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CHECK	ANDRÉ LUIS								
APPROVAL	PEDRO								

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## 1. INTRODUCTION


### 1.1 Object

1.1.1 This technical specification describes the minimum requirements for the supply of an integrated Addressable Fire Detection System (AFDS) to UNIT's SAFETY SYSTEMS during the Basic Design phase of the project.

1.1.2 This supply shall cover all equipment, materials, software, interconnection, documentation, configuration, tests, installation and training.

### 1.2 Definitions

UNIT	FPSO (Floating, Production, Storage and Offloading), FSO (Floating, Storage and Offloading), SS (Semi-Submersible) or Fixed Offshore Unit.
PACKAGE	An assembly of equipment supplied interconnected, tested and operating, requiring only the available utilities from the UNIT for the PACKAGE operation.
PACKAGER	The responsible for project assembly, construction, fabrication, test and furnishing of the PACKAGE.
MANUFACTURER	The responsible for fabrication of equipment or components internal to the PACKAGE.
MODULE	The metallic structure suitable for lift and transport, where PACKAGES and equipment will be installed, being supplied completely mounted and precommissioned.
MODULE SUPPLIER	The responsible for project assembly, erection, construction, fabrication, test and furnishing of the MODULE.
BIDDER	The responsible for the lift, hook up, installation and integration of all MODULES on the UNIT Hull.

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### 1.3 Abbreviations

A&C	Automation & Control
AC/DC	Alternating Current / Direct Current
AEPR	Automation & Electrical Panels Room
AFDS	Addressable Fire Detection System
ALARM	Alarm Management System
AMI	Alarme Manual de Incêndio (Manual Fire Alarm)
AMS	Asset Management System
CCR-EA	Central Control Room – Equipment Ambiance
CCR-OA	Central Control Room – Operation Ambiance
CCTV	Closed Circuit Television
CD	Compact Disc
CLOTS	Control Loops Optimization Tuning System
CMS	Corrosion Monitoring System
CSS	Control and Safety System
FAT	Factory Acceptance Test
FGS	Fire and Gas System
FMS	Flow Metering System
HMI	Human-Machine Interface
MMS	Machinery Monitoring System
SAT	Site Acceptance Test
SIT	Site Integration Test
SOS	Supervision and Operation System
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 14G	RECOMMENDED PRACTICE FOR FIRE PREVENTION AND CONTROL ON FIXED OPEN-TYPE OFFSHORE PRODUCTION PLATFORMS
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##### IEC – INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC	60079	EXPLOSIVE ATMOSPHERES
IEC	60092 - 502	ELECTRICAL INSTALLATIONS IN SHIPS – PART 502: TANKERS – SPECIAL FEATURES
IEC	61892	MOBILE AND FIXED OFFSHORE UNITS – ELECTRICAL INSTALLATIONS

##### NFPA – NATIONAL FIRE PROTECTION ASSOCIATION

NFPA	72	NATIONAL FIRE ALARM AND SIGNALING CODE
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**INMETRO – INSTITUTO NACIONAL DE METROLOGIA, NORMALIZAÇÃO E QUALIDADE INDUSTRIAL**

PORTARIA 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.

RESOLUTION 270 (21/JUNHO/2011) EMEND TO INMETRO PORTARIA Nº 179 OF 18/MAIO/2010.

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

**2.2 Internal References**

2.2.1 PETROBRAS General Specification

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

SAFETY ENGINEERING

2.2.2 Project Documents

I-ET-3010.00-5140-700-P4X-003

ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS

I-ET-3010.00-5520-888-P4X-001


CSS / SOS PANELS

I-ET-3010.00-1200-800-P4X-010

INSTRUMENTATION CABLES

SAFETY DATA SHEET

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### 3 ENVIRONMENTAL AND OPERATION CONDITIONS

- 3.1 For operating and environmental conditions refer to INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS 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 mould and fungus.
- 3.3 All materials used shall be non-hygroscopic, flame retardant and resistant to corrosion caused by marine environmental and hydro-carbon continuous contact.
- 3.4 Addressable Fire Detection System (AFDS) shall have a stabilized power supply unit for the cabinet internal distribution of 24 Vdc, fed from 2 x 220 Vac (HOLD) – 60 Hz, from Emergency load UPS, as defined in technical specification I-ET-3010.00-5140-700-P4X-003 - ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS. It shall be used two redundant modules to convert from 220 Vac (HOLD) to 24 Vdc.

### 4 GENERAL DESCRIPTION AND REQUIREMENTS

#### 4.1 System Description

- 4.1.1 The AFDS shall consist of 3 (three) main parts: the primary devices (smoke detectors, heat detectors and manual fire alarms), the Addressable Fire Detection System Panels (one for Topsides and one for Hull) and the Addressable Fire Detection System Viewer Panel.
- 4.1.2 The Addressable Fire Detection System Panel for Topsides, Addressable Fire Detection System Panel for Hull and Addressable Fire Detection System Viewer Panel, shall be installed indoors, at air conditioned area. The Addressable Fire Detection System Panel for Topside will be located in AEPR, the Addressable Fire Detection System Panel for Hull shall be located in the CCR-EA and the Addressable Fire Detection System Viewer Panel shall be located in the CCR-OA. The Addressable Fire Detection System Viewer Panel shall be installed indoors, at air conditioned area, in the CCR-OA (in the Hull Accommodation).
- 4.1.3 Each fire detection loop shall have continuous visual indication on the respective Addressable Fire Detection System Panel (Topsides or Hull) and continuous visual indication and acoustic alarms both at the Addressable Fire Detection System Viewer Panel and the SOS HMIs. The visual indication shall be provided including layout location indication in order to ease fault identification, and shall remain activated until the system is reestablished manually.
- 4.1.4 The AFDS shall be linked to the CSS – FGS in order to provide information of any event or alarm. The AFDS shall inform any detection, network malfunction, as well as the signals integrity. It shall also receive reset commands, acknowledge

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commands, bypass commands and similar generated by the CSS through this communication link.


**NOTE 1:** The AFDS interface with the CSS shall only be via the FGS.

**NOTE 2:** All logic shall be implemented at the CSS – FGS.

- 4.1.5 The AFDS design shall allow alarm messages to be immediately sent from the field devices to both Addressable Fire Detection System Panels and Addressable Fire Detection System Viewer Panel as well as to the CSS-FGS, with a maximum total delay of 2 seconds (including all necessary data processing time and network delays). The number of devices per fire detection loop shall be correctly chosen to fulfill this response time requirement.
- 4.1.6 Manual fire alarm (AMI) shall be provided at all areas of the Unit. The AMI, when activated, shall sound a warning (indicating an informed fire) in the Addressable Fire Detection System Viewer Panel, located in CCR-OA, according to item 4.1.3, but their actions are of just alarm.
- 4.1.7 The AFDS shall be monitored for loss of power supply or fault conditions. The occurrence of power supply or a fault condition at any Addressable Fire Detection System Panel shall initiate a visual and audible fault signal at the SOS HMIs. Both the occurrence of power supply and a fault condition shall be distinct from a fire signal.
- 4.1.8 There shall be provided facilities permitting periodical testing of the entire system, including the detectors, system logic, Addressable Fire Detection System Viewer Panel, Addressable Fire Detection System Panels and communications. All the fire detection loops shall be able to be tested without any disconnection.
- 4.1.9 AFDS MANUFACTURER will be responsible to inform the minimum requirements for connections, installations and correct configurations of the primary devices, so that the perfect operation of AFDS is guaranteed. This information will be used and applied in the project during the detail phase.

## 4.2 Primary Devices


- 4.2.1 Addressable heat detectors, addressable smoke detectors and manual fire alarms (AMI) shall be provided for addressable system.
- 4.2.2 Heat detectors, smoke detectors and manual fire alarm (AMI) shall allow immediate identification and location of the fire detection zone at Addressable Fire Detection System Panels, Addressable Fire Detection System Viewer Panel and SOS HMIs.
- 4.2.3 Redundant detectors may be used in the same areas (redundancy requirements are defined at SAFETY DATA SHEET document).
- 4.2.4 Heat detectors, smoke detectors and AMIs shall be linked in loop on a ring configuration, excluding intrinsically safe detectors placed in hazardous explosive atmosphere areas, which can be connected in branches derivating from the loop.

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Instruments installed in external areas shall not be connected to the same loop as instruments located at internal areas.

- 4.2.5 All intrinsically safe (Ex i) AMIs, smoke detectors and heat detectors shall have galvanic isolated barriers installed in non-classified areas connecting them to the respective fire detection loops. A single intrinsically safety associated barrier can be shared among 2 (two) or more intrinsically safe detectors, if this configuration does not compromise their normal functioning. When using addressable intrinsically safe detectors in classified area, independent fire detection loops covering the same area shall be provided.
- 4.2.6 AMIs shall be of break glass and push button type, painted in safety red (MUNSELL notation 5R 4/14).
- 4.2.7 Heat detectors (TST) shall be “raise of temperature rate” (Thermovelocimetric) type or fixed temperature type according to their location as indicated in the SAFETY DATA SHEET document.
- 4.2.8 The detectors and AMIs installed in external areas shall have protection class degree IP-56 and suitable to classification area as defined in AREA CLASSIFICATION – GENERAL document.
- 4.2.9 Point optical detectors shall be used for smoke detection:
- 4.2.9.1 Smoke Detectors shall be installed where defined on SAFETY DATA SHEET document.
- 4.2.9.2 If required by PETROBRAS General Specifications or Safety Data Sheets, more than 1 (one) detector shall be installed in the same zone. Each detector shall send its signal, and the voting shall be carried out in the CSS–FGS.
- 4.2.9.3 Emergency shutdown actions due to smoke or heat confirmation are defined on SAFETY DATA SHEET document.
- 4.2.10 The smoke and fire detectors, after they have been operated, shall be ready to be used again without replacement of any of their components or need of any external reset.
- 4.2.11 All detectors shall have a single internal tag. The AFDS shall not have 2 (two) detectors with the same tag. The tag shall include a prefix to uniquely identify the detector type. All detectors of that type shall have the same prefix in their tag.
- 4.2.12 All detectors shall be factory calibrated by MANUFACTURER. This requirement does not exempt the need for further calibrations by PACKAGER/MODULE SUPPLIER/MANUFACTURER during construction, assembly or commissioning of the PACKAGE/MODULE.
- 4.2.13 There shall be provided a built-in feature in order to enable the system to differentiate false alarms (such as those caused by cigar and cigarette smoke and sprays) from actual smoke caused by a real fire.



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4.2.14 All detectors shall be periodically tested for calibration deviations. Self-diagnosis techniques shall be implemented to allow self-calibration.

4.2.15 For AMIs, smoke detectors and heat detectors quantities and location see item 10 of this specification.

4.2.16 All devices shall include built-in short circuit, open circuit and ground fault monitoring and protection.

4.2.17 All devices shall include self test routines in order to reduce maintenance costs.

### 4.3 Addressable Fire Detection System Panels

4.3.1 The Addressable Fire Detection System Panels (one for Topsides and one for Hull) shall be microprocessor based and shall have a built-in self-diagnostic system to ease fault finding and maintenance. The entire system shall be continuously monitored for wiring failure.

4.3.2 The Addressable Fire Detection System Panels shall have a display suitable for full darkness operation. This display shall be readable from outside the panel.

4.3.3 The electric circuits shall be monitored so that faults to ground, short circuits and current breakdown systems shall be signaled as stated on item 4.1.6.

4.3.4 The Addressable Fire Detection System Panels shall comply with requirements of I-ET-3010.00-5520-888-P4X-001– CSS / SOS PANELS.

4.3.5 The Addressable Fire Detection System Panels shall be provided with all test and maintenance facilities.

4.3.6 The Addressable Fire Detection System Panels shall have protection class degree IP-22.


### 4.4 Addressable Fire Detection System Viewer Panel

4.4.1 The Addressable Fire Detection System Viewer Panel shall be installed at CCR-OA in order to have an independent visualization of the detectors statuses.

4.4.2 The Addressable Fire Detection System Viewer Panel shall have a display suitable for full darkness visualization.

### 4.5 Communication

4.5.1 The communication link between Addressable Fire Detection System Panels (Topsides and Hull) and CSS – FGS shall be implemented using dual TCP/IP communications ports. Each Addressable Fire Detection System Panel shall have 2 ports to communicate with each FGS half cluster, total of 4 ports, in a redundant configuration. MODBUS TCP/IP protocol shall be used.

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4.5.2 Resources shall be provided in order to guarantee the communication with the CSS-FGS without losing supervision data of AFDS, even at the failure of one of the dual CSS-FGS controllers.

#### 4.6 General Requirements

4.6.1 All equipment having electronic components or circuits shall be immune to electromagnetic and radiofrequency (EMI-RFI) interference.

4.6.2 All equipment shall operate without loss of reliability, availability or performance within a voltage variation of 10 % above or below rated voltage (or performance according to IEC 61892 – 1).

4.6.3 All materials and equipment with mechanical protection shall have test certificates issued by an authorized and duly identified laboratory.

4.6.4 Means to prevent electric contacts between different metallic materials shall be provided in order to avoid corrosion.

4.6.5 In the event of confirmed fire, the emergency alarm shall sound at the SOS HMIs or all over the platform, according to the SAFETY DATA SHEET document. In areas with high level noise (> 90 dB), a visual indication shall also be provided.

4.6.6 The electrical connections shall be ½” NPT-F, furnished with cable gland NPT-M (US standard) or M20 (European standard).

4.6.7 MANUFACTURER shall furnish all devices that are necessary for the system, such as intrinsic safety barriers, terminal blocks, test kit, spare parts set, bases with LEDs and connection boxes, etc.

4.6.8 Cables for AFDS shall be in accordance with I-ET-3010.00-1200-800-P4X-010 - INSTRUMENTATION CABLES.


4.6.9 The positioning and quantity of the detectors shall consider the following conditions:

- Area of the installation;
- Presence of obstacles which can affect the heat or smoke propagation;
- Ventilation of the ambient;
- Interference sources that may affect the detection.
- Manufacturer Recommendations.

4.6.10 Each Fire zone shall also be identified on SOS HMIs.

4.6.11 Special tools, such as hand held configurators, shall be supplied along with The Addressable Fire Detection System Panels

## 5 DOCUMENTATION

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- 5.1** Complete documentation of the AFDS covering all devices and services shall be supplied with the proposal for approval and for final acceptance.
- 5.2** There shall be supplied with the proposal, in the number of copies defined at MANUFACTURER documents, at least the following technical documents:
- Technical specifications, comprising: system, equipment, accessories, cables, materials and software;
  - Data-sheets and brochures of all equipment;
  - All equipment and installation data including: material list, equipment list, spare part list, power consumption, weight, panel layout, system layout, etc;
  - Complete description of services, training courses, tests, etc.
- 5.3** Complete AFDS certified documentation, including location plan, address list operation manual, installation manual, maintenance manual and INMETRO Certificates for all detectors and AMIs shall be provided, in the number of CD copies requested at Bid documents, including all programming and configurations tools.

## **6 ACCEPTANCE TESTS**

- 6.1** The following tests, besides the tests required at I-ET-3010.00-5520-888-P4X-001– CSS / SOS PANELS, where applied, shall be performed at supplier installations (FAT) prior to delivery:
- Input and output signal verification;
  - Communication within panels.
- 6.2** After installation the system shall be tested under various conditions of ventilation, covering all possible severe operation conditions of the unit. These tests (SAT) shall be witnessed by PETROBRAS.
- 6.3** For Site Integration Tests (SIT) refer to SAFETY DATA SHEET document and Fire and Gas Cause and Effect Matrix. SIT shall be executed with the AFDS interconnected with the CSS – FGS.
- 6.4** MANUFACTURER shall submit to PETROBRAS, for approval, detailed FAT, SAT and SIT programs 60 (sixty) days in advance.

## **7 TRAINING**


- 7.1** MANUFACTURER shall provide training to qualify PETROBRAS technicians to operate and maintain (install, dismantle, replace parts, make adjustments, etc) each piece of equipment. The training shall encompass all items to its understanding.
- 7.2** The training shall be performed at Platform construction yard, after completion of the FAT and prior to PETROBRAS approval of the FPSO Acceptance Term.

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- 7.3** MANUFACTURER shall provide all documentation and materials required for the training program (including the latest revision of the as built documentation, brochures, booklets, material for presentations, transparencies, etc.).
- 7.4** The training program shall encompass all operation and maintenance aspects. All trainees will be operation and maintenance professionals. The participants shall be awarded certificates after the completion of the training course.
- 7.5** The training course shall be delivered for 10 (ten) technicians, in Brazilian Portuguese and shall be performed using identical equipment as supplied. The quality of attendants will be informed during Detailed Engineering Design phase by PETROBRAS.
- 7.6** MANUFACTURER shall take full responsibility for the professionals teaching the training course, including for their transportation and lodging.
- 7.7** MANUFACTURER shall submit for approval the detailed training program with 2 weeks in advance.
- 7.8** MANUFACTURER shall supply 2 (two) flash drive copies of the Brazilian Portuguese training course.
- 7.9** The training program shall cover, at least, the following items:
- Complete description of equipment;
  - Technical and operational characteristics;
  - Operating principles;
  - Operating cautions;
  - Aspects of construction;
  - Operating procedures and routines;
  - Identification of operational problems and possible causes (troubleshooting);
  - Preventive maintenance routines;
  - Signaling and warning devices;
  - Protection and adjustment;
  - Presentation of drawings and diagrams.

## **8 WARRANTY**

- 8.1** MANUFACTURER shall give warranty for all AFDS components, even for equipment or device furnished by others, up to 24 (twenty four) months from delivery or for 12 (twelve) month operation.
- 8.2** This warranty shall cover fabrication or installation problems, as well as any service included in the scope of supply.
- 8.3** Furnisher shall warranty the supply of spare parts, at least, for up to 10 (ten) years after the acceptance test date, and technical assistance at installation site performed by qualified and certified maintenance staff, when requested.


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**8.4** During warranty period, any defective part shall be replaced for a new one, within 1 (one) week, after the problem is reported by PETROBRAS.

## **9 PACKING REQUIREMENTS**

- 9.1** On completion of FAT all equipment shall be prepared for shipment and storage.
- 9.2** 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.

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## 10 QUANTITY OF DEVICES

### 10.1 General Notes

- 10.1.1 The quantities of detectors and AMIs shall be according to SAFETY DATA SHEET document.
- 10.1.2 The quantities of detectors in excess due to detectors coverage area shall be submitted to PETROBRAS for formal approval and will be confirmed after approval of the Fire Detectors Layout drawings.
- 10.1.3 The type and areas of detectors and AMIs shall be according to SAFETY DATA SHEET document.
- 10.1.4 The quantity of components per loop and their type shall be defined during Detailing Engineering Design.

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