PRYSMIAN
CABLES & SYSTEMS

Umbilicals Thermoplastic and Steel Tube

technergy™
INTEGRATED CABLING SOLUTIONS

About us

Prysmian Cables & Systems is a world-class multinational company. Founded in 1872 as "Ditta Pirelli & C.", it has achieved a leading position for more than a century of operations in its two key international markets - "Energy Cables & Systems" and "Telecom Cables & Systems".

Prysmian Cables and Systems is the world's largest manufacturer of power and telecommunications cables, with 52 manufacturing facilities in 21 countries in five continents and a market share in excess of 10%.

Prysmian Energy Cables and Systems is a global solutions provider, offering a wide range of integrated solutions, such as cable systems, system design and engineering, project management, installation and post-sale services.

Prysmian Energy Cables and Systems concentrates on continuous product innovation and on achieving a competitive edge by focusing on research and development. This is done through Prysmian's own R&D centres and by co-operating with universities, scientific institutions and above all, our customers. Prysmian's world-wide organisation makes and delivers advanced technological solutions to customers anywhere in the world.

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Prysmian's TECHNERGY integrated cabling solutions™ is one of the world's most comprehensive and technologically advanced answers to industry, infrastructure, contractors and OEM's specific requirements.

TECHNERGY integrated cabling solutions™ are designed and structured into twelve different product lines. Each of these offer tailored designs and added value solutions to the most diverse functional and environmental requirements in the following fields:

- > Trains
- > Marine
- > Oil & Gas
- > Plant & Petrochem
- > Mining & Tunnelling
- > Defence
- > Cranes & Mobile Equipments
- > Electro-Mechanical
- > Data & Communication
- > Transportation Infrastuctures
- > Building & Civil Engineering
- > Power Plants

To find out more about the TECHNERGY integrated cabling solutions™, Prysmian Cables and Systems invites you to visit the web site: www.prysmian.com

PRODUCT RANGE

The depth records in the Roncador field for both control and power umbilicals are a direct result of our partnership with Petrobras.
Together we have overcome the challenges of developing ulta-deep water umbilical cables.

WORLD RECORD: 1360 METRES

- > **1360 meters**
  Electro-Optical Umbilical
  Application: Power and Data
  Transmission between P36 and P47
  Installation date: September 2000
- > **1853 meters**
  Control Umbilical
  Application: R0-08 well control
  Installation date: June 2000

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Application

SEVEREX
High Performance Compound

During the last few years, offshore oil extraction activity has been constantly increasing. New platforms are being continuously installed in different parts of the world and operate in deeper and deeper waters. The safe and efficient interconnection from the topside platforms and vessels to the well heads and pumps on the seafloor is necessary to transfer power and data, as well as hydraulic and other fluids to guarantee reliable oil extraction operations. The local generation of electric power and the subsequent distribution to various appliances achieves lower generation costs. In addition broad-band communication systems are now an essential feature of the most modern communication and process control systems. The umbilical cables form this vital link between the various centres of operation. They must be able to withstand high mechanical and chemical stresses, high operating temperatures and pressures in order to ensure the continuous and reliable supply of services in the harsh environments below the sea. **Technergy ™** Umbilicals offer a full range of solutions, which thanks to innovative designs, materials and state of the art processes meet all of the demanding requirements of such applications.

Technergy ™ Umbilicals offer oil companies, contractors, engineers, installers and component manufacturers the following major benefits.

Benefits

> Customised and Multifunctional Design

Prysmian has the possibility to formulate compounds and to design and manufacture umbilicals in order to meet its clients' specific needs, thus offering a full range of products, from medium voltage cables to optical fibres cables.
Multifunctional cables, which integrate power and communication and meet even the most demanding requirements and the most sophisticated designs, are also available for special applications.

> Environment and Performance

Technergy™ Steel Tube Umbilicals, can offer the highest performance levels at the deepest operating depths. Designed to use superior duplex stainless steel, the tubes are not affected by the pressure and so offer the fastest response times for the hydraulic lines. They also prevent permeation of chemicals through the tubes. The tubes themselves are welded together using the very latest laser welding equipment and thoroughly examined post manufacture to ensure the highest levels of reliability.

> Chemical and Climate Resistance

Technergy™ Thermoplastic Umbilicals are designed and manufactured to withstand even the most demanding operating conditions. Prysmian Laboratories have developed **SEVEREX** high-performance compounds in order to meet the severe requirements of this application. A longer lifetime is thus guaranteed to cables even under the highly demanding conditions generally required by their installation. A high resistance to chemical agents (oils and fuels, muds, moisture, acids and bases), as well as to atmospheric and environmental phenomena (extreme low/high temperature, UV irradiation, ozone) is therefore guaranteed.

> High Mechanical Performance

Technergy™ Umbilicals are designed and manufactured to withstand the very high mechanical stresses cables are subject to in normal operating conditions.
In particular, cables are designed to withstand "tensile loads" and "torsion stresses", which develop in either dynamic or static operating conditions.
Fatigue life assessment of the cables has taken into account accumulated plastic strain (APS) and low cycle fatigue (LCF).

> Lower Total Cost of Ownership

Technergy™ Umbilicals offer full range solutions at a lower total cost of ownership, thanks to:
Longer lifetime: innovative materials and designs provide Technergy™ Umbilicals with a proven track record in extended working lifetime versus traditional cables, at the same time reducing maintenance requirements.
Accessories: Prysmian provides a full range of specially developed accessories, which allow a lower installation time and a higher reliability and lifetime of the entire system.

> Contract Management

Prysmian's central co-ordination and sales office network provide our customers with a single and easy to contact interface.
Complete project technical literature and constant technical support are the standard services on which our customers can rely.
Prysmian's manufacturing capacity guarantees meeting deadlines, even in case of complex and large projects.
A dedicated team of engineers provide front end engineering and design (FEED) services in close liaison with the customer design offices.

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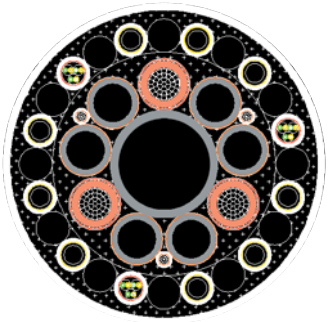
Cable families at a glance

STEEL TUBES

Steel tube umbilicals (STU's) are becoming the preferred solution in many deep water projects for hydraulic control and chemical injection lines for wellhead control systems. The STU technology provides enhanced response times and higher working pressures when compared to more traditional thermoplastic hose based designs. The STU's also prevent the permeation of fluids from the tube, particularly with injection fluids containing methanol. STU's use high-alloy stainless steel tubes with high mechanical strength and fatigue resistance, with an excellent corrosion resistance at high fluid temperatures.
In addition, the STU's allow cables designs with a very compact cable cross-section and in some cases, allow for use of traditional structural support members such as steel armouring to be omitted from the designs, for both static and dynamic applications. For dynamic applications the individual steel tubes can be oversheathed to prevent excessive wear. The manufacturing process of STU's allows the integration of other functional components such as low and medium voltage power cables, control cables, fibre optical cables, as well as a range of different dimensions of steel tubes and thermoplastic tubes. Long continuous cable lengths are possible using the latest sophisticated automated welding machines and NDE testing which guarantee high levels of service and reliability required for this kind of product. Solutions will be designed to suit the individual customer requirements.



DEEP WATER UMBILICALS

> Chemical Injection Control Umbilicals

Designed and tested to withstand harsh environmental conditions in water depths as deep as 1.000 meters in both static and dynamic applications, these umbilicals comprise the following typical functions:

- High pressure hydraulic control hoses;
- High pressure chemical and ethanol injection hoses;
- Electric control cables (optical fibre control core can be provided as an option, on demand).

> Electro – Hydraulic Control Umbilicals

Designed and tested to withstand harsh environmental conditions in water depths as deep as 1.000 meters in both static and dynamic applications, these umbilicals comprise the following typical functions:

- High pressure hydraulic control hoses;
- Electric control cable (optical fibre control core can be provided as an option, on demand).

> Electro – Hydraulic Umbilicals for Multiplexed Systems

Designed and tested to withstand harsh environmental conditions in water as deep as 1.000 meters in both static and dynamic applications, these umbilicals comprise the following typical functions:

- High pressure hydraulic control hoses;
- Electric power and control cables (optical fibre control core can be provided as an option, on demand).

ULTRA DEEP WATER

> Production Well Umbilical

Designed and tested to withstand harsh environmental conditions in water depths as deep as 2.000 meters in both static and dynamic applications, these umbilicals, which require a high level of structural resistance comprise the following typical functions:

- High pressure hydraulic control hoses;
- High pressure chemical and ethanol injection hoses;
- Electrical power and control cables (optical fibre control core can be provided as an option, on demand).

> Power – Optical Umbilicals

Power-optical cables are used in the offshore industry in the following applications:

- Power distribution and two-way communication between production units;
- Single/Dual Subsea Electrical Submersible Pumping Systems;
- Vertical Annular Separation and Pumping System (VASPS);
- Subsea Multiphase Pumping System (M.V. Power feeding), operational control and data transfer of subsea multiphase pumping systems.

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Quality commitment

Prysmian has a built in multi-step quality assurance program, covering the production process from cable design and raw material purchasing, to final inspection and testing documentation.

The quality system of Prysmian has been assessed and approved and is audited regularly by **Lloyd's Register of Quality Assurance to the ISO 9001 and ISO 14001 Quality System Standards**. The ISO 14001 is the environment quality standard.

SEVEREX
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> APPROVALS

Prysmian works closely with major classification societies. Our cable factories have approvals for their cables at:

Lloyd's Register of Shipping (LRS)
Det Norske Veritas (DNV)
Registro Italiano Navale (RINA)
American Bureau of Shipping (ABS)
Bureau Veritas (BV)

Accessories

Prysmian provides a full range of accessories for the mechanical fixing of the umbilical to the support structures, connection of steel tubes, hoses, optical cables and electrical cables to surface and sea bottom equipment and connection of adjacent sections comprising the total umbilical length.

Umbilical accessories are essential components of the umbilical line. They are responsible for the reliable connection of steel tubes, hoses and electrical cables to surface and sea bottom equipment and for the connection of adjacent sections comprising the total umbilical length. They must also provide the mechanical fixing of the umbilical to the support structures.

Accessories are designed taking into consideration data such as:

- > Interfacing support structures characteristics.
- > Installation site weather and sea conditions.
- > Production unit movement behaviour.
- > Installation vessel movement behaviour.
- > Umbilical hydrodynamic behaviour.
- > Marine corrosion.

The mechanical stresses expected to occur during installation and service life of the umbilicals are determined by a specialised software considering worst case conditions. Marine corrosion resistance is achieved with the use of special surface treatments, cathodic protection or use of corrosion-resistant materials, depending on the specific type of accessories.

The most commonly used accessories are listed bellow:

- > Armour pot (featuring interface flange and anchoring of umbilical armour wires).
- > Bend stiffener (polymeric bending limiter for dynamic applications).
- > Bend restrictor (metallic bending limiter for static applications).
- > Electrical submarine connectors.
- > Pulling head.
- > Touch-down point protection.
- > Splice box.
- > Steel Tube/Hose fittings and nipples.

FPSO Termination for Deep and Ultra Deep Water Umbilicals WATER DEPTH 2.000 m

Splice Box for Deep and Ultra Deep Water Umbilicals WATER DEPTH 2.000 m

WCT/Manifold/Splice – Termination for Deep and Ultra Deep Water Umbilicals WATER DEPTH 2.000 m

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