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	AREA:	BÚZIOS	
DP&T-SRGE	TITLE:	GAS DEHYDRATION UNIT	NP-1 ESUP

MICROSOFT WORD / V.2010 / I-ET-3010.1M-1233-560-P4X-001_0.DOCX

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PRELIMINARY

1 INTRODUCTION

This specification covers the minimum requirements for design, engineering, materials, fabrication, inspection, testing, commissioning and pre-commissioning of the GAS DEHYDRATION UNIT (GDU-1) to be supplied for REFERENCE BASIC DESIGN.

This document scope refers specifically to the GDU-1 package composed by the following equipment.

TAG	DESCRIPTION	QTY	LOCATION
T-1233001/ V-T-1233001	TEG CONTACTOR/ KO DRUM	1	M-06

Details of equipment dimensions, operating and design conditions shall be consulted in the technical data sheet: I-FD-3010.1M-1233-550-P4X-001 - GAS DEHYDRATION UNIT (T-1233001/V-T-1233001) – M-06.

2 NORMATIVE REFERENCES AND DESIGN SPECIFICATIONS

2.1 CLASSIFICATION

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

2.2 CODES AND STANDARDS

- 2.2.1 The latest editions of the following codes and standards shall be used as design guidelines:

ASME BPVC sec. V:	- Non-destructive Examination
ASME BPVC sec. VIII:	- Rules for Construction of Pressure Vessels
ASME BPVC sec. IX:	- Qualification Standard for Welding, Brazing and Fusing Procedures
ASTM A262	- Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
ISO 15156	- Petroleum and natural gas industries - Materials for use in H2S-containing environments in oil and gas production

2.3 GOVERNMENTAL REGULATION

- NR - 13: - Caldeiras e Vasos de Pressão

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



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2.4 DESIGN SPECIFICATIONS

DR-ENGP-M-I-1.3	SAFETY ENGINEERING
DR-ENGP-I-1.15	COLOR CODING
I-DE-3010.1M-5400-94A-P4X-001	AREA CLASSIFICATION – GENERAL
I-DE-3010.1M-1200-942-P4X-002	GENERAL ARRANGEMENT
I-DE-3010.1M-1416-942-P4X-001	M-06 - GAS DEHYDRATION AND HCDP - EQUIPMENT LAYOUT PLAN
I-DE-3010.1M-1233-944-P4X-001	GAS DEHYDRATION SYSTEM
I-DE-3010.1M-1233-944-P4X-005	TEG REGENERATION SYSTEM
I-DE-3010.00-5140-700-P4X-003	GROUNDING INSTALLATION TYPICAL DETAILS
I-ET-3000.00-1200-940-P4X-001	TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN.
I-ET-3010.00-1200-251-P4X-001	BOLT MATERIALS
I-ET-3010.1M-1200-300-P4X-001	NOISE CONTROL REQUIREMENTS FOR TOPSIDE
I-ET-3010.00-1200-540-P4X-001	REQUIREMENTS FOR PRESSURE VESSELS DESIGN
I-ET-3010.00-1200-540-P4X-002	REQUIREMENTS FOR PRESSURE VESSELS FABRICATION
I-ET-3010.00-1200-955-P4X-001	WELDING
I-ET-3010.00-1200-955-P4X-002	REQUIREMENTS FOR WELDING INSPECTION
I-ET-3010.00-1200-800-P4X-002	AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGED UNITS
I-ET-3010.1M-1200-800-P4X-014	AUTOMATION INTERFACE OF PACKAGED UNITS
I-ET-3010.00-1200-956-P4X-002	GENERAL PAINTING
I-ET-3010.1M-1200-940-P4X-002	CORROSION MONITORING SYSTEM.
I-ET-3010.00-5140-700-P4X-001	SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS
I-ET-3A36.00-1000-941-PPC-001_D (Revision D)	METOCEAN DATA
I-FD-3010.1M-1233-550-P4X-001	GAS DEHYDRATION UNIT (T-1233001/V-T- 1233001) – M-06
I-RL-3010.1M-1200-940-P4X-001	GENERAL SPECIFICATIONS FOR AVAILABLE UTILITIES



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I-RL-3010.1M-1350-960-P4X-009 MOTION ANALYSIS

2.5 CONFLICTING REQUIREMENTS

In case of conflicting requirements between this technical specification and other cited references, the most stringent shall prevail. If necessary the PACKAGER/MANUFACTURER may revert to PETROBRAS for clarification.

3 DEFINITIONS AND ABBREVIATIONS

3.1 DEFINITIONS

- 3.1.1 PACKAGER: Company responsible for the project, assembly, construction, fabrication, test and furnishing of the Package.
- 3.1.2 MANUFACTURER: The supplier, vendor or Contractor. Company responsible for the fabrication of equipment or components internal to the Package.
- 3.1.3 PURCHASER: The Company designated as such in the contract or in the purchase order.
- 3.1.4 PACKAGE UNIT or PACKAGE: An assembly of equipment supplied interconnected, tested and operating, requiring only the available utilities from the FPSO for full operation

3.2 ABBREVIATIONS

- SS: - Stainless Steel
- CS: - Carbon Steel
- FAT: - Factory Acceptance Test
- ITP - Inspection and Test Plan
- P&ID: - Piping & Instrumentation Diagram

4 GENERAL FUNCTIONAL REQUIREMENTS

PACKAGER/MANUFACTURER shall be responsible for supplying complete and fully operative systems in accordance with the requirements of this specification, codes and standards referenced therein.

PURCHASER shall select a PACKAGER/MANUFACTURER considering a proven experience supplying this type of equipment/technology.

PURCHASER shall submit the name of the PACKAGER/MANUFACTURER to PETROBRAS approval.

4.1 PROCESS CONDITIONS

- 4.1.1 PACKAGER/ MANUFACTURER shall design the equipment for the full range of process conditions as specified in the Process Data Sheet: I-FD-3010.1M-1233-550-P4X-001 - GAS DEHYDRATION UNIT (T-1233001/V-T-1233001) – M-06 and in accordance with the following process diagrams: I-DE-3010.1M-1233-944-P4X-001 – GAS DEHYDRATION SYSTEM and I-DE-3010.1M-1233-944-P4X-005 – TEG REGENERATION SYSTEM.



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4.2 DESIGN REQUIREMENTS

4.2.1 Mechanical:

4.2.1.1 All items shall be designed in accordance with I-ET-3010.00-1200-540-P4X-001 REQUIREMENTS FOR PRESSURE VESSELS DESIGN, I-ET-3010.00-1200-540-P4X-002 REQUIREMENTS FOR PRESSURE VESSELS FABRICATION and Brazilian National Regulation NR-13.

4.2.1.2 All equipment shall be provided with lifting lugs.

4.2.1.3 Studs, bolts, tightening bolts and nuts shall be according I-ET-3010.00-1200-251-P4X-001 – BOLT MATERIALS

4.2.2 Welds Testing

4.2.2.1 Generally all welding shall meet the requirements of standards and codes specified in applicable sections of listed specifications. For vessels, refers I-ET-3010.00-1200-955-P4X-001 - WELDING and to I-ET-3010.00-1200-955-P4X-002 – REQUIREMENTS FOR WELDING INSPECTION.

4.2.2.2 The following are the minimum requirements:

- Vessels
 - A. 100% RT on all main seam welds plus the pipe / flange connections on nozzles.
 - B. 100% UT on nozzle to shell connections.
 - C. 100% MP (CS) or LP (SS) on all weld attachments to pressure retaining parts.
 - D. 100% LP on all weld overlays.
- Ferrite Content
 - A. Ferrite content level on weld overlays shall not exceed 10%.
- Corrosion Test
 - A. A HUEY test according to ASTM A262 has to be carried out for sensitization of SS 316 overlay.
- Structural steel
 - A. 100% RT or UT on all main beam welds and on lifting lugs
 - B. 10% on all other welds
 - C. 100% MP on all primary steel welds

4.2.3 Painting

4.2.3.1 External and Internal

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

4.2.3.2 Color

Color code adopted shall be in accordance with the latest revision of DR-ENGP-I-1.15 – COLOR CODING.

4.2.4 Installation Requirements

All equipment shall be installed over structural steel deck plate. If installation by others, it shall be according to PACKAGER/MANUFACTURER's instructions and supervision.



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4.3 OPERATON ENVIROMENT

4.3.1 The equipment shall be suitable for the environment and range of ambient conditions, including, atmospheric pressure, relative humidity, rainfall, dry-bulb air temperature, characteristic monthly values and wind motions defined in revision D of I-ET-3A36.00-1000-941-PPC-001– METOCEAN DATA.

4.4 MOTION REQUIREMENTS

4.4.1 The necessary design data and information on motion requirements are given in I-RL-3010.1M-1350-960-P4X-009 - MOTION ANALYSIS

4.5 CORROSION MONITORING

4.5.1 PACKAGER/ MANUFACTURER shall verify the need for corrosion monitoring within the package and submit verification to PETROBRAS for approval. Refer to I-ET-3010.1M-1200-940-P4X-002 – CORROSION MONITORING SYSTEM.

4.6 EQUIPMENT LOCATION AND AREA CLASSIFICATION

4.6.1 The TEG Contactor and K.O. Drum will be installed on the module M-06 as informed in I-DE-3010.1M-1200-942-P4X-002 - GENERAL ARRANGEMENT and I-DE-3010.1M-1416-942-P4X-001 - M-06 - GAS DEHYDRATION AND HCDP - EQUIPMENT LAYOUT PLAN

4.6.2 For area classification see I-DE-3010.1M-5400-94A-P4X-001 – AREA CLASSIFICATION – GENERAL.

4.7 DESIGN LOADS

4.7.1 In addition to the Code described loads and loads due to vessel motion described in I-RL-3010.1M-1350-960-P4X-009 – MOTION ANALYSIS, the following design loads must be considered where relevant:

- Equipment transportation and erection loads;
- Nozzle loads;
- Wind loads;
- Weight loads;
- Thermal loads;

*NOTE: Equipment basis and supports shall be designed for fire and explosion conditions as mentioned in the latest revision of DR-ENGP-M-I-1.3 – SAFETY ENGINEERING.

4.8 DESIGN LIFETIME

4.8.1 PACKAGER/ MANUFACTURER shall design and fabricate the complete equipment for a minimum service life of 25 years.

4.9 NOISE

4.9.1 Noise control analysis is a mandatory item to be carried out, according to I-ET-3010.1M-1200-300-P4X-001 - NOISE CONTROL REQUIREMENTS FOR TOPSIDE.



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4.10 GROUNDING INSTALLATION

- 4.10.1 Protection against static electricity shall comply with grounding requirements of IEC 61892-6 and Classification Society.
- 4.10.2 Additionally, for FPSOs units, the requirements of IEC 60092-502 shall be complied with.
- 4.10.3 Grounding installation shall comply with the latest revision of I-DE-3010.00-5140-700-P4X-003 – GROUNDING INSTALLATION TYPICAL DETAILS and I-ET-3010.00-5140-700-P4X-001 – SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS.

5 PACKAGE SPECIFICATION


The SCOPE OF SUPPLY shall include but not be limited to the following listed items:

5.1 PROCESS DESIGN

- 5.1.1 Process design and size verification of all vessels;
- 5.1.2 Verification of the number, size and location of all process and instrument related nozzles (refer to the I-FD-3010.1M-1233-550-P4X-001 GAS DEHYDRATION UNIT (T-1233001/V-T-1233001) – M-06 and the P&ID I-DE-3010.1M-1233-944-P4X-001 - GAS DEHYDRATION SYSTEM)
- 5.1.3 Design and definition of all vessel internals and their appropriate locations;
- 5.1.4 Design and definition of internal support requirements for installing the internals in the vessels;
- 5.1.5 Internal baffles shall be installed to restrict liquid movement due to ship motion. For liquid supply to the stripping gas column, provisions shall be made to avoid alternate starving and flooding of the column caused by the same motion.

5.2 TEG CONTACTOR (T-1233001)

- 5.2.1 TEG Contactor shall contain structured packing and a suitable demisting device (wire mesh or cyclone type) to minimize TEG entrainment. The application of cyclone type demister devices shall only be considered if this results in appreciable savings in contactor dimensions and weight, without adversely affecting the turndown capability.
- 5.2.2 Due attention shall be given to the turndown requirements of the liquid distributor in combination with vessel motions and trim.
- 5.2.3 The minimum liquid holdup for control shall be no less than 3 minutes.
- 5.2.4 The distance between alarms and the liquid levels are shown in I-FD-3010.1M-1233-550-P4X-001 – GAS DEHYDRATION UNIT (T-1233001/V-T-1233001) – M06
- 5.2.5 Mechanical design of TEG Contactor Pressure Vessel:
 - The vessel shall be designed in accordance with ASME VIII, Division 1 Boiler and Pressure Vessel Code and NR-13 Brazilian Code, according I-ET-3010.00-1200-540-P4X-001 REQUIREMENTS FOR PRESSURE VESSELS DESIGN

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<ul style="list-style-type: none"> • The vessel shall be designed for CS material (SA-516 Gr70N) with an internal cladding (3 mm thickness) 316L SS; • The design shall include brackets for a “hanging” arrangement. The brackets shall be designed to withstand the dynamic forces as defined in I-RL-3010.1M-1350-960-P4X-009 – MOTION ANALYSIS • The design shall include two man-ways (24”) with davits for removal of the cover to provide maintenance access; • The design shall include sufficient lifting lugs and documented information concerning lifting, handling and installation; • The design shall include two diametrically opposed located earthing bosses, mounted on the supporting brackets; • Full set of documentation • Classification Society certification. <p>5.2.6 Design and supply of internals:</p> <ul style="list-style-type: none"> • The inlet distributors, structured packing, liquid distributors, cyclonic demister pads and the supporting structures shall all be fabricated from 316L SS; • All vessel internals shall be designed to be removable via the man-ways; • Classification Society certification; • Preparation and packing for shipment. <p>5.2.7 TEG Contactor shall also comprise the following:</p> <ul style="list-style-type: none"> • TEG Contactor shall be provided with internal vessel trims (e.g. structure packing /demister). Efficiency of TEG Contactor shall be indicated in the data sheet. Liquid from the vessel shall be removed automatically, using level control, into PETROBRAS disposal system. • For material specification see Table 9.1. <p>5.3 TEG KO DRUM (V-T-1233001)</p> <p>5.3.1 This vessel shall feature sufficiently high separation efficiency over the full operating range. Demisting devices of proven suitability shall be used.</p> <p>5.3.2 The minimum liquid holdup for control shall be no less than 3 minutes.</p> <p>5.3.3 The distance between alarms and the liquid levels are shown in I-FD-3010.1M-1233-550-P4X-001 – GAS DEHYDRATION UNIT (T-1233001/V-T-1233001) – M06</p> <p>5.3.4 Mechanical design of this pressure vessel:</p> <ul style="list-style-type: none"> • The vessel shall be designed in accordance with ASME VIII, Division 1 Boiler and Pressure Vessel Code and NR-13 Brazilian Code, according I-ET-3010.00-1200-540-P4X-001 REQUIREMENTS FOR PRESSURE VESSELS DESIGN. • The vessel shall be designed for CS material (SA-516 Gr70N) with an internal cladding (3 mm thickness) 316L SS; • The design shall include brackets for a “hanging” arrangement. The brackets shall be designed to withstand the dynamic forces as defined in I-RL-3010.1M-1350-960-P4X-009 – MOTION ANALYSIS; 				

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- The design shall include a man-ways (24") with davits for removal of the cover to provide maintenance access;
- The design shall include sufficient lifting lugs and documented information concerning lifting, handling and installation;
- The design shall include two diametrically opposed located earthing bosses, mounted on the supporting brackets;
- Full set of documentation
- Classification Society certification.

5.3.5 Design and supply of internals:

- All vessel internals including supports shall be fabricated from 316L stainless steel;
- All vessel internals shall be designed to be removable through the manway connection;
- Classification Society certification;
- Preparation and packing for shipment.

5.3.6 The TEG Contactor K.O. Drum shall also comprise the following:

- The equipment shall be provided with internal vessel trims (e.g. demister).
- Efficiency of the separator shall be indicated in the data sheet.
- Liquid from the vessel shall be removed automatically, using level control, into PETROBRAS disposal system.
- Level, pressure and temperature instrument to be incorporated, including vents.
- Given alarm when the liquid level facility exceeds a pre-determined high level.

5.4 ISSUES TO BE ADDRESSED BY PACKAGER/ MANUFACTURER

PACKAGER/MANUFACTURER shall revert on the following issues:

- 5.4.1 Reference is made to I-RL-3010.1M-1200-940-P4X-001 – GENERAL SPECIFICATION FOR AVAILABLE UTILITIES. Confirm suitability of specified utilities and anticipated utility and stripping gas consumption within 10% accuracy;
- 5.4.2 Estimated TEG carryover from the contactor at full capacity and turndown, taking the high operating pressure into account;
- 5.4.3 Required separation efficiency for the TEG Contactor K.O. Drum (V-T-1233001);
- 5.4.4 Start-up procedures, in particular considering the non-availability of dry stripping gas during start up;
- 5.4.5 Required Chemical Injection points, taking contingency into consideration;
- 5.4.6 Operating Envelope (XY chart, indicating the achieved water content for various stripping gas flowrates as a function of contactor operating pressure & temperature);
- 5.4.7 Total TEG volume contained in the system [to allow sizing of the drain tank];
- 5.4.8 Lean TEG purity at which the system is operated to meet the dew point specification;
- 5.4.9 Unit circulation rate [Liter TEG per kg water removed], and design margins used determine the required circulation rate.



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5.5 INSTRUMENTATION

- 5.5.1 When applicable, all instrumentation equipment and interface with FPSO Automation and Control design shall comply with the latest revision of I-ET-3010.00-1200-800-P4X-002 - AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGED UNITS.
- 5.5.2 For Gas Dehydration Unit (GDU-1) classification see last revision of I-ET-3010.1M-1200-800-P4X-014 – AUTOMATION INTERFACE OF PACKAGED UNITS

6 NAMEPLATES

MANUFACTURER shall attach SS 316 nameplates on each item of equipment in an accessible location, fastened with corrosion resistant pins, and in Portuguese language. Nameplates shall be according to I-ET-3010.00-1200-540-P4X-001 – REQUIREMENTS FOR PRESSURE VESSELS DESIGN.

7 TAGS AND SAFETY SIGNS

- 7.1.1 When applicable, tagging of all instrumentation, electrical, mechanical, and piping items, including valves, shall be in accordance with latest revision of I-ET-3000.00-1200-940-P4X-001 - TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN.
- 7.1.2 The main items shall have individual tag numbers as dictated by PETROBRAS. The actual tag numbers will be advised to the PACKAGER after award.
- 7.1.3 Tags shall be supplied with the number and description in English, unless otherwise stated in the project data sheets.
- 7.1.4 Tag numbers for remaining ancillary equipment shall be given after Purchase Order placement.
- 7.1.5 All safety signs shall be in Portuguese.

8 CERTIFICATIONS REQUIREMENTS

8.1 CLASS CERTIFICATION

- 8.1.1 For each equipment within the package, a class certificate shall be supplied, suitable for the vessel to be classified.

8.2 GENERAL CERTIFICATION

- 8.2.1 PACKAGER/ MANUFACTURER shall be responsible for obtaining all required certification of the equipment.
- 8.2.2 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.

9 MATERIALS

9.1 GENERAL

- 9.1.1 TEG CONTACTOR/K.O. DRUM materials shall follow Table 9.1
- 9.1.2 All materials that are exposed to hydrocarbons containing hydrogen sulphide must follow the requirements of ISO 15156 for sour service. This requirement also must be applied in systems that are located downstream of Dehydration Unit, including the unit itself.
- 9.1.3 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.
- 9.1.4 Castings are not allowed.
- 9.1.5 Details of all major weld repairs and the heat treatment shall be recorded and reported to PETROBRAS.
- 9.1.6 The use of asbestos or materials containing asbestos is prohibited.

9.2 MATERIAL CERTIFICATION

- 9.2.1 In order 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
 - Non-Destructive Examination method and results
 - Heat treatment procedure

9.3 MATERIAL SPECIFICATION

Table 9.1 – Material specification for TEG CONTACTOR/K.O. DRUM

TEG CONTACTOR/K.O. DRUM (T-1233001/V-T-1233001)	
COMPONENT	MATERIAL
SHELL	SA-516 Gr 70N + internally SS 316L 3mm CLAD
HEADS	SA-516 Gr 70N + SS 316L 3mm CLAD
NOZZLES > 3 in	ASTM A106 Gr B + SS 316L 3mm CLAD
NOZZLES ≤ 3 in	SA-312 Gr.316L
SKIRT	SA-36
FLANGES > 3 in	SA-105 + 3mm SS316L internally CLAD and sealing areas
FLANGES ≤ 3 in	SA-182 F316L
EXTERNAL BOLTS/ EXTERNAL NUTS	ASTM A 193 Grade B7+ Zn-Ni Coated/ ASTM A 194 Gr 2H + Zn-Ni Coated
INTERNAL BOLTS/ INTERNAL NUTS	ASTM A193 B8M ASTM A194 8M
INTERNALS	SS316L

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Note: Any conflict with Table 9.1 (Material Specification) and other PETROBRAS' document the PACKAGER/MANUFACTURER shall inform PETROBRAS of the conflict and seek clarification.

10 INSPECTION, TESTING AND COMISSIONING

10.1 INSPECTION

- 10.1.1 PACKAGER shall submit an ITP with the bid.
- 10.1.2 PETROBRAS shall identify all the required witnessed inspections on a marked up copy of the ITP.
- 10.1.3 PETROBRAS reserve the right to inspect the package equipment anytime during fabrication to ensure that material and workmanship are in accordance with this specification.
- 10.1.4 PACKAGER shall ensure that all the witnessed inspection requirements by the classification society are met and due notice is given.
- 10.1.5 The notification period for such inspections shall be mutually agreed upon during the kick-off meeting.

10.2 PACKAGE INSPECTION

- 10.2.1 Unless waived by PETROBRAS, the following inspections and checks shall be witnessed by PETROBRAS surveyor:
 - Verification of the construction materials of the equipment for conformity with the requirements of the specification;
 - Verification that piping and fittings conform with specification of materials and fabrication;
 - Inspection by radiographic, dye penetrant, magnetic particles, ultrasonic inspection of welds of the pressure pertaining parts of vessels;
 - Review of ITR's;
 - A visual check noting:
 - A. That the thickness of pressure retaining parts meets or exceeds the quoted design thickness;
 - B. Any repairs;
 - C. Internal coating is complete (dry-film thickness as quoted);
 - D. General appearance, materials, workmanship and finish standard are acceptable;
 - Dimensional check;
 - Alignment check to be demonstrated;
 - All instrumentation, control panels and ancillary equipment shall be built checked, tested and function tested prior to installation as defined in the specification.

10.3 PACKAGE TEST

- 10.3.1 PACKAGER/ MANUFACTURER shall perform a full function test of completed package.



PETROBRAS

TECHNICAL SPECIFICATION

Nº. I-ET-3010.1M-1233-560-P4X-001

REV: 0

AREA: BÚZIOS

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TITLE: **GAS DEHYDRATION UNIT**

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10.3.2 PACKAGER/ MANUFACTURER shall submit to the PETROBRAS a Factory Acceptance Testing (FAT) procedure with a test schedule covering all items within the scope of supply.

10.3.3 PACKAGER/ MANUFACTURER shall prepare an FAT procedure covering all items within the scope of supply and submit it to for PETROBRAS approval.

10.3.4 The following tests shall be included in PACKAGER/MANUFACTURER's scope:

- Hydrotest of all vessels;
- Electrical continuity checks on all earthing connectors;

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

10.3.6 Acceptance of the FAT will not be considered as the final acceptance test of the package unit. Final acceptance will be on satisfactory completion of commissioning tests as specified by PETROBRAS.

10.4 ASSEMBLY ASSISTANCE AND COMMISSIONING REQUIREMENTS

10.4.1 PACKAGER is responsible for assembly supervision of the equipment, including assembly of components delivered loose (for example, vessel internals etc.).

10.4.2 PACKAGER is responsible for pre-commissioning and commissioning supervision of the equipment/ system. Final acceptance will be on satisfactory completion of commissioning tests as specified by PETROBRAS.

11 PACKAGER/MANUFACTURER RESPONSIBILITY

PACKAGER/MANUFACTURER shall assume sole contractual and total engineering responsibility for the package equipment.

PACKAGER/MANUFACTURER's responsibility shall also include but not limited to:

- Resolving all engineering questions and/or problems relating to design and manufacture.
- Providing details as requested of any-vendors relating to design and manufacturing.
- In all cases of conflict between this specification and applicable documents listed herein, the more stringent requirements shall prevail. In such cases, PACKAGER shall inform **PETROBRAS** of the conflict and seek clarification.
- If installation at site is included, the presence of supervision will be required.
- PACKAGER/MANUFACTURER's responsibility shall also include Commissioning & Training for operation.

Compliance by the PACKAGER/MANUFACTURER with the provisions of this specification does not relieve the PACKAGER/MANUFACTURER of his responsibility to furnish



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equipment and accessories of a proper mechanical design suited to meet the specified service conditions.

12 PREPARATION FOR SHIPMENT

12.1 MARKING

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

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

12.1.3 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

12.2 SHIPMENT PACKING

12.2.1 The equipment shall be supplied tested, flushed and preserved.

12.2.2 The preparation shall make the equipment suitable for 12 months outdoor storage from the time of shipment.

12.2.3 The equipment shall be protected from corrosion.

12.2.4 All open ends of pipes flanged or not on the equipment shall be treated and closed off by plastic caps and taped. Small bore threaded connections shall be taped over.

12.2.5 PACKAGER shall submit the packing design to **PETROBRAS** for approval.

12.2.6 PACKAGER shall pack the equipment in accordance with the packaging requirements of the country which the equipment is being shipped to.

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

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

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

12.2.10 PACKAGER shall specify any limitations applicable to the transportation and installation phase.