PETROBRAS	**TECHNICAL SPECIFICATION**	No. I-ET-3010.00-1260-510-P4X-001	
	CLIENT:		SHEET: 1 of 21
	JOB:		-
	AREA:		
SRGE	TITLE: **CHEMICAL INJECTION UNITS**		INTERNAL
			ESUP

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INDEX OF REVISIONS

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0	ORIGINAL ISSUE
A	REVISED ITEM 4.3 AND ITEM 9.1.10, PROJECT SPECIFIC INFORMATION EXCLUDED FROM SECTION 6.7, ITEM 9.1.11 ADDED.

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SUMMARY

1 OBJECTIVE

This technical specification covers the minimum requirements for the design, materials, fabrication, assembly, inspection, testing, preparation for shipment, installation, pre-commissioning, and commissioning of CHEMICAL INJECTION UNITS.

2 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

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

g: Gravitational acceleration
ITP: Inspection and Test Plan
ITR: Inspection and Test Record
NDT: Nondestructive Testing
SS: Stainless Steel

3 SCOPE OF SUPPLY

3.1 General

PACKAGER scope of supply shall include the chemical injection units described on CHEMICAL INJECTION – BASIS OF DESIGN.

Each Chemical Injection Unit shall include pumps, tanks, structures, piping, instrumentation, and accessories according to the following items.

3.2 Pumps

The scope of supply for pumps shall be according to I-ET-3010.00-1200-310-P4X-002 – Positive Displacement Pumps.

3.3 Tanks

The scope of supply for tanks shall include, but not be limited to the following:

- Nozzle connections
- Drip pan connections
- Baffles
- Manholes
- Local level indicators (standpipe type), level transmitters and all required instrumentation
- Platforms, handrails, and ladders
- All necessary clips

3.4 Structures, Piping and General Items

The scope of supply for the Chemical Injection Units shall also include, but not be limited to the following:

- Baseplates with drip pans, lifting lugs, grounding lugs, and drains with valves
- All interconnection piping between tanks and pumps
- Suction and discharge pulsation dampeners, complete with overpressure protection
- Y-type strainers, isolation valves and drain valves on all pumps suction lines
- Filters, check valves and stop valves on all pumps discharge lines

- Manual valves
- Calibration pots
- Pressure safety valves
- Manometers on each pump head discharge
- Pressure transmitters, isolation valves, flowmeters/transmitters, according to P&IDs
- Electrical and instrumentation installation (including cable termination details, motor terminal box details, and grounding)
- All raw materials and consumables
- Gaskets
- Tightening bolts and nuts
- Nameplates manufactured in SS 316 in Portuguese for all equipment and instruments
- Surface preparation and painting proper for offshore installations, according to I-ET-3010.00-1200-956-P4X-002 – General Painting and DR-ENGP-I-1.15 – Color Coding
- Spreader bars and specific handling devices for installation
- Technical assistance during installation, pre-commissioning, start-up, and commissioning phases
- Safety signaling in Portuguese
- All required tests at MANUFACTURER's shop
- Preparation for shipment and preservation, including equipment handling conditioning and storage at job site
- Consumables and special tools for assembly, disassembly, maintenance, commissioning, and start-up
- Spare parts recommended for commissioning, pre-operation, start-up, NR-13 tests and by CS
- Hazardous area certificates
- Inspection, testing, NDT examination, and quality assurance
- All structural calculations
- Training
- Commissioning supervision at job site
- Total process and mechanical warranty
- A complete engineering package including design, fabrication, inspection, testing, commissioning, documentation, certification, and data required on this specification and on other applicable documents.

4 NORMATIVE REFERENCES

PACKAGE shall comply with the requirements of this technical specification, documents as stated below and with those referred to herein. Any conflict between the requirements of this specification and related codes and standards, specification, etc. shall be presented in writing for BUYER's resolution prior to manufacturing.

4.1 Applicable Codes and Standards

The latest issue of the following codes and standards shall be fully complied with:

API Specification 12F	Specification for Shop-Welded Tanks for Storage of Production Liquids
API Std 675	Positive Displacement Pumps – Controlled Volume for Petroleum, Chemical, and Gas Industry Services
API Std 2000	Venting Atmospheric and Low-Pressure Storage Tanks
ASME B16.5	Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.47	Large Diameter Steel Flanges NPS 26 Through NPS 60 Metric/Inch Standard
ASME B31.3	Process Piping
ASME BPVC	Boiler and Pressure Vessel Code
NR-10	Brazilian Government Regulation – Norma Regulamentadora Nº 10, Segurança em Instalações e Serviços em Eletricidade
NR-12	Brazilian Government Regulation – Norma Regulamentadora Nº 12, Segurança no Trabalho em Máquinas e Equipamentos

NR-13	Brazilian Government Regulation – Norma Regulamentadora Nº 13, Caldeiras, Vasos de Pressão, Tubulações e Tanques Metálicos de Armazenamento
NR-26	Brazilian Government Regulation – Norma Regulamentadora Nº 26, Sinalização de Segurança
NR-37	Brazilian Government Regulation – Norma Regulamentadora Nº 37, Segurança e Saúde em Plataformas de Petróleo
Classification Society	Rules for Offshore Facilities

Brazilian Government regulations are mandatory and shall prevail, if more stringent, over the requirements of this specification and other references herein. PACKAGER / MANUFACTURER shall comply with any other government regulations stated in the Contract and not listed above.

4.2 Reference Codes and Standards

The following codes and standards shall be used as reference or followed wherever they are mentioned throughout this specification:

API RP 14C	Analysis, Design, Installation and Testing of Safety Systems for Offshore Production Facilities
API RP 14E	Recommended Practice for Design and Installation of Offshore Production Platform Piping Systems
API RP 14FZ	Recommended Practice for Design, Installation and Maintenance of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class 1, Zone 0, Zone 1 and 2 Locations
API RP 14J	Recommended Practice for Design and Hazard Analysis for Offshore Production Facilities
API RP 505	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2
ASTM F 1940-07A	Standard Test Method for Process Control Verification to Prevent Hydrogen Embrittlement in Plated or Coated Fasteners
AWS D1.1	Structural Welding Code – Steel
IEC 60092-502	Electrical Installation in Ships – Tankers – Special Features
IEC 60529	Degrees of Protection Provided by Enclosures (IP Code)
IEC 61892/all parts	Mobile and Fixed Offshore Units – Electrical Installations
IEC 60034/all applicable parts	Rotating Electrical Machines
ISO 13702	Petroleum and natural gas industries – Control and Mitigation of Fires and Explosions on Offshore Production Installations – Requirements and Guidelines

4.3 Applicable Documents

4.3.1 Typical Documents

The following design documents shall be fully complied with:

General

DR-ENGP-M-I-1.3	Safety Engineering
DR-ENGP-I-1.15	Color Coding
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
I-ET-3010.00-1350-940-P4X-001	Systems Operation Philosophy
I-ET-3010.00-5400-947-P4X-002	Safety Signaling

Mechanical

I-ET-3010.00-1200-251-P4X-001	Requirements for Bolting Materials
I-ET-3010.00-1200-955-P4X-001	Welding

Static Equipment

I-ET-3010.00-1200-510-P4X-001	Metallic Tanks Design for Topside
I-ET-3010.00-1200-500-P4X-001	Non Metalic Tanks and Pressure Vessels Design
I-ET-3010.00-1200-940-P4X-005	Chemical Injection Points
I-ET-3010.00-1200-540-P4X-001	Requirements for Pressure Vessels Design and Fabrication

Dynamic equipment

I-ET-3010.00-1200-310-P4X-002	Positive Displacement Pumps Specification
I-ET-3010.00-1200-300-P4X-001	Noise and Vibration Control Requirements

Piping

I-ET-3010.00-1200-200-P4X-115	Requirements for Piping Fabrication Assembly and Commissioning

Painting, Coating and Thermal Insulation

I-ET-3010.00-1200-956-P4X-002	General Painting
I-ET-3010.00-1200-431-P4X-001	Thermal Insulation for Maritime Installations
I-ET-3010.00-1200-956-P4X-003	Thermal Spray Coating Application of Aluminum

Electrical

I-DE-3010.00-5140-700-P4X-003	Grounding Installation Typical Details
I-DE-3010.00-5140-797-P4X-001	Electrical System Automation Architecture Diagram
I-ET-3010.00-5140-700-P4X-001	Specification for Electrical Design for Offshore Units
I-ET-3010.00-5140-700-P4X-002	Specification for Electrical Material for Offshore Units
I-ET-3010.00-5140-700-P4X-003	Electrical Requirements for Packages for Offshore Units
I-ET-3010.00-5140-712-P4X-001	Low-Voltage Induction Motors for Offshore Units
I-ET-3010.00-5140-797-P4X-001	Electrical System Automation Architecture
I-DE-3010.00-5140-797-P4X-002	Electrical System Automation Typical Actuation Diagrams
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-3010.00-5140-741-P4X-004	Specification for Low-Voltage Generic Electrical Panels for Offshore Units
I-ET-3010.00-5140-772-P4X-002	Specification for Low-Voltage Frequency Converter, Soft-Starters and Inverters for Offshore Units.

Automation

I-ET-3010.00-1200-800-P4X-002	Automation, Control, and Instrumentation on Package Units
I-ET-3010.00-5520-888-P4X-001	Automation Panels
I-ET-3010.00-1200-800-P4X-013	General Criteria for Instrumentation Projects
I-ET-3010.00-1200-800-P4X-015	Requirements for Tubing and Fitting (Aligned to IOGP-JIP33 S-716)

Structure

I-DE-3010.00-1400-140-P4X-004	General Notes for Topsides Structures
I-ET-3010.00-1352-130-P4X-001	Floor Gratings, Tray Systems and Guardrails Made of Composite Materials

4.3.2 Specific Project Documents

The following project documents, supplied by OWNER, shall be fully complied with. Since these documents are specific to each project, their identification numbers are not unique, and their titles may vary slightly from one project to another. Project's DOCUMENT LIST shall be consulted to verify the correct document number and title.

General

- GENERAL ARRANGEMENT
- METOCEAN DATA
- CHEMICAL UNITS, PRODUCTS STORAGE AND UTILITIES - EQUIPMENT LAYOUT PLAN
- AREA CLASSIFICATION – GENERAL
- MOTION ANALYSIS
- ERGONOMIC REQUIREMENTS FOR TOPSIDES
- MATERIAL SELECTION PHILOSOPHY FOR DETAILED DESIGN

Process

- CHEMICAL INJECTION – BASIS OF DESIGN
- GENERAL SPECIFICATION FOR AVAILABLE UTILITIES
- CHEMICAL FILLINGS STATION

Piping

- PIPING SPECIFICATION FOR TOPSIDES
- REQUIREMENTS FOR PIPING SUPPORT
- MINIMUM REQUIREMENTS FOR PIPING MECHANICAL DESIGN AND LAYOUT
- REQUIREMENTS FOR PIPING STRESS ANALYSIS

Automation

- INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS
- FIELD INSTRUMENTATION
- AUTOMATION INTERFACE OF PACKAGE UNITS

5 PACKAGER RESPONSIBILITY

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

5.2 PACKAGER shall assume sole contractual and total engineering responsibility for the items supplied.

5.3 PACKAGER's responsibility shall also include but not be limited to:

- Resolving all engineering questions and/or problems relating to design and manufacturing.
- Providing details as requested, for the main and auxiliary equipment, relating to design and manufacturing.
- Training.

5.4 Compliance by the PACKAGER with the provisions of this specification does not relieve the PACKAGER's responsibility to furnish equipment and accessories of a proper mechanical design suited to meet the specified service conditions.

5.5 PACKAGER is responsible for all coordination with MANUFACTURERS and collections of all details, drawings, and data to achieve optimum design and full submission of all documents requested in this specification.

6 DESIGN REQUIREMENTS

6.1 Operation Environment

PACKAGE supplied shall be suitable for the environment and range of ambient condition defined in the METOCEAN DATA.

6.2 Motion Requirements

6.2.1 The necessary design data and information on motion requirements are given by MOTION ANALYSIS report.

6.2.2 PACKAGE shall be able to withstand when the UNIT is subjected to 100-year return period environmental conditions and to operate when the UNIT is subjected to 1-year return period environmental conditions, at any draft from fully loaded to 20% loaded/ballasted condition, and under inclination (static and dynamic) as per Classification Society Rules.

6.3 Design Loads

In addition to Code-described loads and loads due to UNIT motions defined in the MOTION ANALYSIS report, the following loads shall be considered where relevant:

- Equipment transportation and erection loads
- Nozzle loads
- Thermal loads
- Wind loads according to METOCEAN DATA
- Self-weight loads.

6.4 PACKAGE Requirements

6.4.1 PACKAGE 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.

6.4.2 The utility consumption of the equipment shall be clearly defined by PACKAGER. This information shall also be included in the technical proposal. The consumption of utilities shall comply with the requirements of GENERAL SPECIFICATION FOR AVAILABLE UTILITIES.

6.4.3 PACKAGE shall be provided with all necessary auxiliaries and instruments for safe, efficient, and uninterrupted operation.

6.4.4 PACKAGE, including all auxiliary equipment, shall be assembled to the maximum extent possible, aligned, and pre-checked in PACKAGER / MANUFACTURER's shop, allowing shipment to the integration yard with minimal fieldwork.

6.4.5 PACKAGE shall be manufactured, inspected, and verified to comply with all specifications mentioned in Normative References and the Classification Society regulations.

6.4.6 PACKAGE shall be located according to CHEMICAL UNITS, PRODUCTS STORAGE AND UTILITIES - EQUIPMENT LAYOUT PLAN.

6.4.7 PACKAGE shall be suitable for classified areas according to AREA CLASSIFICATION – GENERAL.

6.5 Pumps

6.5.1 Pumps shall be designed, fabricated, and tested according to I-ET-3010.00-1200-310-P4X-002 – Positive Displacement Pumps Specification.

6.5.2 The pumps configuration, number of heads, process and chemical products requirements shall be according to CHEMICAL INJECTION – BASIS OF DESIGN.

6.5.3 Metering pump type shall be double diaphragm. Hazardous chemical products shall require leak detection between diaphragms.

6.5.4 Pump heads sequence shall be defined by manufacturer to minimize the momentum of pump.

6.5.5 Pumps installed side by side shall be mounted on a common skid, providing clearance for safe operation and maintenance.

6.6 Tanks

6.6.1 Tanks shall be designed, fabricated, and tested according to I-ET-3010.00-1200-500-P4X-001-Non Metalic Tanks and Pressure Vessels Design

6.6.2 For areas where is not acceptable the use of non metallic tanks due to safety reasons (i.e. fire propagation study), the tanks shall be in material SS316L and designed, fabricated, and tested according to I-ET-3010.00-1200-510-P4X-001 – Metallic Tanks Design for Topside.

6.6.3 Tank sizes and quantities shall be defined during the detailed engineering design.

6.6.4 Tank roof shall be designed to sustain the loads of 200kgf/m².

6.6.5 Tanks installed side by side shall have a common access platform.

6.6.6 Bottom floor drip pan shall be designed to avoid accumulation of liquid spills. Drip pan connections shall be at the skid edge, 2” minimum, provided with blind flange.

6.6.7 Tank cradle shall be elevated enough to completely drain the tanks. The connection points shall be on the aft side of module.

6.6.8 Tanks shall be fitted with baffles or similar devices to restrict fluid sloshing motions.

6.6.9 All atmospheric tanks shall be provided with an atmospheric vent, a level gauge and transmitter, an overflow, a dedicated fill connection, and a manway as a minimum.

6.7 Arrangement Requirements

6.7.1 The equipment within the packages shall be designed to provide necessary space for operability and maintainability over the range of normal and emergency conditions and to allow safe and good personnel access for all operation and maintenance activities.

6.7.2 PACKAGER shall provide a preliminary general layout showing the skid sizes and weight (dry and operating) when submitting bid offer and inform if the space allocated is sufficient or otherwise.

6.7.3 PACKAGER shall identify the required maintenance access space on General Arrangement drawings.

6.8 Piping and Hoses

6.8.1 All piping shall be routed and terminated with valves and/or flanges for isolation and maintenance purposes at the skid edge, unless otherwise specified by BUYER.

6.8.2 All interconnecting piping shall comply with the requirements of ASME B31.3. Tubing shall comply with spec T60 and T60 A of PIPING SPECIFICATION FOR TOPSIDES.

6.8.3 Pipping shall be selected among the listed spec for each service at PIPING SPECIFICATION FOR TOPSIDES.

6.8.4 The spec of the piping included in the scope of supply must be compatible with the pressure spec of piping from outside the scope of supply, otherwise overpressure protection devices (eg. Pressure Safety Valves, Pressure Control Valves) must be foreseen inside Manufacturer's scope of supply.

6.8.5 The design, assembly and commissioning of all process piping shall be according ASME B31.3 code, I-ET-3010.00-1200-200-P4X-115 – Requirements for Piping Fabrication and Commissioning and MINIMUM REQUIREMENTS FOR PIPING MECHANICAL DESIGN AND LAYOUT.

6.8.6 Process tubbing shall be designed, assembled, commissioned and tested considering the applicable requirements of I-ET-3010.00-1200-800-P4X-015 - Requirements for Tubing and Fitting (Aligned to IOGP-JIP33 S-716) and I-ET-3010.00-1200-200-P4X-115 – Requirements for Piping Fabrication and Commissioning.

6.8.7 Stress and flexibility analysis shall be performed as required by REQUIREMENTS FOR PIPING STRESS ANALYSIS.

6.8.8 Flanges shall be flush with the transverse ends of the skid having a uniform B.O.P. (Bottom of Pipe) at an elevation as low as practical. SELLER's P&ID's and General Arrangement drawings shall represent this requirement. All tubing for the off-skid interfaces shall be terminated at the skid by means of compression fitting valves.

6.8.9 Connections elevations shall be defined at a minimum height of 250 mm above the coamings, to favor the ergonomics conditions and the correct operation of the equipment (emptying the tanks) and shall be carried out with BUYER approval. This definition shall occur during detail design.

6.8.10 All piping and tubing shall be rigidly supported for service and shipment. Supports on the module plates shall not be accepted without under-deck stiffening. Supporting and installation shall enable piping removal without disturbing structural members.

6.8.11 Fabricated branch weld connections (fittings, couplings, etc.) shall be directly joined to the header with full penetration welds, where applicable.

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

6.8.13 All piping shall be properly supported considering the service loads, shipment, results of pipe flexibility analysis studies and transportation loads. Piping supports shall be in accordance with REQUIREMENTS FOR PIPING SUPPORT. Supports applied directly to the module base plates shall not be performed without prior under deck stiffening. The supporting and installation shall enable piping removal without disturbing structural members.

6.8.14 All valves shall be positioned with the stem pointing upwards. They shall be located in such a way that the hand wheel or actuator will not obstruct walkways and be easily accessible for operation and maintenance, according to ERGONOMIC REQUIREMENTS FOR TOPSIDES. Where hand operated valves are not easily operable, gear operated valves shall be used.

6.8.15 SELLER shall check and approve all piping with respect to stresses, vibration, and layout. Anchor points shall be provided at skid edge.

6.8.16 All drain lines shall be routed through the deck to a common drain header, terminated at one flange 300 mm below the pancake level at the skid edge, for connection to overboard drain system.

6.8.17 Drain lines shall have continuous slope, with no low point traps, toward the end point. Connections into the drain header shall enter from the top.

6.8.18 All drain lines shall be rigid and provided with means to prevent vacuum conditions in the line.

6.8.19 Valves shall be positioned with their stem pointing upwards and located in such way that the hand wheel or stem will not obstruct walkways. Where hand operated valves are not easily operable, gear operated valves shall be used.

6.8.20 Hoses supports shall be installed near the tank supply connections.

6.8.21 Hoses shall be stored in horizontal position and stretched. The supports may be installed in the handrail but shall not interfere with the escape route.

6.8.22 Calibration pots shall have sufficient volume to withhold at least 70 seconds of maximum flow rate of the pump.

6.9 Skids

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

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

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

6.9.4 Welding shall be carried out with procedures and operators qualified in accordance with ASME BPVC Sec. IX. Welding shall not be performed before qualified welding procedure is approved. Intermittent fillet welds are not permitted.

6.9.5 Skids shall be designed to be completely seal welded to the support structure, unless otherwise specified by BUYER.

6.9.6 Welds underneath skid beams shall be ground flush.

6.9.7 Ladders and/or stairs and platforms shall be installed on all operation and maintenance areas (e.g.: valves, instruments, etc.) elevated more than 1.75 m above the skid baseplate.

6.9.8 Worker platforms and walkways shall be made of non-slip plate materials.

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

6.9.10 Skids shall have 2 diagonally opposed grounding bosses.

6.10 Mechanical Handling

6.10.1 SUPPLIER shall ensure that the area around the PACKAGE has enough clearance for maintenance. SUPPLIER shall create a reserved area on the 3D model to avoid installation of any other equipment or accessory in this area.

6.10.2 SUPPLIER shall ensure that the volumes required to move any item for maintenance, including handling devices, do not clash with pipes, cables, or any other fixed items.

6.10.3 SUPPLIER shall provide withdrawal spaces and clearances for all removable vessel/pipe internals (e.g.: filters, membranes, etc.). SUPPLIER shall provide suitable lifting facilities to allow filter cleaning and replacement.

6.10.4 SUPPLIER shall provide all handling devices required for safe and easy maintenance.

6.10.5 Lifting beams shall overhang by at least 1.2m into agreed laydown areas.

6.10.6 Deflection of lifting beams shall not exceed 1/500 of the span length.

6.10.7 All handling devices shall be subject to load testing, witnessed by BUYER's representative and CS.

6.11 Noise and Vibration Control

6.11.1 Noise and vibration control concerning human exposure shall be performed according to I-ET-3010.00-1200-300-P4X-001 – Noise and Vibration Control Requirements.

6.12 Pressure Vessels

6.12.1 Pressure vessels within Chemical Injection Units shall be in accordance with I-ET-3010.00-1200-540-P4X-001 – Requirements for Pressure Vessels Design and Fabrication.

6.12.2 All pressure vessels shall comply with the requirements of NR-13.

6.13 Special Tools and Spare Parts

6.13.1 All special tools necessary for the installation, alignment, operation, or maintenance of the equipment shall be supplied with the delivery of the PACKAGE.

6.13.2 Spare parts required for NR-13 tests and those recommended by Classification Society shall be provided.

6.13.3 All special tools and spare parts shall be detailed in the packing list and shall be consistent with the lists 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.

7 MATERIALS

7.1 General

7.1.1 The SELLER is responsible for the materials selection considering the philosophy detailed in MATERIAL SELECTION PHILOSOPHY FOR DETAILED DESIGN, and the operational condition and process data stated in this document (I-ET-3010.00-1260-510-P4X-001 – CHEMICAL INJECTION UNITS) and in CHEMICAL INJECTION – BASIS OF DESIGN.

7.1.2 Materials for pumps, tanks, piping, instruments, and accessories shall be suitable for the fluid handled and design life required.

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

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

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

7.1.6 Bolting materials shall be according to I-ET-3010.00-1200-251-P4X-001 – Requirements for Bolting Materials.

7.2 Repairs

7.2.1 The repair and defects in pressure-containing castings by peening or burning-in or by impregnation with other compounds is not allowed.

7.2.2 Repair by welding or by plugging shall be undertaken only when permitted by the material specification and shall only be applied with the procedures specified.

7.2.3 After weld repair, castings shall be heat treated, if specified in the material specification. A major weld repair shall always be followed by heat treatment.

7.2.4 Details of all major weld repairs and the heat treatment shall be recorded and reported to BUYER.

8 ELECTRICAL

8.1 All electrical equipment shall be manufactured and tested in compliance with Classification Society and IEC requirements.

8.2 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.

8.3 Electrical induction motors shall comply with requirements of I-ET-3010.00-5140-712-P4X-001 – Low-Voltage Induction Motors for Offshore Units.

8.4 Electrical panels inside the package shall comply with I-ET-3010.00-5140-741-P4X-004 - Specification for Low-Voltage Generic Electrical Panels for Offshore Units.

8.5 Variable speed drives (VSD) and soft-starters, when required in project documentation, shall comply with I-ET-3010.00-5140-772-P4X-002 - Specification for Low-Voltage Frequency Converter, Soft-Starters and Inverters for Offshore Units.

8.6 Electrical installations inside the PACKAGE and the voltages to be supplied for electrical loads (motors, heaters, control panels, etc.) shall comply with I-ET-3010.00-5140-700-P4X-003 – Electrical Requirements for Packages for Offshore Units.

8.7 Grounding installations inside the PACKAGE shall comply with requirements of I-ET-3010.00-5140-700-P4X-001 – Specification for Electrical Design for Offshore Units and I-DE-3010.00-5140-700-P4X-003 – Grounding Installations Typical Details.

8.8 Electrical interfaces of the PACKAGE shall comply with I-DE-3010.00-5140-797-P4X-001 – Electrical System Automation Architecture Diagram and I-ET-3010.00-5140-797-P4X-001 – Electrical System Automation Architecture.

8.9 For typical electrical actuation, refer to I-DE-3010.00-5140-797-P4X-002 - Electrical System Automation Typical Actuation Diagrams.

9 CONTROLS AND INSTRUMENTATION

9.1 General

9.1.1 PACKAGER / MANUFACTURER shall ensure that the equipment is properly certified for the specified classification. For further information, see FIELD INSTRUMENTATION and I-ET-3010.00-1200-800-P4X-013 – General Criteria for Instrumentation Projects.

9.1.2 PACKAGE automation type classification shall be according to AUTOMATION INTERFACE OF PACKAGE UNITS.

9.1.3 The PACKAGE automation, control and instrumentation shall fully comply with I-ET-3010.00-1200-800-P4X-002 – Automation, Control, and Instrumentation on Package Units and I-ET-3010.00-1350-940-P4X-001 – Systems Operation Philosophy.

9.1.4 All sensors shall be suitable for prevailing temperatures. When applicable, field amplifiers, transducers, etc., shall be installed as per PACKAGER / MANUFACTURER practices, according to the area classification and to protect them against mechanical damage.

9.1.5 Pumps shall be fitted with all instrumentation required for safe and reliable unattended operation.

9.1.6 Tanks shall be provided with local level indicators, level transmitters and other instruments required for operation and monitoring, in accordance with FIELD INSTRUMENTATION.

9.1.7 Instruments shall not be mounted on the skid frame.

9.1.8 Control and safeguarding instrumentation shall be segregated according to reference documents.

9.1.9 All instruments shall be provided with process isolation valves, vent and drain valves as applicable.

9.1.10 For each chemical product, there shall be one Coriolis flowmeter and an associated control valve to each consumer. In other words, there shall be one Coriolis flowmeter and an associated control valve at each Tie-in point of each Chemical Injection Unit. Each of these Coriolis flowmeters shall:

- indicate the flow rate of the fluid,
- indicate the density of the fluid,
- indicate the accumulated total flow in a customizable period of time,
- alarm when the flowrate is below a configurable threshold (low flow alarm).

The primary objective of each of these control valves is to stabilize the flowrate going to each consumer in a given setpoint, which shall be configurable and defined in the applicable supervisory system.

9.1.11 The system shall be capable to generate the following reports: Chemical consumption per day/month, Historical data on flow rates and valve position.

9.2 Automation, Control, and Instrumentation System Cabling

9.2.1 All wiring within the limits of the enclosure shall be clearly marked on the wire and at the terminal.

9.2.2 All cabling between the driver and the local gauge board shall be furnished. All cables and cable routes shall contain at least 20% of the extra capacity.

9.2.3 Level, temperature, pressure, and any other instrument cabling shall be led to the PACKAGE limits to make the signals available for connection with the UNIT automation and monitoring systems.

9.3 Alarms and Shutdown

Alarm and shutdown functions shall be foreseen in SELLER's P&IDs and cause & effect matrix. Functions shall be foreseen in order to prevent all dangerous scenarios. Besides, at least the following alarms shall be available for operator action:

- Chemical product's tanks Low (and very low) alarms in every tank
- Chemical product's tanks high (and very high) alarms in every tank
- Low flowrate of chemical products in chemical injection each line
- Very high pressure, where applicable

10 PAINTING AND COLOR

10.1 PACKAGER / MANUFACTURER paint system shall be according to I-ET-3010.00-1200-956-P4X-002 – General Painting.

10.2 Color code adopted shall be in accordance with DR-ENGP-I-1.15 – Color Coding.

11 SAFETY

11.1 The use of couplings in pipes with flammable liquids between UNIT decks and Process Plant shall be minimized to reduce the risk of pool fire. The use of couplings in gas lines shall be minimized.

12.2 SDVs shall be installed in locations where they are not affected by fire originating in other areas.

12 NAMEPLATES

12.1 MANUFACTURER shall attach corrosion resistant SS 316 nameplates on main and auxiliary equipment in an accessible location, fastened with corrosion resistant pins.

12.2 Nameplates for pumps shall be according to I-ET-3010.00-1200-310-P4X-002 – Positive Displacement Pumps Specification.

12.3 Nameplates for tanks shall be according to I-ET-3010.00-1200-510-P4X-001 – Metallic Tanks Design for Topside.

12.4 For the other equipment, nameplates shall include, as a minimum, the following items in Portuguese:

- Tag number.
- Service.
- Manufacturer and year of build.
- Equipment serial number.
- Main data for design, operation, and testing (power, pressure, volume, temperature, flow rate, etc.).
- Design code.
- Empty, operation and test weight.
- Specific requirements.

13 TAG NUMBERING

13.1 Tagging of all instrumentation, electrical, mechanical, and piping items, including valves, shall be according to I-ET-3000.00-1200-940-P4X-001 – Tagging Procedure for Production Units Design.

13.2 Tag plates shall be supplied with number and description in Portuguese.

13.3 All tag plates shall be made from SS 316 material.

13.4 Valves shall be tagged with the applicable number only.

13.5 Tag numbers for remaining auxiliary equipment shall be defined in detail design after approval of BUYER.

14 CERTIFICATION REQUIREMENTS

14.1 Class Certification

PACKAGER / MANUFACTURER shall supply a Classification Society Certificate of compliance with Rules requirements for pumps and tanks.

14.2 Material Certification

14.2.1 PACKAGER / MANUFACTURER shall obtain all necessary certification of the equipment.

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

14.2.3 For pressure containing parts of equipment and main components, PACKAGER / MANUFACTURER shall attest material properties and chemical composition by means of appropriate certificates.

14.2.4 To ensure that the materials of construction are in accordance with data sheets, all certificates shall contain the following information:

- Name of manufacturer.
- Purchase order number and issue date.
- Identification number of certificate and issue date.
- Material specification(s).
- Material charge, batch, or heat number.
- Mechanical properties recorded from test results.
- NDT methods and results.
- Heat treatment procedure.

15 INSPECTION, TESTING AND COMMISSIONING

15.1 Inspection and Testing

15.1.1 PACKAGER shall submit the Inspection and Test Plan (ITP) in accordance with document schedule. BUYER shall identify all the required witnessed inspections on a marked-up copy of the ITP.

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

15.1.3 BUYER reserves the right to inspect the PACKAGE anytime during fabrication to ensure that material and workmanship are in accordance with this specification.

15.1.4 Inspections and tests are an integral part of the purchase order, which will not be considered complete until such inspections and tests have been carried out in full. BUYER shall issue an Inspection Release Certificate (IRC) after completion of these inspections and tests only.

15.2 NDT Examination

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

15.3 Hydrostatic Testing

15.3.1 All applicable equipment shall be hydrostatically tested, and may be witnessed by BUYER surveyors, including:

- All tanks.
- All piping according to ASME B31.3.
- All vessels according to ASME BPVC Sec. VIII-1.
- All pumps according to API Std 675.

15.3.2 BUYER shall witness hydrostatic test of vessels classified in NR-13 within PACKAGE.

15.3.3 All piping systems shall be drained of water and dried after hydrostatic testing.

15.4 Electrical Testing

Testing may be witnessed by BUYER surveyors and shall include a Megger test for cables and electric motors, and all tests in accordance with the reference standards and documents. Electrical continuity checks on all wiring and grounding shall be performed as well.

15.5 Instrumentation Testing

Testing may be witnessed by BUYER surveyors and shall include at least:

- Hydrostatic test (valves).
- Running test (actuators).
- Functional checks on all instruments and valves.
- Review of calibration certificate (PSVs).

15.6 Factory Acceptance Test (FAT)

15.6.1 SUPPLIER shall prepare a factory acceptance test / procedure (FAT) and submit for BUYER's approval.

15.6.2 For the Factory Acceptance Test (FAT), the PACKAGER / MANUFACTURER shall make preliminary test to ensure that all parts of the equipment are operating satisfactorily prior to the arrival of the BUYER's representative. SUPPLIER shall advise BUYER of the test schedule before the planned test dates.

15.6.3 When required, SUPPLIER shall arrange with the appointed Classification Society surveyor to witness FAT.

15.6.4 Motors tests shall be in accordance with I-ET-3010.00-5140-712-P4X-001 – Low-Voltage Induction Motors for Offshore Units.

15.6.5 Monitoring systems of P2 type PACKAGE UNITS and monitoring sensors of P0 type PACKAGE UNITS shall be tested on the FAT.

15.6.6 Acceptance of the FAT will not be considered as the final acceptance test of the equipment.

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

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

15.7 Commissioning

15.7.1 PACKAGER / MANUFACTURER shall provide any necessary support for installation and commissioning of the equipment either at a shore-based fabrication yard or on the UNIT, including monitoring systems of P0 and P2 type PACKAGE UNITS.

15.7.2 SUPPLIER shall inform PACKAGER / MANUFACTURER regarding specific commissioning conditions for the equipment, i.e., conditions in which the equipment will have to operate temporarily, if they are different from the conditions defined in the data sheet.

16 PREPARATION FOR SHIPMENT

16.1 Marking

16.1.1 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 does not damage or impair the component. Marking may be done on the item itself or on its packing or nameplate.

16.1.2 Items that cannot be identified shall be rejected. Rejected items may be recertified by carrying out all relevant testing, with prior approval of the BUYER.

16.1.3 As a minimum, the following identification shall be provided:

- Project number.
- Manufacturer’s name.
- Purchase order number.
- Shipping weight.
- Item number.
- Classification Society surveyor’s stamp.

16.2 Shipment Packing

16.2.1 The equipment shall be supplied tested, flushed, and preserved and, if practical, already charged up with coolant and lubricants.

16.2.2 The preparation shall make the equipment suitable for 24 months outdoor storage from the time of shipment. The PACKAGE shall be protected from corrosion.

16.2.3 All open ends of piping shall be treated and closed off by plastic caps and taped.

16.2.4 PACKAGER shall submit the packing specification to the SUPPLIER for approval.

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

16.2.6 PACKAGER shall provide the procedures for unpacking, handling and installation, as well as repacking, and long-term storage requirements.

16.2.7 PACKAGER shall specify any limitations applicable to the transport and installation phase.

16.2.8 Unless otherwise advised, each item of equipment shall be checked for its suitability to resist horizontal and vertical acceleration of 0.8g in any direction during sea transportation.

17 REQUIRED DOCUMENTATION

17.1 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. Whenever required by BUYER, source files shall also be provided.

17.2 All documents required in this section shall be text searchable, including PDF files.

17.3 Before any document is issued by PACKAGER / MANUFACTURER, a document list shall be issued and approved by BUYER. This is required to guarantee the correct document numbering.

17.4 Drawings and diagrams shall use the symbols defined on I-ET-3000.00-0000-940-P4X-002 – Symbols for Production Units Design.

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

- First part – tag number.
- Second part – service description.
- Third part – document description

EXAMPLE: TQ-UQ-1261001-XX – Example Tank – General Arrangement Drawing

17.6 If PACKAGER / MANUFACTURER issues documents which contain information valid for the whole Chemical Injection Unit, tag and service description shall be omitted and replaced by the unit name.

EXAMPLE: Oil and Gas Chemical Injection Unit – Inspection and Test Plan.

17.7 The following documents shall be issued and approved before FAT execution. Otherwise, BUYER will not attend the FAT and will not accept its execution:

- Piping and instrumentation diagram
- General arrangement drawing
- Details and/or cross section drawings with part list
- Main and auxiliary equipment datasheets
- Weight and center of gravity datasheet
- Noise datasheet
- Performance curves
- Utility consumption list and heat dissipation
- Inspection and Test Plan (ITP), including auxiliary equipment
- Hydrostatic test procedure
- Painting and insulation specification
- FAT procedure

17.8 The following documents shall be issued and approved before delivery of the PACKAGE. Otherwise, BUYER will not attend to the receiving inspection, and will not accept the PACKAGE:

- Nameplate drawings

- Noise report
- FAT report
- Handling drawing for installation
- Installation manual
- Instruments and instrumented valves datasheets
- Packing list
- Certificates for electrical equipment suitable for installation in hazardous areas

17.9 The following documents shall be issued and approved before issuance of the Databook. Otherwise, BUYER will not accept the Databook:

- Outline drawings of auxiliary equipment
- Operation and maintenance manuals for main and auxiliary equipment
- List of spare parts for commissioning and start-up
- List of recommended spare parts for two years of operation
- List of special tools
- List of instruments and instrumented valves
- List of set points, alarms, and shutdown
- Logic diagrams
- Cause and effect charts
- Loop diagram
- Electromechanical panel drawing
- Memory maps
- Automation architecture
- Interconnection wiring diagram
- Calculation notes of control valves, PSVs and flowmeters
- I/O List
- HMI screen layout
- Calibration certificates of instruments
- Fabrication procedures of pressure vessels classified in NR-13
- NDT procedures of pressure vessels classified in NR-13
- Hydrotest reports for pressure vessels classified in NR-13
- Hydrotest report of tanks, pumps, and piping
- NDT reports
- Material certificates
- Heat treatment records
- Databook index.

17.10 Documents for pumps shall be according to I-ET-3010.00-1200-310-P4X-002 – Positive Displacement Pumps Specification.

17.11 Documents for electric motors shall be according to I-ET-3010.00-5140-712-P4X-001 – Low-Voltage Induction Motors for Offshore Units.

17.12 Installation, operation, and maintenance manuals shall be issued in Portuguese. PACKAGER / MANUFACTURER may choose to issue one single manual with installation, operation, and maintenance instructions.

17.13 Installation, operation, and maintenance manuals shall apply specifically to the units installed. PACKAGER is fully responsible for the contents of all data sheets and documentation.

17.14 Installation manual shall contain all recommendations for preservation during storage on erection stage. If PACKAGER / MANUFACTURER fails to provide this information on the installation manual, any damages due to the lack of preservation will be PACKAGER / MANUFACTURER's responsibility.

17.15 Installation manual shall contain a list of all consumables to be used for erection, commissioning and start up.

17.16 PACKAGER / MANUFACTURER may choose to include specific commissioning instructions on the operation manual, or to issue a separate document, such as a procedure, for commissioning instructions. PACKAGER / MANUFACTURER shall confirm in these instructions if the equipment can operate with water, for services which the operation fluid is not water.

17.17 Operation manual shall contain, among other information, the control system description of the PACKAGE.

17.18 General arrangement drawings shall contain the connection list, i.e., a list with all connection tie-in points of the skids, which shall have the following minimum information: Connection identification number (which shall be represented in the drawing), connection description, tie-in connection specification, that is, flange or thread rating, manufacturing standard, flange face type, connection nominal diameter and fluid.

17.19 PACKAGER / MANUFACTURER shall 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.

17.20 Each material certificate and NDT report provided by third parties shall be preceded by a PACKAGER / MANUFACTURER sheet, informing to which part of the equipment the document refers.

17.21 PACKAGER/ MANUFACTURER shall provide detailed drawings and description of the operation of instrumentation and controls, as well as the makes, materials and types of auxiliary equipment.

17.22 PACKAGER/ MANUFACTURER shall provide a description of the alarm and shutdown facilities of the PACKAGE.