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| | JOB: | | |
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| DP&T-SRGE | TITLE: HYDRAULIC POWER UNIT (HPU) FOR TOPSIDES VALVES | NP-1 ESUP | |

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INDEX OF REVISIONS

| REV. | DESCRIPTION AND/OR REVISED SHEETS |
|------|-----------------------------------|
| 0 | ORIGINAL ISSUE (FOR BID) |

PRELIMINARY

| | REV. 0 | REV. A | REV. B | REV. C | REV. D | REV. E | REV. F | REV. G | REV. H |
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AREA:

SHEET 2 of 16


TITLE: **HYDRAULIC POWER UNIT (HPU) FOR TOPSIDES VALVES**

NP-1

ESUP

SUMMARY

| | | |
|-----------|--|-----------|
| 1 | INTRODUCTION..... | 3 |
| 1.1 | Object | 3 |
| 1.2 | Definitions | 3 |
| 1.3 | Abbreviations | 3 |
| 2 | REFERENCE DOCUMENTS, CODES AND STANDARDS..... | 4 |
| 2.1 | External References | 4 |
| 2.2 | Internal References | 5 |
| 3 | ENVIRONMENTAL AND OPERATION CONDITIONS | 5 |
| 3.1 | General | 5 |
| 4 | HYDRAULIC SYSTEM REQUIREMENTS | 6 |
| 4.1 | General requirements | 6 |
| 4.2 | Accumulator Bank | 7 |
| 4.3 | Hydraulic Fluid | 7 |
| 4.4 | Pumps..... | 8 |
| 4.5 | Reservoirs..... | 8 |
| 4.6 | Filters | 9 |
| 4.7 | Hydraulic Lines | 9 |
| 4.8 | Pressure Regulating Valves | 10 |
| 5 | CONSTRUCTIVE REQUIREMENTS..... | 10 |
| 5.1 | General Requirements..... | 10 |
| 5.2 | Requirements for Electric Systems and Power Supply | 11 |
| 5.3 | Instrumentation and Control | 12 |
| 6 | HPU INLETS AND OUTLETS | 12 |
| 6.1 | Reservoirs..... | 12 |
| 6.2 | Interconnection with Accumulator Bank | 13 |
| 6.3 | Pneumatic..... | 13 |
| 7 | HYDRAULIC CONTROL RACKS..... | 13 |
| 7.1 | General | 13 |
| 8 | INSTRUMENTATION | 14 |
| 8.1 | General | 14 |
| 8.2 | Level Indicators..... | 14 |
| 8.3 | Pressure Gauges and Pressure transmitters | 14 |
| 9 | IDENTIFICATION..... | 15 |
| 9.1 | General | 15 |
| 10 | TESTS..... | 15 |
| 10.1 | General | 15 |
| 11 | DELIVERY, WARRANTY AND DOCUMENTATION..... | 16 |
| 11.1 | Preparation for Delivery | 16 |
| 11.2 | Warranty | 16 |
| 11.3 | Spare Parts..... | 16 |
| 11.4 | Documentation..... | 16 |

| | | | |
|---|--------------------------------|---|-------------|
|  | TECHNICAL SPECIFICATION | Nº: I-ET-3010.00-5139-390-P4X-001 | REV. 0 |
| | AREA: | SHEET 3 of 16 | |
| | TITLE: | HYDRAULIC POWER UNIT (HPU) FOR TOPSIDES VALVES | |
| | | NP-1 | ESUP |

1 INTRODUCTION

1.1 Object

1.1.1 This technical specification describes the minimum requirements and basic characteristics for a Hydraulic Power Unit for controlling Topsides Hydraulic Actuated Valves.

1.1.2 This HPU shall be used for driving all Topsides Hydraulic Valves. All scope in this specification, unless otherwise specified, is HPU MANUFACTURER scope of supply.

1.2 Definitions

1.2.1 Refer to I-ET-3010.00-1200-940-P4X-002 - GENERAL TECHNICAL TERMS.

1.3 Abbreviations

The following abbreviations were used in this document:

| | |
|-----|----------------------------------|
| BDV | Blowdown Valve |
| CSS | Control and Safety System |
| FAT | Factory Acceptance Test |
| FPU | Floating Production Unit |
| HMI | Human Machine Interface |
| HPU | Hydraulic Power Unit |
| MCC | Motor Control Center |
| MMS | Machinery Monitoring System |
| PCS | Process Control System |
| PSD | Process Shutdown System |
| PSV | Pressure Safety Valve |
| SAT | Site Acceptance Test |
| SIT | Site Integration Test |
| SOS | Supervision and Operation System |
| SDV | Shutdown Valve |
| UCP | Unit Control Panel |
| XV | On-Off Valve |

2 REFERENCE DOCUMENTS, CODES AND STANDARDS

2.1 External References

2.1.1 International codes, recommended practices and standards

API – AMERICAN PETROLEUM INSTITUTE

| | | |
|-----|--------|--|
| API | RP-14B | DESIGN, INSTALLATION AND OPERATION OF SUBSURFACE SAFETY VALVE SYSTEM |
| API | RP-14C | ANALYSIS, DESIGN, INSTALLATION AND TESTING OF SAFETY SYSTEMS FOR OFFSHORE PRODUCTION FACILITIES |
| API | RP-14F | DESIGN, INSTALLATION AND MAINTENANCE OF ELECTRICAL SYSTEMS FOR FIXED AND FLOATING OFFSHORE PETROLEUM FACILITIES FOR UNCLASSIFIED AND CLASS I, DIVISION 1, AND DIVISION 2 LOCATIONS |

IEC – INTERNATIONAL ELECTROTECHNICAL COMMISSION

| | | |
|-----|-------|---|
| IEC | 60079 | EXPLOSIVE ATMOSPHERES |
| IEC | 60529 | DEGREES OF PROTECTION PROVIDED BY ENCLOSURES (IP CODE) |
| IEC | 61511 | FUNCTIONAL SAFETY – SAFETY INSTRUMENTED SYSTEMS FOR THE PROCESS INDUSTRY SECTOR |
| IEC | 61892 | MOBILE AND FIXED OFFSHORE UNITS – ELECTRICAL INSTALLATIONS |

ISO - INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

| | | |
|-----|------|--|
| ISO | 3448 | INDUSTRIAL LIQUID LUBRICANTS - ISO VISCOSITY CLASSIFICATION |
| ISO | 4406 | HYDRAULIC FLUID POWER - FLUIDS - METHOD FOR CODING THE LEVEL OF CONTAMINATION BY SOLID PARTICLES |

2.1.2 Brazilian codes and standards

INMETRO – INSTITUTO NACIONAL DE METROLOGIA, NORMALIZAÇÃO E QUALIDADE INDUSTRIAL

| | |
|--|--|
| PORTARIA Nº 179 (18/MAIO/2010) | REGULAMENTO DE AVALIAÇÃO DA CONFORMIDADE DE EQUIPAMENTOS ELÉTRICOS PARA ATMOSFERAS POTENCIALMENTE EXPLOSIVAS, NAS CONDIÇÕES DE GASES E VAPORES INFLAMÁVEIS E POEIRAS COMBUSTÍVEIS. |
| PORTARIA Nº 89 (23/FEVEREIRO/ 2012) | ALTERAÇÃO DA PORTARIA INMETRO Nº 179, DE 18/MAIO/2010. |

2.1.3 All MTE – Ministério do Trabalho regulations (NRs) shall be followed.

2.1.4 Classification Society Rules

The Detail Design phase shall be submitted to approval by Classification Society. The design and installation shall take into account their requirements and comments.

2.2 Internal References

2.2.1 Project Documents

| | |
|-------------------------------|--|
| I-ET-3010.00-1200-800-P4X-002 | AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS |
| I-ET-3010.00-1200-800-P4X-013 | GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS |
| I-ET-3010.00-5140-700-P4X-002 | SPECIFICATION FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS |
| I-ET-3010.00-5140-700-P4X-003 | ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS |
| I-ET-3010.00-5140-712-P4X-001 | LOW-VOLTAGE INDUCTION MOTORS FOR OFFSHORE UNITS |
| I-ET-3010.00-1200-940-P4X-002 | GENERAL TECHNICAL TERMS |

2.2.2 Names below and respective document codes may vary according to each project but, in general, the following documents shall be considered along with this technical specification.

- HYDRAULIC POWER UNIT (HPU) FOR TOPSIDES VALVES - HYDRAULIC DIAGRAM
- POSITIVE DISPLACEMENT PUMPS SPECIFICATION FOR TOPSIDE
- PIPING SPECIFICATION FOR TOPSIDES
- AUTOMATION INTERFACE OF PACKAGE UNITS
- GENERAL SPECIFICATION FOR AVAILABLE UTILITIES
- INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS


3 ENVIRONMENTAL AND OPERATION CONDITIONS

3.1 General

3.1.1 For HPU operating and environmental conditions, refer to INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS project documentation.

3.1.2 This HPU shall be installed at marine environment, at hazardous area Zone 2, Group IIA, T3, in accordance with standard IEC 60079 and shall have IP-56 Protection Degree according to IEC 60529.

3.1.3 Electrical equipment installed in external areas shall be certified for installation in hazardous areas Zone 1 Group IIA temperature T3.

| | | | |
|---|--------------------------------|---|-------------|
|  | TECHNICAL SPECIFICATION | Nº: I-ET-3010.00-5139-390-P4X-001 | REV. 0 |
| | AREA: | SHEET 6 of 16 | |
| | TITLE: | HYDRAULIC POWER UNIT (HPU) FOR TOPSIDES VALVES | |
| | | NP-1 | ESUP |

3.1.4 The dry compressed air shall be supplied as specified in GENERAL SPECIFICATION FOR AVAILABLE UTILITIES documentation.

4 HYDRAULIC SYSTEM REQUIREMENTS

4.1 General requirements

4.1.1 The HPU shall generate hydraulic energy for the actuation of the XVs, SDVs or BDVs valves that are provided with hydraulic actuators.

4.1.2 All interlocking signals shall be electric and are included in the scope of this specification.

4.1.3 The following parameters shall be taken into account for the sizing of the system:

| | |
|---|---|
| Estimate volume to operation of the FPU hydraulic Topsides valves | To be calculated during Detail Design phase |
| Distance between Hydraulic Control Rack and each valve | To be calculated during Detail Design phase |
| Diameter of tubing from Hydraulic Control Rack to each valve | To be calculated during Detail Design phase |
| Maximum distance between HPU and each Hydraulic Control Rack | To be calculated during Detail Design phase |
| Hydraulic fluid | Mineral Oil |

4.1.4 The HPU shall have as a minimum:


- 4 supply pumps:
 - 2 of which shall be electrically driven (1 on duty and 1 on stand-by), and the other 2 pneumatic driven (1 on duty and 1 on stand-by);
- 1 loading and recirculation electrical pump;
- 2 pressure regulating valves;
- 1 supply reservoir;
- 1 return reservoir;
- 1 Unit Control Panel (UCP)
- Filters to keep the cleanliness class;
- Other valves, accessories, lines and fittings


4.1.5 Relief valves shall be foreseen on the pump discharge, adjusted 10 % higher than maximum work pressure of the line. They shall permit the fluid return to the reservoir in case of system overpressure.

4.1.6 The hydraulic system shall also foresee filters on the pump suction, safety relief valves, non-return and block valve when necessary and a manometer on the front of the HPU to indicate the pressure of hydraulic supply.

4.1.7 Each HPU header shall have pressure transmitter with local indication as well as safety relief valves (PSV).

4.1.8 All hydraulic circuit components shall be in AISI-316L, except where otherwise specified in this document.

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|--|--------------------------------|---|--------|-------------|-------------|
|  | TECHNICAL SPECIFICATION | Nº: I-ET-3010.00-5139-390-P4X-001 | REV. 0 | | |
| | AREA: | SHEET 7 of 16 | | | |
| | TITLE: | HYDRAULIC POWER UNIT (HPU) FOR TOPSIDES VALVES | | | |
| <table border="1"> <tr> <td style="text-align: center;"> NP-1 </td> </tr> <tr> <td style="text-align: center;"> ESUP </td> </tr> </table> | | | | NP-1 | ESUP |
| NP-1 | | | | | |
| ESUP | | | | | |
| <p>4.1.9 All hydraulic components shall be selected in order to guarantee a level of tightness to the HPU (zero leakage) during the working life of the platform.</p> <p>4.1.10 All hydraulic fluid drains shall converge to the same outlet.</p> <p>4.1.11 All components of the pneumatic and hydraulic systems shall have permanent stainless steel identification and name plates with lettering in low relief according to the HPU functional diagram.</p> <p>4.2 Accumulator Bank</p> <p>4.2.1 The accumulator bank shall be provided with complete and independent manifold block for each accumulator with 3/4" NPT bulkhead, ball valves and piping in AISI-316L stainless steel.</p> <p>4.2.2 The hydraulic accumulators shall be of the bladder type for 41,380 kPa (6,000 psi) maximum allowed pressure. Accumulators design capacity criteria shall consider 34,473.79 kPa (5,000 psi) as the maximum operation pressure.</p> <p>4.2.3 The accumulators chassis shall be made of AISI-316L stainless steel and internally covered with Nickel coating. All materials, such as gaskets and bladders and their coatings shall be compatible with hydraulic fluid used. It shall be provided with facilities (spaces, quick connections, manometers, etc.) for individual recharge from nitrogen cylinders.</p> <p>4.2.4 The accumulator bank shall be provided with 1 (one) 0 – 55,158 kPa (8,000 psi) manometer with glycerin filling in the nitrogen pre-charge circuit of each accumulator.</p> <p>4.2.5 Each accumulator of the bank shall have a block, bleed and safety relief valves and a safety drain.</p> <p>4.2.6 The accumulator bank shall be sized to allow, at least, one half operation of the Topsides hydraulic valves without using the pumps. The minimum pressure used to size the accumulator units shall be greater or equal to the highest pressure acceptable at the pressure regulator valve outlets.</p> <p>4.3 Hydraulic Fluid</p> <p>4.3.1 The hydraulic fluid for operation of the HPU shall be mineral oil, compatible with viscosity grade (VG) 32, according to ISO 3448. The cleanliness class of the hydraulic fluid shall be 17/15/12 according to ISO 4406. Water based type production control fluids shall not be used for the HPU.</p> <p>4.3.2 The HPU shall be supplied clean with hydraulic fluid at the aforementioned cleanliness class. The connection of the lines to the HPU shall be done only after its cleaning by flushing.</p> <p>4.3.3 It shall be supplied a fluid cleanliness analyses kit with consumables slides for a 2 (two) year period of operation with 2 (two) samples per week for use on the HPU.</p> | | | | | |

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|---|--------------------------------|---|-------------|
|  | TECHNICAL SPECIFICATION | Nº: I-ET-3010.00-5139-390-P4X-001 | REV. 0 |
| | AREA: | SHEET 8 of 16 | |
| | TITLE: | HYDRAULIC POWER UNIT (HPU) FOR TOPSIDES VALVES | |
| | | NP-1 | ESUP |

4.3.4 Compatibility Certificates with the mineral oil specified for the HPU shall be required for all components of the Hydraulic System it shall attend.

4.4 Pumps

4.4.1 All supply pumps shall be positive displacement type, lubricated by the hydraulic fluid, equipped with PSV, pulsation damper and check valve downstream them. Pumps upstream header shall have filters in 2x100 % configuration.

4.4.2 The loading and recirculation pump shall be sized to supply a flowrate equal to the maximum between:

- 20 L/min;
- The flowrate needed to recirculate all return reservoir volume in 2.5 hours, considering the pressure drop in the filters.

4.4.3 The loading and recirculation pump shall be electrically driven.

4.4.4 The electrical supply pumps shall be sized to supply the flowrate needed to elevate accumulators pressure from the minimum (used in accumulator sizing) to the maximum (used in accumulator sizing) in up to 5 minutes. Since these two pumps operate in a 2x100 % configuration, each pump shall be capable of supply this flowrate alone.

4.4.5 The pneumatic supply pumps shall be sized to supply a flowrate equal to the maximum between:

- 8 L/min;
- 10 % of the electrical pumps flowrate.

4.4.6 The air pressure of the pneumatic pumps shall be considered as the minimum supplied by the FPU according to GENERAL SPECIFICATION FOR AVAILABLE UTILITIES project documentation. The external connections for the compressed air supply shall be 3/4" compression type fittings. The air supply lines shall have redundant filters and redundant pressure-regulating valves.

4.4.7 The selection of which pump is on duty and which one is on stand-by, for both electrical and pneumatic pumps, shall be done in UCP HMI.


4.5 Reservoirs

4.5.1 Two hydraulic fluid reservoirs shall be foreseen. One shall receive the return fluids while the other shall handle the supply.

4.5.2 The hydraulic fluid reservoirs shall be made of AISI-316L stainless steel and shall have the following accessories: level gauge, level transmitters, drains, vents, overflow and other necessary accessories.

4.5.3 The supply reservoir shall be sized to have a working volume equal to the maximum value between:

- The volume needed to pressurize all valves and accumulators;
- 1.5 times the total accumulators' volume.

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|---|--------------------------------|---|-------------|
|  | TECHNICAL SPECIFICATION | Nº: I-ET-3010.00-5139-390-P4X-001 | REV. 0 |
| | AREA: | SHEET 9 of 16 | |
| | TITLE: | HYDRAULIC POWER UNIT (HPU) FOR TOPSIDES VALVES | NP-1 |

4.5.4 The supply reservoir shall have:

- A free volume of 10 % of its total volume;
- A dead volume of 3 % of its total volume;
- A minimum volume of 10 % of its total volume.

4.5.5 The return reservoir shall be sized to a volume twice as the supply reservoir volume.

4.5.6 All reservoirs shall have a geometry that allows the complete draining of them, including their dead volume.

4.6 Filters

4.6.1 Downstream the set of pumps, in the supply header, there shall be a pair of filters in a 2x100 % configuration, not allowing internal or external bypass. The filters shall be sized to the maximum flowrate of electrical supply pumps and shall have a mesh of 3 μm ($\beta = 200$).

4.6.2 Upstream the set of pumps and downstream the supply reservoir there shall be a pair of filters in a 2x100 % configuration with a mesh of 125 μm ($\beta = 200$).

4.6.3 Upstream the load and recirculation pump there shall be a filter with a mesh of 125 μm ($\beta = 200$).

4.6.4 Downstream the load and recirculation pump there shall be two filters in sequence with a mesh of 10 μm ($\beta = 1000$) and 3 μm ($\beta = 200$), respectively.

4.6.5 All supply filters shall have blockage valves upstream and downstream them, a drain valve and a saturation indication in their body.

4.7 Hydraulic Lines

4.7.1 All hydraulic lines in the HPU, hydraulic control racks and interconnections shall be in accordance with PIPING SPECIFICATION FOR TOPSIDES project documentation, sized with a minimum pressure safety factor of 3:1.

4.7.2 All hydraulic connections in the HPU shall be made of double ferrule compression-type fittings, capable of preserving their sealing for at least 25 (twenty five) years of service.

4.7.3 For each service, the maximum speed in the hydraulic lines shall be in accordance with Table 1. The hydraulic lines shall be sized accordingly, and also considering the flushing operation.

Table 1 – Maximum speed for each service

| Service | Maximum speed (m/s) |
|--|---------------------|
| Pumps suction | 1.22 |
| Pumps discharge an pressure distribution lines | 5.18 |
| Return lines | 3.05 |

4.7.4 The hydraulic distribution shall be made by racks, in which the solenoid valves will be located. Each FPU MODULE shall have its own rack. All solenoid valves shall be encapsulated in epoxy to avoid corrosion, with a minimum of class F isolation.

4.7.5 In every elevations of the hydraulic system, there shall be foreseen a needle valve with a vent-screw, in order to remove retained air in lines.

4.8 Pressure Regulating Valves

4.8.1 Pressure regulator valves shall be sized to supply a flow compatible with the required for the opening/closing of the XVs, SDVs, BDVs and the nominal flow of hydraulic fluid.

4.8.2 They shall be made of AISI 316 stainless steel with metallic seat and have a self-venting aligned to the return reservoir. The regulated pressure shall be 1,500 psi. They shall be sized to have a maximum variation of 5% of set pressure and to avoid:

- The “droop effect”, when a decrease in flowrate may cause an increase in outlet pressure and an increase in flowrate may cause a decrease in outlet pressure;
- The “lock-up effect”, when an interrupted flow through the valve may cause an increase in outlet pressure;
- The “supply pressure effect”, when a decrease in inlet pressure may cause an increase in outlet pressure and an increase in inlet pressure may cause a decrease in outlet pressure.

5 CONSTRUCTIVE REQUIREMENTS


5.1 General Requirements

5.1.1 HPU shall be made of stainless steel without painting, with closed SKID(s), and can be divided in up to 3 (three) sections:

- A skid containing electrical and pneumatic pumps, pressure regulating valves, Motor Control Center and UCP;
- A skid containing hydraulic fluid reservoirs, supply header, pumps and filters;
- A skid containing hydraulic accumulators.

5.1.2 The packing shall be designed for transportation by sea on tugboat decks subject to seawater splashes.

5.1.3 All skids shall be enclosed and adequate to environmental conditions described in item 3.

| | | | |
|---|--------------------------------|---|-------------|
|  | TECHNICAL SPECIFICATION | Nº: I-ET-3010.00-5139-390-P4X-001 | REV. 0 |
| | AREA: | SHEET 11 of 16 | |
| | TITLE: | HYDRAULIC POWER UNIT (HPU) FOR TOPSIDES VALVES | |
| | | NP-1 | ESUP |

5.1.4 The structure of the skids shall be designed to withstand the stresses of sea transportation, shall be attached to the base and have the whole of the components assembled in place. For sea transportation, HPU MANUFACTURER shall indicate the necessary lashing to be applied to the skids. In lashing down, the hoisting pad eyes shall be used.

5.1.5 HPU shall be provided with Classification Society certificate.

5.2 Requirements for Electric Systems and Power Supply

5.2.1 Electrical material and equipment shall be complying with I-ET-3010.00-5140-700-P4X-002 - SPECIFICATION FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS. Electrical installations inside the package shall comply with I-ET-3010.00-5140-700-P4X-003 - ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS.

5.2.2 It shall be provided 3 feeders:

- 2 (two) feeders for hydraulic supply pumps;
- 1 (one) feeder for recirculation pump.

5.2.3 All electrical signal connections for external interconnection with the HPU shall be clustered in junction boxes with at least IP-56 protection degree, located in the skid and grouped according to the different types of signals involved.

5.2.4 Each junction box shall have 20 % spare (non-used) terminal blocks per type of signal.

5.2.5 The HPU shall be grounded according to I-ET-3010.00-5140-700-P4X-003 - ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS.

5.2.6 The junction boxes rail-mounted terminal blocks shall be designed for 2.5 mm² and 1.5 mm² cross-section conductors and be non-hygroscopic. The wiring can only be opened near the connection points, and shall be perfectly identified at both ends.

5.2.7 The cables used shall have 450 / 750 V insulation and the diameter of each conductor shall be 2.5 mm² for the solenoid valves and 1.5 mm² for the other instruments.

5.2.8 All cables for analog signals inside the HPU shall be shielded to avoid electromagnetic interference caused by electric motors. The cable shielding shall not be grounded, but rather connected through junction box terminals.

5.2.9 All electrical cable entries and connections shall be made through the bottom.

5.2.10 Electrical Motors shall be in accordance with I-ET-3010.00-5140-712-P4X-001 – LOW-VOLTAGE INDUCTION MOTORS FOR OFFSHORE UNITS.



5.3 Instrumentation and Control

- 5.3.1 HPU is considered a P2 type package and shall comply with I-ET-3010.00-1200-800-P4X-002 – AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS, and other requirements herein described.
- 5.3.2 Despite the fact that the HPU is a P2 package, its UCP shall be located near the HPU, instead of in the Automation and Electrical Panels Room (AEPR).
- 5.3.3 The UCP shall have protection IP-56 according to IEC-60529.
- 5.3.4 The UCP shall be made out of stainless steel plates.
- 5.3.5 The UCP shall be certified as Ex-pz, according to IEC-60079. In order to be certified as such, the HPU shall have a gas detector that, in case of confirmed gas in the HPU area while the UCP is opened, the power supply for the UCP shall be interrupted.
- 5.3.6 For interface signals between CSS and HPU UCP, refer to AUTOMATION INTERFACE OF PACKAGE UNITS project documentation.
- 5.3.7 Power supply for HPU UCP shall be in accordance with I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS

6 HPU INLETS AND OUTLETS

6.1 Reservoirs


6.1.1 Inlets

- 6.1.1.1 One fluid return inlet, compression type fittings, for each Hydraulic Control Rack (used in the actuation of the valves). The diameter shall be calculated during Detail Design phase. Minimum diameter acceptable is 2"
- 6.1.1.2 One inlet for fluid filling with 3/4" minimum diameter with quick coupling fitting. A corresponding hose with quick coupling fitting at one end and a check valve at the other end shall be supplied.

NOTE: Considering that the fluid flow from the return reservoir shall be as free as possible, the routing of the return lines shall remain independent and without any reduction in diameter.

6.1.2 Outlets

- 6.1.2.1 Hydraulic fluid supply reservoir shall have drain, with 3/4" minimum diameter, compression type fitting.
- 6.1.2.2 Hydraulic fluid return tank shall have drain, with 3/4" minimum diameter, compression type fitting.

| | | | |
|---|--------------------------------|---|-------------|
|  | TECHNICAL SPECIFICATION | Nº: I-ET-3010.00-5139-390-P4X-001 | REV. 0 |
| | AREA: | SHEET 13 of 16 | |
| | TITLE: | HYDRAULIC POWER UNIT (HPU) FOR TOPSIDES VALVES | |
| | | NP-1 | ESUP |

6.1.2.3 One 1" minimum diameter hydraulic fluid supply outlet, compression type fitting, for each Hydraulic Control Racks.

6.1.2.4 One outlet, with 2" minimum diameter used for overflow in the return tank.

6.2 Interconnection with Accumulator Bank

6.2.1 Two connections, 1" minimum diameter, compression type fitting, used for connection among accumulators.

6.2.2 Interconnection with the Reservoirs Skid.

6.2.2.1 One hydraulic fluid supply line, 1" minimum diameter, compression type fitting.

6.2.2.2 One 1" minimum diameter line for the return to the return reservoir.

NOTE 1: The return of the drains from the accumulator bank shall be routed to the return reservoir.

NOTE 2: The electric signals and commands shall be routed to proper junction boxes in the HPU skid.

6.3 Pneumatic

6.3.1 Inlet

6.3.1.1 One air supply inlet, with 3/4" minimum diameter, compression type fitting.

NOTE: All air filter regulators shall have drains, with 1/4" minimum diameter, compression type fitting.

6.3.2 Outlets

6.3.2.1 Pneumatic pump vents (1" minimum on top of the HPU, with mufflers).


7 HYDRAULIC CONTROL RACKS

7.1 General

7.1.1 The FPU shall have Hydraulic Control Racks for the command of hydraulic valves, containing the solenoids. The Hydraulic Control Racks have the function of distribution hydraulic fluid to the valves. For racks operating and environmental conditions, refer to INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS project documentation.

7.1.2 Hydraulic Control Racks shall be certified for installation in Zone 2, Group IIA, T3 hazardous areas according to IEC-60079 standard and certified as IP-56 according to IEC-60529.

7.1.3 The Racks shall be made out of AISI 316L stainless steel with self-support, two front access doors and two rear access doors.

| | | | |
|---|--------------------------------|---|--------|
|  | TECHNICAL SPECIFICATION | Nº: I-ET-3010.00-5139-390-P4X-001 | REV. 0 |
| | AREA: | SHEET 14 of 16 | |
| | TITLE: | HYDRAULIC POWER UNIT (HPU) FOR TOPSIDES VALVES | |
| | | NP-1 | |
| | | ESUP | |

- 7.1.4 The Racks shall use mineral-based hydraulic fluid with 3 μm absolute filtering.
- 7.1.5 All solenoids in hydraulic control racks shall have integrated blockage valves in all their connections, to allow individual maintenance.
- 7.1.6 Each hydraulic control rack shall have a pressure transmitter in supply line and one pressure transmitter in return line.

8 INSTRUMENTATION

8.1 General


- 8.1.1 Requirements for instrumentation shall refer to and be in compliance with the document I-ET-3010.00-1200-800-P4X-013 - GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS.
- 8.1.2 All instruments, panels, materials and equipment proper to be used in hazardous areas, shall have conformity certificates complying with PORTARIA INMETRO Nº 179, de 18/maio/2010, and its annexes, changed by PORTARIA INMETRO Nº 89, de 23/fevereiro/2012, and shall be approved by Classification Society.

8.2 Level Measurement

- 8.2.1 All internal parts of all instruments in contact with the fluids shall be AISI-316L stainless steel. It shall be supplied the following level measurements:
- 8.2.2 Two local level indicators, 1 in each hydraulic fluid reservoir. The level indicator shall be made of stainless steel, with magnetic float indicator.
- 8.2.3 One level transmitter of the hydraulic supply reservoir. The level transmitter shall be used for remote monitoring of the tank level as well as triggering an alarm to detect eventual leaks in the system. High and low level signals shall also be used to start or stop the recirculation and hydraulic fluid supply pumps.
- 8.2.4 One return reservoir level transmitter, aimed at remote monitoring of the tank level as well as alarming. The signal shall be equally used for low and high level monitoring in order to turn off the recirculation and hydraulic fluid supply pump.

8.3 Pressure Gauges and Pressure transmitters

- 8.3.1 Pressure gauges and transmitters shall be interconnected with a two-way manifold. Their calibrated range shall be in accordance with the service they are performing.

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|  | TECHNICAL SPECIFICATION | Nº: I-ET-3010.00-5139-390-P4X-001 | REV. 0 |
| | AREA: | SHEET 15 of 16 | |
| | TITLE: | HYDRAULIC POWER UNIT (HPU) FOR TOPSIDES VALVES | |
| | | NP-1 | |
| | | ESUP | |

9 IDENTIFICATION

9.1 General

9.1.1 All controls, connections and gauges assembled on the HPU shall be clearly identified with at least tag number, description, manufacturer and model. Numbers and codes alone are NOT acceptable for identifications.

9.1.2 The identification plates shall be made of AISI 316L stainless steel, with lettering in low relief and shall be attached with AISI 316L stainless steel bolts. The identification shall be in Brazilian Portuguese and all translations shall be submitted for verification and approval by PURCHASER.

10 TESTS

10.1 General


10.1.1 HPU MANUFACTURER shall be responsible for performing all tests of the HPU until the final commissioning and the acceptance of the unit by Petrobras. HPU MANUFACTURER shall also be responsible for provide personnel, material, equipment and instrument needed for all the tests, independent of the location where it is going to take place, until the final commissioning and acceptance of the unit by PURCHASER

10.1.2 At least the following tests shall be performed at HPU MANUFACTURER installations (FAT) prior to delivery:

- Visual inspection;
- Tightness/leakage;
- Continuity (electric, pneumatic and hydraulic);
- Functional Test;
- Loop test;
- Electric insulation;
- Painting adherence;
- Chemical grade nickel plating at accumulators;
- Immunity to electric noise;
- Cleanliness class of hydraulic fluid.
- Calibration, configuration and diagnostic of each field instrument.

10.1.3 After the installation of the equipment on board, at least, the following tests shall be repeated (SAT).

- Visual inspection;
- Tightness/leakage;
- Functional Test;
- Loop test;
- Electric Isolation.

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|---|--------------------------------|---|-------------|
|  | TECHNICAL SPECIFICATION | Nº: I-ET-3010.00-5139-390-P4X-001 | REV. 0 |
| | AREA: | SHEET 16 of 16 | |
| | TITLE: | HYDRAULIC POWER UNIT (HPU) FOR TOPSIDES VALVES | |
| | | NP-1 | ESUP |

10.1.4 For Site Integration Tests (SIT) all the tests performed during FAT shall be repeated, after the assembly of the hydraulic circuits.

10.1.5 In order to shorten the time at the tests on board, the documentation shall be checked at platform office.

10.1.6 HPU MANUFACTURER shall submit to PURCHASER, for approval, detailed FAT, SAT and SIT programs 60 (sixty) days in advance.

10.1.7 HPU MANUFACTURER shall be responsible for all the consumables necessary for all tests, commissioning and final acceptance of the HPU by PURCHASER, including the hydraulic control fluid, the qualified personnel and equipment for the verification of the cleanliness class.

11 DELIVERY, WARRANTY AND DOCUMENTATION

11.1 Preparation for Delivery

11.1.1 HPU MANUFACTURER shall ensure that all components in his supply are delivered in a clean condition in accordance with ISO 4406 17/15/12 cleanliness class. After flushing and cleaning, the hydraulic equipment shall be filled with relevant filtered hydraulic fluid and all termination points capped with stainless steel caps / blind flanges.

11.2 Warranty

11.2.1 HPU, including the accumulator bank, shall have total warranty for a period of 18 (eighteen) months operation counting from date of commissioning and acceptance by PURCHASER.

11.3 Spare Parts

11.3.1 HPU shall be supplied with spare parts for the startup commissioning and spare parts list for 02 (two) years operation.

11.4 Documentation

11.4.1 All tests, certificates, manuals, materials, drawings shall be delivered upon the acceptance of the HPU as approved.