	TECHNICAL SPECIFICATION		Nº: I-ET-3010.1Y-1351-800-P4X-001
	CLIENT:	BÚZIOS	SHEET: 1 of 17
	JOB:	HIGH CAPACITY FPSO	
	AREA:	BÚZIOS	
SRGE	TITLE: HULL STRUCTURAL TANKS LEVEL, INTERFACE, PRESSURE AND TEMPERATURE MONITORING SYSTEMS		INTERNAL
			ESUP

MICROSOFT WORD / V. 365 / I-ET-3010.1Y-1351-800-P4X-001_A.DOC

INDEX OF REVISIONS

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

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATE	FEB/22/21	APR/07/21							
DESIGN	ESUP	ESUP							
EXECUTION	U44D	U44D							
CHECK	U4KE	U4KE							
APPROVAL	U49R	U49R							

INFORMATION IN THIS DOCUMENT IS PROPERTY OF PETROBRAS, BEING PROHIBITED OUTSIDE OF THEIR PURPOSE

FORM OWNED TO PETROBRAS N-381 REV. L



AREA: BÚZIOS

SHEET 2 of 17

TITLE: HULL STRUCTURAL TANKS LEVEL, INTERFACE, PRESSURE AND TEMPERATURE MONITORING SYSTEMS

INTERNAL
ESUP

SUMMARY

1	INTRODUCTION.....	3
2	REFERENCE DOCUMENTS, CODES AND STANDARDS	3
3	ENVIRONMENTAL AND OPERATION CONDITIONS.....	5
4	DESIGN REQUIREMENTS	5
5	DOCUMENTATION	16
6	ACCEPTANCE TESTS.....	17



1 INTRODUCTION

1.1 Objective

1.1.1 This specification describes the minimum requirements for the supply of the Hull Structural Tanks Level, Oil-water Interface, Pressure and Temperature Monitoring Systems (HSTS), to be installed at the UNIT, covering: all equipment, materials, software, interconnection, documentation, configuration, tests, installation and training.

1.2 Definitions

1.2.1 Refer to I-ET-3010.00-1200-940-P4X-002 – GENERAL TECHNICAL TERMS.

1.3 Abbreviations, acronyms and initialisms

CCR	Central Control Room
CCR-OA	Central Control Room – Operation Ambiance
CCR-EA	Central Control Room – Equipment Ambiance
CS	Classification Society
CSS	Control and Safety System
FAT	Factory Acceptance Test
HCS	Hull Control System
HMI	Human-Machine Interface
HSD	Hull Shutdown System
HSTS	Hull Structural Tanks Level, Interface, Pressure and Temperature Monitoring Systems
I/O	Input / Output
IP	Ingress Protection Ratings
mm WC	Millimeters of Water Column
OLE	Object Linking and Embedding
OPC	Open Platform Communications
SAT	Site Acceptance Test
SIT	Site Integration Test
SOS	Supervision and Operation System

2 REFERENCE DOCUMENTS, CODES AND STANDARDS

2.1 External references

2.1.1 International codes, recommended practices and standards

IEC – INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC	60079	ELECTRICAL APPARATUS FOR EXPLOSIVE GAS ATMOSPHERES
IEC	60529	DEGREES OF PROTECTION PROVIDED BY ENCLOSURES (IP CODE)
IEC	62381	AUTOMATION SYSTEMS IN THE PROCESS INDUSTRY-FACTORY ACCEPTANCE TEST (FAT), SITE ACCEPTANCE TEST (SAT) AND SITE INTEGRATION TEST (SIT)



IMO – INTERNATIONAL MARITIME ORGANIZATION

SOLAS International Convention for the Safety of Life at Sea

MARPOL International Convention for the Prevention of Pollution from Ships

2.1.2 Classification Society

2.1.2.1 The detailed design shall be submitted to approval by the Classification Society. The design and installation shall take into account their requirements and comments.

2.1.3 Brazilian Codes and Standards

INMETRO – INSTITUTO NACIONAL DE METROLOGIA, NORMALIZAÇÃO E QUALIDADE INDUSTRIAL

PORTARIA Nº 179 (18/MAIO/2010) REGULAMENTO DE AVALIAÇÃO DA CONFORMIDADE DE EQUIPAMENTOS ELÉTRICOS PARA ATMOSFERAS POTENCIALMENTE EXPLOSIVAS, NAS CONDIÇÕES DE GASES E VAPORES INFLAMÁVEIS E POEIRAS COMBUSTÍVEIS.

PORTARIA Nº 89 (23/FEVEREIRO/2012) ALTERAÇÃO DA PORTARIA INMETRO Nº 179 DE 18/MAIO/2010.

2.2 Internal references

2.2.1 Project Documents

I-DE-3010.1Y-5520-800-P4X-002	AUTOMATION AND CONTROL ARCHITECTURE
I-DE-3010.1Y-1350-944-P4X-005	TANK LEVEL, PRESSURE, TEMPERATURE AND FLOODING INDICATION SYSTEM
I-ET-3010.00-5140-700-P4X-003	ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS
I-ET-3010.1Y-1200-800-P4X-001	INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS
I-ET-3010.1Y-1200-800-P4X-005	FIELD INSTRUMENTATION
I-ET-3010.00-1200-800-P4X-013	GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS
I-ET-3010.00-1200-800-P4X-002	AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS
I-ET-3010.00-5520-861-P4X-001	CONTROL AND SAFETY SYSTEM - CSS
I-ET-3010.00-5520-861-P4X-002	SUPERVISION AND OPERATION SYSTEM – SOS
I-ET-3010.00-5520-888-P4X-001	AUTOMATION PANELS



AREA:

BÚZIOS

SHEET

5 of 17

TITLE:

**HULL STRUCTURAL TANKS LEVEL, INTERFACE,
PRESSURE AND TEMPERATURE MONITORING SYSTEMS**

INTERNAL

ESUP

I-ET-3010.1Y-1200-800-P4X-014	AUTOMATION INTERFACE OF PACKAGE UNITS
I-ET-3010.00-1200-940-P4X-002	GENERAL TECHNICAL TERMS
I-DE-3010.1Y-6650-944-P4X-001	DRAUGHT, TRIM AND HEEL INDICATION SYSTEM
I-MD-3010.1Y-5520-800-P4X-003	AUTOMATION NETWORK DESCRIPTION

3 ENVIRONMENTAL AND OPERATION CONDITIONS

- 3.1 All instrumentation components, including alarm and indicator devices, shall be designed for use in a marine environment, resistant to corrosion, and capable of operating under all prevailing environmental conditions. Each component shall be designed and tested for the full range of pressure and temperature in service. For operating and environmental conditions, refer to I-ET-3010.1Y-1200-800-P4X-001 - INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS.
- 3.2 HSTS components will be installed at different classification areas and at different environmental conditions. They will also be subject to electromagnetic and radio-frequency interferences, vibration and/or mechanical shocks. HSTS components shall be adequate to these afore mentioned conditions.
- 3.3 All equipment proper to be used in hazardous areas shall have conformity certificates complying with PORTARIA INMETRO Nº 179 DE 18/MAIO/2010, and its annexes, changed by PORTARIA INMETRO Nº 89, de 23/FEVEREIRO/2012.
- 3.4 The whole system, as well as the components individually, shall be approved by the Classification Society.
- 3.5 The system shall be designed taking into account that it will continuously operate for 24 hours x 7 days a week, for 25 years.

4 DESIGN REQUIREMENTS

- 4.1 Hull Structural Tanks Level, Interface, Pressure and Temperature Monitoring Systems shall consist of tank sensors, associated electronics, communication systems and computer-based workstations including monitor and keyboard. The system shall also be used to measure the vessel's draft. The workstations shall display all measured values in form of figures, bar graphs and mimics. Setting of Low, High (LSH – 90%), High High (LSHH – 95%), and Emergency (LSHHH – 98%) level alarms shall be included in system.
- 4.2 Hull Structural Tanks Level, Interface, Pressure and Temperature Monitoring Systems shall include, at least, the following items, in accordance with Classification Society requirements:



- Remote Ullage, Pressure and Temperature Monitoring System, composed by level, oil-water interface, pressure and temperature monitoring system for structural inert gas blanketed tanks and level monitoring system for structural atmospheric tanks;
- High Level Overfill System for structural inert gas blanketed tanks;
- Draft Measurement System;
- Stability and Load Calculator;
- Portable Closed Ullage Manual Measuring Systems.

- 4.3 Only one supplier shall be responsible for the design, integration and supply of Remote Ullage, Pressure and Temperature Monitoring System, High Level Overfill System, Draft Measurement System and Stability and Load Calculator.
- 4.4 All instruments shall be designed according to I-ET-3010.00-1200-800-P4X-013 - GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS and I-ET-3010.1Y-1200-800-P4X-005 – FIELD INSTRUMENTATION.
- 4.5 HSTS shall be powered according to the requirements in I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS. The different power supplies inside the panels shall be converted and distributed, including where necessary an AC/DC stabilized power supply unit for the cabinet internal distribution of 24 Vdc.
- 4.6 The relevant related P&IDs are I-DE-3010.1Y-1350-944-P4X-005 - TANK LEVEL, PRESSURE, TEMPERATURE AND FLOODING INDICATION SYSTEM and I-DE-3010.1Y-6650-944-P4X-001 - DRAUGHT, TRIM AND HEEL INDICATION SYSTEM. Other documentation can be asked if necessary.
- 4.7 Prior to integration into the overall CSS, the HSTS shall be available on a standalone basis for early marine operations such as towing to the topsides integration yard. The Remote Ullage, Pressure and Temperature Monitoring Workstation shall be capable of being temporarily located at an existing temporary control room during early marine operations.
- 4.8 The transmitters shall not depend on an internal battery, eliminating the necessity of regular battery maintenance.
- 4.9 All data from HSTS shall be monitored in the UNIT Supervisory System screens (SOS HMI's) through an Ethernet IEEE 802.3 channel.



4.9.1 In order to perform the data integration to SOS HMI's, the communication between the Remote Ullage, Pressure and Temperature Monitoring Panel (PN-1358501) and the Package Unit Data Servers shall be performed by 100 Mbps or Gigabit Ethernet (IEEE 802.3) through Package Unit LAN.

4.9.2 The communication driver between SOS and HSTS, based on OPC, shall be supplied, certified as OPC compliant by OPC Foundation.

4.9.3 For more details, refer to I-DE-3010.1Y-5520-800-P4X-002 – AUTOMATION AND CONTROL ARCHITECTURE, I-ET-3010.00-5520-861-P4X-002 - SUPERVISION AND OPERATION SYSTEM – SOS and I-MD-3010.1Y-5520-800-P4X-003 - AUTOMATION NETWORK DESCRIPTION.

4.10 HSTS shall comply with the requirements of a P2S Package described in document I-ET-3010.00-1200-800-P4X-002 – AUTOMATION, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS.

4.11 All sensors wet parts shall have materials compatible to their process fluids.

4.12 Tankage

4.12.1 The UNIT is equipped with tanks described in P&IDs mentioned in item 2.

4.13 System Architecture

4.13.1 It shall be supplied a system in approved and established technologies with emphasis in use of field-proven software and hardware components.

4.13.2 The basic architecture of HSTS is described in Figure 1. It shall be included in the proposal the following structure to satisfy the requirements of this specification.

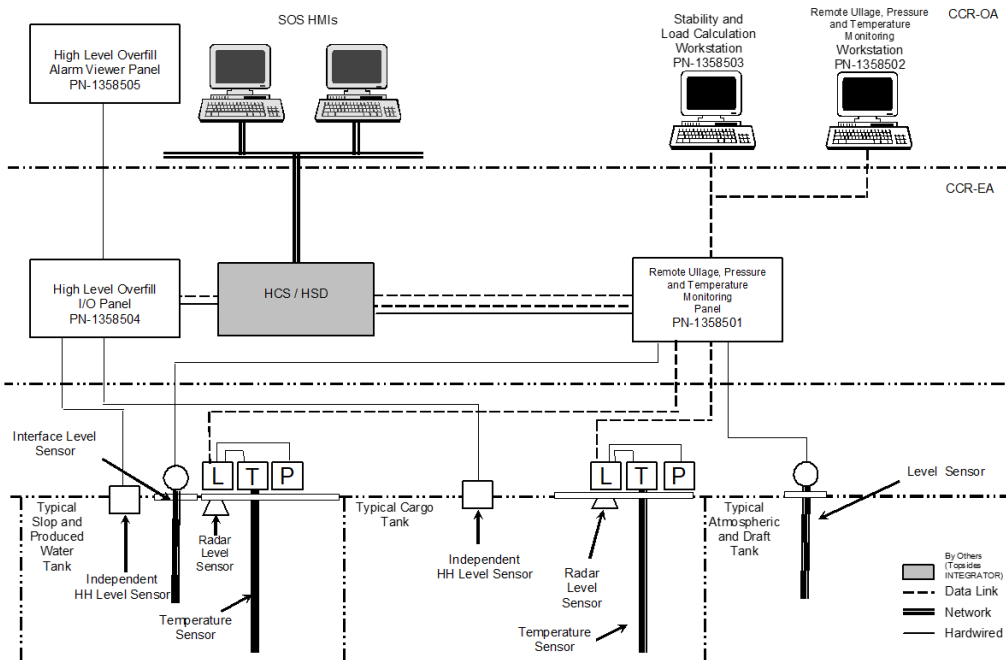


Figure 1 – HSTS Automation Architecture

4.13.2.1 Another type of architecture may be presented and subjected to PETROBRAS approval.

4.14 Draft Measurement System

4.14.1 Hull draft shall be measured at six (6) positions, in both sides: forward, mid ship and aftward. It shall be used either indirect or direct draft measurement by hydrostatic pressure.

4.14.2 Draft indication shall be made available at the SOS HMI's and also in the Stability and Load Calculation Workstation.

4.14.3 The sensors shall be intrinsically safe type and certified for hazardous areas Zone 0, Group IIA, Ex ia T3.

4.14.4 The transmitters shall be certified for hazardous areas Zone 1, Group IIA, T3, Ex ia.

4.14.5 The draft transmitters shall be installed on the main deck and their enclosures shall have protection degree IP-66/67 according to IEC-60529.

4.14.6 The draft sensors shall be installed immersed in the ballast tanks and have enclosure class IP68. Draft sensors shall be IP68 adequate to at least 32 meters depth.



AREA:

BÚZIOS

SHEET

9 of 17

TITLE:

**HULL STRUCTURAL TANKS LEVEL, INTERFACE,
PRESSURE AND TEMPERATURE MONITORING SYSTEMS**

INTERNAL

ESUP

4.14.7 The draft transmitters shall be connected to the Remote Ullage, Pressure and Temperature Monitoring Panel (PN-1358501). The output signals shall be 4-20 mA/HART, 24 Vdc.

4.14.8 The draft transmitters shall have blockage valves to allow proper maintenance, not requiring changes of tank level.

4.15 Remote Ullage, Pressure and Temperature Monitoring System

4.15.1 Main components of Remote Ullage, Pressure and Temperature Monitoring System

- Level, inert gas pressure and temperature measurements for inert gas blanketed tanks (cargo, slop and produced water tanks);
- Level measurement for atmospheric tanks (ballast, bilge, water, diesel and sludge);
- Oil-water interface level measurement for slop and produced water tanks;
- Remote Ullage, Pressure and Temperature Monitoring Panel (PN-1358501);
- Remote Ullage, Pressure and Temperature Monitoring Workstation (PN-1358502).

4.15.2 Level Measurement for Inert Gas Blanketed Tanks

- For each inert gas blanketed tank, the ullage (level) shall be measured by radar sensors, with the transmitters placed on the top of each tank.
- These radar level sensors can be combined with pressure sensors. If they are not combined, separate pressure sensors/transmitters shall also be supplied. The radar's antenna shall be appropriate for the measurement ranges.
- The sensors shall be intrinsically safe type (Ex-ia) and certified for hazardous areas Zone 0, Group IIA, T3, according to IEC-60079.
- The transmitters shall be certified for hazardous areas Zone 1, Group IIA, T3, Ex ia.
- The transmitters' enclosures shall have protection degree IP-66/67, according to IEC-60529.
- All necessary cables to interconnect the panel to physical instruments shall be properly specified. PETROBRAS shall confirm the length of cables required for this interconnection in the Detail Design phase.



AREA:

BÚZIOS

SHEET

10 of 17

TITLE:

**HULL STRUCTURAL TANKS LEVEL, INTERFACE,
PRESSURE AND TEMPERATURE MONITORING SYSTEMS**

INTERNAL

ESUP

- The Cargo, Slop and Produced Water Tanks levels shall continuously be monitored in the Central Control Room (Remote Ullage, Pressure and Temperature Monitoring Workstation and SOS HMIs).
- The following alarm levels shall be included in both HSTS workstation and SOS HMIs:
 - Low Level: To be defined during Detail Design
 - High Level: LSH = 90%
 - High High Level: LSHH = 95%
 - Emergency Level: LSHHH= 98%

4.15.3 Inert Gas Pressure Measurement for Inert Gas Blanketed Tanks

- Each cargo, slop and produced water tank shall have a dedicated internal pressure monitoring system. This system shall be designed to operate in a pressure range between the vacuum of 1000 mm WC and a pressure of 2400 mm WC.
- The pressure sensors can be combined with the radar level sensors. In this case, the pressure sensor output can be multiplexed together with the level signal for transmission or be interconnected directly as an analog input to the Remote Ullage, Pressure and Temperature Monitoring Panel (PN-1358501).
- The sensors shall be intrinsically safe type (Ex-ia) and certified for hazardous areas Zone 0, Group IIA, T3, according to IEC-60079.
- The cargo, slop and produced water tanks internal pressure shall continuously be monitored in the Central Control Room (Remote Ullage, Pressure and Temperature Monitoring Workstation and SOS HMIs).
- Whenever the vacuum is lower than 350 mm WC or the pressure is higher than 1,100 mm WC, visual and sounding alarms shall be actuated in the Central Control Room (both in Remote Ullage, Pressure and Temperature Monitoring Workstation and SOS HMIs).

4.15.4 Temperature Measurement for Inert Gas Blanketed Tanks

- Each cargo, slop and produced water tank shall be fitted with three (3) temperature sensors. Measurement shall be made using PT-100 temperature sensors fitted in fabricated thermowells in each tank. A deck connection box shall be provided at the top of each well. The temperature sensors shall be protected by a stainless steel thermowell.
- This system shall be designed to operate in a temperature range between 5°C and 100°C (Celsius degrees).



AREA:

BÚZIOS

SHEET

11 of 17

TITLE:

**HULL STRUCTURAL TANKS LEVEL, INTERFACE,
PRESSURE AND TEMPERATURE MONITORING SYSTEMS**

INTERNAL

ESUP

- Whenever the temperature of any sensor is over 80°C or the internal tank painting maximum temperature limit (whichever is smaller), a visual and sound alarm shall be generated in the Central Control Room (both in Remote Ullage, Pressure and Temperature Monitoring Workstation and SOS HMIs).
- The temperature sensors shall be positioned in the tanks as follows: one (1) sensor near the tank bottom, one (1) meter above the tank bottom plating; one (1) sensor in the middle of the tank; one (1) sensor near the tank top, 5 (five) meters below the main deck plating.
- The 03 (three) temperature measurements shall be continuously monitored in the Central Control Room (Remote Ullage, Pressure and Temperature Monitoring Workstation and SOS HMIs).
- The sensors shall be intrinsically safe type (Ex-ia) and certified for hazardous areas Zone 0, Group IIA, T3, according to IEC-60079.
- Each temperature sensor can be connected directly to the respective radar level sensor or be interconnected directly as an analog input to the Remote Ullage, Pressure and Temperature Monitoring Panel (PN-1358501).

4.15.5 Level Measurement for Atmospheric Tanks

- For atmospheric tanks (ballast, bilge, diesel, sludge, water, etc), the liquid level shall be measured and transmitted by submerged hydrostatic pressure sensors.
- The sensors shall be intrinsically safe type (Ex-ia) and certified for hazardous areas Zone 0, Group IIA, T3 and the transmitters shall be certified for hazardous area Zone 1, Group IIA, T3, Ex ia, according to IEC-60079.
- The transmitters' enclosures shall have protection degree IP-66/67 and the sensors enclosures shall have protection degree IP-68, according to IEC-60529. The depth required to IP-68 for the level sensors is at least 4 (four) meters, respecting the sensor position in relation to the full tank level.
- The sensors shall have blockage valves to allow proper maintenance, not requiring changes of tank level.
- The analog output signals shall be 4-20 mA/HART, 24 Vdc.
- All necessary cables to interconnect the Remote Ullage, Pressure and Temperature Monitoring Panel (PN-1358501) to the physical instruments shall be properly specified. PETROBRAS shall confirm the length of cables required for this interconnection in the Detail Design phase.



AREA:

BÚZIOS

SHEET

12 of 17

TITLE:

**HULL STRUCTURAL TANKS LEVEL, INTERFACE,
PRESSURE AND TEMPERATURE MONITORING SYSTEMS**

INTERNAL

ESUP

- The atmospheric tanks levels shall be continuously monitored in the Central Control Room (Remote Ullage, Pressure and Temperature Monitoring Workstation and SOS HMIs).

4.15.6 The following alarm levels shall be included both HSTS workstation and SOS HMIs:

- Low Level: To be defined by during Detail Design;
- High Level: LSH = 90%
- High High Level: LSHH = 95%
- Emergency Level: LSHHH= 98%

4.15.7 Oil-Water Interface Level Measurement for Slop and Produced Water Tanks

- For slop and produced water tanks, the oil-water interface liquid level shall be measured and transmitted by an oil-water interface level transmitter.
- The sensors shall be intrinsically safe type (Ex-ia) and certified for hazardous areas Zone 0, Group IIA, T3 and the transmitters shall be certified for hazardous area Zone 1, Group IIA, T3, Ex ia, according to IEC-60079.
- The enclosures shall have protection degree IP-66/67 according to IEC-60529.
- The technology of the sensors (for instance, differential pressure or capacitive) shall be chosen according to I-ET-3010.00-1200-800-P4X-013 - GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS.
- The analog output signals shall be 4-20 mA/HART, 24 Vdc.
- All necessary cables to interconnect the Remote Ullage, Pressure and Temperature Monitoring Panel (PN-1358501) to physical instruments shall be properly specified. PETROBRAS shall confirm the length of cables required for this interconnection in the Detail Design phase.
- The slop and produced water tanks oil-water interface levels shall be continuously monitored in the Central Control Room (Remote Ullage, Pressure and Temperature Monitoring Workstation and SOS HMI).

4.15.8 Remote Ullage, Pressure and Temperature Monitoring Panel (PN-1358501)

- The Remote Ullage, Pressure and Temperature Monitoring Panel shall be installed indoors, in air conditioned area, at CCR-EA and shall be in accordance



AREA:

BÚZIOS

SHEET

13 of 17

TITLE:

**HULL STRUCTURAL TANKS LEVEL, INTERFACE,
PRESSURE AND TEMPERATURE MONITORING SYSTEMS**

INTERNAL

ESUP

with I-ET-3010.00-5520-888-P4X-001 - AUTOMATION PANELS. The Panel shall be supplied fully assembled and tested.

- Cabinet configurations shall be based on a modular size of 800mm (W) x 800mm (L) x 2100mm (H), with a maximum of two modules fixed together for shipping purposes.
- The Remote Ullage, Pressure and Temperature Monitoring Panel (PN-1358501) shall be composed of dedicated power supply, programmable logic-controllers, I/O cards, network cards, Ethernet switches and any other equipment necessary for the data acquisition, logic execution and data transmission to the Remote Ullage, Pressure and Temperature Monitoring Workstation and SOS Package Unit Data Servers.
- Remote Ullage, Pressure and Temperature Monitoring Panel shall be certified by the Classification Society.
- For other requirements for Remote Ullage, Pressure and Temperature Monitoring System, see I-ET-3010.00-1200-800-P4X-002 – AUTOMATON, CONTROL AND INSTRUMENTATION ON PACKAGE UNITS.

4.15.9 Remote Ullage, Pressure and Temperature Monitoring Workstation (PN-1358502)

- The System shall be supplied with a Remote Ullage, Pressure and Temperature Monitoring Workstation, composed of a computer running an operating system and a supervisory software, able to display all the variables and alarms related to the Remote Ullage, Pressure and Temperature Monitoring System (level, pressure, temperature, ullage and draft measurements and alarms).
- The Remote Ullage, Pressure and Temperature Monitoring Workstation shall be supplied as an industrial microcomputer for use in offshore environmental conditions with one 23" video monitor, hard disk, ABNT2 keyboard and optical mouse - all of them wired - and 1000/100 Ethernet IEEE 802.3 network interface cards. Processor type, hard disk type/space and memory shall be according to the use of the necessary software in its maximum performance configuration. Use of refurbished, used or economy-line equipment is forbidden.
- The Remote Ullage, Pressure and Temperature Monitoring Workstation shall be installed in CCR-OA. All interconnection cables shall be supplied by HSTS SUPPLIER.

4.16 Stability and Load Calculation Workstation (PN-1358503)

- 4.16.1 As per Classification Society requirements, it shall be provided an independent computer with a system capable to perform loading calculations such as bending moment and shear forces, stability on normal or damaged conditions.



AREA:

BÚZIOS

SHEET

14 of 17

TITLE:

**HULL STRUCTURAL TANKS LEVEL, INTERFACE,
PRESSURE AND TEMPERATURE MONITORING SYSTEMS**

INTERNAL

ESUP

4.16.2 The Loading Calculator shall acquire on-line data from Remote Ullage, Pressure and Temperature Monitoring System and Draft Measurement System, and shall be able to use that information online and offline. Draft and trim corrections shall be done automatically within the system.

4.16.3 Loading Calculator software shall comply with the requirements from IP/API for calculations and naming.

4.17 High Level Overfill System

4.17.1 Each cargo, slop and produced water tank shall be fitted with a High Level Overfill System independent from Remote Ullage, Pressure and Temperature Monitoring System, in accordance with Classification Society rules.

4.17.2 The High Level Overfill System shall be composed of level sensors for each above mentioned tank and an Alarm panel located at CCR-OA.

4.17.3 Sensors can be capacitive transmitters or other technology as long as it is approved by PETROBRAS.

4.17.4 For each level measurement, three (3) alarm levels shall be generated: High Level (LSH - 90%), High High Level (LSHH - 95%) and Emergency Level (LSHHH - 98%).

4.17.5 The sensors shall be intrinsically safe (Ex-ia) type, and certified for hazardous areas Zone 0, Group IIA, T3, according to IEC-60079.

4.17.6 The instrument enclosures shall have IP protection degree according to I-ET-3010.00-1200-800-P4X-013 - GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS.

4.17.7 All necessary cables to interconnect the High Level Overfill Panel (PN-1358504) to physical instruments shall be properly specified. PETROBRAS shall confirm the length of cables required for this interconnection later in the Detail Design phase.

4.17.8 The independent level instruments shall be connected to High Level Overfill System Panel PN-1358504 and then to CSS – HSD. This connection to CSS-HSD shall be done through hardwired signals (discrete output in High Level Overfill Panel, discrete input in CSS-HSD, 24 Vdc).

4.17.9 Xenon beacon lights of different colors and air horn shall be provided, to be installed on main deck, in order to alarm in case of High (90%), High High (95%) or Emergency Level (98%) in any cargo, slop or produced water tank, in accordance with CS, SOLAS and MARPOL Requirements. These lights and horn shall be connected to High Level Overfill System Panel (PN-1358504).



AREA:

BÚZIOS

SHEET

15 of 17

TITLE:

**HULL STRUCTURAL TANKS LEVEL, INTERFACE,
PRESSURE AND TEMPERATURE MONITORING SYSTEMS**

INTERNAL

ESUP

4.18 PORTABLE CLOSED ULLAGE MANUAL MEASURING SYSTEMS

4.18.1 It shall be supplied two Portable Closed Ullage Manual Measuring Systems, and the necessary tank fittings, to be used as manual level measurement system for cargo, slop and produced water tanks.

4.18.2 The necessary tank fittings include tank penetration pieces on Main Deck, ball valves, adaptors for connection of instruments, and weather protection caps.

4.18.3 Each portable closed ullage manual measuring system shall consist of a densimeter, oximeter, H₂S meter, hydrocarbon meter (tankscope), ullage sensor, thermometer, portable oil-water interface sensor and sampler.

4.18.4 The ball valves shall be locked closed. They shall be installed on Main Deck above the tanks in the following setup:

- Cargo tanks: four (4) ball valves per tank;
- Slop and Produced Water Tanks: two (2) ball valves per tank.

4.18.5 Adaptors for connection of each instrument to the valves shall be supplied.

4.18.6 Weather protection caps shall be supplied in order to protect the necessary tank fittings.

4.18.7 Ball valves and weather protection caps must have their material specifications approved by PETROBRAS.

4.18.8 All systems shall be intrinsically safe (Ex-ia) type, suitable to operate in Zone 1, Group IIA, T3 (CS approved type certificate) and the installation design and work shall be approved by the Classification Society on site, as well.

4.18.9 The equipment shall be mounted and used on deck and shall be waterproof type, suitable to be exposed to the sunrays and to the marine environment.

4.18.10 Electrical/electronic equipment and instruments enclosures for use on deck shall have protection degree IP-66/67.

4.18.11 The oil-water interface sensor and sampler shall be able to measure from tanks top to bottom.

4.19 Accessories and Tools

4.19.1 Junction Boxes shall comply with requirements of I-ET-3010.00-1200-800-P4X-013 - GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS.

4.19.2 Spare parts shall be in suitable quantities for system maintenance during UNIT life cycle.



4.20 Cabinet Project

4.20.1 All panels shall be in accordance with I-ET-3010.00-5520-888-P4X-001 - AUTOMATION PANELS.

4.21 Interface with CSS and SOS

4.21.1 As HSTS is considered a P2S package-unit, it has hardwired connections with CSS and network connections (Ethernet IEEE 802.3) with SOS.

4.21.2 The hardwired interface with CSS is described in I-ET-3010.1Y-1200-800-P4X-014 - AUTOMATION INTERFACE OF PACKAGE UNITS.

4.21.3 All HSTS data shall be available at SOS HMIs, besides in its panels and workstation.

5 DOCUMENTATION

5.1 Complete documentation of the HSTS, covering all devices and services, shall be supplied with the proposal, for approval, and for final acceptance.

5.2 It shall be supplied with the proposal at least the following technical documents:

- Technical specifications, comprising: system, equipment, accessories, cables, materials and software;
- Datasheets and brochures for each equipment;
- All equipment and installation data including: material list, equipment list, spare part list, power consumption, weight, software manual, panel lay-out, system lay-out, etc;
- Complete description of services, training courses, tests, etc.

5.3 It shall be supplied for approval along with the HSTS itself at least the following technical documents:

- Technical specifications, comprising: system, equipment, accessories, cables, materials and software;
- Datasheets and drawings for each equipment;
- Installation drawings including general arrangement, electrical diagrams, wiring diagrams, cable list, material list, equipment list;
- Test procedures, training course program, services schedule;
- Programming tools, system reports, system diagnosis, etc.

5.4 All supplied documents shall be text searchable.

5.5 Complete HSTS certified documentation, including operation manual, installation manual and maintenance manual shall be provided, in the number of CD copies requested at BID documents, including all programming, configurations software and commented source codes.

5.6 NOTE: The commented programming, configuration and source codes are



AREA:

BÚZIOS

SHEET

17 of 17

TITLE:

**HULL STRUCTURAL TANKS LEVEL, INTERFACE,
PRESSURE AND TEMPERATURE MONITORING SYSTEMS**

INTERNAL

ESUP

mandatory, to be kept during the UNIT lifecycle.

6 ACCEPTANCE TESTS

6.1 The following tests shall be performed at FAT prior to delivery:

- Visual Inspection;
- Input and output signal levels verification;
- Functional test;

6.2 After the installation of the system the above tests shall be repeated at the site (SAT). For Site Integration Tests (SIT) refer to IEC-62381 – AUTOMATION SYSTEMS IN THE PROCESS INDUSTRY – FACTORY ACCEPTANCE TEST (FAT), SITE ACCEPTANCE TEST (SAT) AND SITE INTEGRATION TEST (SIT).

6.3 It shall be submitted to PETROBRAS, for approval, detailed FAT, SAT and SIT programs at least 60 (sixty) days in advance of programmed test date.