
	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 2 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL
			OI/CS

INDEX

1. SUBJECT.....	3
2. ABBREVIATIONS.....	3
3. REFERENCE DOCUMENTS, CODES AND STANDARDS.....	4
4. GENERAL REQUIREMENTS	5
5. SYSTEM DEFINITIONS.....	10
6. TECHNICAL REQUIREMENTS.....	14
7. SCOPE OF SUPPLY	20
8. DIMENSIONING CRITERIA.....	21
9. COMMISSIONING.....	26


	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 3 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

1. SUBJECT

- 1.1 The subject of this document is to establish the criteria and basic characteristics for the detailed design, supply and installation of Public Address and General Alarm System (PAGA) that shall be installed in TOPSIDE PETROBRAS FPSO Unit.
- 1.2 The PAGA System is intended to provide, with prioritized selective diffusion of public announcements, calls, alarms and warning messages by sound transducers network suitably distributed around the TOPSIDE PETROBRAS FPSO Unit, which includes enclosed areas and external areas in the Topside modules. The Hull areas are out of this scope of this technical specification, but the HULL provider shall prepare the interface boxes outside of Accommodation Modules and nearby to Pipe rack Module to connect the HULL PAGA SYSTEM to the TOPSIDE PAGA SYSTEM.
- 1.3 The connections from TOPSIDE PAGA SYSTEM to HULL PAGA SYSTEM in the interface boxes is scope of this Technical Specification.

2. ABBREVIATIONS

ABNT	Associação Brasileira de Normas Técnicas (Brazilian Association of Technical Standards)
ACU	Alarm Control Unit (Console)
AFT	Ceiling Loudspeaker
AMP	Audio Amplifier
CA	Alarms Command Switch (Abandon, Emergency And Reset)
CAC	Acoustic Box
CDI	Intercommunication Distributor Box
CIT	Public Address Central Station
CJE	Electrical Junction Box
CJS	Connection Box
COR	Acoustic Horn
CTA	Alarms Tone Generator
DGI	General Intercommunication Distributor
DPC	Departamento de Portos e Costas (Department of Ports and Coasts)
AC	Access Control
EPR	Ethyl-Propylene Rubber
FAI	Power Supply for Public Address Station
GT	Tests Tone Generator
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
INMETRO	Instituto Nacional de Metrologia (National Institute of Metrology)
ISO	International Organization for Standardization
LSE	Emergency Lamp
LSZH	Low Smoke Zero Halogen
MA	Amplification Monitor
MCT	Multi Cable Transit


	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 4 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

MDF	Main Distribution Board
NORMAN	Normas da Autoridade Marítima (Maritime Authority Standards)
NR	Regulatory Standard
PAGA	Public Address and General Alarm System
SOLAS	Safety Of Life At Sea
TP	Priority Microphone
UAM	Access Unit
XLPE	Crosslinked Polyethylene

3. REFERENCE DOCUMENTS, CODES AND STANDARDS

3.1 The detail design shall be made, at least, in accordance with requirements of those International and National Standards listed below:

- ABNT NBR 5410 – Instalações Elétricas de Baixa Tensão
- NR-10 – Segurança em Instalações e Serviços em Eletricidade
- NR-37 – Segurança e Saúde em Plataformas de Petróleo
- INMETRO/Portaria nº 115, March 21st 2022 and its annexes
- DPC/NORMAM 1 – Normas da Autoridade Marítima para Embarcações Empregadas na Navegação em Mar Aberto
- IEC 61892 – Mobile and fixed offshore units – Electrical installations – All Parts
- IEC 60079 – Explosive Atmospheres – All Parts
- IEC 60092 – Electrical installations in ships – All Parts
- IEC 60331 – Fire-resisting characteristics of electric cables
- IEC 60332 – Flame-retardant characteristics of electric cables
- IEC 62444 – Cable glands for electrical installations
- IEC 60228 – Conductors of insulated cables
- IEC 60529 – Degrees of Protection Provided by Enclosures (IP Code)
- IEC 60268-16:2011 - Objective rating of speech intelligibility by speech transmission index
- IMO/LSA-Code – International Lifesaving appliance Code (MSC.48(66))
- IMO/SOLAS Consolidated Edition 2014, or later
- IMO – A 26/Res.1021 – 2009 – Code on Alerts and Indicators
- ISO 9613-1 - Acoustics - Attenuation of sound during propagation outdoors - Calculation of the absorption of sound by the atmosphere
- ISO 9613-2 - Acoustics - Attenuation of sound during propagation outdoors - General method of calculation
- ISO 17534-1 - Acoustics — Software for the calculation of sound outdoors - Part 1: Quality requirements and quality assurance

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 5 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

u. ISO 17534-2 - Acoustics — Software for the calculation of sound outdoors - Part 2: General recommendations for test cases and quality assurance interface

v. ISO/TR 17534-3 - Acoustics — Software for the calculation of sound outdoors — Part 3: Recommendations for quality assured implementation of ISO 9613-2 in software according to ISO 17534-1

3.2 Electrical installations, equipment and materials shall comply with the requirements of IEC 60079, IEC 61892-1, IEC 61892-7 and Classification Society.

3.3 All equipment, installations and materials shall be of type approved and certified by international recognized laboratory and shall be in accordance with INMETRO Portaria nº 115, March 21st 2022 and its annexes.

3.4 In addition, it shall be followed all other NR's – Normas Regulamentadoras (Regulatory Standards) the Ministério do Trabalho (Ministry of Labor) applicable to this Technical Specification.

3.5 Classification Society

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

4. GENERAL REQUIREMENTS


4.1 CONTRACTOR shall provide all the materials to install all equipment, accessories, cables and infrastructure that compose the TOPSIDE Public Address and General Alarm System (PAGA).

4.2 For PETROBRAS detailed design requirements, Installation, Configuration, Tests training and Commissioning CONTRACTOR shall be complied with the DESCRIPTIVE MEMORANDUM I-MD-3010.00-5510-760-PPT-001 – GENERAL CRITERIA FOR TELECOMMUNICATIONS DESIGN.

4.3 For telecommunications symbols, the Detailed Design shall comply with the Technical Specification: I-ET-3000.00-0000-940-P4X-002 – SYMBOLS FOR PRODUCTION UNITS DESIGN.


4.4 For telecommunications TAGs, the Detailed Design shall comply with the Technical Specification: I-ET-3000.00-1200-940-P4X-001 – TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN.

4.5 All electrical requirements for telecom package shall be in accordance with I-ET-3010.00-5140-700-P4X-003 – ELETRICAL REQUIREMENTS FOR PACKAGES FOR OFFSHORE, I-ET-3010.00-5140-700-P4X-001 - SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS, I-DE-3010.00-5140-700-P4X-003 - GROUNDING INSTALLATION TYPICAL DETAILS and I-ET-3010.00-5140-700-

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 6 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

P4X-005 - REQUIREMENTS FOR HUMAN ENGINEERING DESIGN FOR ELECTRICAL SYSTEMS OF OFFSHORE UNITS.

- 4.6 The HULL scope provider will be responsible to install the Central Station (CIT) to the Public Address and General Alarm System (PAGA) Systems, composed by System A and System B.
- 4.7 The TOPSIDE Public Address and General Alarm System (PAGA) Network shall be duplicated for System A and System B and connected to the respective HULL Public Address and General Alarm System (PAGA) through interface interconnection boxes (CDI).
- 4.8 The equipment and accessories shall attend the ingress protection degree, protection type, classifications zone and groups established by IEC / ABNT.
- 4.9 CONTRACTOR shall supply all equipment, cables and accessories with TYPE APPROVAL certificated by Classifying Society and technical conformity with the International and National standardization organism: ABNT, IEC and INMETRO.
- 4.10 All equipment, cables, accessories shall have Classification Society TYPE APPROVAL.
- 4.11 The Access Control shall generate public announcements.
- 4.12 PAGA interface junction box: It shall be provided by HULL supply scope and it will extend the PAGA Systems (System A and System B) facilities to Topsides modules.
 - a. The Hull PAGA systems A and B amplifiers audio lines will be terminated in the interface box located on the main deck of the unit, in place that will be defined during the detailed design, to connect the TOPSIDE sound transducers distribution network.
 - b. It shall be foreseen interface boxes located on the main deck of the FPSO, in place that will be defined during the detailed design, to connect the Emergency Signaling Lamps (LSE) lines from PAGA System to Topsides LSE Network.
 - c. It will be foreseen interface boxes located on the main deck of the FPSO, in place that will be defined during the detailed design to connect the ACCESS UNIT lines and audio lines from PAGA system to the Topsides ACCESS UNIT network and sound transducers distribution network.
- 4.13 Equipment and accessories installed in outdoor or industrial areas shall be suitably rugged and their external bodies shall be made in non-metallic material, suitable for harsh environments and in accordance with IEC and ABNT standards, apart from the ones whose classification area require to be metallic as Ex-d junction boxes.
- 4.14 Brackets, bolts, nuts, washers and any other mechanical fixing elements shall be made in stainless steel.

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 7 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

4.15 In case of difficulty for supplying some accessory with external body made with non-metallic materials, it will be necessary to submit them for analysis and approval of PETROBRAS.

4.16 It shall be avoided equipment and accessories with their external bodies built in aluminum alloy. Anything different shall be submitted to PETROBRAS approval. In case of approval, this alloy shall not contain in its composition more than 0.25 % of copper and shall comply with the ASTM-B-179 standard (ANSI alloy 356.1).

4.17 The equipment and accessories shall attend the classifications zone and groups established by IEC / ABNT.

4.18 The equipment and materials shall be supplied packed suitable for long periods of storage and be protected against mechanical impact and adverse weather conditions.

4.19 Equipment and materials shall be supplied and installed with all threads, hinges, bolts, cover plugs, cable glands and flanges lubricated with anti-seize (loctite) or similar grease.

4.20 Equipment and materials shall be supplied with cable passage holes sealed with plastic plugs in the holes to be used and definitive plugs (made of the same material as the equipment and accessories) in the spare holes.

4.21 In outdoor areas, exposed to marine atmosphere, CONTRACTOR shall avoid the galvanic corrosion of junction boxes supports, horns supports and bolts. Galvanic insulation shall be implemented wherever contact between different metallic materials is needed.


4.22 The designer shall make arrangements for avoid acoustic feedback from loudspeakers/sound transducers through microphones/transmitter cartridges, that can produce whistle and other undesirables' noises in system.

4.23 The Public Address System designer shall take actions to avoid acoustic feedback which generates undesirable noises (whistle by acoustic coupling between microphone and sound transducers) and guarantee the audibility and intelligibility of messages.

4.24 Electrical equipment installed in external (open) safe areas, foreseen to operating during emergency shutdown ESD-3 shall be certified for installation in hazardous areas Zone 2 Group IIA temperature T3,

4.25 Detailed engineering of design shall be render feasible through strategic installation of components, so as to minimize the number of connections and thus optimize costs of materials and/or work to be done.

4.26 Detailed design of TOPSIDE PAGA System shall be performed in such a manner as to permit the maximum number of facilities (equipment, cables, accessories) to be installed during construction of PETROBRAS FPSO Unit at Job Site (on shore).

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 8 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

4.27 Equipment shall have casing or enclosure grounded. Grounding by simply supporting the casing on the steel structure of the FPSO shall not be deemed adequate.

4.28 Equipment, cables, boxes, materials and accessories for installation in the industrial areas (outdoor or indoor) of unit shall be specified and assembled taking into account the adverse operating conditions on FPSO such as:

- Atmosphere with high content of humidity, salts hydrocarbons and other corrosive factors;
- Environment subject to the presence of explosive gases shall be in accordance with Hazardous area classification;
- Exposure to weather conditions (sun and rain) and maritime atmosphere;
- Air temperature: From -10°C up to +50°C;
- Air Humidity: 95%

4.29 A free space of, at least, 01 (one) meter wide shall be left between the front of the connection boxes and any other structure or piece of equipment, in order to facilitate servicing.

4.30 Equipment and accessories shall be specified, built and assembled using non-combustible, non-corrosive and mechanically rigid materials.

4.31 The equipment and Intercommunication Distribution Boxes (CDI) for industrial areas shall be built in such a manner that, after installation, the rear face is spaced away from the wall support.


4.32 All equipment of the PAGA System, located in external and in industrial areas, shall be installed under conditions whereby there is always a floor below them so as to provide protection and easy access for maintenance.

4.33 It shall be taken as parameter for the height of the sound transducers between 2.20 and 2.50 meters from its level/deck floor, to also facilitate the servicing.

4.34 Launch down of cables shall constitute the following criteria:

- Horizontal runs, at intervals of less than 2 (two) meters;
- Vertical runs, at intervals of less than 1 (one) meter;
- Curves, at the ends only (beginnings and end) for the cables.

4.35 The Intercommunication Distribution Boxes shall be installed in such a way that their geometrical center is 1.30 meters above floor level, and in places where there is free access, never in locations where might be closed at any time. It shall also be positioned so that doors open preferably to the leftward side and, in no case, upwards.


	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 9 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

- 4.36 When designing an Intercommunication Distribution Boxes, its size and shape should be chosen taking into account the devices it will house and what else may be added in future (20% spare), in order to enable easy maintenance even after future expansion.
- 4.37 Intercommunication Distribution Boxes shall not be installed in areas where they would be exposed to the weather. If, in fact, that installation is necessary, boxes suitable for the purpose and built with necessary Ingress Protection degree shall be used.
- 4.38 In order to avoid humidity and water ingress inside the junction boxes, CONTRACTOR shall apply appropriate material in the screw thread, bolts, cable glands, cover plugs and joints according to IEC 60079 standard.
- 4.39 When drilling holes in Intercommunication Distribution Boxes for incoming and outgoing cables by means of cable glands, care shall be taken to refrain from drilling more holes than it is necessary and, if in fact this may occur, the extra holes shall be closed with plugs.
- 4.40 The PAGA distribution boxes shall have the cable glands installed facing lateral sides and/or bottom side. Cable glands installed facing upward are not acceptable. It is also not acceptable any opening facing the upward of the box, even if it is closed by cover plug.
- 4.41 All grounding bus bars shall be of tin-plated copper and painted with green strips.
- 4.42 Connections to the grounding network for equipment and boxes shall be made by means of bolted.
- 4.43 The terminals installed in the Distribution Boxes shall be SAK type or similar as shown in Figure 1A, as reference. In these terminal blocks the conductors shall be separated by separation plate as shown in Figure 1B as reference.



Figure 1A: Screw Connection Terminal Block Figure 1B: SAK type separation plate.

- 4.44 CONTRACTOR must do all derivation of cable inside of any peripheral device such as Access Unit, Acoustic Horns, Ceiling Loudspeakers, Acoustic Boxes and others.

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 10 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS


- 4.45 The derivation also could be done inside of the Junction Boxes and Intercommunication Distribution Boxes.
- 4.46 Acoustic booths and hoods shall be installed with the front side acoustically protected against the main source of noise (which accounts for the greater portion of the ambient noise).
- 4.47 ACCESS UNIT installed in harsh environments shall be suitable for the respective environmental conditions.
- 4.48 Desk type ACCESS UNIT shall be used only in offices and panel room.
- 4.49 Wall type ACCESS UNIT shall be installed with their center of gravity placed about 1.50 m above the floor.
- 4.50 ACCESS UNIT and LSE shall be identified with a visible plate (in Brazilian Portuguese).
- 4.51 In the Acoustic Horns at indoor or outdoor areas, all cable glands shall be installed facing to the bottom direction. Cable glands installed facing upward are not acceptable.
- 4.52 In each diving areas it shall be foreseen the installation of an Intercommunication Distribution Box (CDI) for each PAGA System (A and B) in order to prepare to connect the PAGA systems to the Diving Container.
- 4.53 CONTRACTOR shall ensure by inspection of a qualified personnel that all equipment installations are according to the IEC/ABNT standards requested in this technical specification.

5. SYSTEM DEFINITIONS

- 5.1 The FPSO UNIT will have a fully duplicated PAGA system, consisting of 02 (two) identical sub-systems designated "A" and "B", which will be operated as independent systems, such that failure of one system do not affect the operation of the other.
- 5.2 The designing, supplying and installation of each rack set (subsystem "A" and "B") will be scope of the HULL provider.
- 5.3 In case of failure of one of systems, the other system still shall be able to sound all areas in the FPSO unit TOPSIDE.

5.4 PUBLIC ADDRESS SYSTEM

This system comprises the equipment, supplies and accessories duly arranged for the acoustic distribution of communications. The system may be broken down into the following functional components:

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 11 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS


5.4.1. Communication Service Lines (Audio Lines)

This service comprises the audio outputs circuits, consisting of peripheral and central equipment, cables and electronic modules for generating, equalizing levels and frequencies, control, monitoring, control of auxiliary functions and layout of the priority services pertaining to the PAGA System.

5.4.2. Sound Transducers Distribution Network

- a. The sound transducer network shall be arranged as ring/loop wired configurations for prevent a failure for a single cable break because this will not inhibit operation to all loudspeakers.
- b. The audio output circuits (Audio Lines) consisting of central and peripheral equipment (sound processing units and accessories), for selective acoustic distribution of communications.
- c. The PAGA System will be capable of supporting the operation of 02 (two) different sub-networks of sound transducers, operating as sound transducers distribution networks at 100 Volts lines.
- d. The schedule defining the areas covered by Alarm/Operational Calls will be delivered to CONTRACTOR during detailed engineering design phase.
- e. For the optimization of cable trays and routes it can be done the loop in-out of the cable in the same cable tray of the same system for inner areas of Modules: cable tray dedicated for PAGA-A and cable tray dedicated for PAGA-B. For outer Modules areas, the return loop cable shall be run to different routes as far as possible to each other.
- f. The audio loop return lines shall be designed so that no long paths without any transducer or junction box installed is provided. It shall be taken into account the feasibility of installation and maintenance of long paths to better define how long this path can be. Such detail design shall be submitted to PETROBRAS approval.

5.4.3. The following figure, only for reference, is a schematic drawing of the PAGA System.

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 12 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

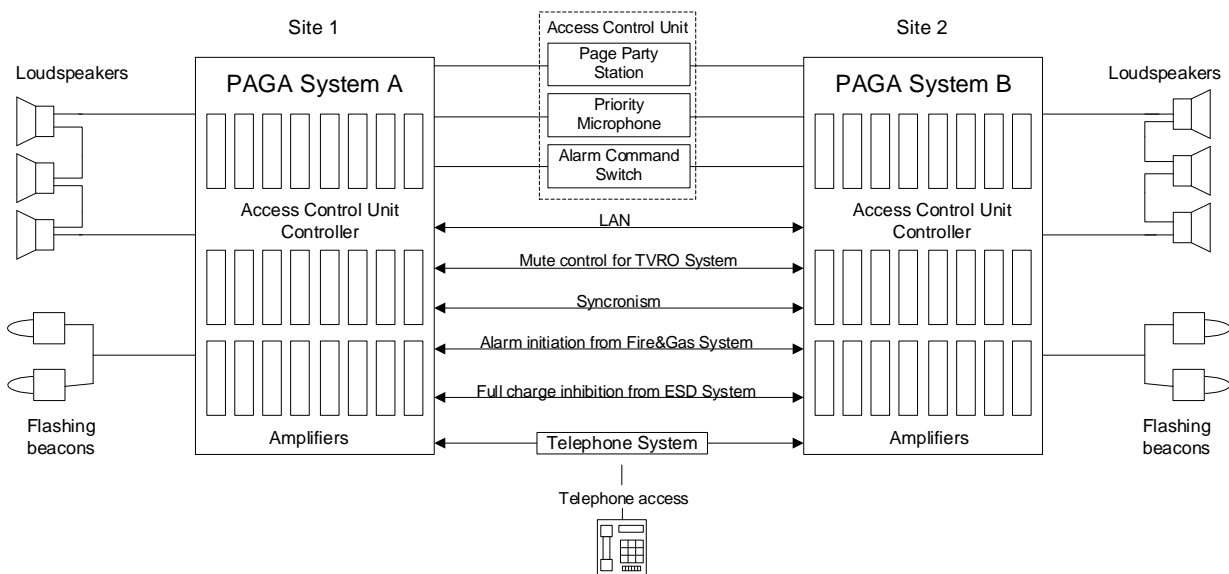



Figure 2: Schematic drawing of the PAGA System


5.5 ACCESS UNIT (AU)

- 5.5.1. Peripheral equipment located at strategic places, featuring button that provides public announcements.
- 5.5.2. Access Unit shall be provided strategically located at electrical panels rooms and operator room.
- 5.5.3. The Access Unit is commonly called page-party station, but with no conversation features among them.

5.6 SOUND TRANSDUCERS

- 5.6.1. Peripheral equipment that permits release of power sound messages around the FPSO Unit, from amplifiers and that may consist of an Acoustic Boxes, Ceiling Loudspeakers or Acoustic Horns.
- 5.6.2. The sound transducers shall be supplied with a “line transformer” installed internally, coupling them with the distribution line, with taps for audio power adjustment to be done only by the maintenance personnel.
- 5.6.3. Sound transducers Input line: 100V
- 5.6.4. By changing taps of “line transformer” shall be possible to do the power adjustment and obtain the suitable hearing of audio messages in ambient.

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 13 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS
<p>5.7 INTERCOMMUNICATION DISTRIBUTION BOX (CDI)</p> <p>This is the intermediate distributor box or panel, used for the distribution of the interconnections of the GENERAL INTERCOMMUNICATION DISTRIBUTOR (DGI) with the PAGE PARTY STATION, and the sound transducers networks.</p> <p>5.8 ELECTRICAL JUNCTION BOX (CJE)</p> <p>This is the intermediate distributor box or panel, used for the distribution of the interconnections of the PAGA CENTRAL UNIT (CIT) with EMERGENCY SIGNALING LAMP networks.</p> <p>5.9 TERMINAL BLOCKS</p> <p>5.9.1. Blocks for connecting electrical conductors of Access Unit and sound transducers networks and sub-networks installed in General Intercommunication Distributor and Intercommunication Distributor Box.</p> <p>5.9.2. The terminal blocks shall be arranged so as to facilitate differentiation between the circuits of the respective networks.</p> <p>5.10 CABLE GLANDS</p> <p>5.10.1. Devices used for mechanical attachment of the electric cables to the distribution boxes or panels providing for the use of such units.</p> <p>5.11 COVER PLUGS</p> <p>5.11.1. Devices used for mechanical cover of the not used or spare openings in the distribution boxes or panels.</p> <p>5.12 EMERGENCY SIGNALING LAMP</p> <p>5.12.1. Lamps used together or not with the sound transducers in areas where are high surrounding noise level. Lamps indicate, "Emergency" or "Prepare to Abandon" warnings of danger shall be in green color and flashing or strobe type.</p> <p>5.13 MULTI CABLE TRANSIT</p> <p>5.13.1. The characteristics of these devices shall be in accordance with areas where they will be installed. The supplier shall present Certificates of Conformity to attend requirements, such as:</p> <ul style="list-style-type: none"> a. Protection against fire, smoke, gas, water, vibration or noise; b. To be models suitable for installation in Hazardous Areas (potentially explosive areas). 			

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 14 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

5.14 INTERCONNECTIONS NETWORK – HULL & TOPSIDES MODULES

- 5.14.1. Intercommunication Distribution Boxes for each system (“A” and “B”) shall be installed by HULL provider in different places at the external area of UNIT for interface with the Main Deck, Topside, each Module and each crane of PAGA networks of systems “A” and “B”.
- 5.14.2. In each Module shall be installed, by Module Supplier, 02 (two) Intercommunication Distribution Boxes, as far as possible each other, connected to internal sound transducers networks (System “A” and System “B”).
- 5.14.3. The interconnection of Hull Intercommunication Distribution Boxes with modules, cranes Intercommunication Distribution Boxes shall be done by CONTRACTOR. So, it will be gotten the Intercommunication and the Sound Coverage, with system “A” and system “B”, all over the whole Unit (Hull and all Topside Modules).
- 5.14.4. CONTRACTOR shall install and connect one PAGA cable from PAGA junction boxes at main deck to each crane PAGA junction box or straight to slip ring inside crane.

6. TECHNICAL REQUIREMENTS

- 6.1 CONTRACTOR shall assure that all sound transducers supports for fixing them, shall have azimuthal adjustable facilities, as illustrated below:

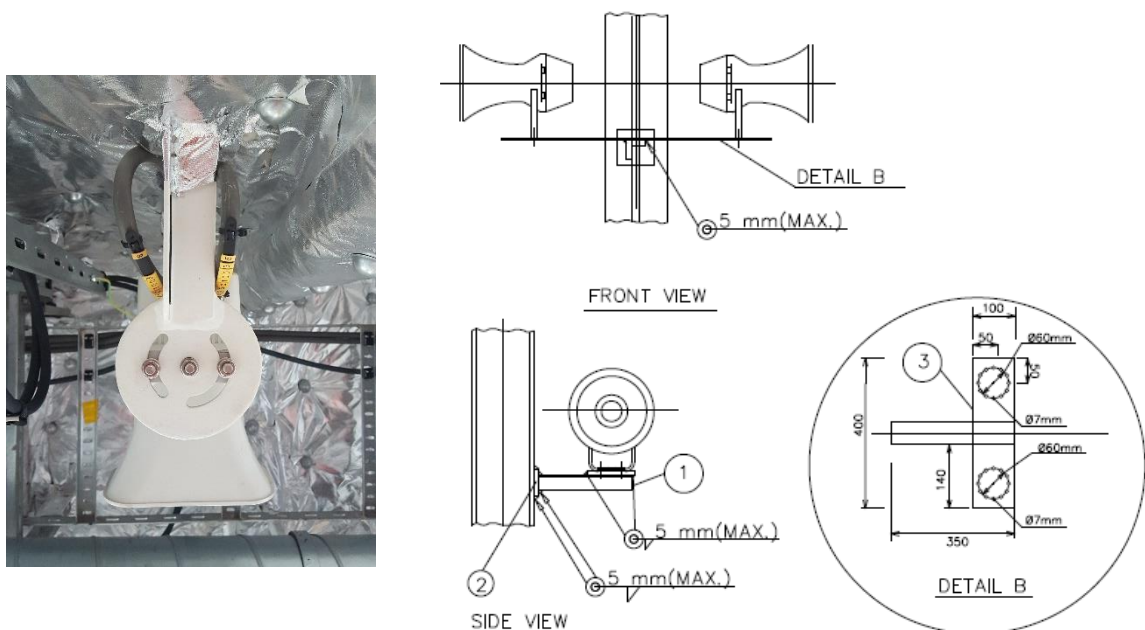



Figure 3: Horn support examples

- 6.2 Audible signals in high noise areas shall be supplemented with visual signals.

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 15 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

- 6.3 The Emergency Signaling Lamps (LSE) shall be used together with the loudspeakers in areas where the surrounding noise level exceeds 90 dB(A).
- 6.4 The Emergency Signaling Lamps shall indicate “Emergency” or “Prepare to Abandon” warning of danger shall be in green color, strobe or flashlight type.
- 6.5 CONTRACTOR shall identify the rooms and spaces that will have audible notification and those where audible notification will not be enough to overcome the surrounding noise and will be necessary signaling lamps.
- 6.6 Characteristic of Classification Areas and Environmental Conditions

HAZARDOUS AREAS (potentially explosive areas) Zones and groups attending the standards defined by IEC and ABNT	Areas exposed to weather and/or harsh environments	ACCESS UNIT	Certified (In protection box)
		LSE, COR, CDI, Cable Gland, cover plug	Certified (Minimum Protection Level: IP-66)
	Areas not exposed to weather and/or harsh environments	ACCESS UNIT, CDI, LSE, COR, Cable Gland, cover plug	Certified (Minimum Protection Level: IP-55)
NON HAZARDOUS AREAS		ACCESS UNIT	Certified (In protection box)
	Areas exposed to weather and/or harsh environments	CDI, LSE, COR, Cable Gland, cover plug	Certified (Minimum Protection Level: IP-66)
	Areas not exposed to weather and/or harsh environments	ACCESS UNIT, CDI, LSE, COR, CAC, AFT, Cable Gland, cover plug	Uncertified (Minimum Protection Level: IP-44)


Table 1: Characteristic of Classification Areas and Environmental Conditions

6.7 Sound Transducer Characteristics

6.7.1. Acoustic

a. Acoustic Horns (COR):

- Sensitivity to 1 kHz / 1 watt / 1 meter > 105 dBA
- Angle of spreading (horizontal & vertical) > 60 degrees
- Suitably rugged and with its external bodies made in non-metallic materials

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 16 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

b. Acoustic Boxes (CAC) and Ceiling Loudspeakers (AFT):

- Sensitivity to 1 kHz / 1 watt / 1 meter > 90 dBA
- Angle of spreading (horizontal & vertical) > 60 degrees

6.7.2. Frequency Responses

- Acoustic Horns (COR) Better than 300 to 7,000 Hz; +/- 20 dB
- Acoustic Boxes (CAC) Better than 400 to 8,000 Hz; +/- 10 dB
- Ceiling Loudspeakers (AFT) Better than 400 to 8,000 Hz; +/- 10 dB
- Other equipment > 200 to 10,000 Hz; +/- 3 dB

6.7.3. Electrical Impedance

- Input Transformer 70/100 volts audio lines
- Output Transformer 8 / 20 ohms

6.7.4. Access Units electrical features:


- Power Supply 24 VDC from power supply (FAI);
- Maximum harmonic distortion 10%
- Frequency response 300 to 5,000 Hz, within + 3 dB
- Operating temperature From -10 °C to +50 °C
- Maximum relative air humidity 95%
- Cabinet with "PTT" button for public announcements
- Handset with spiral cable and microphone couplet
- The transmitter microphone cartridge shall be a noise canceling type

6.8 Protection Box

6.8.1. The "Protection Box" is used to shelter a "Access Unit" in harsh environments areas; its main function is offer a protection against mechanical attacks; it can be considered an additional function, to protect the "Access Unit" against damage due to excessive saline atmospheres.

6.8.2. The enclosure has a main body with a front door supported by hinges; the front door is kept closed by means of a quick release latch.

6.8.3. By closing the front door, it cannot squeeze the spiral cable of "Access Unit" handset.

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 17 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

6.8.4. The "Protection Box" is constructed of "non-metallic" materials (fiberglass, reinforced plastic).

6.8.5. Protection level: according to Detailed Design and typical details.

6.9 Emergency Signaling Lamps (LSE)

• Operational temperature	-55°C to +65°C
• Material	corrosion-free GRP
• Lens colour	green
• Mounting	wall mounted via bracket
• Light power	10 Joules
• Type	Flash light or strobe
• Operating modes	flashing light or strobe light
• Flash rate (max.)	1Hz

6.10 CABLES AND OTHER EQUIPMENT REQUIREMENTS

6.10.1. To ensure proper operation of the PAGA System, care shall be taken to maintain public address cables far from energy cables to prevent against electrical noise or others undesirable interference. Crossings, if any, shall be arranged at right angles.


6.10.2. For cables incoming and outgoing the PAGA Systems equipment rack, shall be sealed with cable passive fire stop systems to prevent the spread of flames out of the rack in case there is fire inside it.



Figure 4: Physical Barrier example

6.10.3. For cables crossing between external and internal area, which would make use of MCT, it shall be sealed with rubber stoppers so as prevent the passage of gases between different compartments.

6.10.4. All cables shall be suitable for installation in cable trays, conduits or ducting and subject to exposed to rainfall liquid hydrocarbon splashing, maritime atmosphere and exposition to sunshine (UV Resistant).

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 18 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

- 6.10.5. Cables shall have no curves in their routing tighter than the limit values specified by the manufacturers.
- 6.10.6. Cables shall have no splices at any point of their run.
- 6.10.7. Armored cables shall be used only in areas, in which there is considerable probability of accident by mechanical attack and its armor shall be properly grounded.
- 6.10.8. Cables and conductors shall be identified at the both ends by means of tags, made with suitable material for each place.
- 6.10.9. Cables shall be terminated in cable glands classified in accordance with the equipment they will be attached to. When equipment is not suited to the use of cable clamps, the cables shall have their ends terminated with sweated-on sleeves or self-melting tape.
- 6.10.10. Cables shall have its outer sheaths in orange color.
- 6.10.11. All incoming and outgoing cables in the boxes shall be installed using cable glands, for all cases, only through the lower or laterally sides. It will be not accepted cable glands or cover plugs facing to the upside of the boxes.
- 6.10.12. The interface boxes shall be tagged with a stainless steel plate fixed in its front door by bolt or other suitable material to fix it.
- 6.10.13. The acoustic horns shall be tagged with a stainless steel plane fixed in its supports with bolts or other suitable material to fix it. As the example in Figure 5.

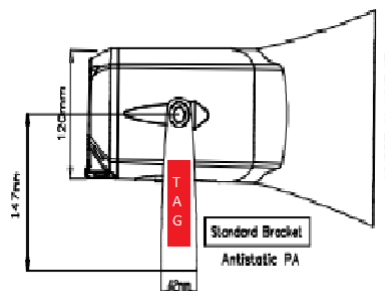



Figure 5: Example of Acoustic Horn Tagging

- 6.10.14. The other devices of the PAGA System shall be tagged in its bodies or in structures close to these devices by bolts or other suitable material to fix it. In case of the tag fixed in structure close to the device the distance between both shall not exceed 20 mm.
- 6.10.15. Cable shall be flexible type (Class 2) complying with the applicable existing standards.

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 19 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

6.10.16. For PAGA cables it will accept the use of Class 2 Cable, obeying the same criteria used by the Electrical and Automation disciplines listed in item 5.13.3 (Constructive training) of I-ET-3010.00-5140-700-P4X-002 (SPECIFICATION FOR ELECTRICAL MATERIAL AND EQUIPMENT FOR OFFSHORE UNITS).

6.10.17. The cables shall contain insulation in ethyl-propylene rubber (EPR) or Crosslinked Polyethylene (XLPE) for use in industrial areas and halogen-free rubber / Low Smoke Zero Halogen (LSZH) for internal and industrial cables installed in panels and lodging areas, with good thermal characteristics, ozone and corona effects resistant, in addition to withstanding the following temperature conditions:

- a. A maximum of 85°C in continuous operations (damp or dry places);
- b. 130°C under emergency over-load conditions;
- c. 200°C under short-circuit conditions;
- d. Twisting Pairs: each pair of cables shall be twisted with an adequate pitch winding.

6.10.18. Outer sheath insulation (protective cover) type shall be SHF1 or SHF2 accordance to IEC 60092-360 and IEC 61892-4.

6.10.19. Network Cabling


a. The cables used on equipment interconnection shall attend the criteria bellow:

- i. Minimum cross section cables: 1.00 mm²
- ii. Voltage drop in "audio circuits" (at AC): < 10 %
- iii. Voltage drop in "DC" circuits: < 5 %

b. The cableway of the System A and of the System B shall run for two different routes, as far as possible, avoiding them crossing.

6.10.20. Other requirements in according with Classifying Society

- a. Cables for circuits that shall operate under fire conditions, such as those installed in topsides Process areas, and cables crossing machinery space category A, as defined by SOLAS, shall be certified for circuit integrity under fire conditions, according to IEC60331. CONTRACTOR shall attend this requirement without additional costs to PETROBRAS. The Classifying Society shall supply a list with the places or one document of rules to be followed by CONTRACTOR, where will show these requirements.
- b. CONTRACTOR shall submit the detailed design with the cables list for approval by the PETROBRAS and Classifying Society.

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 20 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

7. SCOPE OF SUPPLY

7.1 CONTRACTOR shall be responsible to realize, at least, all activities of the Scope of Work below:

7.1.1. It shall provide for PETROBRAS, the detailed design documentation of Module, Arrangement design, Classification risk area map and noise level map, for all levels of the Module.

7.1.2. It shall consider all requirements of this system received from PETROBRAS.

7.1.3. It shall install all internal infrastructures in Module for this system as required by PETROBRAS technical specification, considering all requirements necessities of cable trays, Multi-cable transits, mounting brackets and the peripheral attachment points, including all materials and accessories for the correct mounting.

7.1.4. It shall run and fix all cables of the system that shall be supplied according to the detailed design of Module.

7.1.5. It shall install in the Module all equipment, materials and accessories that compose the system according to Detailed Design and this Technical Specification.

7.1.6. It shall elaborate the Detailed Design of sounding for all areas of Topside and Modules, including the Sounding Calculation report, drawings (One line diagram and arrangements), typical details of installation (infrastructure, equipment, boxes, cables and other components of the system), cable lists, equipment list and other documents necessities for the development of design. For more details and directives of project consider this technical specification.

7.1.7. It shall install in the Topside Modules the equipment, materials and accessories necessary for integration between the system of each structure mentioned above and the Hull System, which compose the system according to Detailed Design and this Technical Specification. The quantity and type shall be defined during the detailed design.


7.1.8. It shall test and certify all the whole system installed.

7.2 CONTRACTOR shall be responsible to supply all items of the Scope of Materials bellow.

7.2.1. It shall be supplied all cables in the Modules according to detailed design and typical details issued by CONTRACTOR.

7.2.2. It shall be provided all Cables that will be used in the Topside for integration between Hull and Modules System. The cables type and quantities shall be confirmed in the Telecommunications Cable List, to be done in the detailed design.

7.2.3. It shall be provided all internal infrastructures in each Module for this system as required by the Detailed Design approved by PETROBRAS, considering all requirements necessities as cable trays, Multi-cable transits, mounting brackets

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 21 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

and the peripheral attachment points, including all materials and accessories for the correct mounting.

7.2.4. It shall be provided all equipment, materials and accessories in the Module that compose the system according to Detailed Design and this Technical Specification.

7.2.5. It shall be provided all infrastructures required for integration between the HULL system and the System on each Module and Main Deck. Including cables trays, Multi-cables transits, mounting brackets, cables, boxes and other materials necessities for the complete integration and operation of the systems.

7.2.6. CONTRACTOR shall provide in each Module all the equipment, materials and accessories needful to execute the integration activities of these systems and the Hull System according to Detailed Design and this Technical Specification. The quantity and type shall be defined during the detailed design.

7.3 SOUND TRANSDUCERS (AFT, CAC and COR)

7.3.1. Peripheral equipment that permits release of power sound messages around the FPSO Unit, from AMPs and that may consist of an Acoustic Boxes (CAC), Ceiling Loudspeakers (AFT) or Acoustic Horns (COR).

7.3.2. The final number of each type of loudspeakers shall be defined though a SPL calculation memory report issued by CONTRACTOR during the detailed design using the software described in this technical specification.

7.3.3. The minimum number of loudspeakers to be supplied by CONTRACTOR shall be as defined in basic design one line diagram and arrangement drawings from Topsides.


8. DIMENSIONING CRITERIA

8.1 CONTRACTOR shall submit the Sounding Calculation Report to analysis and approval by PETROBRAS and Classifying Society.

8.2 Modeling methodology

8.2.1. CONTRACTOR shall use the noise computation method, with an Acoustic Engineering software, to calculate, presentation, assessment and prediction of environmental noise and sound traducers noises results, for example: **EASE** – Enhanced Acoustic Simulator for Engineers, **CadnaA** (Computer Aided Noise Abatement), **CadnaR** or **SoundPLAN** softwares.

8.2.2. In addition, this software will be based on the general noise propagation theory of point sources including reflection, screening and diffuse effects.

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 22 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

8.2.3. The Predictive acoustic modeling of the unit shall involve determining the acoustic impact of each significant source and combining these individual impacts to determine the overall sound emissions. The modeling procedure accounts for the sound emission level, frequency spectrum, location, height and radiation directivity of the noise source.

8.2.4. Once noise source identification and selection it shall be performed, calculation of noise over the FPSO Unit shall be conducted according to noise propagation theory taking into account environment industrial plant geometrical design and equipment accommodation. This noise calculation includes the following items:


- Effect of reflecting surfaces;
- Screening effects;
- Diffusion effects;
- Effect of atmospheric attenuation;
- Absorption effects.

8.3 The sounding design shall be presented in 05 (five) conceptual parts as defined:

- Sound gradient for high noise environments;
- Description of sounding calculation for ambient to be sounded;
- Electrical and mechanical features for the equipment;
- Sound transducers distribution network;
- Configuration for Central Sounding System.

8.4 CONTRACTOR shall be responsible by the Sounding Calculation Description that shall be elaborated according to specific ISO Standards, taking into consideration, at least, the following criteria:

- Open ambient and closed ambient;
- Gradients for sound noise levels foreseen in the ambient;
- Areas of required sound coverage;
- Minimum intelligibility of 85%;
- Signal / Noise (S/N) ratio within 10 up to 25 dB;
- Time of reverberation (RT60) calculated taking into account the dimensions and absorption factor for materials in the ambient.
- In emergency alarms the minimum sound pressure level in indoor environments, such as corridors, offices and entertainment rooms and in outdoor environments is 80dBA, with a minimum signal-to-noise ratio of 10 dB.
- The minimum sound pressure level in emergency alarms in cabins and cabin bathrooms must be 75 dBA, with a signal-to-noise ratio of 10 dBA.

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 23 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

- i. The minimum indoor sound pressure level for voice announcements must be 75 dBA, with a margin of at least 20 dB above the speech interference level.
- j. The minimum sound pressure level for voice announcements in outdoor environments must be 80 dBA, with a margin of at least 15 dB above the speech interference level.

8.5 However, if the ambient noise levels reach exceedingly high levels — greater than 90 dB — then attempting to present a signal with sufficient level to overcome the ambient noise level will likely decrease the intelligibility of the message.

8.5.1. The total sound pressure level produced by combining the ambient sound pressure level with all audible notification appliances operating shall not exceed 110 dB(A) at the minimum hearing distance.

8.6 Within the set of documents that make up the Sounding Design it shall be provided in the arrangement plants the noise level gradients for all areas to be covered by the PAGA System.

8.6.1. Surrounding noise mapping modeling

CONTRACTOR shall calculate the noise map considering the FPSO Unit equipment noise only, without any loudspeaker of the PAGA System noise contribution, like an example illustrated on the figure below, which noise interval range used in heat map color must be 3dB minimum.

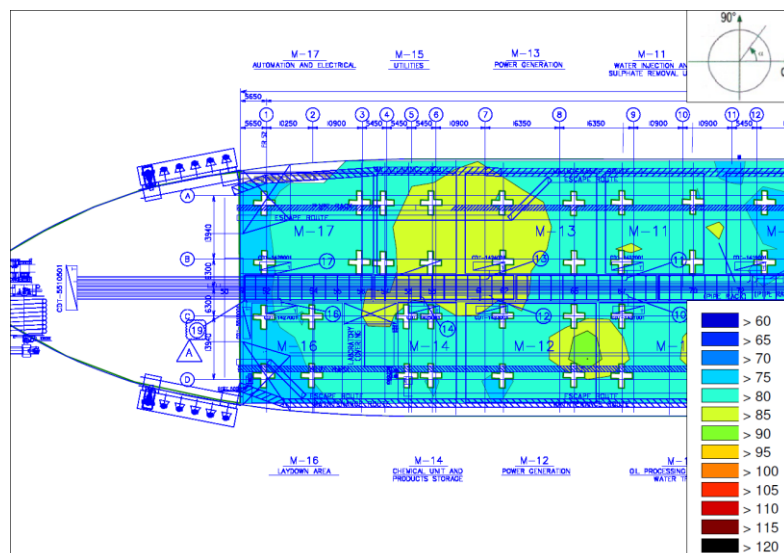


Figure 6: Example of FPSO Noise Mapping

8.6.2. PAGA loudspeakers noise mapping

CONTRACTOR shall calculate the noise map considering the FPSO Unit PAGA loudspeakers only as example below.

TECHNICAL SPECIFICATION		Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
AREA:		SHEET: 24 of 26	
TITLE:		INTERNAL	
TOPSIDES PUBLIC ADDRESS SYSTEM		OI/CS	

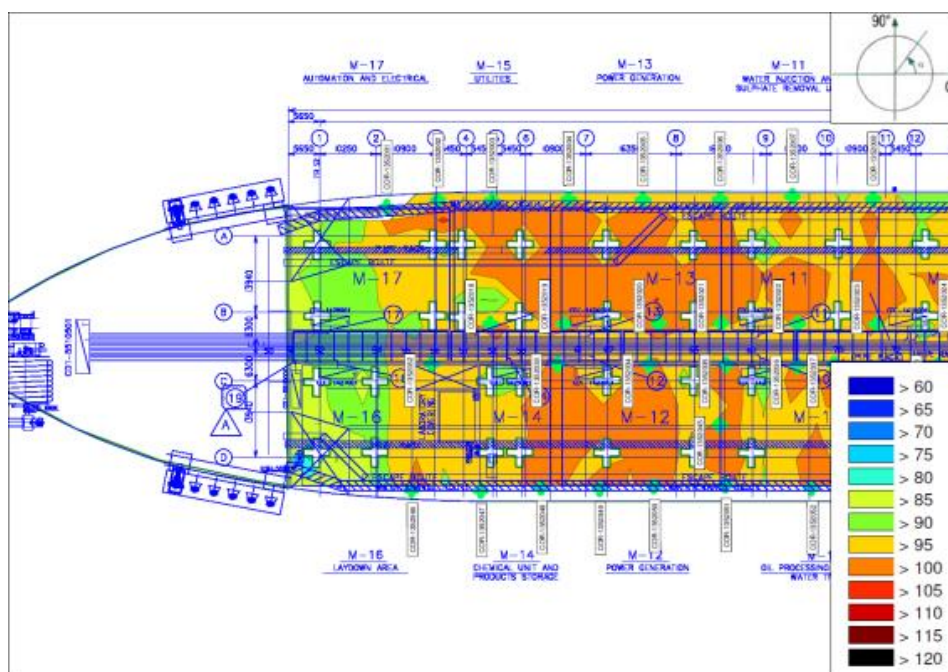


Figure 7: Example of PAGA loudspeakers Sound Mapping

8.6.3. Signal-to-noise ratio

The signal-to-noise ratio on the FPSO Unit Module (difference of surround pressure levels and without PAGA loudspeakers) shall be given with PAGA loudspeakers.

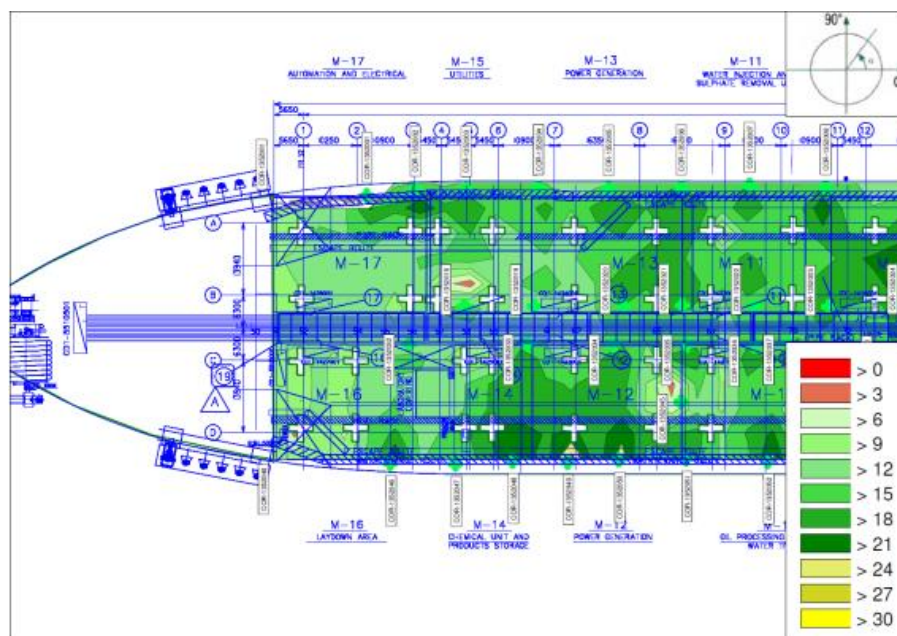


Figure 8: Example of Signal-to-Noise Mapping

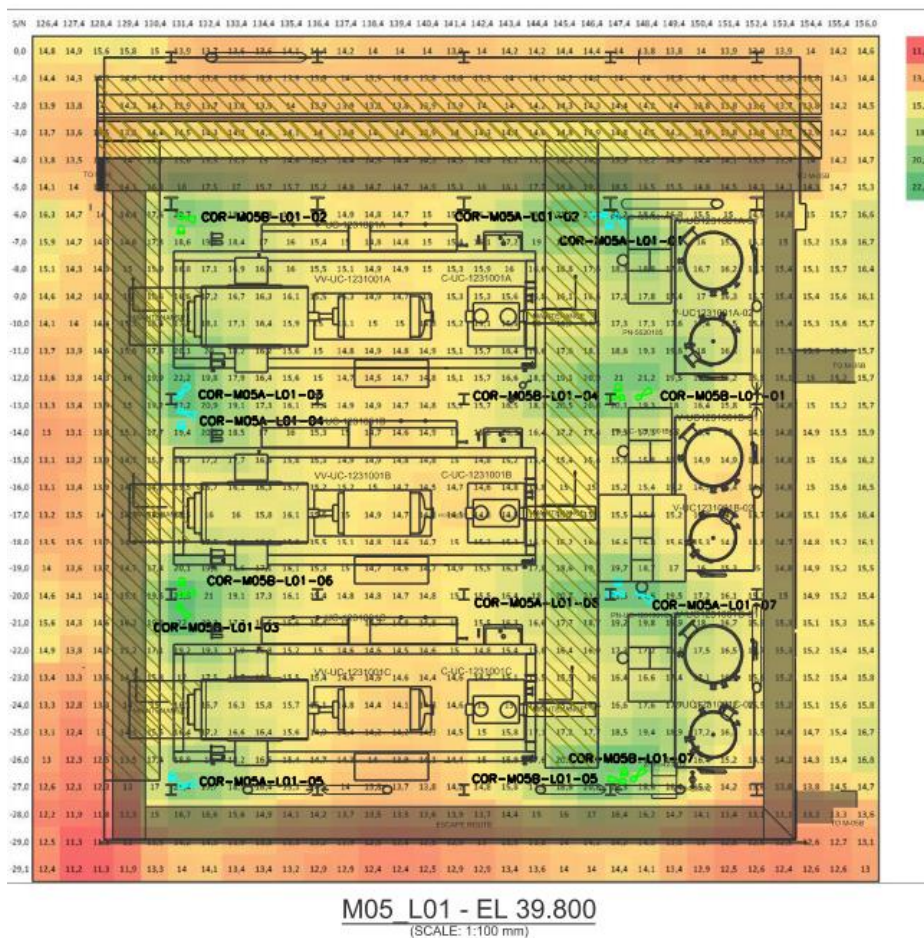



Figure 9: Example of Signal-to-Noise Mapping in a Module

8.6.4. Summary Table Results

- a. Addition to previous maps, technical information shall be presented on a summary table for the calculation of the required electrical powers, defining the density of sound transducer distribution, parameters and technical criterion attributed.
- b. CONTRACTOR, after the Acceptance Performance Test (TAP), shall schedule with PETRORAS and the Classifying Society a new test onboard where shall be verified the audibility of alarms and speech messages for final approval of the PAGA System. If necessary, adjustments and increase of the equipment and accessories to obtain the final approval, it shall be done by CONTRACTOR without costs to PETROBRAS.

8.7 Electrical cable gauge

- 8.7.1. It shall be taken into account the voltage drop for long path cables so that the proper cable gauge can be calculated. One line diagram can be used as reference, but final dimensioning shall be calculated and presented for approval.
- 8.7.2. Final acceptance success is scope of CONTRACTOR.

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5518-767-PPT-002	REV. B
	AREA:	-	SHEET: 26 of 26
	TITLE:	TOPSIDES PUBLIC ADDRESS SYSTEM	INTERNAL OI/CS

9. COMMISSIONING

- 9.1 Before commissioning activities, CONTRACTOR shall measure impedance and power from each amplifier line towards each PAGA junction box and from each PAGA line inside each junction box towards field transducers.
- 9.2 Such measurement shall be done by calibrated digital power/impedance meter and decibel meter (like the ones from Manufacturer NTI-Audio) and reported by tables so that measured values can be compared to predicted values from calculation report.
- 9.3 All PAGA sub networks divided by areas and audio lines shall be ended so general audio measurements can be tested by calibrated audio meter devices.
- 9.4 PAGA-A and PAGA-B shall be commissioned individually.
- 9.5 For TAP-1, it will be possible to run test procedures for individual amplifiers lines that cover specific areas to be combined with Petrobras like engine room, accommodation, main deck and forecastle.
- 9.6 For Topsides modules it will be required that all PAGA transducers of each system A or B to be installed, per test procedures and per audio line, once on such areas the signal from neighborhood transducers reinforces the local measurement.
- 9.7 It shall be attended speech intelligibility in announcements as per IEC 60268-16 all over the Unit. Any specific instrument shall be used in order to confirm such intelligibility.
- 9.8 As a matter of general acceptance, it shall be considered capacity and autonomy tests for battery banks and chargers done; alarm and announcement tests done; triggered alarm from CSS System done; intelligibility of alarms and announcements successes reached; PABX interface test and remote access from Corporative Network successfully done.