	<b>TECHNICAL SPECIFICATION</b>		Nº: I-ET-3010.2D-1200-800-P4X-001
	CLIENT:	AGUP	SHEET: 1 of 13
	JOB:	HIGH CAPACITY FPSO - GAS EXPORTATION ALL ELECTRIC	
	AREA:	ATAPU 2 AND SÉPIA 2	
SRGE	<b>TITLE: INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS</b>		INTERNAL
			ESUP

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### INDEX OF REVISIONS

REV.	DESCRIPTION AND/OR REVISED SHEETS
0	ORIGINAL ISSUE
A	REVISED WHERE INDICATED

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E	REV. F	REV. G	REV. H
DATE	MAR/24/22	AUG/05/22							
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EXECUTION	U44D	U44D							
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### SUMMARY

- 1 INTRODUCTION ..... 3**
  - 1.1 Object ..... 3
  - 1.2 Definitions ..... 3
  - 1.3 Abbreviations ..... 3
- 2 REFERENCE DOCUMENTS, CODES AND STANDARDS ..... 3**
  - 2.1 External References ..... 3
  - 2.2 Internal Documents ..... 4
- 3 ENVIRONMENTAL AND OPERATING CONDITIONS ..... 6**
  - 3.1 General ..... 6
  - 3.2 Installation Environment ..... 7
  - 3.3 Electromagnetic Interference Sources ..... 7
  - 3.4 Vibration ..... 8
  - 3.5 Mechanical Shocks ..... 8
  - 3.6 Storage ..... 8
  - 3.7 Available Power Supply ..... 9
  - 3.8 Available Instrument Air Supply ..... 9
- 4 TECHNICAL REQUIREMENTS ..... 9**
  - 4.1 Identification Criteria ..... 9
  - 4.2 Transmission and Control Signals ..... 9
- 5 TESTS REQUIREMENTS ..... 10**
  - 5.1 General ..... 10
  - 5.2 Ambient Air Temperature ..... 10
  - 5.3 Humidity ..... 10
  - 5.4 Salt Mist ..... 10
  - 5.5 Electromagnetic Compatibility ..... 11
  - 5.6 Vibration ..... 11
  - 5.7 Power Supply Variations ..... 11
  - 5.8 Insulation Resistance ..... 12
  - 5.9 Inclinations ..... 12
- 6 ADDITIONAL LOGIC REQUIREMENTS ..... 12**
  - 6.1 Transmitters ..... 12
  - 6.2 Override of process sensors ..... 13

	<b>TECHNICAL SPECIFICATION</b>	Nº: I-ET-3010.2D-1200-800-P4X-001	REV. A
	AREA: ATAPU 2 AND SÉPIA 2	SHEET 3 of 13	
	TITLE: <b>INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS</b>	INTERNAL ESUP	

## 1 INTRODUCTION

### 1.1 Object

1.1.1 This document establishes the Instrumentation and Automation Additional Technical Requirements for the UNIT.

1.1.2 These requirements are general information related to all systems or refer to subjects that are not defined in other documents and some are remarks that shall be considered at detailed design phase.

### 1.2 Definitions

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

### 1.3 Abbreviations

The following abbreviations are used in this document:

AEPR	Automation & Electrical Panels Room
CSS	Control Safety System
ESD	Emergency Shutdown
HART	Highway Addressable Remote Transducer
IP	Ingress Protection Ratings
SOS	Supervision and operation System

## 2 REFERENCE DOCUMENTS, CODES AND STANDARDS

### 2.1 External References


2.1.1 International Codes, Recommended Practices and Standards


#### ASTM - AMERICAN SOCIETY FOR TESTING AND MATERIALS


ASTM	G21	STANDARD PRACTICE FOR DETERMINING RESISTANCE OF SYNTHETIC POLYMERIC MATERIALS TO FUNGI
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#### IEC - INTERNATIONAL ELECTRO TECHNICAL COMMISSION

IEC	60068	ENVIRONMENTAL TESTING – ALL PARTS
IEC	60079	EXPLOSIVE ATMOSPHERES – ALL PARTS
IEC	60092-504	ELECTRICAL INSTALLATIONS IN SHIPS - PART 504: AUTOMATION, CONTROL AND INSTRUMENTATION
IEC	60529	DEGREES OF PROTECTION PROVIDED BY ENCLOSURES (IP CODE)
IEC	60533	ELECTRICAL AND ELECTRONIC INSTALLATIONS IN SHIPS - ELECTROMAGNETIC COMPATIBILITY (EMC) – SHIP WITH A METALLIC HULL
IEC	61000	ELECTROMAGNETIC COMPATIBILITY (EMC) – ALL PARTS
IEC	61086	COATINGS FOR LOADED PRINTED WIRE BOARDS

	<b>TECHNICAL SPECIFICATION</b>		Nº: I-ET-3010.2D-1200-800-P4X-001	REV. A	
	AREA: ATAPU 2 AND SÉPIA 2			SHEET 4 of 13	
	TITLE: <b>INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS</b>			INTERNAL	
			ESUP		
IEC	61892	(CONFORMAL COATINGS) – ALL PARTS MOBILE AND FIXED OFFSHORE UNITS -ELECTRICAL INSTALLATIONS – ALL PARTS			
IEC	CISPR-16	SPECIFICATION FOR RADIO DISTURBANCE AND IMMUNITY MEASURING APPARATUS AND METHODS – ALL PARTS			
<b>INMETRO – INSTITUTO NACIONAL DE METROLOGIA, NORMALIZAÇÃO E QUALIDADE INDUSTRIAL</b>					
PORTARIA Nº 115 (21/MARÇO/2022)		REQUISITOS DE AVALIAÇÃO DA CONFORMIDADE PARA EQUIPAMENTOS ELÉTRICOS PARA ATMOSFERAS EXPLOSIVAS - CONSOLIDADO.			
2.1.2 Classification Society					
The detailed design shall be submitted to approval by Classification Society. The design and installation shall take into account their requirements and comments.					
<b>2.2 Internal Documents</b>					
2.2.1 Project Specification					
I-ET-3010.00-1200-800-P4X-013		GENERAL CRITERIA FOR INSTRUMENTATION PROJECTS			
I-ET-3010.00-1352-130-P4X-001		FLOOR GRATINGS, TRAY SYSTEMS AND GUARDRAILS MADE OF COMPOSITE MATERIALS			
I-ET-3000.00-1200-940-P4X-001		TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN			
I-ET-3010.00-5140-700-P4X-001		SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS			
I-ET-3010.00-5140-700-P4X-009		GENERAL REQUIREMENTS FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS			
I-ET-3010.00-5140-700-P4X-003		ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS			
I-ET-3010.00-5520-861-P4X-001		CONTROL AND SAFETY SYSTEM – CSS			
I-ET-3010.00-5520-861-P4X-002		SUPERVISION AND OPERATION SYSTEM – SOS			
I-ET-3010.00-5520-888-P4X-001		AUTOMATION PANELS			
I-ET-3010.00-5515-762-PPT-002		GMDSS AND OPERATIONAL RADIO SYSTEMS			
I-ET-3010.00-5512-762-PPT-002		LTE TRANSMISSION SYSTEM			
I-ET-3010.2D-1200-800-P4X-005		FIELD INSTRUMENTATION			
I-RL-3010.2D-1200-940-P4X-001		GENERAL SPECIFICATION FOR AVAILABLE UTILITIES			


	<b>TECHNICAL SPECIFICATION</b>	Nº: I-ET-3010.2D-1200-800-P4X-001	REV. A
	AREA: ATAPU 2 AND SÉPIA 2	SHEET 5 of 13	
	TITLE: <b>INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS</b>	INTERNAL	
		ESUP	
I-RL-3010.2D-1350-960-P4X-002      MOTION ANALYSIS DR-ENGP-M-I-1.3                      SAFETY ENGINEERING GUIDELINE			

	<b>TECHNICAL SPECIFICATION</b>	Nº: I-ET-3010.2D-1200-800-P4X-001	REV. A
	AREA: ATAPU 2 AND SÉPIA 2	SHEET 6 of 13	
	<b>TITLE: INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS</b>	INTERNAL ESUP	

### 3 ENVIRONMENTAL AND OPERATING CONDITIONS

#### 3.1 General

- 3.1.1 All equipment and instrumentation devices shall be suitable to withstand the dynamics loads imposed by wave motions during tow and on location. For a detailed evaluation of maximum expected motions and accelerations during transit and operational conditions, see I-RL-3010.2D-1350-960-P4X-002 – MOTION ANALYSIS.
- 3.1.2 All equipment and their components, instruments shall be suitable for service and storage under tropical conditions of high temperature, high humidity, and heavy rainfalls and resistant against mold and fungus.
- 3.1.3 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 manufacturers' experiences and related rules, aiming to provide a robust and reliable construction.
- 3.1.4 All electrical/electronic instruments and equipment located in hazardous areas shall be according to IEC 60079 and IEC 61892-7 standards.
- 3.1.5 Electrical equipment installed in external areas, that shall be kept operating during emergency shutdown ESD-3P and ESD-3T shall be certified for, at least, installation in hazardous areas Zone 2 Group IIA temperature T3.
- 3.1.6 All instruments, junction box, panels, materials and equipment proper to be used in hazardous areas, shall have conformity certificates complying with PORTARIA INMETRO Nº 115, published in 21/Mar/2022 (or the one that succeeds it) and shall be approved by Classification Society. The certificate file names shall be in accordance with the requirements defined in I-ET-3010.00-5140-700-P4X-001 - SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS.
- 3.1.7 All materials used shall be non-hygroscopic, flame retardant and resistant to corrosion caused by marine environmental and hydrocarbon continuous contact and they shall be in accordance with the Classification Society requirements.
- 3.1.8 All equipment, panels and instrumentation devices shall be suitable to be installed at the following minimum environmental and operating conditions described in item 3.2.

	<b>TECHNICAL SPECIFICATION</b>	Nº: I-ET-3010.2D-1200-800-P4X-001	REV. A
	AREA: ATAPU 2 AND SÉPIA 2	SHEET 7 of 13	
	TITLE: <b>INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS</b>	INTERNAL ESUP	

## 3.2 Installation Environment

### 3.2.1 Indoors Equipment

#### 3.2.1.1 Air-conditioned area

- Operational Temperature: 24 °C (± 1%, normal situations)/40°C (emergency situations);
- Maximum Temperature 45 °C (room)/70 °C (panel) (See note);
- Relative Air Humidity: 50% (± 5%);
- Salinity: 1 mg of NaCl/m<sup>3</sup> of air.

**NOTE:** In emergency situations, the room temperature will operate normally at 35°C and may reach up to 45°C. Inside Panels and other equipment, however, air temperature may reach 70°C. Therefore, all equipment, including Panels, and their internal components shall be designed to withstand room temperature of 45°C and air temperature inside them of 70°C without reduction of equipment's life expectancy and without operational interruptions.

#### 3.2.1.2 Not air-conditioned area

- Maximum Temperature: 45 °C (ambient air)/70 °C (panel)
- Minimum Temperature: 4 °C;
- Max. Rel. Air Humidity: 100%;
- Min. Rel. Air Humidity: 30%;
- Salinity: 1 mg of NaCl/m<sup>3</sup> of air.

### 3.2.2 Outdoors equipment


#### 3.2.2.1 Operating conditions

- Temperature: 4 °C to 45 °C;
- Relative Air Humidity: 100%;
- Salinity: 1 mg of NaCl/m<sup>3</sup> of air;
- Altitude above sea level: 30 m (ship deck).

## 3.3 Electromagnetic Interference Sources

- UHF, VHF and SHF;
- Portable Radios, according to I-ET-3010.00-5515-762-PPT-002;
- LTE System, according to I-ET-3010.00-5512-762-PPT-002.

All equipment, panels and instrumentation devices shall comply with the standards series IEC 61000.

	<b>TECHNICAL SPECIFICATION</b>	Nº: I-ET-3010.2D-1200-800-P4X-001	REV. A
	AREA:	ATAPU 2 AND SÉPIA 2	
	TITLE:	<b>INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS</b>	SHEET 8 of 13
			INTERNAL
			ESUP

### 3.4 Vibration

#### 3.4.1 Vibration Sources

- Diesel generator;
- Centrifugal and reciprocating machines;
- Valves operating under cavitation;
- Cranes;
- Helicopters;
- Platform structure.

#### 3.4.2 Vibration Characteristics

##### 3.4.2.1 Eventual

- Frequency: 5 Hz to 10 Hz;
- Period: 30 s to 1 min;
- Amplitude: ±1.0 mm.

##### 3.4.2.2 Continuous:

- Frequency: 10 Hz to 200 Hz;
- Period: Continuous;
- Acceleration: 1.5 g.

### 3.5 Mechanical Shocks

#### 3.5.1 Shock Sources

- Transportation;
- Operation.


#### 3.5.2 Characteristics:

- Acceleration: 5 g (peak);
- Duration: Less than 10 ms;
- Frequency: Maximum of 2/s.

### 3.6 Storage

- Maximum Temperature: 60 °C;
- Minimum Temperature: 0 °C;
- Max. Rel. Air Humidity: 90%;
- Min. Rel. Air Humidity: 40%.



	<b>TECHNICAL SPECIFICATION</b>	Nº: I-ET-3010.2D-1200-800-P4X-001	REV. A
	AREA: ATAPU 2 AND SÉPIA 2	SHEET 9 of 13	
	TITLE: <b>INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS</b>	INTERNAL ESUP	

### 3.7 Available Power Supply

- 3.7.1 For instrumentation and automation equipment, available power supply is defined in technical specification I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS. The different power supplies inside the panel shall be converted and distributed, including where necessary an AC/DC stabilized power supply unit for the cabinet internal distribution of 24 Vdc. For further details, see I-ET-3010.00-5520-888-P4X-001 – AUTOMATION PANELS
- 3.7.2 Electrical equipment shall be capable of withstanding transient voltage variations. For further details refer to I-ET-3010.00-5140-700-P4X-009 - GENERAL REQUIREMENTS FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS.
- 3.7.3 For Package Units, other power supplies will be available, depending on the specific system requirements. For details see I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE UNITS;

### 3.8 Available Instrument Air Supply

For details about specifications for air quality, see I-RL-3010.2D-1200-940-P4X-001 – GENERAL SPECIFICATION FOR AVAILABLE UTILITIES

## 4 TECHNICAL REQUIREMENTS

### 4.1 Identification Criteria

- 4.1.1 Refer to I-ET-3000.00-1200-940-P4X-001 – TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN.

### 4.2 Transmission and Control Signals

#### 4.2.1 Pneumatic Instrumentation

- 20 to 100 kPa (0.2 to 1.0 bar). Also 40 to 200 kPa (0.4 to 2.0 bar) is allowed for the control valves, whenever necessary.

#### 4.2.2 Electronic Instrumentation

- 4 – 20 mA plus digital communication with HART protocol, certified by the HART FOUNDATION.

#### 4.2.3 Thermocouples

- Output signal in the range of millivolts (mV).

## 5 TESTS REQUIREMENTS

### 5.1 General

5.1.1 Control, safety and monitoring equipment and devices (power supplies, workstations, microcomputers, data servers, communication cards, controllers, I/O racks and network devices, among others) shall be designed to operate satisfactorily under the environmental conditions stipulated by the Classification Society and project documents.

### 5.2 Ambient Air Temperature

5.2.1 For proper test classification, the following locations are foreseen:

- a) Machinery spaces and AEPR;
- b) Indoor panels, racks and consoles installed in AEPR;
- c) Pump rooms;
- d) Open deck (such as: Topsides area, Main deck, etc.) and inside panels, racks or consoles installed in Open deck and Pump rooms.

**Table 1 – Ambient air temperature by Location**

Location	Range of Temperature
(a)	+ 0 °C to + 55 °C
(b)	+ 0 °C to + 70 °C
(c)	- 25 °C to + 55 °C
(d)	- 25 °C to + 70 °C

### 5.3 Humidity

- a) Location to avoid condensation: relative humidity up to 96% at all relevant temperatures;
- b) General: relative humidity up to 100% at all relevant temperatures.

5.3.1 In order to comply with the ambient air temperature and humidity requirements described above, the equipment/devices shall be tested in accordance with I-ET-3010.00-5140-700-P4X-009 – GENERAL REQUIREMENTS FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS.

### 5.4 Salt Mist

5.4.1 The applicable salt-contamination atmosphere is to be 1 mg/m<sup>3</sup> of air, at all relevant temperatures and humidity conditions. In order to comply with this salt mist requirement, the equipment shall be subjected to specific test severity in accordance with IEC 60092-504. The test procedure shall be in accordance with IEC 60068-2-52 Test Kb.

## 5.5 Electromagnetic Compatibility

5.5.1 Electronic equipment shall be designed to operate properly under conducted and radiated disturbance levels and shall not affect the operation of any other equipment or system. The equipment shall be subject to the specific type tests procedures and severity listed in Table 3.

**Table 3 – Type tests for electromagnetic compatibility approval**

Test	Procedure	Severity
Electrostatic discharge	IEC 61000-4-2 level 3 severity standard	IEC 60092-504
Electromagnetic field	IEC 61000-4-3 level 3 severity standard	
Conducted radio frequency interference	IEC 61000-4-6 level 2 severity standard	
Conducted fast transients (burst)	IEC 61000-4-4 level 3 severity standard	
Conducted slow transients (surge)	IEC 61000-4-5 level 2 severity standard	
Radiated emissions	IEC CISPR 16-1; CISPR 16-2	
Conducted emissions	IEC CISPR 16-1; CISPR 16-2	

## 5.6 Vibration

5.6.1 The vibration levels are those indicated in IEC 60092-504. The test procedure shall be in accordance with IEC 60068-2-6 Test Fc.


## 5.7 Power Supply Variations

5.7.1 All Panels, Instruments and any other equipment shall be designed and manufactured such that they are capable of operating satisfactorily under the variations of voltage, frequency and harmonic distortion of the power supply. For further details refer to I-ET-3010.00-5140-700-P4X-009 – GENERAL REQUIREMENTS FOR ELECTRICAL MATERIAL AND EQUIPMENTS FOR OFFSHORE UNITS.

5.7.2 In order to guarantee the properly operation under these severe power supply conditions, the equipment shall be tested to the type tests procedures and severity listed below:

### 5.7.3 Power Supply Failure

5.7.3.1 The test conditions for power supply failure are those indicated in IEC 60092-504 and the test procedure shall be in accordance with IEC 61000-4-11.

	<b>TECHNICAL SPECIFICATION</b>	Nº: I-ET-3010.2D-1200-800-P4X-001	REV. A
	AREA: ATAPU 2 AND SÉPIA 2	SHEET 12 of 13	
	<b>TITLE: INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS</b>	INTERNAL ESUP	

#### 5.7.4 Power Supply Variations

5.7.5 The test conditions for power supply variations shall be in accordance with I-ET-3010.00-5140-700-P4X-009 – GENERAL REQUIREMENTS FOR ELECTRICAL MATERIAL AND EQUIPMENTS FOR OFFSHORE UNITS.

5.7.5.1 The test procedure for power supply variations shall be in accordance with IEC 61000-4-11.

#### 5.7.6 Conducted Low Frequency Interference (harmonics)

5.7.6.1 The test conditions for harmonic distortion are those indicated in IEC 60092-504 and the test procedure shall be in accordance with IEC 60533.

### 5.8 Insulation Resistance

5.8.1 The insulation resistance applicable to electrical and electronic equipment is those indicated in IEC 60092-504.

### 5.9 Inclinations


5.9.1 The functional tests are performed at the rated operational voltage. The severities shall be in accordance with IEC 60092-504. The testing conditions are the following ones:

- Static test:
  - Inclination to the vertical at an angle of at least 22.5°, then inclination to at least 22.5° on the other side of the vertical and in the same plane;
  - Inclination to the vertical at an angle of at least 22.5° in plane at right angle to the one used previously, then inclination to at least 22.5° on the other side of the vertical and in the same plane;
- Dynamic test:
  - The equipment is to be rolled to an angle of 22.5° each side of the vertical with a period of 10 s;
  - The test in each direction is to be carried out for not less than 15 min.

## 6 ADDITIONAL LOGIC REQUIREMENTS

### 6.1 Transmitters

6.1.1 Whenever an equipment has two transmitters operating in parallel, one connected to PCS and the other to PSD, a logic shall be implemented in the SOS comparing the measurement informed by both instruments. If the informed values differ from each other above an adjustable percentage value (this percentage value shall be defined during detailed design for each instrument), this shall be flagged in a report. An alarm shall not be generated.

	<b>TECHNICAL SPECIFICATION</b>	Nº: I-ET-3010.2D-1200-800-P4X-001	REV. A
	AREA: ATAPU 2 AND SÉPIA 2	SHEET 13 of 13	
	TITLE: <b>INSTRUMENTATION ADDITIONAL TECHNICAL REQUIREMENTS</b>	INTERNAL ESUP	

## 6.2 Override of process sensors

- 6.2.1 The following override logic is valid only for process sensors only. For Fire and Gas Detectors override refer to DR-ENGP-M-I-1.3 – SAFETY ENGINEERING GUIDELINE.
- 6.2.2 For voting groups where, at least one instrument is in failure, the override command to instruments that are in normal operation shall be available only after all instruments in failure have been overridden.