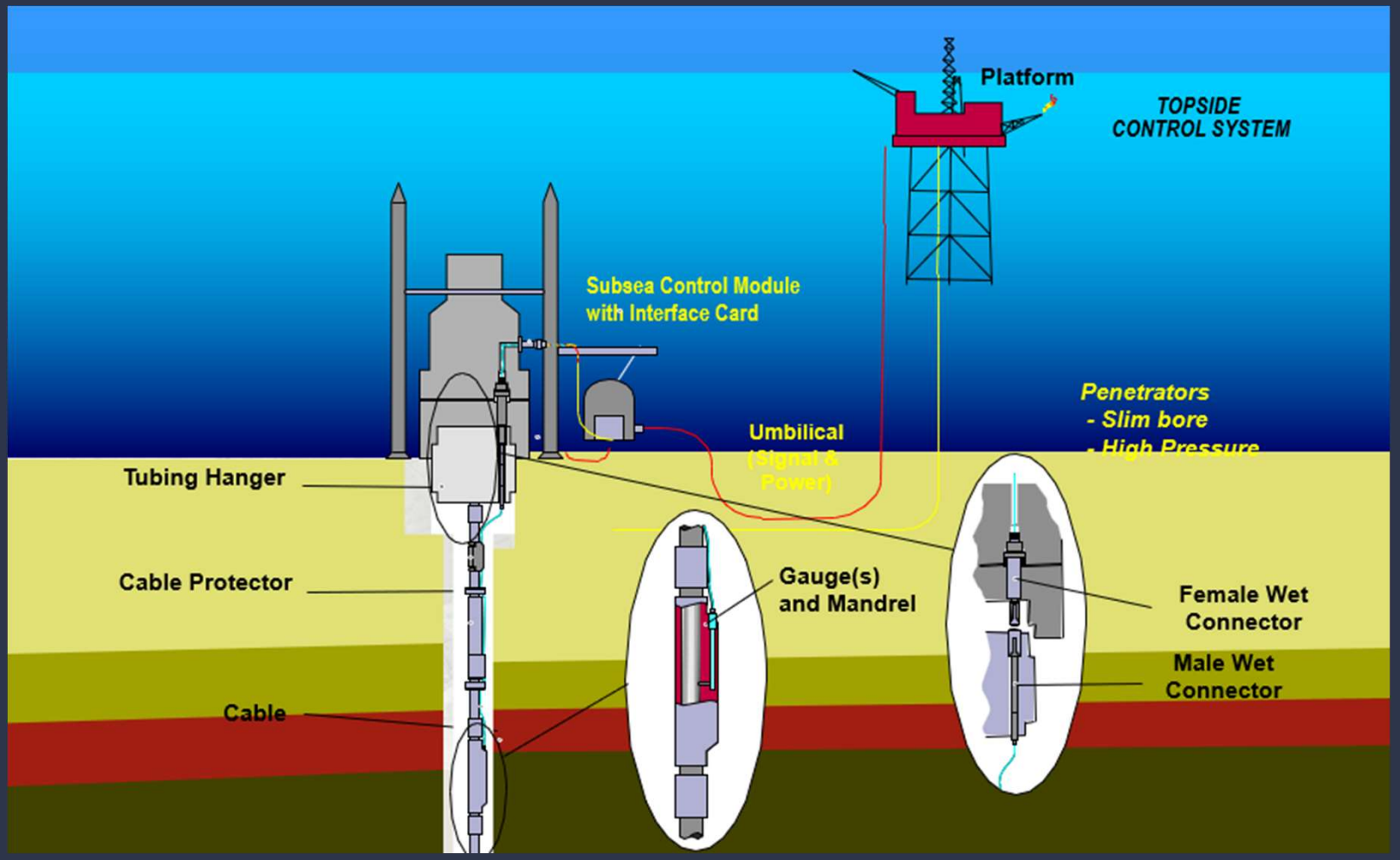
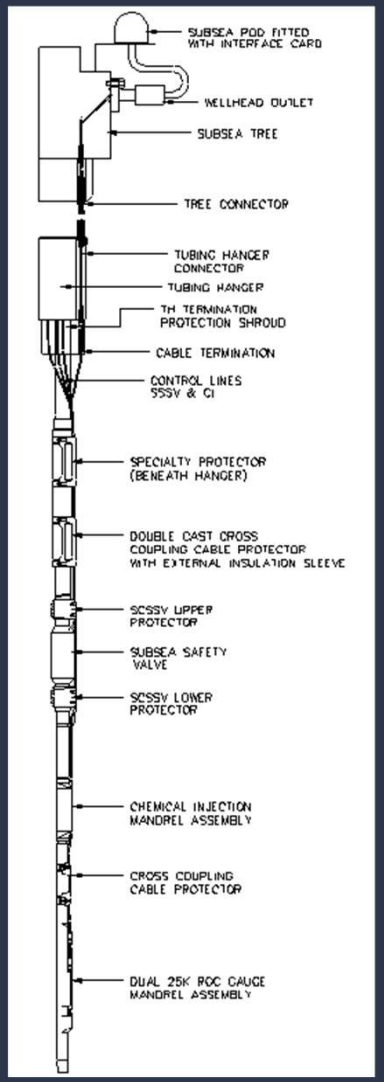
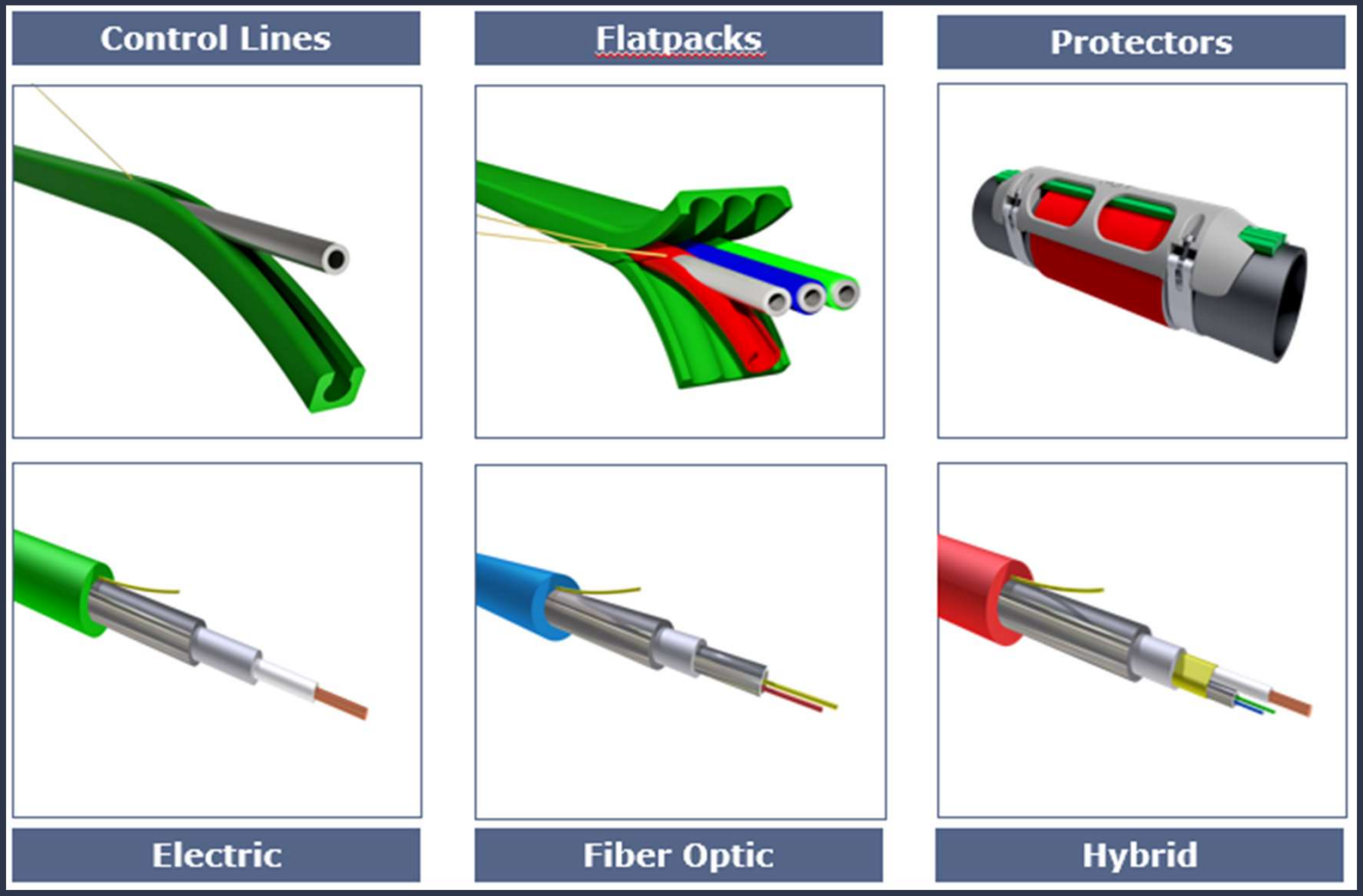
Our Products Application

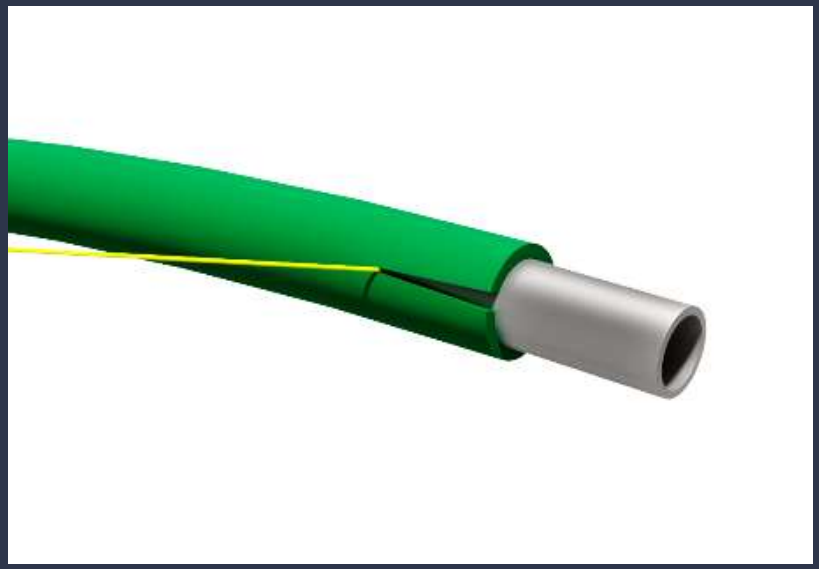




Prysmian – Fully Integrated Manufacturer



Control Lines



Typical Materials

Incoloy (high Nickel): **A825** & A625
Stainless Steel: **316L** & 304L
Duplex: 2205 / 2507

Typical Sizes

1/8" x 0.022", 0.028" & 0.035"
1/4" x 0.035", **0.049" & 0.065"**
3/8" x **0.049", 0.065"** & 0.083"
1/2" x 0.049", **0.065" & 0.083"**
5/8" x 0.049" & 0.065"

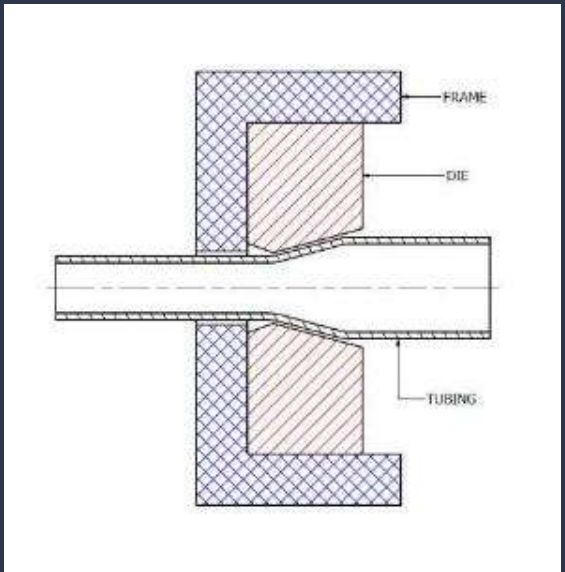
Service Companies pressure ratings will vary dependent on calculation method and factor of safety.

FOUR TYPES of CONTROL LINE TUBING

1. Welded at Size
2. Welded & Drawn (including E.P. - enhanced property tube) – (WD)
3 Welded & Floated Plug Drawn – (WFPD)
4 Seamless

All Made to ASTM Specs

Control Lines



Welded and Drawn

Drawing down the tube (sinking) by pulling it through a die provides several benefits:

- The process can stretch and therefore “magnify”, weld defects that will be detected by the dual eddy current test.
- The process reshapes the weld bead creating a truly round tube with a good surface finish.
- This cold working process helps to achieve homogenization of the weld

Welded, Floated Plug Drawn

With WFPD tube the inside of the tube is also subjected to a cold working process.

The plug is ‘floating’ inside the tube surrounded by lubricant.

The plug balances in position, being pulled forward by the tube being drawn, while at the same time it’s pushed back as it tries to pass through the dies.

Flush and Fill

Standard process

- Based on fluid type and tube size calculate flow rate
- Circulated fluid in tank to required cleanliness
- Lines filled
- Pressure test
- Lines circulated a min. of 5 times
- Samples taken for cleanliness

NAS 1638 Class 6 and SAE AS4059 6B-F are cleanliness levels and not specifications/process for cleaning lines.

Most Service Companies do not provide procedural requirement for cleaning, circulating or testing the lines.

Tubing Encased Conductor TEC/PDC

Tube Design
- Materials — **A825 & 316L**
- Tube Sizes — 1/8” to 3/8” OD

Conductor Design
- Size, quantity & type
- Plating (if required)

Electric Core Design
- Insulation materials
- Double Extruded

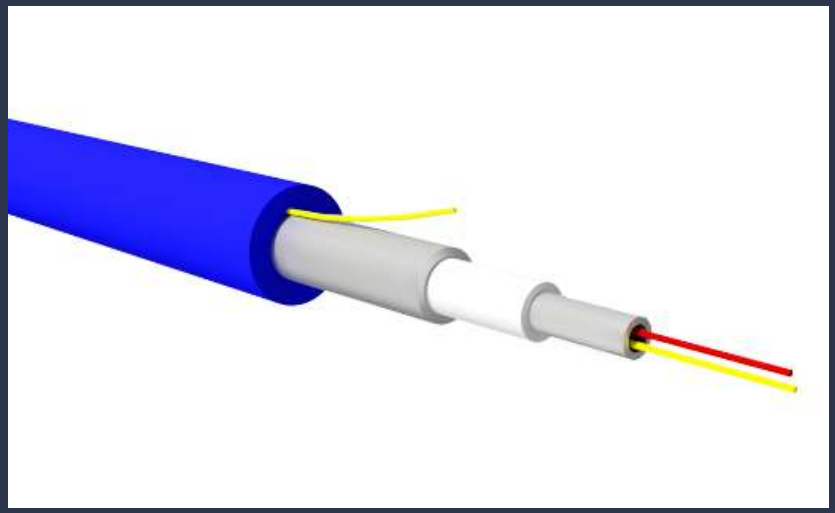
Encapsulation Design
- Materials, profiles and colors
- Optional Bumper Bars
- Customer specific line marking
- Safety – Strip®

Features
- Temp ratings up to 260 Deg C
- Centralized conductor
- Application specific
- Stock availability

Tubing Encased Conductor

	Parameter	Options
1	**Operating Temperature**	-40C to +260C
2	**Number of Components**	Single conductors, twisted pair or multiple conductors
3	**Bumpers**	Stranded, galvanized or ungalvanized steel cable for crush resistance
4	**Electrical Conductors (gauge)**	6 AWG to 26 AWG
5	**Electrical Conductors (material)**	Copper, copper alloy, silver, solid or stranded
6	**Electrical Conductor (coating)**	Bare, tinned, nickel, silver
7	**Fiber Optics**	Polymeric loose tube or 304, 316L or A825 FIMT
8	**Insulation and Fillers**	Polypropylene, ETFE, FEP, PFA
9	**TEC Tubing Diameter**	Minimum: 1/8" (3.2mm) Maximum: 5/8" (15.9mm)
10	**TEC Wall Thickness**	.022, .028, .035, & .049
11	**TEC Tubing Alloys**	316L SS, Alloy 825
12	**TEC Encapsulation Material(s)**	Nylon, PVDF, PP, Santoprene, FEP, ETFE (Tefzel), ECTFE (Halar), PFA
13	**Length**	20,000' (6.1km) average, up to 60,000' (18.3km) custom, no minimum lengths

Tubing Encased Fiber TEF



Tube Design

Materials	**A825 & 316L**
Tube Sizes	1/8” to 3/8” OD

FIMT Design

- Size, quantity & type
- Multi Mode (MM) or Single Mode (SM)
- Various fiber coatings
- Gel filled
- Extrusion over central FIMT (Belted)

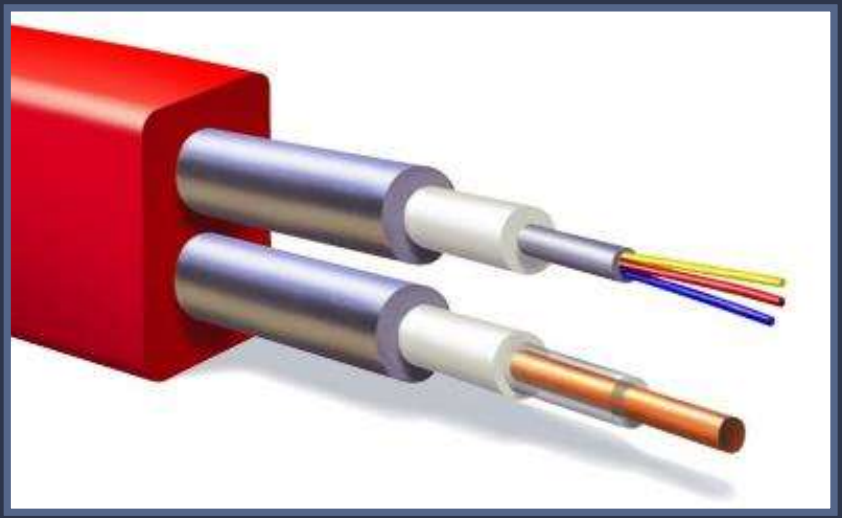
Encapsulation Design

- Materials, profiles and colors
- Optional Bumper Bars
- Customer specific line marking
- Safety – Strip®

Features

- Temp ratings up to 300 Deg C
- Centralized FIMT
- Application specific

Hybrid - Braided



In applications where electrical and fiber optic devises are installed downhole, hybrid cables combine both of these data transmission mediums into a single package. The simplest Hybrid design is achieved by combining a standard TEC with a standard Fiber Optic cable.

Fiber Cable

- Centralized 1/8” FIMT
  - MMF(s) & SMF(s)
  - Gel
- Secondary Extrusion
- ¼” Tube (welded and drawn)

TEC

- Centralized Conductor
  - Typically 18 or 16AWG
- Insulation
- Secondary Extrusion
- ¼” Tube (welded and drawn)

Hybrid - Braided

The micro-tube of the FIMT is the conductor.

A copper braid/copper tape on the outside of the FIMT improves the conductivity.

The braided/copper tape FIMT is insulated with an extruded fluoropolymer.

A secondary extrusion centralizes and supports the core assembly in the outer tube.

Small diameter FIMT limits the EFL to < 0.05%, therefore only suitable for low temperature applications.

The 0.052” FIMT can be terminated to standard 16AWG electronic gauge termination but the fiber dead ends at electronic gauge termination.

Jumper wire must be attached to the braid and / or FIMT at the wellhead exit.

Hybrid - Helix

In a ¼” tube two, three or four element constructions can be made with a large diameter FIMT and conductors up to 18AWG.

Multiple elements can be twisted together but it is recommended to incorporate only “active” elements and not to include filler rods.

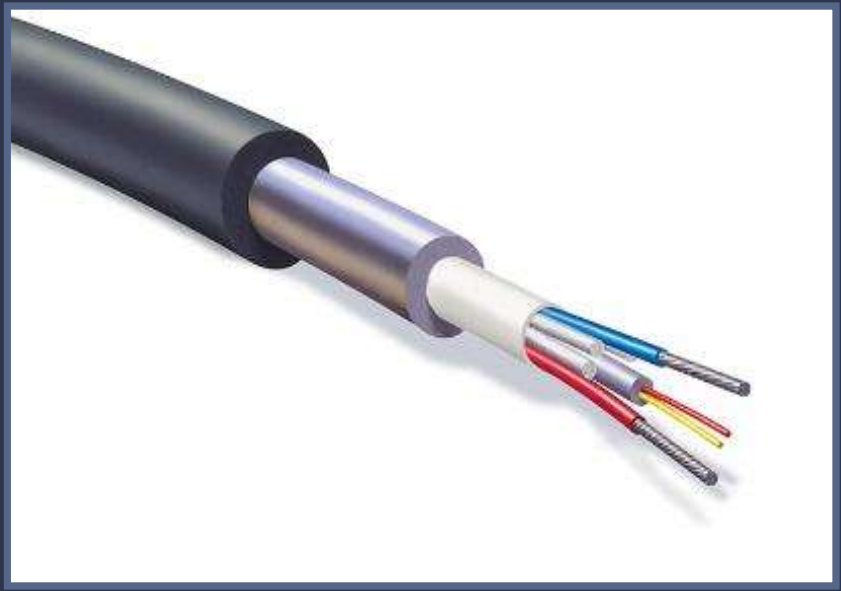
Twisting dissimilar elements into a helical construction significantly increases the manufacturing risk.

Compared to the parallel design the Helix helps to reduce the strain effect which is caused by the FIMT not being centralized.

This design allows for large diameter FIMT and larger diameter insulated conductors.

Twisting dissimilar elements into a helical construction increases the manufacturing risk especially with long lengths.

Hybrid - Helix



The multiple insulated wires are wrapped around the central FIMT.

If the number of insulated wires is reduced filler rope or rods can be added to in place of insulated conductors to maintain “round” core construction.

A tape wrap is usually used to create a binding layer that centralizes and supports the core inside the tube.

The design allows for a large diameter FIMT however there is a trade off between FIMT size and diameter of the insulated wires.

The typical conductor sizes are 22AWG and 24AWG.

Wires can be joined together to increase the effective conductor CSA.

Encapsulation

Safety–Strip ® Encapsulation is available with all materials

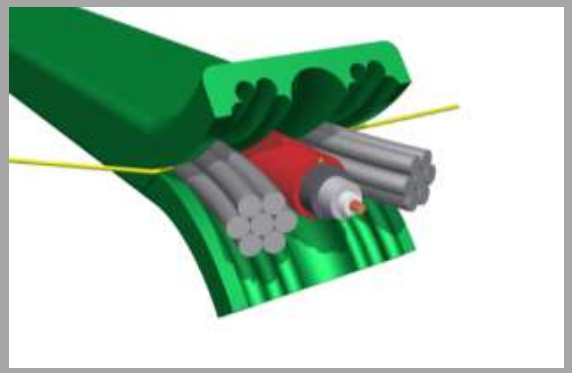
	Material	Encapsulation of TEC, Control Lines and Flat pack
1	**Polypropylene**	To 150ºC for Brine Only
2	**Santoprene**	To 150ºC for Brine Only
3	**Nylon**	To 150ºC for Hydrocarbons Only
4	**PVDF**	To 150ºC for Brine or Hydrocarbons or mix
5	**Halar (ECTFE)**	To 175ºC for Brine or Hydrocarbons or mix
6	**Tefzel (ETFE)**	To 175ºC for Brine or Hydrocarbons or mix
7	**FEP**	To 200ºC for Brine or Hydrocarbons or mix
8	**PFA**	To 260ºC for Brine or Hydrocarbons or mix
9	**Steel Bumpers – Galvanized or ungalvanized**	Available

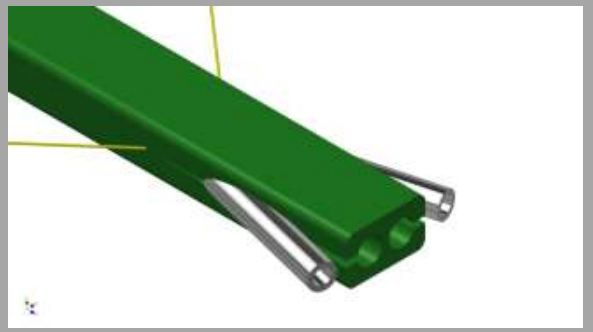
Encapsulation – Removal Reasons

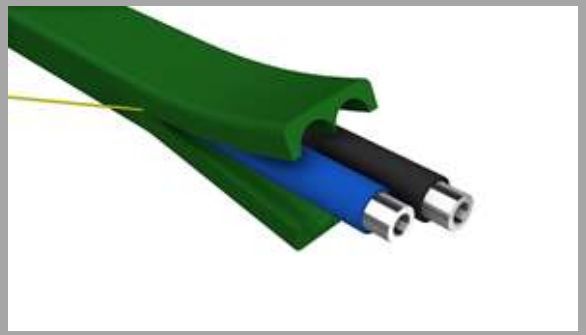
- Termination to downhole devices
- Dry tree to feed through the tubing hanger and tree
- Terminate to subsea tubing hanger connectors
- Splices when the cable has been damaged RIH
- Feed through packers to pass through ports in the packer and to be spliced above the packer
- By-pass slots in tight clearance assemblies
- To split line(s) from a multi line Flatpack to terminate the line at a different setting depth.
- To fit bare cable into sealing slots on swell packers

Encapsulation – Safety Strip Flatpacks

A full range of configurations with different tube sizes and encapsulation materials are available using single and dual pass encapsulations.







Protectors

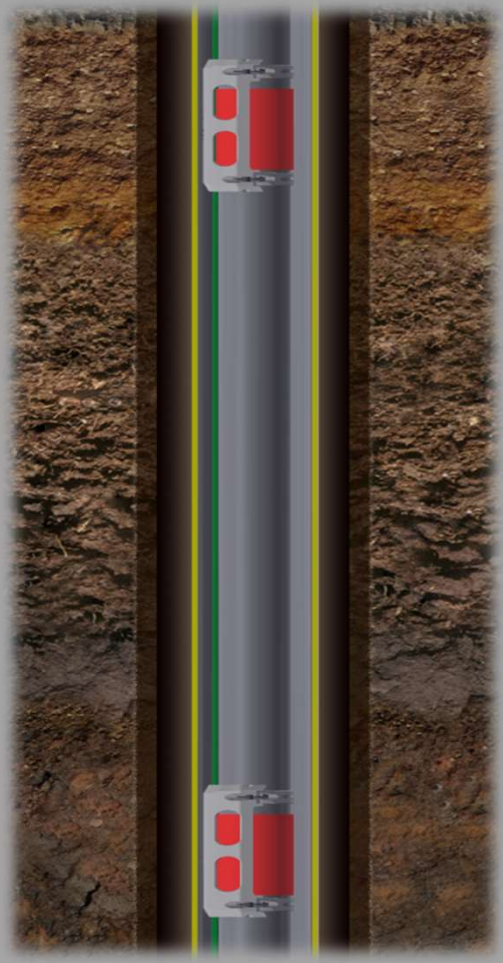
PDT protectors covers the full range of downhole applications from shallow land wells through to deep and harsh environment wells.
There is no accepted industry test protocol, specification or standard for protectors. However, there are customers that have a specification that detail the requirements.
A variety of different products are available in the market to hold lines to the production tubing.

- Bands and pressed steel covers
- Bands and Cast steel covers
- "Cannon Style" Pressed steel
- Cast Protectors
    - Interlocking
    - Strap and Shoulder
- Specialty Protectors
    - Specialty Designs for SSSV, Splice, SSSV, CI

Design
In house design capabilities
All cast body with cast/steel strap
One piece assembly with captive fasteners
No loose parts
Interlocking straps
Side Ribs with centralized support pillar
Compact design for restricted access
Chamfered ends
Quick / easy to install

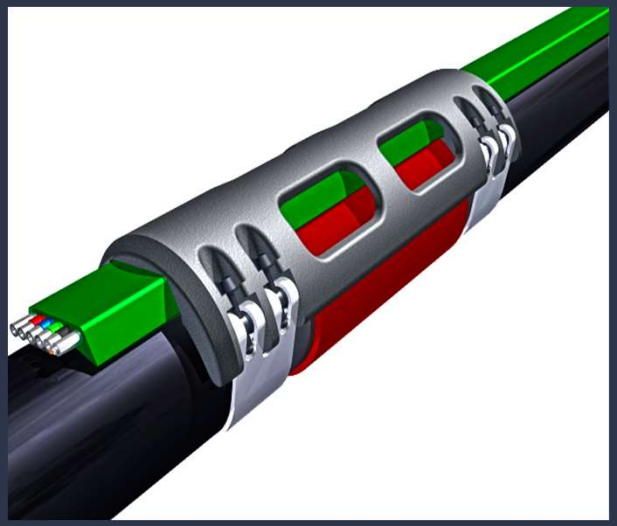
Materials
NACE MR0175 compliant
Carbon Steel, 316 SS, 13Cr, 25Cr, Supex Duplex

Load Ratings
First article Design Validation Testing
30-75 ton axial and lateral hold
3 Ton rotational load
Support minimum of 100ft of monitoring cable, control line, and flatpack

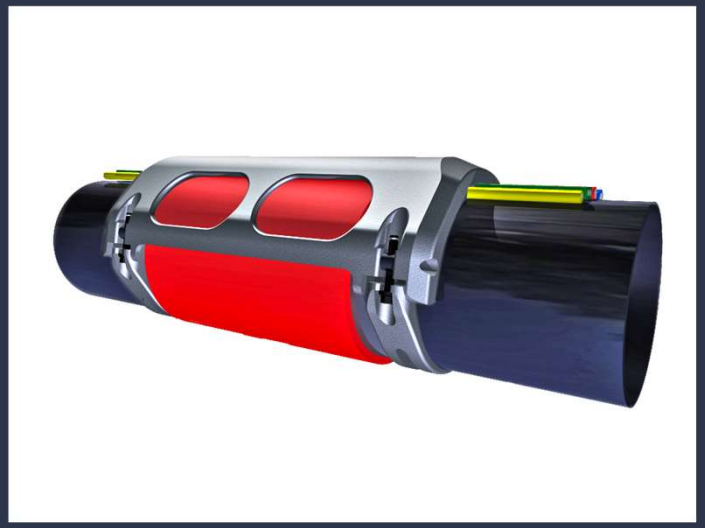


Protectors

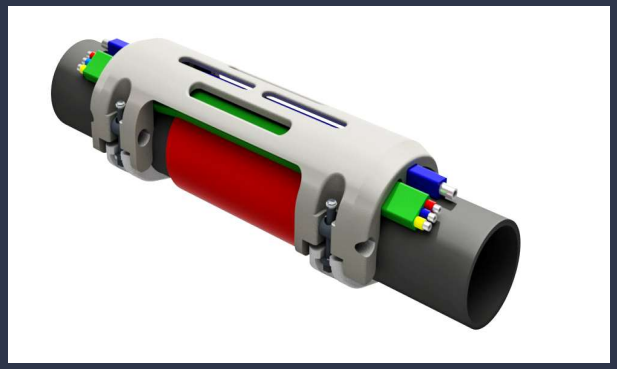
SL Protector



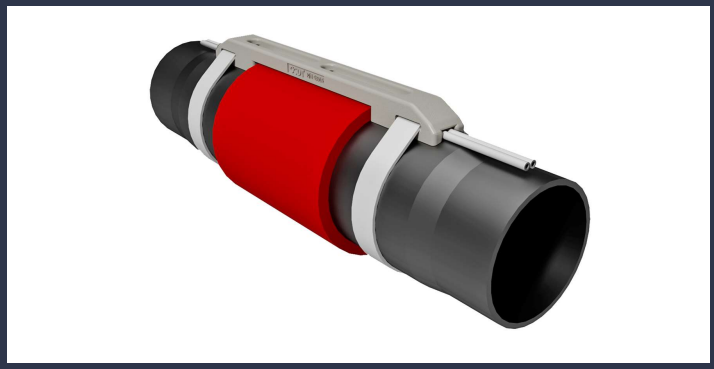
SSL Protector



HD Protector



LT Protector



BC Protector

Protectors

Blast Joint Protector

Splice Protector