PETROBRAS	TECHNICAL SPECIFICATION	Nr: I-ET-3010.00-5138-322-P4X-001	
	CLIENT:		SHEET: 1 of 19
	JOB :		
	AREA:		
SRGE	TITLE: EMERGENCY AND AUXILIARY GENERATOR START-UP AIR COMPRESSOR UNITS		INTERNAL
			ESUP

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INDEX OF REVISIONS

REV.	DESCRIPTION AND/OR REVISED SHEETS
0	ORIGINAL ISSUE
A	REVISED WHERE INDICATED. ITEM 5.2.6 TRANSFERRED FROM SECTION 5.5.

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATE	SEP/05/22	DEC/09/22							
PROJECT	EDCO	EDCO							
EXECUTION	UPF8	UPF8							
CHECK	CXLB	CXLB							
APPROVAL	CXM6	CXM6							

TABLE OF CONTENTS PAGE

1. OBJECTIVE

The purpose of this technical specification is to describe the minimum requirements for the design, manufacturing, assembly, supply, installation, commissioning and tests of EMERGENCY GENERATOR START-UP AIR COMPRESSOR UNIT and AUXILIARY GENERATOR START-UP AIR COMPRESSOR UNIT in conformance with relevant regulations.

2. DEFINITIONS AND ABBREVIATIONS

2.1. DEFINITIONS

2.1.1. EMERGENCY GENERATOR START-UP AIR COMPRESSOR UNIT - air compression unit that will supply compressed air for the air receiver, to start-up the emergency generator of the UNIT through the pneumatic starting system.

2.1.2. AUXILIARY GENERATOR START-UP AIR COMPRESSOR UNIT - air compression unit that will supply compressed air for the air receiver, to start-up the auxiliary generator of the UNIT through the pneumatic starting system.

2.1.3. START-UP AIR COMPRESSOR UNIT refers to either EMERGENCY GENERATOR START-UP AIR COMPRESSOR UNIT or AUXILIARY GENERATOR START-UP AIR COMPRESSOR UNIT.

2.1.4. Air Receiver Vessel – refer to either auxiliary or emergency generator start-up air receivers.

2.1.5. All terms and definitions are established in the latest revision of I-ET-3010.00-1200-940-P4X-002 – General Technical Terms.

2.2. ABBREVIATIONS

CS	Classification Society
FAT	Factory Acceptance Tests
FPSO	Floating Production Storage and Offloading Unit
SOS	Supervisory and Operation System
SOS-HM	Human Machine Interface of SOS

3. NORMATIVE REFERENCES

START-UP AIR COMPRESSOR UNITS shall comply with the requirements of this technical specification, data sheets, documents, codes and standards as stated below.

3.1. CLASSIFICATION

PACKAGER/MANUFACTURER shall perform the work in accordance with the requirements of Classification Society. PACKAGER/MANUFACTURER is responsible for submitting to the Classification Society all documentation in compliance with stated Rules.

3.2. APPLICABLE CODES AND STANDARDS

The following codes and standards shall be fully complied with:

- ASME BPVC Sec VIII Div 1 - Rules for Construction of Pressure Vessels

- ASME B16.5 - Pipe Flanges and Flanged Fittings
- ASME B31.3 - Process Piping
- ASME IX - Welding and Brazing Qualifications
- AWS D1.1 - Structural Welding Code – Steel
- IMO MODU CODE 2009
- Classification Society defined for the Hull scope.
- IEC 60034 – Rotating Electrical Machines
- IEC 60529 – Degrees of Protection Provided by Enclosures
- IEC 61892 – Mobile and Fixed Offshore Units – Electrical Installations – All parts
- IEC 60092-502 – Electrical Installation in Ships – Tankers – Special Features

3.3. BRAZILIAN REGULATIONS

- NR 10 - Segurança em Instalações e Serviços em Eletricidade (Safety in Electrical Facilities and Services)
- NR-12 - Segurança no Trabalho em Máquinas e Equipamentos (Safety on Labour in Machines and Equipment).
- NR 13 - Caldeiras, Vasos de Pressão, Tubulações e Tanques Metálicos de Armazenamento (Boilers, Pressure Vessels, Piping and Metallic Storage Tanks)
- NR 26 - Sinalização de Segurança (Safety Signaling)
- NR 37 - Segurança e Saúde em Plataformas de Petróleo (Safety and Health in Petroleum Platforms)
- NORMAM-01 – Normas da Autoridade Marítima para Embarcações Empregadas na Navegação em Mar Aberto;

3.3.1. Brazilian Government regulations are mandatory and shall prevail over the requirements of this specification and other references herein.

3.3.2. PACKAGER/MANUFACTURER shall comply with any other government regulations stated in the Contract and not listed above.

3.4. APPLICABLE DOCUMENTS

The following design documents shall be fully complied with:

3.4.1. TYPICAL DOCUMENTS

GENERAL

I-ET-3000.00-0000-940-P4X-002 SYMBOLS FOR PRODUCTION UNITS DESIGN
I-ET-3000.00-1200-940-P4X-001 TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN
I-ET-3010.00-1200-940-P4X-002 GENERAL TECHNICAL TERMS

MECHANICAL

I-ET-3010.00-1200-970-P4X-003	REQUIREMENTS FOR PERSONNEL QUALIFICATION AND CERTIFICATION
I-ET-3010.00-1000-970-P4X-002	REQUIREMENTS FOR NDT
I-ET-3010.00-1200-200-P4X-115	REQUIREMENTS FOR PIPING FABRICATION ASSEMBLY AND COMMISSIONING
I-ET-3010.00-1200-251-P4X-001	REQUIREMENTS FOR BOLTING MATERIALS
I-ET-3010.00-1200-300-P4X-001	NOISE AND VIBRATION CONTROL REQUIREMENTS
I-ET-3010.00-1200-540-P4X-001	REQUIREMENTS FOR PRESSURE VESSELS DESIGN AND FABRICATION
I-ET-3010.00-1200-955-P4X-001	WELDING
I-ET-3010.00-1200-956-P4X-002	GENERAL PAINTING
DR-ENGP-I-1.15	COLOR CODING

NAVAL

I-ET-3010.00-1350-960-P4X-001	DESIGN REQUIREMENTS – NAVAL ARCHITECTURE

SAFETY

DR-ENGP-M-I-1.3	SAFETY ENGINEERING GUIDELINE
I-ET-3010.00-5400-947-P4X-002	SAFETY SIGNALING

ELECTRICAL

I-DE-3010.00-5140-700-P4X-003	GROUNDING INSTALLATION TYPICAL DETAILS.
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-005	REQUIREMENTS FOR HUMAN ENGINEERING DESIGN FOR ELECTRICAL SYSTEMS OF 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-3010.00-5261-700-P4X-001	EMERGENCY GENERATOR PACKAGE FOR OFFSHORE UNITS
I-ET-3010.00-5262-700-P4X-001	AUXILIARY GENERATOR PACKAGE FOR OFFSHORE UNITS

INSTRUMENTATION AND AUTOMATION

I-ET-3010.00-1200-800-P4X-002	AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS
I-ET-3010.00-1200-800-P4X-013	GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS
I-ET-3010.00-5520-888-P4X-001	AUTOMATION PANELS

3.4.2. SPECIFIC PROJECT DOCUMENTS

This section specifies documents that are referenced along the text and are part of a specific project. For that reason, the document's identification number is not yet defined and may vary according to project. The document title may also vary slightly from one project to another. Project's DOCUMENT LIST shall be consulted in order to verify the correct document number and title.

GENERAL

GENERAL ARRANGEMENT
AREA CLASSIFICATION – GENERAL
GENERAL SPECIFICATION FOR AVAILABLE UTILITIES
METOCEAN DATA

HULL SYSTEMS

AUXILIARY AND EMERGENCY GENERATORS START-UP AIR SYSTEM (P&ID)
EMERGENCY AND AUXILIARY GENERATORS (P&ID)
HULL EXHAUST GAS DISCHARGE SYSTEM (P&ID)
DESCRIPTIVE MEMORANDUM - HULL SYSTEMS

NAVAL

MOTION ANALYSIS

MECHANICAL

MATERIAL SPECIFICATION FOR PRESSURE VESSELS AND TANKS
PIPING SPECIFICATION FOR HULL
TOPSIDES STRUCTURAL REQUIREMENTS
MATERIAL SELECTION PHILOSOPHY FOR DETAILED DESIGN
HULL/ACCOMMODATION MECHANICAL HANDLING PROCEDURES

INSTRUMENTATION AND AUTOMATION

AUTOMATION INTERFACE OF PACKAGE UNITS

3.5. CONFLICTING REQUIREMENTS

Any conflict between the requirements of this specification and related codes and standards, specification, etc. shall be presented in writing for OWNER's resolution prior to manufacturing.

4. DESIGN REQUIREMENTS

4.1. DESIGN LIFE

4.1.1. Equipment shall be designed for a 30-year life in a corrosive offshore environment without the need for replacement of any major component due to wear, corrosion, fatigue, or material failure.

4.1.2. All equipment and components shall be manufactured up to two years before the delivery date at most.

4.2. DESIGN CONDITIONS

4.2.1. PACKAGER shall design the equipment for the full range of operational conditions as specified on the P&ID AUXILIARY AND EMERGENCY GENERATORS START-UP AIR SYSTEM.

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

4.3. EQUIPMENT LOCATION

START-UP AIR COMPRESSOR UNIT will be installed on the location defined in GENERAL ARRANGEMENT drawing of the UNIT.

4.4. SAFETY REQUIREMENTS

4.4.1. Personnel safety protection shall be provided according to Regulatory Standards (NR).

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

4.4.3. Rotating equipment outer parts, such as pulleys, couplings, belts and flywheels, shall have rigid protection, and shall be capable of being easily removed.

4.4.4. In accordance with the requirements of SOLAS II-1, Regulation 3-5, and MSC.1/Circ. 1379, all equipment and material to be supplied by PACKAGER must be “asbestos free”.

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

4.4.6. For area classification, refer to the drawing AREA CLASSIFICATION – GENERAL.

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

4.5. NOISE AND VIBRATIONS

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.

4.6. ENVIRONMENTAL CONDITIONS

The equipment supplied shall be suitable for the environment and range of ambient conditions defined in the document METOCEAN DATA and also the range of ambient conditions at the construction yard.

4.7. MOTIONS AND ACCELERATION

4.7.1. PACKAGE shall be able to withstand and operate in accordance with I-ET-3010.00-1350-960-P4X-001 - DESIGN REQUIREMENTS – NAVAL ARCHITECTURE.

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

4.7.3. For design data on motion requirements, refer to MOTION ANALYSIS report.

4.7.4. The equipment shall withstand inertial forces during transportation from construction site to operation site (onshore or offshore).

5. PACKAGE SPECIFICATION

5.1. SCOPE OF SUPPLY

5.1.1. Each EMERGENCY GENERATOR START-UP AIR COMPRESSOR UNIT PACKAGE shall be composed by:

- Emergency Generator Start-up Air Compressor Unit baseplate with the main components as below listed:
  - Start-Up Air Compressor
  - Diesel Engine
  - Control Panel
  - Radiators, interstage and discharge.
  - Diesel Tank
- Emergency Generator Start-up Air Receiver

- And all internals, accessories and interconnection devices of the above components.

5.1.2. Each AUXILIARY GENERATOR START-UP AIR COMPRESSOR UNIT PACKAGE shall be composed by:

- Auxiliary Generator Start-up Air Compressor Unit baseplate with the main components as below listed:
  - Start-Up Air Compressor.
  - Electric Motor.
  - Control Panel.
  - Radiators, interstage and discharge.
- Auxiliary Generator Start-Up Air Receiver.
- And all internals, accessories and interconnection devices of the above components.

5.1.3. Quantities and configuration of EMERGENCY GENERATOR START-UP AIR COMPRESSOR UNIT and AUXILIARY GENERATOR START-UP AIR COMPRESSOR UNIT are defined on the P&ID AUXILIARY AND EMERGENCY GENERATORS START-UP AIR SYSTEM.

5.2. COMMON REQUIREMENTS FOR START-UP AIR COMPRESSOR UNITS

5.2.1. Air compressors of START-UP AIR COMPRESSOR UNIT shall be a two-stage reciprocating compressor type.

5.2.2. START-UP AIR COMPRESSOR UNIT cooling system shall be provided with two (2) radiators, one interstage and another on the discharge.

5.2.3. START-UP AIR COMPRESSOR UNIT shall be controlled by a local control panel. For control panel requirements, refer to sections ELECTRICAL REQUIREMENTS and INSTRUMENTATION AND AUTOMATION REQUIEMENTS.

5.2.4. START-UP AIR COMPRESSOR UNIT shall have a selector switch to allow remote operation.

5.2.5. PACKAGER shall provide devices to control and protect the PACKAGE equipment against overpressure.

5.2.6. PACKAGER shall provide a temperature protection device to ensure that the PACKAGE working and design temperature are under the limits informed on the P&ID AUXILIARY AND EMERGENCY GENERATORS START-UP AIR SYSTEM.

5.2.7. A drip tray shall be installed at the lowest part of the baseplate with a proper flange ASME B16.5 for the connection with the Hull draining system.

5.2.8. PACKAGER shall provide a detailed P&ID for each START-UP AIR COMPRESSOR UNIT. The starting arrangements for the START-UP AIR COMPRESSOR UNIT shall be in accordance with CS.

5.2.9. The utility requirements and consumption of the equipment shall be clearly defined by PACKAGER in the technical proposal and detailed design. The consumption of utilities shall comply with the requirements of GENERAL SPECIFICATION FOR AVAILABLE UTILITIES.

5.3. EMERGENCY GENERATOR START-UP AIR COMPRESSOR UNIT

5.3.1. EMERGENCY GENERATOR START-UP AIR COMPRESSOR UNIT shall be driven by a Diesel Engine.

5.3.2. Diesel engine of EMERGENCY GENERATOR START-UP AIR COMPRESSOR UNIT shall be air cooled type, suitable for manual and battery starting.

5.3.3. Diesel engine discharge line shall have a silencer with spark arrester and with drain connector. Diesel Engine discharge line shall also have an expansion joint.

5.3.4. Diesel engine tank shall have overflow, drain and vent systems with flange ASME B16.5 for connection with Hull systems.

5.3.5. Diesel Engine Tank shall have low and high-level switches for diesel oil inlet control.

5.3.6. For additional requirements for Emergency Generator start-up system, refer to I-ET-3010.00-5261-700-P4X-001 – EMERGENCY GENERATOR PACKAGE FOR OFFSHORE UNITS.

5.4. AUXILIARY GENERATOR START-UP AIR COMPRESSOR UNIT

5.4.1. Auxiliary Generator Start-up Air Compressor Unit shall be driven by an Electric induction motor.

5.4.2. For additional requirements for Auxiliary Generator start-up system, refer to I-ET-3010.00-5262-700-P4X-001 – AUXILIARY GENERATOR PACKAGE FOR OFFSHORE UNITS.

5.5. AUXILIARY AND EMERGENCY GENERATOR START-UP AIR RECEIVERS

5.5.1. Each START-UP AIR COMPRESSOR UNIT shall have an Air Receiver Vessel to receive the compressed air from the start-up air compressors.

5.5.2. Each air receiver vessel shall have the volume designed to allow three (03) attempts to start either the Emergency or the Auxiliary Generator.

5.5.3. For protection against overpressure, each Air Receiver Vessel shall have two (2) pressure relief valves (PSV) installed at the same outlet piping branch. PSVs discharge shall be directed to the same drain tray.

5.5.4. For maintenance purpose and PSVs removal, single blocking manual valves shall be installed upstream and downstream the PSVs. A mechanical interlock device shall be installed in each block valve, to ensure that PSVs are not blocked unintentionally during operation. For details, refer to I-ET-3010.00-1200-800-P4X-013 – GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS.

5.5.5. For vessel pressure monitoring and control, a pressure gauge and a pressure indicator / transmitter shall be provided.

5.5.6. For pressure transmitter interlocking to start / stop the START-UP AIR COMPRESSOR UNIT with low / high pressure of the start-up Air Vessel, refer to the P&ID AUXILIARY AND EMERGENCY GENERATORS START-UP AIR SYSTEM.

5.5.7. For liquid level indication one (1) magnetic type level indicator shall be provided.

5.5.8. For inspection, cleaning and maintenance purposes one (1) manhole or inspection hole shall be provided.

5.5.9. Air Receiver Vessel shall be certified by CS.

5.5.10. Inlet / outlet shut-off valves shall have rating 300#, CS approved, ASME B16.5 flanged.

5.5.11. 01 (One) automatic drain trap, rating 300#, CS approved, shall be provided, including:

- 01 (One) drain automatic trap.
- 01 (One) shut-off valve at trap inlet.
- 01 (One) by-pass shut-off manual drain valve.

5.5.12. A drip tray shall be installed at the lowest part of the Air Receiver Vessel with proper flange ASME B16.5 for the connection with Hull draining system.

5.6. PIPING

5.6.1. All piping shall be designed, fabricated, and inspected in accordance with ASME B31.3 and PIPING SPECIFICATION FOR TOPSIDE. Threaded connections shall not be used.

5.6.2. All connections shall be located at baseplate edge and provided with flanged connections, according to ASME B16.5 and PIPING SPECIFICATION FOR TOPSIDE. Locations, size and rating of all connections shall be clearly defined by PACKAGER/MANUFACTURER.

5.6.3. All auxiliary piping shall terminate with block valves at the edge of the baseplate and shall be designed to allow easy disconnection of pipework. Drains and vents shall be flanged with valves.

5.6.4. After completion of fabrication, all fabricated pipe spools shall be internally and externally cleaned to remove all loose scale, weld spatter, sand, and other foreign materials.

5.6.5. PACKAGER shall check and approve all piping with respect to stresses, vibration and layout. Piping support shall be provided at baseplate edge.

5.6.6. Spectacle blinds shall be supplied and assembled for maintenance and testing.

5.7. PRESSURE VESSELS (DESIGN AND FABRICATION)

For pressure vessels, requirements of I-ET-3010.00-1200-540-P4X-001 - Requirements for Pressure Vessels Design and Fabrication shall be followed.

5.8. MATERIAL SELECTION AND CERTIFICATION

5.8.1. The SELLER is responsible for the materials selection considering the philosophy detailed at MATERIAL SELECTION PHILOSOPHY FOR DETAILED DESIGN, and the operational condition and process data stated at AUXILIARY AND EMERGENCY GENERATORS START-UP AIR SYSTEM (P&ID).

5.8.2. 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.

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

5.8.4. 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.

5.8.5. Dissimilar materials shall be isolated to avoid galvanic corrosion.

5.9. ELECTRICAL REQUIREMENTS

5.9.1. All electrical equipment installed in hazardous areas (see Area Classification documentation) or

installed outdoors and kept on during emergency condition (ESD) shall be certified according to IEC 61892, INMETRO Resolution 115, March 21st, 2022.

5.9.2. Electrical equipment and material shall comply with requirements of 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 and I-ET-3010.00-5140-700-P4X-009 - GENERAL REQUIREMENTS FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS.

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

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

Notes:

1. It shall be possible to start the emergency generator start-up air compressor during emergency condition in platform (ESD) and in case of failure in any external electrical power supply. It shall be possible to start the diesel engine of this compressor manually during emergency condition (ESD) in case of failure in any external electrical power and in case of failure of all internal electrical power (control and starting voltages).

2. Control panel for Auxiliary Generator Start-up Air Compressor shall be fed from external redundant UPS power supplies, with voltage according to I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS.

3. Control panel for Emergency Generator Start-up Air Compressor shall be fed from internal battery charger and respective batteries bank, fed from external power supply according to I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS. This batteries bank shall allow operation in case of failure in external power supply.

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

5.10. INSTRUMENTATION AND AUTOMATION REQUIREMENTS

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

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

i. I-ET-3010.00-1200-800-P4X-002 – AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS.

ii. I-ET-3010.00-1200-800-P4X-013 – GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS.

5.10.3. The minimum requirements for the adequate interfacing of the PACKAGE Automation and Instrumentation System with the UNIT are described on AUTOMATION INTERFACE OF PACKAGE UNITS.

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

5.10.5. All electrical signal connections for external interconnection with the panel shall be clustered in junction boxes with at least IP-56 protection degree. The terminal blocks located inside the control panel shall be grouped according to the different types of signals involved.

5.11. PAINTING REQUIREMENTS

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

5.11.2. All components shall be delivered fully painted/coated, except on the machined surfaces for alignment shims, which shall be protected with a coating against corrosion.

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

5.12. MAINTENANCE HANDLING

5.12.1. PACKAGER/MANUFACTURER and SUPPLIER shall follow the requirements for maintenance handling on HULL/ACCOMMODATION MECHANICAL HANDLING PROCEDURES.

5.12.2. PACKAGER/MANUFACTURER shall supply spreader bars and specific handling devices for maintenance with the applicable certificates.

5.12.3. Lifting facilities shall permit the equipment to be lifted by 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 baseplate.

5.13. BASEPLATE AND LAYOUT

5.13.1. The baseplate shall not distort during lifting, operation and shipment and shall withstand the imposed loads due to the vessel motion.

5.13.2. Baseplate foundation structural steel components shall be designed and fabricated in accordance with TOPSIDES STRUCTURAL REQUIREMENTS.

5.13.3. The baseplate main frame shall be all welded construction. Structural baseplate welds, including lifting facilities shall be continuous and shall comply with AWS D1.1 (structural welding code) and CS Rules, where the most restrictive requirements shall prevail.

5.13.4. Baseplate structure shall be designed to be welded to the supporting structure unless otherwise specified.

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

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

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

6. NAMEPLATES

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

- Petróleo Brasileiro S.A. – PETROBRAS;
- Purchase order number;
- PACKAGER/MANUFACTURER's name;
- Year of build;
- Serial number;
- Main data for design, operation and testing (Power, Discharge Pressure, Discharge Temperature, Rotation, Flow rate in normal reference);
- Maximum Allowable Working Pressure of the casing;
- Module and UNIT identification;
- Driver power rating and speed;
- Equipment TAG;
- Empty Weight;
- Service.

6.2. For pressure vessels (filters, heat exchangers, moisture separators, among others, as per ASME BPVC Sec VIII definition) the nameplates shall be according to I-ET-3010.00-1200-540-P4X-001 – Requirements for Pressure Vessels Design and Fabrication.

6.3. Valves, instruments and orifices shall have a nameplate with tag number and serial number.

6.4. Auxiliary equipment shall have nameplates in accordance with respective technical specifications defined on section NORMATIVE REFERENCES.

7. TAG NUMBERING

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

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

7.3. For Instrumentation tagging, ISA 5.1 shall be followed.

7.4. All tag plates shall be made from AISI 316 stainless steel material.

8. SPARE PARTS, CONSUMABLES AND TOOLS

8.1. Spare parts recommended by the Classification Society, if applicable, and those required for NR-13 tests shall be provided.

8.2. All spare parts and special tools shall be detailed in the packing list and shall be consistent with the list of spare parts or special tools issued for the engineering documentation. These items shall have

an item number in the packing list, which shall match the item number fixed on the packing.

9. PACKAGE MANUFACTURING

9.1. WELDING AND NDT

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

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

9.1.3. Intermittent fillet welds are not acceptable.

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

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

9.1.5. Qualification and Certification for procedures and personnel shall be in accordance with I-ET-3010.00-0000-970-P4X-001 – REQUIREMENTS FOR PROCEDURES AND PERSONNEL QUALIFICATION AND CERTIFICATION.

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

9.2. INSPECTION AND TESTS

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

9.2.2. The following inspection activities and tests shall be included in PACKAGER/MANUFACTURER's scope:

i. review of Inspection and Test Records.

ii. visual check.

iii. Electrical tests as:

- Insulation (MEGGER) test for cables and electric motors.
- all tests stated in the respective motors and power / control panel respective specifications.

iv. Hydrotest of all vessels and pipes.

- Note: All piping systems and equipment shall be drained and dried after hydrostatic testing.
- Hydrostatic test of vessels classified in NR-13 within the PACKAGE shall be witnessed by OWNER.

v. Electrical continuity checks on all wiring and earthing.

vi. Functional checks on all instruments and valves.

vii. Alarms and Equipment Protection Tests.

9.3. FACTORY ACCEPTANCE TEST (FAT)

9.3.1. MANUFACTURER shall make preliminary test to ensure that all parts of the equipment are operating satisfactory prior to the arrival of the OWNER's representative.

9.3.2. PACKAGE shall be tested according to the parameters defined on the AUXILIARY AND EMERGENCY GENERATORS START-UP AIR SYSTEM P&ID and datasheet issued by SELLER.

9.3.3. Acceptance of the FAT will not be considered as the final acceptance test of the PACKAGE.

9.3.4. PACKAGER shall ensure that all the witnessed inspection requirements by the Classification Society are fully accommodated and the due notice requirements are satisfied.

9.3.5. Acceptance of shop tests shall not constitute a waiver of requirements to meet the field tests under specified operating conditions, nor shall inspection relieve MANUFACTURER of his responsibilities in any way whatsoever.

9.3.6. For all inspections predicted on ITP, a respective inspection report shall be issued and included in Databook.

9.3.7. If it is necessary to dismantle any equipment during the FAT, because of a malfunction, the test may then be invalidated, and a full test shall be required after the repair of the fault.

10. PREPARATION FOR SHIPMENT

10.1. MARKING

10.1.1. 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.

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

10.1.3. PACKAGER shall issue during engineering stage the packing list, which shall contain the item number of each part supplied loose in the PACKAGE.

10.2. SHIPMENT PACKING

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

10.2.2. All open ends of pipes shall be treated and closed off by plastic caps and taped. Small bore threaded connections shall be taped over.

10.2.3. Packing shall be in accordance with the requirements of the country to which the equipment is being shipped.

10.2.4. All internally unpainted carbon steel pressure vessels and piping shall be protected with corrosion

inhibitor prior to shipment. If necessary, PACKAGER/MANUFACTURER shall provide instructions to remove the corrosion inhibitor prior to the commissioning.

10.2.5. Equipment and accessories shall be protected from corrosion.

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

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

10.2.8. All crates and boxes shall contain sufficient moisture absorbing agent to avoid condensation.

10.2.9. PACKAGER/MANUFACTURER shall specify any limitations applicable to the transportation and installation phase.

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

11. DOCUMENTATION REQUIREMENTS

11.1. PACKAGER/MANUFACTURER shall supply a certificate of compliance with the rules of Classification Society.

11.2. Before any document is issued by PACKAGER/MANUFACTURER, document list shall be issued and approved by OWNER.

Note: This is required in order to guarantee that document number in accordance with N-1710 is correct. If PACKAGER/MANUFACTURER assigns wrong document numbers, document number changing procedure is time consuming, therefore detrimental to the project.

11.3. If any other documents are issued at the same time as the document list or even before issuance of document list, these documents will be rejected.

11.4. Document list shall be submitted with the source file, otherwise it will be rejected;

11.5. Title of all documents to be issued by PACKAGER/MANUFACTURER shall have the following format:

- First part – tag number;
- Second part – equipment description;
- Third part – document description

EXAMPLE: C-UC-UG-5261501 - Emergency Generator Start-up Air compressor – General Arrangement Drawing

11.6. If PACKAGER/MANUFACTURER issues documents which contain information valid for the whole package, title shall be summarized to the compression unit tag and document purpose.

EXAMPLE: UC-UG-5261501 – Inspection and Test Plan.

11.7. PACKAGER/MANUFACTURER shall provide source files of all required documents, whenever required by OWNER.

11.8. The following documents shall be issued within the first two weeks from the beginning of the detailed design stage and approved before manufacturing or procurement starts:

- Piping and Instrument diagram (P&ID), which shall follow I-ET-3000.00-0000-940-P4X-002 - Symbols for Production Units Design.
- General arrangement drawing.
- Weight and center of gravity datasheet.
- Utility consumption list and heat dissipation.
- Inspection and test plan (ITP), including auxiliary equipment.

11.9. The following documents shall be issued and approved before FAT. If these documents are not approved prior to the FAT, OWNER will not attend the FAT and will not consider it as executed:

- Main equipment datasheet.
- Performance curves.
- Hydrostatic test report of Air Receiver Vessels.
- Painting and insulation specification.
- Noise datasheet.
- FAT procedure.
- Control panels layout and functional drawings.

11.10. The following documents shall be issued and approved before delivery of the PACKAGE. If these documents are not approved prior to the delivery of the PACKAGE, OWNER will not attend to the receiving inspection, and will not consider the receiving of the PACKAGE:

- Nameplate drawing.
- Noise report.
- FAT report.
- Handling drawing for installation.
- Painting report.
- Installation manual.
- Packing list

11.11. The following documents, besides those mentioned previously, shall be issued and approved before issuance of the Databook. Otherwise, OWNER will not accept the Databook:

- Cross sectional drawing of the compressor, with part list.
- Details drawings of pressure vessels.
- Outline drawings of auxiliary equipment.
- Nameplate drawings.

- List of spare parts for commissioning and start-up.
- List of recommended spare parts for two years of operation.
- List and datasheets of instruments and instrumented valves.
- List of set points, alarms and shutdown.
- Electromechanical panel drawing.
- Calculation notes of control valves, PSVs, thermowells and flowmeters.
- Calibration certificates of instruments and PSVs.
- Databook index.
- Fabrication procedures of pressure vessels classified in NR-13.
- NDT procedures of pressure vessels classified in NR-13.
- Calculation notes of pressure vessels.
- Welding, heat treatment and NDT reports, specially for pressure vessels.
- Material certificates of all pressurized components, specially for pressure vessels.
- Hydrotest procedures and reports of piping and pressure vessels. For pressure vessels classified in NR-13, hydrotest reports shall contain the Qualified Professional signature, as per NR-13 requirement.

11.12. All documents to be issued for motors during Detailed Design shall be according to I-ET-3010.00-5140-712-P4X-001 - Low-Voltage Induction Motors for Offshore Units.

11.13. Datasheets and outline drawings shall be submitted not only for the main equipment, i.e., the compressors, but also for the auxiliary equipment. PACKAGER/MANUFACTURER may include data in the outline drawing of each auxiliary equipment rather than issuing a separate datasheet for the auxiliary equipment, under approval of OWNER.

11.14. PACKAGER/MANUFACTURER shall include manual of auxiliary equipment in the Databook.

11.15. All inspections, NDTs and tests predicted by PACKAGER in the Inspection and Test Plan shall have a report, which shall be included in the Databook.

11.16. PACKAGER/MANUFACTURER operation and maintenance manual shall contain the specification of lubricant fluids, besides periodicity to replace it. A lubricant schedule may be issued separately.

11.17. PACKAGER/MANUFACTURER shall provide original documents in PDF format for all required documents. Extracted figures from catalogue or manual, especially for the outline drawings of components such as couplings, mechanical seals and auxiliary equipment, will not be accepted.

11.18. General arrangement drawings shall contain the connection list, i.e., a list with all connection tie in points of the baseplates, which shall have the following minimum information: Connection identification number (which shall be indicated in the drawing), connection description, connection specification (design code), rating, flange face type, connection nominal diameter and fluid.

11.19. Each material certificate and NDT report provided shall be preceded by a PACKAGER/

MANUFACTURER sheet, informing to which part of the equipment the document refers.

11.20. PACKAGER/MANUFACTURER is required to indicate on the general arrangement drawing the distance required for removal of all internal parts, which shall be disassembled periodically for maintenance, in accordance with recommendations on the maintenance manual.

11.20.1. SUPPLIER shall include this information on the respective handling arrangement drawing or handling study, along with the required handling equipment used to remove and transport the internal part. SUPPLIER is also required to check if there is any clash between the space required to remove the internal part and any obstacle nearby the PACKAGE using the 3D model.

11.21. Calculation notes of air receivers shall include the calculation of the volume, based on the required volume or flow rate for three attempts to start the emergency of auxiliary generator, and the minimum final pressure on the last attempt. These parameters shall be provided by Diesel engine manufacturer of the Emergency and Auxiliary Generator package.