 590 X Cameron PN 619011-24 (Lubricant)	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 40 % Glycol PN 619011-10 55 % Demineralized Water	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285

5 Specific Equipment Preservation and Maintenance Requirements

Note: Preservation during storage shall be performed in accordance with the check lists shown in section 6.
Any damage occurring during the periodical checks must immediately be repaired and reported to the Maintenance Supervisor.

5.1 Instruments for Surface Containers and Frames

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

All moving parts are to be lubricated with Molycote 3402 or equivalent.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

5.2 Hydraulic Power Unit and Local Control Panel

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines, including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen precharge of each hydraulic accumulator down to 10 bar / 145 psi. This is for safety reasons and to keep e.g. bladder in a stable position.

Air accumulators must be vented and drained of water.

Open ends of piping must be sealed off by plugs or caps.

All moving parts including the push rod of the panel valves must be protected by Molycote 3402 or equivalent.

Operation panels must be protected by a protective cover or door.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anti-condensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect ventilation grills / air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof local control panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

All isolation valves (except drain valves) must be closed. 4/3-way panel valves must be moved to "CENTER" position. 3/2-way panel valves must be in "CLOSE" or "VENT" position.

5.2.1 Hydraulic Oil

For long term storage no fluid exchange is required to get conservation against corrosion if equipment is filled with clean hydraulic oil.

After usage or longer storage (>3 months) hydraulic reservoirs must be checked for cleanliness and water content. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

Note: Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

If the water content of the oil is too high, check the hydraulic fluid for bacterial contamination. Clean the system up if necessary by following instructions of supplier.

Hydraulic lines have to be flushed to customer required cleanliness level.

Note: Cleaning of the hydraulic lines of an empty system must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

5.2.2 Water Based Fluid

General

For long term storage (>6 months) a special fluid preparation is required to get conservation against corrosion of equipment.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Reservoirs must be checked for cleanliness.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluid should be within the system during long term storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions. The table in section 4.2 shows different possibilities for long term (>6 months) storage.

5.3 Remote Control Panel

Painting, frame and moving parts must be checked in accordance with section 5.1.

5.3.1 Electric Remote Control Panel

Cable connections are to be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Operation panel must be protected by a protective cover or door if available.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

Rack mounted equipment shipped separately from cabinets should be bagged with desiccant and tagged with shock fuses.

5.3.1.1 Control Panel for climatic controlled environment

Control panel for use in climatic controlled environment e.g. Master Control Station (MCS), Electric Power Unit (EPU), Remote Workstations etc.

Equipment should be stored in a warehouse in undamaged packaging under the following conditions excluding intensive dust and condensation of humidity.

Temperature -18 - +60°C

Humidity 20-90% RHNC

When packaging has to be opened e.g. for site receive tests it is recommended to use corrosion inhibitors (e.g. Cortec®VCI 110) for further preservation.

5.3.2 Pneumatic Remote Control Panel

Pneumatic connections are to be cleaned up and protected by non aggressive protective shield, protection against dust or mating protective cover if available. Check pneumatic jumper cable as well.

Air receivers must be vented and drained of water.

Operation panel front must be protected by a protective cover or door.

Acryl glass window panes on panels located in hazardous areas must be cleaned with wet cloth only due to electrostatic charge.

5.4 Hydraulic Umbilicals, Umbilical Jumpers & Steel Flying Leads

General Instructions

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the applicable hydraulic fluid.

All hydraulic connections must be cleaned from dirt by using cleaning solvents which do not harm the seals (see Operation and Maintenance Procedure).

The connection plate of the junction boxes must be protected by protective covers.

After cleaning mating protective caps or plugs must be mounted to the quick coupling or single connection.

Stainless steel junction boxes and plates must be covered with a thin film of non aggressive oil.

Painting, frame and moving parts must be checked in accordance with section 5.1.

The umbilical can be stored in a box or on a drum. The minimum bending radius for storage indicated by supplier may not be exceeded.

5.4.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The umbilical shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.4.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

All lines with poppets must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids and compositions (see table in section 4.2).

5.5 Electric Cables and Cable Jumpers

Contacts of electrical connectors must be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Check that cable minimum bending radius is kept for storage.

Cable materials have to be protected for storage to avoid mechanical impact and ageing impact caused by sunlight (UV).

5.6 Umbilical Reels

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cleaned piping must be sealed off by using protective plugs, caps or covers.

Parts for power transmission like gear, chain with sprockets etc. must be protected and lubricated.

Open gear drive with gear ring and cog	-	ANTI SEIZE (or equivalent)
Chain drive	-	ESSO CAZAR K2 (or equivalent)
Gear box for direct drive	-	See Operation and Maintenance Manual of gear box for specific oil type.

5.7 Uninterruptable Power Supply (UPS)

WARNING:

Hydrogen may discharge from batteries and cause explosion (depending from battery type). Sufficient ventilation is required.

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cable connections must be protected with non aggressive protective shield.

For storage of the UPS check the allowed temperature range in Operation and Maintenance Manual to avoid damage of sensitive parts like batteries etc.

Recharge batteries to full range. Deep discharge must be avoided.

Follow specific long term storage procedure for installed type of batteries.

Disconnection of batteries may be required.

Ensure that the UPS is tagged with a shock fuse indicator.

5.8 Subsea Valve Packages

Remark: Subsea valve packages are normally mounted to the subsea running tools (e.g. Lower Marine Riser Package), which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.8.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.8.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.9 Subsea Control Modules (direct / pilot hydraulic types)

Remark: This section is **not** to be applied for CAMTROL subsea control modules. Refer to the "CAMTROL Subsea Production Control Equipment" section.
Subsea Control Modules (SCM) are normally mounted to the subsea running tools which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool. Flushing and testing can be done with the appropriate flushing and testing unit.

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Hydraulic pressure from all lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

If applicable, cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

5.9.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.9.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.10 Hydraulic Flushing and Testing Units

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

Air receivers must be vented and drained of water.

Open connection ends must be sealed off by plugs or caps.

All moving parts must be protected by Molycote 3402 or equivalent.

Junction plates must be protected by an overall cover or individual caps and plugs.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anticondensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

5.10.1 Hydraulic Oil

Reservoirs must be checked for cleanliness and water content. Water content of hydraulic oil must be checked to be within the maximum allowed range. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.10.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.11 Running Tools for Subsea Modules

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines must be discharged.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Hydraulic lines are to be flushed to customer required cleanliness level.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.12 Hydraulic Cylinder (e.g. on SCM Test Stand)

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

Hydraulic cylinders are to be flushed to customer required cleanliness level. Ensure that the cavities are completely filled with hydraulic control fluid. Ensure that no air is left in the cylinders as remaining air might cause corrosion.

Painting must be checked in accordance with section 5.1.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Put piston of the cylinder in retract position. This ensures that the rod is protected inside the cylinder against corrosion or damage.

Grease the cylinder rod with silicon grease or equivalent non aggressive grease.

Store the cylinder in a dry indoor environment. Room temperature should not be below 37°F (3°C).

5.13 Float Type Accumulators

Note: Preservation has to be carried out when the float type accumulators are unused and storage will be longer than three (3) months.

<u>Disassembly of Accumulator</u>

Bleed the pressure from hydraulic fluid supply.

Ensure that the ¼" needle valve at the bottom of the accumulator is in the closed position.

Remove the ¼" NPT plug.

Open the ¼" needle valve at the bottom of the accumulator.

Ensure that the accumulator is depressurised.

Open the hammer union at the bottom of the accumulator.

Ensure that the floater is at the lower end of the accumulator.

Remove the plug at the end of the floater pipe.

Inspect the seals (floater pipe plug, hammer union).

Spray non aggressive anticorrosive lubricant into the accumulator to protect the inner surface of the accumulator.

Carefully move the accumulator in vertical position and ensure that the lubricant flows out of the accumulator.

Assembly of Accumulator

Grease the o-ring of the plug and fix the plug at the lower end of the floater pipe.

Grease the thread at the end of the accumulator bottle and connect the hammer union.

Close the ¼" needle valve at the bottom of the accumulator and install the ¼" plug.

Painting must be checked in accordance with section 5.1.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.14 Topside Umbilical Termination Unit / Assembly

Topside Umbilical Termination Units / Assemblies (TUTU / TUTA) will be treated like Hydraulic Power Units (HPU). The workload is reduced as the TUTU / TUTA does not contain motors, pumps and reservoirs.

5.15 Wire Rope

Grease the wire ropes with wire rope grease. Ommex or Kendal or equivalent wire rope grease can be used.

Store the wire ropes in a dry outdoor or indoor environment.

5.16 Load Cell

Protect the load cells by a thin film of non aggressive oil.

Store the load cells in a dry indoor environment. Room temperature should not be below 37°F (3°C).

6 Preservation Maintenance Check Lists

The following checklists must be used to get a controlled storage of the equipment with proper maintenance.

6.1 Hydraulic Power Unit and Local Control Panel (Main Control Unit)

Preservation Maintenance Check List	**Sheet: 1 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-65390-03-00-00 or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film; repair if necessary	Non aggressive oil
8.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Motors, Distribution Boxes, Relay Boxes, Subswitchboards, Junction Boxes**					
1.0			X		Inspect protection on cable connections; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0		X			Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check drain valves to be open	
6.0			X		Inspect fluid according to section 5.2.1 or 5.2.2	

6.2 Umbilical Reel with Umbilical

Preservation Maintenance Check List — **Sheet: 1 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check lines to be pressureless, drain valves to be open	
6.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.3 Electric Remote Control Panels

Preservation Maintenance Check List						**Sheet: 1 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A. General Inspection						
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, Vaseline or equivalent
4.0			X		Check pneumatic circuits to be depressurized (for purged system only)	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil

Preservation Maintenance Check List						**Sheet: 2 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.4 Pneumatic Remote Control Panels

Preservation Maintenance Check List — **Sheet: 1 of 1**

Description of Equipment: **Pneumatic Remote Control Panels**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on pneumatic hose connection, repair if necessary	Non aggressive protective shield with additional cover
4.0			X		Check pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
7.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
8.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
9.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
10.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
11.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.5 Hydraulic and Electrical Jumpers

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Hydraulic and Electrical Jumpers**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0	X				Check junction boxes and couplings for proper protection by covers, caps or plugs	
4.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield; acid free Vaseline or equivalent; protective caps
6.0			X		Check protection of electric cable against mechanical impact and ageing impact by sunlight	
7.0			X		Check that cable minimum bending radius is kept for storage	
8.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.6 Subsea Valve Package

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Valve Package**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
6.0			X		Check lines to be pressureless; drain valves to be open	
7.0			X		Inspect fluid according to section 5.8.1 or 5.8.2	

6.7 Subsea Control Module (direct / pilot hydraulic types)

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Control Module (not for CAMTROL SCM)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
6.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
7.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
8.0			X		Check lines to be pressureless; drain valves to be open	
9.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
10.0			X		Inspect fluid according to section 5.9.1 or 5.9.2	

6.8 Hydraulic Flushing and Testing Unit

Preservation Maintenance Check List						**Sheet: 1 of 3**
Description of Equipment:	**Hydraulic Flushing and Testing Unit**					
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
6.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List	**Sheet: 2 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C. Hydraulic Circuits						
1.0			X		3/2-way valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way valves to be in open centred position; function lines to be pressureless	
3.0			X		Check lines to be pressureless; drain valves to be open	
4.0			X		Inspect fluid according to section 5.10.1 or 5.10.2	

6.9 Running Tool for Subsea Module

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Running Tool for Subsea Module**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
6.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
7.0			X		Inspect fluid according to section 5.11	

7 CAMTROL Subsea Production Control Equipment

Note: Use the instructions in this section as check lists.

7.1 Subsea Control Module / SCM

Check on the bill of material if individual “Shipping, Transportation and Storage Guidelines” are available for the SCM, otherwise follow the instructions below:

Verify: _____

Store the SCM in the crate until it is required for use.

If it is necessary to gain access to the SCM, remove the top and sides of the crate, but leave the SCM on the shipping frame.

Visually inspect the SCM / packing before use and every **3 month** when it is not used.

Verify: _____

The storage environment must be free from harmful substances which can affect resilient seals (i.e. high Ozone level).

Verify: _____

The ambient temperature for storage must be within the range -10°C to 40°C to maintain the integrity of the pressure compensation system and ensure that no dielectric oil bleeds out.

Verify: _____

CAUTION:
If the loss of dielectric oil exceeds 3 Litre the SCM needs to be refilled in accordance to Cameron “Field refill procedure”. The lower reservoir of the shipping frame is seized to 3 Litre. If you are in doubt please contact Cameron Germany Engineering Department (Tel +49 (0)5141 8060).

7.2 Subsea Accumulator Module / SAM

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Any damage occurring during the periodical checks must immediately be reported and repaired by Cameron Controls.

Verify: _____

Drain the hydraulic pressure from the accumulators.

Verify: _____

Bleed nitrogen pre-charge from the accumulators. Leave 10 BAR residual pressure in the accumulator to prevent the bladder from collapsing.

Verify: _____

Close the two (2) Gas Valves on the HP Accumulators.

Verify: _____

Open ends of Accumulators must be sealed by plugs or protective caps off stainless steel on the gas side off the accumulators.

Verify: _____

Lubricate all moving parts, except the Hydraquad hydraulic connectors, by water-resistant grease.

Verify: _____

Painting, frame and moving parts must be checked for damage.

Verify: _____

Stainless Steel parts must be protected by a thin film of non aggressive oil (Pelox Protector or similar).

Verify: _____

7.3 Subsea Distribution Unit / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.3.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Set all valves to CLOSE position.

Verify: _____

Protect the mounting base of the SAM by a protective cover.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes

Verify: _____

7.3.2 Electrical Parts

Check that all ROV connectable fuses are installed.

Verify: _____

Check that all electrical connectors are protected by caps

Verify: _____

7.4 Umbilical Termination Assembly / UTA

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.4.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes.

Verify: _____

7.4.2 Electrical Parts

Check that all electrical connectors are protected by caps.

Verify: _____

7.5 Foundation Base & Mud Mate for UTA / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Foundation Base only: Verify the proper operation of the two (2) pile locks and confirm that they are in the unlocked position.

Verify: _____

Check the SDU locking mechanism by operating.

Verify: _____

Check the guide post locking mechanism by operating.

Verify: _____

Inspect all lift shackles for deformation and other damage.

Verify: _____

Check condition of all protection anodes.

Verify: _____

8 Handling Requirements for Special Materials

8.1 Rubber Goods

GENERAL

There is very little published information on the storage and care of rubber goods as used in the oil field. When we speak of rubber goods we include the synthetic packings of Nitrile Copolymers and Neoprene as well as natural rubber parts. Natural rubber parts have become relatively rare but the same things that are harmful to natural rubber are also harmful to the synthetics in varying degrees.

Generally speaking, light and air are bad for rubber goods. The exact chemical action is not fully understood and what has been written disagrees on the mechanism involved.

Ozone is known to be bad for rubber goods. Ozone (O_3) is a very active form of oxygen. As far as we know two principle sources contribute the ozone that reaches rubber goods. One is atmospheric ozone which is generated in the stratosphere carried downward by convection currents and eventually absorbed by organic matter. The other source is electrical discharges, such as lightning, high voltage corona, but more commonly, electrical machinery. Ozone attack is characterized by fairly deep cracks in the rubber parts.

Rubber is attacked by ordinary oxygen (O_2) much as steel rusts in the presence of oxygen. Oxidation is characterized by a hard skin which eventually crazes in a multitude of small cracks and may turn chalky or assume a bark-like appearance.

A strong direct light, especially sunlight, has deleterious effects on rubber goods. This is attributed to the ultraviolet content of the spectrum which accelerates cracking. Whatever the mechanism however, light, particularly sunlight, is undesirable. In extremely cold climates some rubber goods will become so brittle that upon dropping or rough handling they will shatter.

In very warm humid climates, particularly those found in some parts of the tropics, fungi and bacteria find their way to the rubber goods and attack the organic content. This is especially true on duck reinforced rubber parts. However, parts reinforced with synthetics will not be attacked in the reinforcement.

Heat also has a bad effect on rubber. This could be the result of sunlight or artificial or accidental heating of any type. Heat results in a gradual hardening of the part and if ozone or oxygen are present, will accelerate their action.

Any stretching or bending of rubber in storage will result in very accelerated ageing. By the term ageing, we mean the cumulative effects of all the above mentioned attacking agents over a period of time. Ozone attacks rubber preferentially at points of strain.

Rubber goods, both natural and synthetic, all possess some degree of susceptibility to various solvents including water, but especially the liquid hydro-carbons. These manifest themselves in various ways by either swell or shrinkage of the rubber goods with which they are in contact.

No precise figure can be given as a "storage life" of a part. This is dependent on all of the above conditions and also the size of the part, its material and function. Generally speaking, the greater the relative surface area is to the volume, the more susceptible a part is to being rendered useless by ageing. For example, a relatively bulky part such as a ram front packer might be expected to have a much longer useful shelf life than a thin large diameter o-ring type of seal such as used on the bonnet seals of preventers or the rings in 'X' bushing.

STORAGE

From the preceding section we can draw a few rules governing storage of rubber goods. Briefly put - a cool, dry, dark storage place would be the best. The ideal would be to store the packings in vacuum sealed containers. The following rules, however, should not be difficult to follow under the average storage conditions experienced throughout our operation.

- Keep the rubber storage area as dark as possible. Certainly not out of doors, and, if indoors, away from skylights or windows and with subdued or indirect artificial lighting.
- Select the coolest location possible and be sure that no heaters or stoves are near by and particularly that the direct blast from a space heater does not blow on the rubber parts.
- Be sure that no electrical machinery (motors, switch gear, or any high voltage equipment producing corona) is near the rubber goods and that drafts will not carry the atmosphere from electrical machinery to the area in which the rubber goods are stored.
- The practice of first in - first out is essential with rubber goods. There is a natural tendency to remove parts from the front of a bin and when stock is replenished to leave the parts that are in the back in place, in which case years might pass before these are finally pulled out for use.
- Store rubber goods in a relaxed position. For example, do NOT hang o-rings on nails. Where possible, do not keep assemblies in stock where the rubber goods are stretched in order to assemble them on the part. For example, o-rings on blanking plugs, tubing hangers and 'X' bushing. In some cases this is difficult as it is with the aforementioned 'X' bushings. On these, periodic inspection should be employed to detect any signs of ageing as quickly as possible.

  On parts, such as the 'X' bushing rings, where we know the rubber parts will be stretched in storage, the best age resistant compounds we can buy are used.
- Keep storage as dry as possible and remove any oil, gas, etc. of hydro-carbon nature that may accidentally get on the rubber.
- Do not store the rubber goods on top shelves near galvanized roofs. There are several reasons for this; one is that heat is passed through galvanized roofing and also there is some opinion that ozone may be generated in this area.
- If possible, store rubber goods in buildings of wooden construction and wooden shelves. Wood is believed to scavenger ozone quite effectively.
- If store for extended periods is unavoidable, sealed containers will aid considerably; impervious surface coverings such as "Sea-Peel" or waxing will help.

USABILITY CHECKS

No general rule can be drawn regarding usability. The final measure is whether or not the cumulative effects of ageing have affected the physical properties of the part to such an extent that it will no longer perform the function for which it is designed. Thus, a large heavy part might suffer the same total amount of ageing as a small, light, thin piece, and still be usable whereas the small part is rendered useless. In these cases some judgement must be used in deciding usability.

Prior to shipment or use out of stock, rubber goods should be examined to see that no "chalking" or "barking" (bark-like surface appearance) is present, that there is not a hard skin on the rubber and that there are no cracks. Sometimes cracks will be obvious, but it is wise to stretch or bend the part in question so that any incipient cracks or very thin cracks will reveal themselves. Where a part is suspect, a check of hardness should be run. In the event that the hardness runs 15 points higher than the nominal hardness of the part, it is considered non-usable. Hardness is affected by temperature and readings should be taken with the rubber part at 70°F – 100°F (21°C - 38°C).

8.2 Hydraulic Hoses

STORAGE

- Before placing hose in storage, it should be completely drained.
- Whenever feasible, store the hose in the original wooden shipping crate. This will provide some protection against the deteriorating effects of solvents, corrosive liquids, ozone and sunlight. Hose should be stored so that the coils are in a horizontal plane.
- Certain rodents and insects will damage the hose. Adequate protection from them should be provided.
- The ideal temperature for storing the hose ranges from 50°F (10°C) to 70°F (21°C) with a maximum limit of 100°F (38°C). If stored below 32°F (0°C), the hose will become stiff and would require warming before placed in service. The hose should not be stored near sources of heat, such as radiators, base heaters, etc., nor should the hose be stored under conditions of high or low humidity.
- To avoid the adverse effects of high ozone concentration, the hose should not be stored near electrical equipment that may generate ozone or be stored for any lengthy period in geographical areas of known high ozone concentration. Exposure to direct or reflected sunlight - even through windows - should also be avoided.

HANDLING

CAUTION: Care should be exercised to prevent mishandling. Crushing or kinking of the hose can cause severe damage to the reinforcement. If this occurs, remove hose from service.

- In order to minimize the danger of kinking, the hose preferably should be removed from its crate by hand, laid out in a straight line, then lifted by means of a catline attached near one end of the hose. If a catline is used to remove the hose from its crate, the crate should be rotated as the hose is removed. Recommended practice is to protect the hose in some manner when moving to a new location. It is considered bad practice to handle the hose with a winch, to hand the hose from a truck gin pole, or to place heavy pieces of equipment on the hose.

8.3 Electronic Goods and Tools containing Electronics

8.3.1 General Instructions

Rapid temperature changes must be excluded to avoid condensation of humidity and mechanical stress.

The packing should protect electronic goods against:

- Dust
- Humidity
- Electrostatic Charge
- Shock
- Direct Sunlight

Generally the original transport packing serves the above requirements best.

Normally antistatic bags, desiccant and anti-shock pads are applied to prevent damage.

Electronic goods should be stored in a warehouse secured against theft.

8.3.2 Fiberoptic Terminations

Optic Link Modules (OLM) should be capped. Caps have to be removed before installation.

8.3.3 Handling Procedure for CMOS Devices

Electrical environments such as overvoltages and electrostatic discharges damage CMOS devices and printed circuit cards containing the devices. Most CMOS devices have diode input protection circuits and gate protection structures to protect against such electrical environments.

In addition to the internal protection network, use the following steps to prevent the generation of severe electrical transient voltages during handling of CMOS devices.

- Read the manufacturer's equipment specification and data sheets before performing maintenance. Do not exceed recommended maximum voltage levels.
- Use grounding wrist straps which contact the skin.
- Ground all work surfaces.
- If lead-straightening or hand-soldering is necessary, provide ground straps for the equipment, and ground the soldering ties.
- Connect all unused inputs to an appropriate logic voltage level, either power or ground.
- Inspect test equipment for proper polarity of voltage before conduction parametric or functional testing.
- Inspect all power supplies used for testing to ensure there are no voltage transients present.
- Do not insert or remove devices from test sockets with power applied.
- Do not contact edge connectors which are wired directly to device inputs.
- If external connections to a printed circuit card address only an input of the integrated circuit, use a resistance of 10 K ohms or greater in series with the input. The resistance limits damage to the card if it is removed and contacts static generating materials.
- Connect all low impedance equipment such as pulse generators to inputs only after the device has power applied. Disconnect the equipment before power is removed.
- Do not allow nylon or other static generating materials to contact the devices.
- Store or transport the devices in materials that are antistatic. Do not insert the devices into plastic packing material, styrofoam, or plastic trays.

8.3.4 Lithium Manganese Dioxide Battery

Replacement of the Lithium Manganese Dioxide battery mounted in the subsea transmitter & battery module: The battery supports the AMF-System (Automatic Mode Function / Dead Man System) belonging to multiplex drilling control systems. Under normal operation conditions replacement is required **after each one-year period**. Battery storage conditions should be in a range of 23°F – 59°F (–5°C to 15°C).

9 Attachment

- Data Sheets of Protective Materials (if required)
- Data Sheets of Hydraulic Fluids (if required)

STATUS: Released REVISION : 04
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : K5F UTA

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
1	0001	06	222416-64	1.000	EA	K5F UTA FRAME		
10	0010	03	2197024-53-09	4.000	EA	3/8" COUPLER, MALE HALF, 690 BAR WP (10KSI), WITH POPPET, 316 SST, END CONNECTION: TUBE STUD WITH 300MM LONG TUBE SUPER DUPLEX, 3/4" OD x 0.083" WT, FLUIDS: WATERBASED FLUIDS (e.g. CASTROL TRANSAQUA HT) METHANOL, CORROSION INHIBITOR, KINECTIC HYDRATE INHIBITOR AND SEAWATER KEYING: NO, COLOUR: NA, MFG NO: TBA, SUPPLIER: MSCM, PROTECTION CAP: TBA, FEMALE HALF: CAMERON PN 2197024-52-03/-04/-05		
101	0101		619901-13-14-09	176.000	EA	SCREW, HEX, DIN 933, M8 X 20, SST MATERIAL: AISI 316 (1.4401)		
102	0102		619901-11-14-09	16.000	EA	SCREW, HEX, DIN 933, M6 X 20, SST MATERIAL: AISI 316 (1.4401)		
103	0103		619903-08-12-06	24.000	EA	SCREW, SOC, DIN 912, M6 X 25, SST MATERIAL: AISI 316 (1.4401)		
104	0104		619901-15-14-09	25.000	EA	SCREW, HEX, DIN 933, M12 X 20, SST MATERIAL: AISI 316 (1.4401)		
105	0105		619901-13-20-09	16.000	EA	SCREW, HEX, DIN 933, M8 X 40, SST MATERIAL: AISI 316 (1.4401)		
106	0106		619979-04-07-08	72.000	EA	SCREW, CTK, DIN 7991, M6 X 20, SST MATERIAL: AISI 316 (1.4401)		
107	0107		619901-13-35-09	16.000	EA	SCREW, HEX, DIN 933, M8 X 130, SST MATERIAL: AISI 316 (1.4401)		
108	0108		619901-13-35-09	4.000	EA	SCREW, HEX, DIN 933, M8 X 130, SST		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						MATERIAL: AISI 316 (1.4401)		
11	0011	03	2197024-53-08	4.000	EA	3/8" COUPLER, MALE HALF, 690 BAR WP (10KSI), WITH POPPET, 316 SST, END CONNECTION: TUBE STUD WITH 300MM LONG TUBE SUPER DUPLEX, 3/4" OD x 0.083" WT, FLUIDS: WATERBASED FLUIDS (e.g. CASTROL TRANSAQUA HT) METHANOL, CORROSION INHIBITOR, KINECTIC HYDRATE INHIBITOR AND SEAWATER KEYING: 144°, COLOUR: WHITE, MFG NO: TBA, SUPPLIER: MSCM, PROTECTION CAP: TBA, FEMALE HALF: CAMERON PN 2197024-52-05		
111	0111		619910-14-09	24.000	EA	NUT, HEX, DIN 934, M6, SST MATERIAL: AISI 316 (1.4401)		
112	0112		619910-16-09	4.000	EA	NUT, HEX, DIN 934, M8, SST MATERIAL: AISI 316 (1.4401)		
12	0012	03	2197024-53-07	4.000	EA	3/8" COUPLER, MALE HALF, 690 BAR WP (10KSI), WITH POPPET, 316 SST, END CONNECTION: TUBE STUD WITH 300MM LONG TUBE SUPER DUPLEX, 3/4" OD x 0.083" WT, FLUIDS: WATERBASED FLUIDS (e.g. CASTROL TRANSAQUA HT) METHANOL, CORROSION INHIBITOR, KINECTIC HYDRATE INHIBITOR AND SEAWATER KEYING: 108°, COLOUR: BLACK, MFG NO: TBA, SUPPLIER: MSCM, PROTECTION CAP: TBA, FEMALE HALF: CAMERON PN 2197024-52-04		
121	0121		619010-06-76-02	25.000	EA	TECKENTRUP CONNECTING WASHER ARTICLE: 88129 FORM K: WITH CONTACT TEETH ID X OD X T: 12 X 24.25 X		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						1.6 mm MATERIAL: AISI 316 (1.4401)		
122	0122		619010-06-76-01	208.000	EA	TECKENTRUP CONNECTING WASHER ARTICLE: 88129 FORM K: WITH CONTACT TEETH ID X OD X T: 8 X 16.2 X 1.4 mm MATERIAL: AISI 316 (1.4401)		
123	0123		619954-01-13-03	40.000	EA	WASHER, DIN 6798, TYPE A, 6.4 ID SERRATED LOCK WASHER EXTERNAL TOOTH MATERIAL: AISI 316 (1.4401)		
124	0124		619936-10-04-01	16.000	EA	WASHER, DIN 9021, 13 X 37 X 3, SST TYPE: A ; MAT.: AISI 316 (1.4401)		
125	0125		619919-13-01-08	8.000	EA	WASHER, MEDIUM, DIN 125, A 8.4, SST TYPE A: W/O. CHAMFER ; ID: 8.4 MM MATERIAL: AISI 316 (1.4401)		
13	0013	03	2197024-57-02	4.000	EA	3/4" COUPLER, MALE HALF, 517 BAR WP (7.5KSI), WITH POPPET, 316 SST, END CONNECTION: TUBE STUD WITH 300MM LONG TUBE IN SUPER DUPLEX, 3/4" OD x 0.083" WT, FLUIDS: WATERBASED FLUIDS (e.g. CASTROL TRANSAQUA HT) METHANOL, CORROSION INHIBITOR, KINECTIC HYDRATE INHIBITOR AND SEAWATER KEYING: 162°, COLOUR: VIOLET, MFG NO: AS036508, SUPPLIER: MSCM, PROTECTION CAP: PLASTIC FEMALE HALF: CAMERON PN 2197024-56-01		
14	0014	01	2197024-90-04	4.000	EA	CAP FOR 3/4" COUPLER, 316 SST KEYING: NO, COLOUR: NA, MFG NO: TBA SUPPLIER: MSCM		
15	0015	02	2197024-90	16.000	EA	CAP FOR 3/8" COUPLER, 316 SST KEYING: NO, COLOUR: NA MFG NO:		

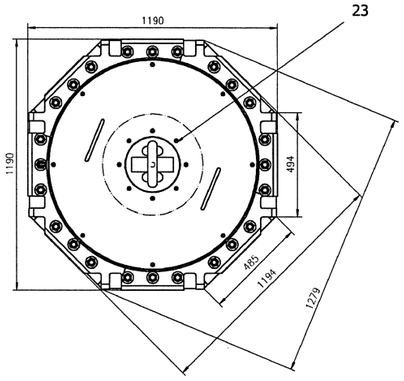
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						AS006002 SUPPLIER: MSCM PROTECTION CAP: TBA		
16	0016	G01	619046-20-61-51	1.000	EA	TAG: "CONTROL UNIT" (90X110) BLANK, 1.4301 COLOUR OF WRITING: BLACK		
17	0017	02	222704-18	3.000	EA	EARTH STRAP, 600 mm lg. M12 / M12 MATERIAL - 316 SST DIA. 3 mm WIRE ROPE WELDED WITH 2 END TABS & 2 HOLES FOR M12 / M12		
2	0002	10	223242-84	1.000	EA	PIPING AND FITTING UTA TOTAL K5F		
20	0020	01	222237-82	4.000	EA	ADAPTER PLATE FOR MEOH COUPLING		
21	0021	01	222480-50	8.000	EA	ADAPTER PLATE FOR COAX CABLE CONNECTOR		
22	0022	02	222648-27	1.000	EA	HEAD COVER HALF 1		
23	0023	02	222648-28	1.000	EA	HEAD COVER HALF 2		
24	0024	03	222505-01	8.000	EA	K5F UTA BODY SIDE COVER		
25	0025	01	222720-23	2.000	EA	GUIDE CLAMP FOR HEAD COVER		
4	0004	01	2197088-17-10	4.000	EA	Gisma Coax Flange Receptacle 80/4, m for UTA with one coax -contact	e-connector	
5	0005	01	2197088-17-11	4.000	EA	Gisma Coax LTC, female Pressure watertight Longterm Protective Cap for Receptacle (e.g.2197088-17-10)		
6	0006	02	223450-89	1.000	EA	TAGGING & MARKING UTA TOTAL K5F		
7	0007	01	2197010-06-75	1.000	EA	WIRE ROPE SLING, 4 Legs 1200, 14T		
8	0008	01	2197010-02-85	1.000	EA	HIGH-STRENGH SHACKLE, ANCHOR, FORM C, 25 TONS, TYPE:HEX HD BOLT, NUT & COTTER PIN, WORK. LOAD: 25 TONS, OPEN. WIDTH: 74MM, SHACKLE DIA.:45MM, BOLT DIA.: 50MM, MATERIAL: STEEL ZINC PLATED, CERTIFICATES DIN EN 10.204 / 3.1B SHACKLE HANDLE FROM MANGANESE STEEL BOLT TYPE: HEX HD BOLT WITH		

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						NUT AND SPLIT PIN PROTECTION, FROM ALLOYED STEEL, RECOMPENSES		
9	0009	02	2197024-53-06	4.000	EA	3/8" COUPLER, MALE HALF, 690 BAR WP (10KSI), WITH POPPET, 316 SST, END CONNECTION: TUBE STUD WITH 300MM LONG TUBE IN SUPER DUPLEX, 3/8" OD x 0.049" WT, FLUIDS: WATERBASED FLUIDS (e.g. CASTROL TRANSAQUA HT) METHANOL, CORROSION INHIBITOR, KINECTIC HYDRATE INHIBITOR AND SEAWATER KEYING: 36°, COLOUR: YELLOW, MFG NO: TBA, SUPPLIER: MSCM, PROTECTION CAP: TBA, FEMALE HALF: CAMERON PN 2197024-52-03		
>>>B/M Category : Engrg Spec/Document item								
800	0800	08	QP-000160-01-18	1.000	EA	Main Quality Plan for DC Tree Systems		
801	0801	25	D-000100-09-17	1.000	EA	PART IDENT: LOW STRESS STAMP, "ASSY", ASSY P/N, "REV" REV, "CAM" SAP PLANT NO, S/N ("CCV" MAY BE USED IN PLACE OF "CAM". SEE X-043764-01 FOR DETAILS)		
900	0900	03	SK-066398-99	1.000	EA	AS: K5F UTA		
901	0901	02	SK-066398-99-01	1.000	EA	FLOW DIAGRAM UTA TOTAL K5F		
902	0902	03	X-065437-01-19	1.000	EA	FAT - K5F UTA		
904	0904	02	X-076715-22	1.000	EA	SRT Procedure for Cam Supplied Equipment Site Received Test Procedure for Visual Inspection and Verification of Completeness of Cameron Supplied Equipment General		
905	0905	02	X-076709-03-47	1.000	EA	PACKING INSPECTION RECORD K5F UTA		
906	0906	01	X-065467-02-46	1.000	EA	UTA Handling Procedure K5-F		

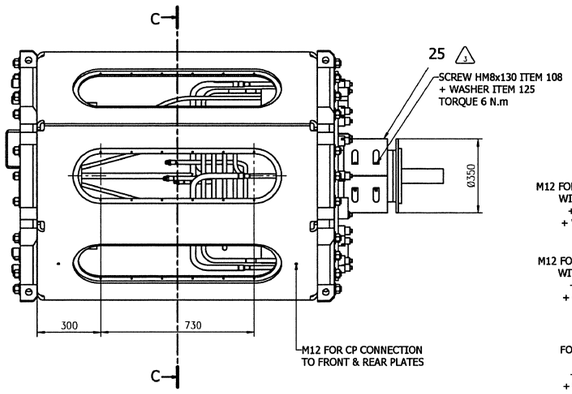
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						for Umbilical Termination Assembly Project: TOTAL K5-F		
907	0907	02	SK-066398-99-04	1.000	EA	CD: UTA, K5-F		
>>>B/M Category : Expendable item								
700	0700		619011-53	40.000	LI	OIL CASTROL TRANSAQUA HT 1.07 g/cm3 WATER BASED HYDRAULIC CONTROL FLUID VISKOSITY AT 40°C: 2.2 CST DENSITY: 1.07 g/cm3 POUR POINT: -42°C		
>>>B/M Category : Special Test equipment								
601	0601	01	2197024-52-06	2.000	EA	3/8" COUPLER, FEMALE HALF, 1035 BAR WP (10KSI), WITH POPPET, 316SST, WIRE LOCKING END CONNECTION: STRAIGHT JIC 8 (3/4"-16UNF) MALE FLUIDS: WATERBASED FLUIDS (e.g. CASTROL TRANSAQUA HT) METHANOL, CORROSION INHIBITOR, KINECTIC HYDRATE INHIBITOR AND SEAWATER KEYING: NO, COLOUR: NA, MFG NO: TBA, SUPPLIER: MSCM, PROTECTION PLUG: TBA, MALE COUPLER: CAMERON PN 2197024-53-05 UP TO -10		
602	0602	01	2197024-56-02	2.000	EA	3/4" COUPLER, FEMALE HALF, 776 BAR WP (11.2KSI), WITH POPPET, 316SST, WIRE LOCKING END CONNECTION: STRAIGHT JIC 12 (1.1/16"-12UNF) MALE FLUIDS: WATERBASED FLUIDS (e.g. CASTROL TRANSAQUA HT) METHANOL, CORROSION INHIBITOR, KINECTIC HYDRATE INHIBITOR AND SEAWATER KEYING: NO, COLOUR: NA, MFG NO: TBA, SUPPLIER: MSCM, PROTECTION PLUG: TBA,		

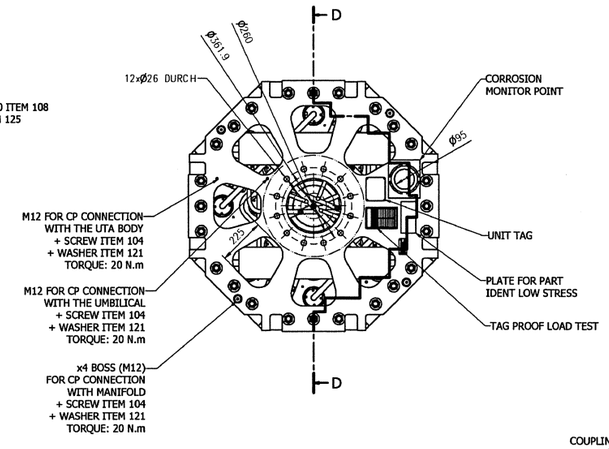
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						MALE COUPLER: CAMERON PN 2197024-57-02		
>>>B/M Category : Optional item								
18	0018	01	2197010-07-97	1.000	EA	SHACKLE, 25 T, SST		
>>>B/M Category : Reference Call Outs								
1000	1000	07	A-020025-01	1.000	EA	Total L4G Polyamide Paint system-Witness Polyamide epoxy paint system to be used for surface temperatures up to 65.C		
1001	1001	A02	WS-000542	1.000	EA	NON-NACE WELD.SPEC. FOR FAB./REPAIR OF ASME SECTION IX, P-1 GR. 1 OR 2 CARBON STEEL, NO PWHT, LOW TEMP. IMPACT REQ'TS. DO NOT APPLY, MEETS ASME SECTION IX, API 6A PRIOR TO 15TH ED., API 6D		
1002	1002	07	X-065429	1.000	EA	GENERAL PRESERVATION AND STORAGE PROCEDURE FOR CAMERON CONTROLS EQUIPMENT		

VIEW WITH COVER

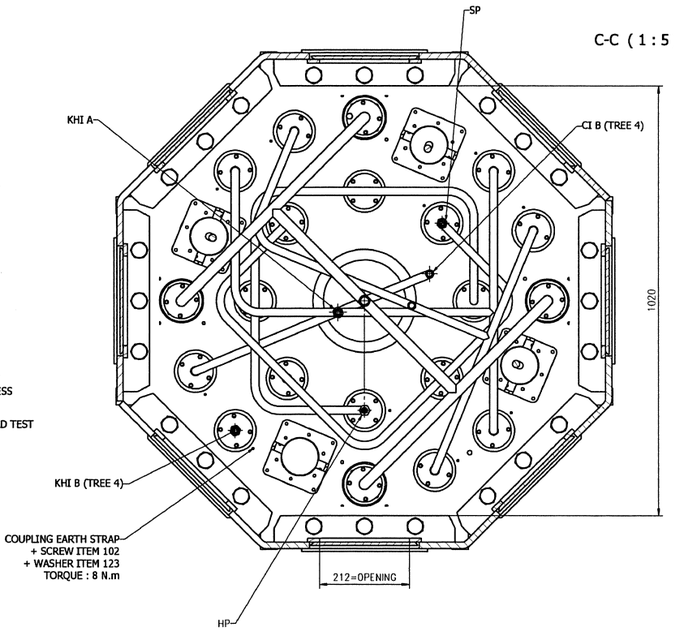


VIEW WITHOUT COVER

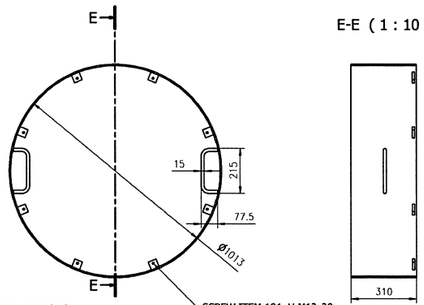




C-C (1 : 5)



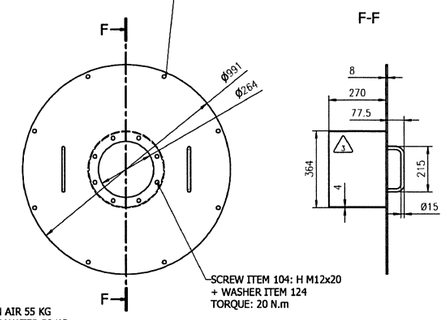
ITEM 22



NOTE:
- WEIGHT IN AIR 56 KG
- WEIGHT IN WATER 50 KG
- ONE HANDLE IS SUITTABLE FOR 150 KG

SCREW ITEM 104: H M12x20
+ WASHER ITEM 124
TORQUE: 20 N.m

ITEM 23

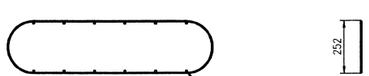


F-F

NOTE:
- WEIGHT IN AIR 55 KG
- WEIGHT IN WATER 50 KG
- ONE HANDLE IS SUITTABLE FOR 150 KG

SCREW ITEM 104: H M12x20
+ WASHER ITEM 124
TORQUE: 20 N.m

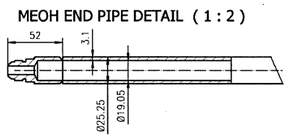
ITEM 24



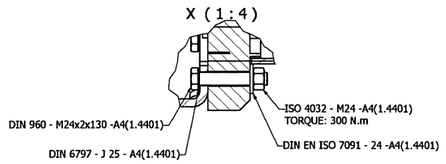
NOTE:
- WEIGHT IN AIR 14 KG
- WEIGHT IN WATER 12 KG

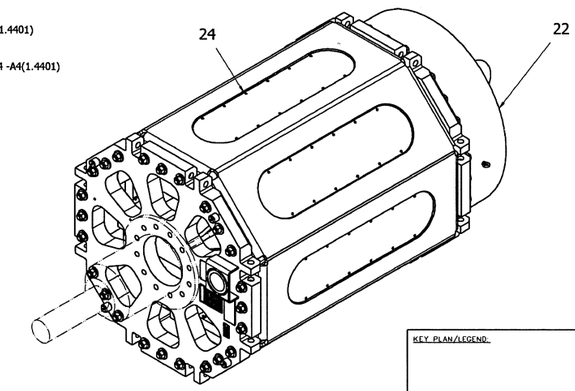
SCREW ITEM 104: H M8x20
+ WASHER ITEM 122
TORQUE: 20 N.m

MEOH END PIPE DETAIL (1 : 2)

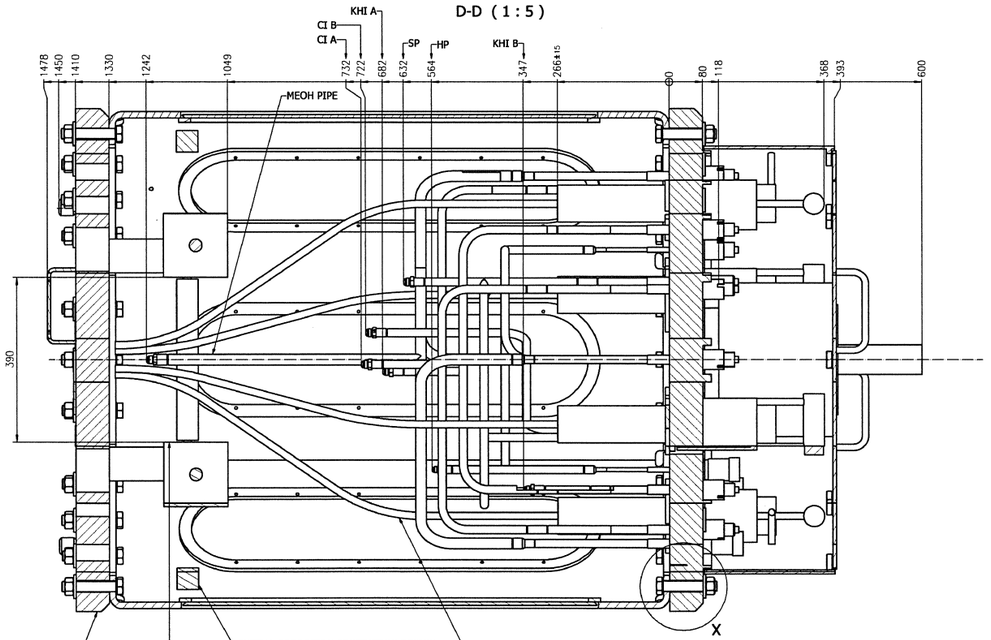


X (1 : 4)





D-D (1 : 5)



"EQUIPED" UTA REAR PLATE
WEIGHT IN AIR: 580 KG

INITIAL CORROSION PROTECTION DESIGN
x4 ANODES PROVIDING 2 YEARS
CORROSION PROTECTION FOR UTA

FINAL CORROSION PROTECTION DESIGN
x2 ANODES PROVIDING 20 YEARS
CORROSION PROTECTION FOR
UTA INNER PARTS + UMBILICAL FLANGE

APPROXIMATE SHAPE OF
THE ELECTRICAL CABLE

NOTES:

1. COLORS: EVERYTHING IS YELLOW RAL 1004; EXCEPT:
- PAD EYES + HALF COVER HANDLES: ORANGE RAL 2004
- PART OF THE UTA FRONT PLATE: AREA TREE 1
  + AREA TREE 3: WHITE RAL 9010

2. UTA EST. WEIGHT IN AIR: SEE LAYOUT
   UTA EST. WEIGHT IN WATER 1800 KG

3. CORROSION PROTECTION CONTINUITY
- AT GENERAL, USE OF EARTH STRAPS
- FOR MEOH COUPLING + E-CONNECTOR, USE OF SPECIAL CONIC WASHERS INCLUDING NIDDLES
- FOR SCREWS H M24x130, USE OF STAR WASHERS

4. E-CONNECTORS MOUNTED AT CAM WORKSHOP
   DISASSEMBLIED, MOLDED & ASSEMBLIED AGAIN ON SITE

5. THE MEOH PIPE IS RETRIEVABLE FROM UTA ON SITE:
- REMOVE THE UTA REAR PLATE
- REMOVE MEOH PIPE CLAMPING
- UNSCREW MEOH COUPLINGS

6. CAMERON SUPPLIES:
- SURFACE HANDLING SLING SET
- SUBSEA FRONT PULLING SHACKLE, ITEM 18

7. UTA CATHODIC PROTECTION
- TOTAL UTA UNCOATED SURFACE: 5 m²
- TOTAL UTA COATED SURFACE: 18 m²
- OUTER UTA UNCOATED SURFACE: 2,5 m²
- OUTER UTA COATED SURFACE: 9 m²

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

⚠3 ITEM 25 ADDED AND ITEM 23 MODIFIED

REASON FOR ISSUE	DATE	CLIENT REV.
Re-issued Approved for Construction	16JUL07	3
Approved for Construction	06JUN07	2
Issued for Client Comment	17AVR07	1
Re-issued for internal IDC	03AVR07	N/A
Re-issued for internal IDC	23MAR07	N/A
Re-issued for internal IDC	05MAR07	N/A

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-03-506

C AD	REV. BY: G. Durand	DATE: 11.07.2007	REV.: 3

TOLERANCES ACCORDING TO DIN 8015	SURFACE TREATMENT	DO NOT SCALE	
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219		DRAWN: G. Durand	DATE: 19.04.2007
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K	MATERIAL AND HEAT TREATMENT	CHECKED: R. Wede	DATE: 17.07.2007
		APPROVED: G. Durand	DATE: 17.07.2007
EST. WEIGHT: 2100 KG	SCALE: 1:10	SUPERSEDES:	

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

UMBILICAL TERMINATION ASSEMBLY
ASSEMBLY DRAWING

INITIAL USE BOM	SHEET	DRAWING NUMBER:
223398-99	1 OF 2	SK-066398-99

COUPLING DIVER VIEWS

3/8" MALE DIVER COUPLER (HP) (1 : 4)

KEY: 36°
YELLOW

3/8" MALE DIVER COUPLER (CI) (1 : 4)

KEY: 108°
BLACK

3/8" MALE DIVER COUPLER (KHI) (1 : 4)

KEY: 144°
WHITE

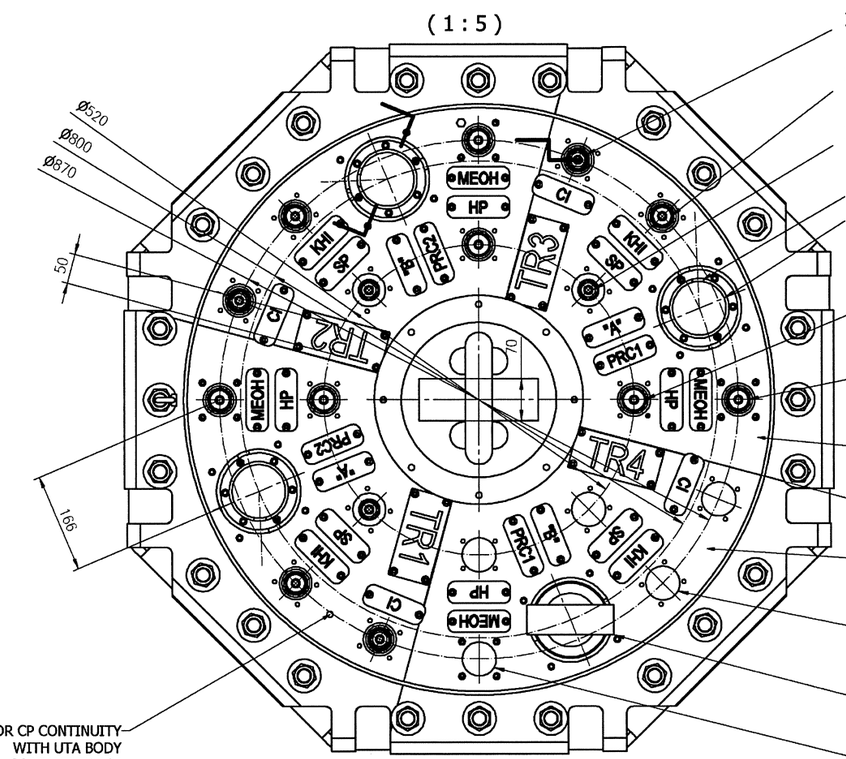
3/8" MALE DIVER COUPLER (SPARE) (1 : 4)

KEY: NO KEY
BLANKE

3/4" MALE DIVER COUPLER (MEOH) (1 : 4)

KEY: 162°
VIOLET

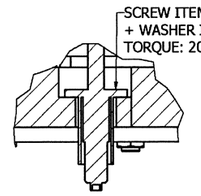
(1 : 5)



12
11
10 — KEYING
4 — x4 E-CONNECTORS
9
13
COLOR: WHITE (AREA TREE 1, 3)
LIMIT BETWEEN COLOR YELLOW / WHITE
COLOR: YELLOW (AREA TREE 2, 4)
15 — x16 COVER FOR 3/8" COUPLING
5 — x4 COVER FOR E-CONNECTOR
14 — x4 COVER FOR 3/4" COUPLING

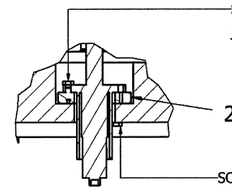
M12 FOR CP CONTINUITY WITH UTA BODY
+ SCREW ITEM 104
+ WASHER ITEM 121
TORQUE: 20 N.m

3/8" COUPLING (REAR SCREWED) (1 : 4)



SCREW ITEM 101
+ WASHER ITEM 122
TORQUE: 20 N.m

3/4" COUPLING (MEOH - FRONT OR REAR SCREWED) (1 : 4)

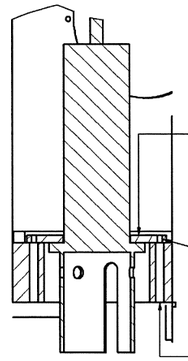


SCREW ITEM 106
+ WASHER ITEM 122
TORQUE: 20 N.m

20 — x4 ADAPTER PLATES FOR FRONT MOUNTING OF THE MEOH COUPLINGS

SCREW ITEM 101
+ WASHER ITEM 122
TORQUE: 20 N.m

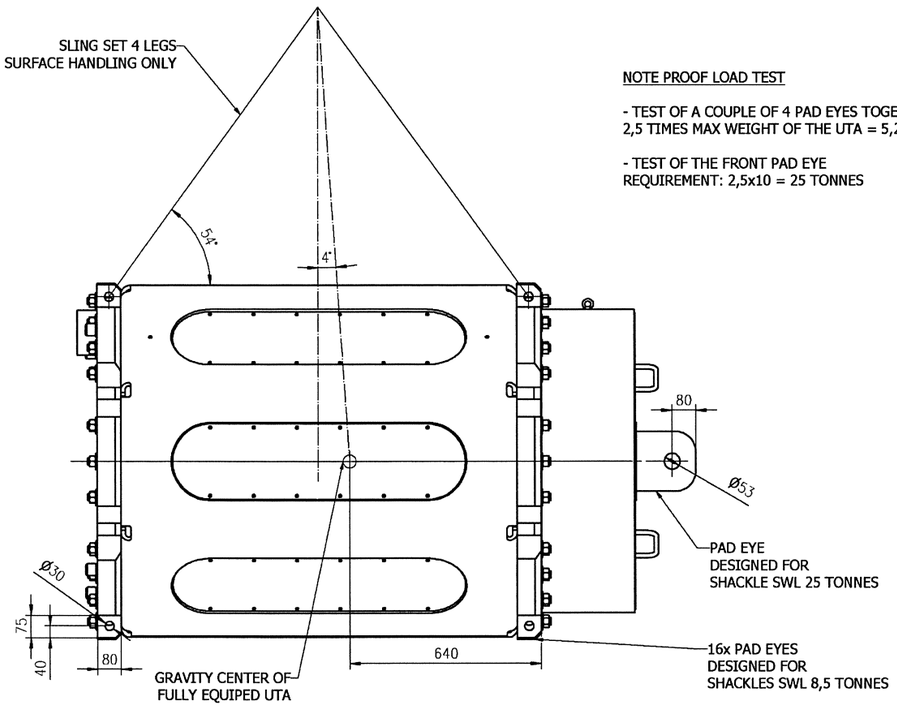
E-CONNECTOR (FRONT OR REAR SCREWED) (1 : 4)



SCREW ITEM 103
+ WASHER ITEM 123
+ NUT ITEM 111
TORQUE : 8 N.m

21 — x8 HALF PLATES FOR MOUNTING OF THE E-CONNECTOR

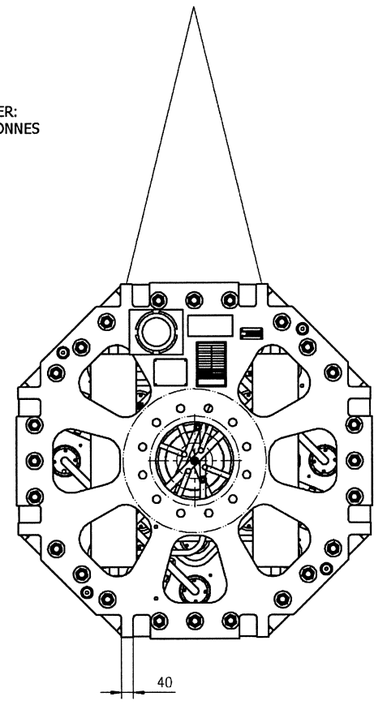
SCREW ITEM 107
+ WASHER ITEM 122
TORQUE : 20 N.m



NOTE PROOF LOAD TEST

- TEST OF A COUPLE OF 4 PAD EYES TOGETHER:
2,5 TIMES MAX WEIGHT OF THE UTA = 5,2 TONNES

- TEST OF THE FRONT PAD EYE
REQUIREMENT: 2,5x10 = 25 TONNES



Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER: 4600000416

CLIENT DOCUMENT NUMBER: 54NL92-W-03-506 — CLIENT REV.: 3

	REV. BY:	DATE:	REV.:
C AD	G. Durand	11.07.2007	3

SURFACE TREATMENT	DO NOT SCALE		
TOLERANCES ACCORDING TO DIN 8015	DRAWN: G. Durand	DATE: 19.04.2007	
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219	CHECKED: R. Wrede	DATE: 17.07.2007	
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K	APPROVED: G. Durand	DATE: 17.07.2007	
MATERIAL AND HEAT TREATMENT			
EST. WEIGHT: 2100 KG	SUPERSEDES:	SCALE: 1:10	

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

UMBILICAL TERMINATION ASSEMBLY
ASSEMBLY DRAWING

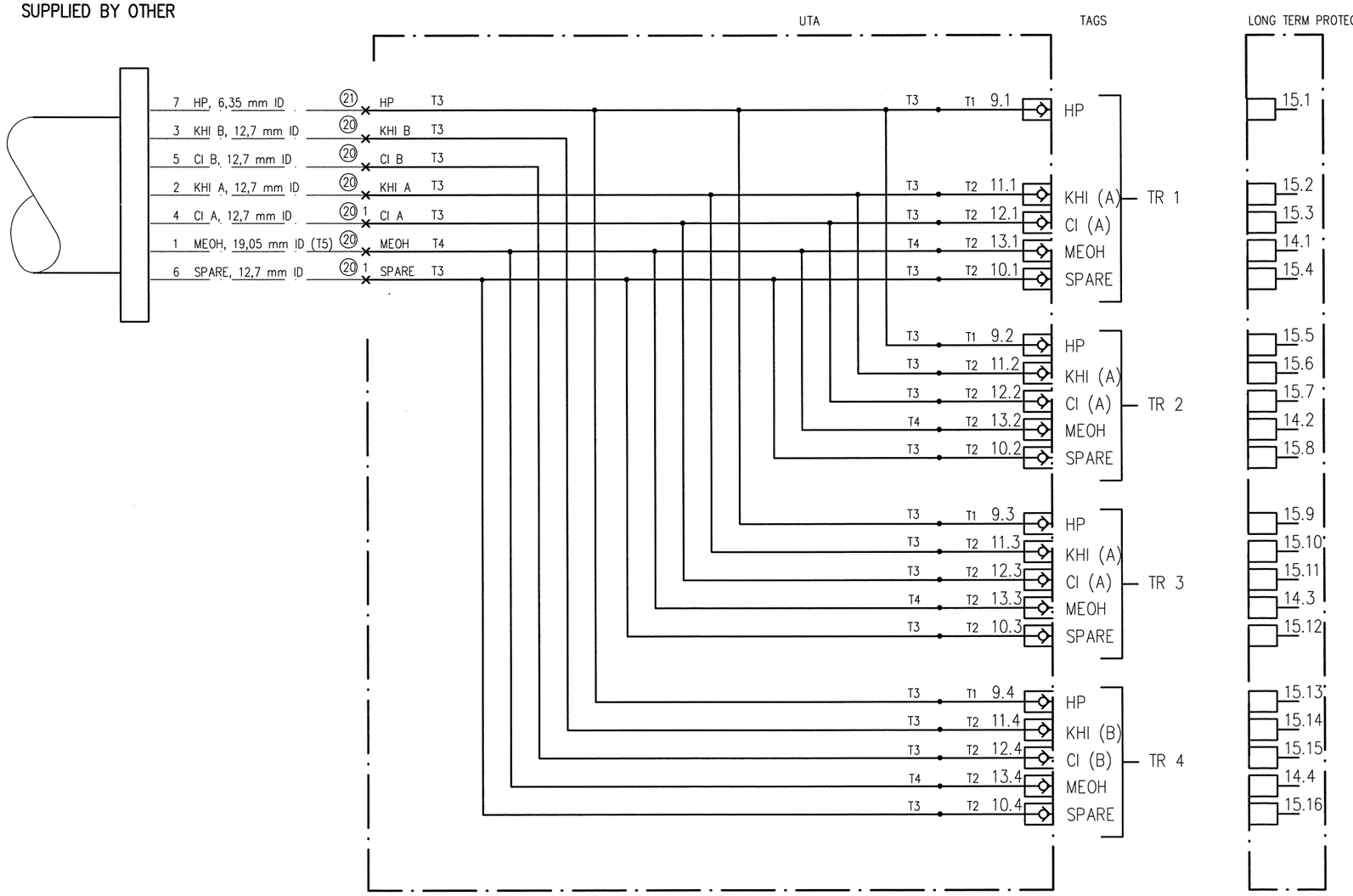
INITIAL USE BOM:	SHEET	DRAWING NUMBER:
223398-99	2 OF 2	SK-066398-99

LINE NO.	DESCRIPTION	MAX. WORKING PRESSURE (BAR)	DESIGN PRESSURE (BAR)	UTA INLET CONNECTION (UMBILICAL SIDE)	UTA OUTLET CONNECTION (TREE SIDE)
7	HP – HIGH PRESSURE	627	690	JIC 6 MALE 9/16"–18UNF	DIVER COUPLING 3/8" MALE
6	SP – SPARE	627	690	JIC 8 MALE 3/4"–16UNF	DIVER COUPLING 3/8" MALE
2	KHI A – KINETIC HYDRATE INHIBITOR	403	448	JIC 8 MALE 3/4"–16UNF	DIVER COUPLING 3/8" MALE
3	KHI B – KINETIC HYDRATE INHIBITOR	403	448	JIC 8 MALE 3/4"–16UNF	DIVER COUPLING 3/8" MALE
4	CI A – CORROSION INHIBITOR	403	448	JIC 8 MALE 3/4"–16UNF	DIVER COUPLING 3/8" MALE
5	CI B – CORROSION INHIBITOR	403	448	JIC 8 MALE 3/4"–16UNF	DIVER COUPLING 3/8" MALE
1	MEOH – METHANOL	403	448	WELDED PIPE	DIVER COUPLING 3/4" MALE

02

REFERENCE	DIAMETER x WT (inch)	DIAMETER x WT (mm)	MATERIAL
T1	3/8 OD x 0,049	9,53 OD x 1,24	SUPER DUPLEX
T2	3/4 OD x 0,083	19,05 OD x 2,11	SUPER DUPLEX
T3	1/2 ID x 0,126	12,7 ID x 3,2	SUPER DUPLEX
T4	3/4 ID x 0,122	19,05 ID x 3,1	SUPER DUPLEX
T5	3/4 ID x 0,043	19,05 ID x 1,1	SUPER DUPLEX

UMBILICAL
SUPPLIED BY OTHER



KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

APPROVED FOR CONSTRUCTION	11JUN07	1
ISSUED FOR CLIENT COMMENTS	17AVR07	N/A
RE–ISSUED FOR INTERNAL IDC	16MAR07	N/A
ISSUED FOR INTERNAL IDC	26MAR07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92–W–41–500

CAD

REV. BY: G. Durand | DATE: 11.06.2007 | REV.: 02

NOTE:
1. ITEM NO. IN CIRCLE ⓧ ARE IN BOM 223242–84
2. ITEM NO. NOT IN CIRCLE "X" ARE IN BOM 223398–99
3. FOR PIPE DIMENSIONS AND QUANTITY OF FITTING ELBOWS SEE SK–066242–84
4. JIC CONNECTIONS & MEOH TEST PORT ARE PLUGGED ←
5. ALL WELDS BUTT WELDED
6. NSW DOCUMENT REFERENCE FOR LINE NUMBERING: DU001456 K5F – REV 2 02

TOLERANCES ACCORDING TO DIN ISO 8015
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

SURFACE TREATMENT
MATERIAL AND HEAT TREATMENT

DO NOT SCALE

DRAWN: G. Durand	DATE: 10.01.2007
CHECKED: R. Wrede	DATE: 11.06.2007
APPROVED: G. Durand	DATE: 11.06.2007

EST. WEIGHT: .000 KG | SUPERSEDES: | SCALE:

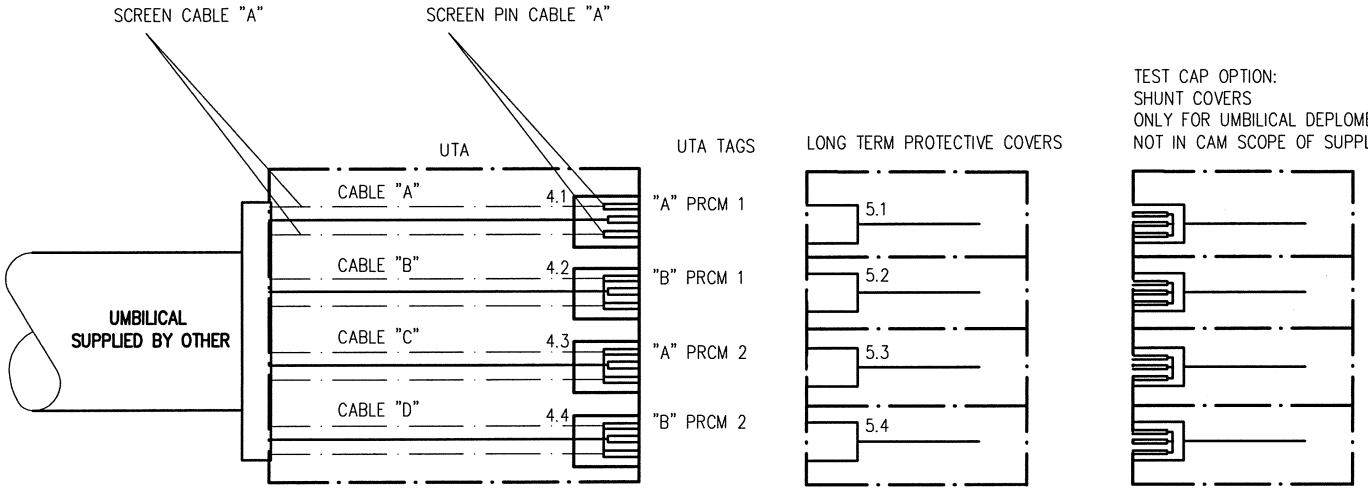
CAMERON

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

FLOW DIAGRAM
UMBILICAL TERMINATION ASSEMBLY

INITIAL USE BOM: 223398–99 | SHEET: 1 OF 1 | DRAWING NUMBER: SK–066398–99–01

STATUS: APPROVED



NOTE:
1. NSW DOCUMENT REFERENCE FOR CABLE IDENTIFICATION: DU001456 K5F – REV2

CABLES INFORMATIONS		
OD (mm)	STATIC MBR (mm)	DESCRIPTION
16,8	350	16 mm^2 – COAXIAL – 5 KV

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

APPROVED FOR CONSTRUCTION	11JUN07	1
ISSUED FOR CLIENT COMMENT	21MAR07	N/A
ISSUED FOR INTERNAL IDC	21FEV07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production Netherlands K5 F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92-W-31-503

CAD

CUSTOMER DOCUMENT NUMBER

REV. BY: G. Durand | DATE: 11.06.2007 | REV.: 02

SURFACE TREATMENT

DO NOT SCALE

DRAWN: G. Durand | DATE: 27.02.2007
CHECKED: R. Wrede | DATE: 11.06.2007
APPROVED: G. Durand | DATE: 11.06.2007

TOLERANCES ACCORDING TO DIN ISO 8015
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

MATERIAL AND HEAT TREATMENT

EST. WEIGHT:.000 KG | SUPERSEDES: | SCALE:

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

CIRCUIT DIAGRAM
UMBILICAL TERMINATION ASSEMBLY

INITIAL USE BOM: 223398-99 | SHEET: 1 OF 1 | DRAWING NUMBER: SK-066398-99-04

STATUS: APPROVED

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 2, Section 6

MISCELLANEOUS EQUIPMENT

CONTENTS

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 2, Section 6
MISCELLANEOUS EQUIPMENT

DESCRIPTION, INSTALLATION, OPERATION & MAINTENANCE

CONTENTS

Project No.	Cameron No.	Description
54NL92-W-0S-502	X-076721-87	SPS – Subsea & Topsides Functional Requirement Specif. *See Volume 1, Section 1 Total System*
54NL92-W-0S-523	X-065438-05-01	Anode Umbilical – Installation Requirements
-	X-065467-02-19	Gisma Jumpers – Installation Procedure
-	X-065429	General Preservation & Storage Procedure *See Volume 1, Section 1 Total System*

Total
K5F FIELD DEVELOPMENT PROJECT
Subsea Production System

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

Volume 2, Section 6
MISCELLANEOUS EQUIPMENT

PARTS LISTS & DRAWINGS

CONTENTS

Project No.	Cameron No.	Description
Jumpers (cont.)		
-	2197089-17-11	Jumper, PRCM to Interm. C., Type 5, blue, 6 m – Parts List
-	2197089-17-23	Jumper, PRCM to Interm. C., Type 5, blue, 12 m – Parts List
-	2197089-17-61	Jumper, PRCM to Interm. C., Type 5, yellow, 6 m – Parts List
-	2197089-17-69	Jumper, PRCM to Interm. C., Type 5, yellow, 10 m – Parts List
-	2197089-18-19	Jumper, UTA to PRCM, Type 6, blue, 10 m – Parts List
-	2197089-18-20	Jumper, UTA to PRCM, Type 6, blue, 10.5 m – Parts List
-	2197089-18-65	Jumper, UTA to PRCM, Type 6, yellow, 8 m – Parts List
-	2197089-18-74	Jumper, UTA to PRCM, Type 6, yellow, 12.5 m – Parts List
-	2197089-19-09	Jumper, J. Box to DHPT Sensor, Type 7, 4500 mm – Parts List
-	2197089-20-03	Jumper, J. Box to Sensor, Type 8, blue, 2000 mm – Parts List
-	2197089-20-05	Jumper, J. Box to Sensor, Type 8, blue, 3000 mm – Parts List
-	2197089-20-20	Jumper, J. Box to Sensor, Type 8, blue, 4400 mm – Parts List
-	2197089-20-21	Jumper, J. Box to Sensor, Type 8, blue, 4500 mm – Parts List
-	2197089-20-24	Jumper, J. Box to Sensor, Type 8, blue, 4800 mm – Parts List
-	2197089-20-33	Jumper, J. Box to Sensor, Type 8, blue, 6000 mm – Parts List
-	2197089-20-36	Jumper, J. Box to Sensor, Type 8, blue, 6300 mm – Parts List
-	2197089-20-53	Jumper, J. Box to Sensor, Type 8, yellow, 2000 mm – Parts List
-	2197089-20-54	Jumper, J. Box to Sensor, Type 8, yellow, 2500 mm – Parts List
-	2197089-20-68	Jumper, J. Box to Sensor, Type 8, yellow, 4200 mm – Parts List
-	2197089-20-70	Jumper, J. Box to Sensor, Type 8, yellow, 4400 mm – Parts List
-	2197089-20-71	Jumper, J. Box to Sensor, Type 8, yellow, 4500 mm – Parts List
-	2197089-20-75	Jumper, J. Box to Sensor, Type 8, yellow, 4900 mm – Parts List
-	2197089-20-86	Jumper, J. Box to Sensor, Type 8, yellow, 6300 mm – Parts List
-	2197089-21-12	Jumper, Interm. to eSCM, Type 9, blue, 3700 mm – Parts List
-	2197089-21-54	Jumper, Interm. to eSCM, Type 9, yellow, 1600 mm – Parts List
-	2197089-23-06	Interm. Jumper to Act., Type 11, blue, 3500 mm – Parts List
-	2197089-23-07	Interm. Jumper to Act., Type 11, blue, 4000 mm – Parts List
-	2197089-23-57	Interm. Jumper to Act., Type 11, yellow, 4000 mm – Parts List
-	2197089-24-17	Jumper PRCM to Cath., Type 12, blue, 9 m – Parts List
-	2197089-24-67	Jumper PRCM to Cath., Type 12, yellow, 9 m – Parts List

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

31 MAR 2009	As Built	A. Weilandt	T. Appel	A. Weilandt
06 AUG 2007	Approved for Construction	A. Weilandt	T. Appel	A. Weilandt
02 MAY 2007	Issued for Client Comment	A. Weilandt	S. Horne	
12 OCT 2006	Issued for Internal IDC	A. Weilandt	D.Coonrod	
Date	**Reason for Issue**	**Originator**	**Checker**	**Approver**

CAMERON	**Document Title:** **Subsea and Topsides Functional Requirement Specification**		
PAGE 1 OF 34	**Customer Document Number:**	54NL92-W-0S-502	REV. 2
	Cameron Document No.	X-076721-87	REV. 02

TABLE OF CONTENTS

1 Document Revision Status / Record

Rev.	Date	Description of change	Reason for change
A	12OCT06	Initial release Celle	- - -
B	02MAY07	Section 7.5.6.1: Use of Swagelok added for LP lines and added the need for metric size on all LP tubing Section 8.4: cable entry changed from top to bottom Section 9.2: List of Total Tag Numbers added Section 9.1.1.2: Colour for topside equipment changed from RAL5015 to RAL7035 (light grey) 10.8 & 10.9: updated description as per current design of anode and cathode package 10.10: complete section added for Anode Umbilical Assembly	Comments from internal IDC
01	06AUG07	Section 10.8: Anode Package Foundation Base added	Updated to Approved for Construction
02	31MAR09	Minor cosmetic Customer Comments implemented	Update to “As Built”

2 Introduction

This document is written to consolidate the technical requirements for the subsea control system intended to be used on the TOTAL K5F Project from those specified within the clients specification, the Cameron tender and the clarifications to that tender.

It shall be updated throughout the project to reflect changes generated from design & safety reviews, client requirement changes and testing.

It will be submitted for approval early on in the project cycle and upon approval will be used for the design of the system.

Referenced client specifications within this document also need to be considered for the design.

3 Scope of this document

The scope of this document is to define the functional requirements for the subsea control system intended to be used on the TOTAL K5F Project.

Technical requirements relate but shall not be limited to:

- Design basis data
- Functional requirements

The Intervention & Workover Control System (IWOCS) shall **NOT** be covered by this document.

4 Abbreviations & Definitions

4.1 Abbreviations

AIV	Annulus Isolation Valve
AMV	Annulus Master Valve
APTA	Annulus Pressure Transmitter A
APTB	Annulus Pressure Transmitter B
BAIV	B Annulus Isolation Valve
CI	Corrosion Inhibitor
CIV	Chemical Injection Valve
CP	Cathodic Protection
CR	Control Room
DCS	Distributed Control System
DHSV	Downhole Safety Valve
DHPT	Downhole Pressure Temperature Transmitter
EPCU	Electrical Power and Communication Unit
ESD	Emergency Shutdown
ESCM	Electrical Subsea Control Module
HPU	Hydraulic Power Unit
ICSS	Integrated Control and Safety System
ISO	International Standardisation Organisation
K6CC	K6 Central Complex (K6P & K6C)
KHI	Kinetic Hydrate Inhibitor
LPMV	Lower Production Master Valve
MEOH	Methanol
PCS	Process Control System
PPD	Production Pressure Downstream
PPU	Production Pressure Upstream
PSV	Production Swab Valve
PTD	Production Temperature Downstream
PTU	Production Temperature Upstream
PWV	Production Wing Valve
PRCM	Power Regulation and Communication Module
SCSSV	Surface Controlled Subsurface Safety Valve
SSS	Safety Shutdown System
TUTU	Topside Umbilical Termination Unit
UPMV	Upper Production Master Valve
UPS	Uninterruptible Power Supply
UTA	Umbilical Termination Assembly
WH	Wellhead
XOV	Crossover Valve

4.2 Definitions

COMPANY	Total E&P Nederland B.V. (TEPNL)
CONTRACTOR	Cooper Cameron UK Ltd.

5 References

5.1 Cameron documents

Following documents **MUST** be considered during the design phase.

Description	Number
Subsea Production Control System Interconnection Diagram	SK-066001-88-04
K5F Field Development Project Contract	4600000416
Bill Of Material – Subsea Production Control System	223001-88
Project Quality Specification	SP-003118-15

5.2 External documents

Following documents **MUST** be considered during the design phase.

Description	Number
Total “Design basis for K5F project”	EDMP #32611
Design of cathodic protection of offshore structures	GS GR COR 100
External protection of off-shore and coastal structures and equipment by painting	GS EP COR 350
Electrical design criteria	GS EP ELE 001
Design of earthing and bonding systems	GS EP ELE 031
Minimum CONTRACTOR document requirements	GS EP ELE 091
Electrical cables	GS EP ELE 161
Cable trays/ladders	GS EP ELE 311
Precommissioning and commissioning specification	GS EP EXP 101
Precommissioning and commissioning technical preparation	GS EP EXP 103
Precommissioning execution	GS EP EXP 105
Commissioning execution	GS EP EXP 107
Operations preparation during project – Maintenance and inspection documentation	GS EP EXP 203
Requirements for contractor quality management	GS EP PJC 501
Requirements for contractor critically rating of a unit	GS EP PJC 502
Requirements for contractor quality control	GS EP PJC 503
Valves	GS EP PVV 142
Welding of duplex and superduplex stainless steel	GS EP PVV 614
Area classification	GS EP SAF 216

Description	Number
Completed wells safety systems and safety rules	GS EP SAF 226
Impacted area, restricted area and fire zones	GS EP SAF 253
Emergency shut-down and emergency de-pressurisation (ESD & EDP)	GS EP SAF 261
Design philosophy and requirements for subsea stations	GS EP SPS 001
Subsea ball valves	GS EP SPS 005
Service valves in subsea stations	GS EP SPS 006
Tie-in systems	GS EP SPS 007
Corrosion protection of subsea stations	GS EP SPS 009
Preservation requirements for subsea package	GS EP SPS 010
Mechanical completion of subsea stations	GS EP SPS 011
Documentation requirements for subsea stations	GS EP SPS 012
Wellhead and guidance systems	GS EP SPS 013
Subsea gate valves and actuators in subsea Xmas-tree systems	GS EP SPS 015
Subsea insert chokes and associated running and retrieval tools	GS EP SPS 016
Subsea production control system	GS EP SPS 019
Subsea control unit functional requirements	GS EP SPS 020
Subsea mateable electrical/optical connectors	GS EP SPS 021
Environmental testing of subsea electronics	GS EP SPS 022
Cleaning and flushing of hydraulic systems	GS EP SPS 023
Subsea mechanical quarter turn actuator (manually operated gearbox)	GS EP SPS 024
Subsea hydraulic spring return quarter turn actuators	GS EP SPS 025
Load-out, sea-fastening, transportation and installation of offshore structures	GS EP STR 401
Power, earthing and control cables for offshore installations	NL00-U-6S-011
Static 230Vac power supply units for on- and offshore installations	NL00-U-6S-037
Electrical construction and installation specification	NL00-U-6S-061
Electrical design guidelines	NL00-U-6S-071
Instrument and control cables	NL00-U-7S-011
Typical earthing details	NL00-U-64-042
Typical cable tray details (offshore)	NL00-U-64-044
Elec. Cable colour seq. (onsh. + offsh.)	NL00-U-64-045
Protection and Instrument Earth. Det. (onsh. + offsh.)	NL00-U-64-046
Presentation of engineering and final documentation	NL00-Z-0S-002

Description	Number
Microstation Version 5.0: User Definable Attributes	NL00-Z-0S-005
Codification & Numbering of New Technical Documents for Offshore Installations	NL00-Z-0S-006
Instrumentation/piping interface standards	NL00-Z-4S-042
Actuators and control systems for hydraulically operated control valves	NL00-Z-7S-041
Actuators and control system for hydraulically operated ball valves	NL00-Z-7S-043
Instrumentation – design, construction and installation	NL00-Z-7S-061
Instrument earthing: design & installation	NL00-Z-7S-073
Codification of instrumentation links & equipment	NL00-Z-7S-077
Electrical/instrument interface diagram typicals for normally unmanned offshore installations	NL00-Z-71-002
Loop diagrams typicals	NL00-Z-71-003
Instrumentation - process hook-up typicals	NL00-Z-74-011
Hydraulic hook-up typicals	NL00-Z-74-021
Mounting typicals	NL00-Z-74-031
Instrument name plate detail	NL00-Z-74-055
Completion dossier guidelines	CS-3-OPE-EC-701 (EDMP-40657)
K5F MCS – K6CC SSS/PCS Interface	EDMP #59401

Any agreed deviations from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

Any clarifications from the above specifications are found in the contract within the relevant section or within relevant documents as indicated in section 5.1 of this document.

In case of conflict between documents the following order of priority shall be applied:

1) Local and international rules and regulations
2) Company Safety Specifications (GS EP SAF)
3) Project Specifications
4) Company Standards (NL00)
5) Company General Specifications

5.3 Codes, standards and regulations

Following codes, standards and regulations shall be considered during the design phase.

Description	Number
Design and operation of sub sea production systems	ISO 13628
Design & Operation Of Subsea Production Control Systems	ISO 13628-6
Aerospace Fluid Power - Cleanliness Classification for Hydraulic Fluids	SAE AS4059

Description	Number
EMC Directive	89/336-EEC
Process measurement control functions and instrumentation Symbolic representation	ISO 3511
Quality management and quality assurance standards - Part 3:Guidelines for the application of ISO 9001 to the development, supply and maintenance of software	ISO 9000-3

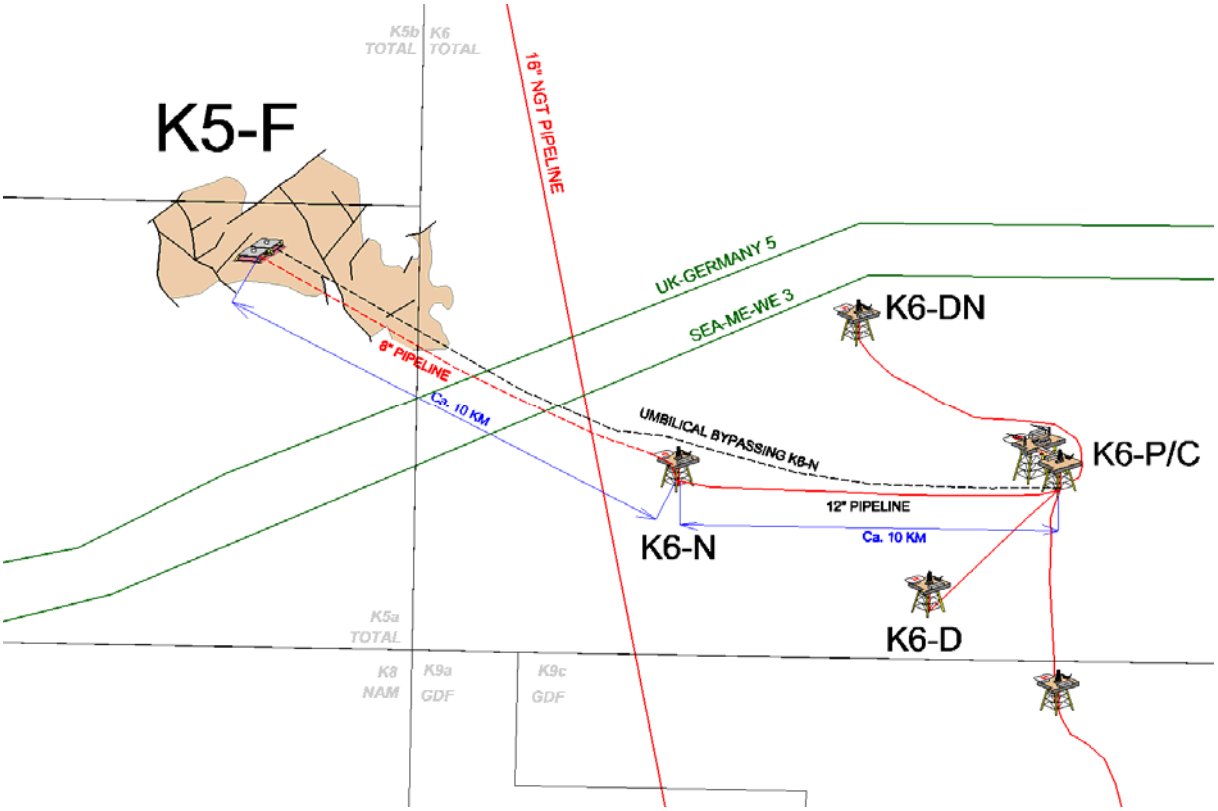
5.4 CE marking

CE marking **will** be required for the K5F project.

6 Project Overview

The K5F is a gas field located 10 km NW of the existing satellite platform K6N and 20km NW of the K6 Central Complex, all operated by TEPNL.

In the first phase, K5F will be developed with two wells. In order to be able to increase the reserves recovery in the future a third well might be connected in the future on the Subsea Protection Structure and it is also possible to connect a fourth future satellite well.



7 Design basis

The following sections are describing the systems information particularly relevant to the design of the Production Control System:

7.1 Field data

Present Number of Production Wells	Two plus two future wells
Design Life	20 years

7.2 Environmental conditions

7.2.1 Climatic data

Parameter		Data
Ambient Temperature (Outdoors)	Minimum Air Temperature	- 16°C
	Maximum Air Temperature	+ 40°C
Ambient Temperature (Indoors)	Minimum Air Temperature	-5°C
	Maximum Air Temperature	+ 40°C

7.2.2 Subsea Design Information

Parameter	Data
Water Depth	37 metres
Temperature	+4°C to +9.5°C
Seawater density	1025 kg/m³
Seawater Electrical Resistivity	0.3 OhmMeter
Wellhead Shut-in Pressure	350 barg

7.2.3 Hazardous Area Classification

The HPU and the TUTU shall be specified for hazardous area Zone 1, Gas Group IIB, Temperature Class T3, on the Platform deck.

7.2.4 Local equipment room

The platform local electrical switch room shall be used to accommodate the MCS and the ECPU cabinets. The maximum temperature during normal conditions within the LER shall be limited to 25 °C, but all of the equipment shall be able to operate as long as the room temperature does not exceed 40°C.

7.2.5 Hydraulic system pressures for the SCSSV line

The subsea production control system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
HP Hydraulics	627 barg	690 barg	1035 barg
Return Lines	< 207 barg	207 barg	N/A
Reservoir Fill Lines	<10 barg	10 barg	15 barg

NOTE: The design pressures shown above shall be used for specification of the HP hydraulic system relief valves and these shall release at the shown design pressures.

The return lines of the HPU are piped directly to the return reservoir and open to atmosphere. Pressure testing of these lines is neither necessary nor possible.

7.2.6 Chemical system pressure requirements

The chemical injection system shall be specified for operating within the following pressure parameters:

System	Maximum Working Pressure	Design Pressure	Test Pressure
Methanol Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Corrosion Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg
Kinetic Hydrate Inhibitor Lines	5.845psi / 403barg	6.500psi / 448barg	9.750psi / 672barg

7.2.7 List of chemicals

The following chemicals are considered to be used for chemical injection for the K5F project:

- Methanol (MEOH)
- Corrosion Inhibitor (CI)
- Kinetic Hydrate Inhibitor (KHI)

7.3 Design life

The design life of the Subsea equipment shall be equal to the service life of the field.

The Subsea and related topside facilities shall be designed for a minimum design life of **20 years**.

7.4 Utilities

7.4.1 Platform utilities

The subsea production control system shall be designed to operate from the platform power and utilities as follows:

Electrical Supply (ECPU)	400VAC , 3 phase, 50 Hz ± 2% from UPS (floating), redundant
Electrical Supply (MCS)	230VAC 50 Hz ± 2%,from UPS (floating), redundant
Electrical supply (HPU PLC Cabinet)	230VAC 50 Hz ± 2% from UPS (floating)
Electrical supply (HPU Lighting)	230VAC 50 Hz from MCC
Electrical supply (HPU Motors)	380VAC 3ph 50 Hz, floating (3 wires) from MCC
Electrical supply (Motor heaters)	230VAC 50 Hz from MCC (if applicable)
Electrical supply (ESD solenoids)	24 V DC when healthy, 0V on ESD

7.5 Hydraulic systems

7.5.1 Sealing systems

Hydraulic couplers with primary metal seals are preferred for permanently installed Subsea equipment. Where possible, secondary, non-metallic seals should be considered as back-up for primary metal-to-metal seals. Hydraulic and chemical couplers within removable assemblies like single diver mate able hydraulic/chemical couplings shall have non-metallic primary seals and non-metallic back-up seals.

7.5.2 Hydraulic distribution

The subsea production control system high pressure (HP) hydraulic supplies shall be single from the HPU pumps. The hydraulic system shall be open utilising a water based control fluid.

7.5.3 Hydraulic fluid

The hydraulic system shall use Castrol Transaqua HT water based control fluid.

7.5.4 Fluid cleanliness

The production control system hydraulic control fluid shall be water based. All production control system hydraulic equipment shall be delivered with fluid cleanliness levels of SAE AS4059 class 6 or better. All methanol and chemical lines and equipment shall be delivered with fluid cleanliness level of SAE AS4059 class 12 or better.

Protective caps shall be provisioned for all hydraulic couplings to avoid accidental contamination. Assembly of hydraulic components shall take place in areas where the environment is controlled. The objective shall be to “assemble clean to keep clean” such that subsequent flushing operations are simplified.

Cleaning methods used for sub-assemblies shall include shop air flushing, solvent cleaning, pipe cleaning and ultrasonic bathing as appropriate. Cleaning of major assemblies shall in general be confined to flushing with control fluid of known cleanliness. As far as is practical, designs shall take due note of the subsequent flushing requirements e.g. avoiding blind holes, avoiding welding or grinding on assembled components and ensuring that systems allow turbulent flow for flushing.

All hoses and flying leads intended for chemical service (Methanol, Corrosion Inhibitor and Kinetic Hydrate Inhibitor) should be supplied filled with either control fluid or a suitable fluid compatible with the chemicals to be used.

7.5.5 Tubing

All hydraulic tubing and fittings shall be sized for efficient operation of the system with due regard to design pressures and minimising pressure drops within the system.

- For the topside equipment minimum seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the subsea equipment seamless ASTM A-213 AISI 316L stainless steel tubing with a maximum hardness of Rb90 shall be used.
- For the UTA, the Methanol tubing has to be super duplex.

The tubing of the hydraulic circuits shall be accurately cut and bent using standard tube cutters and tube benders to fitting manufacturer’s recommendation. No burrs shall be allowed and each section of the tubing shall be cleaned and blown dry before assembly to ensure that no contamination is permitted to enter the control components.

All hydraulic tubing together with the associated fittings shall be capable of withstanding the application of a 1.5 times design pressure test for 15 minutes without any deformation or other damage.

7.5.6 Threaded connection systems

All threaded fittings for equipment used subsea shall withstand external ambient pressure at the design depth.

7.5.6.1 Topside equipment

For all circuits Autoclave MP Piping and fittings shall be used, except return lines where Swagelok can be used. All non Autoclave lines need to be in metric size.

7.5.6.2 Permanent subsea equipment

Ferrulok tube end reducers are to be welded to the back of hydraulic couplers, etc., where practical, rather than pipe threaded connections.

High-pressure ports requiring threaded fittings, such as valve actuator ports shall be SAE thread with 37-degree bottom taper conforming to SAE standard J514. Autoclave anti-vibration type fittings shall also be acceptable.

National Pipe Thread (NPT) fittings or any other thread seal type fitting shall **NOT** be used without specific approval from the project.

Fitting assembly torque shall be independently verified and sealed/secured to identify, that fittings have been properly made-up and inspected.

7.5.6.3 Thread sealants

Where taper threads are permitted for use, they shall be sealed using Loctite 572 fluid applied in accordance with the manufacturer's instructions. No other thread sealant shall be used. Teflon tape is **NOT** permitted for use on any equipment used with this system.

7.5.7 Welded connection systems

All couplers, whether in hydraulic or chemical services shall be butt-welded, except were otherwise specified within this document. All couplers shall be fitted with seals from identical compounds. All hydraulic or chemical service valves and fittings shall be butt welded.

- Connections shall be welded to the extent practical
- Autogenously welding shall be acceptable on 316L materials
- Liquid penetrate testing shall be performed on all tubing welds

Note: all welding has to be performed in accordance to approved Cameron welding specification.

8 Electric Systems

8.1 Terminal Type

Screw type terminals shall be used on all topside equipment.

8.2 Instrument Type

For the use in hazardous area EEx-d type instruments shall be used.

8.3 Electrical Motor Type

For the use in hazardous area EEx-d type electrical motors shall be used.

8.4 Cable entry for cabinets located in the Control Room

All cabinets located in the control room shall be designed to allow bottom cable entry only.

9 Functional Requirements

9.1 Coating & protection systems

9.1.1 Coating systems

All equipment manufactured from Carbon steels shall be protected with an approved coating system suitable for the design life of the equipment.

9.1.1.1 Subsea painting

Painting of all subsea components manufactured from Carbon steels shall be done in accordance to the approved paint specification A-020025-01

9.1.1.2 Painting of topside equipment for outside installation

Painting of all topside components located outside shall be done in accordance to the approved paint specification X-065460-04-04

- Top colour for surface equipment shall be light grey (RAL 7035).
- SST framework and parts shall normally NOT be painted, if not separately specified.

9.1.1.3 Painting of topside equipment for inside installation

Paint colour for MCS or EPU cabinet housings shall be light grey (RAL 7035).

9.1.2 Cathodic protection

9.1.2.1 General

The primary corrosion protection system for the control system Subsea equipment shall be via materials selection and suitable paint coatings.

A cathodic protection system using sacrificial anodes shall be utilised to protect the ‘bare steel’ components and to protect uncoated areas of any other control system hardware, i.e. such as those items not protected by the host equipment. Special attention shall be given to SST screws and bolts. All items to be protected shall be electrically connected using stranded, flexible SST 316 earthing braids of a suitable cross sectional area.

9.1.2.2 Calculations

Suitable CP calculations shall be carried out in accordance with the standard applicable for control system hardware i.e. not tree mounted equipment (this shall be part of the Subsea tree CP system). The CP system shall be designed to be capable of protecting the control system for the 20-year design life of the equipment.

9.1.2.3 Construction

The following principles shall be adhered when designing equipment for the subsea control system:

- All equipment metalwork shall be welded (or bolted) onto the equipment main structure to ensure any static potential build up is avoided by continuous drain to earth.
- All metallic items shall have earth continuity by physical connection i.e. metallic fastenings, clamps or earth straps. This shall include all valves, tubing, components, tubing clamps etc.

Electrical connectors may remain isolated from the structure provided suitable materials are chosen for their construction.

- When stainless steel fasteners are used in the construction of subsea structures or equipment, they shall be suitably earth bonded using earth straps. Carbon steel fasteners may alternatively be used.
- Anodes mounted on equipment sub-structures shall be manufactured from material identical and from the same batch as those fitted to the main structure.
- The anodes shall comply with the Cameron material specification MS-011310-01.
- The minimum distance from hydraulic tubing to anodes shall be 80 mm. If unavoidable it is acceptable to have a distance of less than 80 mm for some cases.
- Earthing conductors shall be of corrosion resistant material and shall be securely fastened and protected where necessary against damage and electrolytic corrosion. Where earth-bonding straps are used, conductive paste shall be smeared on contact surfaces (not threads) to ensure a lasting low resistance contact. Where the metallic composition of equipment requiring earth bonding differs from the main structure, care shall be taken in the selection of the bonding strap material to minimise possible ill effects of different contact potentials.
- Connections shall be secured using star-type shake proof washers such that they cannot work loose under vibration.

9.2 Project specific Tag Numbers

This is a list of Tag numbers to be used for K5F equipment. All units and components on this list need to be marked with these numbers as per Total Spec. NL00-Z-74-055.

Instruments	Equipment	Description	Comments
	NN-82201	TUTU	
	NN-82202	HPU	
	NN-82203	HPU PLC	
	NN-81203	MCS	
	NN-81204-1	EPCU 1	
	NN-81204-2	EPCU 2	
	NN-81204-3	EPCU 3	
	NN-81204-4	EPCU 4	
	SA-92100A	Anode Package A	
	SA-92100B	Anode Package B	
	UTA-92100	UTA	
	UTA-92101	IUTA	FUTURE
	UTA-92102	IUTA	FUTURE
	PRCM-92100.1A	PRCM A well 1	
	PRCM-92100.1B	PRCM B well 1	
	SC-92100.1A	Cathode A well 1	
	SC-92100.1B	Cathode B well 1	
	ESCM-92100.1A	ESCM A well 1	
	ESCM-92100.1B	ESCM B well 1	
	DVA-92103.1	Dump valve assembly well 1	
	DHSV-92103.1	Downhole safety valve well 1	

	PRCM-92100.2A	PRCM A well 2	
	PRCM-92100.2B	PRCM B well 2	
	SC-92100.2A	Cathode A well 2	
	SC-92100.2B	Cathode B well 2	
	ESCM-92100.2A	ESCM A well 2	
	ESCM-92100.2B	ESCM B well 2	
	DVA-92103.2	Dump valve assembly well 2	
	DHSV-92103.2	Downhole safety valve well 2	
	PRCM-92100.3A	PRCM A well 3	
	PRCM-92100.3B	PRCM B well 3	
	SC-92100.3A	Cathode A well 3	
	SC-92100.3B	Cathode B well 3	
	ESCM-92100.3A	ESCM A well 3	
	ESCM-92100.3B	ESCM B well 3	
	DVA-92103.3	Dump valve assembly well 3	
	DHSV-92103.3	Downhole safety valve well 3	
	PRCM-92100.4A	PRCM A well 4	
	PRCM-92100.4B	PRCM B well 4	
	SC-92100.4A	Cathode A well 4	
	SC-92100.4B	Cathode B well 4	
	ESCM-92100.4A	ESCM A well 4	
	ESCM-92100.4B	ESCM B well 4	
	DVA-92103.4	Dump valve assembly well 4	
	DHSV-92103.4	Downhole safety valve well 4	
	HP-92100.1	HP Jumper UTA to tree 1	
	MEOH-92100.1	MeOH Jumper UTA to tree 1	
	KHI-92100.1	KHI Jumper UTA to tree 1	
	CI-92100.1	CI Jumper UTA to tree 1	
	COAX-92100.1A	Coax Jumper UTA to PRCM A tree 1	
	COAX-92100.1B	Coax Jumper UTA to PRCM B tree 1	
	PC-92100.1A	P/C Jumper PRCM A to ESCM A tree 1	
	PC-92100.1B	P/C Jumper PRCM B to ESCM B tree 1	
	HP-92100.2	HP Jumper UTA to tree 2	
	MEOH-92100.2	MeOH Jumper UTA to tree 2	
	KHI-92100.2	KHI Jumper UTA to tree 2	
	CI-92100.2	CI Jumper UTA to tree 2	
	COAX-92100.2A	Coax Jumper UTA to PRCM A tree 2	
	COAX-92100.2B	Coax Jumper UTA to PRCM B tree 2	
	PC-92100.2A	P/C Jumper PRCM A to ESCM A tree 2	
	PC-92100.2B	P/C Jumper PRCM B to ESCM B tree 2	
	HP-92100.3	HP Jumper UTA to tree 3	FUTURE
	MEOH-92100.3	MeOH Jumper UTA to tree 3	FUTURE
	KHI-92100.3	KHI Jumper UTA to tree 3	FUTURE

	CI-92100.3	CI Jumper UTA to tree 3	FUTURE
	COAX-92100.3A	Coax Jumper UTA to PRCM A tree 3	FUTURE
	COAX-92100.3B	Coax Jumper UTA to PRCM B tree 3	FUTURE
	PC-92100.3A	P/C Jumper PRCM A to ESCM A tree 3	FUTURE
	PC-92100.3B	P/C Jumper PRCM B to ESCM B tree 3	FUTURE
PCV-92101.1		Production Choke valve well K5F-1	
PWV-92101.1		Production Wing Valve well K5F-1	
UPMV-92102.1		Upper Production Master Valve well K5F-1	
DHSV-92103.1		Down Hole Safety Valve well K5F-1	
AMV-92103.1		Annulus Master Valve well K5F-1	
BAIV-92100.1		B Annulus Isolation Valve well K5F-1	
XOV-92101.1		Crossover Valve well K5F-1	
CIV-92101.1		Chemical Injection Valve well K5F-1	
CIV-92102.1		Chemical Injection Valve well K5F-1	
CIV-92103.1		Chemical Injection Valve well K5F-1	
XEV-92103.1		HP Dump Valve (solenoid) well K5F-1	
PPU-92101.1		Production Pressure Upstream well K5F-1	
PPD-92111.1		Production Pressure Downstream well K5F-1	
APTA-92103.1		Annulus Pressure Transmitter A well K5F-1	
APTB-92105.1		Annulus Pressure transmitter B well K5F-1	
PTD-92101.1		Production Temperature Downstream well K5F-1	
PTU-92104.1		Production Temperature Upstream well K5F-1	
PT-92104.1		Downhole Pressure Transmitter	
TT-92-103.1		Downhole Temperature Transmitter	
PCV-92101.2		Production Choke valve well K5F-2	
PWV-92101.2		Production Wing Valve well K5F-2	
UPMV-92102.2		Upper Production Master Valve well K5F-2	
DHSV-92103.2		Down Hole Safety Valve well K5F-2	
AMV-92103.2		Annulus Master Valve well K5F-2	
BAIV-92100.2		B Annulus Isolation Valve well K5F-2	
XOV-92101.2		Crossover Valve well K5F-2	
CIV-92101.2		Chemical Injection Valve well K5F-2	
CIV-92102.2		Chemical Injection Valve well K5F-2	
CIV-92103.2		Chemical Injection Valve well K5F-2	
XEV-92103.2		HP Dump Valve (solenoid) well K5F-2	
PPU-92101.2		Production Pressure Upstream well K5F-2	
PPD-92111.2		Production Pressure Downstream well K5F-2	
APTA-92103.2		Annulus Pressure Transmitter A well K5F-2	
APTB-92105.2		Annulus Pressure transmitter B well K5F-2	
PTD-92101.2		Production Temperature Downstream well K5F-2	
PTU-92104.2		Production Temperature Upstream well K5F-2	
PT-92104.2		Downhole Pressure Transmitter	
TT-92103.2		Downhole Temperature Transmitter	
PCV-92101.3		Production Choke valve well K5F-3	FUTURE
PWV-92101.3		Production Wing Valve well K5F-3	FUTURE
UPMV-92102.3		Upper Production Master Valve well K5F-3	FUTURE

DHSV-92103.3		Down Hole Safety Valve well K5F-3	FUTURE
AMV-92103.3		Annulus Master Valve well K5F-3	FUTURE
BAIV-92100.3		B Annulus Isolation Valve well K5F-3	FUTURE
XOV-92101.3		Crossover Valve well K5F-3	FUTURE
CIV-92101.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92102.3		Chemical Injection Valve well K5F-3	FUTURE
CIV-92103.3		Chemical Injection Valve well K5F-3	FUTURE
XEV-92103.3		HP Dump Valve (solenoid) well K5F-3	FUTURE
PPU-92101.3		Production Pressure Upstream well K5F-3	FUTURE
PPD-92111.3		Production Pressure Downstream well K5F-3	FUTURE
APTA-92103.3		Annulus Pressure Transmitter A well K5F-3	FUTURE
APTB-92105.3		Annulus Pressure transmitter B well K5F-3	FUTURE
PTD-92101.3		Production Temperature Downstream well K5F-3	FUTURE
PTU-92104.3		Production Temperature Upstream well K5F-3	FUTURE
PT-92104.3		Downhole Pressure Transmitter	FUTURE
TT-92103.3		Downhole Temperature Transmitter	FUTURE
PCV-92101.4		Production Choke valve well K5F-4	FUTURE
PWV-92101.4		Production Wing Valve well K5F-4	FUTURE
UPMV-92102.4		Upper Production Master Valve well K5F-4	FUTURE
DHSV-92103.4		Down Hole Safety Valve well K5F-4	FUTURE
AMV-92103.4		Annulus Master Valve well K5F-4	FUTURE
BAIV-92100.4		B Annulus Isolation Valve well K5F-4	FUTURE
XOV-92101.4		Crossover Valve well K5F-4	FUTURE
CIV-92101.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92102.4		Chemical Injection Valve well K5F-4	FUTURE
CIV-92103.4		Chemical Injection Valve well K5F-4	FUTURE
XEV-92103.4		HP Dump Valve (solenoid) well K5F-4	FUTURE
PPU-92101.4		Production Pressure Upstream well K5F-4	FUTURE
PPD-92111.4		Production Pressure Downstream well K5F-4	FUTURE
APTA-92103.4		Annulus Pressure Transmitter A well K5F-4	FUTURE
APTB-92105.4		Annulus Pressure transmitter B well K5F-4	FUTURE
PTD-92101.4		Production Temperature Downstream well K5F-4	FUTURE
PTU-92104.4		Production Temperature Upstream well K5F-4	FUTURE
PT-92104.4		Downhole Pressure Transmitter	FUTURE
TT-92103.4		Downhole Temperature Transmitter	FUTURE

9.3 Special Requirements

All warning and emergency signs need to be English **and** Dutch language as per NL00-U-6S-061.

10 Equipment Requirement Specification

10.1 Master Control Station (MCS)

The redundant MCS will be the communication interface between the ICSS and the K5F electrical Subsea Control Modules (ESCM). The MCS will be located in the electrical switch room of the K6P Platform (safe area) and will be powered from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-01 Supplemental Requirements Specification for MCS Hardware

X-076721-87-02 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Control and Management

X-076721-87-03 Supplemental Requirements Specification for MCS Subsea and Topside Equipment Process Interlocks and Shutdowns

X-076721-87-12 Supplemental Requirements Specification for MCS/ICSS Control Interface

10.2 Electrical Power and Control Unit (EPCU)

The EPCU is a redundant electrical power and communication unit for high voltage DC power supply and communication to the subsea installed ESCM's. The EPCU will be located in the electrical switch room of the K6P Platform (safe area) and will receive separate power supply for channel A and B from an UPS.

Refer to the following documents for detailed technical requirements:

X-076721-87-04 Supplemental Requirements Specification for EPCU

10.3 Hydraulic Power Unit (HPU)

A dedicated Hydraulic Power Unit (HPU) will be installed on the K6C platform to provide clean hydraulic HP power for the control of the K5F Downhole Safety Valves (DHSV). The HPU will be controlled from a remote PLC located in a safe area and will be monitored by the MCS/ICSS.

Design Pressure = 690 bar

Hydraulic Fluid = Castrol Transaqua HT

Refer to the following documents for detailed technical requirements:

X-076721-87-05 Supplemental Requirements Specification for HPU

10.4 Topside Umbilical Termination Unit (TUTU)

The Topside Umbilical Termination Unit (TUTU) shall terminate the main electro/hydraulic/chemical umbilical lines and provide the interface to the K6C platform equipment. It will only provide a hardware interface without any block/bleed-valves and/or Pressure gauges for testing or maintenance work. All tubing and couplers need to be supplied by others. The electrical cables shall be terminated in separately mounted explosion proof Junction Boxes or with moulded splice connections.

Refer to the following documents for detailed technical requirements:

X-076721-87-06 Supplemental Requirements Specification for TUTU

10.5 Umbilical Termination Assembly (UTA)

The Umbilical Termination Assembly (UTA) shall be a robust construction to provide interfaces with the umbilical and shall allow to suitably terminating all functions. The UTA shall be setup for the hydraulic connection of the two trees currently in the scope of supply and the two future trees.

Refer to the following documents for detailed technical requirements:

X-076721-87-07 Supplemental Requirements Specification for UTA

10.6 Power Regulation and Control Module (PRCM)

The Power Regulation and Communication Module (PRCM) regulate the power to the ESCM and provide communication to the ESCM. It also provides the connection to the external cathode package.

The PRCM shall be diver recoverable by using a special change out tool and shall be connected to a mounting base.

10.7 Electric Subsea Control Module (eSCM)

The eSCM controls various electric actuators on the tree/wellhead and acquires data from the subsea instrumentation for the transmission to the surface.

The following functions need to be controlled by the eSCM:

No.	Function	Actuator Size	Location	Note
1	CIV 1	¾”	Tree	
2	CIV 2	¾”	Tree	
3	CIV 3	¾”	Tree	
4	BAIV	¾”	Wellhead	
5	AMV	2”	Wellhead	
6	XOV 1	2”	Tree	
7	UPMV	5”	Tree	
8	PWV	5”	Tree	
9	PCV	N/A	Tree	
10	SCSSV Open	N/A	Tree	
11	SCSSV Close	N/A	Tree	

The following tree sensors need to be monitored by the eSCM:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

10.8 Anode Package / Anode Package Foundation Base

There are two separate Anode Packages for the A and the B channel of the system. The Anode Package shall be a robust frame construction for two separate and diver retrievable Anodes. The Anode package requires two separate electrical connectors for each anode for the connection via a flying lead to the anode umbilical assembly. The Anode Packages need to be clearly marked with “A” and “B”. The painted steel frame is protected by FRP grating on all four sides and on top to prevent damages caused by dropped objects. The two anode packages for the channels A and B will be placed on a further support frame to minimize the required installation effort. Both Anode Packages will be located on a Foundation Base.

10.9 Cathode Package

There are four separate Cathode Packages for the A and B channel of each tree. The Cathode Packages will be connected to the respective PRCM on the Subsea Protection Structure via an electrical flying lead. The Cathode Packages are diver installable and will be hooked into the outside plates of the Subsea Protection Structure. The Cathode Package contains the cathode itself and a frame with FRP grating on top to provide mechanical protection.

10.10 Anode Umbilical Assembly

The complete Anode Umbilical Assembly includes the following items:

- an approx. 100m long umbilical with an overall armour and four separate armoured 2,5mm² cores
- a pulling head assembly with 100mm diameter
- a hang-off assembly
- bend restrictor assembly at the Subsea end of the umbilical incl. clamping surface to fix the umbilical
- 4 pigtails, each 6m long, at the end of the umbilical

10.11 Electrical Flying Leads

The electrical flying leads shall comprise a cable moulded to the subsea connectors at both ends. The colour of these cables shall be black with a marking by means of approx. 30cm long heat shrinks at both ends. System A will be marked “blue” and System B “yellow”. These flying leads shall be designed for diver make up only.

10.12 Tree/Wellhead Pressure and Temperature Sensors

The following Pressure and Temperature Sensors are located on the Tree and the Wellhead:

No.	Function	Location	Range	Note
1	PTU	Tree	-60 to +100°C	
2	PPU	Tree	0 to 400 barg	
3	PTD	Tree	-60 to +100°C	
4	PPD	Tree	0 to 400 barg	
5	APT A	Wellhead	0 to 500 barg	
6	APT B	Wellhead	0 to 200 barg	

These sensors shall meet the following requirements:

- Field proven design
- The sensors shall be suitable for the intended subsea service
- Redundant with separate interconnection cables for the A and B channel
- Diver retrievable sensors
- With block-bleed-block assemblies on the pressure sensors
- Minimum accuracy of:
    - +/- 0.03% x full scale accuracy and a drift of 0.2%/year for the pressure sensors
    - +/- 0.3°C accuracy and a drift of 0.2°C/year for the temperature sensors

10.13 SCSSV Dump Valve Assembly

A 3/2 way valve shall be located on the tree for the operation of the SCSSV. The operation of this valve will be direct hydraulic by use of Transaqua HT fluid from a dedicated HPU through a single HP supply line in the main umbilical. The valve shall be designed for the design pressure of the SCSSV system and shall be activated by the ESCM. This assembly will consist of a fixed plate which will be located on the tree and a free plate with the dump valve on which is diver retrievable. Both plates will be connected via quick couplers without the use of poppets. The tree tubing will be connected to the fixed plate by using Autoclave anti-vibration couplers.

11 Quality requirements

A Quality Plan to be used for the project shall be created. For the Project Quality Specification see section 5.1 of this document.

11.1 CE Marking

The topside hardware and software is to be supplied with a CE declaration of conformity, which confirms compliance with all relevant directives.

12 Handling/Installation/Intervention & Shipping

Project shall provide detailed installation and intervention recommendations, and step-by-step project specific procedures, for review as part of the project-engineering phase.

All separately installable and retrievable items shall be provided with suitable lifting points and be generally designed to allow a smooth, simple and quick installation/retrieval process to be performed by divers. This shall include the following items:

- Electric Subsea Control Module (eSCM)
- Power Regulation & Communication Module (PRCM)
- Electrical flying leads between
  - Tree/Wellhead located junction boxes and sensors
  - UTA and PRCM
  - PRCM and ESCM
  - PRCM and Cathode Package

  Tree and Wellhead Pressure and Temperature Sensors
- SCSSV Dump Valve Assembly
- Anode Umbilical Assembly

All subsea assemblies shall be designed to withstand an abandonment period of 6 month sub sea, located where required but not connected to its services (hydraulic, chemical, electrical, ..)

12.1 Use of guidelines

All Subsea equipment (trees, choke inserts, jumpers, control modules, etc.) shall be designed for installation and retrieval by divers with the use of guidelines.

12.2 Lifting / Handling

All equipment shall be designed for safe handling and transportation, both onshore and offshore. All lifting points on all equipment handled offshore shall be:

- Physically load tested to rated weight
- Designed for loads as defined in API 17D and API RP 17G.
- Any welding and associated NDE, which is required for lifting apparatus shall be in compliance with API 17D and API RP 17G.
- All lifting points on all equipment, both purchased and rented; to be handled offshore shall be tested and labelled in accordance with API 17D and API RP 17G.
- All shipped equipment assemblies shall be labelled with their weight.
- Slings and rigging shall be provided for items that require lifting.

12.3 Connection of flying leads

The Subsea hydraulic and electrical flying leads shall be designed to be installed by the use of divers.

Following installation of the Xmas tree, the diver (after removing the LTC from the remote stab or connector) shall pick up the remote end connection and install it to the UTA or Wellhead.

The process shall be similar for the electrical connector.

For recovery the procedure shall be reversed.

12.4 ROV Interfaces

All ROV and diver interfaces shall be designed in accordance with ISO 13628-8.

12.5 ROV Marking of Subsea Stations

Marking of subsea station shall be in accordance with ISO 13628-1 and the following requirements:

- Letter size shall be 50mm

13 Testing

Each item of deliverable equipment shall be tested in accordance with a project approved and CAMERON supplied acceptance test procedure to verify the following as a minimum:

- Functionality
- Internal pressure testing
- External pressure testing
- Control fluid cleanliness to SAE AS4059

CAMERON shall provide written step-by-step procedures for these tests to be provided to COMPANY.

A Control System Integration Test shall be performed in accordance with a COMPANY approved procedure to demonstrate that all of the individual items of equipment function correctly as a system.

The testing programme for the Subsea Production Control System shall be undertaken in the stages detailed as follows:

- Factory Acceptance Test for single units (FAT's)
- System Factory Integration Testing (FIT)
- Tree EFAT
- System Integration Testing (SIT)
- Platform Commissioning
- Offshore Pre-submergence Testing/Deck Testing
- System Commissioning

13.1 Factory Acceptance Test (FAT)

Each deliverable item shall be subjected to a Factory Acceptance Test (FAT). The purpose of this FAT shall be to demonstrate the item is suitable for the intended purpose and functions correctly. FAT tests shall include hydrostatic proof pressure testing to 1.5 times the design pressure of the Subsea control system.

All FAT procedures shall be step-by-step and submitted for review and approval prior to testing commencing.

All critical equipment components shall be subjected to sub-assembly tests during the assembly phase of manufacture and to carry out these tests, the necessary equipment and fittings are specialised in-house equipment and are not project deliverable.

Each item of equipment shall be subject to an in-house FAT in accordance to an approved standard procedure document to demonstrate these meet the specified operational and functional requirements.

The tests shall include interface connections and mechanical alignment tests to verify design and manufacturing limit tolerance effects, component inter-changeability, together with hydraulic fluid system flushing and / or cleanliness checks as necessary to ensure the system meets SAE AS4059. The hydraulic tubing and piping pressure lines shall be hydrostatic pressure tested to 1,5 times the design pressure.

The test equipment shall be determined by the proposed testing programme, however in the event of additional testing or if testing in other locations is required, the quantity of test equipment detailed shall be subject to review.

Testing of fabricated items shall also include continuity testing of bolting.

Testing on subsea assemblies shall include continuity testing and earthing testing.

The maximum value for the resistance measured shall be 0.1 Ohm.

13.1.1 Environmental Stress Screening (ESS)

Modules or subassemblies containing electrical equipment and/or electronic equipment, which are intended for permanent subsea installation shall comply with section 4 of the Total specification GS EP SPS 022 “Environmental testing of Subsea Electronics”.

13.2 Factory Integration Test (FIT)

A System Factory Integration Test (FIT) shall be conducted to verify the correct interfacing and inter-working of all items of the subsea production control system equipment. External interfaces, for example Xmas tree valves & sensors, umbilical cables, DCS, MCC & ESD systems etc. shall be simulated for the purpose of the test. The testing shall be designed to verify the functional and operational integrity of the subsea production control system.

13.3 Xmas Tree/SCM system integration test (Tree eFAT)

A Xmas Tree/SCM System Integration Test shall be conducted for the Xmas tree, following completion of the Xmas tree FAT within the factory.

14 Special packing/shipping procedures/Instructions

For deliverables consisting of a main assembly with additional loose items (Lifting Slings, Test Hoses/Cables, Fill Lance, Pre-Charge Kit, Fluid in Barrels etc.), separate packing/shipping procedures/instructions with included component check-lists shall be provided.

The same shall apply for deliverables that can not be shipped as complete units, as transportation could result in damage of internal components.

These procedures/instructions should be part of the BOM from the related parts.

For all units which include any fluids or substances, COSHH sheets (Control of Substances Hazardous to Health) shall be delivered with the unit. These COSHH sheets shall be available early in the process for supply to the client.

Total Exploration and Production Netherlands B.V.

K5F Field Development Project

Subsea Production System (SPS)

Contract No. 4600000416

31.07.2007	Approved for Construc.	J. Grochowski	J. Dannehl	R. Wrede
25.07.2007	Issued for Client Com.	J. Grochowski	J. Dannehl	A. Weilandt
04.07.2007	Issued for internal IDC	J. Grochowski	J. Dannehl	A. Weilandt
Date	**Reason for Issue**	**Originator**	**Checker**	**Approved**

CAMERON	**Document Title:** **Installation Requirements** **For Anode Umbilical**		
PAGE 1 OF 8	**Customer Document Number:**	54NL92-W-0S-523	REV. 1
	Cameron Document No.	X-065438-05-01	REV. 01

Document Revision History

Rev	Date	Description of change	Reason for change
A	04. July 2007		Initial Release
B	25. July 2007	Comments included	Internal review
01	31. July 2007	No change	Released

Table of Contents

1 Abbreviations

BOM	Bill Of Material
CAM	CAMERON
EPCU	Electrical Power & Communication Unit
FAT	Factory Acceptance Test
FB	Foundation Base
LTC	Long Term Cover
MCS	Master Control Station
N/A	Not applicable
PCS	Production Control System
PN	Part Number
SAPA	Subsea Anode Package Assembly
TUTU	Topside Umbilical Termination Unit

2 Scope

This document covers the requirements for the Installation of the CAMERON anode umbilical within the K5F project. It is applicable for:

- Part Number 2197406-02

3 Reference Documents / Drawings

Description	CAM Doc. No.	Customer Doc. No.
Bill of Material (BOM) Anode Umbilical	2197406-02	N/A
Assembly Drawing Anode Umbilical	SK-066406-02	54NL92-W-03-542
Generic Installation Procedure For GISMA E-Connectors	X-065467-02-19	N/A
Interconnection Diagram Production Control System	SK-066001-88-04	54NL92-W-03-530
Installation, Retrieval & Maintenance Procedure Subsea Anode Package Assembly	X-065467-02-11	54NL92-W-0P-536
Assembly Drawing Subsea Anode Package Assembly	SK-066170-49	54NL92-W-03-505
Assembly Drawing SAPA Foundation Base	SK-066211-01	54NL92-W-63-504

4 Safety / Warnings

PERSONNEL AND PRODUCT SAFETY ARE PRIMARY OBJECTIVES AND THEREFORE THE FOLLOWING PRECAUTIONS MUST BE TAKEN PRIOR TO CARRYING OUT THIS PROCEDURE:

All personnel must acquaint themselves fully and strictly adhere to all company sites' HEALTH AND SAFETY AT WORK REGULATIONS, together with other specific requirements detailed in this procedure.

All work is to be carried out within either a dedicated test bay area with authorised personnel entry points, or an area adequately protected from unauthorised access with a visible cordoned zone and adequately displayed warning signs detailing the test type and associated hazards.

The lifting and handling of the equipment must be carried out with extreme caution and with regard to the safety regulations.

All personnel in contact with the hydraulic fluid must wear suitable protective clothing and gloves if required, regarding all the necessary precautions detailed on the fluid data sheets.

For work, which includes the use of pressurised fluid, compressed gas and/or electrical voltage, all necessary suitable and adequate precautions must be taken prior beginning of work.

All personal working on the equipment must have the required experience, training and qualifications.

ENSURE THAT NO ELECTRICAL POWER IS APPLIED TO ANY OF THE CONNECTIONS IF CONNECTIONS ARE MADE – UP OR DISCONNECTED.

5 System Description

The anode umbilical connects the Topside Umbilical Termination Unit (moldings) to the Subsea Anode Packages. The two (2) anode packages (A&B) feed back the electric current via the seawater from the cathodes. The applied voltage will be approx. 4000V DC during system operation.

6 Required Equipment (by others)

- Long term protective covers on anode umbilical pigtail ends (already in place)
- Soft slings and mats for handling
- Binding / strapping material for pigtails
- Insulation test equipment

7 Handling

Note: All offshore operations to comply with appropriate Permit to Work system.

Full anode umbilical length: approx.100 m

Weight in air: approx. 3800 kg/km
Weight in seawater: approx. 2300 kg/km

Maintain a minimum bending radius (static) of 450 mm for the anode umbilical and 180 mm for its pigtails.

- Minimum breaking strain of anode umbilical: 300 kN
  Do not pull this force at the pigtails!

Visually inspect the anode umbilical for damage before and after handling.

Verify:_____

8 Requirements for Installation

8.1 General

DANGER!

Risk of electric shock for diver. Switch off all electric power at EPCU before disconnection / connection. Secure electric power against turning on. Refer to tagging and never confuse cable ends subsea.

Refer to “Assembly Drawing Anode Umbilical” as cables are colour coded and are not allowed to be mixed between A&B.

Never run the anode umbilical over sharp edges / rocks.

Recommended bending radius (dynamic) is as follows:

- Anode umbilical: 900 mm
- Pigtails of anode umbilical: 250 mm

E-Connectors at 4 cable pigtail ends must be protected by Long Term Covers until they are connected. Refer “Installation Procedure for GISMA E-Connectors” if required.

8.2 Preparation

Check that the Long Term Covers are mounted on all 4 pigtails.

Bind / strap pigtails together for protection during over-boarding and seafloor operation.

Ensure the pull-in head is prepared as required.

8.3 Load-Out

Anode Umbilical should be stored as supplied until it is used.

For UV-light protection anode umbilical should not lay in direct sunlight for more then 2 weeks.

Never pull anode umbilical over sharp edges. Use soft slings and mats as required.
Maintain instructions from section “Handling”

8.4 Over-Boarding and Seafloor Operation

Anode umbilical pigtails may be strapped to the main umbilical prior to entering the over-boarding chute.

Maintain tensioning forces and instructions in section “Handling”.

Inspect and clear pull in path. The anode umbilical will be pulled in at the J-Tube.

Anode umbilical hang off is shown on Assembly Drawing.

Anode Umbilical will be fixed at the SAPA Foundation Base by clamps.

8.5 Test after Installation

After installation visually inspect the anode umbilical for damage as far as possible.

A core to core insulation test (2500 VDC recommended) is required for the anode umbilical. Therefore the long term protective covers at the end of the 4 pigtails must be still in place.

8.6 Connection after Test

Refer to drawing “Interconnection Diagram PCS” for cable interconnection of SAPA modules. Additional information regarding the SAPA is provided in “Installation, Retrieval & Maintenance Procedure for Subsea Anode Package Assembly”.

Refer to “Assembly Drawing Anode Umbilical” as cables are colour coded and are not allowed to be mixed between A&B.

Retrieve and store long term protective covers.

Generic Installation Procedure (IP)

For

GISMA Connectors and Jumpers

Series 10 & Series 80

Cameron Part Number:
NA

Note: This document is not under CAMERON revision control !

03	25 August 2007	J. Dannehl	F. Tegt
02	30 July 2007	J. Dannehl	F. Tegt
01	29 March 2007	J. Dannehl	S. Fischer
Cameron Revision	**Date**	**Prepared by**	**Checked by**

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1 REVISION STATUS RECORD

REV.	DATE	DESCRIPTION OF CHANGE	SECT.	REASON FOR CHANGE
01	13-Apr-07			Initial Release
02	30-Jul-07	New Gisma Procedure inserted	all	Major Revision
03	25-Aug-07	SAP Fault	all	Minor Revision

2 SCOPE OF DOCUMENT

The purpose of this document is to provide supplier documents in the Cameron documentation system of “SAP”

The following supplier documents are the present releases.

The following supplier documents are not under CAMERON revision control!

3 GISMA DOCUMENT HI 2007-001

GISMA

STECKVERBINDER
GMBH

HIGH PERFORMANCE UNDERWATER ELECTRICAL AND FIBRE-OPTIC CONNECTORS

Content

GISMA ELECTRICAL & FIBRE OPTIC CONNECTORS - PROTECTION, STORAGE, SHIPMENT, UNPACKING, DEPLOYMENT & MAINTENANCE INSTRUCTIONS

1. GENERAL

Thank you for purchasing a GISMA product. The information that follows is an overview of the protection, storage, shipment, unpacking, deployment and maintenance instructions for GISMA electrical and fibre optic products.

GISMA recommend the termination and handling of all equipment only be undertaken by suitably trained and qualified personnel.

2. SCOPE

This procedure includes information on the following connector types:

- GISMA series 10
- GISMA series 14
- GISMA series 22
- GISMA series 35
- GISMA series 40
- GISMA series 80

Sections 3, 4, 5 and 6 detail general information applicable to all GISMA connectors. Section 7 then provides specific information relevant to each connector range.

3. PROTECTION, HANDLING AND SHIPMENT

GISMA electrical, fibre and hybrid connectors are manufactured primarily from materials such as stainless steel 1.4404 / 1.4571 (316L / 316Ti), marine bronze (CW307G) and titanium Grade 5, and as such are designed to withstand harsh saliferous environments. However, the connector insulator and exposed parts are susceptible to mechanical damage if not adequately protected. Dust caps are fitted to all GISMA connectors before transport, but can be fitted with POM protective caps or pressure watertight protective caps, if specified by the customer. Pressure watertight caps must remain in place until the connectors are ready for the underwater mating process.

The connectors are generally relatively small items of equipment, and therefore, can be shipped singularly or in multiples. Care should be taken to protect the connector with bubble wrap or similar wrapping materials to avoid surface damage during transit. Dust caps or POM protective caps must be fitted at all times during transport.

If the connectors are assembled onto cables these must be suitably coiled and secured with tape to prevent uncoiling during transit. Recommended bend radius for storage/transport of cables, refer to cable specification or jumper drawing.

Any connector-specific handling and transport advice is contained within the appropriate section further on in this document.

4. UNPACKING

Remove wrapping material taking care to inspect for any surface damage or items that may have become separated from the connector, such as 'O-ring' seals. Do not use a knife to cut the wrapping material, as this may cause damage to any elastomeric parts of the connector. Do not remove any kind of protection caps until connectors are ready for installation. On removal do not allow the cables to drag over the edges of the packing crate.

5. STORAGE

5.1. Short Term Connector Storage

Prior to installation the connectors are sensitive to environments where grit and dirt are present. To prevent ingress of the above, they should be stored in a clean dry area and be protected by bubble wrap or similar wrapping and packing material. Protective caps must be fitted if supplied.

5.2. Long Term Connector Storage

The connectors must be stored in a clean dry area and be protected by bubble wrap or similar. Suitable protective caps must be fitted, and the storage temperature should be between -40°C and 70°C. Humidity of the store room should be below 75%. Very moist or very dry conditions should be avoided. The connectors should be protected from strong sunlight and strong artificial light with a high ultra violet content.
The connectors should not be allowed to come into contact with solvents, oil, greases or any other semi-solid materials.

6. Jumper handling and mounting

6.1. Jumper handling

GISMA connectors can be delivered as part of the jumper assembly. All terminated connectors are delivered with dust caps for protecting the contacts and the insulator against damage and dust. **These caps have to be removed before subsea usage.**

Before mounting inspect the jumper and especially the cable for damages and debris.

Lightly grease the locking threads of the receptacles, pressure hull penetrators and the through bulkhead receptacles e.c. with Molykote BR2-plus.

After mounting the cable has to be fixed closed to the structure (first fixpoint 500mm behind the connector's endbell and than every 500mm) to aware movement and turning of the jumper cable.

Take care that all connectors are correctly mated and locked with the correct mounting torque or protected by pressure watertight protective caps before going subsea. For defined mounting instructions refer to the different connector series.

Prior to installation the connectors are sensitive to environments where grit and dirt are.

7. DEPLOYMENT & MAINTENANCE

The following section details deployment and maintenance instructions for all GISMA connectors & cables, categorised by product type. Please refer to the appropriate section as listed below:

7.1 – EExd connectors series 10
7.2 – Subsea connectors series 10
6.3 – Subsea connectors series 22
6.4 – Subsea connectors series 80

All information contained within this section is generic. Where customer or project-specific information is required, please refer to the relevant project specification or scope of supply.

For further technical information refer to the catalogues of the different series or special drawings.

Note: It is important to isolate and earth prior to disconnect in order to remove any stray charges in the system. If left, this can induce corrosion on the exposed pins once the plug is removed.

The connector shall have the following periodic maintenance checks:

- Examine the connector for signs of damage.
- Check the locking sleeve, these shall be tight, if loose refer to assembly instruction for torque values, where appropriate.

7.1. EEXD CONNECTORS SERIES 10

This range of connectors is designed for **zone 1**. For mating and demating the power (current) must be switched off. Limited deployment instruction is required with this connector but a few general observations must be followed:

- EExd installation rules
- Cable bend radius limitations
- Connector location
- Cable supports
- Connector mounting details.

To maintain EExd rating, EExd rated dummy caps must be fitted to unmated plugs.

The connector shall have the following periodic maintenance checks:

- Examine the connector for signs of damage.
- Check the locking sleeve, these shall be tight, if loose refer to assembly instruction for torque values, where appropriate.

It is recommended that the above checks be performed from time to time.

For further technical information refer to the catalogue of series 10 EExd or special drawings.

7.2. SUBSEA CONECTORS SERIES 10

7.2.1. General

The series 10 sizes 1 to 7 range of connectors has been developed for long term reliable signal and low power control system applications associated with offshore installations. The underwater mateability of the range of signal connectors series 10 (contact-Ø 1mm and 1,5mm) is achieved by using a patented, conical sealing system at each contact and a lip gasket.

For further technical information refer to the catalogue of series 10 or special drawings.

The connector range series 10 comprises standard **power connectors** for high voltage and high current application as well. **NOTE!** These connectors are not underwater mateable. Please ask for detailed product information.

Connectors are usually supplied with dust caps. The dust caps need to be removed prior to mating the connectors.

All mild steel sealing interfaces shall be inlayed with Inconel 625, or similar, where no additional protection can be provided. This is to prevent localised pitting of the interface.

Stainless steel (1.4404/ 1.4571 comparable to 316L/316Ti) or titanium grade 5 stab plate connectors must be connected to the CP (Cathodic Protection) system at all times. If the connector is designed with a fixed flange and screw mounting, an additional CP connecting would not be required. Super Duplex stainless steel connectors should be isolated from the CP system to reduce the possibility of hydrogen embrittlement.

If the connectors are to be left unmated in seawater for any length of time, pressure watertight protective caps must be used to protect the contacts. Over exposure will increase the risk of corrosion damage or marine growth on the contact surfaces of the pin contacts. This could lead to damage to the seals and insulation within the socket contacts.

The appropriate test connector must always be used to make electrical contact during testing. **UNDER NO CIRCUMSTANCES** should a foreign object (such as a screwdriver, test probe, or crocodile clip) be used as a test connection as this could damage the seals and insulation. Such actions will invalidate the warranty of the connector.

NOTE: NO PART OF THE CONNECTORS SHOULD BE DISMANTLED PRIOR TO OR DURING DEPLOYMENT, APART FROM THE REMOVAL OF PROTECTIVE CAPS, SINCE THERE ARE NO USER SERVICEABLE PARTS INSIDE.

TEST CONNECTORS OR FREE TOUCHABLE CONNECTORS WITH METAL SHELL MUST BE CONNECTED TO THE EARTH CONDUCTOR.

The series 10 range of connectors can be supplied either singularly or as part of a harness assembly. All series 10 connectors require the following acceptance tests during termination:

- Mating test
- Insulation Resistance test
- High Voltage test
- Continuity test

Cable terminations can be performed on-site or offshore by GISMA trained personnel where the cable cannot easily be moved or transported. Each series 10 connector has been mated, hydrostatically tested (applies to receptacles only) and electrically proven prior to despatch. Termination of these connectors should only be undertaken by trained personnel.

7.2.2. Live Mate / Demate

The series 10 range of connectors are designed to be mated / de-mated with **POWER OFF**.

7.2.3. Protection of receptacle's pin contacts

Under no circumstances the pin contacts should be exposed to seawater with power on. If this situation does occur the contact surfaces of the pins will very rapidly degrade by electrolytic action. If these damaged pins are subsequently mated into a socket insert there is a **very high risk** of damage to the insulation and seals within the plug.

7.2.4. Removal of Marine Growth and Calcareous Deposits

To remove calcite growth from GISMA connectors, a solution of 50% Citric Acid is recommended. All seawater exposed elastomeric materials in GISMA connectors have been fully tested against 50% Citric Acid and are compatible for a duration of 1 hour. In addition, the thermoplastic materials have good resistance to Citric Acid.

Other acid cleaners, such as 50% Acetic Acid, should **not be** used as they may cause deterioration of the elastomeric materials.

Chiselling and abrasive methods are not recommended. Use of a water jet is acceptable, but the jet should not be directed onto the pins at the front of the plug as this could result in a risk of damaging the insulator.

7.2.5. Connector Handling

- Pre Mating Check

  The connector that is to be joined must be free of dirt and foreign matter. Coaxial- and fibre-optic inserts must be protected against moisture.

  Before the initial coupling the front side of the socket connectors must be greased with GISMA-grease EK2 (part no.: GISMA-Fett EK2), to fill the conical seal cavities with grease (see drawing below). After 5 underwater matings the connector must be greased again (applies only to series 10).

  Dirty connectors to be daubed with GISMA foam cleaner (SCHAUMREINIGER). Allow three minutes to react. In case of strong dirt repeat the procedure. Then rinse with clean water. Following rinse with the enclosed cleaning liquid (SPÜLLÖSUNG) to neutralize foam cleaner.

  Check to see if the plugs locking sleeve runs smoothly.

- Alignment

  Put the plug onto the receptacle. Twist the connector until the keyway locks into place. While tightening the locking sleeve with the one hand, simultaneously feed in the connector with the other.

- Mating

  After tightening the locking sleeve by hand, screw it onto the receptacle fitting using corresponding wrenches. If the locking sleeve is designed with a safety screw, tighten it. For defined clamping torque refer to table below.

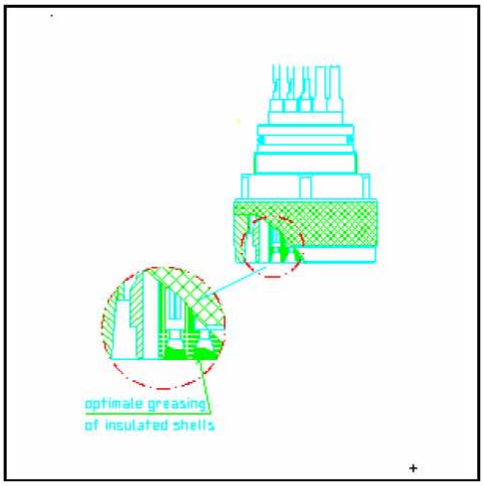
- Cathodic Protection

  Stainless steel (1.4404/ 1.4571 comparable to 316L/316Ti), marine bronze (CW307G) or titanium grade 5 diver mate connectors must be connected to the CP (Cathodic Protection) system at all times. Super Duplex stainless steel connectors should be isolated from the CP system to reduce the possibility of hydrogen embrittlement.

Size	Mounting torque for plug locking sleeves (recommended / maximum)		Wrench size	max. wrench width *
1	15 +/- 5 Nm	30 +/- 5 Nm	26 mm	8,0 mm
2	17 +/- 5 Nm	35 +/- 5 Nm	28 mm	8,5 mm
3	19+/- 5 Nm	40 +/- 5 Nm	34 mm	9,0 mm
4	21 +/- 5 Nm	45 +/- 5 Nm	41 mm	13,8 mm
5	23 +/- 5 Nm	45 +/- 5 Nm	55 mm	16,8 mm
6	25 +/- 5 Nm	45 +/- 5 Nm	55 mm	16,8 mm

*Stated wrench widths apply to standard endbells only. Special endbells may require specific tools. Please check the relevant dimensional drawings.

Recommended torque spanner: Rahsol 4405-05 (Z16)



Picture: grease filling of plug

7.3. SUBSEA CONNECTORS SERIES 22

The connector range series 22 is especially designed for long term subsea use under harsh conditions, e. g. submarines. It can be supplied either singularly or as part of a harness assembly.

Series 22 connectors are only dry mateable.

All GISMA connectors require the following acceptance tests during the terminations:

- Mating test
- Insulation Resistance test
- High Voltage test
- Continuity test

Cable terminations can be performed on-site or offshore by GISMA trained personnel where the cable cannot easily be moved or transported. Each GISMA connector is fitted with a pin or socket insulator which has been tested prior to despatch.

Termination of series 22 connectors should only be undertaken by trained personnel.

Prior to mating an series 22 connector, each conical seal of the socket insert should be filled with a small amount of GISMA grease EK2 (part no.: GISMA-FETT EK-2) dielectric grease.

All series 22 connectors must be fitted with a mating connector or a pressure watertight protective cap prior to subsea installations. Connectors must not be energised subsea unless coupled with a mating connector or fitted with a pressure watertight protective cap, in order to prevent electrolytic damage to the contacts when exposed to sea water.

All mild steel sealing interfaces shall be inlayed with Inconel 625, or similar, where no additional protection can be provided. This is to prevent localised pitting of the interface.

Stainless steel (1.4404/ 1.4571 comparable to 316L/316Ti) or titanium grade 5 stab plate connectors must be connected to the CP (Cathodic Protection) system at all times. If the connector is designed with a fixed flange and screw mounting, an additional CP connecting would not be required. Super Duplex stainless steel connectors should be isolated from the CP system to reduce the possibility of hydrogen embrittlement.

NOTE: Series 22 cannot be used for oil compensated systems or oil compensated hose terminations.

For further technical information refer to the catalogue of series 22 or special drawings.

7.4. SUBSEA CONECTORS SERIES 80

7.4.1. General

The series 80 range of connectors has been developed for long term reliable signal and low power control system applications associated with offshore installations. The subsea mateable capacity of these connectors is achieved using pressure compensated electrical inserts employing the GISMA flushing contact principle.

Connectors are usually supplied with dust caps. The dust caps must be removed prior to mating the connectors.

For further technical information refer to the catalogue of series 80 or special drawings.

All mild steel sealing interfaces shall be inlayed with Inconel 625, or similar, where no additional protection can be provided. This is to prevent localised pitting of the interface.

If the connectors are to be left unmated, in seawater, for any length of time pressure watertight protective cap must be used to protect the pin contacts in the receptacle. Over exposure will increase the risk of corrosion damage or marine growth on the contact surfaces of the receptacle's pin contacts. This could lead to damage to the seals and insulation within the socket contacts. Plugs do not require full pressure watertight protective cap for protection. GISMA advise the fitting of POM caps to protect plugs against marine growth. It is good practice to always fit the protective cap when a connector is unmated topside prior to deployment to provide mechanical protection.

The appropriate test connector must always be used to make electrical contact during testing. **UNDER NO CIRCUMSTANCES** a foreign object (such as a screwdriver, test probe, or crocodile clip) should be used as a test connection as this could damage the seals and insulation. Such actions will invalidate the warranty of the connector.

NOTE: NO PART OF THE CONNECTORS SHOULD BE DISMANTLED PRIOR TO OR DURING DEPLOYMENT, APART FROM THE REMOVAL OF PROTECTIVE CAPS, SINCE THERE ARE NO USER SERVICEABLE PARTS INSIDE.

The series 80 range of connectors can be supplied either singularly or as part of a harness assembly. All series 80 connectors require the following during termination:

- Mating test
- Insulation Resistance test
- High Voltage test
- Continuity test

Cable terminations can be performed on-site by GISMA trained personnel or partner companies where the cable cannot easily be moved or transported. Each series 80 connector has been hydrostatically tested and electrically proven prior to despatch. Termination of these connectors should only be undertaken by trained personnel.

7.4.2. Live Mate / Demate

The series 80 range of connectors are designed to be mated / de-mated with **POWER OFF.**

7.4.3. Protection of receptacle contact pins

Under no circumstances the pin contacts should be exposed to seawater with power on. If this situation does occur, the contact surfaces of the pins will very rapidly degrade by electrolytic action. If these damaged pins are subsequently mated into a socket insert there is a **very high risk** of damage to the insulation and seals in the plug.

7.4.4. Removal of Marine Growth and Calcareous Deposits

To remove calcite growth from GISMA connectors, a solution of 50% Citric Acid is recommended. All seawater exposed elastomeric materials in GISMA connectors have been fully tested against 50% Citric Acid and are compatible for a duration of 1 hour. In addition, the thermoplastic materials have good resistance to Citric Acid.

Other acid cleaners, such as 50% Acetic Acid, should **not be** used as they may cause deterioration of the elastomeric materials.

Chiselling and abrasive methods are not recommended. Use of a water jet is acceptable, but the jet should not be directed onto the shuttle pins at the front of the plug as this could result in a risk of water being forced through the primary seals.

7.4.5. Diver Mate Connectors

- Alignment

  These connectors have been designed to self-align during mating. All that is required to ensure that the alignment pin of the plug is engaged in the alignment groove in the receptacle before pushing the plug in.

- Pre Mating Check

  Before mating, the receptacle connector should be checked for debris. The connectors have been designed to accommodate sand and silt contamination, however large pieces of debris should be removed using a water jet.

- Mating

  The diver mateable plug is assembled with GISMA locking system including 3 clamps and an over-all spring and a GISMA diver handle. For mating just push the plug into the receptacle.

- *Post Mating Checks*

  Full engagement will be achieved, if the over-all spring lays back close to the outer keyway.

- Cathodic Protection

  Stainless steel (1.4404/ 1.4571 comparable to 316L/316Ti) or titanium grade 5 stab plate connectors must be connected to the CP (Cathodic Protection) system at all times. If the connector is designed with a fixed flange and screw mounting, an additional CP connecting would not be required. Super Duplex stainless steel connectors should be isolated from the CP system to reduce the possibility of hydrogen embrittlement.

  .

Size	Mating / Demating forces for contact-Ø 3mm
1	approx. 250 N
2	approx. 430 N
3	approx. 650 N
4	approx. 900 N

Table: Mating and de-mating forces for diver mateable connectors

7.4.6. Stab Plate Connectors

- Compliance

  One half of a stab mate connector pair must be allowed to float so that misalignment tolerances can be accommodated.

- Mate/DeMate Speed

  The connectors have been designed to operate across a wide range of mate / de-mate speeds with **POWER OFF**. There is no practical limit to the speed at which the connectors maybe mated or demated, however as a guide: -

  a) Mating speed should not exceed 1 m/s.
  b) Demating speed should not exceed 5 m/s.

- Pre-Mating Checks

  Before mating, the receptacle connector should be checked for debris. The connectors have been designed to accommodate sand and silt contamination, however large pieces of debris should be removed using a water jet.

- Cathodic Protection:

  Stainless steel (1.4404/ 1.4571 comparable to 316L/316Ti) or titanium grade 5 stab plate connectors must be connected to the CP (Cathodic Protection) system at all times. If the connector is designed with a fixed flange and screw mounting, an additional CP connecting would not be required. Super Duplex stainless steel connectors should be isolated from the CP system to reduce the possibility of hydrogen embrittlement.

Size	Mating / Demating forces for contact-Ø 3mm
1	approx. 200 N
2	approx. 350 N
3	approx. 550 N
4	approx. 750 N

Table: Mating and de-mating forces for stab plate connectors

7.4.7. ROV Connectors

- Alignment

  These connectors have been designed to self align during mating. The connectors must be roughly aligned using the alignment keyway on the plug's locking device and receptacle's main keyway slot. The mounting of the GISMA ROV handle has sufficient compliance to accommodate fine adjustments during the final approach prior to connector engagement.

- Pre Mating Checks:

  Before mating the receptacle connector should be checked for debris. The connectors have been designed to accommodate sand and silt contamination, however large pieces of debris should be removed using a water jet.

- De-Mating

  De-mating is achieved by a straight pull on the ROV handle sufficient to release the latching mechanism.

- Cathodic Protection

  Stainless steel (1.4404/ 1.4571 comparable to 316L/316Ti) or titanium grade 5 stab plate connectors must be connected to the CP (Cathodic Protection) system at all times. If the connector is designed with a fixed flange and screw mounting, an additional CP connecting would not be required. Super Duplex stainless steel connectors should be isolated from the CP system to reduce the possibility of hydrogen embrittlement.

  .

Size	Mating / Demating forces for contact-Ø 3mm
1	approx. 250 N
2	approx. 430 N
3	approx. 650 N
4	approx. 900 N

Table: Mating and de-mating forces for ROV connectors

GISMA

STECKVERBINDER
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Don`t hesitate to contact us for more technical details.
Für ausführliche technische Informationen stehen wir Ihnen jederzeit zu Verfügung.

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DNV

GENERAL PRESERVATION & STORAGE PROCEDURE

FOR

CAMERON CONTROLS EQUIPMENT

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01	27. Aug 02	CAMTROL equipment added	Request from project
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07	12. Mar 08	Comments included	Required by project

Table of contents

1 Introduction

This document outlines the procedure for preservation and storage of a control system before and after use. This includes Production Control Systems, Workover Control Systems and Drilling Control Systems. The purpose of this procedure is to keep the equipment supplied by Cameron Celle in a proper shape during storage. It will be available for further operations without major refurbishment due to insufficient control during storage.

This document provides instructions to ensure preservation and protection of all typical control system equipment in order to prevent deterioration caused by corrosion, damage, influence of weather and foreign materials, during shipment, storage and installation.

2 Reference Procedures

X-065460-( )-( )	Protective Coating Procedure for Cameron Controls Equipment
X-065390-03	General Protection and Coating Procedure for Cameron Celle Controls Equipment
X-065390-03-00-01	Protection and Coating Procedure for Cameron Celle Controls Equipment
X-027055-01	Corrosion Inhibiting Coating of Machined Surfaces

3 General Storage Requirements for Environment

Before starting any activities for preservation & storage all functions need to be verified. It must be checked that maintenance and repair works have been performed by qualified service personnel and that the control system does not have any mechanical damages on framework, umbilicals, hoses and cables.

Clean and dry the equipment prior to storage and place it under cover (if available) in a clean and dry environment.

For outdoor storage use tarpaulin covers. Ensure that covers are correctly attached and check covers for any damage. Replace damaged covers.

Preferred ambient conditions for storage areas[*)]

Temperature range	:	0 to 40°C
Humidity range	:	0 to 50 % (excluding condensation and frost)

[*)] If above values are not available, humidity and temperature must be within project related specified range.

In areas with high ambient temperatures consider protection against UV light / direct sunlight to protect e.g. plastic materials or compensation systems (thermal expansion).

Atmosphere must be free from harmful substances which can effect resilient seals (e.g. high ozone level).

Store equipment and spare parts with sealing surface protection by protective devices and protect after inspection if necessary.

Consider special storage procedures for critical materials like hydraulic fluid, batteries, rubber goods etc.

Handling and transport of equipment must always be in accordance with the conform procedure, shown in the Operation and Maintenance Manual for the control system.

4 Cameron Controls Standard Hydraulic Control Fluids

This section outlines the Cameron Celle Controls standard hydraulic control fluids. If any other fluid is specified the appropriate data sheet must be considered for preparation and storage of the system.

4.1 Hydraulic Oils

The standard oil types for Cameron Celle Controls equipment are:

- SHELL TELLUS (different types)
- CASTROL BRAYCO MICRONIC 864

Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

Note: Further details for treatment of fluid before and during storage for the specific equipment are listed in section 5.

4.2 Water Based Fluid

The typical water based fluid types for Cameron Celle Controls equipment are delivered by **Mac Dermid CANNING (MARSTON BENTLEY) LTD.**:

- Oceanic HW 511
- Oceanic HW 525
- Oceanic HW 540
- Oceanic HW 443
- Oceanic HD 603 Water/Glycol with lubricant

A typical water based fluid supplied by **CASTROL**:

- TRANSAQUA HT or HT2

A typical water based fluid supplied by **CAMERON**:

- CAMERON 590 X Water / Glycol with lubricant

Note: Further details for treatment of water based fluid before and during storage are listed in the following table.

Water Based Fluid	Suitable Storage Fluid (>6 months)	Suitable Storage Fluid (>1 year)	Suitable Storage Fluid (>2 years)
Mac Dermid CANNING OCEANIC HW 525 Cameron PN 619011-36 OCEANIC HW 540 Cameron PN 619011-28 OCEANIC HW 443 Cameron PN 619011-41	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285	EPF Preservation Fluid for all types Cameron PN 711285
Mac Dermid CANNING Water based fluid with ERIFON HD 603 Cameron PN 619011-46 (Lubricant)	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285
	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	Composition Lubricant/Glycol/Water: 5 % Lubricant: PN 619011-46 45 % Glycol PN 619011-10 50 % Clean Potable Water	
CASTROL TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	Clean hydraulic fluid TRANSAQUA HT Cameron PN 619011-53	TRANSAQUA HT Cameron PN 619011-53
CASTROL TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	Clean hydraulic fluid TRANSAQUA HT2 Cameron PN 619011-84	TRANSAQUA HT2 Cameron PN 619011-84
CAMERON Fluid Cameron 590 X Cameron PN 619011-24 (Lubricant)	Composition Lubricant/Glycol/Water: 5 % Lubricant PN 619011-46 40 % Glycol PN 619011-10 55 % Demineralized Water	EPF Preservation Fluid Cameron PN 711285	EPF Preservation Fluid Cameron PN 711285

5 Specific Equipment Preservation and Maintenance Requirements

Note: Preservation during storage shall be performed in accordance with the check lists shown in section 6.
Any damage occurring during the periodical checks must immediately be repaired and reported to the Maintenance Supervisor.

5.1 Instruments for Surface Containers and Frames

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

All moving parts are to be lubricated with Molycote 3402 or equivalent.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

5.2 Hydraulic Power Unit and Local Control Panel

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines, including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen precharge of each hydraulic accumulator down to 10 bar / 145 psi. This is for safety reasons and to keep e.g. bladder in a stable position.

Air accumulators must be vented and drained of water.

Open ends of piping must be sealed off by plugs or caps.

All moving parts including the push rod of the panel valves must be protected by Molycote 3402 or equivalent.

Operation panels must be protected by a protective cover or door.

All doors and protective frames are to be closed and locked.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anti-condensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect ventilation grills / air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof local control panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

All isolation valves (except drain valves) must be closed. 4/3-way panel valves must be moved to "CENTER" position. 3/2-way panel valves must be in "CLOSE" or "VENT" position.

5.2.1 Hydraulic Oil

For long term storage no fluid exchange is required to get conservation against corrosion if equipment is filled with clean hydraulic oil.

After usage or longer storage (>3 months) hydraulic reservoirs must be checked for cleanliness and water content. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

Note: Small quantities of water can enter the hydraulic system e.g. through condensation. A high viscous water in oil emulsion may damage valves and pumps. To avoid these damages the water content of the oil should be less than 1500 ppm.

If the water content of the oil is too high, check the hydraulic fluid for bacterial contamination. Clean the system up if necessary by following instructions of supplier.

Hydraulic lines have to be flushed to customer required cleanliness level.

Note: Cleaning of the hydraulic lines of an empty system must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

5.2.2 Water Based Fluid

General

For long term storage (>6 months) a special fluid preparation is required to get conservation against corrosion of equipment.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Reservoirs must be checked for cleanliness.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluid should be within the system during long term storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions. The table in section 4.2 shows different possibilities for long term (>6 months) storage.

5.3 Remote Control Panel

Painting, frame and moving parts must be checked in accordance with section 5.1.

5.3.1 Electric Remote Control Panel

Cable connections are to be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Operation panel must be protected by a protective cover or door if available.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge. Acryl glass windows should have contact preservation paper applied to prevent damage by paint overspray.

Rack mounted equipment shipped separately from cabinets should be bagged with desiccant and tagged with shock fuses.

5.3.1.1 Control Panel for climatic controlled environment

Control panel for use in climatic controlled environment e.g. Master Control Station (MCS), Electric Power Unit (EPU), Remote Workstations etc.

Equipment should be stored in a warehouse in undamaged packaging under the following conditions excluding intensive dust and condensation of humidity.

Temperature -18 - +60°C

Humidity 20-90% RHNC

When packaging has to be opened e.g. for site receive tests it is recommended to use corrosion inhibitors (e.g. Cortec®VCI 110) for further preservation.

5.3.2 Pneumatic Remote Control Panel

Pneumatic connections are to be cleaned up and protected by non aggressive protective shield, protection against dust or mating protective cover if available. Check pneumatic jumper cable as well.

Air receivers must be vented and drained of water.

Operation panel front must be protected by a protective cover or door.

Acryl glass window panes on panels located in hazardous areas must be cleaned with wet cloth only due to electrostatic charge.

5.4 Hydraulic Umbilicals, Umbilical Jumpers & Steel Flying Leads

General Instructions

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the applicable hydraulic fluid.

All hydraulic connections must be cleaned from dirt by using cleaning solvents which do not harm the seals (see Operation and Maintenance Procedure).

The connection plate of the junction boxes must be protected by protective covers.

After cleaning mating protective caps or plugs must be mounted to the quick coupling or single connection.

Stainless steel junction boxes and plates must be covered with a thin film of non aggressive oil.

Painting, frame and moving parts must be checked in accordance with section 5.1.

The umbilical can be stored in a box or on a drum. The minimum bending radius for storage indicated by supplier may not be exceeded.

5.4.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The umbilical shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.4.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

All lines with poppets must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids and compositions (see table in section 4.2).

5.5 Electric Cables and Cable Jumpers

Contacts of electrical connectors must be cleaned up and protected by non aggressive protective shield.

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Check that cable minimum bending radius is kept for storage.

Cable materials have to be protected for storage to avoid mechanical impact and ageing impact caused by sunlight (UV).

5.6 Umbilical Reels

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cleaned piping must be sealed off by using protective plugs, caps or covers.

Parts for power transmission like gear, chain with sprockets etc. must be protected and lubricated.

Open gear drive with gear ring and cog	-	ANTI SEIZE (or equivalent)
Chain drive	-	ESSO CAZAR K2 (or equivalent)
Gear box for direct drive	-	See Operation and Maintenance Manual of gear box for specific oil type.

5.7 Uninterruptable Power Supply (UPS)

WARNING:

Hydrogen may discharge from batteries and cause explosion (depending from battery type). Sufficient ventilation is required.

Painting, frame and moving parts must be checked in accordance with section 5.1.

Cable connections must be protected with non aggressive protective shield.

For storage of the UPS check the allowed temperature range in Operation and Maintenance Manual to avoid damage of sensitive parts like batteries etc.

Recharge batteries to full range. Deep discharge must be avoided.

Follow specific long term storage procedure for installed type of batteries.

Disconnection of batteries may be required.

Ensure that the UPS is tagged with a shock fuse indicator.

5.8 Subsea Valve Packages

Remark: Subsea valve packages are normally mounted to the subsea running tools (e.g. Lower Marine Riser Package), which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.8.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.8.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.9 Subsea Control Modules (direct / pilot hydraulic types)

Remark: This section is **not** to be applied for CAMTROL subsea control modules. Refer to the "CAMTROL Subsea Production Control Equipment" section.
Subsea Control Modules (SCM) are normally mounted to the subsea running tools which are not within the scope of supply for the control system. This section is for individual treatment when disassembled from tool. Flushing and testing can be done with the appropriate flushing and testing unit.

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Hydraulic pressure from all lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

If applicable, cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

5.9.1 Hydraulic Oil

Water content of hydraulic oil must be checked to be within the maximum allowed range.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.9.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.10 Hydraulic Flushing and Testing Units

General Instructions

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines including the accumulators must be discharged.

Keep all drain valves open to keep pressure out of the system during storage.

Bleed nitrogen pre-charge of accumulators down to 10 bar / 145 psi to keep bladder in a stable position.

Air receivers must be vented and drained of water.

Open connection ends must be sealed off by plugs or caps.

All moving parts must be protected by Molycote 3402 or equivalent.

Junction plates must be protected by an overall cover or individual caps and plugs.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Anticondensation heaters if installed in electrical junction boxes, control boxes etc. have to be put into operation.

Inspect bearing lubrication of electrical motors prior to long term storage. Re-lubricate if necessary. Follow specific lubrication procedure for installed type of motor.

Protect air inlets of electrical motor cooling fans against particle and water pollution.

Cable connections must be protected with non aggressive protective shield or equivalent (e.g. acid free Vaseline).

Contacts of electrical connectors must be cleaned up and protected by adequate protective caps.

Acryl glass window panes on explosion proof panels must be cleaned with wet cloth only due to electrostatic charge.

Fluid must be drained short above level of suction lines. All lines must have been filled once with control fluid to get surface covered with thin fluid film.

5.10.1 Hydraulic Oil

Reservoirs must be checked for cleanliness and water content. Water content of hydraulic oil must be checked to be within the maximum allowed range. Water must be drained, and oil must be dried, if maximum allowed water content is exceeded.

The lines shall be flushed with hydraulic fluid to be cleaned in accordance with customer specified cleanliness class.

Hydraulic lines must be completely filled with fluid to avoid condensation of water.

Note: Check the hydraulic fluid for bacterial contamination if the water content is high.

5.10.2 Water Based Fluid

Check the hydraulic fluid for bacterial contamination. Clean up the system if necessary.

All lines must be filled with control fluid.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.11 Running Tools for Subsea Modules

Painting, frame and moving parts must be checked in accordance with section 5.1.

Pressure from all hydraulic lines must be discharged.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Hydraulic lines are to be flushed to customer required cleanliness level.

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

5.12 Hydraulic Cylinder (e.g. on SCM Test Stand)

Check the hydraulic fluid for bacterial contamination. Clean the system up if necessary.

Cleaning of the hydraulic lines must be performed by considering the information listed in the data sheets for the relevant hydraulic fluid.

Not all water based fluids should be within the system during long term (>6 months) storage. For this purpose the fluid suppliers normally offer special cleaning and storage fluids or compositions (see table in section 4.2).

Hydraulic cylinders are to be flushed to customer required cleanliness level. Ensure that the cavities are completely filled with hydraulic control fluid. Ensure that no air is left in the cylinders as remaining air might cause corrosion.

Painting must be checked in accordance with section 5.1.

All moving parts must be protected by Molycote 3402 or equivalent.

Stainless steel parts must be protected by a thin film of non aggressive oil.

Put piston of the cylinder in retract position. This ensures that the rod is protected inside the cylinder against corrosion or damage.

Grease the cylinder rod with silicon grease or equivalent non aggressive grease.

Store the cylinder in a dry indoor environment. Room temperature should not be below 37°F (3°C).

5.13 Float Type Accumulators

Note: Preservation has to be carried out when the float type accumulators are unused and storage will be longer than three (3) months.

<u>Disassembly of Accumulator</u>

Bleed the pressure from hydraulic fluid supply.

Ensure that the ¼" needle valve at the bottom of the accumulator is in the closed position.

Remove the ¼" NPT plug.

Open the ¼" needle valve at the bottom of the accumulator.

Ensure that the accumulator is depressurised.

Open the hammer union at the bottom of the accumulator.

Ensure that the floater is at the lower end of the accumulator.

Remove the plug at the end of the floater pipe.

Inspect the seals (floater pipe plug, hammer union).

Spray non aggressive anticorrosive lubricant into the accumulator to protect the inner surface of the accumulator.

Carefully move the accumulator in vertical position and ensure that the lubricant flows out of the accumulator.

Assembly of Accumulator

Grease the o-ring of the plug and fix the plug at the lower end of the floater pipe.

Grease the thread at the end of the accumulator bottle and connect the hammer union.

Close the ¼" needle valve at the bottom of the accumulator and install the ¼" plug.

Painting must be checked in accordance with section 5.1.

Stainless steel parts must be protected by a thin film of non aggressive oil.

5.14 Topside Umbilical Termination Unit / Assembly

Topside Umbilical Termination Units / Assemblies (TUTU / TUTA) will be treated like Hydraulic Power Units (HPU). The workload is reduced as the TUTU / TUTA does not contain motors, pumps and reservoirs.

5.15 Wire Rope

Grease the wire ropes with wire rope grease. Ommex or Kendal or equivalent wire rope grease can be used.

Store the wire ropes in a dry outdoor or indoor environment.

5.16 Load Cell

Protect the load cells by a thin film of non aggressive oil.

Store the load cells in a dry indoor environment. Room temperature should not be below 37°F (3°C).

6 Preservation Maintenance Check Lists

The following checklists must be used to get a controlled storage of the equipment with proper maintenance.

6.1 Hydraulic Power Unit and Local Control Panel (Main Control Unit)

Preservation Maintenance Check List	**Sheet: 1 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-65390-03-00-00 or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film; repair if necessary	Non aggressive oil
8.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Motors, Distribution Boxes, Relay Boxes, Subswitchboards, Junction Boxes**					
1.0			X		Inspect protection on cable connections; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0		X			Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Power Unit and Local Control Panel (Main Control Unit)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check drain valves to be open	
6.0			X		Inspect fluid according to section 5.2.1 or 5.2.2	

6.2 Umbilical Reel with Umbilical

Preservation Maintenance Check List — **Sheet: 1 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
7.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List

Sheet: 2 of 3

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone spray, acid free Vaseline or equivalent
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Umbilical Reel with Umbilical**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C.	**Hydraulic Circuits**					
1.0			X		3/2-way panel valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way panel valves to be in open centred position; function lines to be pressureless	
3.0			X		Check all piping to be plugged	Plug and caps, made by plastic, stainless steel or coated carbon steel
4.0			X		Check all blind and sealing valves to be tight	
5.0			X		Check lines to be pressureless, drain valves to be open	
6.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.3 Electric Remote Control Panels

Preservation Maintenance Check List						**Sheet: 1 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A. General Inspection						
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, Vaseline or equivalent
4.0			X		Check pneumatic circuits to be depressurized (for purged system only)	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil

Preservation Maintenance Check List						**Sheet: 2 of 2**
Description of Equipment: **Electric Remote Control Panels**						
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
2.0	X			X	Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	Corrosion inhibitor pads
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.4 Pneumatic Remote Control Panels

Preservation Maintenance Check List — **Sheet: 1 of 1**

Description of Equipment: **Pneumatic Remote Control Panels**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on pneumatic hose connection, repair if necessary	Non aggressive protective shield with additional cover
4.0			X		Check pneumatic circuits to be depressurized	
5.0			X		Inspect unit and panels inside for corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
6.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
7.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield (Silicone spray), acid free Vaseline or equivalent; protective caps
8.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
9.0			X		Ensure that all hinges and fasteners are greased	Non aggressive grease like Silicone grease or equivalent
10.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
11.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

6.5 Hydraulic and Electrical Jumpers

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Hydraulic and Electrical Jumpers**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0	X				Check junction boxes and couplings for proper protection by covers, caps or plugs	
4.0			X		Check protection of the stainless steel parts with a thin oil film; repair if necessary	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield; acid free Vaseline or equivalent; protective caps
6.0			X		Check protection of electric cable against mechanical impact and ageing impact by sunlight	
7.0			X		Check that cable minimum bending radius is kept for storage	
8.0			X		Inspect fluid according to section 5.4.1 or 5.4.2	

6.6 Subsea Valve Package

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Valve Package**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
6.0			X		Check lines to be pressureless; drain valves to be open	
7.0			X		Inspect fluid according to section 5.8.1 or 5.8.2	

6.7 Subsea Control Module (direct / pilot hydraulic types)

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Subsea Control Module (not for CAMTROL SCM)**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
6.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
7.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
8.0			X		Check lines to be pressureless; drain valves to be open	
9.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
10.0			X		Inspect fluid according to section 5.9.1 or 5.9.2	

6.8 Hydraulic Flushing and Testing Unit

Preservation Maintenance Check List						**Sheet: 1 of 3**
Description of Equipment:	**Hydraulic Flushing and Testing Unit**					
Event No.	**Pres. Period (Weeks)**				**Event**	**Preservatives**
	6	**8**	**12**	**24**		
A.	**General Inspection**					
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Inspect protection on cable connection, respray if required	Non aggressive protective shield, ACID free Vaseline or equivalent
4.0			X		Check all hydraulic and pneumatic circuits to be depressurized	
5.0			X		Check oil level of air lubricator and refill if necessary	SHELL TELLUS T 15 or equivalent oil
6.0			X		Check protection of the stainless steel parts (panels, valves etc.) with a thin oil film	Non aggressive oil

Preservation Maintenance Check List	**Sheet: 2 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
B.	**Electrical Parts, Connectors, Distribution Boxes, Junction Boxes**					
1.0			X		Inspect protection on cable connections and multi pin connectors; protect if necessary	Non aggressive protective shield like Silicone Spray, acid free Vaseline or equivalent
2.0	X				Replace corrosion inhibitor pads where applicable after every opening of enclosures. For handling follow specific handling instructions	Corrosion inhibitor pads
				X	Replace corrosion inhibitor pads where applicable when not opened. For handling follow specific handling instructions	
3.0			X		Inspect inner unit for any corrosion, damage, moisture etc.; clean up carefully with dry cloth or vacuum cleaner	
4.0			X		Ensure that all hinges and fasteners are lubricated with grease	Non aggressive grease like Silicone grease or equivalent; Protective caps
5.0			X		Ensure that openings and glands are properly sealed	
6.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
7.0	X				Ensure that enclosure installed anticondensation heaters are in operation	
8.0			X		Inspect electrical contacts inside junction and control boxes for corrosion	
9.0			X		Inspect explosion proof enclosures (increased safety and flameproof enclosures) for corrosion at joints and windings. Follow specific enclosure maintenance procedure	Acid-free anti corrosion substances ESSO RUST BAN 397, MOBIL TECREX 39 or equivalent
10.0			X		Clean Acryl glass window panes on panels located in hazardous areas with wet cloth only due to electrostatic charge	Wet soft cloth

Preservation Maintenance Check List	**Sheet: 3 of 3**

Description of Equipment: **Hydraulic Flushing and Testing Unit**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
C. Hydraulic Circuits						
1.0			X		3/2-way valves to be in "CLOSE", "VENT" or equivalent position; function lines to be pressureless	
2.0			X		4/3-way valves to be in open centred position; function lines to be pressureless	
3.0			X		Check lines to be pressureless; drain valves to be open	
4.0			X		Inspect fluid according to section 5.10.1 or 5.10.2	

6.9 Running Tool for Subsea Module

Preservation Maintenance Check List	**Sheet: 1 of 1**

Description of Equipment: **Running Tool for Subsea Module**

Event No.	Pres. Period (Weeks)				Event	Preservatives
	6	8	12	24		
1.0				X	Check paintwork and rectify if required	X-065460-( )-( ) or other
2.0			X		Check all moving parts to be lubricated and lubricate if necessary	MOLYKOTE 3402 or equivalent
3.0			X		Check all hydraulic circuits to be depressurized	
4.0			X		Check protection of the stainless steel parts (valves etc.) with a thin oil film	Non aggressive oil
5.0			X		Add preservatives as required to unpainted sliding surfaces and static surfaces	X-27055-01 (SHELL Ensis Fluid) or equivalent
6.0			X		Check all piping and connectors to be plugged or covered	Plug and caps, made by plastic, stainless steel or coated carbon steel
7.0			X		Inspect fluid according to section 5.11	

7 CAMTROL Subsea Production Control Equipment

Note: Use the instructions in this section as check lists.

7.1 Subsea Control Module / SCM

Check on the bill of material if individual “Shipping, Transportation and Storage Guidelines” are available for the SCM, otherwise follow the instructions below:

Verify: _____

Store the SCM in the crate until it is required for use.

If it is necessary to gain access to the SCM, remove the top and sides of the crate, but leave the SCM on the shipping frame.

Visually inspect the SCM / packing before use and every **3 month** when it is not used.

Verify: _____

The storage environment must be free from harmful substances which can affect resilient seals (i.e. high Ozone level).

Verify: _____

The ambient temperature for storage must be within the range -10°C to 40°C to maintain the integrity of the pressure compensation system and ensure that no dielectric oil bleeds out.

Verify: _____

CAUTION:
If the loss of dielectric oil exceeds 3 Litre the SCM needs to be refilled in accordance to Cameron “Field refill procedure”. The lower reservoir of the shipping frame is seized to 3 Litre. If you are in doubt please contact Cameron Germany Engineering Department (Tel +49 (0)5141 8060).

7.2 Subsea Accumulator Module / SAM

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Any damage occurring during the periodical checks must immediately be reported and repaired by Cameron Controls.

Verify: _____

Drain the hydraulic pressure from the accumulators.

Verify: _____

Bleed nitrogen pre-charge from the accumulators. Leave 10 BAR residual pressure in the accumulator to prevent the bladder from collapsing.

Verify: _____

Close the two (2) Gas Valves on the HP Accumulators.

Verify: _____

Open ends of Accumulators must be sealed by plugs or protective caps off stainless steel on the gas side off the accumulators.

Verify: _____

Lubricate all moving parts, except the Hydraquad hydraulic connectors, by water-resistant grease.

Verify: _____

Painting, frame and moving parts must be checked for damage.

Verify: _____

Stainless Steel parts must be protected by a thin film of non aggressive oil (Pelox Protector or similar).

Verify: _____

7.3 Subsea Distribution Unit / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.3.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Set all valves to CLOSE position.

Verify: _____

Protect the mounting base of the SAM by a protective cover.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes

Verify: _____

7.3.2 Electrical Parts

Check that all ROV connectable fuses are installed.

Verify: _____

Check that all electrical connectors are protected by caps

Verify: _____

7.4 Umbilical Termination Assembly / UTA

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

7.4.1 Mechanical Parts

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Protect the hydraulic well receptacles by long term protective covers.

Verify: _____

Check condition of all protection anodes.

Verify: _____

7.4.2 Electrical Parts

Check that all electrical connectors are protected by caps.

Verify: _____

7.5 Foundation Base & Mud Mate for UTA / SDU

Checks have to be repeated every **3 month** if the equipment is onshore or offshore.

Equipment has to be secured on deck.

Verify: _____

Paint work must be checked and rectified according to customer or to BOM (bill of material) specified coating procedures.

Verify: _____

Check that all tags are available and fixed according to assembly drawings.

Verify: _____

All moving parts are to be lubricated with water resistant grease.

Verify: _____

Stainless steel parts must be protected by a thin film of non aggressive oil.

Verify: _____

All connection points (screws, welding etc.) are to be checked visually and rectified if necessary.

Verify: _____

Foundation Base only: Verify the proper operation of the two (2) pile locks and confirm that they are in the unlocked position.

Verify: _____

Check the SDU locking mechanism by operating.

Verify: _____

Check the guide post locking mechanism by operating.

Verify: _____

Inspect all lift shackles for deformation and other damage.

Verify: _____

Check condition of all protection anodes.

Verify: _____

8 Handling Requirements for Special Materials

8.1 Rubber Goods

GENERAL

There is very little published information on the storage and care of rubber goods as used in the oil field. When we speak of rubber goods we include the synthetic packings of Nitrile Copolymers and Neoprene as well as natural rubber parts. Natural rubber parts have become relatively rare but the same things that are harmful to natural rubber are also harmful to the synthetics in varying degrees.

Generally speaking, light and air are bad for rubber goods. The exact chemical action is not fully understood and what has been written disagrees on the mechanism involved.

Ozone is known to be bad for rubber goods. Ozone (O_3) is a very active form of oxygen. As far as we know two principle sources contribute the ozone that reaches rubber goods. One is atmospheric ozone which is generated in the stratosphere carried downward by convection currents and eventually absorbed by organic matter. The other source is electrical discharges, such as lightning, high voltage corona, but more commonly, electrical machinery. Ozone attack is characterized by fairly deep cracks in the rubber parts.

Rubber is attacked by ordinary oxygen (O_2) much as steel rusts in the presence of oxygen. Oxidation is characterized by a hard skin which eventually crazes in a multitude of small cracks and may turn chalky or assume a bark-like appearance.

A strong direct light, especially sunlight, has deleterious effects on rubber goods. This is attributed to the ultraviolet content of the spectrum which accelerates cracking. Whatever the mechanism however, light, particularly sunlight, is undesirable. In extremely cold climates some rubber goods will become so brittle that upon dropping or rough handling they will shatter.

In very warm humid climates, particularly those found in some parts of the tropics, fungi and bacteria find their way to the rubber goods and attack the organic content. This is especially true on duck reinforced rubber parts. However, parts reinforced with synthetics will not be attacked in the reinforcement.

Heat also has a bad effect on rubber. This could be the result of sunlight or artificial or accidental heating of any type. Heat results in a gradual hardening of the part and if ozone or oxygen are present, will accelerate their action.

Any stretching or bending of rubber in storage will result in very accelerated ageing. By the term ageing, we mean the cumulative effects of all the above mentioned attacking agents over a period of time. Ozone attacks rubber preferentially at points of strain.

Rubber goods, both natural and synthetic, all possess some degree of susceptibility to various solvents including water, but especially the liquid hydro-carbons. These manifest themselves in various ways by either swell or shrinkage of the rubber goods with which they are in contact.

No precise figure can be given as a "storage life" of a part. This is dependent on all of the above conditions and also the size of the part, its material and function. Generally speaking, the greater the relative surface area is to the volume, the more susceptible a part is to being rendered useless by ageing. For example, a relatively bulky part such as a ram front packer might be expected to have a much longer useful shelf life than a thin large diameter o-ring type of seal such as used on the bonnet seals of preventers or the rings in 'X' bushing.

STORAGE

From the preceding section we can draw a few rules governing storage of rubber goods. Briefly put - a cool, dry, dark storage place would be the best. The ideal would be to store the packings in vacuum sealed containers. The following rules, however, should not be difficult to follow under the average storage conditions experienced throughout our operation.

- Keep the rubber storage area as dark as possible. Certainly not out of doors, and, if indoors, away from skylights or windows and with subdued or indirect artificial lighting.
- Select the coolest location possible and be sure that no heaters or stoves are near by and particularly that the direct blast from a space heater does not blow on the rubber parts.
- Be sure that no electrical machinery (motors, switch gear, or any high voltage equipment producing corona) is near the rubber goods and that drafts will not carry the atmosphere from electrical machinery to the area in which the rubber goods are stored.
- The practice of first in - first out is essential with rubber goods. There is a natural tendency to remove parts from the front of a bin and when stock is replenished to leave the parts that are in the back in place, in which case years might pass before these are finally pulled out for use.
- Store rubber goods in a relaxed position. For example, do NOT hang o-rings on nails. Where possible, do not keep assemblies in stock where the rubber goods are stretched in order to assemble them on the part. For example, o-rings on blanking plugs, tubing hangers and 'X' bushing. In some cases this is difficult as it is with the aforementioned 'X' bushings. On these, periodic inspection should be employed to detect any signs of ageing as quickly as possible.

  On parts, such as the 'X' bushing rings, where we know the rubber parts will be stretched in storage, the best age resistant compounds we can buy are used.
- Keep storage as dry as possible and remove any oil, gas, etc. of hydro-carbon nature that may accidentally get on the rubber.
- Do not store the rubber goods on top shelves near galvanized roofs. There are several reasons for this; one is that heat is passed through galvanized roofing and also there is some opinion that ozone may be generated in this area.
- If possible, store rubber goods in buildings of wooden construction and wooden shelves. Wood is believed to scavenger ozone quite effectively.
- If store for extended periods is unavoidable, sealed containers will aid considerably; impervious surface coverings such as "Sea-Peel" or waxing will help.

USABILITY CHECKS

No general rule can be drawn regarding usability. The final measure is whether or not the cumulative effects of ageing have affected the physical properties of the part to such an extent that it will no longer perform the function for which it is designed. Thus, a large heavy part might suffer the same total amount of ageing as a small, light, thin piece, and still be usable whereas the small part is rendered useless. In these cases some judgement must be used in deciding usability.

Prior to shipment or use out of stock, rubber goods should be examined to see that no "chalking" or "barking" (bark-like surface appearance) is present, that there is not a hard skin on the rubber and that there are no cracks. Sometimes cracks will be obvious, but it is wise to stretch or bend the part in question so that any incipient cracks or very thin cracks will reveal themselves. Where a part is suspect, a check of hardness should be run. In the event that the hardness runs 15 points higher than the nominal hardness of the part, it is considered non-usable. Hardness is affected by temperature and readings should be taken with the rubber part at 70°F – 100°F (21°C - 38°C).

8.2 Hydraulic Hoses

STORAGE

- Before placing hose in storage, it should be completely drained.
- Whenever feasible, store the hose in the original wooden shipping crate. This will provide some protection against the deteriorating effects of solvents, corrosive liquids, ozone and sunlight. Hose should be stored so that the coils are in a horizontal plane.
- Certain rodents and insects will damage the hose. Adequate protection from them should be provided.
- The ideal temperature for storing the hose ranges from 50°F (10°C) to 70°F (21°C) with a maximum limit of 100°F (38°C). If stored below 32°F (0°C), the hose will become stiff and would require warming before placed in service. The hose should not be stored near sources of heat, such as radiators, base heaters, etc., nor should the hose be stored under conditions of high or low humidity.
- To avoid the adverse effects of high ozone concentration, the hose should not be stored near electrical equipment that may generate ozone or be stored for any lengthy period in geographical areas of known high ozone concentration. Exposure to direct or reflected sunlight - even through windows - should also be avoided.

HANDLING

CAUTION: Care should be exercised to prevent mishandling. Crushing or kinking of the hose can cause severe damage to the reinforcement. If this occurs, remove hose from service.

- In order to minimize the danger of kinking, the hose preferably should be removed from its crate by hand, laid out in a straight line, then lifted by means of a catline attached near one end of the hose. If a catline is used to remove the hose from its crate, the crate should be rotated as the hose is removed. Recommended practice is to protect the hose in some manner when moving to a new location. It is considered bad practice to handle the hose with a winch, to hand the hose from a truck gin pole, or to place heavy pieces of equipment on the hose.

8.3 Electronic Goods and Tools containing Electronics

8.3.1 General Instructions

Rapid temperature changes must be excluded to avoid condensation of humidity and mechanical stress.

The packing should protect electronic goods against:

- Dust
- Humidity
- Electrostatic Charge
- Shock
- Direct Sunlight

Generally the original transport packing serves the above requirements best.

Normally antistatic bags, desiccant and anti-shock pads are applied to prevent damage.

Electronic goods should be stored in a warehouse secured against theft.

8.3.2 Fiberoptic Terminations

Optic Link Modules (OLM) should be capped. Caps have to be removed before installation.

8.3.3 Handling Procedure for CMOS Devices

Electrical environments such as overvoltages and electrostatic discharges damage CMOS devices and printed circuit cards containing the devices. Most CMOS devices have diode input protection circuits and gate protection structures to protect against such electrical environments.

In addition to the internal protection network, use the following steps to prevent the generation of severe electrical transient voltages during handling of CMOS devices.

- Read the manufacturer's equipment specification and data sheets before performing maintenance. Do not exceed recommended maximum voltage levels.
- Use grounding wrist straps which contact the skin.
- Ground all work surfaces.
- If lead-straightening or hand-soldering is necessary, provide ground straps for the equipment, and ground the soldering ties.
- Connect all unused inputs to an appropriate logic voltage level, either power or ground.
- Inspect test equipment for proper polarity of voltage before conduction parametric or functional testing.
- Inspect all power supplies used for testing to ensure there are no voltage transients present.
- Do not insert or remove devices from test sockets with power applied.
- Do not contact edge connectors which are wired directly to device inputs.
- If external connections to a printed circuit card address only an input of the integrated circuit, use a resistance of 10 K ohms or greater in series with the input. The resistance limits damage to the card if it is removed and contacts static generating materials.
- Connect all low impedance equipment such as pulse generators to inputs only after the device has power applied. Disconnect the equipment before power is removed.
- Do not allow nylon or other static generating materials to contact the devices.
- Store or transport the devices in materials that are antistatic. Do not insert the devices into plastic packing material, styrofoam, or plastic trays.

8.3.4 Lithium Manganese Dioxide Battery

Replacement of the Lithium Manganese Dioxide battery mounted in the subsea transmitter & battery module: The battery supports the AMF-System (Automatic Mode Function / Dead Man System) belonging to multiplex drilling control systems. Under normal operation conditions replacement is required **after each one-year period**. Battery storage conditions should be in a range of 23°F – 59°F (–5°C to 15°C).

9 Attachment

- Data Sheets of Protective Materials (if required)
- Data Sheets of Hydraulic Fluids (if required)

STATUS: Released REVISION : 02
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : K5F TREE COUPLING SET

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Components/Stock item								
1	0001	02	2197024-01-04	2.000	EA	3/8" Coupler, male, 690 bar, Key2 with poppet, 3/8" tube end (300mm) Diver mate-able	x1 test I + x1 SCSSV	
10	0010	02	2197024-90	2.000	EA	CAP FOR 3/8" COUPLER, 316 SST KEYING: NO, COLOUR: NA MFG NO: AS006002 SUPPLIER: MSCM PROTECTION CAP: TBA	x1KHI + x1CI	
11	0011	01	2197024-90-04	1.000	EA	CAP FOR 3/4" COUPLER, 316 SST KEYING: NO, COLOUR: NA, MFG NO: TBA SUPPLIER: MSCM	x1 MeOH	
12	0012	02	2197024-01-06	2.000	EA	3/8" PROTECTIVE CAP, FEMALE, NO KEY, 690 BAR WP, SST, DIVER MATE-ABLE, MANUFACTURER: WALTHER FOR PROTECTION OF: 3/8" COUPLER, MALE, 690 BAR, KEY:1+2, DIVER MATE-ABLE, CAMERON PN 2197024-01-03/-04	1x test I + 1xSCSSV	
2	0002	03	2197024-53-07	1.000	EA	3/8" COUPLER, MALE HALF, 690 BAR WP (10KSI), WITH POPPET, 316 SST, END CONNECTION: TUBE STUD WITH 300MM LONG TUBE SUPER DUPLEX, 3/4" OD x 0.083" WT, FLUIDS: WATERBASED FLUIDS (e.g. CASTROL TRANSAQUA HT) METHANOL, CORROSION INHIBITOR, KINECTIC HYDRATE INHIBITOR AND SEAWATER KEYING: 108°, COLOUR: BLACK, MFG NO: TBA, SUPPLIER: MSCM, PROTECTION CAP: TBA,	x1 CI	

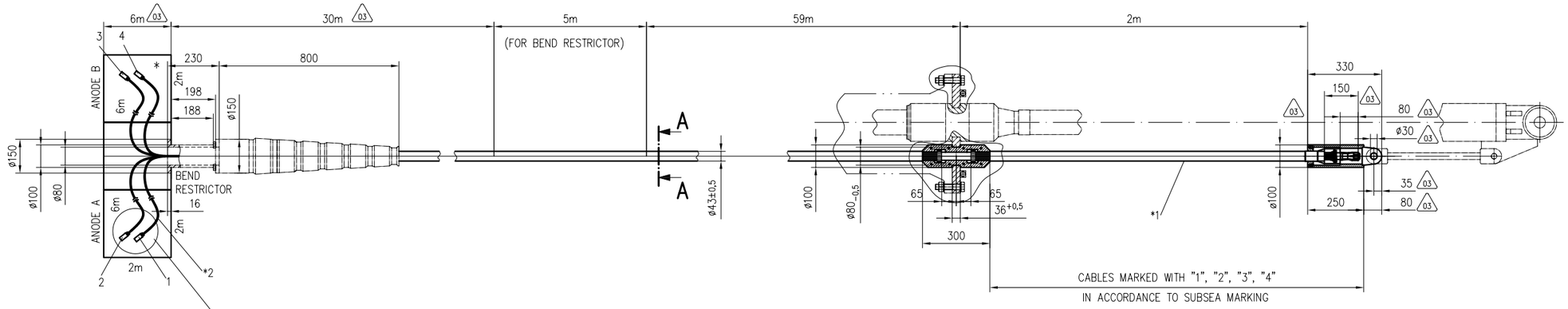
SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
						FEMALE HALF: CAMERON PN 2197024-52-04		
3	0003	03	2197024-53-08	1.000	EA	3/8" COUPLER, MALE HALF, 690 BAR WP (10KSI), WITH POPPET, 316 SST, END CONNECTION: TUBE STUD WITH 300MM LONG TUBE SUPER DUPLEX, 3/4" OD x 0.083" WT, FLUIDS: WATERBASED FLUIDS (e.g. CASTROL TRANSAQUA HT) METHANOL, CORROSION INHIBITOR, KINECTIC HYDRATE INHIBITOR AND SEAWATER KEYING: 144°, COLOUR: WHITE, MFG NO: TBA, SUPPLIER: MSCM, PROTECTION CAP: TBA, FEMALE HALF: CAMERON PN 2197024-52-05	x1 KHI	
4	0004	03	2197024-57-02	1.000	EA	3/4" COUPLER, MALE HALF, 517 BAR WP (7.5KSI), WITH POPPET, 316 SST, END CONNECTION: TUBE STUD WITH 300MM LONG TUBE IN SUPER DUPLEX, 3/4" OD x 0.083" WT, FLUIDS: WATERBASED FLUIDS (e.g. CASTROL TRANSAQUA HT) METHANOL, CORROSION INHIBITOR, KINECTIC HYDRATE INHIBITOR AND SEAWATER KEYING: 162°, COLOUR: VIOLET, MFG NO: AS036508, SUPPLIER: MSCM, PROTECTION CAP: PLASTIC FEMALE HALF: CAMERON PN 2197024-56-01	x1 MeOH	
>>>B/M Category : Engrg Spec/Document item								
900	0900	01	QP-000160-01-17	1.000	EA	QP for Controls Part lists		

COOPER CAMERON CORPORATION HOUSTON, TEXAS
ENGINEERING BILL OF MATERIAL

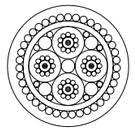
ENTRY NUMBER : 2197406-02

STATUS: Released REVISION : 03
DATE PRINTED : 09/02/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Anode Umbilical for DC-Sys. K5

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
010	0010	03	X-076700-21-01	1.000	EA	DS: Anode Umbilical Design Specification for DC-System, Project Total K5		
900	0900	03	SK-066406-02	1.000	EA	AS: Anode Umbilical Assembly		
905	0905	01	X-065438-05-01	1.000	EA	Anode Umbilical Installation Requirements For DC-System Project Total K5-F		
910	0910	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
920	0920	02	X-076715-22	1.000	EA	SRT Procedure for Cam Supplied Equipment Site Received Test Procedure for Visual Inspection and Verification of Completeness of Cameron Supplied Equipment General		



A–A



CROSS SECTION 03
130231

B–B

CROSS SECTION 03
130232

*1

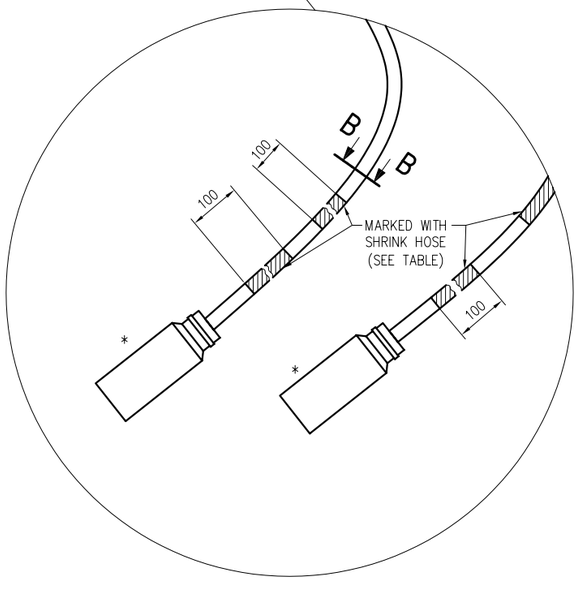
OUTER DIAMETER :	43 MM ± 0,5
WEIGHT IN AIR :	3700 KG/KM
WEIGHT IN SEAWATER :	2300 KG/KM
MIN. BREAKING STRAIN :	409 KN
STATIC BEND RADIUS :	450 M
RECOMMENDED BENDING RADIUS :	900 MM
FULL SLIP BENDING STIFFNESS :	60 Nm²
FULL FRICTION BENDING STIFFNESS :	7000 Nm²

03 03 03

*2

OUTER DIAMETER :	11,5 MM
WEIGHT IN AIR :	290 KG/KM
WEIGHT IN SEAWATER :	180 KG/KM
MIN. BREAKING STRAIN :	49 KN
STATIC BEND RADIUS :	180 MM
RECOMMENDED BENDING RADIUS :	250 MM

03 03 03 03



ANODE	SHRINK HOSE COLORS	CABLE NO.
ANODE A; TREE 1	BLUE/ GREEN–YELLOW	1
ANODE A; TREE 2	BLUE/ RED	2
ANODE B; TREE 1	YELLOW/ GREEN–YELLOW	3
ANODE B; TREE 2	YELLOW/ RED	4

03

* GISMA TYPE: 10/1/1/FEMALE (SPECIAL DESIGN)
ORDERING NO'S: 10.06.1.01.0.00. LV 631 & 10.90.10.xx.0 LV 632

KEY PLAN/LEGEND:

NOTES/HOLDS:

REVISION DESCRIPTIONS:

APPROVED FOR CONSTRUCTION	20JUL07	01
ISSUED FOR CLIENT COMMENT	25APR07	N/A
ISSUED FOR INTERNAL IDC	18APR07	N/A
REASON FOR ISSUE	DATE	CLIENT REV.

Total Exploration & Production Netherlands K5F Project

CLIENT CONTRACT NUMBER:
4600000416

CLIENT DOCUMENT NUMBER:
54NL92–W–03–542

CAD

REV. BY: T. Hein
DATE: 20.07.2007
REV.: 03

SURFACE TREATMENT: DO NOT SCALE

TOLERANCES ACCORDING TO DIN ISO 8015
GRAPHIC SYMBOLS UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 1219
TOLERANCES UNLESS OTHERWISE SPECIFIED ACCORDING TO DIN ISO 2768 m/K

MATERIAL AND HEAT TREATMENT

DRAWN: C. Schulze DATE: 18.04.2007
CHECKED: R. Gabel DATE: 20.07.2007
APPROVED: J. Dannehl DATE: 20.07.2007

EST. WEIGHT: .000 KG | SUPERSEDES: | SCALE: N/A

CAMERON GmbH
Lückenweg 1
29227 Celle, Germany

ANODE UMBILICAL ASSEMBLY DRAWING

INITIAL USE BOM: 223406-02
SHEET: 1 OF 1
DRAWING NUMBER: SK-066406-02

STATUS: APPROVED

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Long Term Protec. Cover 10/1/1/female

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	02	X-076700-17-07	1.000	EA	DS: SS LTC GISMA Series 10/1/1/female Long Term Protective Cover		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Long Term Protec. Cover 10/2/7/male

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	02	X-076700-17-08	1.000	EA	DS: SS LTC GISMA Series 10/2/7/male Long Term Protective Cover		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Gisma Coax LTC, female
Pressure watertight Longterm Protective
Cap
for Receptacle (e.g.2197088-17-10)

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	02	X-076700-17-11	1.000	EA	DS: Gisma LTC Series 80/4 Coax, f Subsea Long Term Protectiv Cap (Plug) Series 80/4, female with Diver Handle		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Gisma Sealing Cap Size 4 for 10/4/12
Receptacle
Longterm Protective Cover

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	02	X-076700-17-20	1.000	EA	DS: SS SealingCap for 10/4/12 Receptacle Longterm Protective Cover		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Gisma Sealing Cap Size 4 for 10/4/12
Plug
Longterm Protective Cover

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-17-21	1.000	EA	DS: SS SealingCap for 10/4/12 Plug Longterm Protective Cover		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Long Term Protec. Cover 10/4/19/male

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	02	X-076700-17-22	1.000	EA	DS: SS LTC GISMA Series 10/4/19/male Long Term Protective Cover		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Long Term Protec. Cover 10/1/1/male

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	02	X-076700-17-24	1.000	EA	DS: SS LTC GISMA Series 10/1/1/male Long Term Protective Cover		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Long Term Protec.Cover 80/3/12/female

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-17-25	1.000	EA	DS: SS LTC GISMA Series 80/3/12/female Long Term Protective Cover		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Long Term Protec. Cover 80/1/1/female

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-17-26	1.000	EA	DS: SS LTC GISMA Series 80/1/4/female Long Term Protective Cover		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

COOPER CAMERON CORPORATION HOUSTON, TEXAS
ENGINEERING BILL OF MATERIAL

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to J-Box Type 1,blue,2400mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-13	1.000	EA	DS:SS Jumper eSCM to J.Box Type 1		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
969	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

COOPER CAMERON CORPORATION HOUSTON, TEXAS
ENGINEERING BILL OF MATERIAL

ENTRY NUMBER : 2197089-13-20

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to J-Box Type 1,blue,5700mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-13	1.000	EA	DS:SS Jumper eSCM to J.Box Type 1		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to J-Box Type 1,blue,6300mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-13	1.000	EA	DS:SS Jumper eSCM to J.Box Type 1		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to J-Box Type 1,yell,4200mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-13	1.000	EA	DS:SS Jumper eSCM to J.Box Type 1		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to J-Box Type 1,yell,5100mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-13	1.000	EA	DS:SS Jumper eSCM to J.Box Type 1		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

COOPER CAMERON CORPORATION HOUSTON, TEXAS
ENGINEERING BILL OF MATERIAL

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to J-Box Type 1,yell,5500mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-13	1.000	EA	DS:SS Jumper eSCM to J.Box Type 1		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,blue,2500mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,blue,3300mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,blue,3600mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

COOPER CAMERON CORPORATION HOUSTON, TEXAS
ENGINEERING BILL OF MATERIAL

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,blue,4200mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,blue,4400mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,blue,4700mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,blue,5600mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,blue,6900mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,yell,3400mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,yell,3500mmCM

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,yell,4100mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,yell,4900mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,yell,5100mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,yell,5200mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,yell,6500mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper eSCM to Act. Type 2,yell,7500mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-14	1.000	EA	DS:SS Jumper eSCM to Actuator Type 2		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jmpr. PRCM to Intrm.C. Type 5,blue, 6,0m

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-17	1.000	EA	DS:SS Jumper PRCM to Interm. Conn Type 5		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jmpr. PRCM to Intrm.C.Type 5,blue, 12,0m

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-17	1.000	EA	DS:SS Jumper PRCM to Interm. Conn Type 5		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jmpr. PRCM to Intrm.C.Type 5,yell, 6,0m

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-17	1.000	EA	DS:SS Jumper PRCM to Interm. Conn Type 5		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jmpr. PRCM to Intrm.C.Type 5,yell, 10,0m

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-17	1.000	EA	DS:SS Jumper PRCM to Interm. Conn Type 5		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper UTA to PRCM Type 6, blue, 10,0m

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-18	1.000	EA	DS:SS Jumper UTA to PRCM Type 6		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

COOPER CAMERON CORPORATION HOUSTON, TEXAS

ENTRY NUMBER : 2197089-18-20

ENGINEERING BILL OF MATERIAL

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper UTA to PRCM Type 6, blue, 10,5m

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-18	1.000	EA	DS:SS Jumper UTA to PRCM Type 6		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper UTA to PRCM Type 6, yell, 8,0m

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-18	1.000	EA	DS:SS Jumper UTA to PRCM Type 6		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper UTA to PRCM Type 6, yell, 12,5m

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-18	1.000	EA	DS:SS Jumper UTA to PRCM Type 6		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

COOPER CAMERON CORPORATION HOUSTON, TEXAS

ENTRY NUMBER : 2197089-19-09

ENGINEERING BILL OF MATERIAL

STATUS: Released REVISION : 01

DATE PRINTED : 04/29/2008 SUPERCEDES :

DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE

DESCRIPTION : SS Jumper J.-Box to DHPT Sensor Type 7
Gisma BR 10/2/7 90° to Tronic 4-way
Connector
Lenght: 4500 mm; Colour Marking: -

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	04	X-076700-19-19	1.000	EA	DS:SS Jumper J.Box to DHPT Type 7		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

COOPER CAMERON CORPORATION HOUSTON, TEXAS

ENTRY NUMBER : 2197089-20-03

ENGINEERING BILL OF MATERIAL

STATUS: Released REVISION : 01

DATE PRINTED : 04/29/2008 SUPERCEDES :

DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE

DESCRIPTION : SS Jumper J.Box to Sensor Type 8
Lenght: 2000 mm; Colour Marking: Blue

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	06	X-076700-19-20	1.000	EA	DS:SS Jumper J.Box to Sensor Type 8		
920	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Jumper J.Box to Sensor Type 8
Lenght: 3000 mm; Colour Marking: Blue

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	06	X-076700-19-20	1.000	EA	DS:SS Jumper J.Box to Sensor Type 8		
920	0950	02	QP-00016Q-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Jumper J.Box to Sensor Type 8
Lenght: 4400 mm; Colour Marking: Blue

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	06	X-076700-19-20	1.000	EA	DS:SS Jumper J.Box to Sensor Type 8		
920	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Jumper J.Box to Sensor Type 8
Lenght: 4500 mm; Colour Marking: Blue

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	06	X-076700-19-20	1.000	EA	DS:SS Jumper J.Box to Sensor Type 8		
920	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Jumper J.Box to Sensor Type 8
Lenght: 4800 mm; Colour Marking: Blue

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	06	X-076700-19-20	1.000	EA	DS:SS Jumper J.Box to Sensor Type 8		
920	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Jumper J.Box to Sensor Type 8
Lenght: 6000 mm; Colour Marking: Blue

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	06	X-076700-19-20	1.000	EA	DS:SS Jumper J.Box to Sensor Type 8		
920	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Jumper J.Box to Sensor Type 8
Lenght: 6300 mm; Colour Marking: Blue

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	06	X-076700-19-20	1.000	EA	DS:SS Jumper J.Box to Sensor Type 8		
920	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		

COOPER CAMERON CORPORATION HOUSTON, TEXAS
ENGINEERING BILL OF MATERIAL

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Jumper J.Box to Sensor Type 8
Lenght: 2000 mm; Colour Marking: Yellow

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	06	X-076700-19-20	1.000	EA	DS:SS Jumper J.Box to Sensor Type 8		
920	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Jumper J.Box to Sensor Type 8
Lenght: 2500 mm; Colour Marking: Yellow

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	06	X-076700-19-20	1.000	EA	DS:SS Jumper J.Box to Sensor Type 8		
920	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Jumper J.Box to Sensor Type 8
Lenght: 4200 mm; Colour Marking: Yellow

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	06	X-076700-19-20	1.000	EA	DS:SS Jumper J.Box to Sensor Type 8		
920	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Jumper J.Box to Sensor Type 8
Lenght: 4400 mm; Colour Marking: Yellow

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	06	X-076700-19-20	1.000	EA	DS:SS Jumper J.Box to Sensor Type 8		
920	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Jumper J.Box to Sensor Type 8
Lenght: 4500 mm; Colour Marking: Yellow

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	06	X-076700-19-20	1.000	EA	DS:SS Jumper J.Box to Sensor Type 8		
920	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Jumper J.Box to Sensor Type 8
Lenght: 4900 mm; Colour Marking: Yellow

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	06	X-076700-19-20	1.000	EA	DS:SS Jumper J.Box to Sensor Type 8		
920	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Jumper J.Box to Sensor Type 8
Lenght: 6300 mm; Colour Marking: Yellow

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	06	X-076700-19-20	1.000	EA	DS:SS Jumper J.Box to Sensor Type 8		
920	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper Interm.to eSCM Type 9,blue,3700mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	04	X-076700-19-21	1.000	EA	DS:SS Jumper Interm. Conn to eSCM Type 9		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper Interm.to eSCM Type 9,yell,1600mm

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	04	X-076700-19-21	1.000	EA	DS:SS Jumper Interm. Conn to eSCM Type 9		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Interm. Jumper to Act. Type 11
Subsea Jumper between Diver Panel
(10/4/19 bulkhead)
and Valve/Actuator(10/4/19, 90°)
Lenght: 3500 mm; Colour Marking: Blue

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	05	X-076700-19-35	1.000	EA	DS:SS Jumper Type 11 (BOM 2197089-23)		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Interm. Jumper to Act. Type 11
Subsea Jumper between Diver Panel
(10/4/19 bulkhead)
and Valve/Actuator(10/4/19, 90°)
Lenght: 4000 mm; Colour Marking: Blue

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	05	X-076700-19-35	1.000	EA	DS:SS Jumper Type 11 (BOM 2197089-23)		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 01
DATE PRINTED : 04/29/2008 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : SS Interm. Jumper to Act. Type 11
Subsea Jumper between Diver Panel
(10/4/19 bulkhead)
and Valve/Actuator(10/4/19, 90°)
Lenght: 4000 mm; Colour Marking: Yellow

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	05	X-076700-19-35	1.000	EA	DS:SS Jumper Type 11 (BOM 2197089-23)		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision controlled!		

STATUS: Released REVISION : 02
DATE PRINTED : 04/09/2009 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper PRCM to Cath. Type 12, blue, 9,0m

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-36	1.000	EA	DS:SS Jumper PRCM to SS Cathode Type 12 (BOM 2197089-24)		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
1000	1000	01	2197089-50	1.000	EA	Jumper PRCM-Cath. Type 12 Modified, 9,0m Subsea Jumper from PRCM to the individual Cathodes	Replacement for P/N 2197089-24-17 for TOTAL K5-F Project due to missing seal at annodes ands cathodes	
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision		

SORT ITEM INDI No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
					controlled!		

STATUS: Released REVISION : 02
DATE PRINTED : 04/09/2009 SUPERCEDES :
DESIGN RESPONSIBILITY : 037 CONTROLS ENGRG - CELLE
DESCRIPTION : Jumper PRCM to Cath. Type 12, yell, 9,0m

SORT INDI	ITEM No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
>>>B/M Category : Engrg Spec/Document item								
910	0910	03	X-076700-19-36	1.000	EA	DS:SS Jumper PRCM to SS Cathode Type 12 (BOM 2197089-24)		
950	0950	02	QP-000160-03-01	1.000	EA	QP Electrical Equipment + CE		
>>>B/M Category : Optional item								
1000	1000	01	2197089-50	1.000	EA	Jumper PRCM-Cath. Type 12 Modified, 9,0m Subsea Jumper from PRCM to the individual Cathodes	Replacement for P/N 2197089-24-67 for TOTAL K5-F Project due to missing seal at annodes ands cathodes	
970	0970		619011-86	1.000	EA	GISMA-FETT EK2 FOR ISOLATING BODY AND O-RINGS. FORM: PASTE. NOT SOLUBLE. DENSITY AT 20°C: 0.833 g/ml. VOLUME: 45 g		
980	0980		619011-87	1.000	EA	FLUSHING SOLUTION FOR CLEANING FROM ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, COLORLESS. DENSITY AT 20°C: 0.973 g/ml. PH-VALUE: 4-5. SOLUBLE IN WATER. ONLY FOR USE WITH FOAM CLEANER PN 619011-88.		
990	0990		619011-88	1.000	EA	FOAM CLEANER FOR ELECTRICAL CONNECTOR. FORM: AEROSOL, LIQUID, GREEN. DENSITY AT 20°C: 0.99 - 1.10 g/ml. PH-VALUE: 11-13. MISCIBLE IN WATER. SUITABLE FOR USE WITH FLUSHING SOLUTION PN 619011-87.		
>>>B/M Category : Reference Call Outs								
960	0960	03	X-065467-02-19	1.000	EA	IP:Installation Procedures Gisma Jumpers Gisma Installation Procedure Numbers: MV 2000-030 & MV 2005-011 In SAP not revision		

SORT ITEM INDI No.	REV LVL	COMPONENT NUMBER	QTY	UNIT	DESCRIPTION	GENERAL NOTES	SPARE PART
					controlled!		

REVISION RECORD

PUBLICATION: TPG Ref. No. E400 / 2008 (54NL92-W0T-547)
Subsea Production System – TOTAL K5F Field Development
INSTALLATION, OPERATION & MAINTENANCE MANUAL

Revision	Date	Section	Description
01	November 2008		Initial Release
02	May 2009	All volumes, behind cover page*	Add revision record Replace page "All the information…"
		Volume 1 / Section 1 Total System: Description, Installation, Operation & Maintenance*	Replace procedure X-076721-87 (54NL92-W-0S-502) Rev. 01 (1) with 02 (2)
		Volume 1 / Section 1 Total System: Parts Lists & Dwgs.*	Replace drawing SK-066001-88-04 (54NL92-W-03-530) Rev. 03 (3) with 04(4)
		Volume 1 / Section 2 Hydraulic Power Unit: Description, Installation, Operation & Maintenance*	Replace table of content page Insert procedure X-065438-02-74 (54NL92-W-0P-542) Rev. 01 (1) Insert procedure X-065438-02-75 (54NL92-W-0P-543) Rev. 01 (1) Insert procedure X-065457-07 (54NL92-W-7P-503) Rev. 01 (1)
		Volume 1 / Section 2 Hydraulic Power Unit: Parts Lists & Dwgs.*	Replace table of content page Replace parts list 223011-32 Rev. 02 with 03 Insert parts list 223011-32-00-97 Rev. 02 Insert document X-076704-02-05 Rev. 02 Replace drawing SK-066011-32-01 (54NL92-W-31-504) Rev. 01 (3) with 02 (4) Insert drawing SK-066011-32-42 (54NL92-W-31-501) Rev. 03 (3) Replace drawing SK-066022-33-04 (54NL92-W-71-500) Rev. 02 (2) with 03 (3) Insert drawing SK-066022-33-42 (54NL92-W-71-501) Rev. 01 (1)

*Documents to be inserted in existing binders by rig book owners.

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Revision	Date	Section	Description
02	May 2009	Volume 1 / Section 3 Master Control Station: Description, Installation, Operation & Maintenance*	Replace table of content page Replace procedure X-065438-02-71 (54NL92-W-0P-539) Rev. 01 (1) with 02 (2) Insert procedure X-065438-02-70 (54NL92-W-0P-538) Rev. 01 (1) Insert procedure X-076738-17 Rev. 01 (1)
		Volume 1 / Section 3 Master Control Station: Parts Lists & Dwgs.*	Replace table of content page Replace drawing SK-066380-25-04 (54NL92-W-61-501) Rev. 03 (2) with 04 (3) Insert drawing SK-066380-25-42 (54NL92-W-01-002) Rev. 01 (1)
		Volume 2 / Section 3 Tree Mounted Equipment: Description, Installation, Operation & Maintenance*	Replace table of content page Insert procedure X-065467-02-87 (54NL92-W-0P-586) Rev. 02 (2)
		Volume 2 / Section 6 Miscellaneous Equipment: Parts Lists & Dwgs.*	Replace parts list 2197089-24-17 Rev. 01 with 02 Replace parts list 2197089-24-67 Rev. 01 with 02
03	July 2009	All volumes, behind cover page*	Replace revision record Replace page “All the information…”
		Volume 1 / Section 1 Total System: Parts Lists & Dwgs.*	Replace drawing SK-066001-88-04 (54NL92-W-03-530) Rev. 04 (4) with 05 (5)
		Volume 1 / Section 3 Master Control Station: Parts Lists & Dwgs.*	Replace drawing SK-066380-25-04 (54NL92-W-61-501) Rev. 04 (3) with 05 (4)
		Volume 1 / Section 4 Electrical Power & Communication Unit: Parts Lists & Dwgs.*	Replace drawing SK-066022-31-42 (54NL92-W-01-501) Rev. 03 (2) with 04 (3)
		Volume 2 / Section 3 Tree Mounted Equipment: Description, Installation, Operation & Maintenance*	Replace table of content page Insert procedure 713205 Rev. 02 ("Gas Production Choke Assembly – Maintenance & Repair Manual"; Cameron Ireland)

*Documents to be inserted in existing binders by rig book owners.