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	CLIENT: SRGE		SHEET: 1 of 19						
	JOB: TELECOMMUNICATION DATA								
	AREA: -								
TIC	TITLE: INFRASTRUCTURE FOR SUBMARINE OPTIC NETWORK		INTERNAL						
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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 the INFRASTRUCTURE FOR SUBMARINE OPTIC NETWORK CONNECTION in the PETROBRAS FPSO unit.


2. ABBREVIATIONS

ABNT	Brazilian Association of Technical Standards
ANATEL	Brazilian Telecommunication Authority
ANSI	American National Standards Institute
APC	Angled Physical Contact polishing
ART	Technical Responsibility Note
ASTM	American Society for Testing and Materials
CLC	European Committee for Electrotechnical Standardization (CENELEC)
CREA	Brazilian Engineering Counsel
DWDM	Dense Wavelength Division Multiplexing
IEC	International Electrotechnical Commission
IEEE	Institute of Electric and Electronic Engineers
INMETRO	National Institute of Metrology
IMO	International Maritime Organization
IP	Internet Protocol
IP-XX	Ingress Protection Code
IS	Intrinsic Safe
ITU	International Telecommunication Union
LAN	Local Area Network
LSZH/LS0H	Low Smoke Zero Halogen
LTE	Long Term Evolution
MODU	Mobile Offshore Drilling Unit
ODF	Optic Distribution Frame
OTDR	Optical Time Domain Reflectometer
OSI	Open Systems Interconnection
PTT	Push To Talk
SOLAS	Safety Of Life At Sea
WAN	Wide Area Network

3. REFERENCE DOCUMENTS, CODES AND STANDARDS

3.1 International Standards

- a. IEC 1000-4-2: Electrostatic discharge (ESD) requirements
- b. IEC 60079: Electrical apparatus for explosive gas atmospheres - all parts

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- c. IEC 60092-502: Electrical installations on ships
- d. IEC 60331: Tests for electric cables under fire conditions - circuit integrity – all parts
- e. IEC 60332: Flame-retardant characteristics of electric cables
- f. IEC 60529: Degrees of protection provided by enclosures (IP code)
- g. IEC 60533: Electrical and electronic installations in ships - electromagnetic compatibility
- h. IEC 61000: Electromagnetic compatibility (EMC) series - all parts
- i. IEC 61892-7: Mobile and fixed offshore units - electrical installations - part 7: hazardous area
- j. IEC 61892-1: Mobile and fixed offshore units – Electrical installations – Part 1: General requirements and conditions.
- k. 61892-6: Mobile and fixed offshore units – Electrical installations – Part 6: Installation
- l. IMO MODU CODE: Code for the construction and equipment of mobile offshore drilling units
- m. IMO SOLAS: International convention for the safety of life at sea
- n. ITU recommendation M.1801: Radio interface standards for broadband wireless access systems, including mobile and nomadic applications, in the mobile service operating below 6 GHz
- o. ITU G.652D: Characteristics of a single-mode optic fiber and cable
- p. CENELEC TR 50427/2004: Assessment of inadvertent ignition of flammable atmospheres by radio-frequency radiation - guide
- q. 3GPP RELEASE 13 3RD generation partnership project (3GPP)


3.2 Brazilian Standards

3.2.1. INMETRO

- a. INMETRO PORTARIA Nº 115 (21/março/2022): regulamento de avaliação da conformidade de equipamentos elétricos para atmosferas potencialmente explosivas, nas condições de gases e vapores inflamáveis e poeiras combustíveis.

3.2.2. NR's – Normas Regulamentadoras

- a. NR-10: Segurança em instalações e serviços em eletricidade;
- b. NR-37: Segurança e saúde em plataformas de petróleo;

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- c. It shall be followed all others NR's – Normas Regulamentadoras (Regulatory Standards) the Ministério do Trabalho (Brazilian Ministry of Labor) applicable to this Technical Specification.

3.2.3. ANATEL – Applicable regulations of ANATEL

3.2.4. DPC – Departamento de Portos e Costas


- a. NORMAM 01: Normas da Autoridade Marítima para Embarcações Empregadas na Navegação em Mar Aberto.

3.3 Classification Society

- 3.3.1. 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 In order to comply with the PETROBRAS Corporate Network, all the required materials shall be based on the technology indicated in this Technical Specification.
- 4.2 For PETROBRAS detailed design requirements, Installation, Configuration, Tests training and commissioning CONTRACTOR shall be complied with the Memorial Description 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-P4X-005 - REQUIREMENTS FOR HUMAN ENGINEERING DESIGN FOR ELECTRICAL SYSTEMS OF OFFSHORE UNITS.
- 4.6 The 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 box.

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4.7 Brackets, bolts, nuts, washers and any other mechanical fixing elements shall be made in stainless steel.

4.8 In case of difficulty for supplying some equipment and accessory with external body made with non-metallic materials, CONTRACTOR shall be approved by Classification Society and submitted for analysis and approval of PETROBRAS.

4.9 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).

4.10 In order to avoid electrolytic corrosion, contacts between different metallic materials shall be avoided. Galvanic insulation shall be implemented where contact between different metallic materials is necessary.

4.11 The equipment and accessories shall be appropriate to be installed on places with marine atmosphere, hazardous areas (dust and gas explosive atmospheres) and in accordance with the classifications zone and groups established by IEC / ABNT.

4.12 In outdoor areas, exposed to marine atmosphere, CONTRACTOR shall beware to mitigate the galvanic corrosion of junction box supports, horns supports and bolts. Galvanic insulation shall be implemented where contact between different metallic materials is necessary.

4.13 The Junction Box shall have the cable glands installed facing the 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


4.14 In order to avoid humidity and water ingress inside the junction box, CONTRACTOR shall apply appropriate material in the screw thread, bolts, cable glands, cover plugs and joints, according to IEC 60079 and IEC 60529.

4.15 All equipment, materials and optic cables, if necessary, shall be homologated by National Telecommunications Agency (ANATEL) as per Resolution nº 715/2019 - Aprova o Regulamento de Avaliação da Conformidade e de Homologação de Produtos para Telecomunicações.

4.16 CONTRACTOR shall present the “Certificate of homologation” emitted by the Brazilian “ANATEL”, for the total characteristics specified. These Certificates shall be presented in the technical proposal and submitted to PETROBRAS for approval before the purchase order.

4.17 The equipment and accessories shall attend the ingress protection degree, protection type, classifications zone and groups established by IEC / ABNT.

4.18 All equipment that will make part of the detailed design shall have type approval certificate for technical conformity with the International and National standardization organism: ABNT, IEC, INMETRO and ANATEL.


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- 4.19 The equipment and materials shall be supplied packed suitable for long periods of storage and be protected against mechanical impact and adverse weather conditions.
- 4.20 For hazardous areas, it shall be deployed equipment for “increased safety”, “intrinsically safe” or “explosion proof” type in this order, in accordance with classification area and applicable requirements standards. The employment of these equipment or any others available models shall be submitted for PETROBRAS analysis. The use of “explosion proof” type shall be avoided.
- 4.21 CONTRACTOR shall submit the Calculation Report with the attenuation loss for each Optic Fiber for Submarine Fiber Optic Network Connection.
- 4.22 CONTRACTOR shall utilize tubing term-contractile materials (adhesive lined heat shrink tube) as a sealant form for ending, cable splices or bundling of cables. It shall create a barrier for against water, moisture, dirt and other environmental contaminants
- 4.23 CONTRACTOR shall design, supply and install all cables type Fire Resistant type and LSZH/LS0H.
- 4.24 CONTRACTOR shall use materials resistant to ultraviolet radiation for installation in outdoor areas.
- 4.25 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 Infrastructure from Riser Balcony to Telecom Upper Room on F deck


- 5.1.1. CONTRACTOR shall supply, install and test the onboard infrastructure to connect the future Optic Umbilical from the Submarine Optic Cable Project. The Optic Umbilical is not in the scope of the FPSO's Contract.
- 5.1.2. The infrastructure in the scope of this document shall be composed by:
- 5.1.2.1. **02 (two) fiber optic cables**, according to this technical specification, from Telecom Upper Room straight to Riser Balcony area, close to I-Tube reserved for umbilical optic riser cable;
- 5.1.2.2. All accessories needed for this scope as 19” rack, dedicated cable away, junction box, Optic Distribution Frame – ODF, electric and optic connectors;
- 5.1.2.3. **02 (two) DWDM subracks**.

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6. TECHNICAL REQUIREMENTS

6.1 Optic Fiber Cable

- 6.1.1. Each of Fiber Optic Cable shall be composed of 12 (twelve) single mode fibers G.652D to be used in DWDM systems.
- 6.1.2. The optic cable shall be manufactured in loose type, 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).
- 6.1.3. This optic cable shall be covered by an external layer of polymeric special for external use with protection UV, Fire Resistant and Flame Retardant type Low Smoke Zero Halogen (LSZH/LS0H).
- 6.1.4. The optic cable shall have the Classification society certificated (Type Approval) to operate in offshore installations.
- 6.1.5. The Fibers Optics shall be according to ITU-T G Series Recommendations and the technical characteristics of recommendation G.652D. On the 1550nm optic window, the fiber optic shall have the following characteristics:
 - a. Attenuation less or equal to 0.20 db/km
 - b. Dispersion less or equal to 18.00 ps/nm.km
 - c. Dispersion Slope less or equal to 0.088 ps/nm².km
 - d. PMD less or equal to 0.20 ps/ $\sqrt{\text{km}}$
- 6.1.6. For each optic cable on the Riser Balcony area, CONTRACTOR shall supply 05 (five) meters of extra cable coiled and protected for connection in the junction box.
- 6.1.7. All fibers shall be terminated in E2000/APC connectors, on the 19 inches optic patch panel (ODF) in Telecommunications Room.
- 6.1.8. The cable shall be identified on the outside along their length (at maximum intervals of 2.0 m), by the following information:
 - a. Type of cable;
 - b. Name of manufacturer;
 - c. Commercial reference of manufacturer.
- 6.1.9. Each optic cable shall be supplied in reels or on spools without splice and they shall be straight cable from Telecom Upper Equipment room to Riser Balcony area, with the length established in the detailed design.
- 6.1.10. Another requirements in according with Classifying Society.

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6.1.11. Cables for circuits that shall operate under fire conditions and cables crossing machinery space Category A, as defined by SOLAS, shall be certified for circuit integrity under fire conditions, according to IEC 60331.

6.1.12. CONTRACTOR shall require the Classifying Society a list of all standards and technical requirements shall be follow by itself.

6.2 Cable Trays

6.2.1. An exclusive cable tray shall be supplied to impact protection of the 02 (two) Fiber Optic Cables, from Junction box at Riser Balcony to Telecom Upper Room.

6.2.2. During the detailed design it shall be choose 02 (two) independent cable tray routes for each fiber optic cable.

7. SCOPE OF SUPPLY

7.1 OPTIC CABLE


7.1.1. CONTRACTOR shall supply, install and test 02 (two) fiber optic cables composed of 12 (twelve) single mode fibers each one, from riser balcony to Telecom Upper Room in accordance with this Technical Specification, including all accessories needed to this installation, junction box and 19 inches optic distribution frame.

7.1.2. CONTRACTOR shall supply 24 (twenty-four) E2000/APC of 2 meters long single-mode LC/PC optical cords for interconnection to optical equipment.

7.2 RACK

7.2.1. CONTRATOR shall provide and install (01) one CLOSED RACK dedicated and exclusive for terminate the optic fiber cables and other equipment with the specifications below:

- It shall be closed, 19 inches standard, 44U height, minimum depth of 1000 mm (internal dimensions) and 800 mm of useful width (internal dimensions).
- It shall have AC universal standard sockets for 19 inches standard. This AC universal standard sockets shall be equipped, at least, 04 (four) AC outlets in additional for PETROBRAS future use.
- Glazed door at the front: Single-pane safety glass, 3 mm, including 130° hinge, and security lock;
- Sheet steel bi-parting rear door, including 130° hinge and security lock;
- 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 for HVAC at I-MD-3010.00-5510-760-PPT-001 GENERAL CRITERIA FOR

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TELECOMMUNICATIONS DESIGN. Vertical cable organizer, for RF cables and controllers cable;

- f. Internal light only on the rear access;
- g. Complete earthing Kit;
- h. Color: RAL 7035;

7.2.2. Following the typical internal bay face of dedicated rack for submarine network system.

BAS-5512502 SUBMARINE NETWORK 44 U

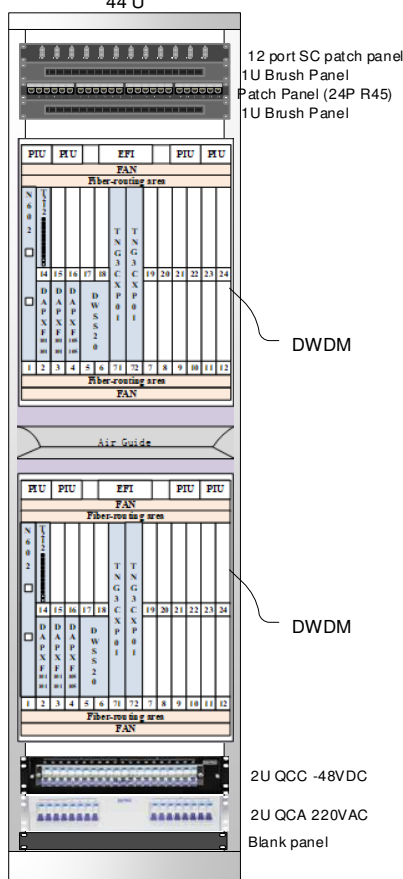



Figure 01 - typical internal bay face for submarine network system

7.3 OPTIC DISTRIBUTION FRAME - ODF

- a. The mechanical system shall consist in a sub-rack with 3UR x 19", with splice modules and optic distribution frame (ODF).
- b. It shall be properly equipped with SM micro loose internal optic pigtails, pre-tested and micro loose connectors stripped, ready to fusion splices.
- c. The ODF shall provide front and rear access for maintenance and testing.

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- d. The ODF shall have optic connectors on the front, in order to allow the connection of single mode cords.
- e. It shall be provided with drawers for storing cord.
- f. The system of fusion splicing trays shall allow the separation of the storage of the spliced fibers of the fibers to be spliced in the future.
- g. There shall be a system for fixing the interfaces of adapters and locking the access tray, which facilitates the entire operation of coupling and decoupling the units.

7.3.1. Following a typical 19in optic distribution frame.




Figure 02 - typical 19in optic distribution frame

7.4 Power requirements

7.4.1. It shall be considered a useful power of at least 3600 Watts for Optic Submarine cabinet equipment.

7.4.2. DC SWITCHBOARD

- a. It shall be provided, installed and commissioned 01 (one) 19 inches rack mounted -48 VDC switchboard in the submarine optic network rack;
- b. DC switchboard shall be fed by 01 (one) 80A circuit breaker from (-)48 VDC panel.
- c. DC switchboard shall be provided with 8 (eight) 40 A circuit breakers.

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7.4.3. AC SWITCHBOARD

- a. It shall be provided, installed and commissioned 01 (one) 19 inches rack mounted AC switchboard in the submarine optic network rack.
- b. AC switchboard shall be fed by 220 VAC from essential panel.
- c. AC switchboard shall be provided with 04 (four) 10 A circuit-breakers.

7.5 JUNCTION BOX

- 7.5.1. CONTRACTOR shall supply and install an appropriate Junction Box for high-power optic fiber fusion, close to designated I-Tube to submarine optic cable pull-in, in the Riser Balcony area. It will be accepted Ex-d or Ex-op Junction box to protect the optic splices between optic submarine cable and topside optic cable.
- 7.5.2. The internal dimensions of the junction box shall be enough to accommodate all splice cassette needed to all fiber fusion and shall has space for maintenance.
- 7.5.3. The junction box shall have at least 02 holes with $\frac{3}{4}$ inch and 02 holes with 01 inch as spare for future submarine optical cable connection. All holes shall be in the bottom of the box.
- 7.5.4. CONTRACTOR shall supply cover plugs for all spare holes for future submarine optical cable connection.

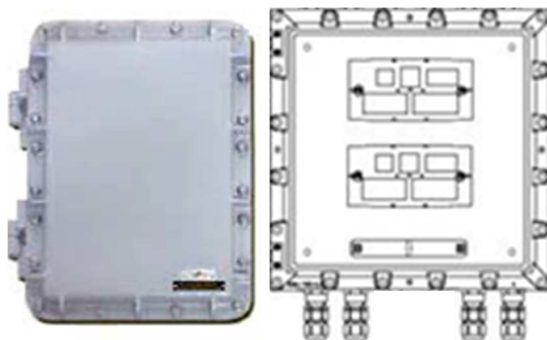



Figure 03 – Ex-d Junction Box



Figure 04 – Splice cassette for securing single optic fiber splices inside the Ex-d Junction Box

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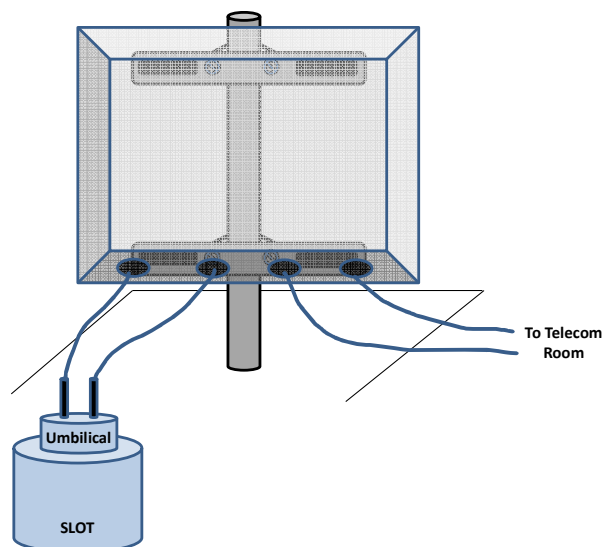



Figure 05 – Typical Arrangement

7.6 DWDM – Hardware and license

7.6.1. CONTRACTOR shall supply and install 02 (two) DWDM HUAWEI 9800 according to the table below:

Item	Model	Quantity	Description
1	OptiX OSN 9800 M24(V100R021) rack&subrack	1	
1.1	TNGK1AFB01	2	Assembly Subrack (OSN 9800M24)
2	Electrical Board		
2.1	TNG3CXP01	4	Universal Cross Connect, System Control and Clock Processing Board
2.2	TNU3N602S33	2	2*200G/400G high performance programable Line Service Processing Board (SLH+, SDFEC2@ 200G E16QAM-400G 16QAM/etc, Flex rate, Coherent, Tunable, Super C, Flex grid) (2*100G Line Capacity Included, RTU Extension Supported)
2.3	TNG1T212S06	2	12*10G Tributary Service Processing Board
2.4	OSX010N01	20	Optical Transceiver, SFP+, 1310nm, 8.5 Gb/s - 11.1 Gb/s, with CDR, -6.0 ~-1 dBm, -14.4 dBm, LC, SM, 10km
3	Optical Board	1	
3.1	TNG2DWSS2001	2	Dual 20 ports flexible wavelength selective multiplexing and demultiplexing board (Supr C_band, 190.65 THz ~ 196.675 THz, 37.5 GHz ~ 40 GHz (10 dimensions included, RTU Extension Supported)
3.2	TNG3DAPXF	6	Extended C-band OA base board with 2 pluggable ports, with XFIU
3.3	TNG3OACE101	8	Pluggable Optical Amplifier, Extended C-band Gain 20~31 dB, Max 21.5 dBm Out
3.4	TNG3OACE1015	4	Pluggable Optical Amplifier, Extended C-band Gain 23~32 dB, Max 23.8 dBm Out

Table 01 – DWDM technical specification

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7.6.2. The quantities related on the table above are the total need to 02 (two) DWDM and must be equally divided by 02 (two) sub racks.


7.6.3. The typical power consumption to be considered for both DWDMs together is 2,454 W (51.1 A) and the maximum power consumption is 3,592 W (74.8 A), at -48 VDC.

7.6.4. CONTRACTOR shall supply the licenses to both DWDM according to the table below:

Hardware RTU Group			
SKU	PN	Description	Quantity
82601308	RTU-LNSDRTUM01	OSN 9800/8800 Line Capacity RTU for 200G+ MSA Port (Per 100G)	2
82601503	RTU-LNSDRTUC08	OSN 9800/8800 Client Port Enable RTU for 10G Port	20
88036BUU	RTU-TNGRTUDWSS20D01	DWSS20 Dimensions RTU (Right for more than 10 dimensions)	2
Basic Software Package & Software Update Fee			
88037CWP	TNGS0000SW21	OptiX OSN 9800 M24-Basic Software Package, V100R021 (Per Subrack)	2
NCE-T,Self-made Software-Enterprise			
Function Software			
88036CFU	NSSSTTPOTNS01	Basic Function Package for Optical Domain OTN Device Management (Per 5 equivalent NEs), Perpetual License	3
Subscription and Support Fee,1 year			
88060VAM	NSSSTENTPOTNS02	Basic Function Package for Optical Domain OTN Device Management (Per 5 equivalent Nes),1 Year Subscription and Support (Annual fee validity period: 1 year from " PO signed plus 90 days ")	6
Subscription and Support Fee,3 year			
88060VAS	NSSSTENTPOTNS03	Basic Function Package for Optical Domain OTN Device Management (Per 5 equivalent Nes),3 Year Subscription and Support (Annual fee validity period : 3 years from " PO signed plus 90 days ")	3

Table 02 – Licenses of DWDM equipment

7.6.1. The Subscription and Support shall be associated with PETROBRAS account, preferably after the commissioning of both DWDM.

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7.6.2. In case of a listed part number (hardware or license) announced by the VENDOR as out of support or end of life, the CONTRATACTOR shall contact PETROBRAS and propose a replacement part or license prior to acquisition.

7.6.3. CONTRACTOR shall be responsible for firmware/software upgrades if required during commissioning due to manufacturer suggestion (bugs and better performance detected) under PETROBRAS request.

7.6.4. CONTRACTOR shall supply and install the electrical power connections and data connections (electrical or optical patch cords) of the equipment.

8. COMMISSIONING

8.1 CONTRACTOR shall perform the following tests to demonstrate the optical cable and DWDM system meet all requirements.:

8.1.1. Total Optic Attenuation

8.1.2. Spectral Optic Attenuation Fiber

8.1.3. DWDM tests

8.2 Total Optic Attenuation

8.2.1. Definition


- a. All tests shall be recorded and submitted to Petrobras approval.
- b. The insertion loss (or total loss or optic fiber attenuation) can be defined as the optic loss accrued from a source along the fiber to the receptor, generally caused by the absorption and scattering of optic energy through the material. The loss of events generated by fusion splices, micro or macro curvatures, and the degeneration caused by the aging of the material.

8.2.2. Measurement Techniques

The insertion loss obtains the total attenuation of the link including connectors, splices and fibers. It is measured using a Power Meter and a source of light: firstly, the optic power provided by the source of light is measured before going through the link, and then the optic power is measured at the end of the link. The total attenuation of the link is the difference between the power in (dBm) and the optic power out (dBm).

8.2.3. Schematic test:

Total attenuation and spectral attenuation using the loss by insertion technique:

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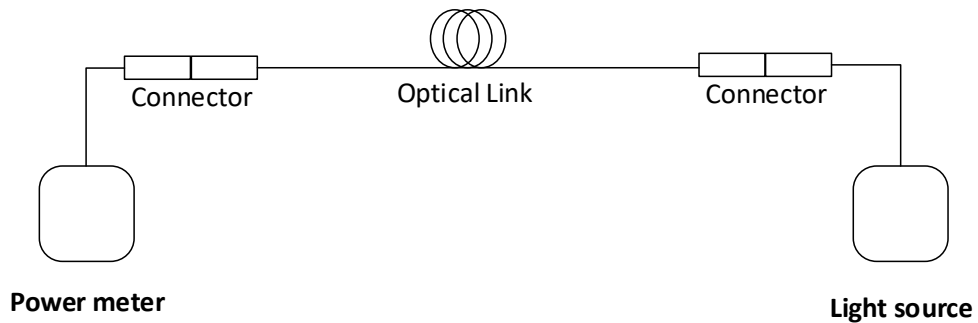


Figure 06 - Attenuation schematic test using a Source of Light and a Power Meter.

8.2.4. Measurement equipment:

In order to perform the Attenuation tests the following equipment is suggested:

- Laser source of light at 1550nm;
- Optic power meter.

8.2.5. Maximum expected values for optic attenuation.

CONTRACTOR shall inform to PETROBRAS during the detailed design the following maximum expected values for optic attenuation, in accordance with the requirements of this technical specification.

Element
Optic fiber [dB/km]
Optic fiber [dB]
Optic splice [dB]
Optic connectors [dB]


Table 03 –Maximum values for optic attenuation record table

8.2.6. Suggestion for a total optic attenuation testing record table.

Spool No. / Binding: _____		Date: _____		Technician in Charge: _____					
Equipment: _____		SN: _____							
Equipment: _____		SN: _____							
Wavelength (λ): _____		Fiber Length: _____							
Fibers		A -> B			B -> A			Average [dB]	Mitigation Coefficient [dB/Km]
Point A	Point B	P _A [dBm]	P _B [dBm]	Att [dB]	P _B [dBm]	P _A [dBm]	Att [dB]		

Table 04 – Total optic attenuation testing record table

8.3 Spectral Optic Attenuation Fiber.

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8.3.1. Definition

This is the total attenuation measured in a larger wavelength bands in order to guarantee the use of dense wave division multiplexing (DWDM) transmission technology.

8.3.2. Measurement Techniques

8.3.2.1. The spectral attenuation must be performed using a broadband source of light (C+L band) and an optic spectrum analyzer, or using a WDM source of light in specific wavelengths.

8.3.2.2. It is recommended to record at least 07 (seven) wavelengths, namely: 1310nm, 1380nm, 1525nm, 1550nm, 1565nm, 1610nm, 1625nm.

8.3.2.3. This test can be performed in a single direction, and only on the optic fiber spools, since the subsequent tests with multi-lambda OTDR are enough to identify post-manufacturing anomalies on the submarine optic fiber cables.

8.3.3. Schematic test:

The spectral attenuation is performed with the same settings as the total attenuation test. However, in this case, the source of light is replaced by a broadband source or by a set of WDM lasers, and the power meter is replaced by an optic spectrum analyzer.

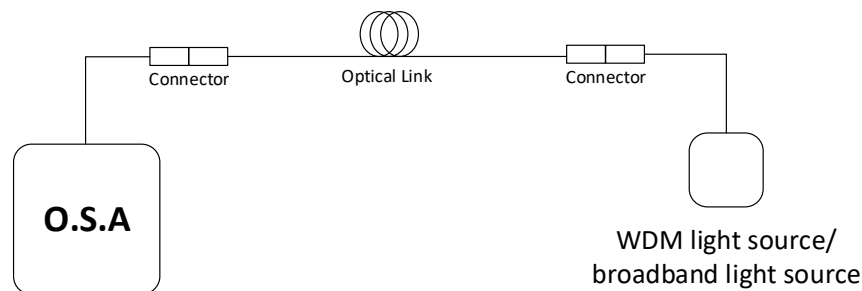



Figure 07 - Attenuation schematic test using Source of Light and Power Meter

8.3.4. Measurement equipment:

In order to perform the attenuation tests the following equipment is suggested:

- Broadband Source of Light and/or WDM Source of Light;
- Optic Specter Analyzer.

8.3.5. Expected values and variations:

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A maximum variation of 0.0002 dB/(km·nm) is expected in band C, less than 0.13 dB in relation to 1310nm and less than 0.03 dB in relation to 1625nm.

8.3.6. Suggestion for a spectral optic attenuation testing record table.

Spool nº / Binding: _____			Date: _____ Technician In Charge: _____						
Equipment: _____			SN: _____						
Equipment: _____			SN: _____						
Fibers			1310nm	1380nm	1525nm	1550nm	1565nm	1610nm	1625nm
Point A	Point B								
		P _A [dBm]							
		P _B [dBm]							
		Att [dB]							
		P _A [dBm]							
		P _B [dBm]							
		Att [dB]							

Table 05 – spectral optic attenuation testing record table

8.4 DWDM subracks

The following DWDM tests can be carried out at the factory or at the shipyard:

8.4.1. Line Board and Tributary Board

- Launched Optical Power at Line Side.
- Mean Launched Optical Power at Client Side.


8.4.2. Passive Board Unit

- Insertion Loss of DWSS20 (AMx to OUT).
- Insertion Loss of DWSS20 (IN to DMx).

8.4.3. Equipment Redundancy Test

- Power Supply Redundancy Test.

8.4.4. Suggestion for DWDM testing records table

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Test Title							
Subrack-Slot	Board Bar Code	Board Type	Port No.	Module type	Module Serial No.	Measure	Pass/Fail
Pass standard:							
Board	Parameter	Unit	Measure				
Test Instrument:							
Remarks:							
Test date:		Technician in charge:					
Conclusion:							
<input type="checkbox"/> Approved <input type="checkbox"/> Approved with Comments <input type="checkbox"/> Not Approved							

Table 06 – DWDM testing record table