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	JOB: <b>REFERENCE HULL 01</b>		
	AREA: <b>-</b>		
<b>SRGE</b>	TITLE: <b>SANITARY TREATMENT AND VACUUM UNIT (Z-5312502)</b>		<b>INTERNAL</b>
			<b>ESUP</b>

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## 1. INTRODUCTION

### 1.1. OBJECTIVE

The purpose of this technical specification is to describe the minimum requirements for the design, manufacturing, assembly, supply, installation, commissioning and tests of SANITARY TREATMENT AND VACUUM UNIT (Z-5312502) in conformance with relevant regulations and REFERENCE HULL 01 FPSO design documentation.

### 1.2. DEFINITIONS

**PACKAGE:** It is defined as an assembly of equipment supplied interconnected, tested and ready to operate, requiring only the available utilities from the Unit for the Package operation.

**PACKAGER:** It is defined as the responsible for project, assembly, construction, fabrication, testing and furnishing of the Package.

All definitions are found on I-ET-3010.00-1200-940-P4X-002 – GENERAL TECHNICAL TERMS.

### 1.3. ABBREVIATIONS

BOD	Biochemical Oxygen Demand
CS	Classification Society
FAT	Factory Acceptance Tests
FPSO	Floating Production Storage and Offloading Unit
SOS	Supervisory and Operation System
SOS-HMI	Human Machine Interface of SOS
STU	Sewage Treatment Unit

## 2. NORMATIVE REFERENCES

### 2.1. INTERNATIONAL CODES, RECOMMENDED PRACTICES AND STANDARDS

The equipment shall be designed and manufactured in accordance with the minimum following codes and standards, if not mentioned otherwise.

- ASME B31.3 – Process Piping
- ASME B16.5 – Pipe Flanges & Flanged Fittings
- AWS D1.1 – Structural Welding Code
- IMO – International Maritime Organization – MPEC.227 (64)
- MARPOL – Chapter IV



- Classification Society defined for the Hull scope.

**2.2. BRAZILIAN CODES AND STANDARDS**

- NR – Brazilian Federal Government Regulatory Norms (Normas Regulamentadoras NRs)
- NORMAM-01 – Normas da Autoridade Marítima para Embarcações Empregadas na Navegação em Mar Aberto;
- CONSELHO NACIONAL DO MEIO AMBIENTE – CONAMA Resolução nº 430, de 13 de maio de 2011;
- NOTA TÉCNICA CGPEG/DILIC/IBAMA Nº 01/11 – PROJETO DE CONTROLE DA POLUIÇÃO – IBAMA
- INMETRO Resolution 115, March 21st 2022

**2.3. CLASS APPROVAL AND CERTIFICATION**

The PACKAGE shall be designed, manufactured and tested according to the design reference documents, normative requirements and in accordance with the latest editions of Classification Society Rules, Regulations and Standards.

**3. REFERENCE DOCUMENTS**

**3.1. REFERENCE HULL 01 FPSO DESIGN**

REF DOC NUMBER	REF DOC NAME
<b>HULL SYSTEMS</b>	
I-DE-3010.2E-5310-944-P4X-001	BLACK AND GREY WATER SYSTEM
I-DE-3010.2E-5310-944-P4X-002	BLACK AND GREY WATER SYSTEM COLLECTION
I-MD-3010.2E-1200-940-P4X-027	DESCRIPTIVE MEMORANDUM - HULL SYSTEMS
<b>OUTFITTING</b>	
I-DE-3010.2E-1351-140-P4X-001	HULL GENERAL NOTES AND TYPICAL DETAILS

Table 1 – Reference Hull 01 FPSO basic design.

**3.2. TYPICAL DOCUMENTS**

REF DOC NUMBER	REF DOC NAME
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TITLE:

**SANITARY TREATMENT AND VACUUM UNIT (Z-5312502)**

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**GENERAL**

I-ET-3000.00-0000-940-P4X-002

SYMBOLS FOR PRODUCTION UNITS DESIGN

I-ET-3010.00-1200-940-P4X-002

GENERAL TECHNICAL TERMS

I-ET-3010.00-1352-130-P4X-001

FLOOR GRATINGS, TRAY SYSTEMS AND GUARDRAILS MADE OF COMPOSITE MATERIALS.

I-ET-3000.00-1200-940-P4X-001

TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN

**CONSTRUCTION**

I-ET-3010.00-1200-955-P4X-001

WELDING

I-ET-3010.00-1000-970-P4X-002

REQUIREMENTS FOR NDT

I-ET-3010.00-1200-955-P4X-002

REQUIREMENTS FOR WELDING INSPECTION

I-ET-3010.00-0000-970-P4X-001

REQUIREMENTS FOR PROCEDURES AND PERSONNEL QUALIFICATION AND CERTIFICATION

**MECHANICAL**

I-ET-3010.00-1200-300-P4X-001

NOISE AND VIBRATION CONTROL REQUIREMENTS

**PAINTING**

I-ET-3010.00-1200-956-P4X-002

GENERAL PAINTING

DR-ENGP-I-1.15

COLOR CODING

**SAFETY**

I-ET-3010.00-5400-947-P4X-002

SAFETY SIGNALING


DR-ENGP-M-I-1.3

SAFETY ENGINEERING GUIDELINE

**PIPING**

I-ET-3010.00-1200-251-P4X-001

REQUIREMENTS FOR BOLTING MATERIALS


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<b>ELECTRICAL</b>	
I-DE-3010.00-5140-700-P4X-003	GROUNDING INSTALLATION TYPICAL DETAILS
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 AND EQUIPMENT 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
<b>INSTRUMENTATION AND AUTOMATION</b>	
I-ET-3010.00-1200-800-P4X-002	AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS
I-ET-3010.00-1200-800-P4X-013	GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS
I-ET-3010.00-5520-888-P4X-001	AUTOMATION PANELS
I-ET-3010.00-1200-800-P4X-015	REQUIREMENTS FOR TUBING AND FITTING (ALIGNED TO IOGP-JIP33 S-716)

Table 2 – Reference Hull 01 Typical Documents.

### 3.3. SPECIFIC PROJECT DOCUMENTS

REF DOC NUMBER	REF DOC NAME
<b>GENERAL</b>	
I-DE- GENERAL ARRANGEMENT	GENERAL ARRANGEMENT
I-DE- AREA CLASSIFICATION – GENERAL	AREA CLASSIFICATION – GENERAL
I-ET- AUTOMATION INTERFACE OF PACKAGE UNITS	AUTOMATION INTERFACE OF PACKAGE UNITS
I-ET- METOCEAN DATA	METOCEAN DATA

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I-RL-MOTION ANALYSIS	MOTION ANALYSIS
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Table 3 – Specific Project Documents.

- Note: Table 3 documents title and number may vary slightly from one project to another. Project's document list shall be consulted in order to verify the correct document number and title.

#### 4. DESIGN REQUIREMENTS

##### 4.1. DESIGN CONDITIONS

- 4.1.1. PACKAGE Equipment shall be designed for a 30-year life in a corrosive offshore environment without the need for replacement of any major component due to wear, corrosion, fatigue, or material failure.
- 4.1.2. PACKAGER shall design the equipment for the full range of operational conditions as specified in this technical specification.
- 4.1.3. PACKAGE Equipment shall be designed with the compliance of the normative and design requirements as stated in this specification and complying with the technical parameters stated on the above item 3 with the REFERENCE HULL 01 FPSO basic design reference documents.

##### 4.2. SAFETY REQUIREMENTS

- 4.2.1. Personnel safety protection shall be provided according to Brazilian Regulatory Norms (NR) issued by Brazilian Government.
- 4.2.2. Warning signs in Brazilian Portuguese language shall be provided where risk of personnel injury exist.
- 4.2.3. Rotating equipment outer parts, such as pulleys, couplings, belts and flywheels, shall have rigid protection, manufactured with aluminum ASTM B211 and shall be capable of being easily removed.
- 4.2.4. In accordance with the requirements of SOLAS II-1, Regulation 3-5, and MSC.1/Circ. 1379, all equipment and material to be supplied by PACKAGER shall be "asbestos free".
- 4.2.5. Safety signaling shall be in full compliance with I-ET-3010.00-5400-947-P4X-002 – SAFETY SIGNALING.
- 4.2.6. For additional safety requirements refer to DR-ENGP-M-I-1.3 – SAFETY ENGINEERING GUIDELINE.

##### 4.3. NOISE AND VIBRATIONS

- 4.3.1. Noise and vibrations limits shall be in conformance with I-ET-3010.00-1200-300-P4X-001 – NOISE AND VIBRATION CONTROL REQUIREMENTS.



#### 4.4. MOTIONS AND ACCELERATION

- 4.4.1. All equipment shall be able to withstand with the UNIT subjected to 100-year return period environmental conditions.
- 4.4.2. All equipment shall be able to operate with the UNIT subjected to 1-year return period environmental conditions.
- 4.4.3. All environmental conditions are defined in I-ET-METOCEAN DATA.
- 4.4.4. For the Hull loading conditions details and the maximum designed operational trim and heel inclinations refer to I-ET-3010.00-1350-960-P4X-001 – DESIGN REQUIREMENTS – NAVAL ARCHITECTURE.
- 4.4.5. For the design data and information regarding motion requirements refer to I-RL- – MOTION ANALYSIS.
- 4.4.6. PACKAGE is also to withstand inertial forces during transportation from construction site to the final offshore location.


#### 5. PACKAGE SCOPE OF SUPPLY

##### 5.1. SCOPE OF SUPPLY

	<b>TAG</b>	<b>Description</b>	<b>Qty</b>
1	Z-5312502A/B	Sewage Treatment Unit	2 x 100%
2	PN-Z-5312502A/B	Sewage Treatment Unit Panel	2 x 100%
3	TQ-Z-5312502	Grease Trap	1 x 100%
4	FT-Z-5312502A/B	Catcher Unit	2 x 100%
5	B-Z-5312502	Sewage Sludge Removal Pump	1 x 100%
6	---	Manual Handheld kits for measuring DO (dissolved oxygen) levels from samples	2 x 100%

Table 4 – Scope of Supply

- 5.1.1. According to the above table 4, PACKAGER shall supply two (2 X 100%) biological type Sewage Treatment Units fully assembled each one in a structural skid and being each one able to attend 100% of the FPSO POB.
- 5.1.2. Additionally, PACKAGER shall supply a grease trap (TQ-Z-5312502) to collect the Accommodation Galley grey water, catcher units (FT-Z-5312502A/B) for black

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waters retention and a (1 x 100%) fixed pump (Z-B-5312502) for the STUs sewage sludge removal and discharge.

5.1.3. PACKAGER shall supply all interconnection piping, flanges, valves, electrical panel and terminations, instrument, and any other device for the safe and full operational performance of the equipment following all normative regulations, standards and the minimum requirements for design and operation herein mentioned on this specification.

## 5.2. EQUIPMENT LOCATION

5.2.1. PACKAGE shall be installed in Engine Room which is a closed and non-classified compartment as defined on I-DE-AREA CLASSIFICATION - GENERAL.

5.2.2. I-DE-GENERAL ARRANGEMENT shall also be used as reference for the PACKAGE equipment location.

## 6. PACKAGE SPECIFICATION – SEWAGE TREATMENT UNIT (STU)

### 6.1. STU GENERAL REQUIREMENTS

6.1.1. STU (2 x 100%) shall be IMO type approved as per MPEC.227 (64) and be designed for a POB of 240 people with a daily flow rate of 200 liters per person, as a minimum, corresponding to a total daily treatment capacity of 48.0 m<sup>3</sup>.

6.1.2. For each STU capacity, PACKAGER shall consider a Biochemical Oxygen Demand (BOD) of 600 mg/liter at STUs inlet and the peak periods treatment demand along the day, to be defined in detailing phase.


6.1.3. The STUs (2 x 100%) shall be conceived to keep one of them in operation while the other one is in stand-by. It shall be conceived means to operate simultaneously both Sewage Treatment Units Z-5312502A/B while the one in operation is put out of operation (for instance, maintenance purposes), and the one, in stand-by, is put to operate.

6.1.4. Focusing on operational change-outs between STUs, it shall be incorporated transference lines between both units, making it possible to transfer the inventory from the STU being put out of operation to the other STU, aiming biological process efficiency during these transfers.

- Note: PACKAGER shall provide a detailed procedure about how to undergo such STUs change-outs, mentioning all operational maneuvers and main operational control parameters to be monitored while the STU which is being put to operate assumes up to 100% of its operational flow rate.

6.1.5. As a recommendation of hazardous operation study, PACKAGER shall provide protection against high level scenario on STU tanks during the treatment peak demand.

6.1.6. STUs shall treat the grey water collected by gravity and black waters collected by

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a vacuum system.

6.1.7. STUs shall be controlled by (2 x 100%) Sewage Treatment Unit Panel (PN-Z-5312502A/B). For those control panels requirements refer to 8.1 and 8.2.

## 6.2. STU EQUIPMENT AND DEVICES

### 6.2.1. STU Aeration Blowers

6.2.1.1. To avoid the absence of oxygen and consequently the growth of anaerobic bacteria, each STU shall be equipped with two air blowers (2 x 100%), able to operate separately or simultaneously (in contingencies), guaranteeing the amount of oxygen the process demands. This aeration system shall be conceived with access facilities to perform maintenance and unclogging tasks.

### 6.2.2. STU biological reactor inspection access hatches

6.2.2.1. The biological reactor of the STUs shall have an ease and practical opening hatch or other similar access device to allow its interior visual inspection, eventual measurements and sample collections from its interior liquid effluents, for example the liquid from the sludge return line or the scum return line.

### 6.2.3. STU disinfection chamber

6.2.3.1. Before leaving the equipment, the liquid effluents shall pass through a disinfection chamber, where it shall be mixed and disinfected with liquid chlorine.

### 6.2.4. STU tanks / chambers level transmitters


6.2.4.1. Tanks/chambers inside the sewage treatment units shall have a level transmitter and alarm to indicate the possibility of overflow.

6.2.4.2. The signal obtained by the level transmitter shall be integrated to platform supervisory system (SOS) in the CCR.

6.2.4.3. This signal shall be interlocked with the first XV (on/off) valve downstream the Gray Water Holding Tank (TQ-5310501). This valve shall close in case of high level at STU tanks.

### 6.2.5. STU effluents discharge

6.2.5.1. Both STUs shall have two pumps (2X100%) each one, to collect the treated fluid and discharge it overboard.

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6.2.5.2. The STU effluents to be discharged to the sea shall follow the MPEC.227 (64) and the Brazilian requirements “CONSELHO NACIONAL DO MEIO AMBIENTE – CONAMA Resolução nº 430, de 13 de maio de 2011” and “NOTA TÉCNICA CGPEG/DILIC/IBAMA Nº 01/11 – PROJETO DE CONTROLE DA POLUIÇÃO – IBAMA”.

### 6.3. STU GREY / BLACK WATERS COLLECTING SYSTEM REQUIREMENTS

6.3.1. The design of the grey and black water collecting system from the Accommodation and other areas to the STUs and from the STUs to overboard shall be submitted to the PACKAGER for formal approval.

6.3.2. Grey and black water collecting system piping lines design, slope, accessories, valves, unions, and the STUs vent lines as detailed on I-DE-3010.2E-5310-944-P4X-001 – BLACK AND GREY WATER SYSTEM and I-DE-3010.2E-5310-944-P4X-002 – BLACK AND GREY WATER SYSTEM COLLECTION shall follow the sewage treatment unit PACKAGER's recommendations.

### 6.4. STU MAINTENANCE REQUIREMENTS

6.4.1. The time interval between periodic maintenance shall not be shorter than 1 month.

6.4.2. During such interventions the maximum sludge removal volume shall be approximately 15 m<sup>3</sup>, considering the regular sludge age (mean Cell Residence Time) conceived for the STUs dimensioning and effectiveness.

6.4.3. STUs shall not require any other sludge removal intervention between periodic maintenance, or within the 1 month period mentioned on 6.4.1.

### 6.5. STU SAMPLING POINTS


6.5.1. STUs shall have as a minimum two (2) remote sampling points at each treatment tank/chamber. One of these remote sampling points shall be at each tank/chamber bottom.


6.5.2. If there is a sludge settlement tank/chamber, it shall be equipped with four (4) remote sampling points, equally distributed in different heights of the sludge settlement tank/chamber, being one (1) at its bottom.

6.5.3. If there are one or more additional treatments downstream the biological process, there shall be a sampling point between the biological process outlet and this additional treatment, and a sampling point between each treatment, if two or more additional treatments are conceived.

6.5.4. It shall be possible to measure the DO (dissolved oxygen) inside the aeration tank/chamber. For this purpose, besides the sampling points mentioned in 6.5.1, 6.5.2 and 6.5.3 above, two (2) manual handheld probes to measure DO levels shall be provided.

- Note 1: the probes shall have appropriate calibration certificates.

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<ul style="list-style-type: none"> <li>▪ Note 2: other alternatives to measure DO levels in the aeration tank/chamber may be proposed by PACKAGER and shall be submitted to OWNER for approval.</li> </ul> <p>6.5.5. Sewage system shall be provided with sample points for the STUs inlet flow of grey and black waters (upstream treatment).</p> <ul style="list-style-type: none"> <li>▪ Note 1: for the grey water inlet sample points refer to I-DE-5310-944-P4X-001 – BLACK AND GREY WATER SYSTEM.</li> <li>▪ Note 2: since black waters are collected by vacuum system, STUs shall be provided with a sample point downstream of the vacuum pumps and upstream the first treatment stage. This sample point is PACKAGER design and scope of supply.</li> </ul> <p>6.5.6. Sample points shall also be provided for grey and black waters STUs outlet flow (treated discharge to overboard) for both STUs. Refer to I-DE-3010.2E-5310-944-P4X-001 – BLACK AND GREY WATER SYSTEM.</p> <p>6.5.7. Besides the individual black and grey waters individual sampling points mentioned above, the black and grey waters piping shall be unified in a sole piping at each STU inlet. This sole entrance of unified streams of grey and black waters shall be equipped with a Sampling Point, immediately upstream the STU.</p> <p><b>6.6. STU VENT SYSTEM</b></p> <p>6.6.1. Each STU shall have a dedicated vent piping system.</p> <p>6.6.2. STUs vent system shall be positioned in an open area on Main Deck aft of Engine Room forward bulkhead in a proper place so that it does not cause any disturbance to the crew with odor dispersed.</p> <p>6.6.3. Also, STU vent piping system shall be distant enough from the Hull air intakes to not create a short circuit.</p> <p>6.6.4. For the STU venting system additional requirements and details refer to I-DE-3010.2E-5310-944-P4X-001 – BLACK AND GREY WATER SYSTEM.</p> <p><b>6.7. STU SLUDGE REMOVAL</b></p> <p>6.7.1. The sludge produced by STU shall be transferred to fill drums at the Topside laydown area by a fixed pump (B-Z-5312502) (PACKAGER scope) through a fixed piping line (HULL SUPPLIER scope) fully dedicated for this transference.</p> <p>6.7.1.1. At the Topside Lay-down area, this fixed piping shall be equipped with a quick coupling to attach a hose with sufficient length to fill the drums.</p> <p>6.7.1.2. In the hose extremity there shall be a device equipped with a blocking valve to be opened just prior to each drum filling, similar to filling pistols used in gas stations. The intention is to prevent sludge spills on Lay-down area.</p>			

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6.7.1.3. After each drum filling, this blocking device is maintained blocked prior the next drum filling.

6.7.1.4. To avoid circuit lines integrity failure, while this blocking device is blocked, and the sludge pump (centrifugal or positive displacement) is working, the circuit lines shall be protected. In the case of centrifugal solution, the lines circuit shall resist to shut-off intervals; in case of positive displacement solution, adequate integrity guarantees shall be adopted.

6.7.2. The fixed pump as called Sewage Sludge Removal Pump (B-Z-5312502) shall be designed, selected and supplied by PACKAGER.

6.7.2.1. PACKAGER may adopt electrical centrifuge pump or pneumatic positive displacement pump, this last one represented in I-DE-3010-2E-5310-944-P4X-001. In any case, the solution shall be conceived to preserve safety during drums filling operations at Lay-down area.

- Note: for pump minimum capacity reference design refer to I-DE-3010.2E-5310-944-P4X-001 – PIPING AND INSTRUMENT DIAGRAM BLACK AND GREY WATER SYSTEM.

6.7.2.2. PACKAGER shall provide a data sheet of this fixed pump with all corresponding design characteristics.

## 7. PACKAGE SPECIFICATION – OTHER EQUIPMENT

### 7.1. GREASE TRAP (TQ-Z-5312502)

7.1.1. Grease trap shall be rectangular type and installed at a level below the galley and messroom.

7.1.2. Grease trap shall have facilities for inspection and maintenance and hot / cold water connections for washing and cleaning. It shall also have one (1) drain point.

7.1.3. All effluents discarded from grease trap shall be treated before the discharge to the sea.


7.1.4. PACKAGER shall provide instructions for grease trap cleaning with information of the minimum interval for cleaning to ensure the system efficiency.

### 7.2. CATCHER UNITS (FT-Z-5312502A/B)

7.2.1. Sewage system shall have two (2) Catcher Filters (2 x 100%) to collect solids and large objects from the black water collection system as detailed on I-DE-3010.2E-5310-944-P4X-001 – BLACK AND GREY WATER SYSTEM.

7.2.2. Both Catcher Filters (FT-Z-5312502A/B) shall be installed on Engine Room with accessible areas for maintenance.

7.2.3. Catcher filters units (FT-Z-5312502A/B) can be replaced by another solution

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approved by PACKAGER if ensured that the collection of solids and large objects could be done without impacting the operation of the sewage treatment system and if solids and large objects collected could be easily removed.

## 8. GENERAL REQUIREMENTS

### 8.1. ELECTRICAL REQUIREMENTS

8.1.1. Electrical equipment, material, low voltage motors and grounding shall comply with requirements stated on the following references:

- a) I-ET-3010.00-5140-700-P4X-001 – SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS.
- b) I-ET-3010.00-5140-700-P4X-002 – SPECIFICATION FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS.
- c) I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS.
- d) I-ET-3010.00-5140-712-P4X-001 – LOW-VOLTAGE INDUCTION MOTORS FOR OFFSHORE UNITS.
- e) I-DE-3010.00-5140-700-P4X-003 – GROUNDING INSTALLATION TYPICAL DETAILS.

### 8.2. INSTRUMENTATION AND AUTOMATION REQUIREMENTS

8.2.1. PACKAGE instrumentation, automation and control design shall fulfill the requirements of the following technical specifications:


- a) I-ET-3010.00-1200-800-P4X-002 – AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS.
- b) I-ET-3010.00-1200-800-P4X-013 – GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS.
- c) I-ET- AUTOMATION INTERFACE OF PACKAGE UNITS.
- d) I-ET-3010.00-5520-888-P4X-001 – AUTOMATION PANELS.

### 8.3. PAINTING REQUIREMENTS

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

8.3.2. All components shall be delivered fully painted/coated, unless otherwise indicated on this specification.

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

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#### 8.4. SKIDS LAYOUT AND FOUNDATION REQUIREMENTS

- 8.4.1. PACKAGE components detailed on item 6 which are supplied assembled on skids shall follow the below minimum requirements.
- 8.4.2. PACKAGE skid structure shall be designed to withstand the design conditions mentioned on item 4.4 and to ensure the lifting conditions on manufacturing site and shipyard. Lifting lugs shall be provided according to PACKAGER lifting procedure.
- 8.4.3. The Skid main frame shall be all welded construction. Structural skid welds, including lifting facilities shall be continuous and shall comply with AWS D1.1 (structural welding code) and CS Rules. Skid structure shall be designed to be welded to the supporting structure unless otherwise specified.
- 8.4.4. PACKAGE skid layout and arrangement shall be designed to provide sufficient access to pumps, instruments, equipment, and control panels so as to ease the operability and maintenance with safe conditions. Instruments and valves shall be installed on a suitable height to allow safe access for monitoring, operation, and maintenance.
- 8.4.5. Access ladders, platforms, gratings and any other access device shall comply with I-ET-3010.00-1352-130-P4X-001 - FLOOR GRATINGS, TRAY SYSTEMS AND GUARDRAILS MADE OF COMPOSITE MATERIALS. Metallic material is also acceptable and I-DE-3010.2E-1351-140-P4X-001 – HULL GENERAL NOTES AND TYPICAL DETAILS, item 3.23, shall be followed for metallic grating requirements.
- 8.4.6. PACKAGE skid shall have a drip pan to collect drained water from the equipment with drain flanges for the connection with the Hull draining system.
- 8.4.7. PACKAGE Equipment and components shall be located entirely within the skids / equipment base perimeter, including all equipment, piping, valves, electrical, instrumentation and controls.
- Note: For the Sewage Treatment Unit Panel (PN-Z-5312502A/B) location requirements refer to I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS.


#### 8.5. AVAILABLE ON BOARD


- 8.5.1. A grey water holding tank (TQ-5310501) for the grey water peak volume as detailed on I-DE-3010.2E-5310-944-P4X-001 – BLACK AND GREY WATER SYSTEM.
- 8.5.2. A grey / black water collecting system as detailed on I-DE-3010.2E-5310-944-P4X-002 – BLACK AND GREY WATER SYSTEM COLLECTION.

#### 8.6. NAMEPLATES AND TAG NUMBERING

- 8.6.1. PACKAGER / MANUFACTURER Equipment shall have nameplates in Brazilian



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<p>Portuguese language, made of stainless steel AISI 316L, with 3 mm minimum thickness and fixed by stainless steel (AISI 316L) bolts or fasteners on visible and accessible location.</p> <p>8.6.2. Tagging of all instruments, electrical, mechanical and piping items, including valves, shall be carried out as detailed on I-ET-3000.00-1200-940-P4X-001 – TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN</p> <p><b>9. PACKAGE MANUFACTURING AND DELIVERY REQUIREMENTS</b></p> <p><b>9.1. GENERAL</b></p> <p>9.1.1. All materials and equipment supplied by PACKAGER / MANUFACTURER shall be brand new (not overhauled), field proven, free from defects and accepted by Owner and the Classification Society.</p> <p>9.1.2. Materials and equipment shall be manufactured according to internationally recognized standards for the offshore oil drilling and production industries and shall be in conformance with the Basic Design and Agreement specifications and requirements.</p> <p>9.1.3. Field proven definition: Systems and equipment shall demonstrate satisfactory operation at least in 3 floating offshore installation units, operating under process conditions (pressure, flow, capacity and similar fluids) for a minimum of 24,000 hours. For rotating equipment, they must demonstrate operation with fluid, flow and discharge pressure similar to the design. Unproven designs or prototypes (including components) without offshore service will not be accepted.</p> <p><b>9.2. WELDING</b></p> <p>9.2.1. PACKAGE equipment, structures and piping welding, welding inspection, non-destructive testing (NDT), bolted joints assembly and piping fabrication and commissioning activities shall be performed in compliance with the following technical specifications:</p> <ul style="list-style-type: none"> <li>a) I-ET-3010.00-1000-970-P4X-002 – Requirements for NDT.</li> <li>b) I-ET-3010.00-1000-955-P4X-002 – Requirements for Welding Inspection.</li> <li>c) I-ET-3010.00-1000-955-P4X-001 – Welding.</li> <li>d) I-ET-3010.00-1200-200-P4X-001 – Requirements for Bolted Joints Assembly and Management.</li> <li>e) I-ET-3010.00-1200-200-P4X-115 – Requirements for Piping Fabrication and Commissioning.</li> </ul> <p><b>9.3. DOCUMENTATION</b></p> <p>9.3.1. For the PACKAGE documentation and data-book requirements refer to EXHIBIT III – DIRECTIVES FOR ENGINEERING.</p>			

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9.3.2. Additionally, for the PACKAGE documentation, data-book requirements refer to EXHIBIT V – DIRECTIVES FOR PROCUREMENT.

#### 9.4. SPARE PARTS

9.4.1. For the PACKAGE, spare parts, special tools, CS required spare parts and spare parts list recommended for two (2) years of operation refer to EXHIBIT V – DIRECTIVES FOR PROCUREMENT.

#### 9.5. INSPECTION AND TESTS

9.5.1. For PACKAGE inspection, tests, factory acceptance test (FAT) and inspection release certificate (IRC), refer to EXHIBIT V – DIRECTIVES FOR PROCUREMENT.

9.5.2. For PACKAGE inspection and test plan (ITP) requirements refer to EXHIBIT VII – DIRECTIVES FOR QUALITY ASSURANCE SYSTEM.

#### 9.6. PRESERVATION, PACKING AND TRANSPORTATION

9.6.1. For PACKAGE preservation, packing and transportation requirements refer to EXHIBIT V – DIRECTIVES FOR PROCUREMENT.