	TECHNICAL SPECIFICATION		Nr: I-ET-3010.2E-5525-850-P4X-002
	CLIENT:	SRGE	SHEET: 1 of 20
	JOB :	REFERENCE HULL 01	
	AREA:	-	
SRGE	TITLE:		INTERNAL
	OXYGEN SAMPLING SYSTEM		ESUP

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INDEX OF REVISIONS

REV.	DESCRIPTION AND/OR REVISED SHEETS
0	ORIGINAL ISSUE
A	REVISED ACCORDING TO THE CONSISTENCY ANALYSIS

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATE	SEP/30/22	DEC/06/22							
PROJECT	ESUP/ENE	ESUP/ENE							
EXECUTION	U3Y0	CXZ0							
CHECK	U4WK	T3P7							
APPROVAL	CXZ0	BYA6							

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THIS FORM IS PART OF PETROBRAS N-381 REV.J ANNEX A – FIGURE A.1.



TABLE OF CONTENTS

PAGE

1. INTRODUCTION	4
1.1. OBJECTIVE.....	4
1.2. DEFINITIONS	4
1.3. ABBREVIATIONS	4
2. NORMATIVE REFERENCES	4
2.1. INTERNATIONAL CODES, RECOMMENDED PRACTICES AND STANDARDS	4
2.2. BRAZILIAN CODES AND STANDARDS.....	5
2.3. CLASS APPROVAL AND CERTIFICATION	5
3. REFERENCE DOCUMENTS	5
3.1. REFERENCE HULL 01 FPSO DESIGN.....	5
3.2. TYPICAL DOCUMENTS.....	6
3.3. SPECIFIC PROJECT DOCUMENTS	7
4. DESIGN REQUIREMENTS.....	8
4.1. DESIGN CONDITIONS	8
4.2. SAFETY REQUIREMENTS.....	8
4.3. NOISE AND VIBRATIONS	9
4.4. MOTIONS AND ACCELERATION	9
5. PACKAGE TECHNICAL SPECIFICATION AND SCOPE OF SUPPLY	9
5.1. GENERAL.....	9
5.2. PACKAGE EQUIPMENT	11
5.3. PACKAGE COMPONENTS, PARTS AND ACCESSORIES	12
5.4. O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET)	12
5.5. SAMPLE CONDITIONING SYSTEMS	14
6. GENERAL REQUIREMENTS	16
6.1. ELECTRICAL REQUIREMENTS.....	16
6.2. INSTRUMENTATION AND AUTOMATION REQUIREMENTS.....	17
6.3. PAINTING REQUIREMENTS.....	17
6.4. SKIDS LAYOUT AND FOUNDATION REQUIREMENTS	17
6.5. NAMEPLATES AND TAG NUMBERING.....	18
7. PACKAGE MANUFACTURING AND DELIVERY REQUIREMENTS.....	19
7.1. GENERAL.....	19
7.2. WELDING	19



TECHNICAL SPECIFICATION

Nr:

I-ET-3010.2E-5525-850-P4X-002

REV.

A

SHEET: 3 of 20


TITLE:

OXYGEN SAMPLING SYSTEM

INTERNAL

ESUP

7.3. DOCUMENTATION	19
7.4. SPARE PARTS	20
7.5. INSPECTION AND TESTS	20
7.6. PRESERVATION, PACKING AND TRANSPORTATION	20
7.7. PRE-COMMISSIONING AND COMMISSIONING	20
7.8. TRAINING	20

	TECHNICAL SPECIFICATION	Nr: I-ET-3010.2E-5525-850-P4X-002	REV. A
	-		SHEET: 4 of 20
	TITLE: OXYGEN SAMPLING SYSTEM		INTERNAL
		ESUP	

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 OXYGEN SAMPLING SYSTEM in conformance with relevant regulations and FPSO basic 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.

OWNER: PETROBRAS.

OXYGEN SAMPLING SYSTEM: the PACKAGE name.

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

SAMPLING LINE: Tubing that interconnects cargo area tanks to the O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) (P/S).

1.3. ABBREVIATIONS

CCR.....Central Control Room

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

O2.....OXYGEN

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.

	TECHNICAL SPECIFICATION	Nr: I-ET-3010.2E-5525-850-P4X-002	REV. A
	-		SHEET: 5 of 20
	TITLE: OXYGEN SAMPLING SYSTEM		INTERNAL

- ANSI American National Standards Institute
- IMO MODU CODE 2009
- SOLAS – International Convention for the Safety of Life at Sea
- VDE / IEC German National Electric Standard Codes / International Electric Codes
- Classification Society defined for the Hull scope.
- IEC TR 61831 On line Analyzer Systems – Guide to Design and Installation
- API-RP 555 Process Analyzers

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;
- PORTARIA 115 (21st March 2022) - REQUISITOS DE AVALIAÇÃO DA CONFORMIDADE PARA EQUIPAMENTOS ELÉTRICOS PARA ATMOSFERAS EXPLOSIVAS - CONSOLIDADO.

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
HULL SYSTEMS	
I-DE-3010.2E-5525-944-P4X-002	OXYGEN SAMPLING SYSTEM
I-MD-3010.2E-1200-940-P4X-027	DESCRIPTIVE MEMORANDUM - HULL SYSTEMS

OUTFITTING
I-DE-3010.2E-1351-140-P4X-001
HULL GENERAL NOTES AND TYPICAL DETAILS
3.2. TYPICAL DOCUMENTS

REF DOC NUMBER	REF DOC NAME
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-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-3010.00-1352-130-P4X-001	FLOOR GRATINGS, TRAY SYSTEMS AND GUARDRAILS MADE OF COMPOSITE MATERIALS
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
PIPING	
I-ET-3010.00-1200-251-P4X-001	REQUIREMENTS FOR BOLTING MATERIALS
ELECTRICAL	
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
INSTRUMENTATION AND AUTOMATION	
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)

3.3. SPECIFIC PROJECT DOCUMENTS

REF DOC NUMBER	REF DOC NAME
GENERAL	
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-FIELD INSTRUMENTATION	FIELD INSTRUMENTATION
I-ET-METOCEAN DATA	METOCEAN DATA
I-RL-MOTION ANALYSIS	MOTION ANALYSIS
I-MD – AUTOMATION AND CONTROL SYSTEM – SCOPE DEFINITION	AUTOMATION AND CONTROL SYSTEM – SCOPE DEFINITION

Table 1 – Reference Documents

NOTE: Item 3.3 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 design requirements


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.
- 4.1.4. 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,

	TECHNICAL SPECIFICATION	Nr: I-ET-3010.2E-5525-850-P4X-002	REV. A
	-		SHEET: 9 of 20
	TITLE: OXYGEN SAMPLING SYSTEM		INTERNAL
<p>shall have rigid protection, manufactured with aluminum ASTM B211 and shall be capable of being easily removed.</p> <p>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”.</p> <p>4.2.5. Safety signaling shall be in full compliance with I-ET-3010.00-5400-947-P4X-002 – SAFETY SIGNALING.</p> <p>4.2.6. Double block & bleed arrangements are required for isolation of equipment in piping classes of 300# and above.</p> <p>4.2.7. All electric and electronic equipment shall be adequate for the area classification where the equipment is placed.</p> <p>4.3. NOISE AND VIBRATIONS</p> <p>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.</p> <p>4.4. MOTIONS AND ACCELERATION</p> <p>4.4.1. All equipment shall be able to withstand with the UNIT subjected to 100-year return period environmental conditions.</p> <p>4.4.2. All equipment shall be able to operate with the UNIT subjected to 1-year return period environmental conditions.</p> <p>4.4.3. All environmental conditions are defined in I-ET-METOCEAN DATA.</p> <p>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-003 – DESIGN REQUIREMENTS - NAVAL ARCHITECTURE.</p> <p>4.4.5. For the design data and information regarding motion requirements refer to I-RL-MOTION ANALYSIS.</p> <p>4.4.6. PACKAGE is also to withstand inertial forces during transportation from construction site to the final offshore location.</p> <p>5. PACKAGE TECHNICAL SPECIFICATION AND SCOPE OF SUPPLY</p> <p>5.1. GENERAL</p> <p>5.1.1. The OXYGEN SAMPLING SYSTEM PACKAGE purpose is to provide O2 measurement and analysis for the Cargo Oil Tanks, Slop Tanks, Produced Water Tanks and Off-spec Oil Tank. The PACKAGE is comprised of at least two (02) O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) P/S (PN-5525512/513) for the collection and analysis of the atmosphere of the referred tanks for oxygen concentration. PACKAGE also comprises one (01) O2</p>			



TITLE:

OXYGEN SAMPLING SYSTEM

INTERNAL

ESUP

SAMPLING SYSTEM PANEL (HC BLANKET) (PN-5525511) system control, local supervision and routing data to the main supervisory system of the unit.

- 5.1.2. The OXYGEN GAS DETECTION SYSTEM shall sequentially sample and analyze each of the protected spaces. The time interval to return to the first analyzed point shall be defined in the DETAILED DESIGN PHASE, according to item 5.4.2.2.
- 5.1.3. O₂ SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) P/S (PN-5525512/513) shall be internally monitored by its own sample point(s), to detect any leakages from the sampling lines to the panel interior. If the gas concentration inside the cabinets reaches the setpoint, the analyzing unit shall be automatically shut down and isolated from the sampling lines (any shutdown or solenoid valves shall be automatically closed), and alarms shall be triggered on the O₂ SAMPLING SYSTEM PANEL (HC BLANKET) (PN-5525511) HMI(s) and SOS-HMI.
- 5.1.4. Audible and visual alarms shall be initiated in the SOS-HMI and at the O₂ SAMPLING SYSTEM PANEL (HC BLANKET) (PN-5525511) HMI(s) when the O₂ concentration in one of the monitored spaces reaches a pre-set value. The alarm shall inform the specific tank where the oxygen concentration above the setpoint was detected. This information shall be available on the OXYGEN SAMPLING SYSTEM HMI(s) and on the SOS-HMI (CCR).
- 5.1.5. The following alarms shall be foreseen in the OXYGEN SAMPLING SYSTEM, as well as any other alarms required by CS, statutory rules or according to PACKAGER design:
- i. When O₂ concentrations are above the setpoint in any monitored space);
 - ii. Low/no flow in any sampling line (clogging alarm);
 - iii. Any fault condition, such as power failure or short-circuit;
 - iv. Any tempering with the alarm setpoint;
 - v. Failure of any self-test functions provided in the system by PACKAGER;
- 5.1.6. A visual alarm should remain in effect while an alarm condition is present. The audible alarm may be silenced manually in the SOS-HMI or in the O₂ SAMPLING SYSTEM PANEL (HC BLANKET) (PN-5525511).
- 5.1.7. If the high O₂ alarm for the O₂ SAMPLING SYSTEM PANEL (HC BLANKET) (PN-5525511) is unanswered within 2 minutes, the helideck status light shall be activated.
- 5.1.8. The O₂ SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) P/S (PN-5525512/513) shall be interconnected with the nitrogen generator system (see I-DE-3010.2E-5525-944-P4X-002), which is in HULL SUPPLIER scope. If any

adjustments on the nitrogen pressure is required for the correct functioning of the PACKAGE, it is PACKAGER scope to provide a pressure regulator device.

5.1.9. PN-5525511 / PN-5525512 / PN-5525513 shall be stopped and isolated upon CH4 or fire confirmation in FWD Panels Room or ESD3T (by HFGS). In this case, care shall be taken in order to ensure that all 24VDC signals will not be kept energized on the field. In order to do this, PN-5525511 shall have one digital input in order to receive a de-energize command, that shall be replicated/propagated to PN-5525512 and PN-5525513.

5.1.10. PACKAGE shall be supplied with all special accessories and auxiliary equipment required for installation, operation, and maintenance of the analyzers (i.e., interconnecting cable, consumable material, calibration kits etc.).

5.1.11. PACKAGER shall inform reliability data from the system and from analyzers during Technical Proposal.

5.1.12. The override of the alarm (AAHH-5525507) and of its associated automatic action (ASHH-5525507 turning off all submersible pumps) shall not inhibit the continuous reading of the O2 content by the individual analyzers of the tanks.

5.2. PACKAGE EQUIPMENT


5.2.1. PACKAGER shall supply the below following items:

TAG	Equipment	Qty	Location
PN-5525511	O2 SAMPLING SYSTEM PANEL (HC BLANKET)	1 X 100%	FWD PANELS ROOM (Forecastle)
PN-5525512	O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) (S)	1 X 100%	Main Deck (NOTE 2)
PN-5525513	O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) (P)	1 X 100%	Main Deck (NOTE 2)

Table 2 – PACKAGE Scope of Supply

- NOTE: The quantity of O2 SAMPLING SYSTEM DETECTOR CABINETS is preliminary. The final quantity of cabinets shall be defined during detailed engineering design by PACKAGER and HULL SUPPLIER, based in the requirements of this document, PACKAGER recommendations and calculation reports.

5.2.2. In addition to the Table 2, PACKAGER shall supply components, parts, accessories, valves, instruments, protection devices as detailed on this technical specification.

	TECHNICAL SPECIFICATION	Nr: I-ET-3010.2E-5525-850-P4X-002	REV. A
	-		SHEET: 12 of 20
	TITLE: OXYGEN SAMPLING SYSTEM		INTERNAL

5.2.3. PACKAGE components are to be installed according to the location described in Table 2.

5.2.4. Forecastle is a closed and non-classified compartment and Main Deck is a classified area.

5.2.5. For Areas Classification refer to I-DE-3010.2E-5400-94A-P4X-001 – AREA CLASSIFICATION - GENERAL.

5.2.6. I-DE-GENERAL ARRANGEMENT and I-DE-3010.2E-5525-944-P4X-002– OXYGEN SAMPLING SYSTEM shall be used as reference for equipment location.

5.3. PACKAGE COMPONENTS, PARTS AND ACCESSORIES

5.3.1. Package is composed by panels described in table 2:

- PN-5525511 - O2 SAMPLING SYSTEM PANEL (HC BLANKET) is a panel containing the package PLC, package HMI and any other accessories for communication both with the analyzers and the Package Unit LAN.
- PN-5525512 - O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) (S) and PN-5525513 - O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) (P) are panels containing the Oxygen analyzers and also containing any sample conditioning systems and accessories for sample collection. For further details regarding these panels and the associated sample lines see sections 5.4 and 5.5.

5.4. O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET)

5.4.1. O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) are panels containing at least 3 Oxygen analyzers each in a voting scheme (2oo3).

5.4.1.1. In case an analyzer indicates malfunction or is removed for maintenance purposes, then voting logic shall degrade (1oo2). No less than 2 sensors shall be allowed.

5.4.2. The quantity of 2 panels shown in basic design documentation is preliminary. The final quantities of O2 sampling system detector cabinets shall be defined during detail engineering design.

5.4.2.1. Supplier shall issue a document with calculations showing the quantity of O2 sampling system detector cabinets necessary in order to comply with:

- Time requirement
- Maximum length of sample lines



TITLE: OXYGEN SAMPLING SYSTEM

INTERNAL

ESUP

5.4.2.2. Time requirement is to make a full cycle between the sampling points of each cabinet shall be 15 minutes (i.e., it shall be possible to cycle between each sampling point in 15 minutes). This time shall be configurable via software.

5.4.2.3. The maximum length of each sample line shall be defined in order to prevent condensate formation (i.e., sample lines shall be minimized, with the objective of reducing temperature loss in main deck and consequential condensate formation).

5.4.3. Special consideration shall be given to sampling streams for which temperature and pressure control are critical to maintain the dew or bubble point, and to prevent deterioration of the sample and analyzer system performance. The sample shall be kept at least 10°C above the dew point. Heat tracing and insulation shall be added whenever necessary in order to ensure this requirement.

5.4.4. Analyzers shall be of thermo-paramagnetic technology and shall have range of about 0-21% of O2 volumetric presence in total sample but shall be configurable to smaller ranges (desired alarm is 5%).

5.4.4.1. Precision shall be better than 1% of full scale and analyzer maximum time response (90% of a step change) shall be 10 seconds.

5.4.5. Analyzers shall have self-cleaning capabilities.


5.4.6. For further requirements regarding O2 analyzers, consult document I-ET-FIELD INSTRUMENTATION

5.4.7. Portable instruments for manual sampling:

- i. PACKAGER shall provide two (02) portable instruments to perform manual sampling of the tanks' atmosphere for oxygen concentration. The manual sampling equipment shall be suitable for connection on the O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) P/S (PN-5525512/PN-5525513). Any adaptors to allow the connection of the manual instrument on the sampling points (O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) P/S) shall be provided by PACKAGER. The portable analyzers shall be provided with a sufficient set of spares, as per PACKAGER design.

5.4.8. Calibration kit:

- i. PACKAGER shall provide 01 (one) calibration kit, containing cylinders for the calibration of all the sensors contained in the O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) P/S (PN-5525512/PN-5525513). The calibration kit shall be provided with all connections/adaptors to allow the correct calibration of the sensors and also the portable analyzers mentioned in item 5.4.26). This kit shall be used for the shipyard tests (commissioning) and final conditioning of the system. It is HULL SUPPLIER responsibility to guarantee that all sensors comprised in the OXYGEN

	TECHNICAL SPECIFICATION	Nr: I-ET-3010.2E-5525-850-P4X-002	REV. A
	-		SHEET: 14 of 20
	TITLE: OXYGEN SAMPLING SYSTEM		INTERNAL
		ESUP	

SAMPLING SYSTEM are correctly calibrated prior to the first oil of the FPSO.

5.4.9. The PACKAGE equipment shall be designed so that it may readily be tested and calibrated.

5.5. SAMPLE CONDITIONING SYSTEMS

5.5.1. PACKAGER shall supply inside each panel PN-5525512 - O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) (S) and PN-5525513 - O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) (P) and at any points of the sample line, a full sample conditioning system adequate to the characteristics of the fluid. At least, it shall be foreseen:

- Sample Probe;
- Sample selection system, and a fast loop system;
- In-line filters for impurities removal;
- Moisture removal devices;
- Control of sample temperature, pressure and flow (if necessary);
- Suction pumps (extraction pumps);
- Small vases (or other means) for liquid/condensate removal;
- Temperature insulation (if necessary, in order to prevent condensate formation);
- Purging system, for occasional system maintenance.

5.5.2. Sample probes shall be supplied and installed at each sampling point. The sampling probe shall foresee accessories in order to be removed for maintenance during plant operation (Hot Removal).

5.5.3. Fast-flow loops shall be considered to avoid sample lines without flow and to minimize transport lag time from sample tap to analyzers entrance. The maximum acceptable transport lag time is thirty (30) seconds. The fast-flow loop streams shall be returned to the HC/IG Header.

5.5.4. During detail engineering design, SELLER shall issue a Datasheet containing both data from tanks atmosphere (source) and from HC/IG Header (destination) in order for PACKAGER to size its components/devices properly. Datasheet shall contain all information relevant to PACKAGER such as pressure, temperature, gas composition, and any other data PACKAGER requires.

5.5.5. Instrumentation and control devices shall be provided in order to indicate and regulate flow in fast-flow loops, with low flow alarm at each gas sampling line.

5.5.6. The sampling system shall be provided with a stream selection system by Double Block-and-Bleed (DBB) designed to minimize cross contamination and reduce dead volumes.

5.5.7. The number and specification of the extraction pumps shall be as per

TITLE:

OXYGEN SAMPLING SYSTEM

INTERNAL

ESUP

PACKAGER design, and it shall be provided one (01) or more back-up pumps of equal power of the main extraction pumps. The design shall be arranged so that the system will switch over to the back-up pump(s) in case of failure of the main pump(s), and an alarm shall be initiated in the O2 SAMPLING SYSTEM PANEL (HC BLANKET) (PN-5525511) and also in the Central Control Room. The suction capacity for the extraction pumps shall be enough for keeping the minimum flow for the defined transport time and for the correct analysis of the atmosphere of the most distant spaces with regards to the O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) P/S (PN-5525512/513).

5.5.8. The sample lines shall have quick connection points in order to connect the purging system for maintenance and occasional line unclogging.

5.5.9. A purging system shall be provided to clear eventual clogging from the gas sampling lines by using nitrogen to perform flushing of the clogged line. The main supply of nitrogen for purging shall be a nitrogen utility line. However, in order to have redundancy, spare inlet connections shall be foreseen in the Gas sampling panels for connection of Nitrogen cylinders. There shall be an alarm indicating if any of the gas sampling lines are clogged, and it shall be identified which of the sampling lines is clogged in the OXYGEN SAMPLING SYSTEM HMI(s).


5.5.9.1. System shall be designed in order to minimize purging. In order to do so, special care shall be taken in sample conditioning and Fast-flow loop design.


5.5.10. Supplier shall issue a document showing that pressure variation, temperature variation and condensation will not interfere with the sample and shall take measures in order to adapt the sample conditioning system of the sample to such variations.


5.5.11. There shall be at least two sampling points in each tank covered by the oxygen sampling system. The smallest number will always be aft of the tank, and the largest number the forward of the tank. Supplier shall define the number of sampling points per tank in a document proving that the samples will represent the tank's gas correctly. Position of the sampling points shall take into consideration the internal geometry of the tank, so that no points of O2 accumulation are left unchecked.


5.5.12. Additional Minor components shall also be supplied for sampling lines (see also I-DE-3010.2E-5525-944-P4X-002), including, but not limited to:

- Non-return valves, supplied loose by PACKAGER to be installed by HULL SUPPLIER;
- Penetration pieces, supplied loose by PACKAGER to be welded by HULL SUPPLIER;
- Isolation valves, supplied loose by PACKAGER to be installed by HULL SUPPLIER;

	TECHNICAL SPECIFICATION	Nr: I-ET-3010.2E-5525-850-P4X-002	REV. A
	-		SHEET: 16 of 20
	TITLE: OXYGEN SAMPLING SYSTEM		INTERNAL
<ul style="list-style-type: none"> ▪ Flame arresters, if required, supplied loose by PACKAGER to be installed by HULL SUPPLIER; ▪ Pipes for the interconnection of the O2 SAMPLING SYSTEM DETECTOR CABINET (HC BLANKET) (P/S) (PN-5525512/ PN-5525513) to the referred tanks are HULL SUPPLIER scope. HULL SUPPLIER shall liaise with packager in order to acquire any recommended accessories necessary for sampling lines (such as insulation, filters, etc). <p>5.5.13. Different components for the O2 SAMPLING SYSTEM from the ones presented above might be acceptable and shall be sent to Petrobras for analysis and approval, as per PACKAGER design.</p> <p>5.5.14. Sampling lines (tubing) shall be of a minimum of six (06) millimeters inner diameter. The sampling lines shall follow I-ET-3010.00-1200-800-P4X-015 – REQUIREMENTS FOR TUBING AND FITTING (ALIGNED TO IOGP-JIP33 S-716). All materials (piping, fitting, tubing, etc) shall be compatible with each other. Other materials may be subjected for Petrobras for analysis and approval but shall follow the CS and statutory applicable requirements.</p> <p>5.5.15. Sampling lines shall be built without detachable connections, except for the connection points for isolating valves, analyzing units and purging connections. Additionally, sample lines shall be routed on the shortest way possible.</p> <p>5.5.16. The oxygen gas sampling lines shall not have low points and shall have a minimum slope in order to prevent condensate accumulation inside sample lines.</p> <p>5.5.17. Sampling lines protection:</p> <ul style="list-style-type: none"> i. All sampling lines shall have a metal protection on the exposed areas, to guard them against any damage due to impact. It is HULL SUPPLIER scope to design and install those protections, following the PACKAGER recommendations. <p>6. GENERAL REQUIREMENTS</p> <p>6.1. ELECTRICAL REQUIREMENTS</p> <p>6.1.1. All electrical equipment installed in hazardous areas (see Area Classification documentation) or installed outdoors and kept on during emergency condition (ESD-3P or ESD-3T) shall be certified according to IEC 61892 and INMETRO Resolution 115.</p> <p>6.1.2. Electrical equipment and material shall comply with requirements of the following references:</p> <ul style="list-style-type: none"> a) I-ET-3010.00-5140-700-P4X-002 – SPECIFICATION FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS. 			

	TECHNICAL SPECIFICATION	Nr: I-ET-3010.2E-5525-850-P4X-002	REV. A
	-		SHEET: 17 of 20
	TITLE: OXYGEN SAMPLING SYSTEM		INTERNAL
<p>b) I-ET-3010.00-5140-712-P4X-001 – LOW-VOLTAGE INDUCTION MOTORS FOR OFFSHORE UNITS.</p> <p>c) I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS.</p> <p>d) 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 INSTALLATION TYPICAL DETAILS.</p>			
<p>6.2. INSTRUMENTATION AND AUTOMATION REQUIREMENTS</p>			
<p>6.2.1. PACKAGE instrumentation and control design shall fulfill the requirements of the following technical specifications:</p>			
<p>a) I-ET-3010.00-1200-800-P4X-002 – AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS.</p> <p>b) I-ET-3010.00-1200-800-P4X-013 – GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS.</p> <p>c) I-ET-FIELD INSTRUMENTATION.</p> <p>d) I-ET-AUTOMATION INTERFACE OF PACKAGE UNITS.</p> <p>e) I-ET-3010.00-5520-888-P4X-001 – AUTOMATION PANELS.</p>			
<p>6.2.2. Package shall replicate main variables via network in SOS-HMI (at CCR).</p>			
<p>6.2.3. The supervisory system of the package shall be accessible both using RDP and VNC. It shall be possible to replicate the screen of the package's HMI at a computer in CCR using both these protocols.</p>			
<p>6.2.4. Signals interchanged with SOS shall follow the types described at I-DE-3010.2E-5525-944-P4X-002 – OXYGEN SAMPLING SYSTEM, I-ET-3010.00-1200-800-P4X-002 – AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS, and I-ET-AUTOMATION INTERFACE OF PACKAGE UNITS.</p>			
<p>6.3. PAINTING REQUIREMENTS</p>			
<p>6.3.1. Painting and coating in accordance with I-ET-3010.00-1200-956-P4X-002 – GENERAL PAINTING and DR-ENGP-I-1.15 COLOR CODING.</p>			
<p>6.3.2. All components shall be delivered fully painted/coated, unless otherwise indicated on this specification.</p>			
<p>6.3.3. The performed pre-treatment and complete coating shall be in accordance with the paint manufacturer's data sheets.</p>			
<p>6.4. SKIDS LAYOUT AND FOUNDATION REQUIREMENTS</p>			

	TECHNICAL SPECIFICATION	Nr: I-ET-3010.2E-5525-850-P4X-002	REV. A
	-		SHEET: 18 of 20
	TITLE: OXYGEN SAMPLING SYSTEM		INTERNAL
ESUP			
<p>6.4.1. PACKAGE components detailed on item 5 which are supplied assembled on skids shall follow the below minimum requirements.</p> <p>6.4.2. 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.</p> <p>6.4.3. 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.</p> <p>6.4.4. Skid structure shall be designed to be welded to the supporting structure unless otherwise specified.</p> <p>6.4.5. 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.</p> <p>6.4.6. All necessary maintenance davits, monorails, padeyes or trolleys shall be provided to ensure the safe and easy maintenance conditions.</p> <p>6.4.7. 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.</p> <p>6.4.8. 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.</p> <p>6.4.9. PACKAGE Equipment and components shall be located entirely within the skids / equipment base perimeter, including all equipment, piping, valves, electrical, instrumentation and controls.</p> <p>6.5. NAMEPLATES AND TAG NUMBERING</p> <p>6.5.1. PACKAGER / MANUFACTURER Equipment shall have nameplates in Brazilian Portuguese language, made of stainless steel AISI 316L, with 3 mm minimum</p>			

	TECHNICAL SPECIFICATION	Nr: I-ET-3010.2E-5525-850-P4X-002	REV. A
	-		SHEET: 19 of 20
	TITLE: OXYGEN SAMPLING SYSTEM		INTERNAL
		ESUP	

thickness and fixed by stainless steel (AISI 316L) bolts or fasteners on visible and accessible location.

6.5.2. 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

7. PACKAGE MANUFACTURING AND DELIVERY REQUIREMENTS

7.1. GENERAL

7.1.1. 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.

7.1.2. 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.


7.1.3. 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.

7.2. WELDING

7.2.1. 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:

- a) I-ET-3010.00-1000-970-P4X-002 – Requirements for NDT.
- b) I-ET-3010.00-1000-955-P4X-002 – Requirements for Welding Inspection.
- c) I-ET-3010.00-1000-955-P4X-001 – Welding.
- d) I-ET-3010.00-1200-200-P4X-001 – Requirements for Bolted Joints Assembly and Management.
- e) I-ET-3010.00-1200-200-P4X-115 – Requirements for Piping Fabrication and Commissioning.

7.3. DOCUMENTATION

	TECHNICAL SPECIFICATION	Nr: I-ET-3010.2E-5525-850-P4X-002	REV. A
	-		SHEET: 20 of 20
	TITLE: OXYGEN SAMPLING SYSTEM		INTERNAL

7.3.1. For the PACKAGE documentation and data-book requirements refer to EXHIBIT III – DIRECTIVES FOR ENGINEERING.

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

7.4. SPARE PARTS

7.4.1. 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.

7.5. INSPECTION AND TESTS

7.5.1. For PACKAGE inspection, tests, factory acceptance test (FAT), Site Acceptancy test (SAT), Site Integration Test (SIT) and inspection release certificate (IRC), refer to EXHIBIT V – DIRECTIVES FOR PROCUREMENT.

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

7.6. PRESERVATION, PACKING AND TRANSPORTATION

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

7.7. PRE-COMMISSIONING AND COMMISSIONING

7.7.1. For PACKAGE pre-commissioning and commissioning requirements and, commissioning spare parts refer to EXHIBIT VIII – DIRECTIVES FOR COMMISSIONING.

7.7.2. The system in which PACKAGE is included has the commissioning and site tests requirements detailed on I-MD-COMMISSIONING DESCRIPTIVE MEMORANDUM.

7.8. TRAINING

7.8.1. PACKAGER shall provide training for BUYER'S operational team to operate and maintain the PACKAGE as a whole (including, but not limited to, analyzers' calibration, operation and maintenance).

7.8.2. For more information related to training requirements see I-MD – AUTOMATION AND CONTROL SYSTEM – SCOPE DEFINITION.