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INDEX OF REVISIONS

REV.	DESCRIPTION AND/OR REVISED SHEETS
0	ORIGINAL ISSUE
A	REVISED WHERE INDICATED / INCLUSION OF THE DUPLEX FILTER FT-5336501A/B – DUPLEX SLOP TREATMENT FILTER.

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATE	DEC/08/20	MAR/24/21							
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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 HULL OIL FILTERS in conformance with relevant regulations and High Capacity FPSO design documentation.

HULL OIL FILTERS PACKAGE is composed by the following filters:

- FT-5133501A/B – Diesel Oil Filters
- FT-5133502 – Duplex Diesel Oil Filters for Service System
- FT-5133503 – Duplex Diesel Oil Filters for Well Service System
- FT-5330503 – Sludge Pump Filter
- FT-5330509A/B – Auxiliary Bilge Pump Filters
- FT-5336501– Duplex Slop Treatment Filter

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.

HULL OIL FILTERS the package name.

OWNER: PETROBRAS.

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

1.3. ABBREVIATIONS

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

2. NORMATIVE REFERENCES

2.1. INTERNATIONAL CODES, RECOMMENDED PRACTICES AND STANDARDS

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

- ANSI American National Standards Institute
- API American Petroleum Institute
- ASME American Society Of Mechanical Engineers
- BGV German Safety Regulations
- DIN German National Standard Code
- EN European Standards
- ISO International Standard Organization
- IMO – International Maritime Organization
- Classification Society defined for the Hull scope.

2.2. BRAZILIAN CODES AND STANDARDS

- NR-13 – Brazilian Federal Government Regulatory Norms “Caldeiras e Vasos de Pressão” Boilers and Pressure Vessels
- NR – Brazilian Federal Government Regulatory Norms (Normas Regulamentadoras NRs)
- NORMAM-01 – Normas da Autoridade Marítima para Embarcações Empregadas na Navegação em Mar Aberto;

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

REF DOC NUMBER	REF DOC NAME
GENERAL	
I-DE-3010.1Y-5400-94A-P4X-001	AREA CLASSIFICATION – GENERAL
I-ET-3000.00-0000-940-P4X-002	SYMBOLS FOR PRODUCTION UNITS DESIGN

I-ET-3000.00-1200-940-P4X-001	TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN
I-RL-3010.1Y-1200-940-P4X-001	GENERAL SPECIFICATION FOR AVAILABLE UTILITIES
I-ET-3010.00-1200-940-P4X-002	GENERAL TECHNICAL TERMS
I-ET-3A36.00-1000-941-PPC-001	METOCEAN DATA
CONSTRUCTION	
I-ET-3010.00-1200-955-P4X-001	WELDING
I-ET-3010.00-1200-955-P4X-002	REQUIREMENTS FOR WELDING INSPECTION
I-ET-3010.00-1000-970-P4X-002	REQUIREMENTS FOR NDT
I-ET-3010.00-0000-970-P4X-001	REQUIREMENTS FOR PROCEDURES AND PERSONNEL QUALIFICATION AND CERTIFICATION
HULL SYSTEMS	
I-DE-3010.1Y-5133-944-P4X-003	DIESEL OIL PURIFIER AND SERVICE SYSTEM
I-DE-3010.1Y-5133-944-P4X-004	DIESEL OIL STORAGE SYSTEM
I-DE-3010.1Y-5330-944-P4X-001	BILGE, SLUDGE, BALLAST (ENGINE ROOM) AND GENERAL SERVICE SEA WATER
I-DE-3010.1Y-5336-944-P4X-005	SLOP DISCHARGE SYSTEM
I-FD-3010.1Y-5133-660-P4X-001	DIESEL OIL FILTERS (FT-5133501A/B)
I-FD-3010.1Y-5133-660-P4X-003	DUPLEX FILTER FOR DIESEL OIL SERVICE SYSTEM (FT-5133502)
I-FD-3010.1Y-5133-660-P4X-002	DUPLEX FILTER FOR DIESEL OIL WELL TRANSFER SYSTEM (FT-5133503)
I-FD-3010.1Y-5330-660-P4X-001	SLUDGE PUMP FILTER (FT-5330503)

I-FD-3010.1Y-5330-660-P4X-002	AUXILIARY BILGE PUMP FILTER (FT-5330509A/B)
I-FD-3010.1Y-5336-660-P4X-002	DUPLEX SLOP TREATMENT FILTER (FT-5336501)
I-MD-3010.1Y-1200-940-P4X-027	DESCRIPTIVE MEMORANDUM – HULL SYSTEMS
NAVAL	
I-ET-3010.1Y-1350-960-P4X-002	DESIGN REQUIREMENTS - NAVAL ARCHITECTURE
I-RL-3010.1Y-1350-960-P4X-009	MOTION ANALYSIS
MECHANICAL	
I-ET-3010.1Y-1200-500-P4X-003	MATERIAL SPECIFICATION FOR HULL SYSTEM PRESSURE VESSELS AND TANKS
PAINTING	
I-ET-3010.00-1200-956-P4X-002	GENERAL PAINTING
DR-ENGP-I-1.15	COLOR CODING
SAFETY	
DR-ENGP-M-I-1.3	SAFETY ENGINEERING GUIDELINE
I-ET-3010.00-5400-947-P4X-002	SAFETY SIGNALING
PIPING	
I-ET-3010.1Y-1200-200-P4X-002	PIPING SPECIFICATION FOR HULL
I-ET-3010.00-1200-251-P4X-001	REQUIREMENTS FOR BOLTING MATERIALS
INSTRUMENTATION AND AUTOMATION	
I-ET-3010.00-1200-800-P4X-013	GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS

Table 1 – Reference Documents

Note: Reference Documents latest revision shall be considered.

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 High Capacity FPSO basic design reference documents.

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

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

4.3. MOTIONS AND ACCELERATION

4.3.1. All equipment shall be able to withstand with the UNIT subjected to 100-year return period environmental conditions.

4.3.2. All equipment shall be able to operate with the UNIT subjected to 1-year return period environmental conditions.

4.3.3. All environmental conditions are defined in I-ET-3A36.00-1000-941-PPC-001 – METOCEAN DATA, at any draft from fully loaded to the minimum loaded /

ballasted condition.

4.3.4. For the Hull loading conditions details and the maximum designed operational trim and heel inclinations refer to I-ET-3010.1Y-1350-960-P4X-002 – DESIGN REQUIREMENTS - NAVAL ARCHITECTURE.

4.3.5. For the design data and information regarding motion requirements refer to I-RL-3010.1Y-1350-960-P4X-009 – MOTION ANALYSIS.

4.3.6. 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

	TAG	Description	Type
1	FT-5133501A/B	Diesel Oil Filters	Simplex
2	FT-5133502	Duplex Diesel Oil Filter For Service System	Duplex
3	FT-5133503	Duplex Diesel Oil Filter For Well Service System	Duplex
4	FT-5330503	Sludge Pump Filter	Simplex
5	FT-5330509A/B	Auxiliary Bilge Pump Filters	Simplex
6	FT-5336501	Duplex Slop Treatment Filter	Duplex

Table 2 – Scope of Supply and location

5.1.1. All filters valves, accessories, instruments, and any other components to ensure the Filters design and operation performance as the minimum requirements herein detailed and according to the applicable rules, regulations and the High Capacity FPSO design reference documents.

5.2. FILTERS LOCATION

5.2.1. All Filters PACKAGE shall be installed on Engine Room which is a closed and non-classified compartment, except FT-5336501 – Duplex Slop Treatment Filter, which shall be installed on Main Deck, a classified area.

5.2.2. For equipment location refer to I-DE-3010.1Y-5400-94A-P4X-001 – AREA CLASSIFICATION - GENERAL.

6. PACKAGE SPECIFICATION

6.1. GENERAL

6.1.1. For Filters material specification and internal lining / coating refer to I-ET-3010.1Y-1200-500-P4X-003 – MATERIAL SPECIFICATION FOR HULL SYSTEM PRESSURE VESSELS AND TANKS.

6.1.2. For Filters external painting / coating specification refer to I-ET-3010.00-1200-956-P4X-002 – PAINTING SPECIFICATION.

6.1.3. Filters flanges shall be specified according to ASME B16.5.

6.1.4. All filters shall follow the design and fabrication recommendation of NR-13 Brazilian Government Norm.

6.1.5. Proper lifting lugs with proper arrangement and position shall be provided according to PACKAGER / MANUFACTURER standard.

6.1.6. PACKAGER / MANUFACTURER shall advise the required maintenance area with the minimum gap for the internals and basket removal.

6.1.7. For Filters data sheet and referred piping and instrumentation diagram refer to:

	TAG / Description	Reference Documents
1	FT-5133501A/B Diesel Oil Filters	I-DE-3010.1Y-5133-944-P4X-004 I-FD-3010.1Y-5133-660-P4X-001
2	FT-5133502 Duplex Diesel Oil Filters for Service System	I-DE-3010.1Y-5133-944-P4X-003 I-FD-3010.1Y-5133-660-P4X-003
3	FT-5133503 Duplex Diesel Oil Filters for Well Service System	I-DE-3010.1Y-5133-944-P4X-003 I-FD-3010.1Y-5133-660-P4X-002
4	FT-5330503 Sludge Pump Filter	I-DE-3010.1Y-5330-944-P4X-001 I-FD-3010.1Y-5330-660-P4X-001
5	FT-5330509A/B Auxiliary Bilge Pump Filters	I-DE-3010.1Y-5330-944-P4X-001 I-FD-3010.1Y-5330-660-P4X-002
6	FT-5336501 Duplex Slop Treatment Filter	I-DE-3010.1Y-5336-944-P4X-005 I-FD-3010.1Y-5336-660-P4X-002

6.2. DIESEL OIL FILTERS (FT-5133501A/B)

6.2.1. These filters have the purpose to ensure eventual impurities from the supply boats diesel oil tanks do not reach the FPSO diesel oil storage tanks.

6.2.2. Diesel Oil Filters (FT-5133501A/B) shall be automatic self-cleaning type and configuration 2 x 100%. Control panel and utilities as air and electrical for self-cleaning operation shall have the requirements informed by PACKAGER.

6.2.3. PACKAGER shall provide protection for fail open condition of the Filter draining valve during the Filter automatic cleaning to avoid the diesel oil to be routed to Bilge Water Settling Tank (TQ-5330501).

6.3. DUPLEX DIESEL OIL FILTERS (FT-5133502 / FT-5133503)

6.3.1. Duplex Filter for Service System (FT-5133502) shall be installed downstream the diesel oil service pumps to ensure that all diesel oil to be distributed to the consumers have been filtered.

6.3.2. Duplex Filter for Service System (FT-5133502) shall have installed a differential pressure transmitter with high pressure indication on SOS-HMI.

6.3.3. Duplex Filter for Well Service System (FT-5133503) shall be installed downstream the Well Service Pumps. Filter mesh to be defined according to the diesel oil injection on the formation.

6.3.4. Duplex Filter for Well Service System (FT-5133503) shall have installed a differential pressure transmitter with high pressure indication on SOS-HMI.

6.4. DUPLEX SLOP TREATMENT FILTER (FT-5336501)

6.4.1. Duplex Slop Treatment Filter (FT-5336501) shall have mesh of 500 micra and shall be installed upstream the Slop Treatment Unit (Z-5336501).

6.4.2. Duplex Slop Treatment Filter (FT-5336501) shall have installed a differential pressure indicator.

6.5. AUXILIARY BILGE PUMP FILTERS (FT-5330509A/B) AND SLUDGE PUMP FILTER (FT-5330503)

6.5.1. Auxiliary Bilge Pump Filters (FT-5330509A/B) shall be installed upstream the Auxiliary Bilge Pumps (B-5330509A/B). For filter mesh refer to I-FD-3010.1Y-5330-660-P4X-002 – Auxiliary Bilge Pumps (B-5330509A/B).

6.5.2. Sludge Pump Filter (FT-5330503) shall be installed upstream the Sludge Pump (B-5330503). For filter mesh refer to I-FD-3010.1Y-5330-660-P4X-001 – Sludge Pump Filter (FT-5330503).

6.5.3. Auxiliary Bilge Pump Filters (FT-5330509A/B) and Sludge Pump Filter (FT-5330503) shall be supplied with vent and drain.

7. GENERAL REQUIREMENTS

7.1. ELECTRICAL REQUIRMENTS

7.1.1. All electrical equipment installed in hazardous areas (see Area Classification documentation) or installed outdoors and kept on during emergency condition (ESD) shall be certified according to IEC 61892, INMETRO Resolution 179, May 18th 2010 and INMETRO resolution 89, February 23rd 2012.

7.1.2. Electrical equipment and material shall comply with requirements of I-ET-3010.00-5140-700-P4X-002 – SPECIFICATION FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS.

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

7.2. INSTRUMENTATION AND AUTOMATION REQUIREMENTS

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

7.2.2. The instrumentation and control design shall fulfill the requirements of the following technical specification: I-ET-3010.00-1200-800-P4X-013 – GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS.

7.3. PAINTING REQUIREMENTS

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

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

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

7.4. NAMEPLATES AND TAG NUMBERING

7.4.1. PACKAGER / MANUFACTURER Equipment shall have nameplates in Brazilian Portuguese language, made of stainless steel AISI 316L, with 3 mm minimum thickness and fixed by stainless steel (AISI 316L) bolts or fasteners on visible and accessible location.

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

7.4.3. Tags shall be supplied with the number and description in the Brazilian Portuguese Language, unless otherwise stated in the technical data sheets.

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

7.4.5. For Instrumentation tagging the ISA –5.1 and N-1710 shall be followed.

8. PACKAGE MANUFACTURING

8.1. GENERAL

8.1.1. 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.

8.1.2. 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.

8.1.3. 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.

8.2. QUALITY ASSURANCE AND CONTROL SYSTEM

8.2.1. PACKAGER shall submit his Quality Assurance / Quality Control handbook to HULL SUPPLIER for information.

8.2.2. Engineering, fabrication and manufacturing shall conform to good manufacturing practices. Quality system according to ISO 9001 in relevant extent shall be in place and implemented.

8.3. WELDING AND NDT

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

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

8.3.3. Intermittent fillet welds are not acceptable.

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

- I-ET-3010.00-1000-970-P4X-002 – REQUIREMENTS FOR NDT and

- I-ET-3010.00-1200-955-P4X-002 – REQUIREMENTS FOR WELDING INSPECTION.

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

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

8.4. INSPECTION AND TESTS

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

8.4.2. PACKAGE inspection, tests and events shall be attended by the MANUFACTURER, PACKAGER, HULL SUPPLIER, CS and OWNER inspection team whenever applicable and necessary.

8.4.3. PACKAGE shall be tested according to the design codes, applicable industry standards, CS Rules and any other one requirement stated on this technical specification.

8.4.4. Unless waive by OWNER, the following PACKAGE inspections and checks shall be witnessed by OWNER inspector:

i. verification of equipment construction materials for conformity with the specification requirements.

ii. verification of piping, fittings and valves conform to specification of materials and fabrication.

iii. reports for all NDT performed on the pressure retaining parts (radiographic, dye penetrant, magnetic particles and ultrasonic inspection).

iv. approval of the relief valve settings and witness of their testing after setting.

v. review of Inspection and Test Records.

vi. visual check.

8.5. FACTORY ACCEPTANCE TEST (FAT)

8.5.1. FAT is a set of functional and performance tests to be executed in any equipment, electrical, instrumentation and telecom panels or any other commissionable item carried out on the PACKAGER / MANUFACTURER factory or in specialized test facilities, in order to demonstrate its compliance with the project specifications

and allow its release to shipyard.

8.5.2. For Factory Acceptance Test (FAT) minimum scope requirements:

i. Pressure test (usually hydrostatic).

ii. All other equipment tests and factory checking to be carried out according to the FAT procedure approved by parts.

8.5.3. For Factory Acceptance Test (FAT) event invitation e reports:

i. OWNER, CS and HULL SUPPLIER shall be communicated about the FAT event following ITP and the fabrication schedule. FAT invitation schedule shall be negotiated during PACKAGE kick-off meeting on the detail design phase.

ii. PACKAGER shall issue the FAT procedure for all parts involved as OWNER, HULL SUPPLIER and CS, where applicable, and submit to them for approval.

iii. PACKAGER shall issue the FAT report with all test results and duly signed or stamped by all parts that witnessed the FAT and with the test reference documentation attached.

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

8.6. PRE-COMMISSIONING AND COMMISSIONING

8.6.1. PACKAGER / MANUFACTURER shall be required to provide any necessary support for installation, assembly, pre-commissioning and commissioning of the PACKAGE either at a shore based fabrication yard or onboard the FPSO.

8.6.2. PACKAGER / MANUFACTURER is responsible for assembly supervision of the PACKAGE equipment, including the assembly of components to be delivered loose (for example, some components of the pumps, like stuffing box, etc.).

8.6.3. Final acceptance will be on satisfactory completion of commissioning tests as specified by OWNER.

9. PACKAGE DELIVERY REQUIREMENTS

9.1. PRESERVATION, PACKING AND TRANSPORTATION

9.1.1. PACKAGER / MANUFACTURER shall ensure all the conditions and practices of preservation, packing and transportation are fulfilled and following the PACKAGE / Equipment specific and technical characteristics recommendations.

9.1.2. PACKAGER / MANUFACTURER shall submit to HULL SUPPLIER the PACKAGE preservation requirements and recommendations with all necessary considerations for the PACKAGE Equipment preservation during the UNIT whole

design life.

9.1.3. Preservation and packing shall be proper for transportation and storage in a marine environment and protected against moisture and damage during transport, handling and lifting.

9.1.4. In any case, suitable preservation and protective measures shall be provided to prevent equipment deterioration prior to entering into service.

9.1.5. All packings shall be clearly marked for shipping, including lifting points, gross weight, dimensions and center of gravity.

9.1.6. All sea fastening and temporary supports used on the equipment for shipment shall be clearly identified.

9.1.7. PACKAGER / MANUFACTURER shall ensure that all loose valves, tubes and instruments are supplied with plastic caps.

9.1.8. PACKAGER / MANUFACTURER shall also ensure that all electric panels and motors will be supplied with Volatile Corrosion Inhibitor (VCI) impregnated plastic protection or similar, and external plug for space heater connection.

9.1.9. PACKAGER / MANUFACTURER shall provide clear and comprehensive instructions on the exterior of all packages advising the necessary warning notices for unpacking, handling and installing the equipment on arrival at destination.

9.1.10. The equipment shall be thoroughly cleaned internally and be free of all loose foreign materials.

i. The preparation shall make the equipment suitable for outdoor storage in a coastal tropical climate from the time of Shipment.

ii. If there is a risk of damage to valves and other appurtenances during transportation, they shall be disconnected and tagged. All components shall then be securely packed as above.

iii. Spare parts and tools to be packed separately and clearly marked “Spare Parts” and “Tools” respectively.

9.2. SPARE PARTS, CONSUMABLES AND TOOLS

9.2.1. All equipment / material consumable and spare parts recommended by PACKAGER / MANUFACTURER for the construction, testing, commissioning, pre-operation and start-up phases.

9.2.2. All spare parts recommended or required by the CS, such spare parts will be delivered together with the relevant equipment;

9.2.3. All special tools required for construction, pre-commissioning, commissioning and all levels of maintenance and operation

9.2.4. Spare parts list recommended by PACKAGER / MANUFACTURER for two years of operation.

9.3. DOCUMENTATION

9.3.1. Drawings and Weight Control

For Engineering Documentation minimum requirements:

i. PACKAGER / MANUFACTURER design drawings shall show all necessary dimensions and details required for interface information and installation.

ii. Clearances for maintenance shall be shown on the drawings.

iii. Drawings and documents shall be clear and completely legible with all text in the English language.

iv. Instruction manuals for operation and maintenance of the PACKAGE equipment shall be provided in Portuguese language.

v. Drawings are only accepted when signed by PACKAGER as checked and approved. All revised editions of drawings or documents shall show the revisions clearly marked up, the issue date and PACKAGER's checked and approved signatures.

vi. PACKAGER / MANUFACTURER shall produce a weight / center of gravity data sheet considering each PACKAGE component with the respective assembly dry and operational weight and CoG.

- Note: Operational weight means the component dry weight added to the respective component fluid weight on operational condition.

vii. PACKAGER shall send in advance all recommendations for PACKAGE installation, maintenance, and commissioning.

9.3.2. Data Book

PACKAGER shall issue a PACKAGE / Equipment Data Book to be delivered to HULL SUPPLIER for approval. Data Book minimum content shall be as the following:

i. Certified drawings, data sheets, technical specifications, performance curves and calculation memorandum.

ii. Construction, maintenance and operating manuals, instructions for preservation and commissioning, and all catalogs, including of the sub-suppliers.

iii. All certificates of materials and equipment, certificates of electrical cables and equipment to hazardous areas, all tests, destructive and non-destructive examinations, test reports (including FAT), certificates and

reports of classification society, procedures for welding qualifications and welding processes.

iv. The documentation requested by Brazilian law NR-13, subdivided for equipment (if applicable).

v. The documentation requested by Brazilian law NR-10, subdivided for equipment (if applicable).

Data Book delivery standard and conditions including number of parts and sections, number of printed and electronic copies will be further defined by OWNER on detail design phase.