PETROBRAS	TECHNICAL SPECIFICATION	No. I-ET-3010.2D-5122-580-P4X-002	
	CLIENT: AGUP		SHEET: 1 of 21
	JOB: HIGH CAPACITY FPSO - GAS EXPORTATION ALL ELECTRIC		-
	AREA: ATAPU 2 AND SÉPIA 2		
SRGE	TITLE: **FRESH WATER MAKER FOR OIL DILUTION (UD-5122002A/B)**		INTERNAL
			ESUP

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INDEX OF REVISIONS

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0	ORIGINAL ISSUE
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DATE	OCT/28/22	DEC/05/22							
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SUMMARY

1 OBJECTIVE

This Technical Specification covers the minimum requirements for design, engineering, materials, fabrication, inspection, testing, commissioning and pre-commissioning of 2 x 100% FRESH WATER MAKER FOR OIL DILUTION (UD-5122002A/B) (Reverse Osmosis Type).

The FRESH WATER MAKER FOR OIL DILUTION (UD-5122002A/B) PACKAGE shall be provided with all necessary instruments to operate safely, adequately and without interruption in an offshore facility.

The requirements herein listed are applicable to all players performing such related activities within the content of this specification, including manufacturers, packagers, main SELLER, sub-sellers, suppliers, sub-suppliers, integrators, constructors, and all technical personnel involved. Within the scope of this document, they are all referred to as being a SELLER.

In addition to the requirements of this technical specification, SELLER shall follow all the requirements of the Exhibit I (SCOPE OF SUPPLY), as well as Exhibit III (DIRECTIVES FOR ENGINEERING EXECUTION), Exhibit IV (DIRECTIVES FOR CONSTRUCTION AND ASSEMBLY), Exhibit V (DIRECTIVES FOR PROCUREMENT), Exhibit VI (DIRECTIVES FOR PLANNING AND CONTROL), Exhibit VII (DIRECTIVES FOR QUALITY MANAGEMENT SYSTEM) and Exhibit VIII (DIRECTIVES FOR COMMISSIONING PROCESS).

2 NORMATIVE REFERENCES AND DESIGN SPECIFICATIONS

2.1 GENERAL

2.1.1 All equipment shall comply with the requirements of this technical specification and references stated below. All equipment parts and details not complying with any of these requirements shall be informed on a “Deviation List”. Otherwise, they will be considered as “Agreed”, and so required.

2.2 CLASSIFICATION SOCIETY

2.2.1 SELLER shall perform the work in accordance with the requirements of Classification Society.

2.2.2 SELLER is responsible for submitting to the Classification Society all documentation in compliance with stated Rules.

2.2.3 Classification Society rules may only be waived upon the formal approval from the Classification Society itself and from BUYER.

2.3 CODES AND STANDARDS

2.3.1 The following codes and standards include provisions which, through reference in this text, constitute provisions of this specification. The latest issue of the references shall be used unless otherwise agreed.

2.3.2 Other recognized standards may be used, provided it can be shown that they meet or exceed the requirements of the standards referenced below. Formal approval from BUYER and from Classification Society is also required.

API RP 14C	Recommended Practice for Analysis, Design, Installation, and Testing of Safety Systems for Offshore Production Facilities

API RP 14E	Recommended Practice for Design and Installation of Offshore Production Platform Piping Systems
API RP 14J	Recommended practice for design and Hazard Analysis for Offshore Production Facilities
API RP 14FZ	Recommended Practice for Design, Installation, and Maintenance of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1, and Zone 2 Locations
API RP 505	Classification of locations for Electrical Installations at Petroleum Facilities Classified as Class 1, Zone 0, Zone 1 and Zone 2
API 520	Sizing, Selection, and Installation of Pressure-relieving Devices Parts I&II
API 521	Pressure-Relieving and Depressuring Systems
API 610	Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries
API 614	Lubrication, Shaft-sealing and Oil-control Systems and Auxiliaries
API 660	Shell and Tube Heat Exchangers for General Refinery Service
API 671	Special-Purpose Couplings for Petroleum, Chemical and Gas Industry Services
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B16.47	Large Diameter Steel Flanges: NPS 26 Through NPS 60 Metric/Inch Standard
ASME B31.3	Process Piping
ASME B73.1	Specification for Horizontal End Suction Centrifugal Pumps for Chemical Process
ASME BPVC II	Part A, B, C and D. Boiler and Pressure Vessel Code. Materials
ASME BPVC V	Boiler and Pressure Vessel Code. Non-Destructive Examination
ASME BPVC VIII	Div.1 and Div.2 - Rules for Construction of Pressure Vessels
ASME BPVC IX	Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators
AWS D1.1	Structural Welding Code – Steel
DOT-3A	Specification for Seamless Steel Transportable Pressure Receptacles
DOT-3AA	Specification for Seamless Steel Transportable Pressure Receptacles
IEC 60079 (all parts)	Explosive Atmospheres
IEC 61260	Electroacoustics-Octave Band and Fractional-Octave-Band Filters
IEC 61672 1/2	Electroacoustics-Sound Level Meters
IEC 61892 (all parts)	Mobile and Fixed Offshore Units – Electrical Installations
ISO 9809 (all parts)	Gas cylinders - Design, construction and testing of refillable seamless steel gas cylinders and tubes
ISO 13702	Control and mitigation of fires and explosions on offshore production installations
ISO 21457	Materials selection and corrosion control for oil and gas production systems
ISA	Handbook of Control Valves, Chapter 7 - Control Valve Noise, Part 2 - Universal Valve Noise Prediction Method
TEMA	Standards of the Tubular Exchanger Manufacturers Association

2.4 GOVERNMENTAL REGULATION

Brazilian Government regulations are mandatory and shall prevail, if more stringent, over the requirements of this specification and other references herein.

NR-10	Segurança em Instalações e Serviços em Eletricidade (Safety in Electrical Facilities and Services/ Brazilian Regulatory standard)
NR-12	Segurança no Trabalho em Máquinas e Equipamentos (Safety in Equipment and Machinery Sevice/ Brazilian Regulatory standard)

NR-13	Caldeiras, Vasos de Pressão e Tubulações e Tanques Metálicos de Armazenamento (Boilers, Pressure Vessels and Piping and Metallic Storage Tanks/ Brazilian Regulatory standard)
NR-17	Brazilian Regulatory Standard - Ergonomics
NR-26	Sinalização de Segurança (Safety Signaling/ Brazilian Regulatory standard)
NR-37	Saúde e Segurança em Plataformas de Petróleo (Health and Safety on Oil Platforms / Brazilian Regulatory standard)
IBAMA	Brazilian IBAMA environmental regulations concerning the discharge of all types of effluents
INMETRO	Resolution nº 115, May 21st 2022

2.5 DESIGN SPECIFICATIONS

Unless otherwise indicated, the latest editions of the following specifications shall be used as guidelines for the referred scope of supply:

DR-ENGP-I-1.15	COLOR CODING
DR-ENGP-M-I-1.3	SAFETY ENGINEERING GUIDELINE
I-DE-3010.00-5140-700-P4X-003	GROUNDING INSTALLATION TYPICAL DETAILS
I-DE-3010.2D-1200-942-P4X-002	GENERAL ARRANGEMENT
I-DE-3010.2D-1426-942-P4X-001	M-15 - UTILITIES – EQUIPMENT LAYOUT PLAN
I-DE-3010.2D-5122-944-P4X-001	FRESH WATER MAKER FOR OIL DILUTION
I-DE-3010.2D-1200-94A-P4X-001	AREA CLASSIFICATION – GENERAL
I-ET-3010.00-1200-970-P4X-003	REQUIREMENTS FOR PERSONNEL QUALIFICATION AND CERTIFICATION
I-ET-3010.00-1200-970-P4X-004	NON-DESTRUCTIVE TESTING REQUIREMENTS FOR METALLIC AND NON-METALLIC MATERIALS
I-ET-3010.00-1200-970-P4X-012	COMPLIANCE WITH NR-12 REQUIREMENTS
I-ET-3010.00-1200-970-P4X-013	COMPLIANCE WITH NR-13 AND SPIE REQUIREMENTS
I-ET-3010.00-1200-972-P4X-006	REQUIREMENTS FOR MANUFACTURING SURVEY INSPECTION
I-ET-3010.00-1200-978-P4X-005	REQUIREMENTS FOR MATERIALS TRACEABILITY
I-ET-3010.2D-1200-200-P4X-005	MINIMUM REQUIREMENTS FOR PIPING MECHANICAL DESIGN AND LAYOUT
I-ET-3010.2D-1200-200-P4X-006	REQUIREMENTS FOR PIPING FLEXIBILITY AND STRESS ANALYSIS
I-ET-3010.00-1200-200-P4X-003	DESIGN, CONSTRUCTION AND ASSEMBLY OF FRP PIPING
I-ET-3010.2D-1200-200-P4X-004	REQUIREMENTS FOR PIPING SUPPORT
I-ET-3010.00-1200-200-P4X-115	REQUIREMENTS FOR PIPING FABRICATION AND COMMISSIONING
I-ET-3010.00-1200-200-P4X-116	REQUIREMENTS FOR BOLTED JOINTS ASSEMBLY AND MANAGEMENT
I-ET-3010.00-1200-251-P4X-001	REQUIREMENTS FOR BOLTING MATERIALS
I-ET-3010.00-1200-431-P4X-001	THERMAL INSULATION FOR MARITIME INSTALLATIONS

I-ET-3010.00-1200-500-P4X-001	NON METALLIC TANKS AND PRESSURE VESSELS DESIGN
I-ET-3010.00-1200-510-P4X-001	METALLIC TANKS DESIGN FOR TOPSIDE
I-ET-3010.00-1200-540-P4X-001	REQUIREMENTS FOR PRESSURE VESSELS DESIGN AND FABRICATION
I-ET-3010.00-1200-800-P4X-002	AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS
I-ET-3000.00-1200-940-P4X-001	TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN
I-ET-3010.00-1200-940-P4X-002	GENERAL TECHNICAL TERMS
I-ET-3010.00-1200-955-P4X-001	WELDING
I-ET-3010.00-1200-956-P4X-002	GENERAL PAINTING
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 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-3010.00-5400-947-P4X-002	SAFETY SIGNALLING
I-ET-3010.2D-1200-200-P4X-001	PIPING SPECIFICATION FOR TOPSIDES
I-ET-3010.00-1200-300-P4X-001	NOISE AND VIBRATION CONTROL REQUIREMENTS
I-ET-3010.00-1200-310-P4X-001	API 610 CENTRIFUGAL PUMPS SPECIFICATION
I-ET-3010.00-1200-310-P4X-002	POSITIVE DISPLACEMENT PUMPS SPECIFICATION
I-ET-3010.00-1200-310-P4X-003	NON-API 610 CENTRIFUGAL PUMPS SPECIFICATION
I-ET-3010.00-1200-451-P4X-001	REQUIREMENTS FOR SHELL & TUBE HEAT EXCHANGER DESIGN AND FABRICATION
I-ET-3010.00-1200-456-P4X-001	REQUIREMENTS FOR PLATE HEAT EXCHANGER DESIGN AND FABRICATION
I-ET-3010.2D-1200-800-P4X-014	AUTOMATION INTERFACE OF PACKAGE UNITS
I-ET-3010.2D-1200-940-P4X-001	MATERIAL SELECTION PHILOSOPHY FOR DETAILED DESIGN
I-ET-3010.2D-1400-140-P4X-001	TOPSIDES STRUCTURAL REQUIREMENTS
I-ET-3A26.00-1000-941-PPC-001_F	METOCEAN DATA – UNITS AND PRODUCTION SYSTEMS – SANTOS BASIN CENTRAL CLUSTER REGION
I-ET-3A36.00-1000-941-PPC-001_F	METOCEAN DATA – PRODUCTION SYSTEM AND UNITS – NOTHERN SANTOS BASIN PRE-SALT FIELDS
I-FD-3010.2D-5122-580-P4X-002	FRESH WATER MAKER FOR OIL DILUTION (UD-5122002A/B)
I-RL-3010.2D-1200-940-P4X-001	GENERAL SPECIFICATION FOR AVAILABLE UTILITIES
I-RL-3010.2D-1200-940-P4X-003	DRAINAGE SYSTEM GUIDELINES
I-RL-3010.2D-1350-960-P4X-002	MOTION ANALYSIS
I-ET-3010.00-5518-767-PPT-002	TOPSIDE PUBLIC ADDRESS SYSTEM

I-MD-3010.00-5510-760-PPT-001	GENERAL CRITERIA FOR TELECOMMUNICATIONS DESIGN
I-ET-3010.2D-1400-196-P4X-001	ERGONOMIC REQUIREMENTS FOR TOPSIDES
I-ET-3000.00-5400-98G-P4X-001	EXPLOSION STUDY
I-DE-3010.00-1400-140-P4X-004	GENERAL NOTES FOR TOPSIDES STRUCTURES

2.6 CONFLICTING REQUIREMENTS

2.6.1 In case of conflicting requirements between this technical specification and other cited references, the most stringent shall prevail. If necessary, the SELLER may revert to BUYER for clarification.

3 DEFINITIONS AND ABBREVIATIONS

3.1 DEFINITIONS

3.1.1 All Terms and definitions are established in I-ET-3010.00-1200-940-P4X-002 – GENERAL TECHNICAL TERMS.

3.2 ABBREVIATION

CLASS: Classification Society
FAT: Factory Acceptance Test
FBE: Fusion Bonded Epoxi
FPSO: Floating Production, Storage and Offloading
FRP: Fibre Reinforced Plastic
HAZOP: Hazard and Operability Study
ITP: Inspection and Test Plan
NDT: Non-Destructive Testing
PHA: Preliminary Hazard Analysis
SS: Stainless Steel
UCP: Unit Control Panel

4 GENERAL REQUIREMENTS

4.1 TECHNICAL FUNCTIONAL REQUIREMENTS

4.1.1 The membrane cartridges shall be enclosed in pressure housings, one cartridge per housing. Housing design shall enable removal of the membrane cartridge without disturbing the operation. The housings shall be arranged in series/parallel configurations, as determined by the SELLER, in order to produce the specified quantity and quality of fresh water and maintain proper minimum brine flows throughout the system. The membrane package shall be designed and built so that the FRESH WATER MAKER SYSTEM can operate at partial capacity with one (or more) membrane cartridges removed. The FRESH WATER MAKER FOR OIL DILUTION (UD-5122002A/B) shall be able to automatically discharge to overboard the water outlet that is not being consumed.

4.2 INFORMATION TO BE PROVIDED BY SELLER

4.2.1 Material and Energy Balance of the desalted water and effluent.

4.2.2 Chemical products requirements:

- Normal and maximum consumption;

- Types and concentrations;
- Frequency of use and operating procedures;
- Handling issues.

4.2.3 Utility consumption including electrical power and instrument air.

4.2.4 Piping and Instrument Diagrams.

4.2.5 Equipment dimensions, weights and center of gravity (see Weight Control datasheet at item 13).

4.2.6 Operating and design conditions.

4.2.7 Instrumentation, nozzle diameters of the skid, pipes, valves, interlocks, alarms, controllers.

4.2.8 Equipment data sheets of the PACKAGE and its auxiliaries.

4.2.9 Description of the Package operation and its interlocks.

4.2.10 Electrical detailed diagrams for all packages.

4.2.11 Detailed block diagrams for all controls.

4.2.12 Detailed wiring diagrams for all electrical equipment.

4.2.13 Filled in data sheets for all electrical equipment.

4.2.14 Detailed protection configuration settings for all electrical equipment.

4.3 BRINE METERING

4.3.1 The brine disposal metering shall comply with IBAMA regulations. The flow meter shall be installed in the brine discharge line (downstream membranes). One total flow transmitter shall be supplied, and the signal shall be taken to the control panel. Total flow value shall be available at the control panel to be sent to Topsides Supervision and Operation System.

4.3.2 SELLER shall design and install a suitable draining system, according to I-RL-3010.2D-1200-940-P4X-003 – DRAINAGE SYSTEM GUIDELINES.

4.4 OPERATION ENVIRONMENT

4.4.1 The equipment supplied shall be suitable for the environment and range of ambient condition defined in I-ET-3A26.00-1000-941-PPC-001_F – METOCEAN DATA – UNITS AND PRODUCTION SYSTEMS – SANTOS BASIN CENTRAL CLUSTER REGION and I-ET-3A36.00-1000-941-PPC-001_F – METOCEAN DATA – PRODUCTION SYSTEM AND UNITS – NOTHERN SANTOS BASIN PRE-SALT FIELDS.

4.5 MOTION REQUIREMENTS

4.5.1 The necessary design data and information on motion requirements are given in I-RL-3010.2D-1350-960-P4X-002 – MOTION ANALYSIS.

4.6 PACKAGE LOCATION AND AREA CLASSIFICATION

4.6.1 The FRESH WATER MAKER FOR OIL DILUTION PACKAGE shall be installed by SELLER over structural steel deck plate on module M-15 as informed in I-DE-3010.2D-1200-942-P4X-002 – GENERAL ARRANGEMENT, exposed to the marine environment. For available space and positioning, also see I-DE-3010.2D-1426-942-P4X-001 – M-15 - UTILITIES – EQUIPMENT LAYOUT PLAN.

4.6.2 For area classification see I-DE-3010.2D-1200-94A-P4X-001 – AREA CLASSIFICATION – GENERAL.

4.7 DESIGN LOADS

4.7.1 In addition to Code described loads and loads due to vessel motions defined in I-RL-3010.2D-1350-960-P4X-002 - MOTION ANALYSIS, the following loads shall be considered where relevant:

- Equipment transportation and erection loads;
- Nozzle loads;
- Thermal loads;
- Wind loads (see METOCEAN DATA);
- Weight loads;
- Blast loads (according to I-ET-3000.00-5400-98G-P4X-001 – EXPLOSION STUDY).

4.8 DESIGN LIFETIME

4.8.1 SELLER shall design and fabricate the complete FRESH WATER MAKER FOR OIL DILUTION PACKAGE for a minimum service life of 30 years.

4.9 NOISE

4.9.1 Noise and vibration control concerning human exposure shall be performed according to I-ET-3010.00-1200-300-P4X-001 – NOISE AND VIBRATION CONTROL REQUIREMENTS.

5 PACKAGE SPECIFICATION

5.1 SCOPE OF SUPPLY

5.1.1 The FRESH WATER MAKER FOR OIL DILUTION PACKAGE shall be complete in all respect and the scope of supply shall include but not be limited to the major components described in the document I-FD-3010.2D-5122-580-P4X-002 – FRESH WATER MAKER FOR OIL DILUTION (UD-5122002A/B).

5.1.2 SELLER shall be responsible for the overall package design and for supplying a fully operating system in accordance with the requirements of this specification, its attachments and the standards referenced therein.

5.1.3 SELLER shall select manufacturers considering a proven experience supplying this type of equipment/technology. SELLER shall submit manufacturers names to BUYER approval.

5.2 PROCESS DESIGN

5.2.1 SELLER shall design and sizing the package equipment for the full range of process conditions specified in the Process Data Sheet I-FD-3010.2D-5122-580-P4X-002 – FRESH WATER MAKER FOR OIL DILUTION (UD-5122002A/B) and in the process diagram I-DE-3010.2D-5122-944-P4X-001 – FRESH WATER MAKER FOR OIL DILUTION.

5.2.2 Provisions shall be made for cleaning of the FRESH WATER MAKER FOR OIL DILUTION PACKAGE when it is not in operation.

5.2.3 Design shall also include the definition of number, size and location of all process and instrument related nozzles of FRESH WATER MAKER FOR OIL DILUTION (UD-5122002A/B) battery limits. Refer to the I-DE-3010.2D-5122-944-P4X-001 – FRESH WATER MAKER FOR OIL DILUTION.

5.2.4 Available Utilities: the design conditions are defined in I-RL-3010.2D-1200-940-P4X-001 – GENERAL SPECIFICATION FOR AVAILABLE UTILITIES.

5.3 MECHANICAL AND PIPING

5.3.1 SELLER shall prepare detailed assembly, disassembly and maintenance procedures, describing the use of all involved handling devices and including all required preventive and corrective maintenance tasks. SELLER shall inform the need for disassembling any component or equipment to facilitate access for maintenance. Suitable maintenance routes shall be provided to remove the main components and auxiliaries, avoiding interference with structures, piping, cabling, electric conduits and supports, equipment etc. This plan shall be submitted to BUYER for approval.

5.3.2 Pumps shall be supplied in accordance with I-ET-3010.00-1200-310-P4X-003 – NON-API 610 CENTRIFUGAL PUMPS SPECIFICATION. Pump materials shall be super duplex for sea water, according to API 610 table H, class D2.

5.3.3 All piping shall have valves (on/off valves) and/or flanges and blind flanges (ASME B16.5/B16.47) at the end of each skid limits of the package.

5.3.4 The design, assembly and commissioning of all process piping shall be according ASME B31.3 code and shall comply with I-ET-3010.2D-1200-200-P4X-005 – MINIMUM REQUIREMENTS FOR PIPING MECHANICAL DESIGN AND LAYOUT, I-ET-3010.2D-1200-200-P4X-006 – REQUIREMENTS FOR PIPING FLEXIBILITY AND STRESS ANALYSIS and I-ET-3010.00-1200-200-P4X-115 – REQUIREMENTS FOR PIPING FABRICATION AND COMMISSIONING.

5.3.5 All seawater piping lines shall be made of FRP. For FRP piping system requirements refer to I-ET-3010.00-1200-200-P4X-003 – DESIGN, CONSTRUCTION AND ASSEMBLY OF FRP PIPING.

5.3.6 In case of metallic material requirements, Cu-Ni or FBE coated carbon steel shall be used. For requirements on FBE coating refer to I-ET-3010.00-1200-956-P4X-002 – GENERAL PAINTING.

5.3.7 SELLER shall follow the technical specification I-ET-3010.2D-1200-200-P4X-001 – PIPING SPECIFICATION FOR TOPSIDES. Alternative piping specifications shall be submitted to BUYER for approval.

5.3.8 All piping shall be properly supported considering the service loads, shipment and transportation loads. Piping supports shall be in accordance with I-ET-3010.2D-1200-200-P4X-004 – REQUIREMENTS FOR PIPING SUPPORT. Supports applied directly to the module base plates shall not be performed without prior under deck stiffening. The supporting and installation shall enable piping removal without disturbing structural members.

5.3.9 Socket welding is only permitted for piping sizes equal or less than 1½ inch until pressure class 1500#. All piping above 1 ½ inch shall be butt-welded.

5.3.10 The use of concentric butterfly valves is not permitted.

5.3.11 Sampling point / facilities shall be provided complete with necessary fittings and valves, and the design should reflect nature of the fluids being sampled.

5.3.12 Utility hose stations shall be installed throughout the package on strategic places for maintenance and cleaning purposes.

5.3.13 All other miscellaneous items and equipment which are required for the service and proper operation of the FRESH WATER MAKER FOR OIL DILUTION PACKAGE shall be included.

5.3.14 Equipment and piping subjected to temperature of 60 ºC and above shall receive a personal protection system. Alternatively, a thermal insulation may be applied. Equipment and piping in which heat conservation is necessary shall be thermal insulated. The personal protection and thermal insulation systems shall be according to I-ET-3010.00-1200-431-P4X-001 – THERMAL INSULATION FOR MARITIME INSTALLATIONS.

5.3.15 Studs, bolts, tightening bolts, nuts and washers shall be according to I-ET-3010.00-1200-251-P4X-001 – REQUIREMENTS FOR BOLTING MATERIALS.

5.3.16 Bolted joints within the package shall be assembled and managed as stablished in I-ET-3010.00-1200-200-P4X-116 – REQUIREMENTS FOR BOLTED JOINTS ASSEMBLY AND MANAGEMENT.

5.4 STRUCTURES

5.4.1 SELLER shall follow the requirements of I-DE-3010.00-1400-140-P4X-004 – GENERAL NOTES FOR TOPSIDES STRUCTURES.

5.5 MATERIAL SELECTION AND CERTIFICATION

5.5.1 The SELLER is responsible for the materials selection considering the philosophy detailed at I-ET-3010.2D-1200-940-P4X-001 - MATERIAL SELECTION PHILOSOPHY FOR DETAILED DESIGN, and the operational condition and process data stated at I-FD-3010.2D-5122-580-P4X-002 – FRESH WATER MAKER FOR OIL DILUTION (UD-5122002A/B).

5.5.2 In all cases, SELLER shall submit the detailed material selection report, including all piping, equipment and their components, for BUYER approval prior to manufacturing activities.

5.5.3 SELLER shall be responsible for obtaining all necessary certification of the equipment, work and materials.

5.5.4 SELLER through the independent certifying authority shall supply all certificates related to the materials, inspections, tests and qualification activities detailed in the approved Quality Plan.

5.6 DESIGN AND FABRICATION

5.6.1 **Pumps** – Pumps shall comply with the requirements of I-ET-3010.00-1200-310-P4X-003 – NON-API 610 CENTRIFUGAL PUMPS SPECIFICATION or I-ET-3010.00-1200-310-P4X-001 – API 610 CENTRIFUGAL PUMPS SPECIFICATION or I-ET-3010.00-1200-310-P4X-002 – POSITIVE DISPLACEMENT PUMPS SPECIFICATION. For pumps up to 7.5 kW, working with non-flammable and non-hazardous service, manufacturer may use its own specification, i.e., no specific design code will be applicable, provided that field proven requirements for the PACKAGE are fulfilled and if approved by BUYER previously during the package technical proposal. Material selection shall still be performed as per ISO 21457.

5.6.2 **Pressure Vessel** – All pressure vessels, columns and filters shall comply with the requirements of the last revision of NR-13 (Brazilian Regulatory Standard), I-ET-3010.00-1200-970-P4X-013 – COMPLIANCE WITH NR-13 AND SPIE REQUIREMENTS and I-ET-3010.00-1200-540-P4X-001 – REQUIREMENTS FOR PRESSURE VESSELS DESIGN AND FABRICATION. If the scope of supply includes any transportable pressure vessels, connected with process plant or platform installations, these items shall be within the scope of NR-13 regulation. Furthermore, transportable containers shall be designed, constructed, inspected and installed in accordance with the requirements addressed by a specific rule of transportable equipment, such as ISO 9809, DOT-3A or DOT-3AA.

5.6.3 **Heat Exchanger** – Heat exchangers shall comply with the requirements of I-ET-3010.00-1200-451-P4X-001 – REQUIREMENTS FOR SHELL & TUBE HEAT EXCHANGER DESIGN AND FABRICATION or I-ET-3010.00-1200-456-P4X-001 – REQUIREMENTS FOR PLATE HEAT EXCHANGER DESIGN AND FABRICATION.

5.6.4 **Metallic Tanks** – Metallic Tanks shall comply with the requirements of I-ET-3010.00-1200-510-P4X-001 – METALLIC TANKS DESIGN FOR TOPSIDE.

5.6.5 **Non-Metallic Tanks and Vessels** – Non-Metallic Tanks and Vessels shall comply with the requirements of I-ET-3010.00-1200-500-P4X-001 – NON-METALLIC TANKS AND PRESSURE VESSELS DESIGN.

5.7 ERGONOMIC REQUIREMENTS

5.7.1 The package shall be arranged such to allow safe and good personnel access for all operation and maintenance activities and in accordance with I-ET-3010.2D-1400-196-P4X-001 - ERGONOMIC REQUIREMENTS FOR TOPSIDES.

5.7.2 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 escape routes, walkways and be easily accessible for operation and maintenance, according to I-ET-3010.2D-1400-196-P4X-001- ERGONOMIC REQUIREMENTS FOR TOPSIDES. Where hand operated valves are not easily operable, gear operated valves shall be used.

5.7.3 Ladders and platform shall be provided to access operational devices, e.g., valves, instruments, manways, etc., whether located in an elevation greater than 1.75 m over the module base plate. All safety signs and notices shall be in Portuguese language.

5.7.4 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.

5.8 SAFETY REQUIREMENTS

5.8.1 Pressure relief system and devices shall comply with the requirements of API 521.

5.8.2 For area classification see I-DE-3010.2D-1200-94A-P4X-001 – AREA CLASSIFICATION – GENERAL.

5.8.3 Mandatory safety items as established in DR-ENGP-M-1.3 - SAFETY ENGINEERING GUIDELINE, are to be considered complementary requirements, to the pertinent extent. In case of items in conflict with this document, BUYER shall be consulted.

5.8.4 HAZOP and PHA shall be performed according to DR-ENGP-M-1.3 - SAFETY ENGINEERING GUIDELINE.

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

5.8.6 All safety signs and notices shall be in Portuguese language according to I-ET-3010.00-5400-947-P4X-002- SAFETY SIGNALLING.

5.9 INSTRUMENTATION

5.9.1 All instrumentation equipment and interface with FPSO automation and control design shall comply with I-ET-3010.00-1200-800-P4X-002 - AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS.

5.9.2 For package automation type classification see I-ET-3010.2D-1200-800-P4X-014 – AUTOMATION INTERFACE OF PACKAGE UNITS.

5.9.3 All control, monitoring and safety protection instruments, instrumented valves, devices and associated accessories (such as, but not limited to, tubings, thermowells, etc) for remote indication, control, alarms, protection and shut down, etc. shall be included.

5.9.4 Automatic temperature control facilities shall be provided for the control of cooling medium flow.

5.9.5 Sampling point / facilities shall be provided complete with necessary fittings and valves for taking glycol samples.

5.9.6 Package Unit Control Panel shall fully comply with requirements of I-ET-3010.00-5520-888-P4X-001 – AUTOMATION PANELS.

5.10 ELECTRICAL

5.10.1 All materials and equipment proper to be used in hazardous areas shall have conformity certificates complying with the latest revision of IEC-60079 and all its parts; PORTARIA INMETRO Nº 115 (March 21st, 2022); and shall be approved by Classification Society.

5.10.2 Electrical equipment installed in external safe areas, that shall be kept operating during emergency shutdown ESD-3P and ESD-3T shall be certified for installation in hazardous areas Zone 2 (EPL Gc) Group IIA temperature T3, unless they are automatically disconnected if there is gas in the equipment area, according to IEC 61892-1.

5.10.3 Low-voltage and Medium-voltage motors inside the package shall comply with latest revision of I-ET-3010.00-5140-712-P4X-001 – LOW-VOLTAGE INDUCTION MOTORS FOR OFFSHORE UNITS and I-ET-3010.00-5140-712-P4X-002 – MEDIUM-VOLTAGE INDUCTION MOTORS FOR OFFSHORE UNITS.

5.10.4 All electrical equipment and material shall fully comply with the document I-ET-3010.00-5140-700-P4X-002 - SPECIFICATION FOR ELECTRICAL MATERIAL FOR OFFSHORE UNITS, I-ET-3010.00-5140-700-P4X-007 - SPECIFICATION FOR GENERIC ELECTRICAL EQUIPMENT FOR OFFSHORE UNITS, I-ET-3010.00-5140-700-P4X-009 - GENERAL REQUIREMENTS FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS and, I-ET-3010.00-5140-741-P4X-004 - SPECIFICATION FOR LOW-VOLTAGE GENERIC ELECTRICAL PANELS FOR OFFSHORE UNITS.

5.10.5 Power lighting and grounding installations inside the package shall comply with requirements of I-ET-3010.00-5140-700-P4X-001 – SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS, I-ET-3010.00-5140-700-P4X-003 - ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS and, I-DE-3010.00-5140-700-P4X-003 - GROUNDING INSTALLATION TYPICAL DETAILS.

5.10.6 Interfaces of the Package with Electrical System shall comply with I-ET-3010.00-5140-797-P4X-001 - ELECTRICAL SYSTEM AUTOMATION ARCHITECTURE, I-DE-3010.00-5140-797-P4X-002 - ELECTRICAL SYSTEM AUTOMATION TYPICAL ACTUATION DIAGRAMS and I-LI-3010.00-5140-797-P4X-001 - ELECTRICAL SYSTEM AUTOMATION INTERFACE SIGNALS LIST.

5.11 INSTALLATION REQUIREMENTS

5.11.1 Skid Details

This section is only applicable for equipment that is built on a skid:

5.11.1.1 The skid shall be designed to accommodate the entire equipment within the scope of supply. The skid shall be of rigid construction, which will not distort during hoisting, operation and shipment and shall withstand all moments and forces due to the vessel motion.

5.11.1.2 All equipment shall be installed by SELLER over structural steel deck plate in position shown in I-DE-3010.2D-1426-942-P4X-001- M-15 - UTILITIES - EQUIPMENT LAYOUT PLAN.

5.11.1.3 All piping terminations shall be flanged.

5.11.1.4 The set of equipment and its skid must be designed, arranged, and assembled in such a way to allow safe access for personnel for all operations and maintenance tasks (mechanical, electrical, painting, insulation, etc.).

5.11.1.5 Lifting facilities shall enable lifting of the equipment with crane as a single point lift for transportation and installation. The design and manufacture of the lifting lugs shall be certified. The arrangement of equipment, piping and superstructure shall be such that the center of gravity coincides approximately with the geometrical center of the skid. When lifting the skids, complete with all equipment mounted, beam deflection shall not exceed 1/400 L.

5.11.1.6 The skid shall resist all sling forces, including both horizontal and vertical components of the applied sling angle (sling angles shall be within between 50 and 90º with the horizontal plane).

5.11.1.7 Lifting beams, spreader bars, slings, shackles etc. are within SELLER's scope of supply.

5.11.1.8 Drip trays with drain connections shall be provided underneath equipment where significant spillage is likely to occur.

5.11.1.9 The skid shall be welded to the supporting structures. Skid floor shall be made of plate material with a raised on-slip tread. Welds underneath skid beams shall be ground flush. Skid shall have 2 diagonally opposed earthing bars.

5.11.2 Maintenance Lifting Beams

5.11.2.1 All required maintenance lifting beams, complete with the necessary hoisting and lifting gear, shall be provided to facilitate safe and easy maintenance.

5.11.2.2 All lifting beams shall overhang by at least 1.2 m into agreed lay-down areas.

5.11.2.3 The deflection of the maintenance crane/ hoisting beams shall not exceed 1/500 of the span length.

5.11.2.4 All beams and lifting gear shall be subject to load testing, witnessed by BUYER representative and CLASS.

5.12 PAINTING

5.12.1 Coating and Painting shall comply with I-ET-3010.00-1200-956-P4X-002 – GENERAL PAINTING requirements.

5.12.2 Color code adopted shall be in accordance with DR-ENGP-I-1.15 – COLOR CODING.

5.13 TELECOMMUNICATIONS REQUIREMENTS

5.13.1 Design of PAGA equipment shall fulfill the requirements, including standards and documents referred to within these, in as well as referenced data sheets. PAGA installations and interfaces shall comply with requirements of:

- I-ET-3010.00-5518-767-PPT-002 - TOPSIDES PUBLIC ADDRESS SYSTEM

- I-MD-3010.00-5510-760-PPT-001 - GENERAL CRITERIA FOR TELECOMMUNICATIONS DESIGN
- I-ET-3010.2D-1350-196-P4X-001 - ERGONOMIC REQUIREMENTS FOR TOPSIDES

5.13.2 Package shall be delivered with PAGA horns and cables installed and tested based on detail design done by SELLER.

5.13.3 SELLER shall be responsible for the design, supply, installation and integration of the Public Address and General Alarm System (PAGA) items of its package, complying with all applicable requirements described in I-ET-3010.00-5518-767-PPT-002 - TOPSIDE PUBLIC ADDRESS SYSTEM for the entire system.

5.13.4 Since the PAGA network inside package to be designed is part of the entire system that is scope of SELLER detailed design, SELLER shall ask the BUYER any specific characteristics of the system, as well as the approval of the sound calculation memories and detailed design, to assure fully interoperability.

5.13.5 The acoustic horns and cables shall be designed by SELLER in two different and independent groups A and B. Each of these groups shall be ended inside a proper interface box to be installed at the edge of the package, in accordance with the classifications zone and groups established by IEC / ABNT and SELLER.

5.13.6 SELLER shall be responsible for commissioning the PAGA segment of its own scope of supply before the lifting of the package, when the system will be accepted by BUYER.

5.13.7 SELLER shall supply all needed facilities to test the PAGA network inside package before lifting.

5.13.8 Wherever there are closed areas in package module, they shall also be covered by UHF, LTE and WLAN systems. So, SELLER shall make available MCT (Multi cable and pipe transit) for cables entrance and internal fixing supports for internal UHF and LTE antennas and their RF cables and industrial access points with its fiber optic cable and electrical cable. Such equipment and cables will be delivered by SELLER according to its detailed design, if required.

5.13.9 Since the UHF Active Repeater, LTE and WLAN Systems are part of complete systems scope of SELLER, SELLER shall ask the BUYER any specific characteristics of infrastructure required and detailed design to assure interoperability and functionality inside closed areas of packages module.

6 NAMEPLATES

6.1 GENERAL

6.1.1 SELLER shall attach corrosion resistant 316 stainless steel nameplates on each item of equipment in an accessible location, fastened with corrosion resistant stainless steel type 316 pins, and in Portuguese language.

6.1.2 For pressure vessels, columns and filters the nameplates shall be according to I-ET-3010.00-1200-540-P4X-001 – REQUIREMENTS FOR PRESSURE VESSELS DESIGN AND FABRICATION.

6.1.3 The nameplate shall include, as a minimum, the following information (in Portuguese):

- Petróleo Brasileiro S.A. – PETROBRAS;
- Purchase order number;
- Manufacturer and building year;
- Tag number;
- Service;

- Serial number;
- Main data for design, operation and testing (Power, Pressure, Volume, Temperature, Rotation, Flow rate), where applicable;
- Specific requirements;
- Installation identification;
- Driver power rating and speed, where applicable;
- Design code;
- Empty, Operation and Test Weight;
- NR-13 information (if applicable).

6.1.4 Valves, instruments and orifice plates shall have its nameplates tagged with the applicable number only.

7 TAG NUMBERING

7.1 GENERAL

7.1.1 Tagging of all instrumentation, electrical, mechanical, and piping items, including valves, shall be carried out according to I-ET-3000.00-1200-940-P4X-001 – TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN.

7.1.2 For main item tag numbers, refer to I-FD-3010.2D-5122-580-P4X-002 – FRESH WATER MAKER FOR OIL DILUTION (UD-5122002A/B).

7.1.3 Tag numbers for remaining ancillary equipment shall be given after purchase order placement.

8 CERTIFICATION REQUIREMENTS

8.1 CLASSIFICATION SOCIETY CERTIFICATION

8.1.1 SELLER shall provide a CLASS Certificate of Compliance for the entire Unit.

8.1.2 In order to obtain the Certificate of Compliance all related CLASS activities and CLASS technical requirements are within the SELLER scope of work, as well as the all cost associated with it.

8.2 HAZARDOUS AREAS CERTIFICATION

8.2.1 All materials and equipment proper to be used in hazardous areas, shall have conformity certificates complying with the latest revision of IEC-60079 and all its parts; PORTARIA INMETRO Nº 115 (March 21st, 2022); and shall be approved by CLASS.

9 REPAIR

9.1 GENERAL

9.1.1 Welding repairs and heat treatments must be recorded and submitted for BUYER's approval.

10 INSPECTION, TESTING AND COMMISSIONING

10.1 GENERAL

10.1.1 SELLER is required to propose a program for inspection and testing of all supplied equipment for approval by BUYER, prior to commencement of work in accordance with document schedule. Inspection and Test Plans (ITP) shall be issued for the equipment that are part of the Package.

10.1.2 Unless otherwise stated, all inspections and tests shall be performed at the workshop of SELLER in the presence of BUYER representative and CLASS surveyor as applicable.

10.1.3 Inspections and tests are an integral part of the order which will not be considered complete until such inspections and tests have been carried out in full and recorded in an inspection report that shall be part of data book.

10.1.4 BUYER shall issue an Inspection Release Certificate (IRC) only after completion of all required inspections and tests and after the manufacturing data books have been issued and approved.

10.1.5 SELLER shall follow the requirements of I-ET-3010.00-1200-978-P4X-005 - REQUIREMENTS FOR MATERIALS TRACEABILITY and I-ET-3010.00-1200-972-P4X-006 - REQUIREMENTS FOR MANUFACTURING SURVEY INSPECTION

10.2 PERSONNEL QUALIFICATION AND CERTIFICATION

10.2.1 Personnel qualification and certification shall be in accordance with I-ET-3010.00-1200-970-P4X-003 - REQUIREMENTS FOR PERSONNEL QUALIFICATION AND CERTIFICATION.

10.3 QUALITY AND INSPECTION

10.3.1 SELLER shall provide documented schedules with the estimated completion dates. These schedules shall be issued by the same time the drawings are submitted for approval, as indicated in the agreed document schedule.

10.3.2 BUYER reserves the right to inspect all items at any time during fabrication to ensure that the materials and workmanship are in accordance with this specification and all applicable documentation.

10.3.3 SELLER is responsible for the overall compliance of the Unit when it comes to the CLASS requirements, including certificates, work examinations and tests, as well as final inspection activities and shipment.

10.3.4 In addition to BUYER inspection, equipment such as valves and fittings, etc. shall be subject to all CLASS authority and may range from a review of SELLER's quality manual to a physical survey of SELLER's shop or end products.

10.3.5 The CLASS inspector shall have the right to request inspections or examinations to ensure that the equipment complies with the relevant CLASS requirements. In case examination reveals any shortcomings, SELLER shall bear the full cost of repair or replacement when necessary. Any repair work shall be approved by BUYER. The subsequent examination necessary to ensure the satisfactory manufacture of the equipment in question will be on behalf of the SELLER.

10.3.6 Except if approved by BUYER inspector, all equipment shall be presented for inspection in an unpainted state. SELLER shall provide notice to the inspector to witness the specified tests at least 2 (two) weeks in advance for Brazilian MANUFACTURER and 3 (three) weeks for foreign MANUFACTURER.

10.3.7 Manufacturing Survey Inspection shall be performed according to I-ET-3010.00-1200-972-P4X-006 - REQUIREMENTS FOR MANUFACTURING SURVEY INSPECTION.

10.3.8 Traceability of material shall comply with I-ET-3010.00-1200-978-P4X-005 - REQUIREMENTS FOR MATERIALS TRACEABILITY.

10.3.9 Equipment, piping, and accessories under scope of NR-13 shall comply with I-ET-3010.00-1200-970-P4X-013 - COMPLIANCE WITH NR-13 AND SPIE REQUIREMENTS.

10.4 WELDING AND WELDING INSPECTION

10.4.1 All equipment (such as pressure vessels, filters, tanks, heat exchangers, pump, turbomachinery etc.), structures, valves and piping weldments shall be according to the requirements stated in I-ET-3010.00-1200-955-P4X-001 – WELDING.

10.4.2 Welding shall be carried out with procedures and welders qualified in accordance with Design Code and additional requirements stated in contractual technical specifications. Welding shall not be performed before qualified welding procedures specification have been approved.

10.4.3 Intermittent fillet welds are not permitted.

10.4.4 Welding inspection shall be according to the Design Code and additional requirements stated in the contractual technical specification, such as I-ET-3010.00-1200-200-P4X-115 – REQUIREMENTS FOR PIPING FABRICATION, ASSEMBLY AND COMMISSIONING, I-ET-3010.00-1200-540-P4X-001 - REQUIREMENTS FOR PRESSURE VESSELS DESIGN AND FABRICATION, I-DE-3010.00-1400-140-P4X-004 - GENERAL NOTES FOR TOPSIDES STRUCTURES, etc.

10.5 NON DESTRUCTIVE TEST

10.5.1 NDT shall be according to the Design Code and I-ET-3010.00-1200-970-P4X-004 - NON-DESTRUCTIVE TESTING REQUIREMENTS FOR METALLIC AND NON-METALLIC MATERIALS.

10.5.2 Final NDTs, for acceptance purposes shall be performed after completion of any post weld heat treatment (when applicable) and prior to paint application, hydrostatic testing, etc.

10.6 TESTING

10.6.1 The following tests shall be included in SELLER's scope:

a) Pressure test (usually hydrostatic) of all vessels, heat exchangers, tanks and piping/valves;
b) Electrical continuity checks on all wiring and earthing;
c) Functional checks on all instruments and valves.

10.6.2 Hydrostatic testing shall be carried out in the presence of BUYER inspectors and shall include all pressure vessels, heat exchangers and applicable piping/valves.

10.6.3 All piping systems and equipment shall be drained and dried after hydrostatic testing.

10.6.4 Preservation to be applied shall be as detailed in I-ET-3010.00-1200-200-P4X-115 – REQUIREMENTS FOR PIPING FABRICATION, ASSEMBLY AND COMMISSIONING.

10.7 ELECTRICAL

10.7.1 The following testing shall be carried out in the presence of BUYER inspectors and shall include:

a) Insulation (MEGGER) test for cables, electric motors and electrical panels shall be provided;
b) Tests stated in the respective motors and power/control panel specifications.

10.8 PACKAGE INSPECTION

10.8.1 Unless waived by BUYER, the following inspections and checks shall be witnessed by BUYER inspector:

A. Verification of equipment construction materials (vessels, heat exchangers, pumps, etc.) for conformity with the specification requirements;
B. Verification of piping, fittings and valves conform to specification of materials and fabrication;
C. Reports for all NDT performed on the pressure retaining parts (radiographic, dye penetrant, magnetic particles and ultrasonic inspection);
D. Approval of the relief valve settings and witness of their testing after setting;
E. Review of Inspection and Test Records;
F. A visual check noting:
   - That the thickness of the pressure retaining parts meets or exceeds the quoted design thickness;
   - Any repairs;
   - Dry-film thickness of applied coatings;
   - The general appearances, materials, workmanship and standard of finish;
   - Dimensional check;
   - Alignment to be demonstrated.

10.9 PACKAGE TEST

10.9.1 A full function test of completed package shall be performed. The satisfactory operation of all indicators, selectors and controllers shall be demonstrated.

10.9.2 The correct operation of all controllers, alarm and fault protection equipment and indicators shall be demonstrated and, if necessary, fault simulations.

10.9.3 SELLER shall submit a FAT procedure with a test schedule covering all items within the scope of supply.

10.9.4 SELLER shall prepare a FAT procedure for the package and submit for BUYER approval.

10.9.5 FAT will be witnessed by BUYER representatives. SELLER shall advise BUYER of the test schedule at least 2 (two) weeks for Brazilian SELLER/Sub-Suppliers and 3 (three) weeks for foreign SELLER/Sub-Suppliers before the planned test dates. SELLER shall invite CLASS surveyor for FAT.

10.9.6 Acceptance of the FAT will not be considered as the final acceptance test of the package.

10.10 ASSEMBLY ASSISTANCE AND COMMISSIONING REQUIREMENTS

10.10.1 SELLER is responsible for assembly supervision of the equipment, including the assembly of components to be delivery as loose parts (for example, some components of the pumps, like stuffing box; some internals of pressure vessels, etc.).

10.10.2 SELLER is responsible for pre-commissioning and commissioning supervision of the equipment/system. Final acceptance shall be on satisfactory completion of commissioning tests as specified by BUYER.

10.10.3 An Initial Service Safety Inspection shall be performed on the piping and on the static equipment of the PACKAGE (pressure vessels, heat exchangers, and so on) once the Package itself has been erected to its final location.

10.10.4 Requirements of I-ET-3010.00-1200-200-P4X-115 - REQUIREMENTS FOR PIPING FABRICATION, ASSEMBLY AND COMMISSIONING shall be attended.

11 SELLER RESPONSIBILITY

11.1 GENERAL

11.1.1 SELLER shall assume sole contractual and total engineering responsibility for the package equipment.

11.1.2 SELLER's responsibility shall also include, but is not limited to:

- Technical responsibility for the entire scope of supply;
- Resolving all engineering questions and/or problems relating to design and manufacture;
- All coordination with manufacturers and collection of all details, drawings, calculations, and data to achieve optimum design and full submission of the documents requested in the specification;
- Providing details as requested of any sub-supplier relating to design and manufacture;
- To submit to the certifying authority the documentation as described in the latest edition of their rules for equipment on offshore facilities;
- Installation at site by others, however, presence of supervision will be required;
- SELLER's responsibility shall also include Commissioning & Training for operation;
- Pre-Commissioning;
- Attend HAZOP meetings arranged by BUYER and update the design with its recommendations.

11.1.3 Any exclusion and/or alternative to what is specified in this Technical Specification, including the use of the SELLER's standard and exclusive technology, shall be presented in a Deviation List, subject to BUYER acceptance during the clarification phase, preceding the proposal presentation. Otherwise the requirements herein will be considered as "Agreed", and so required.

12 PREPARATION FOR SHIPMENT

12.1 MARKING

12.1.1 All items supplied to this specification shall be adequately marked for identification against a certificate or relevant test documentation. Marking shall be such that it will not damage or impair the component.

12.1.2 Items that cannot be identified shall be rejected. Rejected items may be re-certified by carrying out all relevant testing, with prior approval of BUYER.

12.2 SHIPMENT PACKING

12.2.1 Shipment packing preparation of the equipment shall be suitable for 24 months of outdoor storage from time of shipment.

12.2.2 All open ends of tubes on the equipment shall be treated and closed off by plastic caps and taped. Small bore threaded connections shall be taped over.

12.2.3 All carbon steel vessels, etc. shall be protected with corrosion inhibitor prior to shipment.

12.2.4 The package shall be protected from corrosion.

12.2.5 Vulnerable instruments shall be removed and packed separately for shipment.

12.2.6 Transportation bracing/support shall be used where necessary and shall be clearly identified as temporary.

12.2.7 All crates and boxes will contain sufficient moisture absorbing agent to avoid condensation.

12.2.8 SELLER shall specify any limitations applicable to the transport and installation phase.