

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.2D-1200-320-P4X-101	
	CLIENT:	AGUP	SHEET: 1 of 29
	JOB:	HIGH CAPACITY FPSO - GAS EXPORTATION ALL ELECTRIC	
	AREA:	ATAPU 2 AND SÉPIA 2	
SRGE	TITLE:	CENTRIFUGAL GAS MOTOCOMPRESSORS PACKAGE SPECIFICATION	INTERNAL
			ESUP

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DATE	MAR/15/22	AGO/19/22	NOV/07/22	DEC/07/22					
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EXECUTION	CFQ2	CFQ2	CFQ2	CFQ2					
CHECK	UP4Y	UP4Y	UP4Y	UP4Y					
APPROVAL	CXM6	CXM6	CXM6	CXM6					

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TECHNICAL SPECIFICATION

Nº I-ET-3010.2D-1200-320-P4X-101

REV. C

AREA: ATAPU 2 AND SÉPIA 2

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TITLE: CENTRIFUGAL GAS MOTOCOMPRESSORS PACKAGE SPECIFICATION

INTERNAL
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1. INTRODUCTION

- 1.1 This document objective is to detail information related to centrifugal compressor packages of HIGH CAPACITY FPSO - GAS EXPORTATION ALL ELECTRIC project.
- 1.2 Design shall comply with rules and regulations stated by Brazilian Authorities, Classification Society, International Standards. PURCHASER and PACKAGER shall also comply with local codes / regulations and shall be responsible for their legal translations.
- 1.3 PURCHASER and PACKAGER shall comply with Contract exhibits. Requirements for capital spare, spare parts, field proven experience, training, commissioning support and Classification society, among other contractual requirements, shall be according to Contract exhibits.
- 1.4 This document will cover the compression package of the following systems:
 - UC-1231001A/C - MAIN GAS MOTOCOMPRESSION;
 - UC-1231002A/D - EXPORTATION GAS MOTOCOMPRESSION;
 - UC-1254001A/C - CO2 MOTOCOMPRESSION;
 - UC-1252001A/B - INJECTION GAS MOTOCOMPRESSION.

2. DEFINITIONS

PETROBRAS	FPSO contracting and operating company.
PACKAGER	Company responsible for project, assembly, construction, fabrication, test of compressor and project, assembly, tests, integration and furnishing of all other main equipment in the skid, including the auxiliary systems.
PURCHASER	EPC company responsible for project, assembly, erection, construction, fabrication, test and furnishing, lift, hook up, installation and integration of all Modules of FPSO, with complete and fully operative systems in accordance with the requirements of this specification, codes and standards referenced therein.
VENDOR	Company hired by the purchaser or packager to supply equipment, components of equipment, instruments, control systems, etc. that will be part of the main system to be supplied.

3. GENERAL DESIGN REQUIREMENTS

- 3.1 Equipment shall be designed to meet PETROBRAS requirements and for unattended, fail-safe, continuous service as well as for idle periods up to several months in saline atmosphere (marine environment) on the FPSO. Prime importance is given to approve high degree of reliability, durability and maintainability.
- 3.2 PACKAGER shall be the compressor OEM (Original Equipment Manufacturer) and shall assume unit responsibility and shall assure that all subvendors comply with the requirements stated herein.
- 3.3 All points shown in the data sheet, as well as operating points not shown with lower flow rates or intermediate molecular weight, have equal probability of occurrence.

There is no predominant operating point. The certified point does not represent the most frequent operating point. The hydraulic variable speed driver, when used, shall be designed to operate continuously and for a long period at any point in the speed and torque range.

- 3.4 For compressor with speed variation, all cases shown in datasheets, and all additional cases listed on this document shall be located between minimum operating speed e 100% speed curve, they shall be also considered on the API overspeed margins and maximum continuous margins, driver margins, etc.
- 3.5 For compressor with speed variation, PACKAGER shall guarantee compressor performance with the following tolerance at the certified point, which the values shall be verified and guaranteed during the shop performance test: a) Inlet Volume: +/- 0%; b) Compressor Absorbed Power: +4% (as per API 617).
- 3.6 Dry gas Seal (DGS) additional requirements:
- 3.6.1 In order to demonstrate successful experience, DGS manufacturer shall provide a reference list including offshore applications. List shall comprise supplied equipment operating data, service, customer, end-user, location, year of start-up, contact person, e-mail address and telephone number.
- 3.6.2 DGS manufacturer shall demonstrate full capacity for seal maintenance and test in Brazil shop facilities.
- 3.6.3 DGS manufacturer shall demonstrate previous SGP (Seal Gas Panel) and SGCS (Seal Gas Conditioning System) offshore supply including reference list.
- 3.6.4 A minimum of four similar applications of 30,000 kPaa (as minimum) with 25,000 hours successful continuous operation shall be demonstrated. Peripheral speed and sealing pressure (Dynamic and Static) shall be considered to indicate similar operating conditions and shall be plotted in an experience plot.
- 3.7 Besides other standardized items defined in I-ET-3010.00-5140-700-P4X-002 – MEDIUM-VOLTAGE INDUCTION MOTORS FOR OFFSHORE UNITS, in order to allow future acquisition of spare motor suitable to several gas compressor packages, Packager / Motor Manufacturer shall standardize the following items in main electrical motor:
- Frame, including dimensions A, B, BD, C, D, E, F, GA, K and H, as defined by IEC 60072;
 - Quantity of shaft ends;
 - Quantity and positions of feet;
 - Cooling method;
 - Position of lube oil input;
 - Position of lube oil output;
 - Connection method and connection dimensions of lube oil input and output;
 - Lube oil type;
 - Distance from D-end and cooling water input flanges;

- Distance from frame center and cooling water input flanges;
- Distance from D-end and cooling water output flanges;
- Distance from frame center and cooling water output flanges;
- Distance between input and output flanges of cooling water;
- Height of cooling water flanges;
- Cooling water flanges quantity and sizes;
- Cooling water maximum pressure;
- D-end bearings' manufacturer and model;
- N-end bearings' manufacturer and model;
- Bearings axial clearances;
- Quantity of terminal boxes;
- Positions and sizes of terminal boxes;
- Distance from D-end and cables entrance in power terminal box;
- Distance from frame center and cables entrance in power terminal box;
- Height of cables entrance in power terminal box;
- Dimensions of plate for cable glands in power terminal box;
- Quantity, size of holes and distance among holes in plate for cable glands in power terminal box;
- Internal distance between the entrance cables plate and power terminals in power terminal box;
- Quantity, size of holes and distance among holes in auxiliary terminal boxes;
- Current transformers voltage ratio;
- Current transformers class;
- Current transformers burden.

3.8 Besides the mandatory items listed above, Packager / Motor Manufacturer must standardize the following items in main electrical motor:

- Ratio Locker rotor current / Rated current;
- Locke rotor withstand time;
- Rated torque;
- Ratio Locked rotor torque / Rated torque;
- Locked rotor torque;
- Maximum torque;
- Minimum torque;
- Inertia;

- Frame dimensions L, AB, AD, BB and HD, as defined by IEC 60072;
- Total weight;
- Lube oil flow rate;
- Lube oil pressure.

3.9 These standardization requirements shall be considered for different gas compressor Packages when they have the same Packager. See details in I-MD-3010.2D-1200-320-P4X-002 – DESCRIPTIVE MEMORANDUM – TURBOMACHINERY and I-MD-3010.2D-5140-700-P4X-001 – ELECTRICAL SYSTEM DESCRIPTIVE MEMORANDUM.

3.10 Equipment and piping served by cooling water shall also be design with protections/detections against scenario of lack of supply and/or overpressure and/or high cooling water temperature.

4. UC-1231001A/C - MAIN GAS MOTOCOMPRESSION – SPECIFIC REQUIREMENTS

- 4.1 Each main gas motocompression unit consist of an electrical driven compressor, single stage, with HVSD - hydraulic speed variation control and auxiliaries equipment integrated for perfect functioning of the required service (accessories, control panel, machinery protection system, oil system, seal gas system, etc.). A total of 3 units shall be delivered. Each unit shall be designed according I-ET-3010.00-1200-321-P4X-001 - TECHNICAL SPECIFICATION FOR CENTRIFUGAL COMPRESSOR DRIVEN BY ELECTRIC MOTOR. Units shall not share auxiliaries systems. Although compression units are 3x50% configuration, package shall be designed to run all compressor units simultaneously.
- 4.2 Motor rated power shall not exceed 14 MW. If higher power is required, it shall be submitted to PETROBRAS approval due to impact on electrical FPSO system.
- 4.3 Process design cases shall be as per I-FD-3010.2D-1231-321-P4X-001 - MAIN GAS MOTOCOMPRESSION (C-UC-1231001A/C). Additional design cases shall be included as minimum:
- a) 1 case, similar to highest gas power of listed cases at I-FD-3010.2D-1231-321-P4X-001 - MAIN GAS MOTOCOMPRESSION (C-UC-1231001A/C), but with following modification: increase process mass flow by 1%; This case shall be used to compressor and driver sizing. (it covers expected degradation);
 - b) 1 case, similar to highest compressor speed of listed cases at I-FD-3010.2D-1231-321-P4X-001 - MAIN GAS MOTOCOMPRESSION (C-UC-1231001A/C), but with following modification: increase process mass flow by 1%; This case shall also be used to compressor and driver sizing. (it also covers expected degradation);
 - c) 2 cases for inert gas running test according to I-ET-3010.00-1200-321-P4X-001 - TECHNICAL SPECIFICATION FOR CENTRIFUGAL COMPRESSOR DRIVEN BY ELECTRIC MOTOR;

5. UC-1231002A/D - EXPORTATION GAS MOTOCOMPRESSION – SPECIFIC REQUIREMENTS

- 5.1 Each Exportation gas motocompression unit consist of an electrical driven compressor, two stages, back-to-back, with HVSD - hydraulic speed variation control and auxiliaries equipment integrated for perfect functioning of the required service (accessories, control panel, machinery protection system, oil system, seal gas system, etc.). A total of 4 units shall be delivered. Each unit shall be designed according to I-ET-3010.00-1200-321-P4X-001 - TECHNICAL SPECIFICATION FOR CENTRIFUGAL COMPRESSOR DRIVEN BY ELECTRIC MOTOR. Units shall not share auxiliaries systems. Although compression units are 4x33% configuration, package shall be designed to run all compressor units simultaneously.
- 5.2 Package UC-1231002A/D will perform two different services. FPSO will work at two different configuration that affect this package, it can Reinject produced gas or Export part of produced gas and reinject the rest of. Initially, from one until three units shall be aligned to Reinject gas (by sending it to UC-1252001A/B). Once decided to start the exportation, by using valve isolation at headers, a unit will be designated to export conditioned gas and to provide gas lift while up to two other units will remain aligned to Reinject gas (by sending it to UC-1252001A/B). At datasheet, those operational modes can be easily identified by name, by different suction pressure and by different range of molecular weight. Two Capacity (Master) Controllers shall be implemented at Compressor Governor System, one for each service (export and booster). Each Load Sharing controller shall be able to be associated with both Capacity Controllers (one at a time), depending upon which service each compressor is performing. Any unit shall be assigned for exportation or gas boosting services, whereas automatic association with the appropriate capacity controller shall be provided.
- 5.3 Due these two operational modes, PETROBRAS request two certified points for this compressor.
- 5.4 Motor rated power shall not exceed 10.5 MW. If higher power is required, it shall be submitted to PETROBRAS approval due to impact on electrical FPSO system.
- 5.5 Special attention shall be given to low gas temperatures, including in recycle line, and possibility of ice formation outside piping and valves. Compressor shall be able to continuously operate with process gas mass flow varying from zero to value presented on datasheet.
- 5.6 Process design cases shall be as per I-FD-3010.2D-1231-321-P4X-002 - EXPORTATION GAS MOTOCOMPRESSION (C-UC-1231002A/D). Additional design cases shall be included as minimum:
- a) 1 case, similar to highest gas power of listed cases at I-FD-3010.2D-1231-321-P4X-002 - EXPORTATION GAS MOTOCOMPRESSION (C-UC-1231002A/D), but with following modification: increase process mass flow by 1%; This case shall be used to compressor and driver sizing. (it covers expected degradation);
 - b) 1 case, similar to highest compressor speed of listed cases at I-FD-3010.2D-1231-321-P4X-002 - EXPORTATION GAS MOTOCOMPRESSION (C-UC-1231002A/D), but with following modification: increase process mass flow by

1%; This case shall also be used to compressor and driver sizing. (it also covers expected degradation);

- c) 2 cases for inert gas running test according to I-ET-3010.00-1200-321-P4X-001 - TECHNICAL SPECIFICATION FOR CENTRIFUGAL COMPRESSOR DRIVEN BY ELECTRIC MOTOR;

6. UC-1254001A/C - CO₂ MOTOCOMPRESSION – SPECIFIC REQUIREMENTS

- 6.1 Each CO₂ gas motocompression unit consist of an electrical driven compressor, two stages, back-to-back, with HVSD - hydraulic speed variation control and auxiliaries equipment integrated for perfect functioning of the required service (accessories, control panel, machinery protection system, oil system, seal gas system, etc.). A total of 3 units shall be delivered. Each unit shall be designed according I-ET-3010.00-1200-321-P4X-001 - TECHNICAL SPECIFICATION FOR CENTRIFUGAL COMPRESSOR DRIVEN BY ELECTRIC MOTOR. Units shall not share auxiliaries systems. Although compression units are 3x50% configuration (most of lifetime, changing to 3x33% whenever running with more than 70% CO₂ and near maximum design flowrate), package shall be designed to run all compressor units simultaneously.
- 6.2 Motor rated power shall not exceed 14 MW. If higher power is required, it shall be submitted to PETROBRAS approval due to impact on electrical FPSO system.
- 6.3 Due to the low inlet temperature condition including cooled recycle cases, PACKAGER to advise if a choke condition at the first stage compressor inlet flange would be faced.
- 6.4 Special attention shall be given to low gas temperatures, including in recycle line, and possibility of ice formation outside piping and valves. Compressor shall be able to continuously operate with process gas mass flow varying from zero to value presented on datasheet.
- 6.5 Process design cases shall be as per I-FD-3010.2D-1254-320-P4X-001 - CO₂ MOTOCOMPRESSION (C-UC-1254001A/C). Additional design cases shall be included as minimum:
- a) 1 case, similar to highest gas power of listed cases at I-FD-3010.2D-1254-320-P4X-001 - CO₂ MOTOCOMPRESSION (C-UC-1254001A/C), but with following modification: increase process mass flow by 1%; This case shall be used to compressor and driver sizing. (it covers expected degradation);
 - b) 1 case, similar to highest compressor speed of listed cases at I-FD-3010.2D-1254-320-P4X-001 - CO₂ MOTOCOMPRESSION (C-UC-1254001A/C), but with following modification: increase process mass flow by 1%; This case shall also be used to compressor and driver sizing. (it also covers expected degradation);



- c) 2 cases for inert gas running test according to I-ET-3010.00-1200-321-P4X-001 - TECHNICAL SPECIFICATION FOR CENTRIFUGAL COMPRESSOR DRIVEN BY ELECTRIC MOTOR;

7. UC-1252001A/B - INJECTION GAS MOTOCOMPRESSION - SPECIFIC REQUIREMENTS

- 7.1 Each Injection gas motocompression unit consist of an electrical driven compressor, single stage, with HVSD - hydraulic speed variation control, and additional suction throttle valve, if also required by compressor PACKAGER, and auxiliaries equipment integrated for perfect functioning of the required service (accessories, control panel, machinery protection system, oil system, seal gas system, etc.). A total of 2 units shall be delivered. Each unit shall be designed according I-ET-3010.00-1200-321-P4X-001 - TECHNICAL SPECIFICATION FOR CENTRIFUGAL COMPRESSOR DRIVEN BY ELECTRIC MOTOR. Units shall not share auxiliaries systems. Although compression units are 2x100% configuration, package shall be designed to run all compressor units simultaneously. Suction throttling, if required by compressor PACKAGER, shall be submitted to PETROBRAS approval. No suction throttling will be accepted only for HVSD selection in order to avoid a worst operating condition, including for its internals (bearing, internal gears etc.).
- 7.2 Motor rated power shall not exceed 14 MW. If higher power is required, it shall be submitted to PETROBRAS approval due to impact on electrical FPSO system.
- 7.3 If required by PACKAGER, the additional suction throttle valve shall be design and furnished by PACKAGER. Minimum valve pressure drop shall be informed by PACKAGER, and it will affect compressor flange suction pressure at simulated cases presented at I-FD-3010.2D-1252-321-P4X-001 - INJECTION GAS MOTOCOMPRESSION (C-UC-1252001A/B). PACKAGER to inform compressor flange suction pressure at datasheets.
- 7.4 Process design cases shall be as per I-FD-3010.2D-1252-321-P4X-001 - INJECTION GAS MOTOCOMPRESSION (C-UC-1252001A/B). Additional design cases shall be included as minimum:
- 1 case, similar to highest gas power of listed cases at I-FD-3010.2D-1252-321-P4X-001 - INJECTION GAS MOTOCOMPRESSION (C-UC-1252001A/B), but with following modification: increase process mass flow by 1%; This case shall be used to compressor and driver sizing. (it covers expected degradation);
 - 1 case, similar to highest compressor speed of listed cases at I I-FD-3010.2D-1252-321-P4X-001 - INJECTION GAS MOTOCOMPRESSION (C-UC-1252001A/B), but with following modification: increase process mass flow by 1%; This case shall also be used to compressor and driver sizing. (it also covers expected degradation);



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- c) 2 cases for inert gas running test according to I-ET-3010.00-1200-321-P4X-001 - TECHNICAL SPECIFICATION FOR CENTRIFUGAL COMPRESSOR DRIVEN BY ELECTRIC MOTOR;

8. I-ET-3010.00-1200-321-P4X-001 SPECIFIC PROJECT TERMS

8.1 Considering this specific project, the following terms shall be replaced at the I-ET-3010.00-1200-321-P4X-001 - TECHNICAL SPECIFICATION FOR CENTRIFUGAL COMPRESSOR DRIVEN BY ELECTRIC MOTOR:

FROM:	TO:
SPECIFIC PROJECT TOPSIDES UPS AND DC SYSTEMS ONE-LINE DIAGRAM	I-DE-3010.2D-5265-946-P4X-001 - TOPSIDES UPS AND DC SYSTEMS ONE-LINE DIAGRAM
SPECIFIC PROJECT AUTOMATION AND CONTROL ARCHITECTURE	I-DE-3010.2D-5520-800-P4X-002 - AUTOMATION AND CONTROL ARCHITECTURE
SPECIFIC PROJECT PIPING SPECIFICATION FOR TOPSIDE	I-ET-3010.2D-1200-200-P4X-001 - PIPING SPECIFICATION FOR TOPSIDES
SPECIFIC PROJECT INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS	I-ET-3010.2D-1200-800-P4X-001 - INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS
SPECIFIC PROJECT FIELD INSTRUMENTATION	I-ET-3010.2D-1200-800-P4X-005 - FIELD INSTRUMENTATION
SPECIFIC PROJECT AUTOMATION INTERFACE OF PACKAGED UNITS	I-ET-3010.2D-1200-800-P4X-014 - AUTOMATION INTERFACE OF PACKAGE UNITS
SPECIFIC PROJECT TOPSIDE'S MECHANICAL HANDLING PROCEDURES	I-ET-3010.2D-5266-630-P4X-001 - TOPSIDE'S MECHANICAL HANDLING PROCEDURES
SPECIFIC PROJECT EQUIPMENT LIST	I-LI-3010.2D-1200-940-P4X-002 - EQUIPMENT LIST
SPECIFIC PROJECT AUTOMATION AND CONTROL SYSTEM FUNCTIONS	I-MD-3010.2D-5520-800-P4X-001 - AUTOMATION AND CONTROL SYSTEM FUNCTIONS
SPECIFIC PROJECT AUTOMATION NET WORK DESCRIPTION	I-MD-3010.2D-5520-800-P4X-003 - AUTOMATION NET WORK DESCRIPTION
PETROBRAS TOPSIDE'S MECHANICAL HANDLING PROCEDURES	I-ET-3010.2D-5266-630-P4X-001 - TOPSIDE'S MECHANICAL HANDLING PROCEDURES
SPECIFIC PROJECT DESCRIPTIVE MEMORANDUM – PROCESS	I-MD-3010.2D-1200-940-P4X-005 - DESCRIPTIVE MEMORANDUM - PROCESS
SPECIFIC PROJECT DESCRIPTIVE MEMORANDUM – AUTOMATION AND CONTROL SYSTEM - SCOPE DEFINITION	I-MD-3010.2D-1200-940-P4X-011 - DESCRIPTIVE MEMORANDUM - AUTOMATION & CONTROL



9. PETROBRAS GENERAL DELIVERY REQUIREMENTS

- 9.1 Besides the documentation listed in Annex "B" of API 617, which shall be considered as required, VENDOR shall submit the documents described at Annex A of this technical specification. Different schedule may be proposed by VENDOR and submitted to PETROBRAS approval.
- 9.2 Proposal drawings and data shall not be certified or as-built.
- 9.3 PETROBRAS drawings approval shall not be considered as relieving the PURCHASER and PACKAGER from any responsibility for detailed design, dimensioning and construction of equipment or deviations from specifications.
- 9.4 All data, drawings and equipment supplied according to this specification shall use the SI measurement system, except for ordinary piping, flanges, accessories and appurtenances, which shall be in inches.
- 9.5 PURCHASER and PACKAGER shall provide weights, dimensions and center of gravity for all equipment, including auxiliaries in different skids or shipped loose, with accuracy of $\pm 10\%$ in proposal phase and $\pm 3\%$ after order. PURCHASER and PACKAGER shall also furnish required data for dry, operation, test and maintenance cases.
- 9.6 PURCHASER and PACKAGER are required to note on respective data sheets of main equipment the moments of inertia (kg.m^2) of each rotor.

10. MINIMUM SCOPE OF SUPPLY

- 10.1 PURCHASER and PACKAGER shall be responsible for the design, development, engineering, coordination, procurement, fabrication, assembly and shall guarantee overall performance (fully functional and operable) of the whole package, including as a minimum:

- | | | | |
|--|---|---|---|
| <input checked="" type="checkbox"/> Centrifugal compressor | <input checked="" type="checkbox"/> HVSD | <input checked="" type="checkbox"/> Electric motor | <input checked="" type="checkbox"/> Auxiliary equipment |
| <input checked="" type="checkbox"/> Couplings and guards: | <input checked="" type="checkbox"/> Main equipment | | <input checked="" type="checkbox"/> Auxiliary equipment |
| <input checked="" type="checkbox"/> Baseplate (skid): | <input checked="" type="checkbox"/> Main equipment | | <input checked="" type="checkbox"/> Auxiliary equipment |
| <input type="checkbox"/> Inlet system: | <input type="checkbox"/> Heat exchanger | <input type="checkbox"/> Silencer | <input type="checkbox"/> Knock-out drum |
| | <input type="checkbox"/> Temporary strainer | <input type="checkbox"/> Permanent Filter | |
| <input type="checkbox"/> Interstage system: | <input type="checkbox"/> Heat exchanger | <input type="checkbox"/> Silencer | <input type="checkbox"/> Knock-out drum |
| <input type="checkbox"/> Discharge system: | <input type="checkbox"/> Heat exchanger | <input type="checkbox"/> Silencer | <input type="checkbox"/> Knock-out drum |
| <input checked="" type="checkbox"/> Instrumentation, automation and control: | | <input checked="" type="checkbox"/> Unit control panel | |
| | | <input checked="" type="checkbox"/> Machinery protection system | |
| | <input checked="" type="checkbox"/> Load sharing control: | <input checked="" type="checkbox"/> Design & supply | <input checked="" type="checkbox"/> Design data |
| | <input checked="" type="checkbox"/> Capacity control: | <input checked="" type="checkbox"/> Design & supply | <input checked="" type="checkbox"/> Design data |
| | <input checked="" type="checkbox"/> Suc. Throttle valve* | <input checked="" type="checkbox"/> Design & supply | <input checked="" type="checkbox"/> Design data |
| | <input checked="" type="checkbox"/> HVSD: | <input checked="" type="checkbox"/> Design & supply | <input checked="" type="checkbox"/> Design data |



- VFD: Design & supply Design data
- Anti-surge system: For each stage Common for all stages
- Monitoring / controls: Design & supply Design data
- Control valve: Design & supply Design data
- Instrumentation: Design & supply Design data
- By-pass line: Design & supply Design data
- By-pass cooler: Design & supply Design data
- Relief valves: Design & supply Design data
- Non-return valves : Design & supply Design data
- Operational Design & supply Design data
depressurizing valve, with
restriction orifice:
- Oil system: Lube Control Seal
- Sealing system: Main equipment Auxiliary equipment
- Cooling system: Main equipment Auxiliary equipment
- Deluge system
- Piping and accessories for all utility system within skid limits
- MCC Transformers Uninterruptible power supply
- Grounding
- All safety equipment and systems such as emergency shutdown valves, pressure safety valves, etc. within skid limits
- Cables, cables trays, junction boxes and accessories within skid limits
- Lateral analysis of the whole train, with model & report: Typical Dedicated
- Torsional analysis of the whole train, with model & report: Typical Dedicated
- Transient torsional analysis of the whole train, with model & report: Typical Dedicated
- Forced unbalance rotor response analysis of all units, with model & report: Typical Dedicated
- Special tools for main & auxiliary equipment maintenance (field maintenance)
- Capital spare (all required parts included in main quotation with list of itemized prices and its container dimensions)
- Spare parts for tests, commissioning, start-up and assisted operation
- Design and coordination of complete arrangement within package limits
- Painting and procedures
- Preparation for shipment, including a single spreader bar for each FPSO for compressor skid
- Packing, coating, anticorrosive protection and preservation



Hydrostatic test (HT), Performance Test (PT), Mechanical Running Test (MRT), Full Pressure Full Load Full Speed Test (FPFLFS), Factory Stability Test (FST), Sound Level Test (SLT), Factory Integrated Test (FIT), Shipyard Acceptance Test (SYAT), Site Acceptance Test (SAT).

Supply & application of thermal insulation

Supply & application of support system, where applicable

Supply & application of heat tracing devices

Supply & application of noise attenuation devices

All consumables (oils, greases, fluids, products, etc.) for installation, commissioning and start-up

Nameplates

Full package documentation

Full compliance to local codes & regulations

Certification by Classification Society

Quality assurance program

Technical assistance of the following services: engineering during Detailed Engineering Design, erection, installation, onshore / offshore commissioning and start-up of main and auxiliary equipment, Site Acceptance Test, assisted operation before Offshore Acceptance Test and during Offshore Acceptance Test, included in main quotation, with itemized prices.

Training.

[*] – if required (see UC-1252001A/B specific requirement chapter).

10.2 The use of suction throttle shall be according to package description on previous chapters for Injection service.

10.3 PACKAGER shall verify and approve Heat Exchangers and Pressure Vessels Data Sheets which will be supplied by PURCHASER.

10.4 For details about equipment and systems, see complete PETROBRAS specification I-ET-3010.00-1200-321-P4X-001 - TECHNICAL SPECIFICATION FOR CENTRIFUGAL COMPRESSOR DRIVEN BY ELECTRIC MOTOR.

10.5 PURCHASER and PACKAGER are responsible for the complete package. Even if some sub-item is not described (for instance bolts, gaskets, expansion joints, etc.) PURCHASER and PACKAGER shall take it into account and include it in the scope of supply.

11. APPLICABLE DOCUMENTS (STANDARDS, REGULATIONS, ETC.):

Document Nº	Description
NR-1	Brazilian Ministry of Economy - Regulation Standard 1: " <i>Disposições Gerais</i> "
NR-10	Brazilian Ministry of Economy - Regulation Standard 10: " <i>Instalações e Serviços em Eletricidade</i> "
NR-11	Brazilian Ministry of Economy - Regulation Standard 11: " <i>Transporte, Movimentação, Armazenagem e Manuseio de Materiais</i> "
NR-12	Brazilian Ministry of Economy - Regulation Standard 12: " <i>Máquinas e Equipamentos</i> "
NR-13	Brazilian Ministry of Economy - Regulation Standard 13: " <i>Caldeiras e Vasos de Pressão</i> "
NR-15	Brazilian Ministry of Economy - Regulation Standard 15: " <i>Atividades e Operações Insalubres</i> "
NR-17	Brazilian Ministry of Economy - Regulation Standard 17: " <i>Ergonomia</i> "
NR-20	Brazilian Ministry of Economy - Regulation Standard 20: " <i>Líquidos Combustíveis e Inflamáveis</i> "
NR-23	Brazilian Ministry of Economy - Regulation Standard 23: " <i>Proteção Contra Incêndio</i> "
NR-26	Brazilian Ministry of Economy - Regulation Standard 26: " <i>Sinalização de Segurança</i> "
NR-37	Brazilian Ministry of Economy - Regulation Standard 37: " <i>Segurança e Saúde em Plataformas de Petróleo</i> "
API Std 521	Pressure-relieving and Depressuring Systems
API Std 541	Form-Wound Squirrel-Cage Induction Motors - 500 Horsepower and Larger
API Std 610	Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries
API Std 613	Special Purpose Gear Units for Petroleum, Chemical and Gas Industry Services
API Std 614	Lubrication, Shaft-Sealing and Control-Oil Systems and Auxiliaries
API Std 617	Axial and Centrifugal Compressors and Expander-compressors
API Std 662	Plate Heat Exchangers for General Refinery Services
API Std 670	Machinery Protection System
API Std 671	Special-Purpose Couplings for Petroleum, Chemical and Gas Industry Services
API Std 676	Positive Displacement Pumps - Rotary
API Std 682	Pumps - Shaft Sealing Systems for Centrifugal and Rotary Pumps
API Std 692	Dry Gas Sealing Systems for Axial, Centrifugal, Rotary Screw Compressors and Expanders
API RP 14E	Recommended Practice for Design and Installation of Offshore Production Platform Piping Systems
API RP 520	Sizing, Selection and Installation of Pressure-Relieving Devices
API RP 582	Welding Guidelines for the Chemical, Oil and Gas Industries.
API RP 684	API Standard Paragraphs Rotordynamic Tutorial: Lateral Critical Speeds, Unbalance Response, Stability, Train Torsionals and Rotor Balancing
API RP 686	Recommended Practice for Machinery Installation and Installation Design
ASME B 16.5	Pipe Flanges and Flanged Fittings
ASME B 16.34	Valves - Flanged, Threaded and Welding End



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Document Nº	Description
ASME B 31.3	Process Piping
ASME PTC 10	Performance Test Code on Compressors and Exhausters
ASME S.VIII	Rules for Construction of Pressure Vessels
ASME S. IX	Qualification Standard for Welding, Brazing and Fusing Procedures, Welders, Brazers and Welding, Brazing and Fusing Operators
ISO 15156	Petroleum and Natural Gas Industries: Materials for use in H ₂ S-Containing Environments in Oil and Gas Production
ISO 12944-9	Paints and Varnishes – Corrosion Protection of Steel Structures by Protective Paint Systems – Part 9: Protective Paint Systems and Laboratory Performance Test Methods for Offshore and Related Structures.
ISO 23936-2	Petroleum, petrochemical and natural gas industries — Non-metallic materials in contact with media related to oil and gas production – Part 2: Elastomers
IEC 61260	Octave Band and Fractional-Octave-Band Filters
IEC 61672	Electroacoustics - Sound Level Meters
IEC60034	Rotating Electrical Machines
IEC 61892	Mobile and Fixed Offshore Units – Electrical Installations
IEC 60079	Explosive Atmosphere Standards
IEC 60092	Electrical Installations in Ships
IEC 62381	Automation systems in the process industry – Factory acceptance test (FAT), site acceptance test (SAT), and site integration test (SIT)

12. ATTACHED AND REFERENCED DOCUMENTS

12.1 The documents listed below form an integral part of this project. Any deviation from the specifications mentioned in these documents shall be clearly stated by the PURCHASER and PACKAGER and submitted to PURCHASER for approval.

12.2 PURCHASER and PACKAGER shall also consider deviations or comments from paragraphs marked with a bullet in API standards, even if a decision is required or further information will be provided.

12.3 Attached documents (data sheets, drawings, technical specifications, etc.):

Document Nº	Discipline	Title	
I-DE-3010.2D-1200-942-P4X-002	ARR	GENERAL ARRANGEMENT	(1)(7)
I-DE-3010.2D-1415-942-P4X-001	ARR	M-05 - MAIN GAS COMPRESSION - EQUIPMENT LAYOUT PLAN	(1)(3)
I-DE-3010.2D-1417-942-P4X-001	ARR	M-07A - INJECTION AND EXPORT COMPRESSION - EQUIPMENT LAYOUT PLAN	(1)(4) (6)
I-DE-3010.2D-1417-942-P4X-002	ARR	M-07B - INJECTION AND EXPORT COMPRESSION - EQUIPMENT LAYOUT PLAN	(1)(4) (6)
I-DE-3010.2D-1412-942-P4X-001	ARR	M-02 - CO ₂ COMPRESSION - EQUIPMENT LAYOUT PLAN	(1)(5)
I-ET-3000.00-0000-940-P4X-002	COO	SYMBOLS FOR PRODUCTION UNITS DESIGN	(2)(7)
I-ET-3A26.00-1000-941-PPC-001	COO	METOCEAN DATA	(2)(7)
I-ET-3A36.00-1000-941-PPC-001	COO	METOCEAN DATA	(2)(7)



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Document Nº	Discipline	Title	
I-DE-3010.00-5140-700-P4X-003	ELE	GROUNDING INSTALLATION TYPICAL DETAILS	(1)(7)
I-DE-3010.00-5140-797-P4X-001	ELE	ELECTRICAL SYSTEM AUTOMATION ARCHITECTURE DIAGRAM	(1)(7)
I-DE-3010.00-5140-797-P4X-002	ELE	ELECTRICAL SYSTEM AUTOMATION TYPICAL ACTUATION DIAGRAMS	(1)(7)
I-LI-3010.00-5140-797-P4X-001	ELE	ELECTRICAL SYSTEM AUTOMATION INTERFACE SIGNALS LIST	(1)(7)
I-ET-3010.00-5140-700-P4X-002	ELE	SPECIFICATION FOR ELECTRICAL MATERIAL FOR OFFSHORE UNITS	(1)(7)
I-ET-3010.00-5140-700-P4X-003	ELE	ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS	(1)(7)
I-ET-3010.00-5140-700-P4X-005	ELE	REQUIREMENTS FOR HUMAN ENGINEERING DESIGN FOR ELECTRICAL SYSTEMS OF OFFSHORE UNITS	(1)(7)
I-ET-3010.00-5140-700-P4X-007	ELE	SPECIFICATION FOR GENERIC ELECTRICAL EQUIPMENT FOR OFFSHORE UNIT	(1)(7)
I-ET-3010.00-5140-700-P4X-009	ELE	GENERAL REQUIREMENTS FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS	(1)(7)
I-ET-3010.00-5140-712-P4X-001	ELE	LOW-VOLTAGE INDUCTION MOTORS FOR OFFSHORE UNITS	(1)(7)
I-ET-3010.00-5140-712-P4X-002	ELE	MEDIUM-VOLTAGE INDUCTION MOTORS FOR OFFSHORE UNITS	(1)(7)
I-ET-3010.00-5140-797-P4X-001	ELE	ELECTRICAL SYSTEM AUTOMATION ARCHITECTURE	(1)(7)
I-ET-3010.00-5140-741-P4X-003	ELE	POWER PANEL FOR THYRISTORIZED HEATER FOR OFFSHORE UNITS	(1)(7)
I-DE-3010.2D-5265-946-P4X-001	ELE	TOPSIDES UPS AND DC SYSTEMS ONE-LINE DIAGRAM	(1)(7)
I-ET-3010.00-1200-800-P4X-002	INS	AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS	(1)(7)
I-ET-3010.00-5500-854-P4X-001	INS	MACHINERY MONITORING SYSTEM (MMS)	(1)(7)
I-ET-3010.2D-1200-800-P4X-014	INS	AUTOMATION INTERFACE OF PACKAGE UNITS	(1)(7)
I-ET-3010.00-1200-956-P4X-001	MEC	QUALIFICATION TESTS FOR PAINT SYSTEMS	(1)(7)
I-ET-3010.00-1200-956-P4X-002	MEC	GENERAL PAINTING	(1)(7)
I-ET-3010.00-1200-540-P4X-001	MEC	REQUIREMENTS FOR PRESSURE VESSELS DESIGN	(1)(7)
I-ET-3010.00-1200-321-P4X-001	MEC	TECHNICAL SPECIFICATION FOR CENTRIFUGAL COMPRESSOR DRIVEN BY ELECTRIC MOTOR	(1)(7)
I-FD-3010.2D-1231-321-P4X-101	MEC	CENTRIFUGAL COMPRESSOR FOR MAIN GAS MOTOCOMPRESSOR	(1)(3)
I-FD-3010.2D-1231-321-P4X-102	MEC	CENTRIFUGAL COMPRESSOR FOR GAS EXPORTATION MOTOCOMPRESSOR	(1)(4)
I-FD-3010.2D-1254-321-P4X-101	MEC	CENTRIFUGAL COMPRESSOR FOR CO2 MOTOCOMPRESSOR	(1)(5)
I-FD-3010.2D-1252-321-P4X-101	MEC	CENTRIFUGAL COMPRESSOR FOR INJECTION GAS MOTOCOMPRESSOR	(1)(6)
I-FD-3010.2D-1200-346-P4X-001	MEC	HVSD FOR MOTOR DRIVEN CENTRIFUGAL COMPRESSOR	(1)(3)(4) (5) (6)

Document Nº	Discipline	Title	
I-FD-3010.2D-1200-392-P4X-001	MEC	OIL SYSTEM FOR MOTOR DRIVEN CENTRIFUGAL COMPRESSOR	(1)(3)(4) (5)(6)
I-FD-3010.2D-1200-854-P4X-001	MEC	MACHINERY PROTECTION SYSTEM FOR MOTOR DRIVEN CENTRIFUGAL COMPRESSOR	(1)(3)(4) (5)(6)
I-RL-3010.2D-1350-960-P4X-002	NAV	MOTION ANALISYS	(1)(7)
I-FD-3010.2D-1231-321-P4X-001	PRO	MAIN GAS MOTOCOMPRESSION (C-UC-1231001A/C)	(1)(3)
I-FD-3010.2D-1231-321-P4X-002	PRO	EXPORTATION GAS MOTOCOMPRESSION (C-UC-1231002A/D)	(1)(4)
I-FD-3010.2D-1254-320-P4X-001	PRO	CO2 MOTOCOMPRESSION (C-UC-1254001A/C)	(1)(5)
I-FD-3010.2D-1252-321-P4X-001	PRO	INJECTION GAS MOTOCOMPRESSION (C-UC-1252001A/B)	(1)(6)
I-DE-3010.2D-1231-943-P4X-001	PRO	MAIN GAS COMPRESSION UNIT	(2)(3)
I-DE-3010.2D-1231-944-P4X-001	PRO	SAFETY GAS K.O. DRUM	(2)(3)
I-DE-3010.2D-1231-944-P4X-002	PRO	MAIN COMPRESSION UNIT - TRAIN A	(2)(3)
I-DE-3010.2D-1231-944-P4X-003	PRO	MAIN COMPRESSION UNIT - TRAIN B	(2)(3)
I-DE-3010.2D-1231-944-P4X-004	PRO	MAIN COMPRESSION UNIT - TRAIN C	(2)(3)
I-DE-3010.2D-1231-943-P4X-002	PRO	PROCESS FLOW DIAGRAM EXPORTATION/BOOSTER GAS COMPRESSION UNIT	(2)(4)
I-DE-3010.2D-1231-944-P4X-006	PRO	EXPORTATION GAS COMPRESSION UNIT - TRAIN A - 1ST STAGE	(2)(4)
I-DE-3010.2D-1231-944-P4X-007	PRO	EXPORTATION GAS COMPRESSION UNIT - TRAIN B - 1ST STAGE	(2)(4)
I-DE-3010.2D-1231-944-P4X-008	PRO	EXPORTATION GAS COMPRESSION UNIT - TRAIN C - 1ST STAGE	(2)(4)
I-DE-3010.2D-1231-944-P4X-009	PRO	EXPORTATION GAS COMPRESSION UNIT - TRAIN D - 1ST STAGE	(2)(4)
I-DE-3010.2D-1231-944-P4X-010	PRO	EXPORTATION GAS COMPRESSION UNIT - TRAIN A - 2ND STAGE	(2)(4)
I-DE-3010.2D-1231-944-P4X-011	PRO	EXPORTATION GAS COMPRESSION UNIT - TRAIN B - 2ND STAGE	(2)(4)
I-DE-3010.2D-1231-944-P4X-012	PRO	EXPORTATION GAS COMPRESSION UNIT - TRAIN C - 2ND STAGE	(2)(4)
I-DE-3010.2D-1231-944-P4X-013	PRO	EXPORTATION GAS COMPRESSION UNIT - TRAIN C - 2ND STAGE	(2)(4)
I-DE-3010.2D-1254-943-P4X-001	PRO	PROCESS FLOW DIAGRAM CO2 COMPRESSION UNIT	(2)(5)
I-DE-3010.2D-1254-944-P4X-001	PRO	CO2 COMPRESSION UNIT - TRAIN A - 1ST STAGE	(2)(5)
I-DE-3010.2D-1254-944-P4X-002	PRO	CO2 COMPRESSION UNIT - TRAIN B - 1ST STAGE	(2)(5)
I-DE-3010.2D-1254-944-P4X-003	PRO	CO2 COMPRESSION UNIT - TRAIN C - 1ST STAGE	(2)(5)
I-DE-3010.2D-1254-944-P4X-004	PRO	CO2 COMPRESSION UNIT - TRAIN A - 2ND STAGE	(2)(5)
I-DE-3010.2D-1254-944-P4X-005	PRO	CO2 COMPRESSION UNIT - TRAIN B - 2ND STAGE	(2)(5)
I-DE-3010.2D-1254-944-P4X-006	PRO	CO2 COMPRESSION UNIT - TRAIN C - 2ND STAGE	(2)(5)
I-DE-3010.2D-1252-943-P4X-001	PRO	PROCESS FLOW DIAGRAM INJECTION GAS COMPRESSION UNIT	(2)(6)
I-DE-3010.2D-1252-944-P4X-001	PRO	INJECTION GAS COMPRESSION UNIT - TRAIN A	(2)(6)

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Document N°	Discipline	Title	
I-DE-3010.2D-1252-944-P4X-002	PRO	INJECTION GAS COMPRESSION UNIT - TRAIN B	(2)(6)
I-RL-3010.2D-1200-940-P4X-001	PRO	GENERAL SPECIFICATION FOR AVAILABLE UTILITIES	(1)(7)
I-DE-3010.2D-1200-944-P4X-001	PRO	GENERAL NOTES	(1)(7)
I-DE-3010.2D-1200-94A-P4X-001	SAF	AREA CLASSIFICATION - GENERAL	(1)(7)

- (1) The requirements of these documents are mandatory
- (2) These documents shall only be used by PURCHASER and PACKAGER for reference.
- (3) Valid to UC-1231001A/C - MAIN GAS MOTOCOMPRESSOR package.
- (4) Valid to UC-1231002A/D - EXPORTATION GAS MOTOCOMPRESSOR package
- (5) Valid to UC-1254001A/C - CO2 MOTOCOMPRESSOR package
- (6) Valid to UC-1252001A/B - INJECTION GAS MOTOCOMPRESSOR package
- (7) Valid to any packages or equipment on the unit.

Note: Electrical datasheets shall be included during detailed design.



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13. ANNEX

13.1 ANNEX A

Item	Description	With Proposal	For Approval		Certified		Final
		Document	Document	Schedule	Document	Schedule	
A	Centrifugal Compressor Package						
A01	Certified Dimensional Outline Drawing and List of Connections	X	X	4W	X	2W	X
A02	Cross-Sectional Drawings and Part Numbers	X	X	6W	X	2D	X
A03	Rotor Assembly Drawings and Part Numbers	X	X	6W	X	2D	X
A04	Thrust-Bearing Assembly Drawings, Part Numbers, Data Sheet and Sizing Calculations		X	6W	X	2D	X
A05	Journal-Bearing Assembly Drawings, Bill of Materials, Data Sheet and Sizing Calculations		X	6W	X	2D	X
A06	Shaft-Coupling Assembly Drawing and Bill of Materials	X	X	6W	X	2D	X
A07	Lube-Oil Schematics and Bills of Materials	X	X	6W	X	2D	X
A08	Lube-Oil Arrangement Drawings and List of Connections		X	4W	X	2D	X
A09	Lube-Oil Component Drawings and Data		X	6W	X	2D	X
A10	Seal Gas System Schematic and Bill of Materials	X	X	6W	X	2D	X
A11	Seal Gas System Arrangement Drawing and List of Connections		X	4W	X	2D	X
A12	Seal Gas System Component Drawings and Data		X	6W	X	2D	X
A13	Seal Gas System Assembly Drawing and Part Numbers		X	6W	X	2D	X
A14	Seal Gas System Leakage Rates	X	X	6W	X	2D	X
A15	Electrical and Instrumentation Schematics and Bill of Materials	X	X	6W	X	2D	X
A16	Electrical and Instrumentation Arrangement Drawing and List of Connections		X	4W	X	2D	X
A17	Data Sheets (Proposal / As-Built)	X	X	6W	X	2D	X
A18	Noise Sound Level (datasheet and report)	X	X	6W	X	2D	X
A19	Metallurgy of Major Components	X	X	6W	X	2D	X
A20	Lateral Analysis Report		X	6W	X	2D	X
A21	Torsional Analysis Report		X	6W	X	2D	X
A22	Vibration Analysis Report (with Sommerfeld Number Versus Stiffness and Dampening Bearing curves)	X	X	6W	X	2D	X



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Item	Description	With Proposal	For Approval		Certified		Final
		Document	Document	Schedule	Document	Schedule	
A23	Performance Curves for each Compressor Section and for each Operating Case (Polytropic Head, Discharge Pressure, Discharge Temperature, Polytropic Efficiency and Power versus Inlet Volumetric and Mass Flow) SI units. Operation limits (envelope) shall be clearly indicated.	X	X	6W	X	2D	X
A24	Impeller Overspeed Test Report				X	1T	1D
A25	Mechanical Running Test Report				X	1T	1D
A26	Coupling Selection and Rating	X	X	6W	X	2D	X
A27	Spare Parts Recommendations Lists with Itemized Prices for Two (2) Years of Operation)	X	X	10W	X	2D	X
A28	List of Special Tools Furnished for Maintenance		X	10W	X	2D	X
A29	Preparation for Storage at Job Site before Installation		X	6W	X	4D	1D
A30	Weather Protection, Insulation and Tropicalization		X	6W	X	4D	1D
A31	Tabulation of All Utilities	X	X	6W	X	2D	X
A32	Reference List of Similar Equipment Installed and Operating Under Analogous Conditions	X					
A33	Operating Restrictions to protect Equipment During Start-Up, Operation and Shutdown	X	X	6W	X	2D	X
A34	List of Components Requiring PETROBRAS's Approval	X	X	6W	X	2D	X
A35	Summary of Materials and Hardness of Materials exposed to H ₂ S	X	X	6W	X	2D	X
A36	Interstage Cooler System Data						
A37	Drawings, Details and Description of Instrumentation and Controls	X	X	6W	X	2D	X
A38	Minimum Length of Straight Pipe Required at Machine Inlet or Side Inlets	X	X	6W	X	2D	X
A39	Maximum and Minimum Allowable Seal Pressure for each Compressor	X	X	6W	X	2D	X
A40	Statement of Manufacturer's Testing Capabilities	X	X	6W	X	2D	X
A41	Performance Test Data and Curves				X	1T	1D
A42	Back-to-Back Impeller Machine Vendor to provide Thrust Bearing Loads Versus Differential Pressure Curve		X	6W	X	2D	X
A43	Balance Piston Leakage Rates (Test and Field Values)	X	X	6W	X	2D	X
A44	Balance Piston Line Differential Pressure Versus Thrust Load Curves		X	6W	X	2D	X
A45	Testing Procedures		X	6W	X	2D	X
A46	PACKAGER and PURCHASER Progress Reports		X	2W			



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Item	Description	With Proposal	For Approval		Certified		Final
		Document	Document	Schedule	Document	Schedule	
A47	Installation Manual		X	10W	X	2D	X
A48	Operating and Maintenance Manual		X	10W	X	2D	X
A49	Technical Data Manual		X	10W	X	2D	X
A50	Fulton and Kirk-Donald Plot	X	X	6W	X	2D	X
A51	Aerodynamics Cross Coupling Stiffness and Log Decrement Analysis	X	X	6W	X	2D	X
A52	As-Built Dimensions and Data (Including Assemblies Clearances)						X
A53	Certified Hydrostatic Test Logs				X	1T	1D
A54	Rotor Balancing Logs				X	1T	1D
A55	Rotor Combined Mechanical and Electrical Runout Report				X	1T	1D
A56	Weld Procedures and Welders Qualification Certificates		X	6W	X	2D	X
A57	List of Drawings and Documents Index (Status and Delivery Schedule)		X	2W	X	2D	X
A58	Preservation, Packaging and Shipping Procedures, including vendors.		X	6W	X	2D	X
A59	Shipping List		X	6W	X	2D	X
A60	Material Safety Data Sheets	X	X	10W	X	2D	X
A61	Liquid Injection System Drawings, Data and List of Components						
A62	Technical Requirements, Data and Drawings for Anti-Surge System	X	X	6W	X	2D	X
A63	Piping and Support Drawings, Arrangement and Details	X	X	4W	X	2D	X
A64	Pressure Vessels, Coolers Pumps and Auxiliary Equipment Data Sheets and Drawings	X	X	6W	X	2D	X
A65	Structure (Walkaways, Handrails, Grating, etc.) Drawings and List of Components		X	4W	X	2D	X
A66	Baseplate Drawings and List of Components	X	X	6W	X	2D	X
A67	Foundation Plan (With Anchor Bolts and Supports Location)		X	6W	X	2D	X
A68	Dimensions, Weights, Static / Dynamic Loads, Moments and Centers of Gravity	X	X	6W	X	2D	X
A69	Equipment General Description and Catalogs	X					
A70	Painting Specification	X	X	6W	X	2D	X
A71	List of VENDORS	X	X	6W	X	2D	X
A72	Nameplate Drawings for Each Piece of Equipment or Part, Including Applicable Code Stamp		X	6W	X	2D	X
A73	Vent Study Report		X	6W	X	2D	X
A74	List of Exceptions to the Specifications and Applicable Standards	X					
B	HVSD						



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Item	Description	With Proposal	For Approval		Certified		Final
		Document	Document	Schedule	Document	Schedule	
B01	Certified Dimensional Outline Drawing and List of Connections	X	X	4W	X	2D	X
B02	Cross-Sectional Drawing, Parts List and Bill of Materials	X	X	12W	X	2D	X
B03	Rotor Assembly Drawing, Parts List and Bill of Materials	X	X	12W	X	2D	X
B04	Thrust Bearing Assembly Drawing, Parts List, Bill of Materials, Data Sheet and Sizing Calculations		X	6W	X	2D	X
B05	Journal Bearing Assembly Drawing, Parts List, Bill of Materials and Data Sheet and Sizing Calculations	X	X	6W	X	2D	X
B06	Coupling Assembly Drawing, Parts List and Bill of Materials	X	X	10W	X	2D	X
B07	Lube-Oil Schematic and Bill of Materials	X	X	6W	X	2D	X
B08	Lube-Oil Component Drawings and Data Sheets		X	10W	X	2D	X
B09	Electrical and Instrumentation Schematics, Wiring Diagrams and Bill of Materials	X	X	6W	X	2D	X
B10	Electrical and Instrument Gauge Board Arrangement Drawing and List of Connections		X	6W	X	2D	X
B11	Record of Deviations From Manufacturing Process Control System		X	10W	X	2D	X
B12	Mass Elastic Data		X	10W	X	2D	X
B13	Lateral Critical Speed Analysis Report		X	10W	X	2D	X
B14	Torsional Critical Speed Analysis Report		X	10W	X	2D	X
B15	Input and Output Shaft Position Diagram	X	X	10W	X	2D	X
B16	Welding Procedures and Welders Qualification Certificates		X	6W	X	2D	X
B17	Hydrostatic Test Logs				X	1T	2D
B18	Mechanical Running Test Logs				X	1T	2D
B19	Rotor Balancing Logs				X	1T	2D
B20	Rotor Mechanical and Electrical Runout				X	1T	2D
B21	Proposals, Purchase and As-Built Data Sheets	X	X	10W	X	2D	X
B22	As-Built Dimensions or Data (Including Bearing Clearances)				X	2D	X
B23	Installation Manual		X	10W	X	2D	X
B24	Operating and Maintenance Manual		X	10W	X	2D	X
B25	Technical Manual		X	10W	X	2D	X
B26	Spare Parts Recommendations Lists with Itemized Prices for Two (2) Years of Operation)	X	X	10W	X	2D	X
B27	Preservation, Packaging and Shipping Procedures, including vendors.		X	6W	X	2D	X



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Item	Description	With Proposal	For Approval		Certified		Final
		Document	Document	Schedule	Document	Schedule	
B28	List of Special Tools Furnished for Maintenance		X	10W	X	2D	X
B29	Nondestructive Test Procedures and Acceptance Criteria		X	6W	X	2D	X
B30	Book with All Quality Assurance Documents		X	10W	X	2D	X
B31	Dimensions, Weights, Static / Dynamic Loads, Moments and Centers of Gravity	X	X	10W	X	2D	X
B32	Characteristic Curves (Output Torque, Output speed, guide vane position, isoefficiency line) SI units.	X	X	10W	X	2D	X
B33	Equipment General Description and Catalogs	X					
B34	Reference List of Similar Equipment Installed and Operating under Analogous Conditions	X					
B35	Painting Specification		X	6W	X	2D	X
B36	List of VENDORS	X	X	6W			X
B37	Nameplate Drawings for Major Piece or Part, Including Applicable Code Stamp		X	12W	X	2D	X
B38	List of Exceptions to the Specifications and Applicable Standards	X					
B39	Performance Curves for each HVSD and for each Operating Case. Operation limits (envelope) shall be clearly indicated. Isoefficiency curves shall be included.	X	X	6W	X	2D	X
C	Oil system						
C01	Certified Dimensional Outline Drawing and List of Connection	X	X	4W	X	2D	X
C02	Components Drawings and Bill of Materials	X	X	6W	X	2D	X
C03	System Schematics, Bill of Materials and Components Sizing Criteria	X	X	6W	X	2D	X
C04	Component Data Sheets	X	X	6W	X	2D	X
C05	Electrical and Instrumentation Wiring Diagrams and Bill of Materials	X	X	6W	X	2D	X
C06	Electrical and Instrumentation Terminal Box Layout and List of Connections		X	6W	X	2D	X
C07	Test Procedures		X	6W	X	2D	X
C08	Welding Procedures		X	6W	X	2D	X
C09	Hydrostatic Test Logs				X	1T	2D
C10	Operational Test Logs				X	1T	2D
C11	Data Sheets (Proposal / As-Built)	X	X	6W	X	2D	X
C12	Installation, Operation and Maintenance Manuals		X	10W	X	2D	X
C13	Spare Parts Recommendations Lists with Itemized Prices for Two (2) Years of Operation)	X	X	10W	X	2D	X
C14	Pressure Vessel Certification Data		X	6W	X	2D	X



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Item	Description	With Proposal	For Approval		Certified		Final
		Document	Document	Schedule	Document	Schedule	
C15	Preservation, Packing and Shipping Procedures, including vendors.		X	6W	X	2D	X
C16	Dimensions, Weights, Static / Dynamic Loads, Moments and Centers of Gravity	X	X	6W	X	2D	X
C17	Equipment General Description and Catalogs	X					
C18	Reference List of Similar Equip. Installed and Operating Under Analogous Conditions	X					
C19	Painting Specification	X	X	6W	X	2D	X
C20	List of VENDORS	X	X	6W	X	2D	X
C21	Nameplate Drawings for Each Piece or Part, Including Applicable Code Stamp		X	6W	X	2D	X
C22	List of Exceptions to the Specifications and Applicable Standards	X					
D	Automation & Machinery Protection System						
D01	Certified Dimensional Outline Drawing and List of Connections	X	X	4W	X	2D	X
D02	Cross-Sectional Drawing, Part List and Bill of Materials	X	X	6W	X	2D	X
D03	Control and Electrical System Schematics and Bill of Materials	X	X	6W	X	2D	X
D04	Electrical and Instrumentation System Arrangement Plans	X	X	6W	X	2D	X
D05	Grounding Plan		X	6W	X	2D	X
D06	Calibration Curves (Certified)		X	6W	X	2D	X
D07	Rotor Nodal Point Analysis Data		X	6W	X	2D	X
D08	Recommended Alarm (Alert) and Shutdown (Danger) Set-Points	X	X	6W	X	2D	X
D09	Data Sheets (ISA)	X	X	6W	X	2D	X
D10	Dimensions and Data	X	X	6W	X	2D	X
D11	Installation Manual		X	10W	X	2D	X
D12	Operation and Maintenance Manuals		X	10W	X	2D	X
D13	Spare Parts Recommendations Lists with Itemized Prices for Two (2) Years of Operation)	X	X	10W	X	2D	X
D14	List of Drawings and Documents Index (Status and Delivery Schedule)	X	X	6W	X	2D	X
D15	Shipping List		X	6W	X	2D	X
D16	Special Weather Protection and Tropicalization Requirements		X	6W	X	2D	X
D17	deleted						
D18	Technical Data Manual: Hardware and Software Manuals, Application Program, Communication Drivers, Drawings); Instrumentation Cable List with Complete Specification; Electronic Cards Schematic Drawings with Connections)		X	10W	X	2D	X
D19	Material Safety Data Sheets	X	X	6W	X	2D	X



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Item	Description	With Proposal	For Approval		Certified		Final
		Document	Document	Schedule	Document	Schedule	
D20	Cause x Effect Matrix, Ladder Block, Control Narratives, Logic (including Start-Up, Alarm and Shutdown) and Loop Diagrams		X	6W	X	2D	X
D21	P&ID Drawings and Schematics including, as a minimum: Steam, Seal Gas, Electrical Power, Fuel, Water, Lubrication and Process Fluid System	X	X	6W	X	2D	X
D22	EMI and RFI Test Logs				X	1T	2D
D23	Fire Fighting System List of Components, Drawings, Data Sheets and Bill of Materials		X	6W	X	2D	X
D24	Gas Detection System List of Components, Drawings, Data Sheets and Bill of Materials		X	6W	X	2D	X
D25	Preservation, Packing and Shipping Procedures, including vendors.		X	6W	X	2D	X
D26	Dimensions, Weights, Static / Dynamic Loads, Moments and Centers of Gravity	X	X	6W	X	2D	X
D27	Equipment General Description and Catalogs	X					
D28	Reference List of Similar Equipment Installed and Operating Under Analogous Conditions	X					
D29	Painting Specification	X	X	6W	X	2D	X
D30	List of VENDORS	X	X	6W	X	2D	X
D31	Nameplate Drawings for Each Piece or Part, Including Applicable Code Stamp		X	6W	X	2D	X
D32	List of Exceptions to the Specifications and Applicable Standards	X					
D33	Package Control System Architecture Diagram	X	X	6W	X	2D	X
D34	List of Data / Tags for Remote Monitoring from HMI Unit A&C System / Memory Map		X	6W	X	2D	X
D35	Control Panel I/O List		X	6W	X	2D	X
D36	Field Acceptance Test and Site Acceptance Test Procedures		X	6W	X	2D	X
D37	Instrument Index	X	X	4W	X	2D	X
D38	Factory Acceptance Test, Site Acceptance Test and Site Integration Test Procedures		X	6W	X	2D	X
D39	Instrument List		X	10W	X	2D	X
D40	Alarm & Events List		X	10W	X	2D	X
D41	Cable List		X	10W	X	2D	X
D42	PLC Technical Specification		X	10W	X	2D	X
D43	Instrument/Instrumented Valve Datasheets (one per type of instrument/instrumented valve)		X	10W	X	2D	X

Item	Description	With Proposal	For Approval		Certified		Final
		Document	Document	Schedule	Document	Schedule	
D44	Instrument/Instrumented Valve Calculations (Control Valves, PSVs, Orifice Plates/Restriction Orifices and Thermowells)		X	10W	X	2D	X
D45	UCP and RIO Panels General Arrangement		X	10W	X	2D	X
D46	UCP and RIO Panels Internal Interconnections Diagram		X	10W	X	2D	X
D47	Wiring Diagram		X	10W	X	2D	X
D48	Instrumentation certificates, such as, but not limited to: calibration certificates, hazardous areas certificates and IP degree certificates in accordance with INMETRO		X	10W	X	2D	X
E	Main Motor & Electrical Equipment						
E01	Dimensional Drawings, Including Weights	X	X	6W	X	2D	X
E02	Dimensional Drawing and Technical Information for Air-Water Coolers		X	6W	X	2D	X
E03	Dimensional Drawing and Technical Information for Bearings		X	6W	X	2D	X
E04	Dimensional Drawing and Technical Information for Pressurisation System		X	6W	X	2D	X
E05	Required Data-Sheets	X	X	6W	X	2D	X
E06	Starting Time Calculation Report Including Calculation of the Relation T_a/T_r , Current-Speed Curves and Torque-Speed Curves for Motor and Driven Machine, Printed on the Same Chart (100% and 85% of Rated Voltage)	X	X	6W	X	2D	X
E07	Temperature Rise Test Report for Motors Installed in Hazardous Area		X	6W	X	2D	X
E08	Electrical and Mechanical Parameter List in P.U., Including Locked-Rotor, Pull-Up and Breakdown Torques; Rotor Inertia Moment; Rotor Time Constants; Power Factor at Locked-Rotor and at Rated Conditions; Motor Electrical Model with Reactances, Resistances, Slip Dependence, Current Dependence	X	X	6W	X	2D	X
E09	Painting Method	X	X	6W	X	2D	X
E10	Complete Tests List	X	X	6W	X	2D	X



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Item	Description	With Proposal	For Approval		Certified		Final
		Document	Document	Schedule	Document	Schedule	
E11	Spare Parts Recommendations Lists with Itemized Prices (Start-Up, Commissioning, Compulsory Set per Classification Society, One (1) and Two (2) Years of Operation)	X	X	10W	X	2D	X
E12	Wiring Diagram(s) for Motor, Instruments, Panels, Sensors, Lubrication and Pressurisation Equipment		X	6W	X	2D	X
E13	Saturation Curves for Current Transformers		X	6W	X	2D	X
E14	Details of Power and Control Terminal Boxes	X	X	6W	X	2D	X
E15	Nameplate Drawings for Each Piece of Equipment or Part, Including Applicable Code Stamp		X	6W	X	2D	X
E16	Speed-Torque and Speed-Current Curves At 100% And 85% Rated Voltage	X	X	6W	X	2D	X
E17	Protection Study Including the Compatibility of Protection Devices with Permissible Thermal Times at Ambient (Cold Start) and Running (Hot Start) Temperatures						
E18	Heating and Cooling Time Constants		X	6W	X	2D	X
E19	Time-Current Curves Showing the Allowable Starting Condition and Continuous Operation at Rated Voltage and Ambient Temperature		X	6W	X	2D	X
E20	Temperature-Time Curves Showing the Required Stator and Rotor Limits and the Cool-Down Time After All Possible Operational Conditions, Including and Indicating the Worst One		X	6W	X	2D	X
E21	Assembly, Installation, Operation and Maintenance Manuals		X	10W	X	2D	X
E22	Design of all power and control cable routes and sub routes within the machine skid, including trays, supports, grounding connections and other similar structures, giving identification, quotes, elevations, rated sizes, orientation of design		X	6W	X	6W	X
E23	Dimension, weight and functional diagrams for all electrical panels	X	X	6W	X	1T	2D
E24	Electrical load list of auxiliaries	X	X	6W	X	1T	2D
E25	Hazardous area certificates for all electrical equipment	X	X	6W	X	2D	X
E26	Electrical interconnection diagrams		X	6W	X	1T	2D
E27	Technical Reports for All Tests				X	1T	2D
E28	Motor datasheets fulfilled	X	X	6W	X	2D	X
F	General documents						



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Item	Description	With Proposal	For Approval		Certified		Final
		Document	Document	Schedule	Document	Schedule	
F1	Inspection and Test Plan	X	X	2W	X	4W	1D
F2	Engineering, Fabrication, Inspection, Test Plan and Delivery Schedule of the PACKAGE (including details of each major equipment and components)	X	X	2W	X	2D	1D
F3	Factory Acceptance Test, Site Acceptance Test and Site Integration Test Reports.		X	2T	X	3T	1D
F4	Handling drawing for installation		X	4W	X	2D	1D
F5	Instrument and instrumented valve list		X	4W	X	2D	1D
F6	Instrument and instrumented valve data sheets		X	4W	X	2D	1D
F7	Calibration certificates of instruments, control valves and PSVs						1D
F8	Packing list		X	4D	X	2D	1D
F9	Details drawing of pressure vessels, including internal parts.		X	6W	X	2D	1D
F10	Fabrication procedures of pressure vessels classified in NR-13		X	6W	X	2D	1D
F11	NDT procedures of pressure vessels classified in NR-13		X	6W	X	2D	1D
F12	Calculation reports of pressure vessels		X	4W	X	2D	1D
F13	Welding, heat treatment and NDT reports, especially for pressure vessels						1D
F14	Material certificates of all pressurized components, specially for pressure vessels						1D
F15	Painting and insulation inspection report						1D
F16	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		X	6W	X	2D	1D
F17	Databook index		X	6W	X	2D	1D
F18	Dispatch Dossier						1D
F19	Piping isometrics		X	6W	X	2D	1D
F20	Piping class (piping specification data sheet) - which shall contain at least information about: material, sizes, standard and codes of piping, valve and piping fittings		X	6W	X	2D	1D
F21	Calculation report from pipe thickness dimensioning and any other element on piping class		X	6W	X	2D	1D



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		Document	Document	Schedule	Document	Schedule	
F22	Piping support catalog – which shall contain at least support code (tag), detailed draw, material table with: base material, quantity and size of each support element		X	6W	X	2D	1D
F23	Expansion joint calculation report and draws (if existent on project)		X	6W	X	2D	1D
F24	Piping code compliance (ASME B31.3) in a calculation report attending the flexibility analysis requirements from code		X	6W	X	2D	1D
F25	General arrangement		X	6W	X	2D	1D
F26	Piping plant		X	6W	X	2D	1D

Remarks:

Indicated schedule is the required time for PURCHASER and PACKAGER submits documents after order, return of reviewed documents or test execution, with the following legend:

- W: Weeks after order (e.g.: 2 weeks = 2W).
- D: Weeks prior to dispatch;
- T: Weeks after testing, completion or inspection.