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EXECUTION	CAMILA									
CHECK	RAFAELJOSE									
APPROVAL	PEDRO									
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PRELIMINARY



TITLE:

CSS / SOS PANELS**NP-1****ESUP**

1 INTRODUCTION

1.1 Object

1.1.1 This specification establishes the basic design requirements and installation guidelines for the CSS and SOS panels to be installed at the UNIT.

1.1.2 For information on CSS and SOS, see I-ET-3010.00-5520-861-P4X-001 – CONTROL AND SAFETY SYSTEM – CSS and I-ET-3010.00-5520-861-P4X-002 – SUPERVISION AND OPERATION SYSTEM – SOS, respectively.

1.2 Definitions

UNIT FPSO (Floating, Production, Storage and Offloading), FSO (Floating, Storage and Offloading), SS (Semi-Submersible) or Fixed Offshore Unit.

SUPPLIER The Company responsible for supplying the goods and / or services described in this technical specification and designated as such in the Contract.

MANUFACTURER The responsible for fabrication of equipment

1.3 Abbreviations

A&C	Automation & Control
AEPR	Automation and Electrical Panel Room
AFDS	Addressable Fire Detection System
ALARM	Alarm Management System
AMS	Asset Management System
CCTV	Closed Circuit Television
CLOTS	Control Loops Optimization and Tuning System
CMS	Corrosion Monitoring System
CSS	Control and Safety System
FAT	Factory Acceptance Test
FGS	Fire and Gas System
FMS	Flow Metering System
HDS	Historical Data Server
HMI	Human Machine Interface
I/O	Input/Output
LSZH	Low Smoke Zero Halogen
MSHA	Mine Safety and Health Administration
MMS	Machinery Monitoring System
PLC	Programmable Logic Controller
PSD	Process Shut Down System
PVC	Polyvinyl chloride
OFNR	Optical Fiber Nonconductive Riser
PCS	Process Control System
RTDS	Real Time Data Server
SAT	Site Acceptance Test
SIT	Site Integration Test



TITLE:

CSS / SOS PANELS**NP-1****ESUP**

SOS Supervision and Operation System
TFT Thin Film Transistor
UPS Uninterruptible Power Supply
VMS Flexible Riser Visual Monitoring System

2 REFERENCE DOCUMENTS, CODES AND STANDARDS

2.1 External references

2.1.1 International Codes, Recommended Practices and Standards

API – AMERICAN PETROLEUM INSTITUTE

API RP 552 TRANSMISSION SYSTEM FIRST EDITION

ASTM – AMERICAN SOCIETY FOR TESTING AND MATERIALSASTM G21 STANDARD PRACTICE FOR DETERMINING
RESISTANCE OF SYNTHETIC POLYMERIC
MATERIALS TO FUNGIASTM E662 STANDARD TEST METHOD FOR SPECIFIC
OPTICAL DENSITY OF SMOKE GENERATED BY
SOLID MATERIALS**DLA [IS] – DEFENSE SUPPLY CENTER, PHIL-GENERAL AND INDUSTRIAL
ITEMS OF SUPPLY**

MIL C-24643 CABLE, ELECTRICAL

IEC - INTERNATIONAL ELECTROTECHNICAL COMMISSIONIEC 60068 ENVIRONMENTAL TESTING
IEC 60079 EXPLOSIVE ATMOSPHERES - ALL PARTS
IEC 60092-350 ELECTRICAL INSTALLATIONS IN SHIPS – PART
350 - GENERAL CONSTRUCTION AND TEST
METHODS OF POWER, CONTROL AND
INSTRUMENTATION CABLES FOR SHIPBOARD
AND OFFSHORE APPLICATIONSIEC 60092-376 ELECTRICAL INSTALLATIONS IN SHIPS – PART
376 - CABLES FOR CONTROL AND
INSTRUMENTATION CIRCUITS 150/250 V (300 V)IEC 60092-504 ELECTRICAL INSTALLATIONS IN SHIPS - PART
504: AUTOMATION, CONTROL AND
INSTRUMENTATIONIEC 60529 DEGREES OF PROTECTION PROVIDED BY
ENCLOSURES (IP CODE)IEC 60533 ELECTRICAL AND ELECTRONIC INSTALLATIONS
IN SHIPS - ELECTROMAGNETIC COMPATIBILITY
(EMC) – SHIPS WITH A METALLIC HULL



TITLE:

CSS / SOS PANELS**NP-1****ESUP**

IEC	61000	ELECTROMAGNETIC COMPATIBILITY (EMC) SERIES - ALL PARTS
IEC	61086	COATINGS FOR LOADED PRINTED WIRE BOARDS (CONFORMAL COATINGS) – ALL PARTS
IEC	62381	AUTOMATION SYSTEMS IN THE PROCESS INDUSTRY - FACTORY ACCEPTANCE TEST (FAT), SITE ACCEPTANCE TEST (SAT) AND SITE INTEGRATION TEST (SIT)

IEEE - INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

IEEE 802.3D FIBER-OPTICAL INTER-REPEATER LINK

DEF – UK MINISTRY OF DEFENCE

DEF STAN 02-713 DETERMINATION OF THE TOXICITY INDEX OF THE
PRODUCTS OF COMBUSTION FROM SMALL
SPECIMENS OF MATERIALS

NFPA - NATIONAL FIRE PROTECTION ASSOCIATION

NFPA 496 STANDARD FOR PURGED AND PRESSURIZED
ENCLOSURES FOR ELECTRICAL EQUIPMENT

TIA – TELECOMMUNICATIONS INDUSTRIES ASSOCIATION

TIA 568 COMMERCIAL BUILDING ELECOMMUNICATIONS
CABLING STANDARD

TIA 758 CUSTOMER-OWNED OUTSIDE PLANT
TELECOMMUNICATIONS INFRASTRUCTURE
STANDARD

TIA/EIA 598 OPTICAL FIBER CABLE COLOR CODING

2.1.2 Brazilian Codes and Standards

INMETRO - INSTITUTO NACIONAL DE METROLOGIA, NORMALIZAÇÃO E QUALIDADE INDUSTRIAL

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

PORTARIA Nº 270 (21/JUNHO/ 2011) EMENDA À PORTARIA INMETRO Nº 179 DE 18/MAIO/2010.

2.1.2.1 All MTE – *Ministério do Trabalho* regulations (NRs) shall be followed.

2.1.3 Classification Society

2.1.3.1 The DETAIL DESIGN PHASE shall be submitted to approval by Classification Society. The design and installation shall take into account their requirements and comments.

2.1.3.2 The design, installation and operation shall strictly follow the classification society requirements, along with the specific requirements identified in this document, including also all referenced documents' requirements.

2.2 Internal References

2.2.1 Project Documents

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-3010.00-1200-800-P4X-010	INSTRUMENTATION CABLES
I-ET-3010.00-5140-700-P4X-003	ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS

2.2.2 PETROBRAS Reference Documents

DR-ENGP-M-I-1.3-R.4 SAFETY ENGINEERING

2.3 Brazilian regulation (MTE section) and INMETRO regulation superpose all codes and regulations listed in item 2.2, since they are enforced by Brazilian law.

3 ENVIRONMENTAL AND OPERATIONAL CONDITIONS

- 3.1 For operating and environmental conditions refer to project's INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS technical specification document.
- 3.2 All equipment and their components shall be suitable for service and storage under tropical conditions of high temperature, high humidity, and heavy rainfalls and resistant against mold and fungus.
- 3.3 All materials used shall be resistant to corrosion caused by marine environmental and hydro-carbon continuous contact and they shall be in accordance with the Classification Society requirements.
- 3.4 To fulfill this requirement, all electrical and electronic devices, beyond mechanical parts of the equipment, shall be designed and constructed in a tropicalized version. Tropicalization process comprises application of reinforced protective resin Class 2 according to IEC 61086 and fungus proof according to ASTM G21 in all printed circuit boards, use of anti-rust materials and accessories and other implementations according to MANUFACTURER's experiences and related rules, aiming to provide a robust and reliable construction.
- 3.5 All panels, materials and 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" and its annexes, and shall be approved by Classification Society.
- 3.6 Equipment shall be suitable to withstand the dynamic loads imposed by the vessel motions during tow and on location.

4 DESIGN REQUIREMENTS

- 4.1 The panels will be installed on an offshore unit and shall operate continuously in industrial environment requiring high performance, reliability and availability.
- 4.2 The panels and their components shall be designed and supplied to ensure optimum performance, ease of maintenance, safe operation and durability.
- 4.3 Panels located in air conditioned room shall be designed to operate for long periods without air conditioning, including the hookup period and the onshore and offshore tests, under adverse environmental conditions, subject to a damp, salty atmosphere with temperatures varying over an extensive range.
- 4.4 An additional amount of 20% of each panel component, mainly related to switch breakers, terminal blocks, I/O cards and 10 % of rack slots shall be provided, fully assembled and wired as installed spare components.
- 4.5 Side plates shall be used as end plates only, i.e., they shall not be used between panel sections. Standard beams or struts are used for sections reinforcement.

- 4.6 Panels can have either bottom or top cables access depending on the room where they will be installed. This shall be defined during detailed engineering design phase.
- 4.7 Panels with cable top access shall have special cover plates, i.e., plates with openings (cutouts) adequate for cables.
- 4.8 Doors shall be of single type and constructed with a minimum of 14 gauge steel plate, "U" beam reinforcement, grounding bolts, internal hinge, lock and handle. Lock, handle and hinge shall be designed to allow changing of door opening direction (to the right or to the left) without any further piece of equipment, i.e., they shall be interchangeable.
- 4.9 There are 2 (two) types of panels with front door: one with a standard door (full height steel plate) and one with a 4 mm Plexiglas (acrylic resin) window. This window allows visualization of the internal components, has standard dimensions, which depend upon panel dimensions (height and depth), and is located 600 mm above the bottom of the panel (including the base plate).
- 4.10 A mounting frame (19") can be used for panels with front door and it is used for rack mounted type equipment. Some devices, which do not follow 19" standard rack mounting, may be mounted on this frame.

5 MECHANICAL CHARACTERISTICS

5.1 Construction

- 5.1.1 Panels shall be of modular structure type with standardized sections: 800 x 2,000 x 800 mm (L x H x W). Panel and each panel section shall be freestanding units.

NOTE: Panels installed in open areas or accommodation areas may have different dimensions:

- Minimum size for open areas: 800 x 800 x 600 mm (L x H x W);
- Minimum size for accommodation: 600 x 800 x 400 mm (L x H x W).

- 5.1.2 Panel structure shall be constructed of standardized beams, girders and struts with square holes used to accommodate bolts and nuts for the modular assembly and accessories mounting.

- 5.1.3 Panel structure shall be such that they can be lifted into position with eye bolts without causing resultant distortion.

- 5.1.4 Each panel shall be supplied with sub-base and fixing holes to allow for secure fixing of the panel to the floor. Incoming and outgoing cables as well as internal wiring shall be supported and run through plastic gray ducts with covers. In case of intrinsically safe field wiring, the cables must run through blue plastic ducts with protective cover.

- 5.1.5 Processors and I/O cards shall be installed at panel's front section. Marshalling terminal strips and field interconnection shall be installed at panel rear section.

5.1.6 A drawing pocket shall be located on the back side of all doors.

5.1.7 Panels shall be designed to avoid radio frequency and electromagnetic interferences.

5.1.8 Grounding straps shall be provided for all non-fixed surfaces.

5.2 Indoor Panels

5.2.1 Panel and accessories installed in air conditioned room or ventilated room (indoor panels) shall be designed for IP-22, as minimum, environmental protection degree according to IEC-60529. Indoor panels can be constructed with carbon steel plates.

NOTE: Panels housing SOS Servers/HMI, Ethernet switches and network equipment shall be designed for IP-20 instead of IP-22.

5.2.2 Doors shall be provided with ventilation slots and air filtering devices at upper and lower part. A mounting plate shall be located in the middle.

5.2.3 Indoor panels shall be fitted with double doors at both front and rear. A mounting plate shall be located in the middle. Each door is provided with ventilation slots and air filtering devices at top and bottom of each door. Whenever physical arrangement does not allow rear access, panels with front doors only and rear mounted plate are acceptable. For cabinets with width less than or equal to 800 mm, single doors are acceptable. The ingress protection degree for dust and water shall be IP22, as a minimum. Grounding straps shall be provided for all non-fixed surfaces. Cabinets located at indoor equipment rooms shall have bottom entry for cables.

5.2.4 Exhausting fans with filters must be provided, controlled by thermocouples also part of the panel MANUFACTURER's scope.

5.3 Outdoor Panels

5.3.1 Ingress protection degree shall be IP-56 as a minimum, according to IEC 60529. Classification Society requirements shall be taken into account and shall be purged and pressurized according to NFPA 496 requirements ("X" pressurization type) or IEC 60079-2.

5.3.2 Outdoor panels are normally placed in a hazardous area classified as Zone 2. However, according to IEC 61892-7, the panel and all of its components shall be suitable for Zone 1, Group IIA and temperature class T3. Construction plates shall be ASTM 316L stainless steel, 2.5 mm thick plate as a minimum, fitted with double doors on the back and single front door. A mounting plate is fitted to separate the CSS processor and I/O cards from the terminations. The doors shall be fitted with lockable swing handles and door stoppers preventing the doors from opening past their intended design or to move due to the vessel angular motions (roll, pitch and yaw).

5.3.3 Where pressurization/purge is required to comply with hazardous area requirements, panel shall be fitted with a pressurization/purge control unit which

shall be pre-certified by an international standard defined by project engineering design. Panel shall be fitted with instruction plate describing pressurization/purging unit operating procedure for a safe operation. All required labels to panel identification shall be supplied suitable for external use.

5.3.4 Independent air supply systems, with their own air reservoirs, shall be provided for pressurization/purge of the CSS outdoors panels. This feature shall be provided in order to avoid any further consequence caused by a failure in the air supply.

NOTE 1: Regarding the independent air supply system for each panel, in addition to all care and procedures to keep the panel pressurized without air leakage, it shall be provided an air supply system (comprised of air reservoir with all necessary instruments and accessories such as block and drain valves, check valve, pressure gage and safety relief valve) for each panel, as a back-up for the main air supply.

NOTE 2: Each air reservoir shall comply with NR-13 requirements, if applicable. For air reservoir sizing, the following minimum technical requirements shall be taken into account:

- air leakage flow of 1 Nm³/h per panel section;
- the minimum air pressure at the inlet of the air reservoir is 686.5 kPa (7.0 kgf/cm²);
- the air volume of the reservoir shall keep properly pressurized the panel for, at least, thirty (30) minutes;
- the internal diameter of the air reservoir less than 150 mm;
- air supply piping volume and/or other FPSO reservoir's volume shall not be used in the calculations to reduce the air reservoir volume or the 30 minute requirement.

5.3.5 SUPPLIER shall provide all necessary devices related to the pressurization control system (like low pressure switches, timer, interlocking limit switch on the doors to generate alarm on SOS HMIs, manometer, filter-regulators, relief valves, manual valves and electromechanical lock) in order to prevent energization before complete purging of initial internal atmosphere, and other items required by the Classification Society. These devices shall be fitted and terminated to the same panel where they are assembled.

NOTE 1: All doors shall have the limits switches (voltage free contact) interconnected in series in order to provide only one alarm signal (voltage free) to be sent to CSS-PCS/HCS input card.

NOTE 2: The low pressure alarm signal (voltage free contact) shall be sent to CSS-FGS input card. If this subsystem is not present in a specific remote I/O panel, this signal shall be sent to CSS-PSD/HSD input card.

5.3.6 Instrument air shall be used for panel pressurization. High air temperature alarm shall be provided in panels with forced ventilation.

- 5.3.7 Panels shall be provided with hazardous area certificates as established by INMETRO.
- 5.3.8 Outdoor panels shall have a cover in order to allow maintenance. The protection over the panel shall be constructed in such a way that whenever the doors are opened, the arrangement becomes a protected area, i.e., the opened doors will be the side protections. Suitable fixing points among doors, floor and cover over the panel shall be provided.
- 5.3.9 It is SUPPLIER's responsibility to achieve required class approval of outdoor panels for use in hazardous area as specified at design documentation. Any modification required at the field shall be foreseen by SUPPLIER in order to preserve protection degree during commissioning phase.
- 5.3.10 Removable gland plates must be fitted for bottom cable entry. Gland plates shall be strong enough to support the necessary glands and cables. The panels shall have mounting legs of 300 mm height to accommodate installation and cable glands. Panels shall be supplied with anti-vibration mats to be mounted between panel and mounting legs.
- 5.3.11 Failure of any redundant component shall be alarmed on the SOS HMIs. This includes power supplies, AC/DC converters, electrical/optical converters, etc.
- 5.3.12 Interconnection among the power converters and bus distribution bar shall be made through individual static devices and not allow a single failure to cause a system failure.
- 5.3.13 Interconnection among the power converters and bus distribution bar shall be made through individual static devices and not allow a single failure to cause a system failure.
- 5.3.14 Outdoor panels related to safety shall be object of project's EXPLOSION ANALYSIS, project's FIRE PROPAGATION AND SMOKE DISPERSION ANALYSIS, and project's DROPPED OBJECT STUDY. SUPPLIER shall comply with all recommendations present in these studies (e.g. panel physical location).
- 5.4 Accessories
- 5.4.1 Connections
- 5.4.1.1 Panels with more than one section shall be provided with standardized connections between sections, such as standardized angle brackets.
- 5.4.2 Struts
- 5.4.2.1 Standardized struts shall be supplied as required for cable trays. These struts shall be of the same type as the ones used for panel structure but the length and width may vary in accordance with SUPPLIER standards. Typical values (L x W) are 400 mm x 75 mm up to 1,200 mm x 650 mm.
- 5.4.3 Bolts, Nuts and Washers

5.4.3.1 20 % of spare standardized bolts, nuts and washers, per panel section, shall be supplied.

5.4.4 Lifting Lugs

5.4.4.1 4 (four) lifting lugs shall be supplied for each panel section. They are removable type and attached to the "T" beams of the panel.

5.4.4.2 SUPPLIER shall be responsible for stress calculation for lifting.

5.5 Identification of Devices and Accessories

5.5.1 Nameplates shall be provided for all devices, accessories, equipment, switches, etc., installed on the front plate or inside the panels, adjacent to each component, so that when they need to be replaced, the labels shall remain in the panel.

5.5.2 The nameplates shall be made of black acrylic material with chamfered edges and white lettering.

5.5.3 The panels shall be identified on the front plate in a clear and permanent manner by a nameplate attached to the outside, high up in the center of 1 (one) or 2 (two) section(s) (middle section(s)). Nameplate dimension is 200 x 75 mm.

5.5.4 All inscriptions or legends shall be engraved in Brazilian Portuguese language.

5.5.5 When devices on the front plate have their own identification incorporated, this identification shall not be used in place of the nameplates.

5.6 Internal Lay-Out

5.6.1 All devices, equipment and accessories mounted inside the panels shall be installed so as to facilitate access for tests, calibration and maintenance, without using special tools, and also permitting proper circulation of air among the various items to avoid overheating. The terminal connections identification tags shall be clearly visible.

5.6.2 Device MANUFACTURER recommendations related to the supports installation shall be followed. Supports installation shall avoid interference with present and future devices.

5.6.3 Removal of any device shall not interfere with operation of adjacent devices.

5.6.4 The internal layout shall be designed in order to guarantee sufficient space to ease maintenance and tests by operational personnel. Devices, terminal blocks, trays, cables etc. shall be mounted without considering high-density layout purposes.

5.7 Heat Dissipation and Ventilation

- 5.7.1 Ventilation systems shall be designed considering environmental conditions, and heat dissipation.
- 5.7.2 If necessary, high heat dissipation devices shall be distributed to sections and racks to avoid heat concentration. For indoor panels, each panel's door shall be provided with ventilation slots and air filtering devices at upper and lower of each door.
- 5.7.3 The fans shall be of low noise type. Panel's design shall take into account noise levels emission.

NOTE: SUPPLIER shall be responsible to provide heat dissipation calculation and to ensure that panels' internals, under normal operation condition, will be not submitted to temperature greater than 45°C. Classification Society requirements shall be taken into account. SUPPLIER shall take into account solar radiation for outdoor panels and provide sun shields, if necessary.

6 ELECTRICAL CHARACTERISTICS

6.1 General

- 6.1.1 All electronic and electrical components shall be conditioned in order to comply with environmental conditions.

6.2 External Wiring

- 6.2.1 All external connections to the panels shall be carried out through DIN rail mounted terminal blocks of the type permitting addition of extra terminals connectors on the supporting metal rails. Terminal connectors shall be:

- Made of non-hygroscopic material;
- Adequate for conductors with 2.5 and 1.5 mm² cross section;
- Flame retardant;
- Insulated to 300 V;
- Of disconnect type (knife type).

NOTE: Double deck terminal blocks for terminal connectors are not acceptable.

- 6.2.2 The terminal blocks location shall permit easy interconnection and running of cables, and shall be 300 mm away from the base, as a minimum.

NOTE: Terminal blocks shall be provided for each kind of electrical signal, i.e., digital input, digital output (dc), digital output (ac), analog input, analog output, power supply, etc. in order to guarantee proper segregation.

- 6.2.3 Panels with bottom access shall have removable finishing plates in the bottom of each section.
- 6.2.4 Panels with top access shall have special cover plates, i.e., plates with openings (cut-outs) adequate for cables access and bottom plate.
- 6.2.5 Panels wiring terminates on the inside of the terminal blocks and field wiring on the outside.

- 6.2.6 All terminal blocks shall be provided with 20 % of spare terminal connectors.
- 6.2.7 Cable shielding shall be connected individually to a terminal connector on the terminal block.
- 6.2.8 Weldless pressure type terminal connectors shall be used at the ends of the wires, with insulation sleeving, and with suitable identification. All terminals shall be identified with the field device, equipment or accessory tag, and the phase or polarity.
- 6.2.9 Each external cable shall enter at the related panel section. It is not acceptable that some cable enters at one section in order to be interconnected in another panel section.
- 6.2.10 Steel crews and clamps shall be cadmium dichromate-plated.

6.3 Internal Wiring

- 6.3.1 All cable trays shall be sized to not be more than 60 % filled, even if all spare I/O channels are used.
- 6.3.2 All panel wiring shall be identified in both ends by plastic rings with the terminal block number.
- 6.3.3 Only one conductor shall be connected to each side of each terminal block connector. If more conductors in parallel connection are needed, a fixed jump shall be used.
- 6.3.4 Wiring derivations outside the terminal connectors are not allowed.
- 6.3.5 Power supply cables shall run in cable trays segregated from the marshalling termination wiring, low voltage wiring and communication wiring. These terminals shall be covered with protective plastic covers and must have warning signs.
- 6.3.6 All electrical circuits shall be completely wired to the terminal blocks.
- 6.3.7 Interconnections between sections that have to be separated in transportation shall be suitably prepared for subsequent reassembly at the field.

6.4 Power Supply

- 6.4.1 Power supply for the panels shall be according to the following items:
- Topsides CSS Panel and CSS Topsides / Hull Remote I/O Panels shall be powered by 2 (two) **220 Vac, phase-to-phase, 60 Hz (HOLD)**, feeders from the UPS system, power supplies and shall be in accordance with technical specification I-ET-3010.00-5140-700-P4X-003 - ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS.
 - SUPPLIER shall convert and **redundantly (HOLD)** distribute the different power supplies inside the panel, including where necessary **redundant**

(HOLD) AC/DC stabilized power supply units for the cabinet internal distribution of 24 Vdc.

6.4.2 Incoming supplies must be converted inside each panel to 24 Vdc and connected to a 24 Vdc distribution copper bus bar in the panel. AC/DC conversion provided is to be within tolerances required by CSS hardware.

6.4.3 Each 24 Vdc power converter shall be sized to supply all modules and all I/O devices, including full spare capacity, and shall be provided with galvanic isolation between input and output.

6.4.4 Internal rectifiers shall be according to the following items:

- The 2 (two) **220 Vac (HOLD)** supply voltages shall be converted to 24 Vdc for the panel internal devices and for feeding field instruments such as solenoid valves and relays;
- For digital output circuits that require a higher power supply (normally associated to inductive loads of a higher consumption) independent redundant power supplies shall be provided for PCS and HCS;

- The rectifiers shall operate in parallel, and have malfunction, ground fault and short circuit alarms for local and remote monitoring by SOS HMIs, including all 24 Vdc power supplies (PCS, HCS, PSD, HSD, FGS, and Remote I/O panels); **(HOLD)**

NOTE: Each rectifier shall have its alarm signals (voltage free contact) interconnected in series together with the associated rectifier in order to provide only one alarm signal (voltage free) to be sent to the respective CSS subsystem input card. **(HOLD)**

- Interconnection among the power converters and bus distribution bar shall be made through individual static devices and not allow a single failure to cause a system failure;
- Overvoltage input protection or suppression shall be provided for each rectifier. **(HOLD)**
- Circuit-breakers shall be provided at incoming and outgoing circuits of each rectifier. **(HOLD)**
- The calculated load capacity of each rectifier shall take into account the electrical power consumption of installed devices plus 20 % for spare and future expansions. **(HOLD)**
- The rectifiers shall be of switched mode type with current control circuitry. **(HOLD)**
- 24 Vdc positive and negative poles shall not be grounded, i.e., floating system.
- The rectifiers and systems with battery, shall have an output voltage ripple less than 200 mV peak to peak (pp) (70 mV RMS) HART protocol specifications for smart transmitters. **(HOLD)**

6.4.5 All panel internal devices, components and accessories shall be adequate to operate with the following power supply specification:

- Voltage: 24 Vdc, +10% / -15%.
- Ventilation system and internal lighting: **220 Vac at 60 Hz (HOLD)**.

NOTE: The feeders may be linked to a voltage supervision relay in order to feed the exhaust fans (panel ventilation) and internal panel lighting.

6.4.6 Each powered device (dc or ac) shall be individually protected by circuit breakers. These devices shall be installed in the front of the corresponding section. Power supply distribution shall be designed in such a manner that each section can be isolated (de-energized) even with the other sections still in service (energized). 10 % of spare circuits shall be provided.

6.4.7 AC Power wiring shall be segregated from DC power and signal I/O wiring.

6.4.8 External power supply for CSS equipment shall be according to I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS:

- Dual internal power supplies, or
- From a fast AC switch which is fed from both supplies.

NOTE: Independent redundant power supplies shall be provided for PSD, HSD, HCS, FGS and PCS systems (i.e. power for processor and I/O modules), within each CSS cabinet. For digital output circuits that require a higher power supply (normally associated to inductive loads of a higher consumption) independent redundant power supplies shall be provided for PSD, HSD, HCS, FGS and PCS.

6.4.9 After a power supply failure, on reactivating this system, the panels shall operate without the need for restarting, resetting or maintenance activities.

6.5 Grounding

6.5.1 Panel grounding shall comply with API RP 552 and IEC 61000-5-2.

6.5.2 3 (three) bars of electrolytic copper measuring 1" x 1/4" cross section (minimum) mounted on insulators/supports shall be installed inside the panel for separate grounding of 3 (three) circuit types. The distance between these insulators/supports shall be 600 mm.

6.5.3 1 (one) bar shall be used to instrument grounding such as analog electronic circuits and cables shields. This ground shall be the earth (0 Volt) reference for instrumentation. It has the objective of reducing false signals or noise in instrument circuits due to induced electrical interference.

6.5.4 The cable shields shall be left floating in the field end. It shall be electrically continuous from the field equipment and be connected to the instrument grounding bar in the central panel.

6.5.5 The other bar shall be used for safety grounding. This grounding shall be used to protect personnel from electric shock by providing a secure fault current path in the event that metallic components become energized. All powered instrument and equipment enclosures shall be connected to this grounding.

6.5.6 The 3 (three) grounding bars shall be clearly and permanently identified with nameplates. The nameplates shall be made of black acrylic material and white lettering. The identifications to be engraved shall be “ATERRAMENTO DE SINAL” for instrument grounding, “ATERRAMENTO DE SEGURANÇA” for safety grounding and “ATERRAMENTO DE SEGURANÇA INTRÍNSECA” for intrinsic safety grounding.

6.5.7 Grounding bars shall have the following connecting capacity for each panel section:

- 1 (one) connector of 50 mm² section for external grounding;
- Up to 12 (twelve) connectors of 1.5 mm² cross section to device grounding.

6.5.8 Panel structure shall be grounded at only one point, with grounding weldless connector type, by a bare copper wire of 50 mm² gauge.

6.5.9 Adjacent sections shall be bonded by a bare copper wire of 50 mm² section, formed by twisted wires, using earthing mechanical connector.

6.5.10 All panel metallic parts such as structural components, frames, plates shall have electrical continuity among them.

6.5.11 Hinged doors shall be bonded to the main enclosure with flexible earth straps.

6.5.12 Ground fault detection devices shall be provided with alarm at SOS.

NOTE: Each ground fault detection device shall have an alarm fault signal (voltage free contact) interconnected to respective CSS subsystem input card.

6.5.13 Safety Grounding

6.5.13.1 Ground connection for panel body electrical safety is required for all panels. 2 (two) 8 mm stainless steel grounding bolts must be fitted on each panel.

6.5.14 Instrument Grounding

6.5.14.1 Copper made instrument signal ground bar, isolated from the safety grounding shall be provided for each panel, with sufficient screws (including spares) for wires termination, considering only one wire per connection.

6.5.15 Intrinsic Safety Grounding

6.5.15.1 6.5.15.1 Copper made Intrinsic Safety Grounding bar is to be provided for those panels working with intrinsically safe instruments. This bar is to be isolated from the safety and instrument ground. Also, this bar shall be equipped with sufficient screws (including spares) for wires termination.

NOTE: All 3 (three) above mentioned groundings shall be clearly identified.

6.6 Internal Lighting

6.6.1 Internal lighting shall be in accordance with the following specifications:

- 15 W fluorescent lamp;
- Mounted on panel struts (one lamp in each panel section);
- Provided with limit switch to turn on the lights when any door is opened;
- Instantaneous reactor;
- 1 (one) receptacle outlet which ground pin is the same safety ground (for maintenance electrical devices, such as, electrical tools, lamps, notebook etc.): 220 Vac, 10 % at 60 Hz (HOLD);
- Power supply: 220 Vac, 10 % at 60 Hz, from 220 Vac UPS. (HOLD)

6.7 Fiber Optic Cables and Accessories

6.7.1 General

6.7.1.1 Fiber optical cables shall be manufactured to be used in indoor/outdoor environments of industrial plant and accommodations of offshore production platforms.

6.7.2 Optical Fiber

6.7.2.1 Optical fibers shall be **TYPE X (HOLD)** according to I-ET-3010.00-1200-800-P4X-010 – INSTRUMENTATION CABLES.

6.7.2.2 The optical fibers shall be multimode graded index 62.5/125 μm type for operation with LED light source in 850 nm and 1,300 nm wavelength windows. They shall be in accordance with Fast Ethernet IEEE 802.3z 100 BASE-FX (in full duplex operation) standard and the proprietary protocols used in industrial automation networks. (HOLD)

6.7.2.3 Fiber Characteristics:

- Fiber Coating: ACRYLATE
- Core Diameter: $62.5 \pm 3 \mu\text{m}$
- Cladding Diameter: $125 \pm 2 \mu\text{m}$
- Core/Cladding non concentricity: $< 6.0 \%$
- Cladding non circularity: $< 2.0 \%$
- Core non circularity: $< 6.0 \%$
- Core/Clad concentricity: $< 6.0 \%$
- Primary Cladding diameter: $> 250 \mu\text{m}$
- Attenuation at 850 nm: $< 3.0 \text{ dB/km}$
- Attenuation at 1,300 nm: $< 1.0 \text{ dB/km}$
- Numerical Aperture: 0.275 ± 0.015
- Bandwidth at 850 nm: $> 200 \text{ MHz.km}$
- Bandwidth at 1,300 nm: $> 600 \text{ MHz.km (HOLD)}$

6.7.3 Optical Cable

6.7.3.1 Optical cables shall be **TYPE X (HOLD)** according to I-ET-3010.00-1200-800-P4X-010 – INSTRUMENTATION CABLES.

6.7.3.2 The optical cables shall be tight buffered suitable for offshore oil production environment with tight bends and shall have from 4 (four) up to 12 (twelve) optical fibers. The cable shall be made with dielectric material, without metallic components. (HOLD)

6.7.3.3 The optical fibers external jacket shall be flame retardant PVC, LSZH, nonadherent, without rugosity, water blocked, with protection against UV (ultraviolet) radiation, petrochemical agents and fungus. The coating shall be uniformly colored, in orange color, with superficial finishing without roughness. (HOLD)

6.7.3.4 The optical fibers shall be assembled in a mechanical stable group and involved by a flexible and dialectical traction element, composing the optical core of the cable. This core shall also have high mechanical rigidity to protect the optical fibers. (HOLD)

6.7.3.5 Their connection capability shall be direct (no need of special OID) - "breakout" type. (HOLD)

6.7.3.6 The optical cable minimum tensile load rating shall be greater than 2,000 N (short-term)/800 N (log-term) and be able to bear bending with minimum radius less than 10 (ten) times the outside diameter of the cable. (HOLD)

6.7.3.7 All specification and addressing from to cabling is part of SUPPLIER's scope. The interconnecting and procurement of these cables are out of SUPPLIER's scope.

6.7.3.8 Cables shall have UL-listed Riser-rated OFNR, MSHA and Classification Society certifications. (HOLD)

6.7.3.9 Cables shall comply with the following standards:

- ASTM-E662 (Density of Smoke);
- DEF STAN 02-713 (Toxicity index);
- MIL-C-24643 (acid gas test);
- TIA-758 (Water blocked);
- TIA-568/TIA-598-B (Buffer color codes). (HOLD)

6.7.4 Patch Panels

6.7.4.1 The optical cables shall be connected to patch panels. These patch panels shall have a splice tray compartment to hold the connections between the fiber optic cables and the patch cords (pig-tails). The patch panels shall have capacity for all the fibers of the cable. They shall be made of plastic material, non flammable, constructed to be attached to the internal walls of the panels where the optical converter are installed, or may be supplied as metallic tray for 19" rack mounting.

6.7.5 Patch Cords

6.7.5.1 Patch cords (pig-tails) shall be prefabricated and have the same optical fiber specification. The cable shall have the coating made of polyamide or polypropylene. The traction element must be entire dielectric, and can be made of Kevlar. The outer jacket shall be flexible, made of a non flammable material painted in orange. The cord shall have 6 (six) meters length and one of the ends shall have a connector compatible with the optical converter. The connector shall be caged to the traction element of the patch cord to allow a shot-term 500 N tensile load. The cord and the connector shall have attenuation lower than 0.1 dB.

6.7.6 Optical Converters

6.7.6.1 The optical converters shall be installed inside the control panels. They shall be modular standalone type with 24 Vdc power supply. Redundant networks shall have independent optical converters.

6.7.6.2 The converter shall be compatible with the above optical fiber specification and the connector shall be ST or SC style. The electrical connection shall be compatible with the communication card of the PLC, switch or applicable equipment.

6.7.6.3 Each converter shall have an alarm signal (voltage free contact) representative of malfunctioning. This signal shall be interconnected in series together with the associated converter in order to provide only one alarm signal (voltage free) to be sent to the respective CSS subsystem input card.

7 PAINTING FOR PANELS

7.1 Panels painting shall be according to SUPPLIER. Painting procedures shall be submitted to PETROBRAS for approval.

7.2 Internal and external panel color shall be light cream (Munsell notation 2.5 Y 9/4).

NOTE: Other colors, such as SUPPLIER standard color, may be used, but shall be submitted to PETROBRAS written approval.

7.3 The internal mounting plate of panels shall be orange (Munsell notation 2.5 YR 6/14).

8 SOS SERVERS PANEL

8.1 General

8.1.1 SOS Hardware Redundant equipment shall not be installed at the same section of the Server Cabinet.

8.1.2 Server cabinet shall be:

- Composed of 02 (two) sections;

TITLE:

CSS / SOS PANELS
NP-1
ESUP

- Appropriate to house server CPUs, time server, Ethernet switches and network accessories (for reference, see item 8.1.8).

8.1.3 Minimum characteristics of each section of server cabinet:

- Dimensions: Height 2,000 mm, Length externally 800 mm (19 inches internally), Width 1,000 mm;
- Rapid rail;
- Perforated doors (hole diameter 10 mm) ;
- Locking doors and side panels;
- Support 200 kg;
- Forced air ventilation;
- Split rear doors;
- Leveling feet;
- Open bottom.

8.1.4 Each section that house RTDS and/or HDS shall be supplied with built-in rack console, composed of retractable monitor, keyboard, mouse and an 1u console switch in order to allow its configuration and maintenance. The computers CPUs and the above mentioned video monitor, keyboard and mouse shall be connected to the internal console switch.

8.1.5 The retractable video monitor shall occupy 1u and be 15" TFT (flat) with 1280×1024 @ 60/75 Hz resolution.

8.1.6 The internal keyboard shall be PS/2 or USB 104-key ABNT-2 and shall be mounted over a 1u drawer.

8.1.7 The retractable monitor, keyboard and mouse shall be ergonomically placed in order to allow their use by a person in sit-down position (typically 0.80 m above floor).

8.1.8 Reference:

VENTILATION UNIT W/ 4 FANS	VENTILATION UNIT W/ 4 FANS
FREE FOR VENTILATION	FREE FOR VENTILATION
SERVER	SERVER
FREE FOR VENTILATION	FREE FOR VENTILATION
SERVER	SERVER
FREE FOR VENTILATION	FREE FOR VENTILATION
SERVER	SERVER
FREE FOR VENTILATION	FREE FOR VENTILATION
SERVER	SERVER
FREE FOR VENTILATION	FREE FOR VENTILATION
RETRACTABKE TFT MONITOR	RETRACTABKE TFT MONITOR
FREE FOR ERGONOMY	FREE FOR ERGONOMY
KEYBOARD/MOUSE	KEYBOARD/MOUSE
FREE FOR VENTILATION	FREE FOR VENTILATION
HDS	HDS
FREE FOR VENTILATION	FREE FOR VENTILATION
2 GIGABIT ETHERNET SWITCHES	2 GIGABIT ETHERNET SWITCHES

RESERVED FOR FUTURE EXPANSION	RESERVED FOR FUTURE EXPANSION
24P RJ45 x 110 IDC PATCH PANEL	24P RJ45 x 110 IDC PATCH PANEL
ANCED BASE	ANCED BASE

8.2 Scope of Supply

8.2.1 It is SUPPLIERs scope of supply the design of the internal arrangement of each sub-section, taking into account the necessary ventilation and the necessary equipment contained in each sub-section.

8.2.2 The final lay-out shall be defined in detailed engineering design phase.

9 DOCUMENTATION

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

9.2 All documentation shall be supplied in digital media (USB flash drive). All PDF type files shall be searchable.

9.3 There shall be supplied with the proposal, in the number of copies defined at PETROBRAS documents, at least the following technical documents, where applicable:

- Technical specifications, comprising: equipment, accessories, cables, and materials;
- Data sheets and brochures for each component;
- All equipment and installation data including: material list, equipment list, spare part list, power consumption, weight, panel layout, etc.
- Complete description of services, tests, training, etc.

9.4 There shall be supplied for approval and for final acceptance, in the number of copies defined at PETROBRAS documents, at least the following technical documents:

- Technical specifications, comprising: equipment, accessories, cables, and materials;
- Certificate of materials;
- All equipment and installation data including, material list, equipment list, spare part list, power consumption, weight etc.
- Installation drawings including lay-out (external and internal), general arrangement, electrical diagrams, wiring diagrams and cable list;
- Test procedures (both FAT and SAT) and services schedule.

10 TESTS

10.1 Factory Acceptance Tests (FAT)

10.1.1 Factory Acceptance Tests (FAT) shall be in accordance with IEC 62381 requirements, including the following tests to be performed at the factory:

- Mechanical tests;
- Electrical tests;
- Functional tests;
- Temperature-cycling tests;
- RFI & EMI tests;
- Pressurization/purge tests for the panels built according to NFPA 496 or IEC 60079-2.

10.1.2 Prior to the witnessed FAT, SUPPLIER shall execute previous tests and present their documentation to PETROBRAS, in order to reduce repairs and/or alterations during the FAT.

10.1.3 The FAT shall be witnessed by SUPPLIER and fully documented and recorded including any equipment failure, repairs or replacements. The procedure shall include handing over all records made during the construction period such as test results, list of changes, as-built drawings, calibration certificates and any other documentation in digital media (USB flash drive).

NOTE: All FAT report tests shall be signed and sent to PETROBRAS.

10.1.4 Compliance with this specification requirement shall be proven during the FAT. Testing methods and accuracy of the measurement shall be subject to the Classification Society and PETROBRAS approval.

10.1.5 Any malfunctions of the equipment shall be rectified and tested again, at SUPPLIER expense, and to PETROBRAS approval. Evidence shall be required that such faults have been rectified.

10.1.6 PETROBRAS shall decide whether tests may be continued or should be repeated.

10.1.7 FAT facility to include instrument air supply required to test panel purge and cooling control.

10.1.8 The FAT staging shall be set up so that each panel is fed from two power supplies, simulating UPS "A" and UPS "B". Cabinets UPS switchover will be tested.

10.1.9 The FAT facility is to include adequate air conditioning to ensure that the testing environment (where there are numerous screens and other equipment generating large amounts of heat) is maintained at a comfortable temperature (less than 25 °C).

10.1.10 Mechanical Tests

The mechanical tests shall encompass, at least, the following topics or essays:

- Visual inspection of all components, considering product quality, identification of interconnections, layout arrangement, nameplate inscriptions, accessibility etc.;
- Dimensional check;
- Rigidity and structures self-supporting;
- Shock, vibration and inclination (procedures according to Classification Society Rules).

10.1.11 Electrical, Temperature-Cycling and RFI & EMI Immunity tests shall be according to project's INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS technical specification.

10.1.12 Functional Tests shall be as described below:

- Complete system functional test, with simulation of all input situations and observation of expected outputs; the overall reaction time shall be verified;
- Input/Output Tests;
- Devices shall be tested according to test and operation device manuals.

10.1.13 Pressurization/Purge Tests (for the panels built according to NFPA 496 or IEC 60079-2)

10.1.13.1 The panels shall be tested in order to verify if all conditions and devices foreseen in the NFPA 496 or IEC 60079-2 (latest versions) are complied with.

10.1.13.2 The air supply flow shall be measured; the leakage compensation sequence shall be checked; all the interlocks and alarms shall be tested; the internal pressure shall be tested considering the air supply pressure varying from 70 psig up to 113 psig; other tests foreseen in the NFPA 496 or IEC 60079-2 and by the Classification Society shall be carried out.

10.1.13.3 The pressurization/purge shall assure a controlled air flow at low pressure, as required by NFPA 496 or IEC 60079-2, in order to maintain the interior of the panel lightly pressurized, avoiding the ingress of external explosive atmosphere gas and the ingress of saline atmosphere.

10.2 Site Acceptance Test (SAT)

10.2.1 There shall be repeated at the installation site, all tests performed at the factory (SAT). IEC 62381 requirements shall also be taken into account.

10.2.2 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).



11 SERVICES

- 11.1 SUPPLIER shall be responsible for the comprehensive panels covering design, engineering, manufacturing, equipment supply, testing and all documentation according to this specification.

12 WARRANTY

- 12.1 SUPPLIER shall give warranty for all components, even for equipment or device furnished by others, up to 18 (eighteen) months from delivery.
- 12.2 This warranty shall cover fabrication or installation problems, as well as any service included in the scope of supply.
- 12.3 SUPPLIER shall warranty the supply of spare parts, at least, for up to 10 (ten) years after the acceptance tests date, and technical assistance at installation site performed by qualified and certified maintenance staff, when requested.
- 12.4 During warranty period, any defective part shall be changed for a new one, within one week, after the problem reported by PETROBRAS.

13 PACKING REQUIREMENTS

- 13.1 On completion of FAT, all equipment shall be prepared for shipment and storage.
- 13.2 Equipment supplied loose shall be packed and crated for transport. In addition, if some rack equipment is susceptible to transport damage, it shall be removed from the system rack for separate packing and crating.
- 13.3 In order to prevent corrosion, VCI shall be used adequately, where applicable, as part of preparation for shipment and storage instead of desiccants such as silica gel. The later shall be used only in cases where VCI is not applicable. Both VCI and desiccants must not be used together for protecting the same compartment.