

	TECHNICAL SPECIFICATION	Nº: I-ET-3010.00-5517-768-PPT-002
	CLIENT: SRGE	SHEET: 1 of 29
	JOB: TELECOMMUNICATION DATA	
	AREA: -	
TIC	TITLE: HULL STRUCTURED CABLING NETWORK	INTERNAL OI/CS

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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 STRUCTURED CABLING AND OPTICAL DATA NETWORK (LAN) that shall be installed in PETROBRAS FPSO Unit.
- 1.2 It is basically a Local Structured Cabling Network - CAT 6 Multimedia with resources of UTP cables and optical fibers to attend required areas, interconnect equipment and devices, to extend to some external areas and to allow the interface with Topsides for:
- a. Corporative voice and data communications (RIC);
 - b. Industrial automation communications (RAI);
 - c. Corporative and Entertainment IPTV;
 - d. Industrial WLAN;
 - e. CCTV.

2. ABBREVIATIONS

ABNT	Associação Brasileira de Normas Técnicas (Brazilian Association of Technical Standards)
ANSI	American National Standards Institute
CP	WLAN Controller
DIO	Optical Internal Distributor
ECD	Data Communications Equipment
EIA	Electronic Industries Alliance
FO	Optic Fiber
FW	Firewall
GK	Access Media Gateway / Gatekeeper
IEC	International Electrotechnical Commission
IMP	Printer
INMETRO	Instituto Nacional de Metrologia (National Institute of Metrology)
IP	Ingress Protection
ISO	International Organization for Standardization
ITU	International Telecommunication Union
MCO	Microcomputer (Workstation)
NBR	Brazilian Standard
NR	Regulatory Standard
OTDR	Optical Time-Domain Reflectometer
OW	WAN Optimizator
PA	WLAN Access Point
PDD	Data Distributor Panel
PoE	Power Over Ethernet
PP	Patch Panel
ROT	Router
SVR	Server
SW	Layer 2 Switch
SW	Layer 3 Switch
TIA	Telecommunications Industry Association
TMD	Data Plug Socket

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3. REFERENCE DOCUMENTS, CODES AND STANDARDS

- 3.1 The detailed design shall be made, at least, in accordance with requirements of those International and National Standards listed below:
- a. ABNT NBR 5410 – Instalações Elétricas de Baixa Tensão;
 - b. ABNT NBR 14565 – Cabeamento de telecomunicações para edifícios comerciais;
 - c. ANSI/TIA-568.0-D: Generic Telecommunications Cabling for Customer Premises.
 - d. ANSI/EIA/TIA 568-B2-1 – Commercial Building Telecommunications Cabling Standard;
 - e. ANSI/EIA/TIA 568-C.2 – Balanced Twisted-Pair Cabling Components;
 - f. ANSI/TIA-568.3-D – Optical Fiber Cabling Components Standard
 - g. IEC 61892 – Mobile and fixed offshore units – Electrical installations – All Parts;
 - h. IEC 60079 – Explosive Atmospheres – All Parts;
 - i. IEC 60092 – Electrical installations in ships – All Parts;
 - j. IEC 60331 – Fire-resisting characteristics of electric cables;
 - k. IEC 60332 – Flame-retardant characteristics of electric cables;
 - l. IEC 62444 – Cable glands for electrical installations;
 - m. IEC 60228 – Conductors of insulated cables;
 - n. IEC 60529 – IP Protection Degree – All Parts;
 - o. ITU-T G651 - Series G: Transmission systems and media, digital systems and networks;
 - p. ISO/IEC 11801 – Information Technology – Generic cabling for customer premises;
 - q. ISO/IEC 14763 - part 3 Information technology - Implementation and operation of customer premises cabling;
 - r. INMETRO/Portaria nº 115, March 21st 2022 and its annexes;
 - s. NR-10 – Segurança em Instalações e Serviços em Eletricidade;
 - t. NR-37 – Segurança e Saúde em Plataformas de Petróleo.
- 3.2 Electrical installations, equipment and materials shall comply with the requirements of IEC 60079, 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 It shall be observed all Normas Regulamentadoras (NR's) – MINISTÉRIO DO TRABALHO applicable for this Technical Specification.

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4. GENERAL REQUIREMENTS

- 4.1 CONTRACTOR shall provide all the materials to install all equipment, accessories, cables and infrastructure that compose the STRUCTURED CABLING AND OPTICAL DATA NETWORK (LAN).
- 4.2 For PETROBRAS detailed project requirements, Installation, Configuration, Tests training and commissioning CONTRACTOR shall comply with the Technical Specification I-ET-3010.00-5510-760-PPT-002 - BASIC CRITERIA FOR TELECOM 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 For telecommunications infrastructure materials, accessories, cable trays, cable ladders, the Detailed Design shall comply with all electrical requirements for telecom package and shall be in accordance with I-ET-3010.00-5140-700-P4X-003 – ELECTRICAL 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-P4X-005 - REQUIREMENTS FOR HUMAN ENGINEERING DESIGN FOR ELECTRICAL SYSTEMS OF OFFSHORE UNITS.
- 4.6 CONTRACTOR shall provide all the materials to install all equipment, accessories, cables and infrastructure that compose the STRUCTURED CABLING AND OPTICAL DATA NETWORK (LAN).
- 4.7 The equipment and accessories shall attend the ingress protection degree, protection type, classifications zone and groups established by IEC / ABNT.
- 4.8 CONTRACTOR shall supply all equipment, cables, accessories and its must be approved and certificated by Classifying Society and technical conformity with the International and National standardization organism: ABNT, IEC and INMETRO.
- 4.9 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.
- 4.10 Brackets, bolts, nuts, washers and any other mechanical fixing elements shall be made in stainless steel.

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- 4.11 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.
- 4.12 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).
- 4.13 The equipment and materials shall be supplied packed suitable for long periods of storage and be protected against mechanical impact and adverse weather conditions.
- 4.14 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.
- 4.15 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 reserve holes.
- 4.16 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.
- 4.17 In order to avoid water ingress inside the junction boxes, CONTRACTOR shall apply appropriate seal material in the screw thread, bolts, cable glands, cover plugs and joints according to IEC 60079.
- 4.18 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, according to IEC 61892-1.
- 4.19 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.
- 4.20 The Structured Cabling shall be a Gigabit Ethernet network that will allow the use of the VOICE and DATA PETROBRAS Corporate network.
- 4.21 All Structured Cabling Network shall be tested and certificated by appropriate certifying tool and the results of all tests shall be submitted to PETROBRAS approval as a report.
- 4.22 All Structured Cabling Network shall be identified in both ends (sockets and path panel).
- 4.23 It shall be installed one cable organizer between each communication data equipment, patch panels and DIOs.

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4.24 The structured cabling network shall follow the CAT 6 Certification and the Standards NBR 14565, ANSI/EIA/TIA 568-(Balanced Twisted-Pair and Optical Fiber Cabling Cabling latest revisions), ANSI/EIA/TIA-569A, ANSI/EIA/TIA-606 and ANSI/EIA/TIA-607.

4.25 The communication data equipment as, routers, switches, gateways, computers and printers are not part of the scope of this Technical Specification, although there shall be provided space in the racks for the installation of all equipment installed in the racks.

5. SYSTEM DEFINITIONS

5.1 The Detailed 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.

5.2 The Detailed design of Structured Cabling network shall be effected 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).

5.3 The structured cabling rack shall have its casing grounded. Grounding by simply supporting the casing on the steel structure of the UNIT shall not be deemed adequate.

5.4 The cable launch shall meet the following criteria:

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

5.5 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 UNIT such as:

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

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5.6 Junction Boxes

- 5.6.1. 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.
- 5.6.2. When designing a junction box, its size and shape should be chosen taking into account the devices it will house and what else may be added in future, in order to enable easy servicing even after future expansion.
- 5.6.3. Junction boxes shall not be installed in areas where they would be exposed to the weather. If, in fact, that installation is necessary, junction boxes suitable for the purpose and built with necessary Ingress Protection degree shall be used.
- 5.6.4. When drilling holes in junction 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.
- 5.6.5. The Junction 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.
- 5.6.6. All grounding bus bars shall be of tin-plated copper and painted with green strips.
- 5.6.7. Connections to the grounding network for equipment and boxes shall be made by means of bolted terminals.
- 5.6.8. The Junction Box shall be certified according to equipment to be installed inside it. It will be not acceptable the certification for the empty Junction Box.

5.7 The Structured Cabling Network shall be made in a star physical topology of 03 (three) centers and distributed as following:

- 5.7.1. The Telecom Upper Room shall centralize all structured cabling network from the following areas:
 - a. "F" Deck;
 - b. "E" Deck;
 - c. "D" Deck.
- 5.7.2. The Telecom Lower Room shall centralize all structured cabling network from the following areas:
 - a. "C" Deck;
 - b. "B" Deck;

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- c. "A" Deck;
- d. Main Deck;
- e. Hull Diving Stations;

5.7.3. The data rack in Engine Room first elevation shall centralize all structured cabling network from all Engine areas.

5.8 The IPTV Cabling Network shall be made in a star physical topology of 02 (two) centers and distributed as following:

5.8.1. The Telecom Upper Room shall centralize all structured cabling network from:

- a. "F" Deck;
- b. "E" Deck;
- c. "D" Deck.

5.8.2. The Telecom Lower Room shall centralize all structured cabling network from:

- a. "C" Deck;
- b. "B" Deck;
- c. "A" Deck;

6. TECHNICAL REQUIREMENTS

6.1 FTP CATEGORY 6 CABLING

6.1.1. Cable of twisted pair (FTP) shall attend the Standards and composed for 04 (four) equal, 24 AWG, 100 Ohms, rigid copper drivers with isolation in high density polyethylene, with electric and mechanics characteristics compatible with the established patterns and tested up to 250MHz so that throughput can reach up to 1 Gbps. It shall have a cover fire retardant and LSZH.

6.1.2. The Cables FTP CAT 6 shall possess the UL Register and Certification via Laboratory of international recognition for parameters that attend the Standards.

6.1.3. The whole horizontal cabling FTP CAT 6 shall be connected to a group of Patch Panels CAT 6 with 24 positions (1U high) in the central point of distribution (racks in the telecommunications rooms).

6.1.4. The horizontal cabling FTP CAT 6 in the user side (outlet) shall possess a group of 02 (two) female connectors RJ-45 CAT6. The exception occurs only on the external areas (wet areas) and hazardous areas, where the voice service shall be provided by dedicated telephone cabling specific to the explosive atmosphere.

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- 6.1.5. CONTRACTOR shall supply all the necessary accessories certified for CAT6 cabling.
- 6.1.6. All the FTP cables shall be identified in its both extremities, using polyester labels printed mechanically in an indelible way. In the same way shall be identified all the other components of the network as: Patch Panel, fiber optic cables, Patch Cords and Sockets.
- 6.1.7. The organization of the cables inside the racks shall use only hook and loop fastener.
- 6.1.8. On cable trays in external areas the cabling shall be tied with stainless steel tie wraps covered with rubber, taking care to do not smash the cables.

6.2 MULTIMODE OPTICAL FIBER CABLE

- 6.2.1. The network points where there is a technical non viability of service for cable FTP due to the access characteristics (distance) for Hazardous Areas, it shall be assisted by multimode optical fiber cable type OM-4 of 50 μm x 125 μm with at least 6 fibers, according to ANSI/TIA-568.3-D, ISO/IEC 11801 and ITU-T G651.
- 6.2.2. For racks interconnections, telecom rooms interconnections, topside interface junction box and uplink interconnection between switches it shall be used multimode optical fiber cable (MM) of 50 μm x 125 μm with number of fibers sized according to this technical specification and DATA NETWORK ONE LINE DIAGRAM.
 - 6.2.2.1. As all switches shall be interconnected by 25 Gbps SFP interface, the optical mode (OM) of such fibers to be considered shall be OM-4 (MM 50 μm x 125 μm), following ANSI/TIA-568.3-D, ISO/IEC 11801 and ITU-T G651 according to the throughput expected and the bigger expected distance between equipment.
- 6.2.3. The employed optical cables shall be of TIGHT Buffered type, fully waterproof, longitudinally and radially, constituted by fiber optic with primary covering in acrylic and secondary covering in material colored polymer, gathered and covered by dielectric synthetic fibers for mechanical support (resistance to the traction). Covered by an external layer of special polymeric for external use with protection UV and fire retardant and LSZH.
- 6.2.4. The optical cable shall be made to resist the mechanical damages with metal covering in galvanized steel wire braid or tinned copper wire braid. The outer sheath shall be in orange color.
- 6.2.5. The optical cables coming from the operational area shall be finished in DIO pattern 19 inches 1U of 24 or 36 positions with SC-PC connectors on the Structured Network Racks in the Telecommunications Rooms.
- 6.2.6. At the Operational areas, for the access points, cameras and data attended by Optical Cable, these cables shall be terminated with Optical Distributor (DIO) according one line diagrams of each system and herein defined, with SC-PC

connectors, interconnected to 01 (one) or more Optical-Electrical Converters (according to the number of equipment to be activated) installed into the junction box appropriated for hazardous areas.

6.2.7. In the operational area when there is possibility of concentration of several users in a same installation place, the installation of a distribution small rack shall be foreseen for the fiber optic cable used as Backbone. This optical cable shall be terminated in DIO pattern 19 inches of 24 (twenty-four) positions with SC-PC.

6.3 Ethernet/Optical Multimode Converter - Standalone

- a. Electrical Interface – 100/1000BASE-TX 8P8C (RJ-45) with IEEE 802.3bt PoE (with power injector that shall be able to be enabled or disabled by a switch).
- b. Optical interface - Multimode G.651.
- c. Core diameter - 50µm.
- d. Standard –1000BASE-FX SC-PC.
- e. Number of fibers - 2 fibers.
- f. Installation – Standalone box.
- g. Connector – SC.
- h. Operating temperature -10°C to + 50°C.
- i. Link failure pass-through.
- j. Auto MDI / MDI-X for TX port.

6.4 OPTIC PATCH CORDS

6.4.1. Apart from Diving Station junction boxes, whenever a single junction box is due to be interconnected by a single fiber optic cable, this cable shall have enough fibers to attend equipment as designed and at least 02 (two) extra fibers (01 pair) fully ended in DIO position with SC-PC interfaces at both ends and every device shall be adequate for the area to be applied.

6.4.2. At the DIO it shall be used an optical extending multimode (MM) of 50 µm x 125 µm with SC-PC / SC-PC connectors in OM-4 color standard. It shall be foreseen by CONTRACTOR the supply of an excess of 30% for this item for future expansion and spare.

6.4.3. The interconnection of DIO with the active elements of network, shall be used optical multimode patch cords (MM) of 50µm x 125µm in the OM-4 color standard and SC-PC / LC-PC connectors. It shall be foreseen by CONTRACTOR the supply of an excess of 30% for this item for future expansion and spare.

6.4.4. The optical patch cords shall have suitable length to the rack or junction box where they will be installed. Usually used 2.5 meters and 1.5 meter.

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6.4.5. Whenever required a longer optical patch cords shall be supplied to interconnect distant racks or panels inside each Telecom Room.

6.5 PATCH CORD RJ-45 CAT 6

6.5.1. Patch Cords category 6/Class E shall be finished in factory with connector RJ-45 male, with plastic layer (boot) inserted in the connector to relieve the tensions and to avoid the accidental disconnection and the connector shall be shielded. They shall be built with flexible UTP 24 AWG cable. Each patch cord shall have its whole performance 100% tested in factory regarding the Cat. 6 of the standard ANSI/TIA/EIA 568-C.2.

6.5.2. Patch Cords shall be of 1,5 meters and 2,5 meters, in the **Blue Color**, for LAN System connections.

6.5.3. Patch Cords shall be of 1,5 meters and 2,5 meters, in the **Green Color**, for IPTV System connections.

6.5.4. The outer sheath owes being of fire-retardant type and LSZH, with demarcation of indelible length.

6.5.5. Patch Cord shall present acting values in the center of the strip of the values (center tuned) certain for the norm ANSI/TIA/EIA-568-C.2 for NEXT.

6.6 RJ-45 MALE CONNECTOR

6.6.1. RJ-45 male connector shall be engineered correctly and manufactured with precision processes to ensure that the connection is just going to work. Following the minimum requirements for RJ-45 male connector.

- a. Performance category: CAT6
- b. Applications standard: TIA/EIA-568-C
- c. Cable type: FTP
- d. Conductor type: Solid
- e. Housing material: Polycarbonate
- f. UL flammability rating: UL94V-2 [RoHS Compliant]
- g. Contact type: Three prong pin for solid/stranded wires
- h. Contact material: Copper
- i. Contact plating: Gold Plating 50µ [1.27µm]
- j. Impedence: 100 ohms
- k. Conductor Diameters: 0.41mm to 0.51mm (26AWG to 24AWG)

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6.7 RJ-45 FEMALE CONNECTOR

6.7.1. The RJ-45 female connector shall be used in all female data sockets.

6.7.2. RJ-45 female connector shall be engineered correctly and manufactured with precision processes to ensure that the connection is just going to work. Following the minimum requirements for RJ-45 female connector.

- a. Compliant with EIA/TIA Cat6 connecting hardware specifications
- b. Connector: Female RJ-45, IDC compatible with 110 & Krone
- c. Compatible cables: 4 pairs, FTP cable 22 – 26 AWG
- d. UL-certified ANSI/TIA/EIA-568-C
- m. Impedance: 100 ohms

6.8 PATCH PANEL CAT 6

6.8.1. Patch Panel shall be metallic with width of 19 inches according to norm ANSI/TIA/EIA-310D, with 24 connectors type RJ-45 female and 1 U of height.

6.8.2. It shall have a cables guide (bar) in back for supporting and fastening of cables.

6.8.3. It shall still execute the specifications of components Category 6 /Class E ANSI/TIA/EIA 568-C (component compliance).

6.8.4. The modules shall have structure built in plastic of high impact, fire retardant type called UL 94V-0. The circuits printed papers shall totally be contained inside the patch panel, in other words, the panel shall contain protection for the circuits printed, avoiding damages to the same ones during the connectors installing process.

6.8.5. Patch panels for mirroring interconnection between racks or other panels/cabinets inside each Telecom Room or between rooms shall be dedicated ones, different from the ones dedicated to users (computers, printers, access points, cameras).

6.9 CABLE ORGANIZER

6.9.1. It shall be installed one cable organizer between each communication data equipment, patch panels and DIOs with the specs below:

- a. 01 U cable rack mount manager
- b. Mounted horizontally in 19" rack
- c. Rear cut-outs to allow cabling to be fed through the back
- d. Cover



Figure 01: Example of cable organizer

6.10 CLOSED RACK FOR THE TELECOMMUNICATIONS ROOMS

6.10.1. CONTRATOR shall provide, assemble and install CLOSED RACKs, to installation of all systems described below:

- a. Structured Cabling described in this specification named as LAN racks,
- b. All data equipment listed in HULL DATA NETWORK ONE LINE DIAGRAM, named as WAN rack;
- c. All equipment listed in HULL CCTV SYSTEM ONE LINE DIAGRAM named CCTV rack;
- d. All equipment listed in TVRO AND ENTENTEAIMENT SYSTEM ONE LINE DIAGRAM named IPTV and TVRO rack;
- e. All equipment described in I-ET-3010.00-5511-768-PPT-001 IT EQUIPMENT named as SERVER rack.

6.10.2. The quantity of racks shall be defined during the detailed design and each rack shall follow the specifications below:

- a. It shall be closed, 19 inches standard, 44U height, minimum depth of 1000 mm (internal dimensions) and 800 mm of useful width (internal dimensions).
- b. It shall have AC sockets ABNT NBR 14136 standard for 19 inches standard. This AC universal standard sockets shall be equipped, at least, 04 (four) AC outlets in additional for PETROBRAS future use.
- c. Glazed door at the front: single-pane safety glass, 3 mm, including 130° hinge, and security lock;
- d. Sheet steel bi-parting rear door, including 130° hinge and security lock;
- e. A cooling system shall be installed for each cabinet and it shall be composed by 02 (two) fans on the bottom to inflate cold air inside and 02 (two) fans on the top to exhaust heated air to be collected by exhausters on ceiling. Additional clarifications

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for HVAC at I-MD-3010.00-5510-760-PPT-001 GENERAL CRITERIA FOR TELECOMMUNICATIONS DESIGN.

- f. Vertical cable organizer for ethernet cables and optic cables;
- g. Internal light only on the rear access;
- h. Complete earthing Kit;
- i. Color: RAL 7035;
- j. Every time a data rack is leaning the wall and it is not possible to access and open its rear door, the rack shall be swing frame type for easy access and maintenance.

- 6.10.3. It shall be supplied cage nuts (M5) and screws (at least 15 mm) for all of the positions.
- 6.10.4. The number of racks that shall be installed at the Telecommunications Room to accommodate the whole demand of network points and equipment of the structured local network, shall be in accordance with the star physical topology proposed herein and distribution requirements and the Detail Design Arrangement Document as well.

6.11 TOPSIDE INTERFACE JUNCTION BOX

- 6.11.1. Topside interface junction box for optical fiber cables transition between hull and topside structured cabling network shall be foreseen.
- 6.11.2. The Topside interface boxes has functions of cable termination, as well, as fiber distribution, it shall be certified for resisting the harsh environment and shall resist to several climatic changes and hazardous environment.
- 6.11.3. It shall be installed in external area of the accommodation module 01 (one) topside interface box in place defined during the detailed design, with the following specifications:
- a. Certification type: II 3G Ex-ec op pr IIC T6 Gc
 - b. Ingress Protection: IP67
 - c. Size: The dimensions of the interface box shall be defined during the detailed design.
 - d. Inside the interface box shall have a fiber optic termination with SC connections.
 - e. It shall be foreseen 20% of spare for future connections



Figure 02: Typical fiber optic termination box

6.12 TYPICAL RACK BAY FACE

6.12.1. Following below the typical bay face of 03 (three) types of racks: LAN rack, WAN rack and SERVER rack, that shall follow by CONTRACTOR during the detailed design.

- a. In the LAN rack the number of switches shall be sized according to LAN cables terminated in each patch panel;
- b. It shall be installed 01 (one) cable organizer between each device;
- c. The AC switchboard and DC switchboard can be installed in the top of rack or in the bottom of rack.

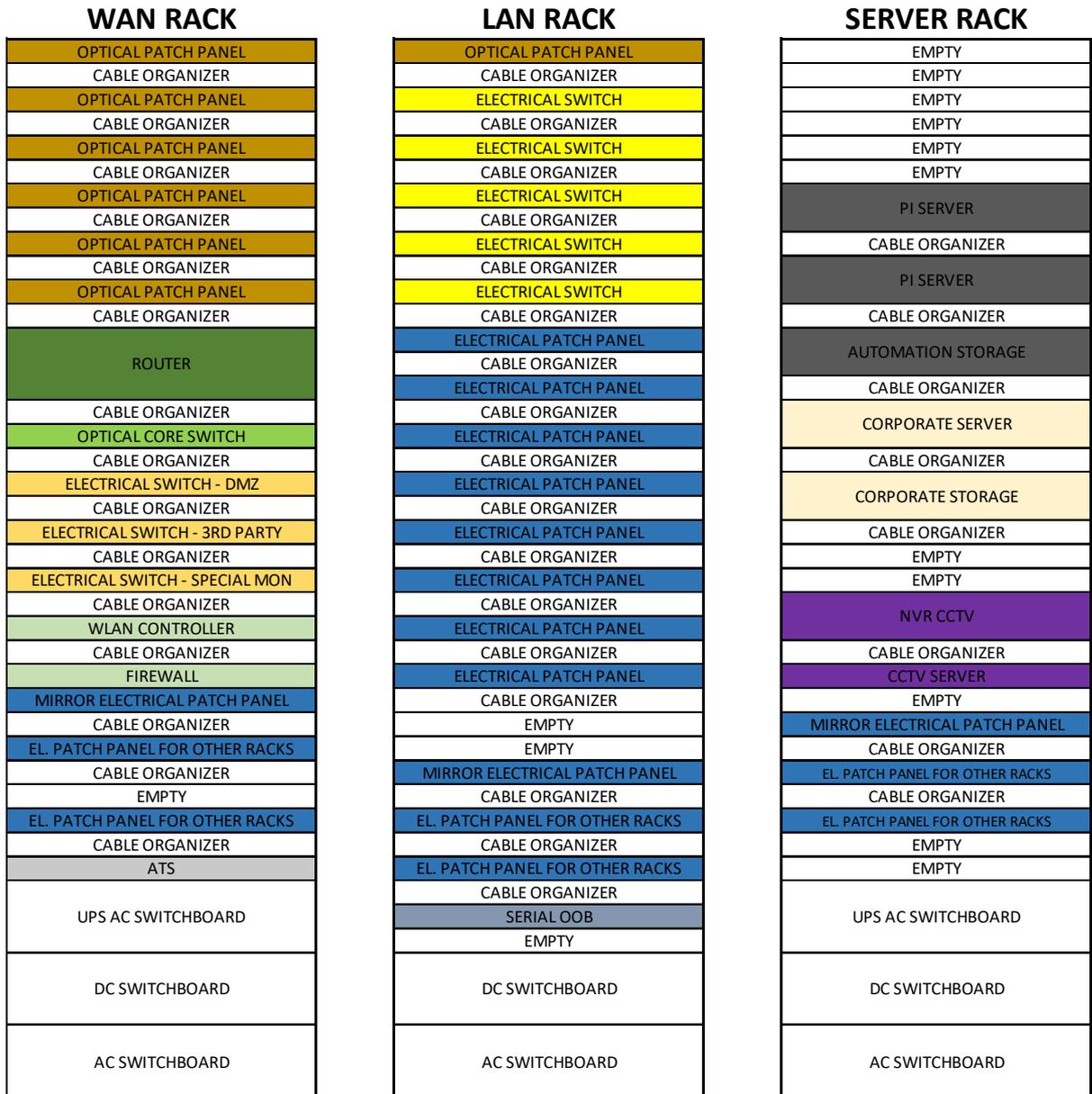


Figure 03: Typical racks frontal bay-face

7. SCOPE OF SUPPLY

- 7.1 CONTRACTOR shall supply, install, test and commissioning the HULL STRUCTURED CABLING NETWORK within the scope of the Contract and in accordance with this Technical Specification.
- 7.2 CONTRACTOR shall be responsible to supply all materials needed to complete installation of the Hull Structured Cabling Network, which final quantities shall be defined during the detailed design.
 - a. LAN cables (Final quantity shall be defined during the detailed design).
 - b. Fiber optic cables (Final quantity shall be defined during the detailed design).

- c. Patch panels (Final quantity shall be defined during the detailed design).
- d. DIOs (Final quantity shall be defined during the detailed design).
- e. Cables organizer (Final quantity shall be defined during the detailed design).
- f. RJ-45 Female sockets (Final quantity shall be defined during the detailed design considering 20% as spare).
- g. 1000 (one thousand) Patch Cords with 1,5 meters, in the Blue Color, for LAN System connections.
- h. 400 (four hundred) Patch Cords with 2,5 meters, in the Blue Color, for LAN System connections
- i. 200 (two hundred) Patch Cords with 1,5 meters, in the Green Color, for IPTV System connections.
- j. 200 (two hundred) Patch Cords with 2,5 meters, in the Green Color, for IPTV System connections.
- k. 500 (five hundred) optical multimode duplex patch cords with 1,5 meters, in the OM-4 color standard, for DIO interconnections inside racks.
- l. 500 (five hundred) optical multimode duplex patch cords with 5 meters, in the OM-4 color standard, for DIO interconnections inside racks.
- m. 50 (fifty) optical multimode duplex patch cords with 10 meters, in the OM-4 color standard, for interconnections inside each Telecom Room.
- n. 02 (two) Topsides interface junction boxes.
- o. All racks defined during the detailed design for LAN, WAN, IPTV/TVRO, SERVER and CCTV system.
- p. Optical-Electrical Converter installed in the box for hazardous areas: 01 (one) for LAN point for each junction box according to Structured cabling one line diagram, WLAN one line diagram and CCTV one line diagram as per the number of equipment to be powered.
- q. 03 (three) RJ-45 female connector to external area for each Diving Station.
- r. 03 (three) optical-ethernet converter for each Diving Station.

7.2.1. All quantities previously listed are the minimum to be supplied. However, the final quantities shall be defined during the detailed design.

7.2.2. In spite of the length of optical duplex patch cord has been informed, the length of each optic patch cord shall be as long enough to connect the DIO port to switch port.

8. DIMENSIONING CRITERIA

8.1 The Structured Network (LAN) shall cover the following areas:

- a. 03 (three) points in each workstation;
- b. 01 (one) point in each office for printer;
- c. 02 (two) points in each cabin;
- d. 08 (eight) points in each meeting room sized for more than 04 people, inlaid in table;
- e. 04 (four) points in each meeting room sized for up to 04 people, inlaid in table;
- f. 28 (twenty eight) points distributed in Central Control Room (CCR) consoles;
- g. 06 (six) points for Central Control Room (CCR);
- h. 03 (three) points in each Central Control Room (CCR) workstation;
- i. 12 (twelve) points in the Radio room;
- j. 08 (eight) points in the Telecommunication room;
- k. 06 (six) points in the Clinic/Hospital;
- l. 04 (four) points in the Treatment room;
- m. 03 (three) points in the Infirmary;
- n. 06 (six) points in each Warehouse;
- o. 12 (twelve) points in Public Internet Room;
- p. 01 (one) point in each telephone both;
- q. 03 (three) points in each diving area;
- r. 08 (eight) points in each Videoconference/Meeting Room;
- s. 06 (six) points in the Messroom;
- t. 06 (six) points in each Recreation Room;
- u. 06 (six) points in each TV room;
- v. 06 (six) point in the METOCEAN rack;
- w. 03 (three) points in each POS system rack;
- x. 03 (three) points in each PRS system rack;
- y. 01 (one) point in each PRM system rack at Seismic Panels Room
- z. 02 (two) point in each PRM system rack at Seismic Control Room;
- aa. 02 (two) point inside CIT for PAGA A;
- bb. 02 (two) point inside CIT for PAGA B;
- cc. 06 (six) point inside Active Repeater Rack;
- dd. 05 (five) point inside TVRO rack;
- ee. 05 (five) point inside CCTV rack;

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- ff. 02 (two) points in each battery charger;
- gg. 03 (three) points in the GMDSS console – Radio Room;
- hh. 03 (three) points in the mini GMDSS console – CCR;
- ii. 03 (three) points in the Operational Radio Console – Radio Room;
- jj. 01 (one) point for each CCTV cameras, which location details are in document HULL CCTV SYSTEM ONE LINE DIAGRAM;
- kk. 01 (one) point for each WLAN access point, which location details are in document HULL WLAN SYSTEM ONE LINE DIAGRAM;
- ll. 02 (two) points in Emergency Response Base Room;
- mm. 02 (two) points in Safety Store Room.
- nn. 04 (four) points in HSHMS (Hull Structure Health Monitoring System) rack;
- oo. 02 (two) points for each main electrical panel room in each Telecom Room and in Radio Room.
- pp. 05 (five) points from the ACR mini rack for EPTA-M to data LAN racks in both Telecom Rooms.

8.1.1. RS232-to-ethernet converter used with AIS transponder shall be connected to LAN point available inside GMDSS console – Radio Room.

8.2 Interconnection cables from data rack patch panels inside PDD to another equipment rack shall be terminated on RJ-45 outlet tagged accordingly to its subsystem. All other LAN points terminated on RJ-45 outlet shall be TAGGED with TMD.

8.3 02 (two) FTP cables shall be installed to interconnect PTV cabinet on deck F (TVRO System) to CTV cabinet on deck C (CCTV System).

8.4 04 (four) fiber optic cables shall be installed to interconnect CTV on deck C (CCTV System) to data rack (PDD) on deck C.

8.5 The IPTV Cabling Network shall cover the following areas:

- a. 01 (one) point in each Cabin;
- b. 01 (one) point in the Radio room;
- c. 01 (one) point in the Treatment room;
- d. 01 (one) point in the Infirmary;
- e. 01 (one) point in each Office;
- f. 02 (two) point in the Central Control room (CCR);
- g. 04 (four) point in the Academy/Gym;
- h. 01 (one) point in each Meeting room;

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- i. 01 (one) point in each Entertainment room;
- j. 01 (one) point in each Television room;
- k. 01 (one) point in the Reception/Briefing room;
- l. 01 (one) point in each Videoconference room;
- m. 01 (one) point in each coffee shop;
- n. 03 (three) points in the Mess room;
- o. 01 (one) IP-44 point in the external area of mess room (barbecue area).

8.6 Rack's interconnections

- 8.6.1. CONTRACTOR shall interconnect all LAN Structured Cabling racks, WAN rack and IPTV rack installed in the Telecom Lower Room following all requirements described in basic design documents DATA NETWORK ONE LINE DIAGRAM and HULL STRUCTURED CABLING ONE LINE DIAGRAM.
- 8.6.2. CONTRACTOR shall interconnect all LAN Structured Cabling racks, WAN rack and IPTV rack installed in the Telecom Upper Room following all requirements described in basic design documents DATA NETWORK ONE LINE DIAGRAM and HULL STRUCTURED CABLING ONE LINE DIAGRAM.
- 8.6.3. CONTRACTOR shall interconnect all LAN Structured Cabling racks, WAN rack and IPTV rack installed in the Telecom Lower Room with all LAN Structured Cabling racks, WAN rack and IPTV rack installed in the Telecom Upper Room following all requirements described in documents DATA NETWORK ONE LINE DIAGRAM and HULL STRUCTURED CABLING ONE LINE DIAGRAM.
- 8.6.4. CONTRACTOR shall interconnect LAN rack in Engine Room to WAN racks in Telecom UPPER and Lower Rooms according to HULL STRUCTURED CABLING ONE LINE DIAGRAM and HULL DATA NETWORK ONE LINE DIAGRAM one line diagrams.
- 8.6.5. The number of FTP cables used for electrical interconnections and of fiber optic (FO) pairs for optic interconnections among racks inside each telecom room and between each telecom room shall be sized to be capable to attend all needed and shall be foreseen an additional of the 30% (rounded up) spare for future installations.
- 8.6.6. CONTRACTOR shall consider 02 (two) independent Interface Junction Boxes with Topside, one for Telecom Upper Room and another one for Telecom Lower Room.
- 8.6.7. CONTRACTOR shall interconnect the WAN rack located in Telecom Upper Room to one Interface Junction Box through a Fiber Optic cable with 60 (sixty) fibers, terminated on DIOs on both sides. Some of them will act as spares, but shall be ended on both sides.

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- 8.6.8. CONTRACTOR shall interconnect the WAN rack located in Telecom Lower Room to other Interface Junction Box through a Fiber Optic cable with 96 (ninety-six) fibers, terminated on DIOs on both sides.
- 8.6.9. Each Hull diving station area shall have, at least, 03 (three) LAN points attended by Optical Cable with Optical Distributor (DIO) and Optical-Electrical Converter installed in the box appropriated for hazardous areas.
- 8.6.10. CONTRACTOR shall interconnect each diving station junction box to C deck Interface Junction Box through a Fiber Optic cable with 06 (six) fibers each, terminated on DIOs on both sides.
- 8.6.11. CONTRACTOR shall interconnect the Forecastle rack in each Interface Junction Box through one Fiber Optic cable with 08 (eight) fibers each, terminated on DIOs on both sides.
- 8.6.12. CONTRACTOR shall interconnect the PRS cabinet in FWD Temporary Refugee to PRS Cabinet in Telecom Upper Room through a direct Fiber Optic cable with 16 (sixteen) fibers, without pass thought interface boxes, terminated on DIOs on both sides.
- 8.6.13. CONTRACTOR shall interconnect the HSHMS Cabinet in Forecastle FWD Panel Room in PDD data rack in the same room by 04 (four) ethernet cables ended in proper patch panel.
- 8.6.14. CONTRACTOR shall interconnect the PRS cabinet in FWD Temporary Refugee to PDD data rack in Forecastle FWD Panel Room by 03 (three) ethernet cables ended in proper patch panel.
- 8.6.15. Each electrical and optical access data switch inside PDDs shall be stacked (electrical with electrical and optical with optical), which pile shall be limited to up to 05 (five) switches. So the 25Gbps uplink port of the first and the last switch of the pile shall be cabled to each core switch, at WAN racks, inside each Telecom Room. For AEPR module, it shall be foreseen a maximum of 20 (twenty) possible electrical or optical access data switches.
- 8.6.16. Apart from electrical and optical access data switch, the other ones, like electrical or optical switch acts as DMZ ones, special monitoring ones, 3rd party's ones, recreative one and IPTV distribution switch one cannot be stacked and shall be directly cabled to each CORE switch, to each DMZ switch and to each 3rd party switch in each Telecom Room.
- 8.6.17. As per I-ET-3010.00-5512-762-PPT-003 INFRASTRUCTURE FOR SUBMARINE OPTIC NETWORK, it shall be run 02 (two) cables of 12 fiber optics from junction box at riser balcony to Telecom Upper Room, inside dedicated rack, without pass thought interface boxes.

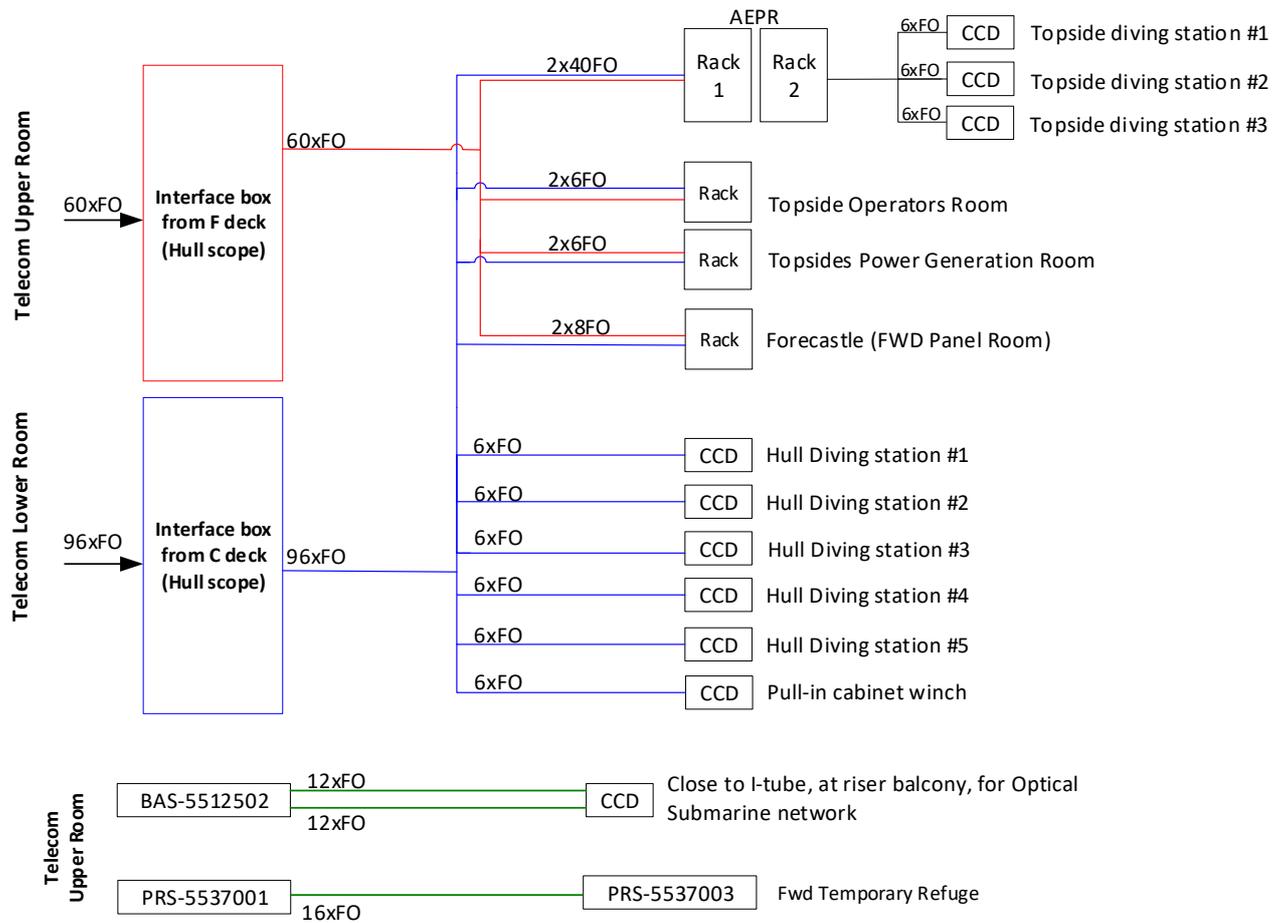


Figure 04: Topology of network connections through interface boxes

8.6.18. CONTRACTOR shall interconnect all LAN Structured Cabling racks, WAN rack and IPTV rack in each telecom room with 12 (twelve) FTP mirrored cables as described at the figure 05, terminated in 01 patch panel (half to one side and half to the other).

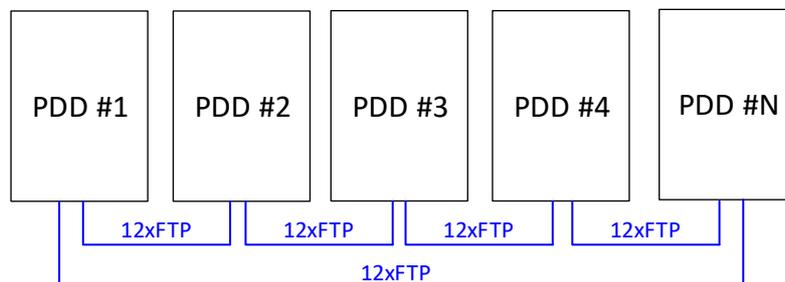
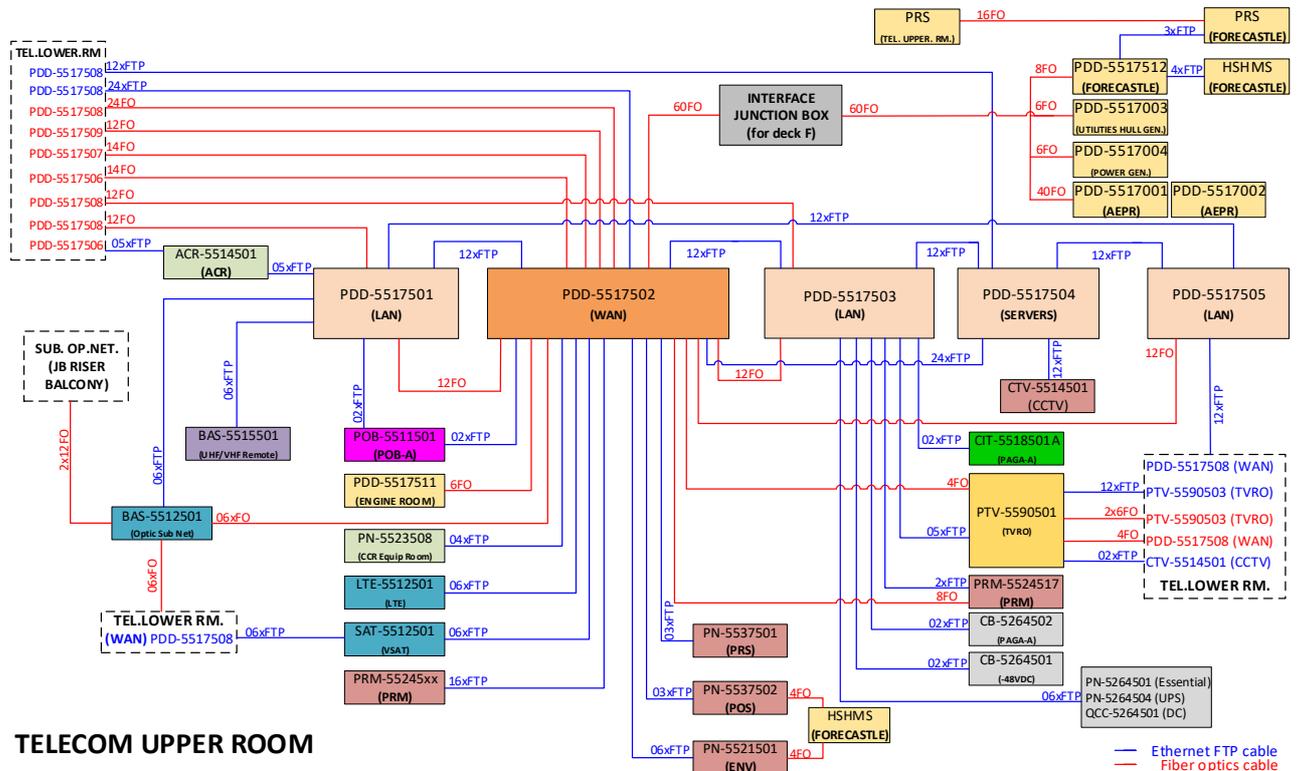


Figure 05: Connections between racks (A)

8.6.19. CONTRACTOR shall interconnect the WAN Structured Cabling rack on Telecom Lower Room to WAN Structured Cabling rack on Telecom Upper Room through 24 (twenty-four) FTP cables, terminated in 02 patch panels, 01 (one) for each side, at least, as illustrated at the figure 06.

- 8.6.20. CONTRACTOR shall interconnect the WAN Structured Cabling rack on Telecom Lower Room to WAN Telecom Upper Room through 04 (four) optical cables of 06 (six) fibers each, terminated in DIOs on both sides, at least, as illustrated at the figure 06.
- 8.6.21. CONTRACTOR shall interconnect the IPTV rack on Telecom Lower Room to IPTV rack on Telecom Upper Room through 12 (twelve) FTP cables, terminated in 02 patch panels, 01 (one) for each side, at least, as illustrated at the figure 06.
- 8.6.22. CONTRACTOR shall interconnect the IPTV rack on Telecom Lower Room to IPTV rack on Telecom Upper Room through 02 (two) optical cables of 06 (six) fibers each, terminated in DIOs on both sides, at least.
- 8.6.23. CONTRACTOR shall interconnect the LAN Structured Cabling rack in Telecom Upper Room to Metocean Rack through 06 (six) FTP cables, terminated on LAN outlets with 06 (six) female Cat 6 FTP sockets on METOCEAN rack, as illustrated at the figure 06.
- 8.6.24. CONTRACTOR shall interconnect all racks and panels in the Telecom Upper Room, in Telecom Lower Room and interface junction boxes, as illustrated at the figure 06, at least.



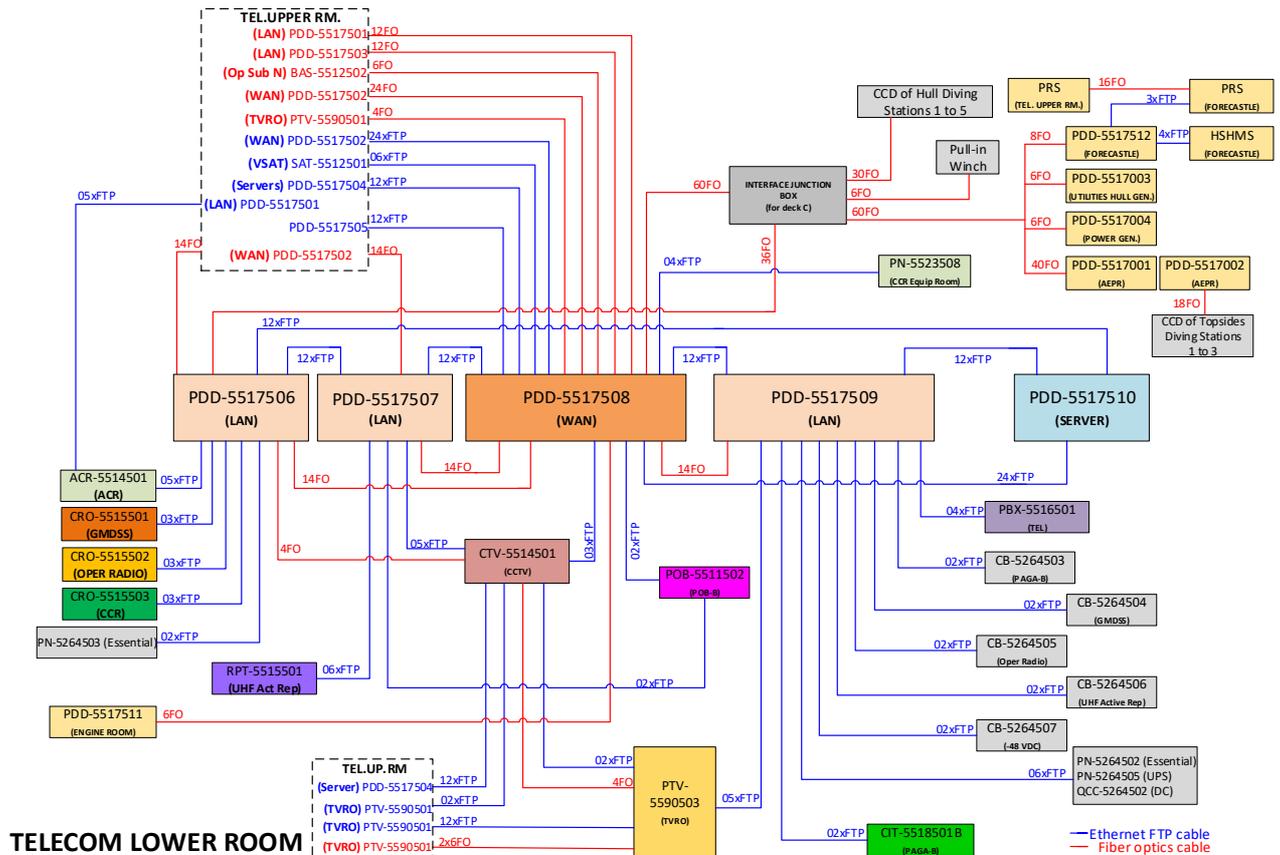


Figure 07: Interconnections for Telecom Lower Room

- 8.7 It shall be installed one cable organizer between each communication data equipment, patch panels and DIOs.
- 8.8 The data points located in the Process Plant and in the Industrial Areas shall be assisted through an optical network that is not part of this Technical Specification.
- 8.9 The telephone points located in the Process Plant and in the Industrial area shall be assisted through a conventional telephone network that is not part of this Technical Specification.
- 8.10 The final quantity of LAN points and cables for rack and panels interconnections shall be defined during the detailed design and shall be approved by the PETROBRAS.

9. COMMISSIONING

- 9.1 The Tests and Certification of the STRUCTURED CABLING AND OPTICAL DATA NETWORK (LAN) shall comply with the Descriptive Memorandum I-MD-3010.00-5510-760-PPT-002- GENERAL CRITERIA FOR TELECOM DESIGN and the Project Commissioning Memorandum bellow.

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- 9.1.1. The horizontal network of Metallic Cables (FTP) shall be certified according to Standard ANSI/EIA/TIA requirements 568-B2-1 CAT 6 /Class E.
- 9.1.2. Preferentially shall be used the DSX2-5000 or better as instrument of certification of Fluke DTX Cable. In case it is other the used instrument, the same shall present message in case of noise in the cabling.
- 9.1.3. CONTRACTOR shall supply microscope of 400x for inspection of the connectors in field. Connectors won't be accepted with flaws in the polishing. The tests will be made by sampling.
- 9.1.4. The network of optical cables shall be certified according to Standard ANSI/EIA/TIA'S requirements 568-B2-1 CAT 6/Class E for optical backbones.
- 9.1.5. Preferentially, the instrument of certification of Fluke DTX Cable shall be used Analyzer DSX2-5000 or an OTDR.
- 9.1.6. CONTRACTOR shall present certification tests CAT 6 for all the installed points, in magnetic media, compatible with the Software of Fluke Link Ware.
- 9.1.7. All instruments to be used shall be accompanied by the Certificate of Calibration that shall be inside its period of validity. The Certificate shall be presented before the beginning of the tests and an authenticated copy of the original shall proceed enclosed the Documentation to be given at the end of the work.

10. ANNEX

- 10.1.1. On the next tables, it is presented an estimative of the number of switches required according to this technical specification requirements.



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ACCESS LAYER

Module	PDD/PTV	Deck/Elevation	Local	General Use (Data/Voice)	Servers / Equipment	WLAN	CCTV	Optical Ports	IPTV	Recreative Internet			
Accommodation	PDD-5517501 PDD-5517503 PTV-5590501	Top Deck	External	4		1	4						
			Clinic (A714)	6									
			Treatment Area	4					1				
			Infirmery (A715)	3	1								
			Reception Briefing (A718)	6			2		1				
			Telecom Control Room (A707)	10	12				1				
			Telecom Upper Room (A708)	8	18	1	2		1				
			Eletronic Equipment Warehouse (A719)	2		1							
			Seismic Control Room (A720)	7		1							
			Seismic Panel Room (A721)	6	1		2						
			Corridor			1	3						
			Phone Cabin 05 (A703)	2									
			Telecom Battery Room (A712)				1						
			EXTERNAL AREA - PS / (FR 13 - L26)				1	1					
			EXTERNAL AREA - STB / (FR 19 - L5)				1	1					
			EXTERNAL AREA - STB / (FR 13 - L15)				1	1					
			Stairs					2					
		E	Cabins (32)		64		13			32			
			Corridors					8					
			Stairs					2					
		D	Cabins (34)		68		11			34			
			Corridors (A500)				1	9					
			Stairs					2					
					HVAC D2 Stern offloading			1					
		Subtotal (per use)				190	32	33	41	0	70	0	
		Upper Levels connected to Telecom Upper Room in deck F				Switch Type			Electrical Access Switches - Deck F (48P) - 30%		Optical Access Switches (24P - 30%)	IPTV Access Switches (48P) - 30%	Recreative Access Switches (48P) - 30%
						Quantity				9			0

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ACCESS LAYER															
Module	PDD/PTV	Deck/Elevation	Local	General Use (Data/Voice)	Servers / Equipment	WLAN	CCTV	Optical Ports	IPTV	Recreative Internet					
Acomodation	PDD-5517506 PDD-5517507 PDD-5517509 PTV-5590502	C	Meeting /Video Conference Room (A409)	10					2						
			Coordination Office (A408)	16			1		1						
			CCR Operation Ambience/Emerg Resp C (A403)	30				2		1					
			CCR Equipment Ambience (A406)	6			1	2							
			CCR Automation and TBM room (A405)	10											
			Phone Cabin 02 (A428)	2											
			Phone Cabin 03 (A429)	2											
			Phone Cabin 04 (A430)	2											
			Auditorium (A427)	4			1	1			3				
			Visitors Office (A422)	8											
			MIEE + MIED Room (A420)	7											
			Inspectors's Office+PH (A419)	7											
			Meeting Video Conf Room / Temp Office (A418)	14							2				
			Main Office 2 (A417)	13			1				1				
			Technical Library / Temporary Office (A416)	15					1						
			Safety Office (A415)	19							1				
			Permit room (A 414)	15											
			Radio Room (A413)	12					1		1				
			Telecom Lower Room (A412)	8			12			2					
			Main Office 1 (A411)	21					1		1				
			Geplat OMI Office	9							1				
			Coffee Point (A426)	2							1				
			HVAC C1/C2/C3						1	5					
			Lifeboat STB							2					
			Lifeboat PS							2					
			Corridor (A400)						3	6					
			Stairs (A401)							2					
			External area STD FR 15 L25						1						
			External area PS FR 16 L25						1						
			B	Internet Room (A311)	22					1			10		
				Telephone Cabin 01 (A312)	2										
				TV/Video Room (A304)	3				1	1		1			
				Camp Boss Catering Office (A315)	7										
				Quiet Recreation Room (A303)	6					1		1			
				Mess Room (A322)	10				2	3		3			
		Games Room 1 (A307)		3					1		1				
		Games Room 2 (A305)		3					1		1				
		Emergency Resp Base (A308)		4				1	1						
		Coffee Shop (A332)		2							1				
		Kiosk (A314)		2											
		External Area - STB							1						
		External Area - PS							2						
		Barbecue Area/Varanda (A329)							1	1		1			
		Dry Storage (A317)								2					
		Galley (A318)								1					
		Corridor 1							2	7					
		Hull Batteries room 1/2								2					
		Stairs (A301)								2					
		A		Warehouse Mezzanine (A203)	6				2	2					
				Multi-Purpose Music Room (A212)	3							1			
				Gym Free Floor Area (A208)	3							1			
				Gymnasium (A209)	3				1	2		2			
				Laudry Folding Space (A215)	2										
				Corridor (A200)					2	4					
				External Area - PS					1						
				External Area - STB					2	1					
				Hull batteries room 3							2				
				Fire pump external STB/PS							2				
				Stairs							2				
				Acomodation	PDD-5517506 PDD-5517507 PTV-5590502	Main Deck	Warehouse Reception Office (A104)	7			1	1		1	
							PSV Workshop (A121)	3				2			
							PSV Office (A122)	7							
							Welding Workshop (A118)						1		
		Paint workshop (A123)									1				
		Safety Store (A119)								1					
		Fiscal Metering Room (A115)	10												
		Instrumentation Workshop (A114)	6							1	2				
		Electrical Workshop (A113)	6								2				
		Sumec/Suein Office (A111 e A112)	7										2		
		Mechanical Workshop (A110)	7								2				
		Warehouse (A105)	2							2	2				
		Tool Shop (A109)	2							1	1				
		External circulation area									1				
		Corridor (A100)								2	3				
		External Area - PS								1	1				
		Coffee Point (A127)	2												
		Auxiliary Generator Room (A.G.R.) (A133)								1	1				
		Hull Transformers Room (H.T.R.) (A134)								1	1				
		Essential Panel Room (E.P.R.) (A136)								2	4				
		Emergency Generator Room (E.G.R.) (A138)								1	1				
		External Area - STB								1	1				
		External Area - STB (oil water)									1				
		Divin Stations (5)										15			
		Stairs (A101)										2			
		Subtotal (per use)				372	12	46	91	15	31	10			
		Lower Levels attended by Telecom Lower Room in deck C	Switch Type	Access Switches - Deck C (48P) - 30%				Optical Access Switches (24P - 30%)	IPTV Access Switches (48P) - 30%	Recreative Access Switches (48P) - 30%					
			Quantity	15				1	1	1					

ACCESS LAYER											
Module	PDD/PTV	Deck/Elevation	Local	General Use (Data/Voice)	Servers / Equipment	WLAN	CCTV	Optical Ports	IPTV	Recreative Internet	
Main deck and Engine Room	PDD-5517511	1st Deck	HNPR1	4		3	6				
			Engine Room	HVAC	2		1	2			
		2nd Deck	Engine Room - PS				1	2			
			Engine Room	HPU Room	2		1	2			
			Engine Room	HTR2			1	1			
			Engine Room	Warehouse	2						
		3rd Deck	Engine Room	Engine Room corridor	2			1			
			Engine Room	Engine Room - PS			1	1			
			Engine Room	Engine Room - STB			1	1			
			Engine Room	Sweage treatment squid				1			
		4th Deck	Engine Room	Near Stairs	2						
			Engine Room	Engine Room - PS				1			
			Engine Room	Engine Room - STB			1	1			
		5th Deck	Engine Room	Near Stairs	2						
			Engine Room	Engine Room - PS				1			
			Engine Room	Engine Room - STB			1	1			
		6th Deck	Engine Room	Near Stairs	2						
			Engine Room	Engine Room cooridor				1			
			Engine Room	Engine Room - PS			1	1			
		Main Deck - Process Plant	Main Deck - Process Plant (under modules)	Near Stairs					8		
Quantity											
Subtotal (per use)				20	0	12	31	0	0	0	
Engine Room areas attended by PPD in Engine room 1st deck				Access Switches - Deck C (48P) - 30%				Optical Access Switches (24P - 30%)	IPTV Access Switches (48P) - 30%	Recreative Access Switches (48P) - 30%	
Switch Type											
Quantity				2				0	0	0	

ACCESS LAYER											
FORECASTLE	PDD-5517512	FC	FC	6		5	2	20	0	0	
			Subtotal (per use)	6	0	5	2	20	0	0	
			Switch Type	Electrical Access Switches - (48P) - 30%				Optical Access Switches (24P - 30%)			
			Quantity	1				2	0	0	

IPTV DISTRIBUTION LAYER						
Module	PTV	Deck/Elevation	Local	Upper Levels IPTV	Lower Levels IPTV Downlinks	
ACCOMM	PTV-5590501	F	Telecom Upper Room	2	0	
				Distribution IPTV switches 24P 1G SFP (30%)		
						1

CORE LAYER									
Module	Deck/Elevation/ Room	Local	WAN Router (2) +Failover (2) + WLAN Controller (1)	Distribution IPTV Downlinks	Accomm. Upper Levels Downlinks	Accomm. Lower Levels Downlinks	M-17 Electrical Switches Downlinks	M-15B / M-13 Electrical Switches Downlinks	Forecastle / Engine Room Electrical Switches Downlinks
ACCOMM	Telecom Upper Room	Subtotal (per use)	5	1	3	4	3	2	3
		Line Card Type	48P x25G SFP/SFP						
		Quantity	1						
	Telecom Lower Room	Subtotal (per use)	5	1	3	4	3	2	3
		Line Card Type	48P x25G SFP/SFP						
		Quantity	1						

Table 1: estimative of the number of switches