

## Tether and Umbilical Cables for Remotely Operated Vehicles



EVERY CONNECTION COUNTS

# 6000 meters down is no place for cable failure

TE Connectivity (TE) helps you go deep, whether it's to the ocean floor, the bottom of a mine, or down an oil well. We develop cables built for some of the most rigorous applications. Our Rochester and Raychem products bring advanced technology to the design and manufacture of cables for rugged applications.

## Raychem: Thinner, Lighter, and More Robust Cables

Raychem pioneered irradiation cross-linked insulation to allow thin-wall and ultra-thin-wall wires and cables. Expertise in material sciences allows us to create insulations that reduce weight and save space while maintaining or enhancing electrical, mechanical, or environmental performance.

Since each application is different, TE continuously develops new products and maintains expertise in the use of an expansive list of materials. Our experience with various metallic and synthetic alloys contributes to the working success of new products and allows for greater design flexibility. Our own wire mill, unique among most cable manufacturers, produces high-carbon, high-tensile wire to exacting requirements to meet your operational parameters and goals.



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## Rochester Cable: Expertise that Runs Deep

Since its founding in 1794 as a manufacturer of ropes, Rochester Cable has evolved to become a recognized leader in the design and manufacture of electro-optical cables for a vast array of applications. Our cables are highly engineered to meet specific application requirements in such demanding industries as petroleum exploration and production, defense, oceanographic, and subsea applications.

Rochester STEEL-LIGHT optical cable was developed to meet the challenges posed by harsh environments and rigorous operational scenarios. Cables using the STEEL-LIGHT product meet the hydrostatic pressures encountered at full ocean depth and endure the mechanical stresses imposed during the repeated flexure affiliated with dynamic systems.

TE's ROV product line of heavy lift umbilical cables, neutrally buoyant tether cables and heavy tether cables for all lifting applications in offshore and marine environments. The small size cables all benefit from reduced weight and diameter, providing longer length on current handling equipment. All three cable types feature high voltage ratings, high temperature, reduced diameter power conductors with flexible conductors, screened twisted pairs for instrumentation and coaxial or databus for data and video. Furthermore the cables feature multimode or single-mode Fiber In Steel Tube (FIST) and grounding via copper tapes.

**Heavy lift umbilical cables** TE heavy lift umbilical products combine the unique technologies of the Raychem and Rochester brands. Irradiated, cross-linked SPEC 44 wire technology along with the STEEL-LIGHT fiber optic elements and preformed, corrosion resistant steel armor offer optimum size and strength cable packages for the heavy lift requirements of the offshore and marine industry.

Our heavy lift umbilical cables are typically 30% smaller than their competition, allowing longer excursion without the heavy investment cost of new winching equipment.

Umbilical cables feature a custom cable design, 2 or 3 layers, torque balanced steel wire armor packages, typical depth ratings to 4000 meters and EMC immunity via tin plated copper braid.



**Neutrally buoyant tether cables** Neutrally buoyant tether cables provide a flexible, yet mechanically robust product. The cables are available in custom designs with aramid armor packages. Excursion lengths are up to 1000 meters. We can also tailor the tether cable's buoyancy in order to maximize the products excursion length or to provide a positively buoyant material.

**Heavy tether cables** Heavy tether cables provide the smallest diameter product which provides the operator with longest excursion length possible. A mechanically robust product is achieved by use of a mechanically resistant sheath.

The cables are available in custom designs with aramid armor packages. Tether and umbilical cables feature high voltage, high temperature, highly flexible power conductors, shielded twisted pairs, data bus or coaxial cables for data or video transmission, fiber in tube, and Rochester STEEL-LIGHT fiber packages.

**Deck cable** We also offer companion deck cables ancillary on-board short-length cables to complete subsea cable's circuit.

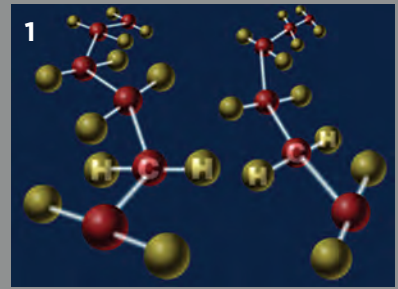
## TE Components . . . TE Technology . . . TE Know-how . . .

AMP | Agastat | CII | Hartman | Kilovac | Microdot | Nanonics | Raychem | Rochester | DEUTSCH

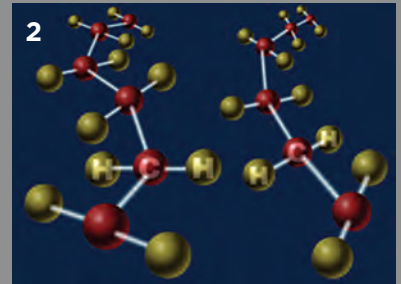
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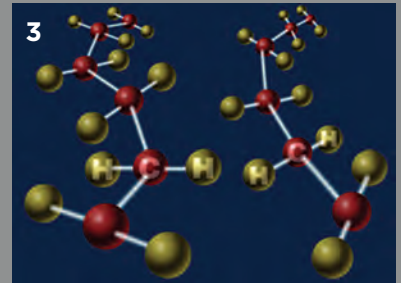
Here you can get connected to the inner circle of TE AD&M's best thinkers. Working together early in your design review process, we can help you reach a better connectivity solution.



**Molecular Chain**



**Crosslinking**



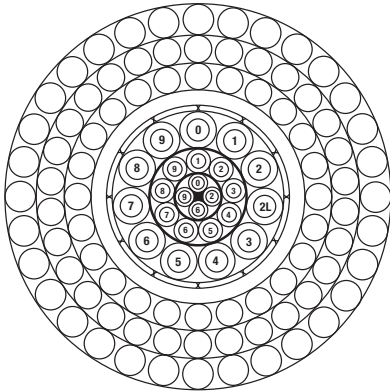
**Crosslinked Molecular Chain**

Expertise in polymer chemistry allows TE to create thin-wall insulations. Our unique formulations go beyond off-the-shelf polymers to ensure performance equivalent to or exceeding comparable thick-wall cables.

Radiation cross-linking creates thin-wall insulation and jacket materials known for being physically rugged even at elevated temperatures, remaining thermally stable, and offering excellent resistance to fluids and chemicals.

TE's Raychem pioneered cross-linked insulation for wire and cable, initially for the aerospace industry. To achieve cross-linking, a polymer product is exposed to high-energy radiation. This is generally done by exposure to high-energy-electron beta radiation using an electron beam.

# Umbilical Cables



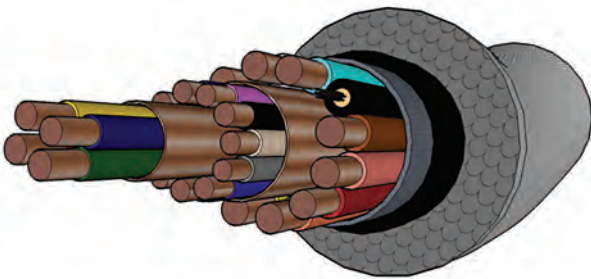
## TMS and ROV POWER

### Capable

- Voltage ratings to 7 kV
- Standard and high-temperature versions available

### Flexible

- Various conductor sizes available
- Flexible bare and tin-plated conductors
- Insulation materials including PP, PE, XLPE and SPEC 44 wire



## TMS and ROV Instrumentation

### Capable

- Voltage ratings to 7 kV
- Standard and high-temperature versions available

### Flexible

- Various conductor sizes available
- Insulation materials including PP, PE, XLPE and SPEC 44 wire

### Versatile

- Constructed as pairs, triples or quads
- Shield: aluminum-laminated foil or tin-plated copper braid
- Controlled impedance components available on request

## Fiber Package

### Versatile

- Single mode, multimode or mixed fiber packages
- 1 to 60 fibers

### Flexible

- Fiber in steel tubes, STEEL-LIGHT or ELECTRO-LIGHT fiber packaging
- Standard and high-temperature versions available

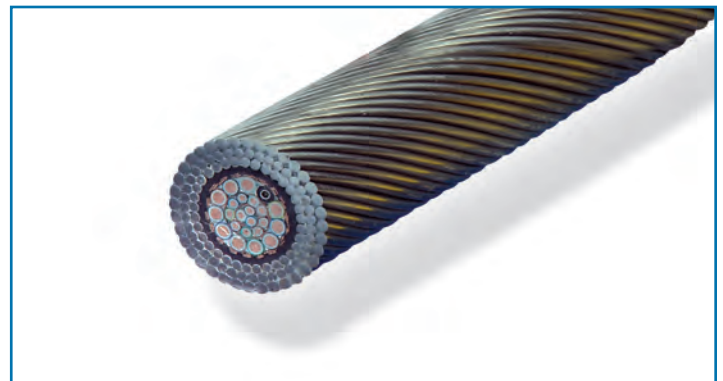
## Sheath, Shielding and Water Blocking

### High Performance

- Copper laminate tape for grounding
- Tin-plated copper braid for grounding and shielding

### Capable

- Temperature rating: -55 to +100°C
- Extended temperature versions available
- Water resistant



## Armor and Cable Design

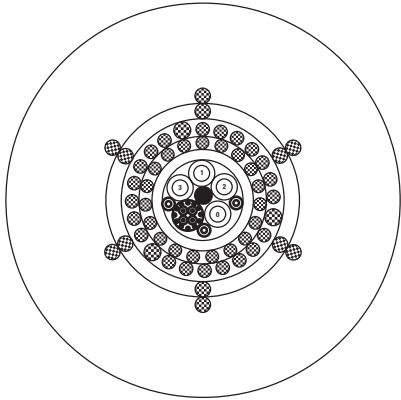
### Customizable

- Custom small size, light weight cable designed to meet customer electrical requirements
- Custom steel wire armor designed to meet customer working and breaking load requirements

### High Performance

- Reduced diameter and weight provides longer lengths on current handling equipment
- Torque balanced 2 or 3-layer steel wire armor package
- Pressure injected lubricant to maximize life in the field

# Neutrally Buoyant Tether Cable



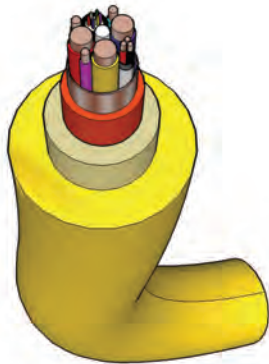
## TMS and ROV POWER

### Capable

- Voltage ratings to 7 kV
- Standard and high-temperature versions available

### Flexible

- Various conductor sizes available
- Flexible bare and tin-plated conductors
- Insulation materials including PP, PE, XLPE and SPEC 44 wire



## TMS and ROV Instrumentation

### Capable

- Voltage ratings to 7 kV
- Standard and high-temperature versions available

### Flexible

- Various conductor sizes available
- Flexible bare and tin-plated conductors
- Insulation materials including PP, PE, XLPE and SPEC 44 wire

### Versatile

- Constructed as pairs, triples or quads
- Shield: aluminium-laminated foil or tin-plated copper braid
- Controlled impedance components available on request

## Fiber Package

### Versatile

- Single mode, multimode or mixed fiber packages
- 1 to 60 fibers

### Flexible

- Fiber in steel tubes, STEEL-LIGHT or ELECTRO-LIGHT fiber packaging
- Standard and high-temperature versions available

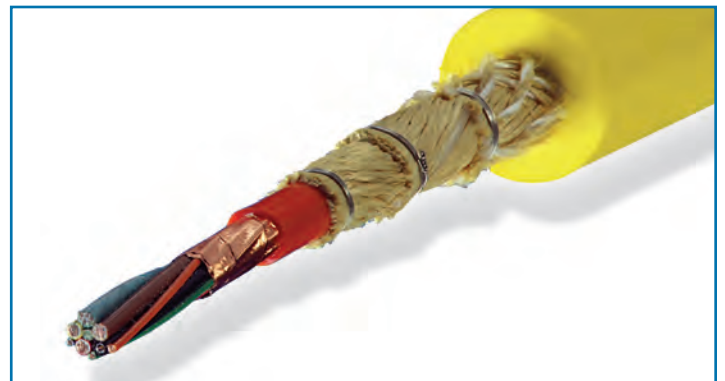
## Inner Sheath, Shielding and Water Blocking

### High Performance

- Copper laminate tape for grounding
- Tin-plated copper braid for grounding and shielding

### Capable

- Various water-blocking materials available
- A variety of sheathing materials available



## Cable Design, Armor and Outer Sheath

### Customizable

- Custom small size, light weight cable designed to meet customer electrical requirements
- Custom aramid armor designed to meet customer working and breaking load requirements
- Custom design to ensure “locking” of outer jacket and armor

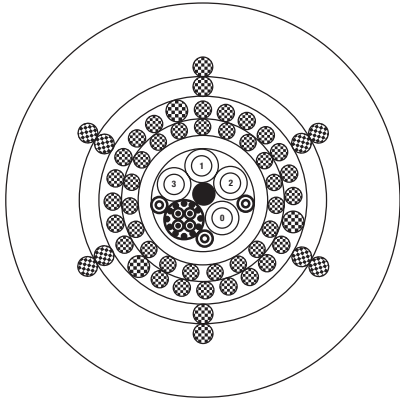
### High Performance

- Reduced diameter and weight provides longer length on current handling equipment
- Mechanically resistant sheath

### Capable

- Highly flexible design
- Neutrally buoyant sheath

# Heavy Tether Cable



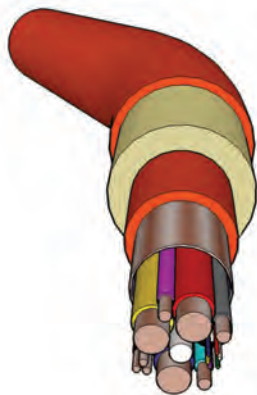
## TMS and ROV POWER

### Capable

- Voltage ratings to 7 kV
- Standard and high-temperature versions available

### Flexible

- Various conductor sizes available
- Flexible bare and tin-plated conductors
- Insulation materials including PP, PE, XLPE and SPEC 44 wire



## TMS and ROV Instrumentation

### Capable

- Voltage ratings to 7 kV
- Standard and high-temperature versions

### Flexible

- Various conductor sizes available
- Flexible bare and tin plated conductors
- Insulation materials including PP, PE, XLPE and SPEC 44 wire

### Versatile

- Constructed as pairs, triples or quads
- Shield: aluminum-laminated foil or tin-plated copper braid
- Controlled impedance components available on request

## Fiber Package

### Versatile

- Single mode, multimode or mixed fiber packages
- 1 to 60 fibers

### Flexible

- Fiber in steel tubes, STEEL-LIGHT or ELECTRO-LIGHT fiber packaging
- Standard and high-temperature versions available

## Inner Sheath, Shielding and Water Blocking

### High Performance

- Copper laminate tape for grounding
- Tin-plated copper braid for grounding and screening

### Capable

- Various water-blocking materials available
- A variety of sheathing materials available



## Cable Design, Armor and Outer Sheath

### Customizable

- Custom small size, light weight cable designed to meet customer electrical requirements
- Custom aramid armor designed to meet customer working and breaking load requirements

### High Performance

- Reduced diameter and weight provides longer length on current handling equipment
- Mechanically resistant sheath
- Highly flexible design

# STEEL-LIGHT Cables

With an increasing focus on optical fibers for data transmission in undersea environments, additional attention must be given to creating robust optical assemblies without the unnecessary addition of weight. TE's Rochester brand STEEL-LIGHT and ELECTRO-LIGHT optical cables were developed to meet the challenges posed by these harsh environments and rigorous operational scenarios faced in subsea applications.

Cables using the STEEL-LIGHT and ELECTRO-LIGHT cable constructions meet the hydrostatic pressures encountered at full ocean depths and endure the mechanical stresses imposed during the repeated flexure affiliated with dynamic systems.

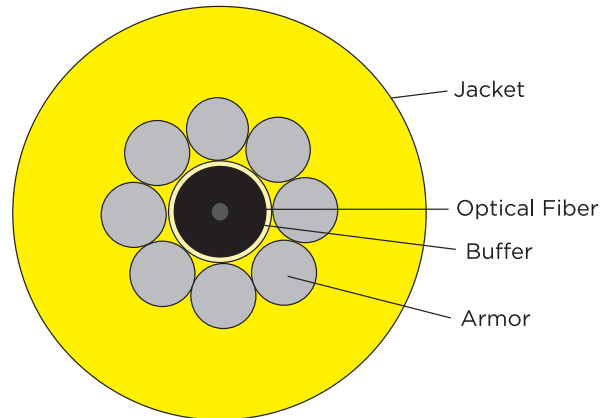
Both STEEL-LIGHT and ELECTRO-LIGHT cable constructions are available in a range of multimode and single-mode fibers and armor packages, together with a variety of jacket materials including polyethylene, nylon, and polyurethane.

## STEEL-LIGHT

The STEEL-LIGHT cable construction uses strands of plow steel concentrically arranged around the fiber buffer to provide protection to the fiber while maintaining flexibility. The steel strands are precisely sized to protect the fiber from breakage and attenuation-inducing hydrostatic pressures.

## ELECTRO-LIGHT

The ELECTRO-LIGHT cable construction uses strands of plain copper wires concentrically arranged around the fiber buffer to provide protection to the fiber. The copper can also be used as a cable conductor to allow composite cables to be designed with a smaller OD.



## FOR MORE INFORMATION

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Consult TE for the latest dimensions and design specifications.



EVERY CONNECTION COUNTS