	TECHNICAL SPECIFICATION	Nr: I-ET-3010.1Y-5336-661-P4X-001
	CLIENT: BÚZIOS	SHEET: 1 of 21
	JOB : HIGH CAPACITY FPSO	
	AREA: BÚZIOS	
SRGE	TITLE: SLOP TREATMENT UNIT	INTERNAL ESUP

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INDEX OF REVISIONS

REV.	DESCRIPTION AND/OR REVISED SHEETS
0	ORIGINAL ISSUE
A	GENERAL REVISION, NEW AIT/SAMPLING POINT REQUIREMENTS
B	REVISED WHERE INDICATED TO COMPLY WITH HAZOP RECOMMENDATION

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATE	MAR/12/21	MAR/30/21	APR/06/21						
PROJECT	ENG	ENG	ENG						
EXECUTION	PMX4	PMX4	CXW3						
CHECK	CXW3	CXW3	PMX4						
APPROVAL	CYEL	CYEL	CYEL						

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



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1. INTRODUCTION

1.1 OBJECTIVE

This specification describes and specifies the minimum requirements and criteria in conformance with relevant regulations and High Capacity FPSO Basic Design documentation, for the design, manufacturing, assembly, supply, installation and tests of the SLOP TREATMENT UNIT (Z-5336501) Package, conceived to treat oily water from Slop Tanks, prior its proper discharge overboard to the sea.

1.2 DEFINITIONS

PACKAGE: Defined as an assembly of equipment supplied interconnected, tested and ready to operate, requiring only the available utilities from the Unit for Package operation, generally supplied onto an integral Skid.

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

SLOP TREATMENT UNIT (Z-5336501) the package name.

All definitions in I-ET-3010.00-1200-940-P4X-002 – GENERAL TECHNICAL TERMS

1.3 ABBREVIATIONS

FPSO: Floating Production Storage and Offloading Unit

AIT: Analyzer, Indicator and Transmitter

SOS: Supervisory and Operation System

SOS – HMI: Human Machine Interface of SOS

FIT – Flow Indicator and Transmitter

2. NORMATIVE REFERENCES

All equipment shall comply with the requirements of this technical specification and normative references as stated below.

2.1 INTERNATIONAL CODES, RECOMMENDED PRACTICES AND STANDARDS

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

- ANSI American National Standards Institute
- API American Petroleum Institute
- ASME American Society Of Mechanical Engineers

- BGV German Safety Regulations
- DIN German National Standard Code
- EN European Standards
- ISO International Standard Organization
- VDE / IEC German National Electric Standard Codes / International Electric Codes
- Classification Society defined for the Hull scope.
- MARPOL 73/78 Convention
- IMO Marine Environment Protection Comitee 1975
- Resolution IMO MEPC 107 (49) 2003

2.2 BRAZILIAN CODES AND STANDARDS

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

2.3 CLASS APPROVAL AND CERTIFICATION

The 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

REF DOC NUMBER	REF DOC NAME
I-DE-3010.1Y-1200-942-P4X-002	GENERAL ARRANGEMENT
I-DE-3010.1Y-5400-94A-P4X-001	AREA CLASSIFICATION – GENERAL
I-DE-3010.1Y-1200-944-P4X-001	GENERAL NOTES
I-DE-3010.1Y-5336-944-P4X-005	SLOP DISCHARGE SYSTEM
I-DE-3010.1Y-6124-944-P4X-001	HULL SERVICE AND INSTRUMENT AIR DISTRIBUTION
I-ET-3A36.00-1000-941-PPC-001	METOCEAN DATA
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
I-ET-3010.00-1200-956-P4X-002	GENERAL PAINTING
DR-ENGP-I-1.15	COLOR CODING
I-ET-3010.1Y-1200-200-P4X-002	HULL PIPING SPECIFICATION
I-ET-3010.00-1200-251-P4X-001	BOLT MATERIALS
I-ET-3010.00-5400-947-P4X-002	SAFETY SIGNALING
I-ET-3010.1Y-1200-300-P4X-002	NOISE CONTROL REQUIREMENTS FOR ACCOMMODATION / SHIPSIDE
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-3010.00-1200-800-P4X-002	AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS
I-ET-3010.1Y-1200-800-P4X-014	AUTOMATION INTERFACE OF PACKAGE UNITS
I-ET-3010.00-1200-800-P4X-013	GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS
I-ET-3010.00-5520-888-P4X-001	AUTOMATION PANELS
I-ET-3010.1Y-1200-800-P4X-005	FIELD INSTRUMENTATION
I-ET-3010.00-1200-588-P4X-001	SAMPLE CONNECTIONS
I-FD-3010.1Y-5336-661-P4X-001	SLOP TREATMENT CENTRIFUGES
I-RL-3010.1Y-1200-940-P4X-001	GENERAL SPECIFICATION FOR AVAILABLE UTILITIES
I-RL-3010.1Y-1350-960-P4X-009	MOTION ANALYSIS
I-ET-3010.1Y-1350-960-P4X-002	DESIGN REQUIREMENTS - NAVAL ARCHITECTURE

I-ET-3000.00-1200-940-P4X-001	TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN
I-ET-3010.00-1200-955-P4X-001	WELDING
I-ET-3010.00-1200-955-P4X-002	REQUIREMENTS FOR WELDING INSPECTION

Table 1 – High Capacity FPSO Design Reference Documents

Note: Reference Documents latest revision shall be considered.

4. DESIGN REQUIREMENTS

4.1 DESIGN CONDITIONS

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.

PACKAGER shall design the equipment for the full range of operational conditions as specified in this technical specification.

Where applicable on a FPSO, the whole slop treatment unit Package and its components must observe specific international regulations such as Resolution IMO MEPC 107 (49) 2003, and the correlates IMO Marine Environment Protection Comitee 1975 and MARPOL 73/78 Convention.

PACKAGE Equipment shall be designed with the compliance of the normative and design requirements as stated in this specification and also complying with the technical parameters stated on the referred Technical Data Sheets indicated on the above High Capacity FPSO basic design reference documents (item 3).

All elements of the PACKAGE shall be of proven design and well within the manufacturer's actual experience.

4.2 SAFETY REQUIREMENTS

Personnel safety protection shall be provided according to Regulatory Standards (NR) by Brazilian Ministry of Labor.

Warning signs in Brazilian Portuguese language shall be provided where risk of personnel injury exist.

Rotating equipment outer parts, such as pulleys, couplings, belts and flywheels, shall have rigid protection, manufactured with aluminum ASTM B211 and easily removed.

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".

Safety signaling shall be in full compliance with I-ET-3010.00-5400-947-P4X-002 SAFETY SIGNALING.

Double block & bleed arrangements are required for isolation of equipment in piping classes of 300# and above.

4.3 NOISE AND VIBRATIONS

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

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

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

All environmental conditions are defined in I-ET-3A36.00-1000-941-PPC-001 – METOCEAN DATA, at any draft from fully loaded to the minimum loaded / ballasted condition.

For the Hull loading conditions details and the maximum designed operational trim and heel inclinations refer to I-ET-3010.1Y-1350-960-P4X-002 – DESIGN REQUIREMENTS - NAVAL ARCHITECTURE.

For the design data and information regarding motion requirements refer to I-RL-3010.1Y-1350-960-P4X-009 – MOTION ANALYSIS.

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

5. PACKAGE SCOPE OF SUPPLY AND LOCATION

5.1 SCOPE OF SUPPLY

Equipment	TAG	Qty
SLOP TREATMENT UNIT	Z-5336501	1

Table 2 – PACKAGE Scope of Supply

Preferably the Slop Treatment Unit shall be provided in a sole Skid. If it is not possible due to space restrictions on main deck or due to Packager limitation, two (2) skids shall be provided, both positioned close to each other on main deck. The following equipment or components shall be supplied by the Slop Treatment Unit Packager, as integral parts of the Package, inside its Skid limits:

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- 2 x 100% Slop Treatment Centrifuges (SC-Z-5336501-A ; SC-Z-5336501-B), 50m³/h capacity each, driven by electrical induction motors. The centrifuges shall operate isolated (50m³/h capacity) or simultaneously (100m³/h).
- 2 slop treatment centrifuges integral Control Panels; one for each centrifuge;
- 2 integral centrifuge Sludge Collection Tanks, to collect Sludge (solids and residual water), result of the Slop Treatment Unit, prior its discharge back to Slop Tanks;
- 2 integral positive displacement centrifuge Sludge Pumps to periodically pump the sludge (solids and residual water) from the sludge collection tanks of each Centrifuge to the Slop Tanks;
- 2 integral centrifuge devices (or pumps) to forward separated oil to Slop Tanks;
- 2 integral centrifuge devices (or pumps) to forward separated water to overboard discharge (treated water) or its return to Slop Tanks (non-treated water);
- 2 FIT Flowmeters to measure and totalize treated water directed to overboard discharge;
- Slop Treatment Unit Package Control Valves;
- One Oil Content Sensor AIT, on Centrifuges unified outlet, commanding via Control Valves, the treated effluent water to overboard discharge or return untreated effluent water to Slop Tanks;
- One Slop Treatment Centrifuges Heater, receiving water from Fresh Water Distribution (I-DE-3010.1Y-5115-944-P4X-003). Auxiliary systems data are informed on I-RL-3010.1Y-1200-940-P4X-001 – GENERAL SPECIFICATION FOR AVAILABLE UTILITIES

PACKAGE shall be connected, wired and supplied as a complete unit, ready for installation and operation.

Additionally, all piping interconnections, flanges, valves, control valves, instruments and all other necessary accessories shall be supplied by PACKAGER in order to ensure the required performance degree of the PACKAGE under safe conditions. All of those items shall be installed within Skid limits.

5.2 EQUIPMENT LOCATION

SLOP TREATMENT UNIT shall be installed on Main Deck, a classified area, aft-portside. All applicable hazardous area certificates shall be supplied.

For equipment location both I-DE-3010.1Y-1200-942-P4X-002 – GENERAL ARRANGEMENT and I-DE-3010.1Y-5400-94A-P4X-001 – AREA CLASSIFICATION PLAN shall be considered.

6. PACKAGE SPECIFICATION

6.1 GENERAL

Slop Treatment Unit (Z-5336501) Package has the purpose to treat oily waters received in Slop Tanks TQ-5336506P/S and discharge treated water overboard.

According to Figure 1 below, besides the two Slop Treatment Centrifuges SC-Z-5336501 A/B, 50 m³/h capacity each, the skid shall be provided with internal by-pass.

The Skid shall be provided with an Oil Content Sensor AIT to check the oil content of the effluent water after the centrifugation process. If it is less or equal to 15 ppm the discharge (treated effluent water) shall be automatically directed overboard to sea. If the oil content is higher than 15 ppm the discharge (untreated effluent water) shall be automatically returned to the slop tanks.

The Skid shall be provided with control valves to divert the discharge of treated or untreated effluent water automatically. On the treated water overboard discharge line stream, two (2) sequential redundant control valves shall be provided, one of them shall have a “fail close” (FC) actuator and the other “fail let” (FL). The untreated effluent water control valve (slop discharge) shall have a “fail open” (FO) actuator.

According to Figure 1, the slop treatment unit Skid shall be provided with two (2) FIT Flowmeters to indicate and record the amount of treated effluent water discharged overboard. The FIT Flowmeters shall be integrated with FPSO supervisory system in the control room.

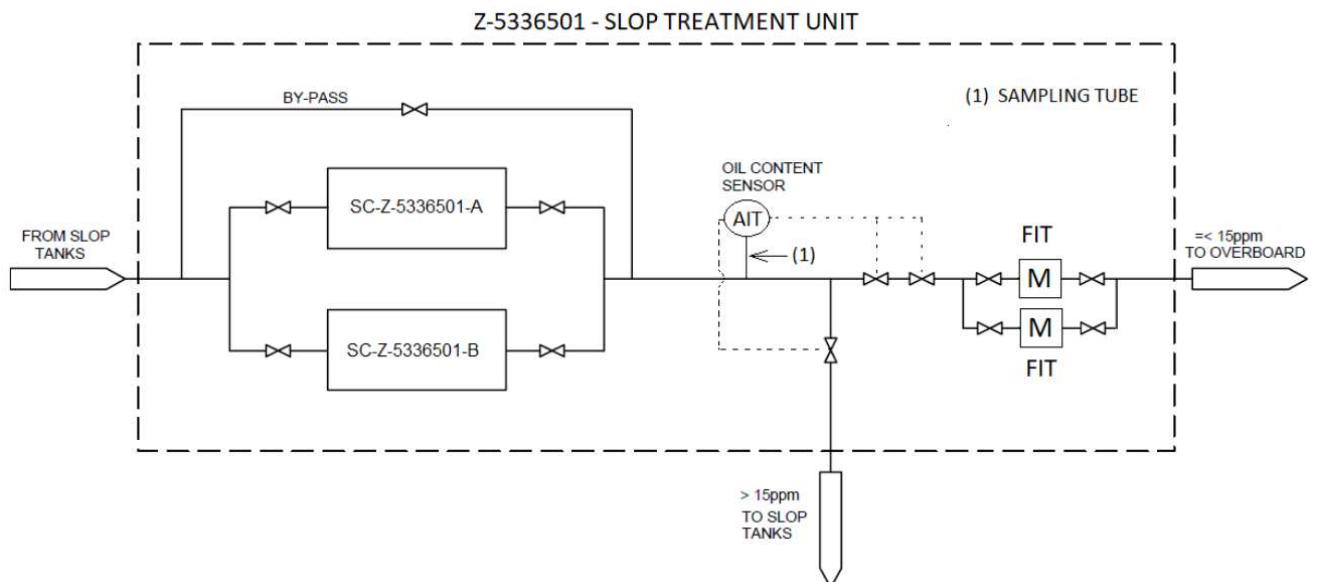


Figure 1 – Slop Treatment Scheme

The skid shall be provided by Packager with protections against oily water inlet low or no-flow or inlet overflow to avoid centrifuges damage. It shall be provided centrifuges integral control valves and FITs (flow indicator and transmitters) to regulate flow through

each centrifuge, allowing inlet overflows to be diverted back to slop tanks using a dedicated overflow line, according to I-DE-3010.1Y-5336-944-P4X-005. These centrifuges protections shall be able to stop the centrifuges.

The Skid shall be provided with inlet oily water low and high pressure protection to avoid centrifuges damage. These additional protections shall be conceived, despite the centrifugal submerged pumps, feeding the Slop Treatment Unit, own flow and pressure control. These centrifuges protections shall be able to stop the centrifuges.

The main pumps to send oily water from Slop Tanks to the Slop Treatment Unit are the Slop Discharge Pumps B-5336503A/B, 100 m³/h capacity each, one pump in each slop tank. Alternatively, Slop Pumps B-5271501A/B, 450 m³/h capacity each, one in each Slop Tank, could be aligned to this purpose, as back-up pumps.

The Centrifuges shall be self-cleaning, with the skid supplied with a heater, fed from a Fresh Water Distribution (I-DE-3010.1Y-5115-944-P4X-003) outlet, to allow in-place cleaning procedures.

The sludge (solids and residual water) retained in the Sludge Collection Tanks shall be discharged to Slop Tanks by their respective positive displacement Pumps. These pumps shall have sufficient head to prevent clogging by debris at the line's siphon outlets inside slop tanks, 400 mm above bottom plate, with slop tanks fully loaded and maximum design pressure in each slop tank inert gas atmosphere of 2000 mm H₂O (g) - I-DE-3010.1Y-5241-944-P4X-004.

The positive displacement sludge pumps shall be protected against overpressure. This protection shall be able to stop the positive displacement sludge pumps.

For structural works PACKAGER / MANUFACTURER shall follow requirements of item 8.3 of this technical specification. For bolt and nuts materials apply the requirements of I-ET-3010.00-1200-251-P4X-001 – BOLT MATERIALS.

For the Centrifuges Low-Voltage Induction Motors, see item 7.1 of this technical specification.

For the Centrifuges Panels, see item 7.1 of this technical specification.

General requirements for instruments, valves and accessories are as the following:

- The level gauges shall be installed in such position that the level indicated in receiver will be easily seen. All level gauges shall have flanged connections, which can be isolated and be complete with vent and drain, valves and connection.
- All valves shall be positioned with the stem pointing upwards. They shall be located in such a way that the hand wheel or actuator will not obstruct walkways, being easily accessible for O&M activities. Where hand operated valves are not easily operable, gear operated valves shall be used.



- Valves, instruments, etc. elevated 1.75 m above the floor, shall have access ladders or platform provided.
- Sampling point / facilities shall be provided complete with necessary fittings and valves, and the design shall reflect nature of the fluids being sampled.

6.2 FLOWMETERS AND OIL CONTENT SENSOR SPECIFIC REQUIREMENTS

According to Figure 1 above, the two FIT Flowmeters shall be installed in parallel with their respective isolating valves, constantly measuring the flow of treated effluent water discharged to sea, if the oil content sensor AIT detects the effluent water is adequately treated.

One FIT Flowmeter will measure the treated water flow to overboard, while the second is conceived as installed spare.

The two FIT Flowmeters shall be of magnetic type and shall comply with I-ET-3010.1Y-1200-800-P4X-005 - Field Instrumentation.

The oil content sensor AIT shall be Petrobras type approved. For more details, see I-ET-3010.1Y-1200-800-P4X-005 - Field Instrumentation.

The oil content constantly measured by oil content sensor AIT must be indicated in SOS-HMI. In case the oil content sensor AIT detects an oily water contamination above or equal to 15 ppm, there must be a specific alarm in the Control Room.

The Packager shall supply a spare oil content sensor AIT as loose item.

The oil content sensor AIT sampling tube (indicated on Figure 1) shall comply with requirements of I-ET-3010.00-1200-588-P4X-001 - SAMPLE CONNECTIONS. A 'SC8 H1' type of sample connection shall be used. The sampling tube shall be installed in the center of the treated water discharge line, with 90 degrees bending against the discharge flow direction.

The oil content sensor AIT and its sampling tube shall comply with applicable requirements of I-DE-3010.1Y-1200-944-P4X-001 – GENERAL NOTES, part 2.

There must be a minimum 3% (three percent) slope between the sampling tube intrusive point and the AIT instrument itself.

Along with oil content sensor AIT, it shall be provided an integral flowmeter indicator and transmitter FIT, magnetic or ultrasonic type, installed on its sampling tube, in order to measure the flow passing through the AIT sensor. This FIT is intentionally not represented on Figure 1.

The Centrifuges outlet line, where the oil content sensor AIT and FIT flowmeters are installed, shall be designed to avoid vacuum, leading to these devices malfunction.

The oil content sensor AIT and FIT flowmeters shall be easily accessible for O&M – Operation and Maintenance – purposes, within Skid limits, never inside any tank.

7. GENERAL REQUIREMENTS

7.1 ELECTRICAL REQUIREMENTS

All electrical equipment installed in hazardous areas (see Area Classification documentation) or installed outdoors and kept on during emergency condition (ESD) shall be certified according to IEC 61892, INMETRO Resolution 179, May 18th 2010 and INMETRO resolution 89, February 23rd 2012.

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

Electrical equipment and material shall comply with requirements of I-ET-3010.00-5140-700-P4X-002 – SPECIFICATION FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS.

Electrical induction motors shall comply with requirements of I-ET-3010.00-5140-712-P4X-001 – LOW-VOLTAGE INDUCTION MOTORS FOR OFFSHORE UNITS.

Concerning electrical system voltages and quantity of feeders for motors, panels and auxiliaries, centrifugal pumps shall be fed according to definitions of I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS.

Power lighting and grounding installations inside the package shall comply with requirements of I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS.

Grounding installations shall comply with I-ET-3010.00-5140-700-P4X-001 – SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS and I-DE-3010.00-5140-700-P4X-003 – GROUNDING INSTALLATION TYPICAL DETAILS.

7.2 INSTRUMENTATION AND AUTOMATION REQUIREMENTS

PACKAGE shall be protected with all necessary instruments to operate safely, adequately and without interruption in a tropical marine environment.

The instrumentation and control design shall fulfill the requirements of the following technical specifications:

- i. I-ET-3010.00-1200-800-P4X-002 – AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS.
- ii. I-ET-3010.00-1200-800-P4X-013 – GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS.



The minimum requirements for the adequate interfacing of the PACKAGE Automation and Instrumentation System with the UNIT are described on I-ET-3010.1Y-1200-800-P4X-014 – AUTOMATION INTERFACE OF PACKAGE UNITS.

For the control and automation panels design requirements I-ET-3010.00-5520-888-P4X-001 – AUTOMATION PANELS shall be considered.

7.3 PAINTING REQUIREMENTS

Painting and coating in accordance with I-ET-3010.00-1200-956-P4X-002 – GENERAL PAINTING and DR-ENGP-I-1.15 COLOR CODING.

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

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

7.4 SKIDS LAYOUT AND FOUNDATION REQUIREMENTS

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

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.

Skid foundation structural steel components shall be designed and fabricated in accordance with AISC ASD.

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.

PACKAGE skid layout and arrangement shall be designed to provide sufficient access to pumps, instruments, equipment, and control panels so as 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.

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

Access ladders, platforms, gratings, and any other access device shall be metallic type and designed according to PACKAGER / MANUFACTURER standard and to the industrial recognized international codes.



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.

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

7.5 AVAILABLE ON BOARD

For utilities available onboard refer to I-RL-3010.1Y-1200-940-P4X-001 – GENERAL SPECIFICATION FOR AVAILABLE UTILITIES

7.6 NAMEPLATES AND TAG NUMBERING

PACKAGER / MANUFACTURER Equipment shall have nameplates in Brazilian Portuguese language, made of stainless steel AISI 316L, with 3 mm minimum thickness and fixed by stainless steel (AISI 316L) bolts or fasteners on visible and accessible location.

Tagging of all instruments, electrical, mechanical and piping items, including valves, shall be carried out.

Tags shall be supplied with the number and description in the Brazilian Portuguese Language, unless otherwise stated in the technical data sheets.

For TAG numbering refer to I-ET-3000.00-1200-940-P4X-001 – TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN

For Instrumentation tagging the ISA –5.1 and N-1710 shall be followed.

8. PACKAGE MANUFACTURING

8.1 GENERAL

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.

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.

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.

8.2 QUALITY ASSURANCE AND CONTROL SYSTEM



Engineering, fabrication and manufacturing shall conform to good manufacturing practices. Quality system according to ISO 9001 in relevant extent shall be in place and implemented.

8.3 WELDING AND NDT

All equipment, structures and piping welds shall be performed according to the requirements described in the latest revision of I-ET-3010.00-1200-955-P4X-001 – WELDING.

Welding shall be carried out with procedures and welders qualified in accordance with ASME Section IX. Welding shall not be performed before qualified welding procedures have been approved.

Intermittent fillet welds are not acceptable.

Welding inspection and NDTs shall be performed according to the requirements described in the latest revision of

- I-ET-3010.00-1000-970-P4X-002 – REQUIREMENTS FOR NDT and
- I-ET-3010.00-1200-955-P4X-002 – REQUIREMENTS FOR WELDING INSPECTION.

Final NDTs, for acceptance purposes shall be carried out after completion of any post weld heat treatment (when applicable) and before the applications of painting, hydrostatic testing, etc.

8.4 INSPECTION AND TESTS

PACKAGER / MANUFACTURER shall develop and implement an Inspection and Test Plan (ITP) containing hold points, review and witness points following the schedule of the PACKAGE inspections, tests and events accordingly.

PACKAGE inspection, tests and events shall be attended by the MANUFACTURER, PACKAGER, HULL SUPPLIER, CS and OWNER inspection team whenever necessary.

PACKAGE shall be tested according to the design codes, applicable industry standards, CS Rules and any other one requirement stated on this technical specification.

Unless waive by OWNER, the following PACKAGE inspections and checks shall be witnessed by OWNER inspector:

- i. verification of equipment construction materials (vessels, heat exchangers, pumps, etc.) for conformity with the specification requirements;
- ii. verification of piping, fittings and valves conform to specification of materials and fabrication;

- iii. reports for all NDT performed on the pressure retaining parts (radiographic, dye penetrant, magnetic particles and ultrasonic inspection);
- iv. approval of the relief valve settings and witness of their testing after setting;
- v. review of Inspection and Test Records;
- vi. visual check.
- vii. Electrical tests as:
 - a MEGGER test for cables and electric motors;
 - all tests stated in the respective motors and power / control panel respective specifications.

8.5 FACTORY ACCEPTANCE TEST (FAT)

FAT is a set of functional and performance tests to be executed in any equipment, electrical, instrumentation and telecom panels or any other commissionable item carried out on the PACKAGER / MANUFACTURER factory or in specialized test facilities, in order to demonstrate its compliance with the project specifications and allow its release to shipyard.

For Factory Acceptance Test (FAT) minimum scope requirements:

- i. Pressure test (usually hydrostatic) test of all vessels, heat exchangers, tanks, pumps, pipes and valves.
 - o Note: All piping systems and equipment shall be drained and dried after hydrostatic testing.
- ii. Performance test, NPSH test and Mechanical running test of all pumps.
- iii. Electrical continuity checks on all wiring and earthing.
- iv. Functional checks on all instruments and valves.
- v. Alarms and Equipment Protection Tests.
- vi. All other equipment tests and factory checking to be carried out according to the FAT procedure approved by parts.

For Factory Acceptance Test (FAT) event invitation e reports:

- i. OWNER, CS and HULL SUPPLIER shall be communicated about the FAT event following ITP and the fabrication schedule. FAT invitation schedule shall be negotiated during PACKAGE kick-off meeting on the detail design phase.



- ii. PACKAGER shall issue the FAT procedure for all parts involved as OWNER, HULL SUPPLIER and CS, where applicable, and submit to them for approval.
- iii. PACKAGER shall issue the FAT report with all test results and duly signed or stamped by all parts that witnessed the FAT and with the test reference documentation attached.
- iv. Acceptance of FAT will not be considered as the final acceptance test of the PACKAGE.

8.6 PRE-COMMISSIONING AND COMMISSIONING

PACKAGER / MANUFACTURER shall be required to provide any necessary support for installation, assembly, pre-commissioning and commissioning of the PACKAGE either at a shore based fabrication yard or onboard the FPSO.

PACKAGER / MANUFACTURER is responsible for assembly supervision of the PACKAGE equipment, including the assembly of components to be delivered loose (for example, some components of the pumps, like stuffing box, etc.).

Final acceptance will be on satisfactory completion of commissioning tests as specified by OWNER.

9. PACKAGE DELIVERY REQUIREMENTS

9.1 PRESERVATION, PACKING AND TRANSPORTATION

PACKAGER / MANUFACTURER shall ensure all the conditions and practices of preservation, packing and transportation are fulfilled and following the PACKAGE / Equipment specific and technical characteristics recommendations.

PACKAGER / MANUFACTURER shall submit to HULL SUPPLIER the PACKAGE preservation requirements and recommendations with all necessary considerations for the PACKAGE Equipment preservation during the UNIT whole design life.

Preservation and packing shall be proper for transportation and storage in a marine environment and protected against moisture and damage during transport, handling and lifting.

In any case, suitable preservation and protective measures shall be provided to prevent equipment deterioration prior to entering into service.

All packing shall be clearly marked for shipping, including lifting points, gross weight, dimensions and center of gravity.

All sea fastening and temporary supports used on the equipment for shipment shall be clearly identified.

PACKAGER / MANUFACTURER shall ensure that all loose valves, tubes and instruments are supplied with plastic caps.

PACKAGER / MANUFACTURER shall also ensure that all electric panels and motors will be supplied with Volatile Corrosion Inhibitor (VCI) impregnated plastic protection or similar, and external plug for space heater connection.

PACKAGER / MANUFACTURER shall provide clear and comprehensive instructions on the exterior of all packages advising the necessary warning notices for unpacking, handling and installing the equipment on arrival at destination.

The equipment shall be thoroughly cleaned internally and be free of all loose foreign materials.

- i. The preparation shall make the equipment suitable for outdoor storage in a coastal tropical climate from the time of Shipment.
- ii. If there is a risk of damage to valves and other appurtenances during transportation, they shall be disconnected and tagged. All components shall then be securely packed as above.
- iii. Spare parts and tools to be packed separately and clearly marked "Spare Parts" and "Tools" respectively.

9.2 SPARE PARTS, CONSUMABLES AND TOOLS

All equipment / material consumable and spare parts recommended by PACKAGER / MANUFACTURER for the construction, testing, commissioning, pre-operation and start-up phases.

All spare parts recommended or required by the CS, such spare parts will be delivered together with the relevant equipment;

All special tools required for construction, pre-commissioning, commissioning and all levels of maintenance and operation.

Spare parts list recommended by PACKAGER / MANUFACTURER for two years of operation.

9.3 DOCUMENTATION

Drawings and Weight Control.

For Engineering Documentation minimum requirements:

- i. PACKAGER / MANUFACTURER design drawings shall show all necessary dimensions and details required for interface information and installation.
- ii. Clearances for maintenance shall be shown on the drawings.
- iii. Drawings and documents shall be clear and completely legible with all text in the English language.

- iv. Instruction manuals for operation and maintenance of the PACKAGE equipment shall be provided in Portuguese language.
- v. Drawings are only accepted when signed by PACKAGER as checked and approved. All revised editions of drawings or documents shall show the revisions clearly marked up, the issue date and PACKAGER's checked and approved signatures.
- vi. PACKAGER / MANUFACTURER shall produce a weight / center of gravity data sheet considering each PACKAGE component with the respective assembly dry and operational weight and CoG.
 - o Note: Operational weight means the component dry weight added to the respective component fluid weight on operational condition.
- vii. PACKAGER shall send in advance all recommendations for PACKAGE installation, maintenance and commissioning.

Data Book


PACKAGER shall issue a PACKAGE / Equipment Data Book to be delivered to HULL SUPPLIER for approval. Data Book minimum content shall be as the following:

- i. Certified drawings, data sheets, technical specifications, performance curves and calculation memorandum.
- ii. Construction, maintenance and operating manuals, instructions for preservation and commissioning, and all catalogs, including of the sub-suppliers.
- iii. All certificates of materials and equipment, certificates of electrical cables and equipment to hazardous areas, all tests, destructive and non-destructive examinations, test reports (including FAT), certificates and reports of classification society, procedures for welding qualifications and welding processes.
- iv. The documentation requested by Brazilian law NR-13, subdivided for equipment (if applicable).
- v. The documentation requested by Brazilian law NR-10, subdivided for equipment (if applicable).

Data Book delivery standard and conditions including number of parts and sections, number of printed and electronic copies will be further defined by OWNER on detail design phase.

9.4 TRAINING

For the OWNER operational and maintenance teams training the minimum requirements shall be as the following:

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		ESUP	

PACKAGER shall provide training to qualify OWNER technicians for operation and maintenance (install, dismantle, replace parts, make adjustment, etc.) of each equipment.