

Vertical XT Optical Feed-through System

For Downhole Completions

The system is a downhole, wet mateable optical connector for use in high pressure/high temperature environments within a vertical Christmas tree (VXT), and is used to provide pressure integrity barriers and optical continuity through TH/XT equipment. The OFS is comprised of a jumper with penetrator to a 1-atm splice region and pressure barrier, a wet mate connector at the tubing hanger and tree interface, and a metal to metal seal at the bottom of the tubing hangar.

Technology Overview

The OFS utilizes 3 single mode optical channels within the design. Each optical interface will feature an Angle Polished Contact (APC) to maximize return loss measurements.

Each connector within the system will include a pressure barrier in the form of an optical penetrator. A high reliability, high temperature, high pressure optical penetrator design is used for this application. The penetrator is capable of hermetically sealing 3 single mode fibers within the unit.

Sealing mechanisms and actuation methods also have special requirements. The operational environment can include sour production fluid and is prone to rapid gas decompression (RGD). This environment is not conducive to the use of bulk elastomers, and will utilize metal, plastic, or RGD resistant elastomers.

Pressure compensation for the optical fluid chambers also relies on RGD-resistant materials. Piston-style compensators will be utilized within the system.

DESIGN BASIS STANDARDS

The latest edition of the following standards shall be used where applicable for the Multichannel Optical Feedthrough System design, manufacture, testing, and operation.

- **SEAFOM TDS-01: Functional Design and Test Requirements for an Optical Feedthrough System used in Subsea Xmas Tree Installations**
- **IEC 60068-2-14: Environmental testing – Part 2-14: Tests – Test N: Change of temperature**
- **NORSOK Standard M-710: Qualification of non-metallic sealing materials and manufacturers**
- **NORSOK Standard M-001: Materials Selection**

NOTE: The following standards are provided for reference only and complete adherence to these standards is not implied. The specific applicability of standards and parts of standards is to be agreed upon with the client



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TECHNICAL SPECIFICATIONS

GENERAL SPECIFICATIONS	
Configuration	Wet Mate
Test Pressure at Ambient Temperature for Non-Metallic Pressure Integrity Barrier	25,000 psi (1,724 bar)
Design Life	25 Years, Continuous Use
Number of Channels	3, Optical
MECHANICAL SPECIFICATIONS	
Mate/De-mate Cycles	100, XX before oil refilling (TBD)
Approximate Landing Speed	0.5 m/s (1.64 ft/s)
Maximum Allowable Mate/Demate Force	112 lbs (500 N)
Allowable Rotational Misalignment	0.387° (A) / 1° (B)
Allowable Angular Misalignment	0.53°
Allowable Radial Misalignment	.0281 in (X) / +/- .0019" (Y)
Allowable Axial Misalignment	+/- 0.085 in
OPTICAL SPECIFICATIONS	
Optical Communication and Test Wavelengths for SM	1310nm and 1550nm (SM) 850nm and 1300nm (MM)
Insertion Loss per Mated Connector Pair (SM/MM)	≤ 0.5 dB/Channel (SM) ≤ 1 dB/Channel (MM) ≤ 1.5 dB/Channel at Maximum Operating Environment (10 kpsi/250°F)
Insertion Loss per Penetrator for SM	≤ 0.1 dB/Channel (SM) ≤ 0.2 dB/Channel (MM)
Return Loss per Mated Connector Pair (-5°C to 121°C)	≥ 45 dB/Channel
Fusion Splice Insertion Loss	≤ 0.05 dB/Channel
ENVIRONMENTAL SPECIFICATIONS	
Water Depth	10,000 ft (3048 m)
Rated Working Pressure	Internal Well Bore Pressure: 10,000 psi (690 bar) External Seawater Hydrostatic Pressure: 5,000 psi (345 bar)
Rated Test Pressure	Internal Well Bore Pressure: 15,000 psi (1,034 bar) External Seawater Hydrostatic Pressure: 7,500 psi (517 bar)
Design Temperature	-5°C to 121°C (23°F to 250°F)
Storage Temperature	-40°C to +60°C (-40°F to 158°F)

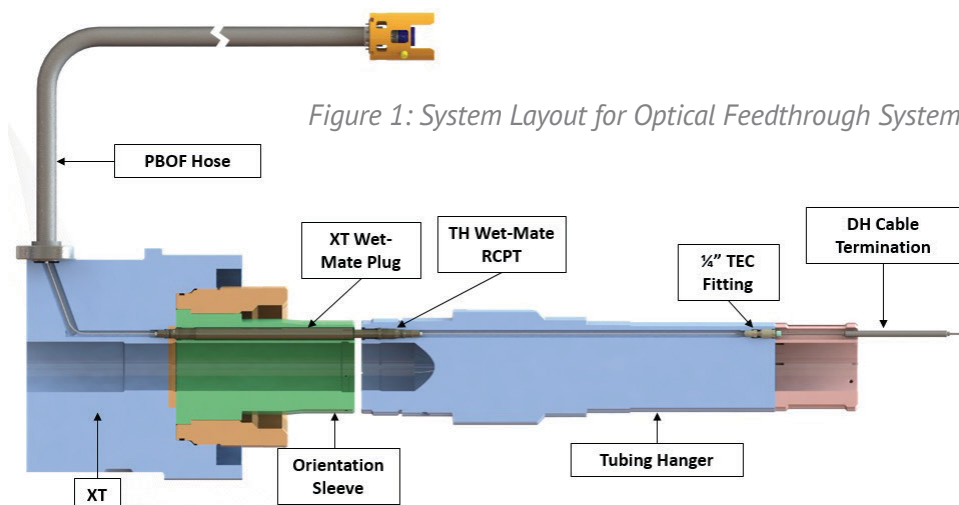


Figure 1: System Layout for Optical Feedthrough System



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