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	AREA:	-	
SRGE	TITLE: CARGO AREA SUBMERGED PUMPS		INTERNAL
			ESUP

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THIS FORM IS PART OF PETROBRAS N-381 REV.M ANNEX A – FIGURE A.1.




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1. INTRODUCTION

1.1. OBJECTIVE

The purpose of this technical specification is to describe the minimum requirements for the design, manufacturing, assembly, supply, installation, commissioning and tests of CARGO AREA SUBMERGED PUMPS package in conformance with relevant regulations and REFERENCE HULL 01 FPSO design.

CARGO AREA SUBMERGED PUMPS package is composed by the cargo area submerged pumps for FPSO deep structural tanks, HPU (main and auxiliar) for hydraulic power distribution, piping, tubing, hydraulic racks, control panels and all other necessary equipment, accessory, or device for the cargo area submerged pumps proper operation.

PACKAGE equipment is listed on item 5 with details of PACKAGE scope supply.

1.2. DEFINITIONS

PACKAGE: It is defined as an assembly of equipment supplied interconnected, tested and ready to operate, requiring only the available utilities from the Unit for the Package operation.

PACKAGER: It is defined as the responsible for project, assembly, construction, fabrication, testing and furnishing of the Package.


OWNER: PETROBRAS.

CARGO AREA SUBMERGED PUMPS the package name.

All other definitions are found on I-ET-3010.00-1200-940-P4X-002 – GENERAL TECHNICAL TERMS.

1.3. ABBREVIATIONS

CCR	Central Control Room
CS	Classification Society
FAT	Factory Acceptance Tests
FPSO	Floating Production Storage and Offloading Unit
HPU	Hydraulic Power Unit
NDT	Non-destructive Tests
SOS	Supervisory and Operational System
SOS-HMI	Human Machine Interface of SOS

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2. NORMATIVE REFERENCES

2.1. INTERNATIONAL CODES, RECOMMENDED PRACTICES AND STANDARDS

PACKAGE equipment shall be designed and manufactured in accordance with the following codes and standards, if not mentioned otherwise.

- ANSI American National Standards Institute
- ASME American Society Of Mechanical Engineers
- IMO – International Maritime Organization
- VDE / IEC German National Electric Standard Codes / International Electric Codes
- Classification Society defined for the Hull scope.

2.2. BRAZILIAN CODES AND STANDARDS

- NR – Brazilian Federal Government Regulatory Norms (Normas Regulamentadoras NRs);
- NORMAM-01 – Normas da Autoridade Marítima para Embarcações Empregadas na Navegação em Mar Aberto.

2.3. CLASS APPROVAL AND CERTIFICATION

PACKAGE shall be designed, manufactured and tested according to the design reference documents, normative requirements and in accordance with the latest editions of Classification Society Rules, Regulations and Standards.

3. REFERENCE DOCUMENTS

3.1. REFERENCE HULL 01 FPSO DESIGN

REF DOC NUMBER	REF DOC NAME
HULL SYSTEMS	
I-DE-3010.2E-1350-944-P4X-003	CARGO SYSTEM
I-DE-3010.2E-5139-944-P4X-001	HYDRAULIC SYSTEM FOR HYDRAULIC SUBMERGED PUMPS
I-DE-3010.2E-5241-944-P4X-005	PURGING AND STRIPPING SYSTEM FOR SUBMERGED PUMPS PIPE STACKS

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I-DE-3010.2E-5271-944-P4X-001	TANKS CLEANING AND RECIRCULATION SYSTEM		
I-DE-3010.2E-5335-944-P4X-001	BALLAST SYSTEM (FWD)		
I-DE-3010.2E-5336-944-P4X-005	SLOP DISCHARGE SYSTEM		
I-DE-3010.2E-5120-944-P4X-001	ENGINE ROOM CENTRAL FRESH WATER COOLING SYSTEM		
I-FD-3010.2E-1350-311-P4X-001	CARGO PUMPS (B-1350501A/T)		
I-FD-3010.2E-1350-311-P4X-004	PORTABLE CARGO PUMPS (B-5139502A/B)		
I-FD-3010.2E-1350-311-P4X-005	BUTTERWORTH PUMP (B-5271502A/B)		
I-FD-3010.2E-1358-311-P4X-001	SLOP OIL SKIMMING PUMP (B-1358501A/B)		
I-FD-3010.2E-5271-311-P4X-001	SLOP PUMPS (B-5271501A/B)		
I-FD-3010.2E-5335-311-P4X-001	BALLAST PUMP (FWD) (B-5335501A/B)		
I-FD-3010.2E-5336-313-P4X-001	SLOP DISCHARGE PUMPS (B-5336503A/B)		
I-FD-3010.2E-5120-456-P4X-001	ENGINE ROOM CENTRAL FRESH WATER COOLER (P-5120501A/B)		
I-MD-3010.2E-1200-940-P4X-027	DESCRIPTIVE MEMORANDUM - HULL SYSTEMS		
PIPING			
I-ET-3010.2E-1200-200-P4X-001	PIPING SPECIFICATION FOR HULL		
I-ET-3010.2E-1200-200-P4X-004	REQUIREMENTS FOR PIPING SUPPORTS		
NAVAL			
I-DE-3010.2E-1350-960-P4X-002	CAPACITIES PLAN		
HULL STRUCTURE			
I-DE-3010.2E-1351-140-P4X-001	HULL GENERAL NOTES AND TYPICAL DETAILS		



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3.2. TYPICAL DOCUMENTS

REF DOC NUMBER	REF DOC NAME
GENERAL	
I-ET-3010.00-1200-940-P4X-002	GENERAL TECHNICAL TERMS
I-ET-3000.00-0000-940-P4X-002	SYMBOLS FOR PRODUCTION UNITS DESIGN
I-ET-3000.00-1200-940-P4X-001	TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN
CONSTRUCTION	
I-ET-3010.00-1200-955-P4X-001	WELDING
I-ET-3010.00-1000-970-P4X-002	REQUIREMENTS FOR NDT
I-ET-3010.00-1200-955-P4X-002	REQUIREMENTS FOR WELDING INSPECTION
I-ET-3010.00-0000-970-P4X-001	REQUIREMENTS FOR PROCEDURES AND PERSONNEL QUALIFICATION AND CERTIFICATION
MECHANICAL	
I-ET-3010.00-1200-300-P4X-001	NOISE AND VIBRATION CONTROL REQUIREMENTS
I-ET-3010.00-1200-451-P4X-001	REQUIREMENTS FOR SHELL AND TUBE HEAT EXCHANGER DESIGN AND FABRICATION
I-ET-3010.00-1200-456-P4X-001	REQUIREMENTS FOR PLATE HEAT EXCHANGER DESIGN AND FABRICATION
I-ET-3010.00-1352-130-P4X-001	FLOOR GRATINGS, TRAY SYSTEMS AND GUARDRAILS MADE OF COMPOSITE MATERIALS
PAINTING	
I-ET-3010.00-1200-956-P4X-002	GENERAL PAINTING
DR-ENGP-I-1.15	COLOR CODING
SAFETY	

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I-ET-3010.00-5400-947-P4X-002 SAFETY SIGNALING			
DR-ENGP-M-I-1.3 SAFETY ENGINEERING			
PIPING			
I-ET-3010.00-1200-251-P4X-001 REQUIREMENTS FOR BOLTING MATERIALS			
ELECTRICAL			
I-DE-3010.00-5140-700-P4X-003 GROUNDING INSTALLATION TYPICAL DETAILS.			
I-ET-3010.00-5140-700-P4X-001 SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS			
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-3010.00-5140-712-P4X-002 MEDIUM-VOLTAGE INDUCTION MOTORS FOR OFFSHORE UNITS			
INSTRUMENTATION AND AUTOMATION			
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-3010.00-5500-854-P4X-001 MACHINERY MONITORING SYSTEM			
I-ET-3010.00-5520-888-P4X-001 AUTOMATION PANELS			
I-ET-3010.00-1200-800-P4X-015 REQUIREMENTS FOR TUBING AND FITTING (ALIGNED TO IOGP-JIP33 S-716)			
NAVAL			



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3.3. SPECIFIC PROJECT DOCUMENTS

REF DOC NUMBER	REF DOC NAME
GENERAL	
I-DE-GENERAL ARRANGEMENT	GENERAL ARRANGEMENT
I-DE-AREA CLASSIFICATION – GENERAL	AREA CLASSIFICATION – GENERAL
I-ET-AUTOMATION INTERFACE OF PACKAGE UNITS	AUTOMATION INTERFACE OF PACKAGE UNITS
I-ET-METOCEAN DATA	METOCEAN DATA
I-RL-GENERAL SPECIFICATION FOR AVAILABLE UTILITIES	GENERAL SPECIFICATION FOR AVAILABLE UTILITIES
I-RL-MOTION ANALYSIS	MOTION ANALYSIS
PROCESS	
I-DE-PRODUCED WATER TANK "A"	PRODUCED WATER TANK "A"
I-DE-PRODUCED WATER TANK "B"	PRODUCED WATER TANK "B"
I-DE-OFF-SPEC OIL TANK	OFF-SPEC OIL TANK
I-FD-OFF-SPEC OIL PUMP (B-1223501A/B)	OFF-SPEC OIL PUMP (B-1223501A/B)
I-FD-PRODUCED WATER TANK BOOSTER PUMP (B-5331501A/D)	PRODUCED WATER TANK BOOSTER PUMP (B-5331501A/D)
I-FD-PRODUCED WATER TRANSFER PUMP (B-5331502A/D)	PRODUCED WATER TRANSFER PUMP (B-5331502A/D)
I-FD-OIL SKIMMING PUMP (B-5336502A/D)	OIL SKIMMING PUMP (B-5336502A/D)

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MECHANICAL	
I-ET- MATERIAL SPECIFICATION FOR HEAT EXCHANGERS	MATERIAL SPECIFICATION FOR HEAT EXCHANGERS
COMMISSIONING	
I-MD- COMMISSIONING DESCRIPTIVE MEMORANDUM	COMMISSIONING DESCRIPTIVE MEMORANDUM

Table 1 – Reference Documents

Note: these documents title and number may vary slightly from one project to another. project's document list shall be consulted in order to verify the correct document number and title.

4. DESIGN REQUIREMENTS

4.1. DESIGN CONDITIONS

- 4.1.1. PACKAGE Equipment shall be designed for a 30-year life in a corrosive offshore environment without the need for replacement of any major component due to wear, corrosion, fatigue, or material failure.
- 4.1.2. PACKAGER shall design the equipment for the full range of operational conditions as specified in this technical specification.
- 4.1.3. PACKAGE Equipment shall be designed with the compliance of the normative and design requirements as stated in this specification and complying with the technical parameters stated on the above item 3 with the REFERENCE HULL 01FPSO basic design reference documents.

4.2. SAFETY REQUIREMENTS

- 4.2.1. Personnel safety protection shall be provided according to Brazilian Regulatory Norms (NR) issued by Brazilian Government.
- 4.2.2. Warning signs in Brazilian Portuguese language shall be provided where risk of personnel injury exist.
- 4.2.3. Rotating equipment outer parts, such as pulleys, couplings, belts and flywheels, shall have rigid protection, manufactured with aluminum ASTM B211 and shall be capable of being easily removed.
- 4.2.4. In accordance with the requirements of SOLAS II-1, Regulation 3-5, and MSC.1/Circ. 1379, all equipment and material to be supplied by PACKAGER must be "asbestos free".
- 4.2.5. Safety signaling shall be in full compliance with I-ET-3010.00-5400-947-P4X-002

– SAFETY SIGNALING.

4.3. NOISE AND VIBRATIONS

4.3.1. Noise and vibrations limits shall be in conformance with I-ET-3010.00-1200-300-P4X-001 – NOISE AND VIBRATION CONTROL REQUIREMENTS.

4.4. MOTIONS AND ACCELERATION

4.4.1. All equipment shall be able to withstand with the UNIT subjected to 100-year return period environmental conditions.

4.4.2. All equipment shall be able to operate with the UNIT subjected to 1-year return period environmental conditions.

4.4.3. All environmental conditions are defined in I-ET–METOCEAN DATA, at any draft from fully loaded to the minimum loaded / ballasted condition.

4.4.4. For the Hull loading conditions details and the maximum designed operational trim and heel inclinations refer to I-ET-3010.00-1350-960-P4X-001–DESIGN REQUIREMENTS – NAVAL ARCHITECTURE.

4.4.5. For the design data and information regarding motion requirements refer to I-RL-MOTION ANALYSIS.


4.4.6. PACKAGE is also to withstand inertial forces during transportation from construction site to the final offshore location.

5. PACKAGE SCOPE OF SUPPLY

5.1. GENERAL

5.1.1. Submerged pumps scope of supply as below detailed:

Equipment	Description	Qty
B-1350501A/T	Cargo Pump	18 x100%
B-5331501A/D	Produced Water Tank Booster Pump	4 x100%
B-5331502A/D	Produced Water Transfer Pump	4 x100%
B-5336502A/D	Oil Skimming Pump	4 x100%
B-1223501A/B	Off-Spec Oil Pump	2 x100%
B-5271501A/B	Slop Pump	2 x100%
B-5336503A/B	Slop Discharge Pump	2 x100%

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B-1358501A/B	Slop Oil Skimming Pump	2 x100%
B-5335501A/B	Ballast pump (FWD)	2 x100%
B-5271502A/B	Butterworth pump	2 x100%
B-5139502A/B	Portable Cargo Pump	2 x100%
UH-5139502A/B	Hydraulic Power Unit for Submerged pump	2 x50%
UH-5139503A/B	Auxiliary Hydraulic Unit for Submerged pump	2 x50%
UH-5139504	Hydraulic Oil Transfer unit for Submerged Pump	1 x100%
Z-B-5335501A/B	Self-Priming Unit for Ballast pumps (FWD)	2 x100%
PN-UH-5139502A/B-01	Hydraulic Power Unit for Submerged Pumps – Control Panel	2 x50%
PN-UH-5139502A/B-02	Remote Control Valve Assembly	2 x50%
PN-UH-5139502A/B-03	Hydraulic power unit for submerged pumps - workstation	2 x50%


Table 2 – Cargo area submerged pumps scope of supply


5.2. CARGO AREA SUBMERGED PUMPS FOR CARGO, SLOP, PRODUCED WATER AND OFF-SPEC OIL TANKS


5.2.1. Submerged pumps shall be completed with at least the following components and accessories:


- a. High pressure hydraulic motor.
- b. Hydraulic pipe stack: which shall be segmented as PACKAGER standard.
- c. Deck trunk.
- d. Top cover plate.
- e. Bolts for connecting pumps top cover plate to deck trunk.
- f. Gasket between pump top cover plate and deck trunk.
- g. Intermediate support rings to be installed inside the tanks.
- h. Bottom support.


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<ul style="list-style-type: none"> i. Hydraulic pressure line ball valve. j. Hydraulic return line non-return valve. k. Hydraulic pilot line connection. l. Ventilating connection with exhaust trap or cofferdam and header tank. m. Cargo purging connection. n. Connection for inert gas (provided by Topside N₂ system. See I-DE-3010.2E-5241-944-P4X-005). o. Corrosion anodes for all cargo area submerged pumps as detailed on item 6.2.4. p. Discharge flange connection. q. Stripping connection. r. Hydraulic remote operated capacity control valve. s. Local operation capacity control valve. t. Submerged cargo pumps shall be arranged with double barriers (cofferdam), preventing the hydraulic system serving the pumps from being directly exposed to the cargo. The double barrier shall be arranged for detection and drainage of possible cargo leakages. <p>5.3. PORTABLE HYDRAULIC SUBMERGED CARGO PUMP (B-5139502A/B)</p> <p>5.3.1. Two (2) Portable Cargo Pumps (B-5139502A/B) shall be completed with at least the following components and accessories:</p> <ul style="list-style-type: none"> a. High-pressure hydraulic motor. b. Portable davit with pneumatic winch for lifting and lowering the pump into the cargo area tanks. c. Connection valves (ball valves and non-return valves) for connection of hydraulic hoses (pressure and return). d. Concentric hoses (two pieces) for pressure / return hydraulic oil to pump with adequate connecting on both sides and control valve for the pressure line. <ul style="list-style-type: none"> o Note 1: hose's length dimensioning shall consider the full access of the portable pump to the tanks bottom, following PACKAGER instruction / recommendations 			


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<ul style="list-style-type: none"> o Note 2: portable pumps not only to the cargo area inerted tanks but also to other adjacent compartments that in any event could be contaminated by oil. e. Cargo adapter – 1 (one). f. Tripod and other arrangements to allow the installation and removal of these pumps from the cargo area tanks. g. Tank hatch with special hatch cover with sluice valve and blind for all inerted structural tanks. <ul style="list-style-type: none"> o Note: for sluice valve details refer to I-DE-3010.2E-1350-944-P4X-003 – CARGO SYSTEM. h. Hatch sluice and special hatch cover to provide means of installing and operate portable pumps, avoiding gas leakage and ensuring tank integrity. i. A suitable place in the FPSO forecastle shall be provided by HULL SUPPLIER to store the portable cargo pumps, the flexible hoses, and the test facilities required by PACKAGER. j. The flexible hose shall be tightly stowed, and the minimum bending radius must be followed according to makers recommendation (PACKAGER to provide). k. A fixed drum and freshwater connection shall be provided for the portable cargo pumps yearly test. Drum drainage shall be done to forecastle bilge wells. The hydraulic headers shall have connections for hydraulic oil pressure and hydraulic oil return as near as possible the portable cargo pumps test place. <p>5.4. CARGO AREA SUBMERGED PUMPS FOR BALLAST TANKS (BALLAST PUMPS (FWD) AND BUTTERWORTH PUMPS)</p> <p>5.4.1. Ballast Pump (Fwd) (B-5335501A/B) and Butterworth Pump (B-5271502A/B) shall be centrifugal submerged pumps type with suction from the ballast tanks sea chests.</p> <p>5.4.2. Complete with at least the following components:</p> <ul style="list-style-type: none"> a. High pressure hydraulic motor. b. Hydraulic pipe stack. c. Deck trunk. d. Top cover plate. e. Bolts in stainless steel for connecting pumps top cover plate to deck trunk. f. Gasket between pump top cover plate and deck trunk. 			


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<p>g. Intermediate support rings.</p> <p>h. Automatic self-priming device for ballast pumps only: Self Priming Unit for Ballast Pumps (Fwd) – Z-B-5335501A/B.</p> <p>i. Cofferdam header tank.</p> <p>j. Hydraulic pressure line ball valve.</p> <p>k. Hydraulic return line non-return valve.</p> <p>l. Discharge and suction flange connection.</p> <p>m. Hydraulic remote operated capacity control valve.</p> <p>n. Local operation capacity control valve.</p> <p>o. Remote reading pressure transmitters with valves (installed submerged in the pump casing);</p> <p>p. Corrosion anodes for ballast and butterworth pumps.</p> <p>5.5. HYDRAULIC POWER UNIT FOR SUBMERGED PUMPS (UH-5139502A/B)</p> <p>5.5.1. Complete assembled, ready to be installed on board, with all components internally connected and wired, comprising at least the following components:</p> <p>a. Main hydraulic pumps with pulsation dampers.</p> <p>b. Hydraulic tank.</p> <p>c. Electric motors for hydraulic pumps driven (starter panel is not part of this scope).</p> <p>d. Electric motors fresh water coolers.</p> <p>e. Flexible coupling with hydraulic pump.</p> <p>f. Hydraulic oil fresh water coolers.</p> <p>g. Hydraulic oil filter with drain valve and differential pressure switch.</p> <p>h. Temperature control valve.</p> <p>i. Automatic pressure/flow control system.</p> <p>j. Pressure control system.</p> <p>k. Auxiliary Hydraulic Unit (UH-5139503A/B) integrated with Hydraulic Power Unit complete with electro-hydraulic feed pumps (one stand-by) including electric</p>			


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<p>motors and hydraulic oil expansion tank equipped with venting filter, local thermometer for reading of oil temperature and oil level switches.</p> <p>l. Hydraulic Oil Transmission Equipment including venting plugs for hydraulic pipe line, hydraulic heating valve and test connections.</p> <p>m. Hydraulic Oil Transfer Unit (UH-5139504) for hydraulic oil filling, venting and drainage using electric hydraulic transfer pump.</p> <p>n. Relief valves.</p> <p>o. Temperature sensors.</p> <p>p. Pressure switches, pressure transducers and adjustment valves as necessary for the safe and efficient operation of the PACKAGE.</p> <p>5.5.2. For Hydraulic Power Unit and control panel additional details and requirements refer to I-DE-3010.2E-5139-944-P4X-001 – HYDRAULIC SYSTEM FOR HYDRAULIC SUBMERGED PUMPS.</p> <p>5.6. HYDRAULIC POWER UNIT - CONTROL PANEL (PN-UH-5139502A/B-01)</p> <p>a. Alarm lamps and audible signal (buzzer) for warnings and shut down functions.</p> <p>b. Indicating lamps for power and running status of each component.</p> <p>c. Push buttons for start/stop of each hydraulic pump set, emergency stop, alarm reset and acknowledgement, test, and other functions.</p> <p>d. Instruments as required for safe monitoring of the unit according to PACKAGER's standard.</p> <p>e. One (1) independent starter panel for each auxiliary electrical driven hydraulic pump set with adequate protection.</p> <p>5.6.1. All components, controls, safety devices and alarms shall be according to the PACKAGER's standard and CS requirement.</p> <p>5.7. HYDRAULIC PIPING</p> <p>5.7.1. The main hydraulic piping scope of supply shall have the following items:</p> <p>a. High pressure, return and pilot lines pipes, supplied in pipe lengths.</p> <p>b. Flanges for above piping lines, supplied loose.</p> <p>c. Prefabricated isometrics.</p> <p>d. Pipe couplings.</p>			


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<p>e. Noise isolating fittings for high pressure, return and pilot lines, comprising Resilient pipe clamps.</p> <p>f. Resilient pipe clamps for cargo/drop lines close to cargo pumps.</p> <p>g. Resilient anchor supports.</p> <p>h. Resilient bulkhead penetrations for vertical and horizontal bulkheads.</p> <p>i. Fixed pipe clamps.</p> <p>j. Inlet and outlet isolation valves.</p> <p>5.7.2. For Hydraulic piping design additional details refer to I-DE-3010.2E-1350-944-P4X-003 – CARGO SYSTEM and I-DE-3010.2E-5139-944-P4X-001 - HYDRAULIC SYSTEM FOR HYDRAULIC SUBMERGED PUMPS.</p> <p>5.8. EQUIPMENT ONBOARD LOCATION</p> <p>5.8.1. Cargo area submerged pumps shall be installed inside the Hull cargo area structural tanks as cargo, slop, produced water and off-spec oil tanks and N°7 and N°8 water ballast tanks.</p> <p>5.8.2. For the hydraulic driven pumps option, HPU units including accessories and components shall be installed in a specific compartment inside the Engine Room and connected to the pumps through hydraulic oil headers on Main Deck on the Marine Pipe Rack.</p> <p>5.8.3. For PACKAGE Equipment Location refer to I-DE-GENERAL ARRANGEMENT and indications on P&IDs listed on the reference documents, item 3.1.</p> <p>5.8.4. PACKAGE equipment shall comply with hazardous area requirements. Document I-DE-AREA CLASSIFICATION – GENERAL shall be noted.</p> <p>6. PACKAGE TECHNICAL SPECIFICATION</p> <p>6.1. GENERAL</p> <p>6.1.1. PACKAGE shall be supplied as hydraulic driven design. For the electrical option refer to item 6.9 of this technical specification.</p> <p>6.1.2. Cargo area submerged pumps hydraulic actuation system design shall be supplied by PACKAGER. For the electric driven system option, the cargo area submerged pumps electrical actuation design shall be formally approved by PACKAGER.</p> <p>6.1.3. Cargo area submerged pumps installation and the interface with the Hull Systems as cargo, slop, produced water, off-spec oil, butterworth and water ballast system shall be formally approved by PACKAGER.</p>			


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<p>6.1.4. All Cargo area submerged pumps shall have rotation speed variation devices in both hydraulic and electrical options.</p> <p>6.1.5. PACKAGE design shall have devices for detection and protection of the PACKAGE equipment against high and low pressure scenarios with corresponding indication on SOS.</p> <p>6.1.6. PACKAGE interconnection piping supports, and accessories shall be PACKAGER standard. PACKAGER shall inform all assembly recommendations in advance. Material for tubing and related accessories shall comply with I-ET-3010.00-1200-800-P4X-015 – REQUIREMENTS FOR TUBING AND FITTING (ALIGNED TO IOGP-JIP33 S-716).</p> <p>6.1.7. For Cargo area submerged pumps operation fluid parameters as density, viscosity and others refer to Technical Data sheet item 3.1 of this technical specification.</p> <p>6.2. CARGO AREA SUBMERGED PUMPS</p> <p>6.2.1. All submerged pumps shall be vertical centrifugal type hydraulic driven with submerged pipe stacks.</p> <ul style="list-style-type: none"> ▪ Note 1: For electrical driven option refer to item 6.9 of this technical specification. ▪ Note 2: cargo area submerged portable pumps shall be hydraulic driven for both hydraulic and electrical PACKAGE design options. <p>6.2.2. Cargo area submerged pumps dimensions including pipe stacks sections / parts lengths shall be as per PACKAGER standard.</p> <ul style="list-style-type: none"> ▪ Note 1: the exact distance from the submerged pumps to the tanks bottom shall follow the PACKAGER recommendation and shall be able to dry the tanks without losing the pumps performance. ▪ Note 2: Oil Skimming pumps (B-5336502A/D) and Slop Oil Skimming pumps (B-1358501A/B) shall be installed on oil collecting basins (not PACKAGER scope of supply). Refer to item 3 reference documents. <p>6.2.3. All cargo area submerged pumps, pipe stacks and shafts, except pumps installed inside produced water and off-spec oil tanks, shall be fabricated in corrosion resistant materials adequate to its duty. The material shall be approved by OWNER.</p> <ul style="list-style-type: none"> ▪ Note 1: Submerged pumps installed on ballast, slop, produced water tanks and off-spec oil tank shall be super duplex stainless steel or 254 SMO material fabricated and considering the tanks maximum temperature of 80°C. <p>6.2.4. All Cargo area submerged pumps shall be provided with a PACKAGER standard</p>			

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<p>cathodic protection system with anodes to be dimensioned according to the following minimum period exposed to the sea water:</p> <ul style="list-style-type: none"> ▪ Two (02) years for cargo pumps. ▪ Six years (06) for all submerged pumps inside slop, ballast, produced water and off-spec oil tanks. <p>6.2.5. Produced Water Tank Transfer Pumps (B-5331502A/D), Oil Skimming Pumps (B-5336502 A/D) and Off-spec Oil Pumps (B-1223501A/B) shall have the discharge pressure / flowrates controlled. The pump control shall be capable to adjust the pump speed automatically according to a defined flowrate setpoint.</p> <p>6.2.6. Slop Discharge Pumps (B-5336503A/B) and Slop Pumps (B-5271501A/B - as backup) will feed two (2) Slop Treatment Centrifuges (SC-5336501A/B – not included on this PACKAGE) installed on main deck, each one with a capacity of 50 m³/h. The Centrifuges shall operate isolated (flowrate of 50m³/h) or simultaneously (flowrate of 100m³/h). Thus, Slop Discharge Pumps (B-5336503A/B) and Slop Pumps (B-5271501A/B) shall have means to control its discharge pressure / flowrates, allowing a synchronized operation with the Centrifuges. The pump control shall be capable to adjust the pump speed automatically according to a defined flowrate setpoint.</p> <ul style="list-style-type: none"> ○ Note: for the above further details refer to I-DE-3010.2E-5336-944-P4X-005 – SLOP DISCHARGE SYSTEM. <p>6.2.7. PACKAGER shall provide devices for detection and protection of the PACKAGE equipment against low and high pressure scenarios and with the corresponding indication on SOS. This shall include protections, for any pump of the PACKAGE, for the scenarios of blocked discharge or blocked suction.</p> <p>6.2.8. Cargo area submerged pumps shall be provided with protections for low level on the tank in which the pump is operating or suctioning from (possible damage due to cavitation, vibration, etc).</p> <p>6.2.9. Since Slop Oil Skimming Pumps (B-1358501A/B) and Oil Skimming Pumps (B-5336502A/D) shall be installed on oil collecting basins as mentioned on item 6.2.2/note 2 of this technical specification, PACKAGER shall provide protections to stop these pumps at the collecting basins low level scenario.</p> <p>6.2.10. All cargo area submerged pumps shall be provided with an anti-rotation mechanism to protect the pumps against counter-rotation movements.</p> <p>6.2.11. Cargo area submerged pumps pipe stacks shall have a purge system and a sealing monitoring system as indicated on I-DE-3010.2E-5241-944-P4X-005 – PURGING AND STRIPPING SYSTEM FOR SUBMERGED PUMPS PIPE STACKS.</p> <p>6.2.12. Cargo area submerged pumps purge system shall have protections against high and low nitrogen supply pressure (nitrogen supply is HULL SUPPLIER scope).</p>			

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<p>The maximum admissible nitrogen supply pressure shall be informed by PACKAGER.</p> <p>6.2.13. For Electrical, Instrumentation, automation and interface with CCR requirements refer to items 7.1 and 7.2 of this technical specification.</p> <p>6.3. CARGO AREA SUBMERGED PUMPS REMOVAL</p> <p>6.3.1. Submerged Pumps removal procedures shall comply with the PACKAGER's standards and shall be submitted to HULL SUPPLIER and OWNER for approval.</p> <p>6.3.2. Hatches with proper hatch covers (not PACKAGER scope of supply) shall be installed on the top of the tanks on Main Deck to allow the pumps removal from the tanks containing submerged pumps.</p> <p>6.3.3. PACKAGER shall inform the minimum dimensions of the hatches to allow the removal of the pumps.</p> <ul style="list-style-type: none"> ▪ Note: since there is not enough clearance between the main deck and the process plant modules, pipe stacks removal is not required, then the pipe stacks sectioning shall be defined as per PACKAGER standard. <p>6.3.4. One (1) tripod with suitable height to proceed with the above mentioned removal procedure shall be included in PACKAGER scope of supply.</p> <p>6.4. PORTABLE HYDRAULIC SUBMERGED CARGO PUMP (B-5139502A/B)</p> <p>6.4.1. Two (2) portable hydraulic submerged cargo pumps shall be supplied as item 5.3 of this technical specification. Those pumps shall be used in case of any of the malfunction of the cargo area submerged pumps or out of operation status.</p> <p>6.4.2. Portable hydraulic submerged cargo pumps shall be driven by the same HPU as the one defined for the cargo area submerged pumps drive. A smaller HPU dedicated solely for the portable hydraulic submerged pumps may be supplied as PACKAGER criteria.</p> <p>6.4.3. Portable Submerged Portable Pumps shall be installed through submerged caissons installed on the cargo area tanks as cargo, slop, produced water and off-spec oil tanks. Submerged caissons are HULL SUPPLIER scope of supply and installation requirements are defined on I-MD-3010.2E-1200-940-P4X-027 – DESCRIPTIVE MEMORANDUM – HULL SYSTEMS and on I-DE-3010.2E-1350-944-P4X-003 – CARGO SYSTEM.</p> <p>6.4.4. As indicated on I-DE-3010.2E-1350-944-P4X-003 – CARGO SYSTEM, Portable Submerged Portable Pumps shall be installed inside the tanks through the structural caissons there installed from the top to the bottom of the tanks in an area close to the original cargo area submerged pumps of this tank. PACKAGER shall advise the proper location and the caisson opening diameter.</p>			

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<ul style="list-style-type: none"> ▪ Note 1: sluice valves (PACKAGER scope) shall be installed at the top of the caissons on Main Deck to ensure no tank gases leaking during the portable pump installation inside the tanks as indicated on a typical detail of I-DE-3010.2E-1350-944-P4X-003 – CARGO SYSTEM. ▪ Note 2: these valves shall be installed not only on cargo, slop tanks, but also on produced water tanks and off-spec oil tanks. <p>6.5. HYDRAULIC POWER UNITS FOR SUBMERGED PUMPS (UH-5139502A/B)</p> <p>6.5.1. Two (2) Hydraulic Power Units (2 x 50%) shall be provided to drive the Cargo area submerged pumps as listed on item 5.1.</p> <p>6.5.2. Each Hydraulic Power Unit Skid shall be comprised by a combination of hydraulic pumps driven by electric motors running at HV 6,3 kV. The rated power of electric motors shall be limited to a maximum of 1040kW. Power ratings above this limit may be proposed by PACKAGER, subject to OWNER approval and feasibility with electrical systems.</p> <p>6.5.3. The power capacity of Hydraulic Power Units (UH-5139502A/B) and number of HV electric motors shall be dimensioned for the two (2) criteria below:</p> <p>A- MAXIMUM DEMAND: To run below cargo area submerged pumps simultaneously:</p> <ul style="list-style-type: none"> ▪ Six (6) Cargo Pumps (B-1350501A/T) @ 1200 m³/h. ▪ Two (2) Ballast Pump (FWD) (B-5335501A/B) @ 800 m³/h. ▪ Two (2) Produced Water Tank Booster Pump (B-5331501A/D) @ 670 m³/h. ▪ One (1) Off-Spec Oil Pump (B-1223501A/B) @ 300 m³/h. <p>B- SPARE POWER: To run below pumps simultaneously, with one (1) spare HV electric motor (and associated pump), on each Hydraulic Power Unit (UH-5139502A and UH-5139502B).</p> <ul style="list-style-type: none"> ▪ Six (6) Cargo Pumps (B-1350501A/T) @ 1200 m³/h. ▪ Two (2) Ballast Pump (FWD) (B-5335501A/B) @ 800 m³/h. <p>Note: For each pump head and additional information, refer to respective pump datasheet (see item 3).</p> <p>6.5.4. HPU shall have both hydraulic oil circuit and HV electric motors fresh water cooled. PACKAGER shall inform the required parameters for the fresh water cooling as the minimum flow, inlet temperature and heat transfer rate.</p> <p>6.5.5. Fresh water heat exchangers shall comply with following technical specifications:</p>			

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<ul style="list-style-type: none"> I-ET-3010.00-1200-451-P4X-001 - REQUIREMENTS FOR SHELL AND TUBE HEAT EXCHANGER DESIGN AND FABRICATION; or I-ET-3010.00-1200-456-P4X-001 - REQUIREMENTS FOR PLATE HEAT EXCHANGER DESIGN AND FABRICATION; and I-ET- MATERIAL SPECIFICATION FOR HEAT EXCHANGERS. <p>6.5.6. Each HPU (UH-5139502A/B) shall be capable to supply hydraulic power to run any cargo area submerged pump of the system. On this situation, it can be assumed that one HPU is in operation (feeding all pumps of the system) and the other HPU is not operating.</p> <p>6.5.6.1. The HPU control panels (PN-UH-5139502A/B-01) shall be designed considering above scenarios, to provide an equivalent control (alarms, pump/HPU protections, interlocks, etc) as the case where each HPU is hydraulic isolated from each other.</p> <p>6.6. HYDRAULIC PIPING SYSTEM</p> <p>6.6.1. The hydraulic power distribution system shall be composed by at least two (2) longitudinal pressure headers and one (1) return header to be installed over the Main Deck, connecting each HPU to the cargo area submerged pumps.</p> <ul style="list-style-type: none"> Note: the hydraulic power distribution to the cargo area submerged pumps shall be performed by means of hydraulic piping PACKAGER standard. Note: for the minimum requirements of hydraulic piping arrangement refer to I-DE-3010.2E-5139-944-P4X-001 – HYDRAULIC SYSTEM FOR HYDRAULIC SUBMERGED PUMPS. <p>6.6.2. The portable cargo pumps shall be connected to the longitudinal headers by hoses provided with valves and connection fittings.</p> <p>6.6.3. The cargo area submerged pumps hydraulic control system is provided by a bundle of tubings connecting the remote control valve assembly to the cargo area submerged pumps for the pumps control valve pilot.</p> <p>6.6.4. The design of hydraulic piping, tubing, valves, fittings, accessories and all parts / components detailed on item 5.7 shall be PACKAGER's standard and submitted to HULL SUPPLIER for approval, however, material for tubing and related accessories shall comply with I-ET-3010.00-1200-800-P4X-015 – REQUIREMENTS FOR TUBING AND FITTING (ALIGNED TO IOGP-JIP33 S-716). This requirement does not exempt the compliance of item 6.5.6 above.</p> <p>6.6.5. PACKAGER shall issue all recommendations for the hydraulic oil piping and tubing design, supply, fabrication, assembly, interconnection, and testing onboard.</p> <p>6.6.6. As indicated on I-DE-3010.2E-5139-944-P4X-001 – HYDRAULIC SYSTEM FOR HYDRAULIC SUBMERGED PUMPS, since hydraulic oil headers shall be</p>			

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installed on Main Deck in a higher position than the HPU and hydraulic oil storage tanks, PACKAGER shall provide feed pumps (or “black out pumps”) to keep the hydraulic oil inventory full inside piping lines to avoid the return of hydraulic oil to the structural storage tanks and to the Auxiliary Hydraulic Units tanks, when the system is stopped or during any shutdown event.

- Note: the solution of item 6.6.6 shall ensure the full restart of the system with the full inventory on the cargo area submerged pumps hydraulic oil system.
- The rated power of this feed pumps (or “black out pumps”) shall be limited to 1.5KW in order to be suitable with FPSO electrical generators during shutdown events.

6.6.7. The hydraulic piping specification supplied by PACKAGER shall be at least:

- high pressure pipes: duplex stainless steel.
- low pressure pipes: stainless steel AISI 316 or equivalent.
- pilot tubing: material shall comply with I-ET-3010.00-1200-800-P4X-015 – REQUIREMENTS FOR TUBING AND FITTING (aligned to IOGP-JIP33 S-716).

6.6.8. PACKAGER shall provide two (02) rack panels (PN-UH-5139502A/B-02 – REMOTE CONTROL VALVE ASSEMBLY) for the hydraulic valves remote control, as per I-DE-3010.2E-5139-944-P4X-001 – HYDRAULIC SYSTEM FOR HYDRAULIC SUBMERGED PUMPS.

6.6.9. Below arrangements shall be provided for each submerged pumps isolation:


- Hydraulic pressure header: Double block & bleed (two blocking valves with intermediate drain).
- Hydraulic return header: Single block & bleed (one blocking valve with drain – besides the non return valve).

6.7. ENGINEERING SERVICES

6.7.1. PACKAGER shall submit to HULL SUPPLIER as part of the documents for approval, a schematic layout of hydraulic high pressure, return and pilot lines piping system inside Engine Room and along Main Deck cargo area, including piping sizes and characteristics.

6.7.2. As well, standard drawings of piping accessories, such as noise isolating fittings (resilient and fixed pipe clamps and bulkhead penetrations), and design recommendations for the correct assembling shall be provided.

6.7.3. Based on this information, HULL SUPPLIER shall prepare and submit to PACKAGER approval, a piping layout showing the actual piping routing and the

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location of inlet and outlet connections of the equipment.

6.7.4. Based on this information PACKAGER shall submit to HULL SUPPLIER's appraisal the following information:

- Isometrics to be used for manufacturing purposes, as well as the location of all piping accessories.
- Hydraulic Piping Calculation.
- List of Material.
- Technical Data Book containing specification, drawings of piping components.
- Documentation of compliance with CS requirements.

6.7.5. If deemed as necessary, a technical meeting between PACKAGER, HULL SUPPLIER and shipyard team will be held with the purpose of clarifying technical details and scope of supply.

6.8. LOCAL CONTROL PANEL (PN-UH-5139502A/B-01) AND REMOTE WORKSTATION (PN-UH-5139502A/B-03)

6.8.1. The Remote Workstation (PN-UH-5139502A/B-03) shall be installed by HULL SUPPLIER in the Control Room – Operation Ambiance, in the same console as SOS-HMI, and shall perform all system control and monitoring.

6.8.2. The Local Control Panel (PN-UH-5139502A/B-01) shall be installed by HULL SUPPLIER at the same room as the Hydraulic Power Unit (UH-5139502A/B) skid inside Engine Room and shall perform all system control and monitoring.

- Note: for the electrical driven option the local control panel shall be installed close to the PACKAGE VSD panels.


6.8.3. The Remote/Local Control panels selecting key shall be designed, supplied and installed by PACKAGER in the Hydraulic Power Unit for Submerged Pumps (UH-5139502A/B). The status of this key shall be monitored in above mentioned HPU Room and in the CCR.


- Note: The interconnection between local control panel (PN-UH-5139502A/B-01) and remote Workstation in CCR (PN-UH-5139502A/B-03) shall be by dedicated network.

6.8.4. To ensure automation redundancy PACKAGE shall have two PLCs.

6.8.5. One PIT (pressure indicator and transmitter) to be installed at the discharge of each submerged pump shall be supplied by PACKAGER with the function to alarm and to stop the pumps at the shut-off condition.

6.8.6. In case, it is required by PACKAGER to adopt more HPU CONTROL PANELS,

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<p>PN-UH-5139502A/B-01, than indicated on I-DE-3010.2E-5139-944-P4X-001, this additional equipment shall be included on PACKAGER scope of supply.</p> <p>6.8.7. Hydraulic Power Unit Control panel (PN-UH-5139502A/B-01) shall provide an alarm at FPSO SOS, if any pump of the PACKAGE stops while operating (without a command by the crew to do so).</p> <p>6.8.8. Hydraulic Power Unit Control panel (PN-UH-5139502A/B-01) shall provide protections and alarms at FPSO SOS for scenarios where cargo area submerged pumps are operating outside their recommended operating range, including scenarios of exceeding pump nominal flowrate.</p> <p>6.9. CARGO AREA SUBMERGED PUMPS DRIVEN BY ELECTRICAL MOTORS ON MAIN DECK – ALTERNATIVE SOLUTION</p> <p>6.9.1. In case HULL SUPPLIER decides to supply cargo area submerged pumps driven by electrical motors on Main Deck instead of hydraulic submerged pumps, the following actions shall be taken:</p> <p>6.9.2. One (1) hydraulic power unit shall be supplied to drive the portable hydraulic submerged cargo pump and the hydraulic piping with fittings, valves and all necessary accessories shall be supplied to the operation of portable hydraulic submerged cargo pumps.</p> <p>6.9.3. The driving shafts of the pumps shall be supported by forced lubricated bearings. Dedicated pumps and a heat exchanging system at the shaft upper part transmission shall be included in the lubrication system that shall consider tropical conditions for the correct dimensioning. Use of cargo oil or oil water mixtures will not be accepted.</p> <p>6.9.4. Electrical motors to drive the cargo area submerged pumps shall be each one installed on Main Deck and shall be vertical type, compatible with zone 1, IP56 protection degree and approved by CS.</p> <p>6.9.5. FPSO Hull shall have two (02) VSD rooms, being one at the forecastle and other on Engine Room.</p> <ul style="list-style-type: none"> ▪ Note: each pump shall be driven by at least one (01) VSD. <p>6.9.6. Two (2) transformers for feeding the VSD. For installation in a closed compartment in the UNIT Hull.</p> <p>6.9.7. The total amount of VSDs shall be able to run simultaneously:</p> <ul style="list-style-type: none"> ▪ Six (6) Cargo Pumps (B-1350501A/T) @ 1200 m³/h. ▪ One (2) Water Ballast Pump (B-5335501A/B) @ 800 m³/h. ▪ Two (2) Produced Water Tank Booster Pump (B-5331501A/D) @ 670 m³/h. 			

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▪ One (1) Off-Spec Oil Pump (B-1223501A/B) @ 300 m³/h.

Note: For additional information, refer to each pump datasheet (see item 3).

6.9.8. VSDs spares shall be provided. VSDs shall be interchangeable in such a way that could support the malfunction of other similar one installed.

6.9.9. The submerged deepwell pumps shall only be controlled by the CCR.

6.9.10. PACKAGER shall supply a control and monitoring panel for the PACKAGE pumps.

6.9.11. The electrical arrangement and design shall be supplied by the HULL SUPPLIER and be approved by the PACKAGER as mentioned on 6.1.2.

6.9.12. At the decision to supply submerged pumps driven by electrical motors on main deck, HULL SUPPLIER shall revise all the Hull auxiliary systems, HVAC, electrical arrangement, and the arrangement of all compartments affected by this decision according to comply with the electrical submerged pumps alternative characteristics, since REFERENCE HULL 01 FPSO Design is based on a hydraulic power submerged pumps system.

7. GENERAL REQUIREMENTS


7.1. ELECTRICAL REQUIREMENTS

7.1.1. Electrical equipment and material shall comply with requirements of the following references:

- a) I-ET-3010.00-5140-700-P4X-002 – SPECIFICATION FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS.
- b) I-ET-3010.00-5140-712-P4X-001 – LOW-VOLTAGE INDUCTION MOTORS FOR OFFSHORE UNITS.
- c) I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS.
- d) I-ET-3010.00-5140-700-P4X-001 – SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS.
- e) I-DE-3010.00-5140-700-P4X-003 – GROUNDING INSTALLATION TYPICAL DETAILS.
- f) I-ET-3010.00-5140-712-P4X-002 – MEDIUM-VOLTAGE INDUCTION MOTORS FOR OFFSHORE UNITS.

7.2. INSTRUMENTATION AND AUTOMATION REQUIREMENTS

7.2.1. PACKAGE instrumentation and control design shall fulfill the requirements of the

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following technical specifications:

- a) I-ET-3010.00-1200-800-P4X-002 – AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS.
- b) I-ET-3010.00-1200-800-P4X-013 – GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS.
- c) I-ET-AUTOMATION INTERFACE OF PACKAGE UNITS.
- d) I-ET-3010.00-5520-888-P4X-001 – AUTOMATION PANELS.

7.3. MACHINERY PROTECTION SYSTEM (MPS)


Note: item 7.3 is only applicable to HPU electric motors and pumps. This item shall not be applicable to submerged pumps.

- 7.3.1. Machinery Protection System (MPS) shall be according to the API 670 latest revision.
- 7.3.2. HPU pumps probe arrangement shall be under PACKAGE / MANUFACTURER's standard.
- 7.3.3. All vibration and temperature protection systems shall be according to Original Equipment Manufacturer (OEM) standards and API 670 compliant.
- 7.3.4. Monitors shall be assembled on Local Control Panel (PN-UH-5139502A/B-01) in Engine Room.
- 7.3.5. The vibration signals (including displacement and accelerometers) of the whole train shall have an unfiltered output at the UCP (one per channel) for recording and maintenance purposes.

7.4. MACHINERY MONITORING SYSTEM (MMS)

Note: item 7.4 is only applicable to HPU electric motors and pumps. This item shall not be applicable to submerged pumps.

- 7.4.1. Besides the control and supervisory UCP system, Machinery Protection System shall be integrated in the Machinery Monitoring System (MMS) of the FPSO, provided by others, for maintenance purposes.
- 7.4.2. PACKAGER shall provide interface cards installed in the Machinery Protection System to allow the interconnection with the MMS (software and hardware). All vibration signals (including displacement and accelerometers) shall be available with buffer signal output.
- 7.4.3. For a basic description, the primary function of this system is to perform analysis of the mechanical parameters: all machinery protection system signals (with possibility to make analysis like FFT, full spectrum, Bode plot, cascade and

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waterfall diagrams, shaft average center line, orbit, X-Y plot and experience-based vibration analysis) and auxiliary system signals (lube, seal, etc.).

- 7.4.4. MPS radial vibration monitoring cards shall have all available variables enabled to send data to MMS.
- 7.4.5. In addition to the signal available through the MPS Communication Card, PACKAGER shall make available the required process variable signals presented in the I-ET-3010.00-5500-854-P4X-001 – MACHINERY MONITORING SYSTEM, through the Package Fast Ethernet Network to perform the functions above in the Machinery Monitoring System.
- 7.4.6. PACKAGER shall provide all documentation of vibration signals and configuration files of the Machinery Protection System to be implemented by the MMS Supplier for Monitoring System configuration.
- 7.4.7. Connectivity to external system through open communication protocols shall be MODBUS and OPC (Open Platform Communications) by Ethernet TPC/IP Protocol. All I/O variables, controllers (including performance, load sharing and surge) and first-out events shall be available.

7.5. AVAILABLE ON BOARD

7.5.1. As indicated on I-DE-3010.2E-5139-944-P4X-001 – HYDRAULIC SYSTEM FOR HYDRAULIC SUBMERGED PUMPS PACKAGE hydraulic system shall have structural hydraulic oil storage and drain tanks (not PACKAGER supply scope) to be assembled on Engine Room, close to the Hydraulic Power Units room.

- TQ-5139501 Hydraulic Storage Tank for Submerged Pumps
- TQ-5139502 Hydraulic Drain Tank for Submerged Pump
 - Note: PACKAGER may advise any requirement or any necessary device to be installed for those above tanks.


7.5.2. PACKAGER shall inform all the consumables: total electric consumption of each voltage, as well as the individual power of each consumer.

7.5.3. For available utilities refer to I-RL– GENERAL SPECIFICATION FOR AVAILABLE UTILITIES.

Note: The fresh water cooling referenced on this document refers to Topsides cooling system. For Engine room fresh water cooling system, refer to I-FD-3010.2E-5120-456-P4X-001 – ENGINE ROOM CENTRAL FRESH WATER COOLER (P-5120501A/B) and I-DE-3010.2E-5120-944-P4X-001 – ENGINE ROOM CENTRAL FRESH WATER COOLING SYSTEM.

7.6. PAINTING REQUIREMENTS

7.6.1. Painting and coating in accordance with I-ET-3010.00-1200-956-P4X-002 –

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GENERAL PAINTING and DR-ENGP-I-1.15 COLOR CODING.

7.6.2. All components shall be delivered fully painted/coated, unless otherwise indicated on this specification.

7.6.3. The performed pre-treatment and complete coating shall be in accordance with the paint manufacturer's data sheets.

7.7. SKIDS LAYOUT AND FOUNDATION REQUIREMENTS

7.7.1. PACKAGE components detailed on item 6 which are supplied assembled on skids shall follow the below minimum requirements.

7.7.2. PACKAGE skid structure shall be designed to withstand the design conditions mentioned on item 4.4 and to ensure the lifting conditions on manufacturing site and shipyard. Lifting lugs shall be provided according to PACKAGER lifting procedure.

7.7.3. The skid main frame shall be all welded construction. Structural skid welds, including lifting facilities shall be continuous and shall comply with AWS D1.1 (structural welding code) and CS Rules. Skid structure shall be designed to be welded to the supporting structure unless otherwise specified.

7.7.4. PACKAGE skid layout and arrangement shall be designed to provide sufficient access to pumps, instruments, equipment, and control panels to ease the operability and maintenance with safe conditions. Instruments and valves shall be installed on a suitable height to allow safe access for monitoring, operation, and maintenance.

7.7.5. All necessary maintenance davits, monorails, padeyes or trolleys shall be provided to ensure the safe and easy maintenance conditions.


7.7.6. Access ladders, platforms, gratings and any other access device shall comply with I-ET-3010.00-1352-130-P4X-001 - FLOOR GRATINGS, TRAY SYSTEMS AND GUARDRAILS MADE OF COMPOSITE MATERIALS, where non-metallic material is used. Metallic material is also acceptable. For grating requirements (metallic and non-metallic), I-DE-3010.2E-1351-140-P4X-001 – HULL GENERAL NOTES AND TYPICAL DETAILS shall be followed.


7.7.7. PACKAGE skid shall have a drip pan to collect drained water from the equipment with drain flanges for the connection with the Hull draining system.

7.7.8. PACKAGE Equipment and components shall be located entirely within the skids / equipment base perimeter, including all equipment, piping, valves, electrical, instrumentation and controls.

7.8. NAMEPLATES AND TAG NUMBERING

7.8.1. PACKAGER / MANUFACTURER Equipment shall have nameplates in Brazilian Portuguese language, made of stainless steel AISI 316L, with 3 mm minimum

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<p>thickness and fixed by stainless steel (AISI 316L) bolts or fasteners on visible and accessible location.</p> <p>7.8.2. Tagging of all instruments, electrical, mechanical and piping items, including valves, shall be carried out as detailed on I-ET-3000.00-1200-940-P4X-001 – TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN</p> <p>8. PACKAGE MANUFACTURING AND DELIVERY REQUIREMENTS</p> <p>8.1. GENERAL</p> <p>8.1.1. All materials and equipment supplied by PACKAGER / MANUFACTURER shall be brand new (not overhauled), field proven, free from defects and accepted by Owner and the Classification Society.</p> <p>8.1.2. Materials and equipment shall be manufactured according to internationally recognized standards for the offshore oil drilling and production industries and shall be in conformance with the Basic Design and Agreement specifications and requirements.</p> <p>8.1.3. Field proven definition: Systems and equipment shall demonstrate satisfactory operation at least in 3 floating offshore installation units, operating under process conditions (pressure, flow, capacity and similar fluids) for a minimum of 24,000 hours. For rotating equipment, they must demonstrate operation with fluid, flow and discharge pressure similar to the design. Unproven designs or prototypes (including components) without offshore service will not be accepted.</p> <p>8.2. WELDING</p> <p>8.2.1. PACKAGE equipment, structures and piping welding, welding inspection, non-destructive testing (NDT), bolted joints assembly and piping fabrication and commissioning activities shall be performed in compliance with the following technical specifications:</p> <ul style="list-style-type: none"> a) I-ET-3010.00-1000-970-P4X-002 – Requirements for NDT. b) I-ET-3010.00-1000-955-P4X-002 – Requirements for Welding Inspection. c) I-ET-3010.00-1000-955-P4X-001 – Welding. d) I-ET-3010.00-1200-200-P4X-001 – Requirements for Bolted Joints Assembly and Management. e) I-ET-3010.00-1200-200-P4X-115 – Requirements for Piping Fabrication and Commissioning. <p>8.3. DOCUMENTATION</p> <p>8.3.1. For the PACKAGE documentation and data-book requirements refer to EXHIBIT III – DIRECTIVES FOR ENGINEERING and to EXHIBIT V – DIRECTIVES FOR</p>			

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PROCUREMENT.

8.4. SPARE PARTS

8.4.1. For the PACKAGE, spare parts, special tools, CS required spare parts and spare parts list recommended for two (2) years of operation refer to EXHIBIT V – DIRECTIVES FOR PROCUREMENT.

8.5. INSPECTION AND TESTS

8.5.1. For PACKAGE inspection, tests, factory acceptance test (FAT) and inspection release certificate (IRC), refer to EXHIBIT V – DIRECTIVES FOR PROCUREMENT.

8.5.2. For PACKAGE inspection and test plan (ITP) requirements refer to EXHIBIT VII – DIRECTIVES FOR QUALITY ASSURANCE SYSTEM.

8.6. PRESERVATION, PACKING AND TRANSPORTATION

8.6.1. For PACKAGE preservation, packing and transportation requirements refer to EXHIBIT V – DIRECTIVES FOR PROCUREMENT.