PETROBRAS	**TECHNICAL SPECIFICATION**	**Nº :** I-ET-3010.00-5522-855-P4X-001	
	CLIENT:		**SHEET:** 1 of 13
	JOB:		
	AREA:		
DP&T-SRGE	**TITLE:** **ADDRESSABLE FIRE DETECTION SYSTEM**		NP-1
			ESUP

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DESIGN	ESUP	ESUP	ESUP	ESUP	ESUP				
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SUMMARY

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

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

1.3 Abbreviations, Acronyms and Initialisms

A&C	Automation & Control
AC/DC	Alternating Current / Direct Current
AEPR	Automation & Electrical Panels Room
AFDS	Addressable Fire Detection 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
CD	Compact Disc
CSS	Control and Safety System
FAT	Factory Acceptance Test
FGS	Fire and Gas System
FMS	Flow Metering System
HFGS	Hull Fire and Gas System
HMI	Human-Machine Interface
SAT	Site Acceptance Test
SIT	Site Integration Test
SOS	Supervision and Operation System
UPS	Uninterruptible Power Supply

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

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

INMETRO – INSTITUTO NACIONAL DE METROLOGIA, NORMALIZAÇÃO E QUALIDADE INDUSTRIAL

PORTARIA Nº 115 (21/MARÇO/2022)	REQUISITOS DE AVALIAÇÃO DA CONFORMIDADE PARA EQUIPAMENTOS ELÉTRICOS PARA ATMOSFERAS EXPLOSIVAS - CONSOLIDADO.

IMO – INTERNATIONAL MARITIME ORGANIZATION

IMO	IB155E	FSS CODE INTERNATIONAL CODE FOR FIRE SAFETY SYSTEMS

NORMAM – NORMAS DA AUTORIDADE MARÍTIMA

NORMAM	05	HOMOLOGAÇÃO DE MATERIAL

2.2 Internal References

2.2.1 PETROBRAS General Specification

DR-ENGP-M-I-1.3	SAFETY ENGINEERING GUIDELINE

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	AUTOMATION PANELS
I-ET-3010.00-1200-800-P4X-010	CRITERIA FOR ESTABLISHING CABLE CODES AND CABLE GLAND CODES
I-ET-3010.00-1200-940-P4X-002	GENERAL TECHNICAL TERMS

2.2.3 This section specifies documents that are referenced along the text and are part of a specific project. For that reason, the document's identification number is not yet defined and may vary according to project. The document's title may also vary slightly from one project to another. Project's DOCUMENT LIST shall be consulted in order to verify the correct document number and title.

- SAFETY DATA SHEET
- INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS
- AREA CLASSIFICATION - GENERAL

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 hydrocarbon 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 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 to 24 Vdc. The manufacturer of these modules shall be as per AFDS MAUFACTURER standards.

4 GENERAL DESCRIPTION AND REQUIREMENTS

4.1 System Description

4.1.1 As a Typical document, this Technical Specification mentions one AFDS for Hull and one AFDS for Topsides. For definition of the scope to be supplied due to CONTRACT premises, project documentation shall be consulted.

4.1.2 Each AFDS for Topsides or for Hull shall consist of 3 (three) main parts: the primary devices (smoke detectors, heat detectors and manual fire alarms), the Addressable Fire Detection System Panels and the Addressable Fire Detection System Viewer Panel.

4.1.3 The Addressable Fire Detection System Panel for Topsides, Addressable Fire Detection System Panel for Hull, Addressable Fire Detection System Viewer Panel for Hull, and Addressable Fire Detection System Viewer Panel for Topsides shall be installed indoors, at air-conditioned area. The Addressable Fire Detection System Panel for Topsides wil 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 (both for Topsides and Hull) shall be located in the CCR-OA.

4.1.4 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 (Topsides or Hull) and at 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.

4.1.5 Each firezone that can cause ESD shall be covered by, at least, 2 (two) AFDS redundant loops. The detector distribuition in the loops shall be such that the total fail of loop will not cause Shutdown of the FPSO. At least one of the detectors in the voting group shall be in one different loop than the other detectors of the same group.

4.1.6 The override of any AFDS detector in SOS shall not override it in the respective AFDS panel. The only action subsequent to the override is the non-participation of this detector in generating alarms and/or shutdowns.

4.1.7 If a detector is inhibited or disabled in the respective AFDS panel, it shall be automatically set in override in SOS and an alarm message shall be announced in SOS, containing the inhibited detector tag.

4.1.8 The AFDS shall be linked to the CSS – FGS and CSS-HFGS 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 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 and HFGS.
NOTE 2: All logic shall be implemented at the CSS – FGS and CSS – HFGS.

4.1.9 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 Panels as well as to the CSS-FGS/CSS-HFGS, 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.

4.1.10 Manual fire alarm pushbuttons (AMI) shall be provided according to project document (SAFETY DATA SHEET). The AMI, when activated, shall sound a warning (indicating a confirmed fire) in the Addressable Fire Detection System Viewer Panels but their actions are of just alarm.

4.1.11 The AFDS shall be monitored for loss of power supply, loss of communication, open loop or fault conditions. The occurrence of power supply, loss of communication, open loop or a fault condition at any Addressable Fire Detection System Panel shall initiate a visual and audible fault signal at the SOS HMIs. The occurrence of power supply, loss of communication, open loop and a fault condition shall be distinct from a fire signal. In case of failure, one or more specific AFDS cards, the respective zone shall also be indicated at the SOS HMIs.

4.1.12 There shall be provided facilities permitting periodical testing of the entire system, including the detectors, system logic, Addressable Fire Detection System Viewer Panels, Addressable Fire Detection System Panels and communications. All the fire detection loops shall be able to be tested without any disconnection.

4.1.13 It shall be informed 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 design phase.

4.1.14 AFDS design shall comply with Brazilian regulation NORMAM 05 – HOMOLOGAÇÃO DE MATERIAL.

4.2 Primary Devices

4.2.1 Addressable heat detectors, addressable smoke detectors and manual fire alarms (AMI) shall be provided in AFDS as primary devices.

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 Panels and SOS HMIs.

4.2.3 Redundant detectors can be used in a same area. Redundancy requirements are defined at SAFETY DATA SHEET document.

4.2.4 All primary devices (for each type – heat detectors, smoke detectors and AMIs) shall be of the same manufacturer.

4.2.5 Heat detectors, smoke detectors and AMIs shall be linked in loop in ring configuration. Intrinsically safe detectors placed in hazardous explosive atmosphere areas (Zone 0 and 1), if any, can be connected in branches derivating from the loop. Instruments installed in externall areas shall not be connected to the same loop as instruments located at internall areas.

4.2.6 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.

4.2.7 Any fire detection loop that covers the accommodation module shall not include a machinery space of category A as per IMO IB155E – FSS CODE INTERNATIONAL CODE FOR FIRE SAFETY SYSTEMS definition.

4.2.8 AMIs shall be of “break glass and push button” type or “lift lid and push button” type, painted in safety red (MUNSELL notation 5R 4/14).

4.2.9 Heat detectors shall be “raise of temperature rate” (Thermovelocimetric) type or fixed temperature type according to their location as indicated in the SAFETY DATA SHEET document.

4.2.10 The detectors and AMIs installed in external areas shall have degree of protection IP 56 according to IEC-60529 and shall be suitable to area classification as defined in AREA CLASSIFICATION – GENERAL document.

4.2.11 Point optical detectors shall be used for smoke detection.

4.2.12 Smoke Detectors shall be installed where defined in SAFETY DATA SHEET document.

4.2.13 If required by PETROBRAS General Specifications or SAFETY DATA SHEET, 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/CSS-HFGS.

4.2.14 Emergency shutdown actions due to smoke or heat confirmation are defined in SAFETY DATA SHEET document. AFDS shall not be used to execute logic.

4.2.15 After actuation, the smoke and fire detectors shall be ready to be used again without replacement of any of their components or need of any external reset.

4.2.16 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 identify the detector type. All detectors of that type shall have the same prefix in their tag.

4.2.17 All detectors shall be calibrated in factory, prior to delivery. This requirement does not exempt the need for further calibrations during construction, assembly or comissiontion of the PACKAGE/MODULE.

4.2.18 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.

4.2.19 All detectors shall periodically be tested for calibration deviations. Self-diagnosis techniques shall be implemented.

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

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

4.2.22 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 4.1.11.

4.3.4 The Addressable Fire Detection System Panels shall comply with requirements of I-ET-3010.00-5520-888-P4X-001– AUTOMATION 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 degree of protection IP-22 according to IEC-60529.

4.4 Addressable Fire Detection System Viewer Panels

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

4.4.3 The Addressable Fire Detection System Viewer Panels CPU shall be suitable for mouting in a 19” rack

4.5 Communication

4.5.1 The communication link between Addressable Fire Detection System Panels (Topsides and Hull) and CSS-FGS/CSS-HFGS shall be redundant implemented using Ethernet communications ports, one to each FGS half cluster (for Topsides AFDS) or HFGS half cluster (for Hull AFDS). In the event of a loss of communication with one FGS/HFGS half cluster, the corresponding CSS processor shall automatically switch the communication to the other half-cluster. MODBUS TCP/IP protocol shall be used (if Ethernet is used) or MODBUS/RTU, if serial communication is used.

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

4.6 General Requirements

4.6.1 All equipment having electronic components or circuits shall be immune to electro-magnetic 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 preventlk 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 It shall be furnished 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 - CRITERIA FOR ESTABLISHING CABLE CODES AND CABLE GLAND CODES.

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 in SOS HMIs.

4.6.11 All manufacturer practices regarding installation shall be followed.

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

5 DOCUMENTATION

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 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– AUTOMATION 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/HFGS.

6.4 It shall be submitted to PETROBRAS, for approval, detailed FAT, SAT and SIT programs 60 (sixty) days in advance.

7 TRAINING

7.1 It shall be provided 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.

7.3 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.) shall be provided.

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 The detailed training program shall be submiiter with 2 (two) weeks in advance, with 2 (two) flash drive copies of the Brazilian Portuguese training course.

7.7 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 Warranty for all AFDS components, even for equipment or device furnished by others, shall be 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.

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.

10 QUANTITY OF DEVICES

10.1 The quantities and location of detectors and AMIs shall be according to SAFETY DATA SHEET document.

10.2 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.

10.3 The type and areas of detectors and AMIs shall be according to SAFETY DATA SHEET document.

10.4 The quantity of components per loop and their type shall be defined during Detalining Engineering Design.