PETROBRAS	TECHNICAL SPECIFICATION	N°. I-ET-3010.2D-1238-560-P4X-001	
	CLIENT: AGUP		SHEET: 1 of 22
	JOB: HIGH CAPACITY FPSO - GAS EXPORTATION ALL ELECTRIC		
	AREA: ATAPU 2 AND SÉPIA 2		
SRGE	TITLE: **GAS REFRIGERATION UNIT (UT-1238001)**		INTERNAL
			ESUP

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1 OBJECTIVE

This Technical Specification covers the minimum requirements for design, engineering, materials, fabrication, inspection, testing, commissioning, and pre-commissioning of the GAS REFRIGERATION UNIT (UT-1238001).

The GAS REFRIGERATION UNIT (UT-1238001) 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 scope of this unit, including manufacturers, packagers, 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 CLASSIFICATION SOCIETY

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

2.1.2 SELLER is responsibility to submit to the Classification Society the documentation in compliance with stated Rules.

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

2.2 CODES AND STANDARDS

2.2.1 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.

2.2.2 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.

Table 1: Codes and Standards

AISC ASD	- Steel Construction Manual
API RP14C	- 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	- Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2
API STD 520	- Sizing, Selection, and Installation of Pressure-relieving Devices Parts I&II
API STD 521	- Pressure-Relieving and Depressuring Systems
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 BPVC II	- Part A, B, C and D. Boiler and Pressure Vessel Code. Materials
ASME BPVC V	- Boiler and Pressure Vessel Code. Nondestructive Examination
ASME BPVC VIII	- Div.1 and Div. 2. Boiler and Pressure Vessel Code. Rules for Construction of Pressure Vessels
ASME BPVC IX	- Boiler and Pressure Vessel Code. 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 61892 (all parts)	- Mobile and fixed offshore units – Electrical installations
IEC 61260	- Electroacoustics-Octave Band and Fractional-Octave-Band Filters
IEC 61672 1/2	- Electroacoustics-Sound Level Meters
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 15156 (all parts)	- Materials for Use in H2S-Containing Environments in Oil and Gas Production
ISO 21457	- Materials selection and corrosion control for oil and gas production systems
TEMA	- Standards of the Tubular Exchanger Manufacturers Association
ISA 75.07	- Control Valve Noise Measurement and Prediction

2.3 GOVERNMENTAL REGULATION

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

Table 2: Brazilian Regulatory Standard and Government Regulation

NR-10	- Brazilian Regulatory Standard – Safety in Electrical Facilities and Services
NR-12	- Brazilian Regulatory Standard - Safety in the Work of Machinery and Equipment
NR-13	- Brazilian Regulatory Standard – Boilers, Pressure Vessels, Pipes and Metallic Storage Tanks
NR-17	- Brazilian Regulatory Standard – Ergonomic
NR-26	- Brazilian Regulatory Standard – Safety Signaling
NR-37	- Brazilian Regulatory Standard – Safety and Health in Petroleum Platforms
IBAMA	- Brazilian IBAMA environmental regulations concerning the discharge of all types of effluents
INMETRO	- INMETRO Resolution nº 115, March 21st 2022

2.4 DESIGN SPECIFICATIONS

Table 3: Design Specifications

DR-ENGP-I-1.15	- COLOR CODING
DR-ENGP-M-I-1.3	- SAFETY ENGINEERING GUIDELINE
I-DE-3010.00-1400-140-P4X-004	- GENERAL NOTES FOR TOPSIDES STRUCTURES
I-DE-3010.00-5140-797-P4X-002	- ELECTRICAL SYSTEM AUTOMATION TYPICAL ACTUATION DIAGRAMS
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-1238-943-P4X-001	- PROCESS FLOW DIAGRAM HYDROCARBON DEW POINT CONTROL SYSTEM
I-DE-3010.2D-1238-944-P4X-001	- HYDROCARBON DEW POINT CONTROL SYSTEM
I-DE-3010.2D-1416-942-P4X-001	- M-06 – GAS DEHYDRATION - EQUIPMENT LAYOUT PLAN

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-3010.00-1200-200-P4X-115	- REQUIREMENTS FOR PIPING FABRICATION, ASSEMBLY 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-3010.00-1200-540-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-3010.2D-1200-800-P4X-005	- FIELD INSTRUMENTATION
I-ET-3010.00-1200-800-P4X-013	- GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS
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-3010.00-1200-940-P4X-006	- CORROSION MONITORING SYSTEM
I-ET-3010.00-1200-940-P4X-005	- CHEMICAL INJECTION POINTS
I-ET-3010.00-1200-955-P4X-001	- WELDING
I-ET-3010.00-1200-955-P4X-002	- REQUIREMENTS FOR WELDING INSPECTION
I-ET-3010.00-1200-956-P4X-002	- GENERAL PAINTING
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-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-3010.00-5140-700-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-3010.00-5140-700-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
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
I-ET-3010.00-5140-741-P4X-004	- SPECIFICATION FOR LOW-VOLTAGE GENERIC ELECTRICAL PANELS FOR OFFSHORE UNITS
I-ET-3010.00-5140-797-P4X-001	- ELECTRICAL SYSTEM AUTOMATION ARCHITECTURE
I-ET-3000.00-5400-98G-P4X-001	- EXPLOSION STUDY
I-ET-3010.00-5400-947-P4X-002	- SAFETY SIGNALLING
I-ET-3010.2D-1200-200-P4X-001	- PIPING SPECIFICATION FOR TOPSIDES
I-ET-3010.2D-1200-200-P4X-004	- REQUIREMENTS FOR PIPING SUPPORT
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-3010.00-1200-300-P4X-001	- NOISE AND VIBRATION CONTROL REQUIREMENTS
I-ET-3010.2D-1200-800-P4X-014	- AUTOMATION INTERFACE OF PACKAGE UNITS
I-ET-3010.00-5520-888-P4X-001	- AUTOMATION PANELS
I-ET-3010.2D-1200-940-P4X-001	- MATERIAL SELECTION PHILOSOPHY FOR DETAILED DESIGN
I-ET-3010.2D-1238-323-P4X-001	- HYDROCARBON DEW POINT CONTROL SYSTEM ROTARY COMPRESSOR
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-ET-3010.2D-1400-196-P4X-001	- ERGONOMIC REQUIREMENTS FOR TOPSIDES
I-ET-3010.00-5518-767-PPT-002	- TOPSIDE PUBLIC ADDRESS SYSTEM
I-FD-3010.2D-1238-560-P4X-001	- GAS REFRIGERATION UNIT (UT-1238001)
I-FD-3010.2D-5400-947-P4X-001	- SAFETY DATA SHEET - TOPSIDE
I-LI-3010.00-5140-797-P4X-001	- ELECTRICAL SYSTEM AUTOMATION INTERFACE SIGNALS LIST
I-MD-3010.00-5510-760-PPT-001	- GENERAL CRITERIA FOR TELECOMMUNICATIONS DESIGN
I-MD-3010.2D-1200-947-P4X-003	- DESCRIPTIVE MEMORANDUM – SAFETY
I-RL-3010.2D-1200-940-P4X-001	- GENERAL SPECIFICATION FOR AVAILABLE UTILITIES
I-RL-3010.2D-1350-960-P4X-002	- MOTION ANALYSIS

2.5 CONFLICTING REQUIREMENTS

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

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

3.2 ABBREVIATIONS

CLASS	-	Classification Society
FAT	-	Factory Acceptance Test
FPSO	-	Floating Production Storage and Offloading
HAZOP	-	Hazard and Operability Study
ITP	-	Inspection and Test Plans
NDT	-	Non-Destructive Test
PAGA	-	Public Address and General Alarm
PHA	-	Process Hazards Analyses

4 GENERAL FUNCTIONAL REQUIREMENTS

4.1 OPERATION ENVIRONMENT

4.1.1 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.

4.2 MOTION REQUIREMENTS

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

4.3 PACKAGE LOCATION AND AREA CLASSIFICATION

4.3.1 The Gas Refrigeration Unit shall be installed on module M-06 as informed in I-DE-3010.2D-1200-942-P4X-002 - GENERAL ARRANGEMENT, I-DE-3010.2D-1238-943-P4X-001 – PROCESS FLOW DIAGRAM HYDROCARBON DEW POINT CONTROL SYSTEM and I-DE-3010.2D-1238-944-P4X-001 – HYDROCARBON DEW POINT CONTROL SYSTEM. For available space, also see I-DE-3010.2D-1416-942-P4X-001 - M-06 – GAS DEHYDRATION - EQUIPMENT LAYOUT PLAN.

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

4.4 DESIGN LOADS

4.4.1 In addition to the Code described loads and loads due to vessel motion described in I-RL-3010.2D-1350-960-P4X-002 – MOTION ANALYSIS, the following design loads shall be considered whenever applicable:

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

4.5 DESIGN LIFETIME

4.5.1 SELLER shall design and fabricate the complete equipment of the package for a minimum lifetime of 30 years.

4.6 NOISE

4.6.1 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 SELLER shall select a sub supplier considering a proven experience supplying this type of equipment/technology. SELLER shall submit the name of the sub supplier to BUYER approval.

5.1.2 The GAS REFRIGERATION UNIT (UT-1238001) shall be complete in all respect and the scope of supply shall include but not be limited to the major equipment described in the document I-FD-3010.2D-1238-560-P4X-001 - GAS REFRIGERATION UNIT (UT-1238001).

5.2 PROCESS DESIGN

5.2.1 SELLER shall design and sizing the package's equipment for the full range of process conditions as specified in the Process Data Sheet I-FD-3010.2D-1238-560-P4X-001 - GAS REFRIGERATION UNIT (UT-1238001) and in the process diagrams I-DE-3010.2D-1238-943-P4X-001 – PROCESS FLOW DIAGRAM HYDROCARBON DEW POINT CONTROL SYSTEM and I-DE-3010.2D-1238-944-P4X-001 – HYDROCARBON DEW POINT CONTROL SYSTEM.

5.2.2 Design shall also include the definition of number, size and location of all process and instrument related nozzles of GAS REFRIGERATION UNIT (UT-1238001) at the battery limits (refer to the I-DE-3010.2D-1238-943-P4X-001 – PROCESS FLOW DIAGRAM HYDROCARBON DEW POINT CONTROL SYSTEM and I-DE-3010.2D-1238-944-P4X-001 – HYDROCARBON DEW POINT CONTROL).

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

5.3.3 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.

5.3.4 Piping layout shall observe the requirements presented on I-ET-3010.2D-1200-200-P4X-005 - MINIMUM REQUIREMENTS FOR PIPING MECHANICAL DESIGN AND LAYOUT.

5.3.5 Piping stress analysis shall be performed according to I-ET-3010.2D-1200-200-P4X-006 - REQUIREMENTS FOR PIPING FLEXIBILITY AND STRESS ANALYSIS.

5.3.6 Vents and drains on heat exchanger shall have a valve and a blind flange.

5.3.7 All piping shall be properly supported considering the service loads, shipment, results of pipe flexibility analysis studies 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.

5.3.8 Socket welding connections in lieu of butt-welding connections are only permitted for piping sizes equal or less than 1½ inch NPS (Nominal Pipe Size). All piping above 1½ inch shall be butt-welded.

5.3.9 The use of concentric type butterfly valves and straight-through diaphragm valves with open body (open body tubular diaphragm valves) is not permitted.

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

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

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

5.3.13 All structural steel work including main structural skid, support frames, supports for equipment, ladders, walkways, platforms, grating and drip trays shall be provided.

5.3.14 All other miscellaneous items and equipment which are required for the service and proper operation of the Gas Refrigeration Unit shall be included.

5.3.15 Equipment and piping subjected to temperature of 60 ºC and above shall receive a personal protection system, by means of stainless steel 316 wire mesh / perforated plates. Alternatively, a thermal insulation may be applied. Equipment and piping in which heat conservation is necessary shall be thermal insulated. The thermal insulation shall be according to the latest revision of I-ET-3010.00-1200-431-P4X-001 – THERMAL INSULATION FOR MARITIME INSTALLATIONS.

5.3.16 All fasteners (studs bolts, tightening bolts and nuts) shall be according to I-ET-3010.00-1200-251-P4X-001 – REQUIREMENTS FOR BOLTING MATERIALS.

5.3.17 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.

5.3.18 SELLER shall provide a design book with all piping detailed design documentation, which must include, but not be limited, to the following documents: isometrics, piping plan, support detail drawings, stress analysis report (with native program file), list of supports, valve list, special item list, document list, stress analysis list, tie-in list, welding procedures, strainers datasheet, and piping elements datasheet.

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-1238-560-P4X-001 - GAS REFRIGERATION UNIT (UT-1238001).

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

5.5.3 The use of asbestos or materials containing asbestos is prohibited.

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

5.5.5 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.

5.5.6 Titanium plates with minimum 0.8 mm thickness is required for the shell and plate heat exchangers.

5.6 DESIGN AND FABRICATION

5.6.1 Pressure Vessel

All pressure vessels, columns and filters shall comply with the requirements of 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 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 Brazilian Regulatory Standard NR-13. 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.

5.6.2 Heat Exchanger

5.6.2.1 The heat exchangers shall be shell and plate type and comply with the requirements of NR 13 (Brazilian Regulatory Standard) and I-ET-3010.00-1200-970-P4X-013 – COMPLIANCE WITH NR-13 AND SPIE REQUIREMENTS.

5.6.2.2 The design of heat exchanger shall be in accordance with ASME BPVC Sec. VIII and the connection of shell and cover shall be bolted.

5.6.2.3 The heat exchanger shall be provided with a davit or hinge to remove the blind flange.

5.6.2.4 A filter is required for the heat exchanger seawater inlet. Heat exchanger manufacturer shall inform the proper filter mesh size in order to avoid channel blocking.

5.6.2.5 The pipe arrangement shall consider a free maintenance area for the withdrawal of the heat exchangers internals.

5.6.2.6 The detailed inspection plan for heat exchanger manufacture shall be submitted to BUYER´s approval.

5.6.2.7 SELLER shall submit a fatigue analysis of plate pack, in accordance with ASME Sec. VIII division 2, for BUYER´s approval.

5.6.3 Compressor

5.6.3.1 Compressor shall comply with the requirements I-ET-3010.2D-1238-323-P4X-001 – HYDROCARBON DEW POINT CONTROL SYSTEM ROTARY COMPRESSOR.

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 STD 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-I-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-I-1.3 - SAFETY ENGINEERING GUIDELINE.

5.8.5 Double block & bleed arrangements are required for isolation of equipment in piping classes of 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 and additional interfaces 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; INMETRO Resolution 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

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

5.11.1.2 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.

5.11.1.3 All equipment shall be installed by SELLER over structural steel deck plate in position shown in I-DE-3010.2D-1416-942-P4X-001 M-06 – GAS DEHYDRATION - EQUIPMENT LAYOUT PLAN.

5.11.1.4 All piping terminations shall be flanged.

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

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 Painting requirements shall be according to I-ET-3010.00-1200-956-P4X-002 - GENERAL PAINTING.

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 - 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

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 stainless steel type 316 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 For the other equipment the nameplates shall include, as a minimum, the following information:

- Petróleo Brasileiro S.A. – PETROBRAS;
- Purchase order number;
- Manufacturer and year of build;
- 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 weight;
- NR-13 information (if applicable).

6.1.4 Valves, instruments and orifices shall be tagged with the applicable number only.

7 TAG NUMBERING

7.1 GENERAL

7.1.1 Tagging of all instruments, electrical, telecommunication, mechanical and piping items, including valves, shall be in accordance with latest revision of 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-1238-560-P4X-001 – GAS REFRIGERATION UNIT (UT-1238001).

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 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; INMETRO Resolution 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 Unit.

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 the 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.

10.2 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 NDT

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) Compressor tests;
b) Pressure test (usually hydrostatic) of all vessels, heat exchangers, tanks and piping/valves;
c) Electrical continuity checks on all wiring and earthing;
d) 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 IMPACT TESTING

10.7.1 Charpy impact test shall be included, where applicable. SELLER shall verify the applicability as per code, taking into consideration the material thickness for each application and the minimum design temperature the material is subjected to.

10.7.2 Impact testing shall be as per material specifications and codes. Guaranteed values are not acceptable, impact testing shall show the actual results.

10.8 ELECTRICAL

10.8.1 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.

10.9 PACKAGE INSPECTION

10.9.1 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 according 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.

10.10 PACKAGE TEST

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

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

10.10.3 SELLER shall prepare a FAT procedure for the package with a test schedule covering all items within the scope of supply and submit for BUYER approval.

10.10.4 FAT will be witnessed by BUYER representatives. SELLER shall advise BUYER of the test schedule at least 2 (two) weeks in advance for Brazilian

MANUFACTURERS and 3 (three) weeks for foreign MANUFACTURERS. SELLER shall invite CLASS surveyor for FAT.

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

10.11 ASSEMBLY ASSISTANCE AND COMMISSIONING REQUIREMENTS

10.11.1 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.).

10.11.2 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.

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

10.11.4 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-vendors 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

11.1.4 The Deviation List mentioned above shall contain, at least, for each requirement that the SELLER intends to change:

- The document's description, code and section that contain the requirement;
- The reason for deviation, and the costs, schedule and technical benefits/impacts of the change;
- The SELLER proposal.

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, as cables entrances, shall be temporary plugged.

12.2.3 All carbon steel vessels, stainless steel instruments/piping/tubing, 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 provide the procedures for unpacking, handling, installation, repacking, and long-term storage requirements.

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