

A-5



CABLE
TECHNOLOGIES

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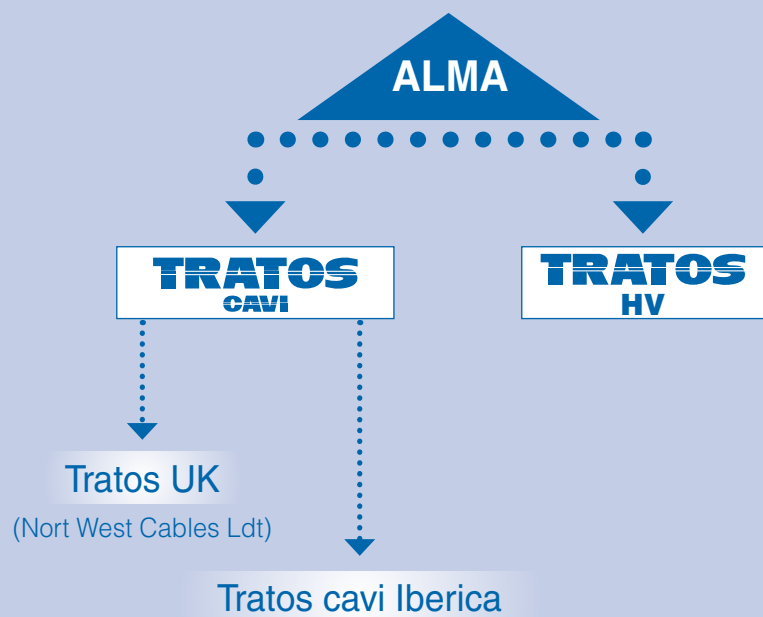


Tratos group

TRATOS CAVI S.p.A. is the acronym for TRAFilerie TOScane (Tuscany drawing mills), a company set up in 1966 in Tuscany by engineer Egidio Capaccini, initially devoted to copper drawing and then enlarged to produce electric cables. In 1974, when engineer Albano Bragagni joined the company, a challenging process of investments, product diversification and technological growth started, enabling the company to enter new and qualified markets.

Then, with the setting up of new industrial and commercial companies such as Smaltos, Braids, Tramet, Hamilton Cable, an integrated industrial group was created, controlled by the holding company Alma.

This is the group structure, recently changed following mergers and updates of corporate operating functions.



With over 40 years of industrial experience, Tratos Cavi has targeted its activity towards selected production sectors with a high value added. Continuous innovation process, along with well developed professional skills in terms of human resources, direct assumption of responsibilities and team work, focus on objectives and decentralization of local operating liabilities are the foundations of the company competitive strength, which is consolidating in spite of globalization processes.

Telecommunications
Energy
Cranes & Mobile Equipment
Trains
Transportation Infrastructure
Oil & Gas
Plants & Petrochemical industry
Mining & Tunnelling
Fire resistant cables

Tratos Cavi (headquarters)
Tratos HV



Pieve S. Stefano (Italy)

Tratos Cavi



Catania (Italy)

Tratos UK



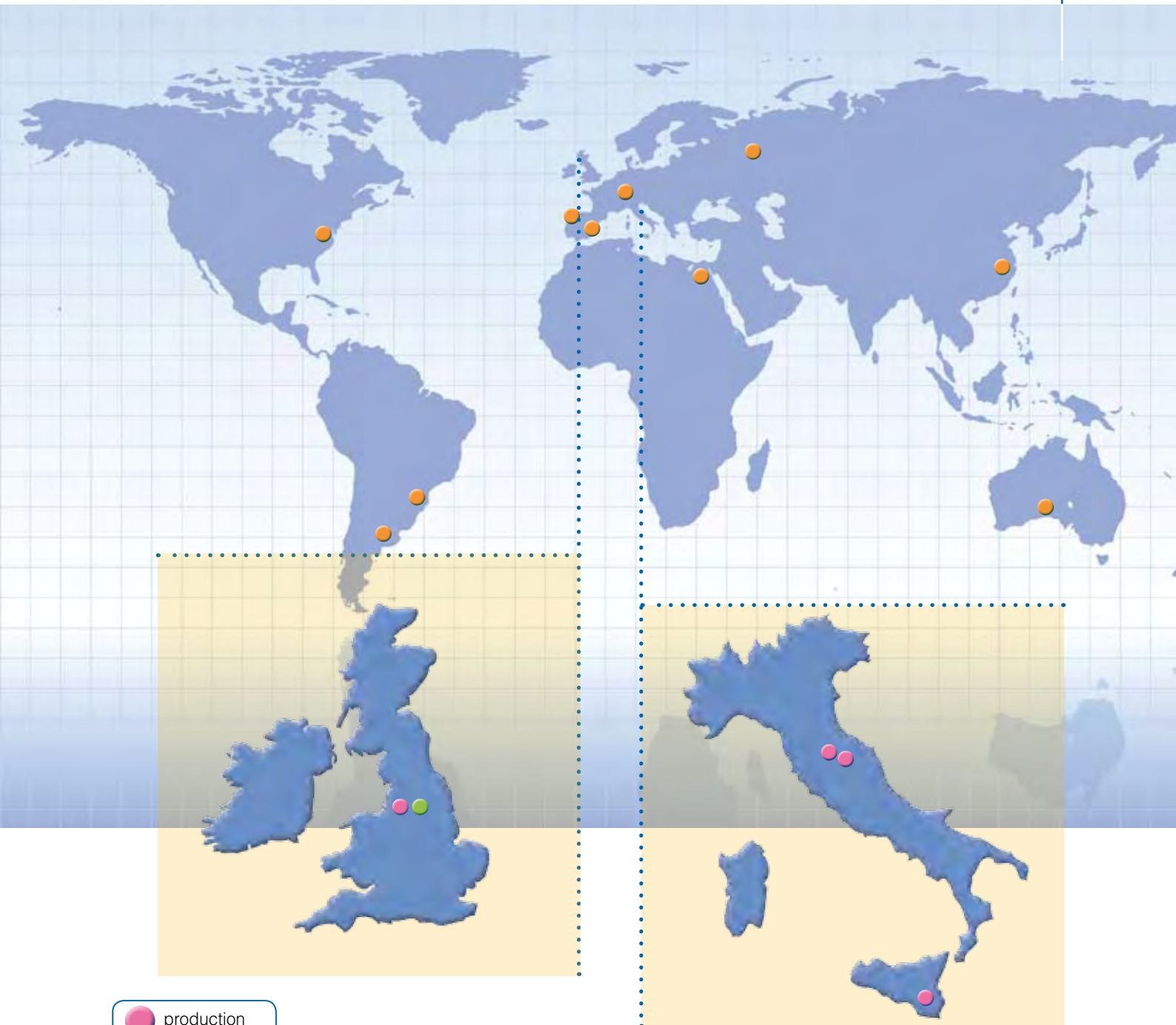
Chesterfield (UK)
(North West Cables Ltd)

Tratos cavi Iberica



Madrid (Spain)

location



- production
- warehouse
- agency office

group companies activities

Alma - Plant of Pieve S. Stefano - Holding company

Tratos Cavi - Plant of Pieve S. Stefano

MV cables up to 26/45 kV, HEPR insulation, copper and aluminium conductors
LV cables, XLPE and HEPR insulation, copper and aluminium conductors
Telecommunications optical fibre cables and copper foam skin insulation cables
Instrumentation cables
Signalling cables
Overhead conductors made of steel and aluminium or aluminium alloy
Optical Protection Ground Wires OPGW

Tratos Cavi - Plant of Catania

MV cables up to 26/45 kV, XLPE and HEPR insulation, copper and aluminium conductors
LV cables, XLPE and HEPR insulation, copper and aluminium conductors
Signalling cables

Tratos HV - Plant of Pieve S. Stefano

Metallurgic process for copper and aluminium
HV cables up to 220 kV, XLPE and HEPR insulation, copper and aluminium conductors
MV cables up to 26/45 kV, XLPE and HEPR insulation, copper and aluminium conductors
LV cables, XLPE and HEPR insulation, copper and aluminium conductors
Telecommunications cables with copper foam skin insulation
Copper and aluminium ropes

Insulation and sheathing compound process

MV and LV compounds, halogen free, flame retardant, oil resistant, fire resistant, semi-conductive compounds

Tratos UK - Warehouse of Chesterfield

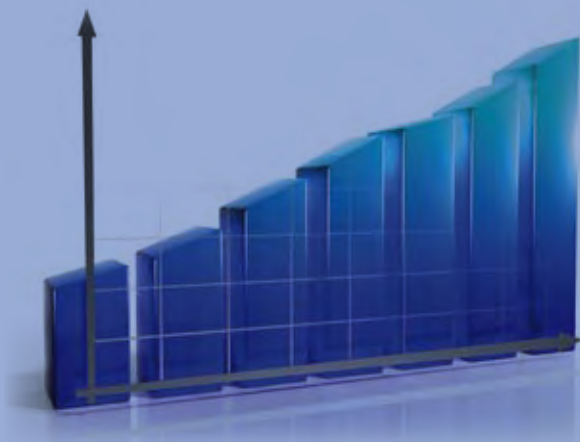
North West Cables Ltd - Cables plant of Knowsley

UK based company operating as distribution branch of Tratos Cavi SpA to major UK customers, including electrical contracting and manufacturing companies, regional electricity distribution authorities and government departments.

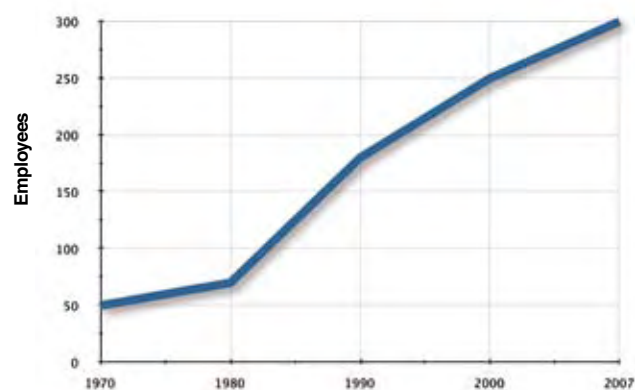
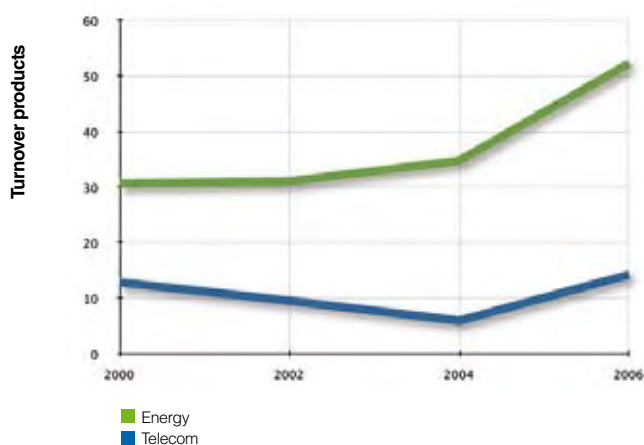
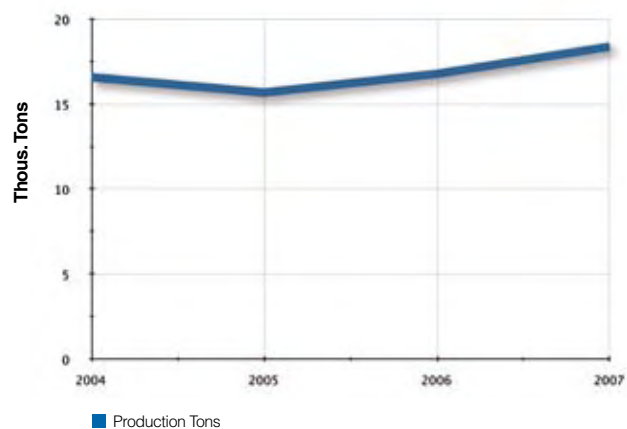
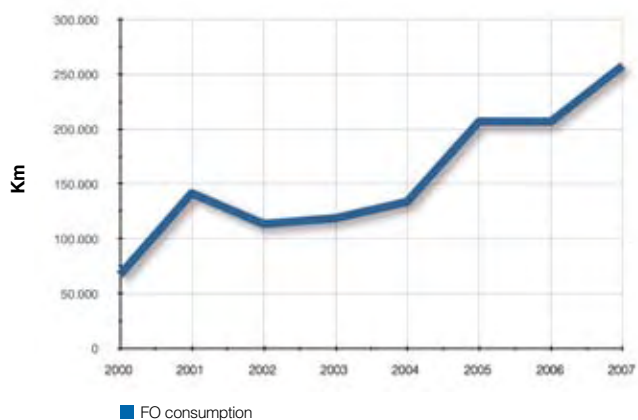
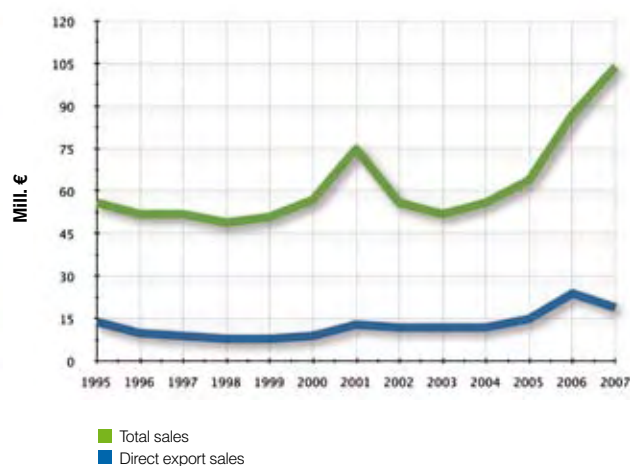
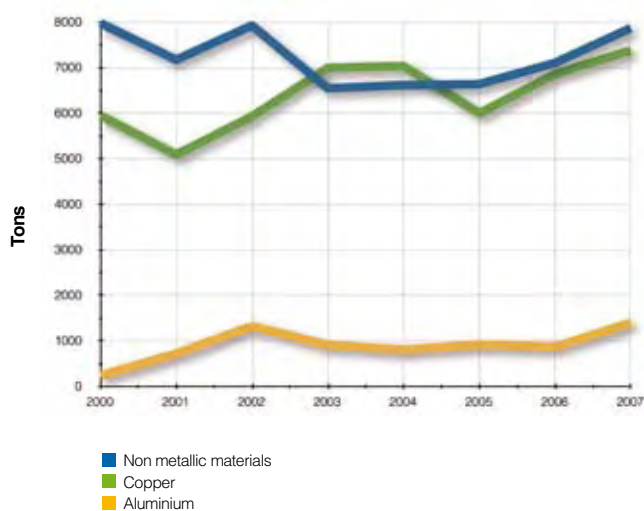
The product range includes: Single to Multi Core, High Temperature, Low to Medium Voltage, Railway, Motorway, Energy, Telecommunications, Optical Fibres and many other specific cables for a wide range of industries.

New plant of Low and Instrument cables production





indexes



quality management system

As soon as the Quality Assurance rationale started being adopted by electric and telephone cables manufacturing companies, Tratos Cavi was certified ISO 9002 (1987) by the certifying body BASEC (UK) and then ISO 9001 (1993).

Everything can be improved, this is the principle guiding us in assessing our daily results.

The Quality System is systematically applied to the entire production cycle, according to strict operating procedures concerning the setting and spreading of the rules to be applied to any fields of activity and the distribution of tasks and responsibilities to staff, and it involves all company departments.

The considerable financial investment has produced and continues to produce important results in terms of product quality and per capita productivity.

Fundamental Keys

- Setting tasks and responsibilities
- Monitoring all processes
- Improving and maintaining a high level of training of the staff involved
- Adjusting the system to market changes
- Abiding by regulations
- Quality is a company issue concerning all operators



The logo graphic consists of a large blue rectangle with the word 'telecom' in white lowercase letters centered near the bottom. Below the blue rectangle is a solid green horizontal bar.

telecom

We produce state-of-the-art cables in the field
of telecommunications

We are able to provide a complete range
of products

Optical fibre and copper cables

telecom

With over 20 years of experience in the production of optical fibre cables, we have acquired all the technologies needed to meet the highest performance requests in the field of telecommunications.

optical fibre cables

Use sectors:

- Indoor & Outdoor
- Railways
- Highways
- Sewers
- Overhead Power Lines
- Subways
- Roads
- Waterways
- Gas Pipelines
- Homes & Work areas



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1. Conductor for overhead power lines OPGW.

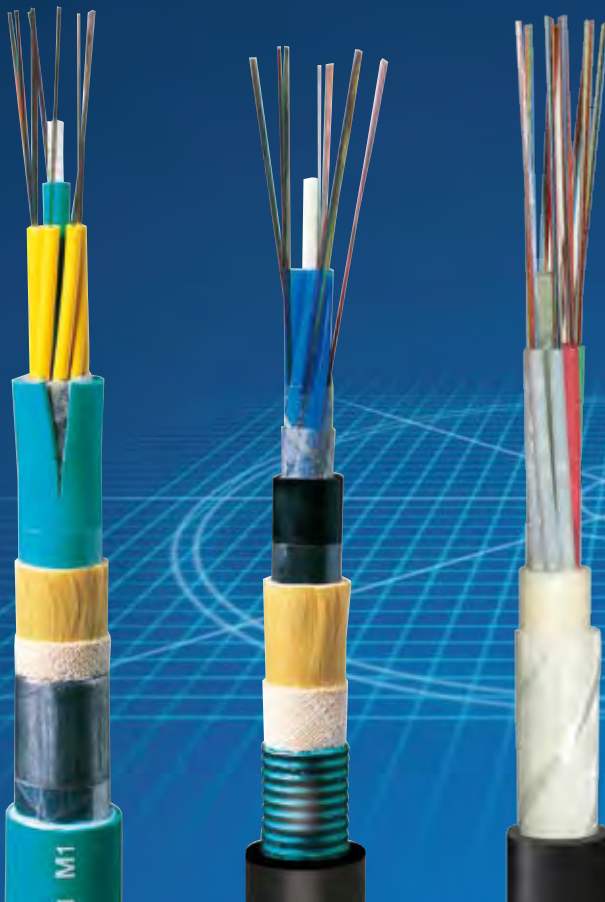
2. Micro-cable for micro-tubes, maximum overall diameter mm 6.00 with a capacity of up to 96 fibres, suitable for installation into tubes with air blowing technology.

3. Loose tube with longitudinally arc-welded and corrugated steel tape for railway links.

4. Loose tube with longitudinally welded aluminium moisture barrier.

optical fibre cables

1 2 3



4



1. Loose tube and flame retardant Low Smoking and Zero Halogen LSZH with metallic armour.

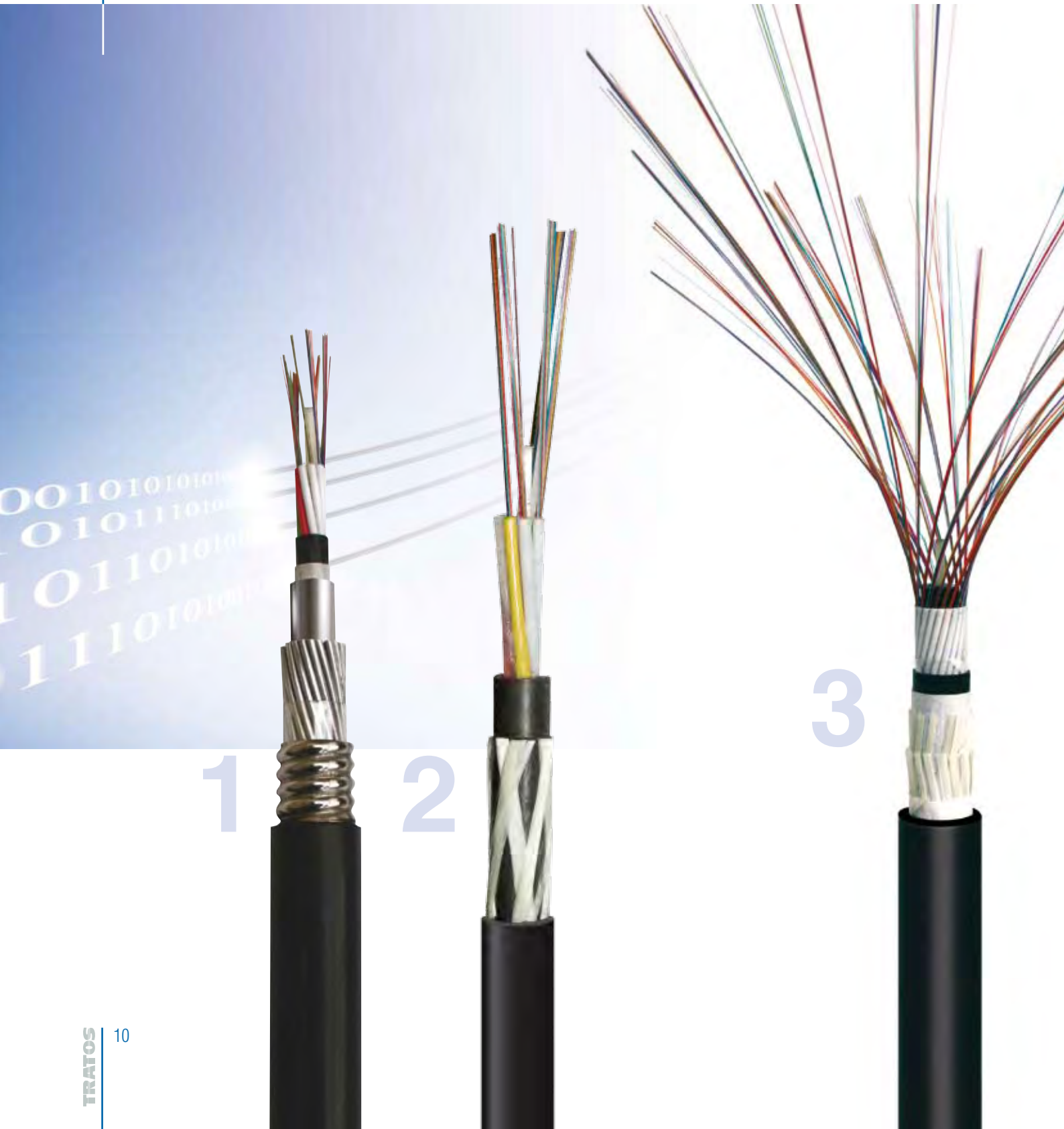
2. Slotted core with ribbon fibres and metallic armour.

3. Fully dielectric loose tube with special foam plastic layer as protection instead of metallic armour.

4. Hybrid cable with copper conductors and optical fibres, longitudinally corrugated and welded steel tape armour.

1. Optical cable for special applications where a high safety level is required:
 - loose tube core
 - extruded aluminium tube
 - ACS (Aluminium Clad Steel) wire armouring
 - corrugated steel tube
 - HDPE high density polyethylene outer sheath.
2. Dielectric cable with high fibres capacity armoured with fibreglass flat wire.
3. Loose tube armoured with aramidic thread braid able to stand a very high pull force.

optical fibre cables



optical fibre cables

FTTx

new concept very simple cables

A new series of optical cables especially designed for last mile network cabling. Considering the increasing development of broadband services, this type of cables will be one of the most developing sectors in the next few years.

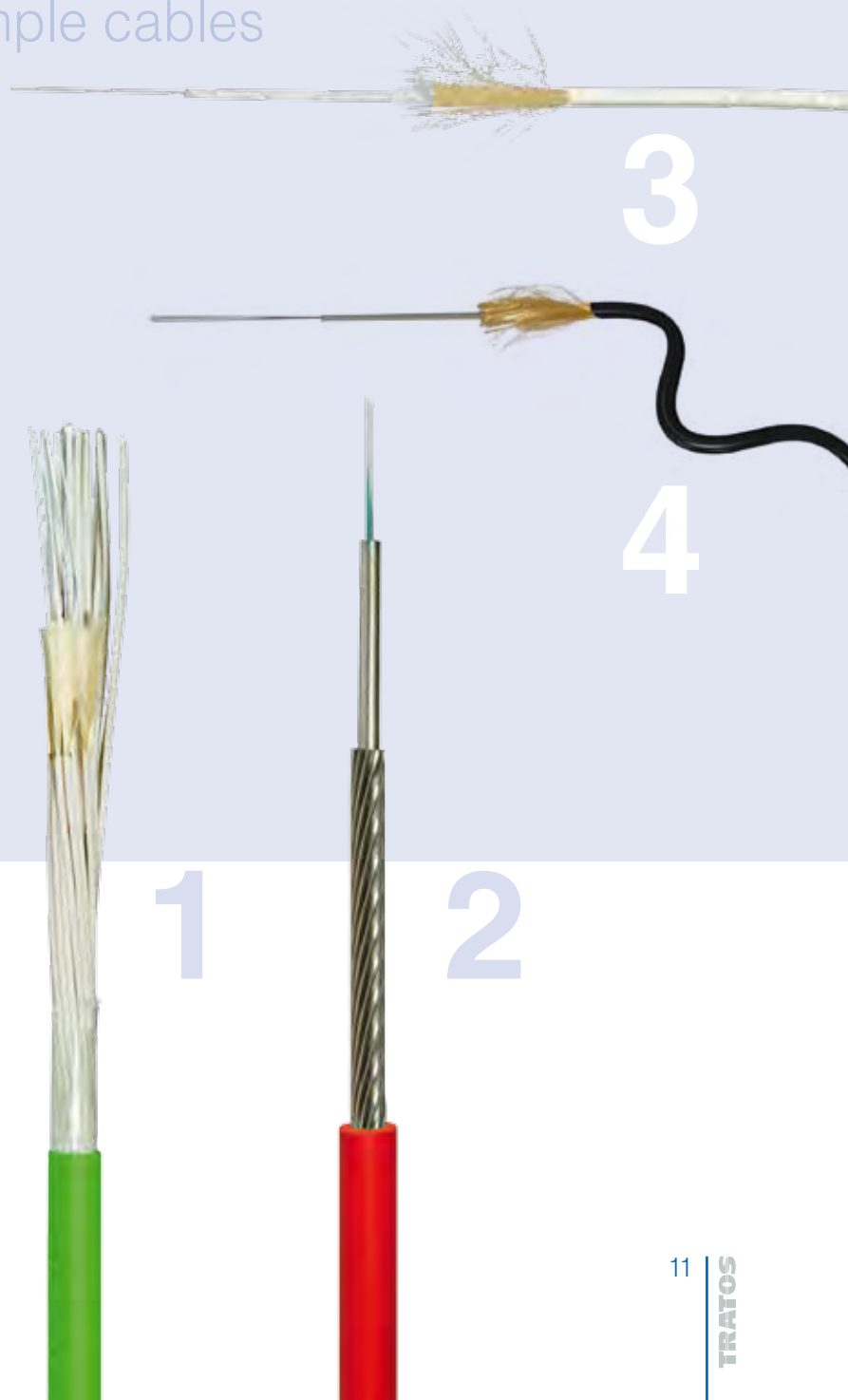
They are a simple solution for different installation systems, including compressed air to be blown into pre-installed tubes.

These cables are designed to be used inside buildings to connect independent flats. The cable goes up vertically from the bottom to the top of the building and one or more of the cables included in the bundle cable can be branched off at any point of the route and oriented towards another route to be connected to the end user.

1. Bundle of 24 micro optical cables covered with LSZH sheath, its outer diameter is mm 8.00 maximum. Any micro cables inside the bundle cable have one single optical fibre and are reinforced with a secondary tight acrylic coating plus aramidic yarns and covered with a nylon layer.

2. Micro cable with fibres inside steel corrosion resistant tube, steel wires armour and HDPE sheathed, suitable for end user connection in particular environments.

3-4. Two single or double fibre micro cables for home installation.



A wide range of traditional cables suitable for urban and intercity networks, perfectly integrating with optical fibre networks. Dry and jelly filled type cables, with solid polyethylene insulation and foam skin, metal and non metal mechanical protections, flame retardant and LSZH versions.

copper cables

Use sectors:

- Underground
- Aerial Drop wire
- Aerial self supporting
- Aerial circular
- Indoor distribution
- Indoor jumper wire
- Indoor subscriber wire
- Aerial DSL Drop
- Indoor DSL screened cables

1

2



5

3

4



1-2. Jumper wires.

3. LSZH and flame retardant cable for underground railway links.

4. Foam skin insulation cable, screened and armoured.

5. Railway cable with foam skin insulation, laminated aluminium screen and armoured with double steel tapes.



energy

We produce cables for energy transport
up to 220 kV and can provide
solutions for any installation system.

energy

Low voltage cables with aluminium conductor
solid round and shaped type,
round and shaped stranded class 2.
Cables with XLPE and HEPR insulation,
special compound, flame retardant and LSZH.

power cables with aluminium conductors

3



1



2



1. Single core 1000 mm² solid shaped aluminium conductor, low voltage 0.6/1 kV and aluminium alloy wire armour.

2. Three cores, 25 mm² each, solid round aluminium conductor, low voltage 0.6/1 kV with copper neutral concentric conductor.

3. Four cores cable, stranded shaped aluminium conductor, low voltage 0.6/1 kV and PVC sheathed.

U₀/U 26/45 kV

Copper conductor - XLPE insulated - aluminium alloy armour



An example of perfect organization of all the components used to produce this type of cable, fully fitting in the design plan. We can meet any customers' requirements and suitably adjust design and production for our cables to fit in with any installation systems.

1. Medium voltage cable 12/20 kV with aluminium conductor, HEPR insulation, longitudinal welded aluminium tape screen protecting the cable also against damp, outer polyethylene sheath. At the centre of the cable there is an ACS (aluminized steel) conductor necessary to support the cable when installed overhead in urban and rural areas.

cables for energy distribution link



1

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2. Low voltage cable 0.6/1 kV with sector copper conductors, XLPE insulation, steel wires armour, outer PVC sheath. Cable suitable to be laid directly underground.

3. 1.8/3 kV cable, with tinned copper conductors, XLPE insulation, common copper tapes screen, inner sheath, steel tapes armour, outer PVC sheath. Cable suitable to be laid directly underground.



1. Increasingly often, installation problems mainly due to bending and handling difficulties and to the weight of standard steel threads or tapes armoured cables are solved by using cables that are protected mechanically, but without using metals.

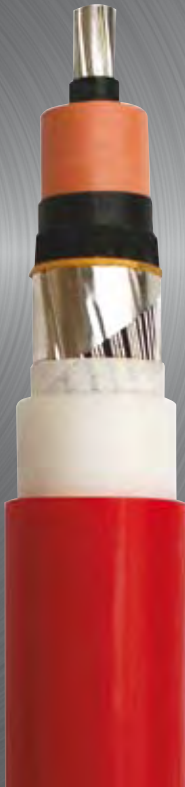
RootCables is an alternative to usual solutions and is often used, since it guarantees great performance and customer satisfaction.

This cable is being used in a submarine supply network.

Unipolar 18/36 kV cable with tinned copper conductor, HEPR insulation, tinned copper counter-spiral tape and wires screen, high density polyethylene sheath, expanded plastic material layer able to absorb shocks and pressure, outer HDPE high density polyethylene sheath.

special cable applications

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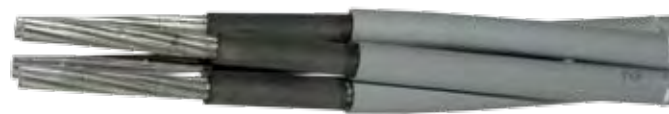
2. Used in continuous current power networks.

Single core, medium voltage, HEPR insulated, copper wires screen, double steel tapes armour, yellow outer sheath.

3. Low voltage, single core, tinned copper conductor, class 2 cable, flame retardant and LSZH suitable for underground transportation links.

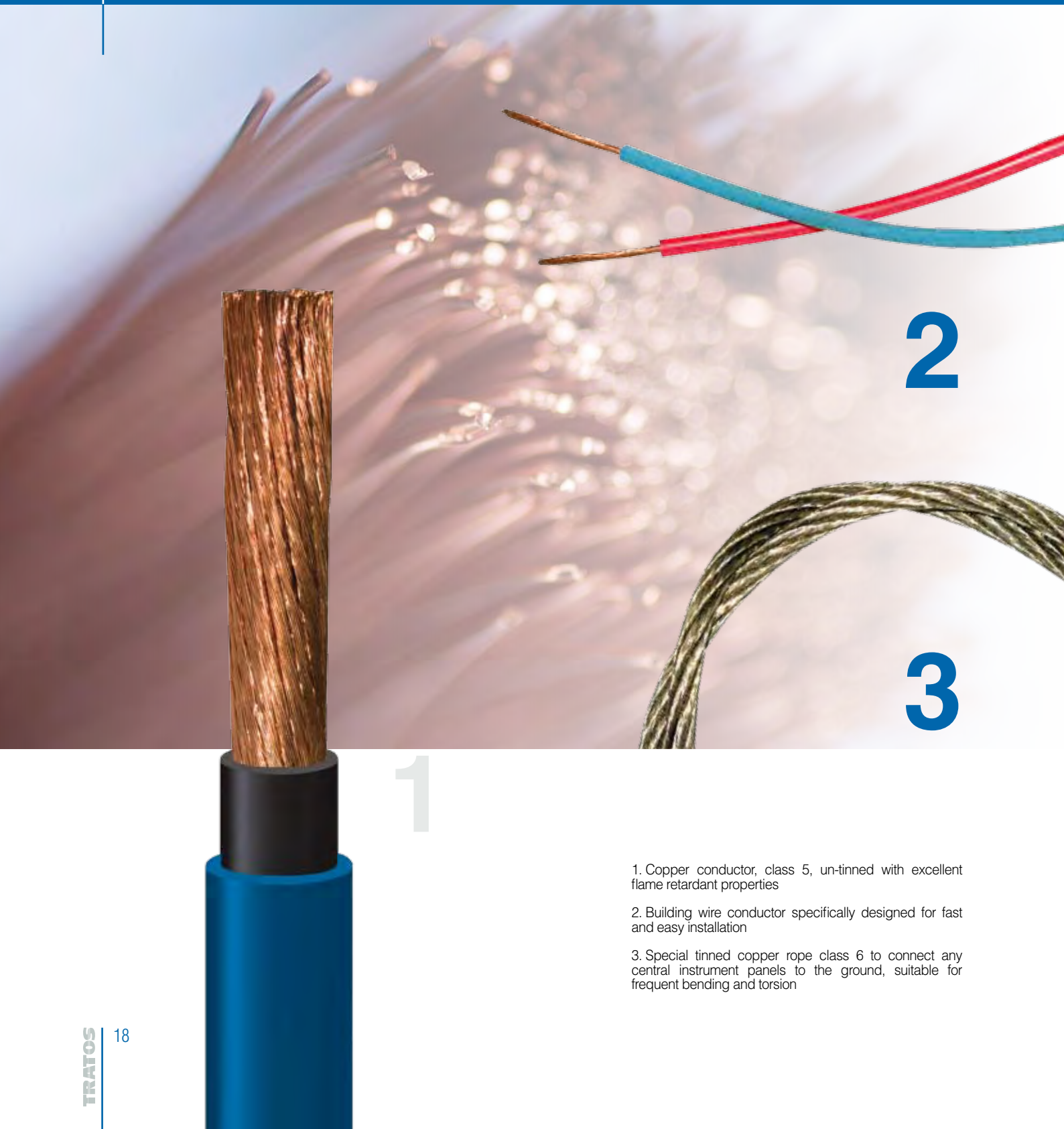
4. Standard overhead cable for low voltage power distribution links, available with copper and aluminium conductors, XLPE insulation and sheathed.

4



Mainly used for voltages up to 0.6/1 kV, flexible conductor cables, classes 5 and 6, are widely used in houses, offices and industrial buildings. In particular, the small sections have been designed to be easily and rapidly installed in groups inside plastic tubes and the insulation material used guarantees a low level of friction and adherence to the other conductors with which it comes into contact, hence it is not necessary to apply much traction force to the cable during installation.

flexible cables



1

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3

1. Copper conductor, class 5, un-tinned with excellent flame retardant properties

2. Building wire conductor specifically designed for fast and easy installation

3. Special tinned copper rope class 6 to connect any central instrument panels to the ground, suitable for frequent bending and torsion



other worldwide market segments

Cranes & Mobile Equipment
Trains
Transportation Infrastructure
Oil & Gas
Plants & Petrochemical industry
Mining & Tunnelling
Fire Resistant

other worldwide market segments

other worldwide market segments

Series of round and flat cables for cranes and lifting systems used in heavy industry and in harbours and inter-modal areas. Used for both LV and MV supply and integrated with suitable elements for signalling and data transfer. Integrated power cables solutions are available with signalling elements and pre-assembled optical fibre cables. Environmental conditions, use conditions and mechanical stress are essential elements to be considered when designing and producing this type of cables to guarantee that they will work and last. The type of cable to be used must be chosen very carefully, according to the type of use, and bending radii and working speed have to be thoroughly checked.

cranes & mobile equipment



1

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3

1. Cable for gravity-fed collector into basket, suitable for spreader connection. Low voltage 300/500 V, plain copper, class 5, HEPR insulation, central Kevlar rope support, PCP outer sheath.

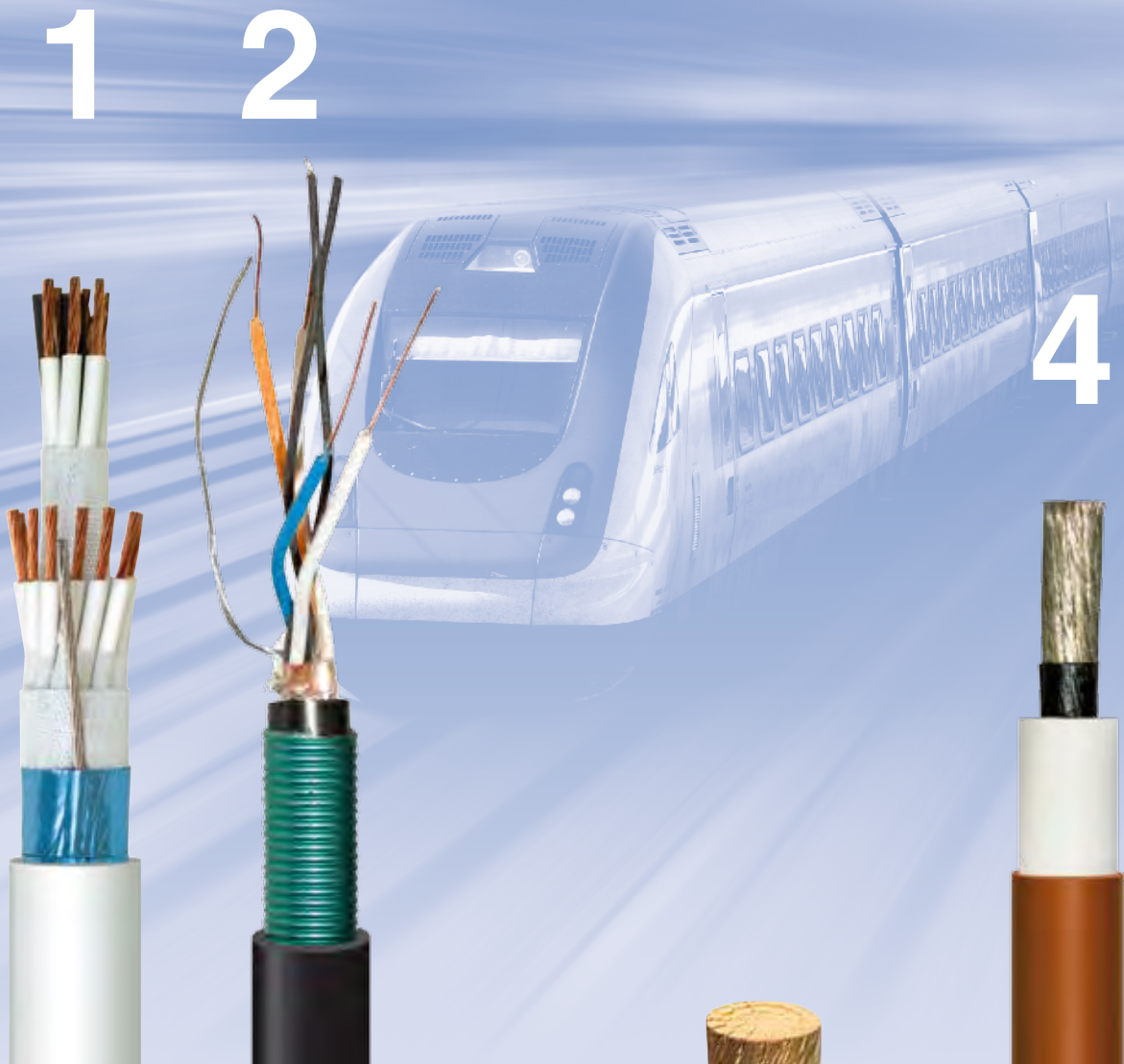
2. Low voltage 0.6/1 kV, plain copper, class 5 conductor, HEPR insulation, thermoplastic inner sheath, anti-torsional braid and polyurethane outer sheath.

3. Medium voltage cable, tinned high flexibility conductor, HEPR insulation, ground conductor, semiconductor layer cover, signalling cores group, loose tube optical fibre element, anti-torsional braid and outer special compound sheath.

Over the last few years, the development of cables to be installed on board trains has been targeted to guarantee passengers' safety and reduce cable installation room.

Design has focussed above all on new models with improved performance in case of fire, high temperature resistance capacity, increasingly reduced dimensions and weight and has applied new concepts to realize integrated systems in collaboration with the most important operators in the sector.

trains



1. Cable with excellent working features also during combustion, suitable to keep alarm systems active to enable warning and evacuation of peopled places

2. Cable for audio and video signals transmission systems

3. For high voltage connection of pantograph and transformer on board electric railway engines Designed to be used with limited bending radii, easy to handle and with specific features against UV rays and to withstand any environmental conditions

4. High temperature cable with less bulky insulation and outer sheath, very flexible and with high power transport capacity



other worldwide market segments

The shift from low to high speed lines has boosted technological development in this sector over the last few years, involving all railway components, including supply systems, which passed from 3 kV with continuous current to 25 kV with alternate current.

Also electric and signalling cables have progressed from a technological point of view and their performance has very much increased, in particular in terms of EMC (electro-magnetic compatibility) and resistance to fire.

transportation infrastructure



1



1. 1.8/3 kV unscreened cable, armoured with double steel tape, suitable for direct underground installation below tracks.

2



2. Signalling cable with double features: un-armoured and armoured with double steel tapes. Tinned solid copper conductor, HEPR insulation, HEPR inner sheath, PCP outer sheath. If an armour is required, it should be applied over the outer sheath and then covered with another PVC layer.

3



3. Multi-composed cable with joint power conductor and signalling cores, concentric copper conductor in contact with the magnetic steel tape, two layers of special compound as fire protection. A special feature for installation in tunnels with special protection against Electro Magnetic Fields.

To meet cable demand in this sector, technical knowledge and knowledge of regulations worldwide are necessary. Usually, products must abide by national and international technical specifications and sector companies specifications. Many different technologically advanced materials are needed to meet the requests of the sector and the different types of cables must be certified by certifying bodies. In the Oil & Gas sector, as in other sectors, one of the main problems is the aggression by substances cables get in contact with such as: hydrocarbons, acids, solvents, moisture, which rapidly damage cable functioning, if they seep through the cable. A longitudinal double plated aluminium tape barrier solves the problem and avoids the use of corrugated metal tapes and lead sheaths, which are far more expensive and heavy.

oil & gas

1. Instrument cable, single and overall aluminium foil screen, armoured with galvanized steel wires braid, LSZH outer sheath.

2. Medium voltage cable with tinned copper conductor, HEPR insulated, copper wires screen and protected by longitudinally welded rolled aluminium, chemical resistant special compound as outer sheath.

3. Signalling cable for long distances, protected by a galvanized steel wires braid.

4. Low voltage cable with moisture barrier made of longitudinally welded aluminium tape, able to protect the cable against corrosive elements, instead of corrugated metal or lead sheath.



From power stations to the transport network, from refining plants to their management control. We can supply cables for energy, data and signals transmission for any equipment present in industrial areas. Ours is a complete package of products that helps our customers streamlining the network design procedure and saving in terms of supply.

plant & petrochemical

1. Medium voltage cable with copper conductors, XLPE insulation, copper tape screen, inner sheath and steel wires armour, outer sheath.

2. Low voltage cable, XLPE insulation and mica containing glass taping, double overall screen with aluminium tape and tinned copper braid, moisture barrier made of longitudinally welded aluminium tape, able to protect the cable against corrosive aggression, inner sheath and steel wires armour, outer sheath.

3. Low voltage cable with tinned copper conductors, mica containing glass taping, HEPR insulation, overall aluminium screen, inner sheath and steel wires braid armour, outer sheath.

4. Signalling cable, tinned copper and XLPE insulated, inner sheath covered with a layer of extrusion lead, inner sheath plus flat steel wires armour, outer sheath.



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4



Nowadays, new generation mechanical means with a high technological content are increasingly used both in opencast and underground mines. To supply these new machines, extremely strong but flexible cables are needed, with a voltage up to 18/30 kV. Rapid manoeuvring, abrasion due to contact with different surfaces, environmental conditions, contact with aggressive substances, pressure and tugging are extreme conditions cables must withstand.

We have a wide range of cables that can be chosen according to expected use, the quantity of transported current, both continuous or alternate, feeding systems, manoeuvring rapidity.

mining & tunnelling

1. Medium voltage cable with high conductivity semiconductor layer, ground wires located inside timing conductors cracks, anti-torsion textile thread braid with high traction capacity, PCP sheath.

2. Signalling cable, HEPR insulated, with a screen of tinned copper braid strengthened by textile threads.

1



2



other worldwide market segments

Standard and new generation fire resistant electric cables make up a large family of cables for fire detection and fire alarm systems.

All these cables have been designed to safeguard the integrity of the circuit in case of fire longer than conventional cables. In addition, they are designed to produce low levels of smoke and corrosive gases when affected by fire.

The wide range of available cables enable users to choose the type that suits them most, according to cable use (transmission of signals or energy transport), installation mode, required safety level in terms of working period in case of fire.

fire resistant cables

Specific national and international regulations set the performance levels manufacturers must meet and the testing methods to be used to certify the product and check that set quality levels are maintained.

Often, the type of cable to be used is provided for in building regulations. Fire authorities consider fire resistant cables as one element of a complex fire protection system and the performance of each element is assessed according to the relevant technical regulations.

Components used to produce the different types of cables:

- Conductor: copper, plain or tinned, class 1 – 2 – 5
- Mica containing Glass, Mineral ceramic, fire resistant tape
- High performance damage resistant silicone insulation
- HEPR insulation
- XLPE insulation
- Aluminium/Polyester tape
- Laminated aluminium tape screen
- Laminated aluminium tape screen bonded to sheath
- Tinned copper drain wire
- SWA protection
- Corrugated and arc-welded steel tape
- Thermoplastic LSZH sheath

As for fire resistant cables, the most used tests are:

- Horizontal fire resistance test
- Flame specially fed to reach different temperature levels
- Testing length 30'
- Testing length 60'
- Testing length 90'
- Testing length 120'
- Mechanical percussion test
- Water spray test

1

2

1. Timing plain copper conductors class two, silicone insulated, aluminium foil screen in direct contact with the drain wire tinned conductor, same cross sectional area as the insulated conductors, red LSZH outer sheath. Cable type PH 30 suitable to continue working for a maximum of 30 minutes in case of fire

2. Timing plain copper conductors class two, silicone insulated, aluminium foil screen in direct contact with the drain wire tinned conductor, same cross sectional area as the insulated conductors, white LSZH outer sheath. Cable type PH 120 suitable to continue working for a maximum of 120 minutes in case of fire



research & development

Our mission is continuously
creating and improving

research & development

The growth of a technological culture able to attain corporate strategic objectives is the focus of the development of all the activities of the Research & Development department. Identifying novelties worldwide is a target we intend to reach in the short term, meanwhile, our objective is creating new products with improved performance.

Human and financial resources are therefore devoted to the research and development of products both in the energy and the telecommunications sectors.

One of the many topics continuously monitored by our researchers is: **fire and the toxic substances released during combustion.**

Considering the risks it implies for people, fire is a topic constantly present in our corporate strategies and in our Research and Development laboratories. We are continuously studying new cables, with special structures, special compounds and including all the elements necessary to abide by international regulations.

Within this framework and following thorough research, we have introduced the use of nano-structured materials to produce new compounds for insulators, fillers and sheaths, thus greatly improving the mechanical characteristics and reactivity to fire of the compounds produced within our group.

Research projects, studies and tests are carried out within our structure directly by our staff.

Currently, we are analyzing how to adjust the fire performance of our cables according to the new **European CPD Directive (Construction Product Directive)** setting the minimum fire performance levels of the products to be used in building.

These products, sometimes similar between them, must have different performance levels according to the countries to which they are exported. This requires a strong engagement on the part of the company and the analysis of economic parameters for the final product to be competitive on the different markets.

The research activity is wide ranging and we are continuously using our dedicated equipment and infrastructure:

FTIR (Fourier Transform Infra-Red) Spectrophotometer to check composition of solid, liquid, dust and gas materials

MicroFTIR detailed chemical-physical analysis of thin layers and analysis of impurities

Thermo-gravimetric analysis to check the loss of mass according to temperature

DSC (Dynamic Scanning Calorimeter) to check the fusion points and vitreous transition within the following temperature range from -50°C to + 300°C

TMA (Thermo-Mechanical Analysis) to analyse mechanical behaviour according to temperature from - 50°C to + 500°C

FTT (Cone Calorimeter) suitable to check Rate of heat release - Mass loss rates - Time to ignition - Rates of release of toxic gas - Smoke release rates - Critical ignition flux - Effective heat of combustion

Combustion tests ovens to check that fire does not spread

Fire resistant tests systems

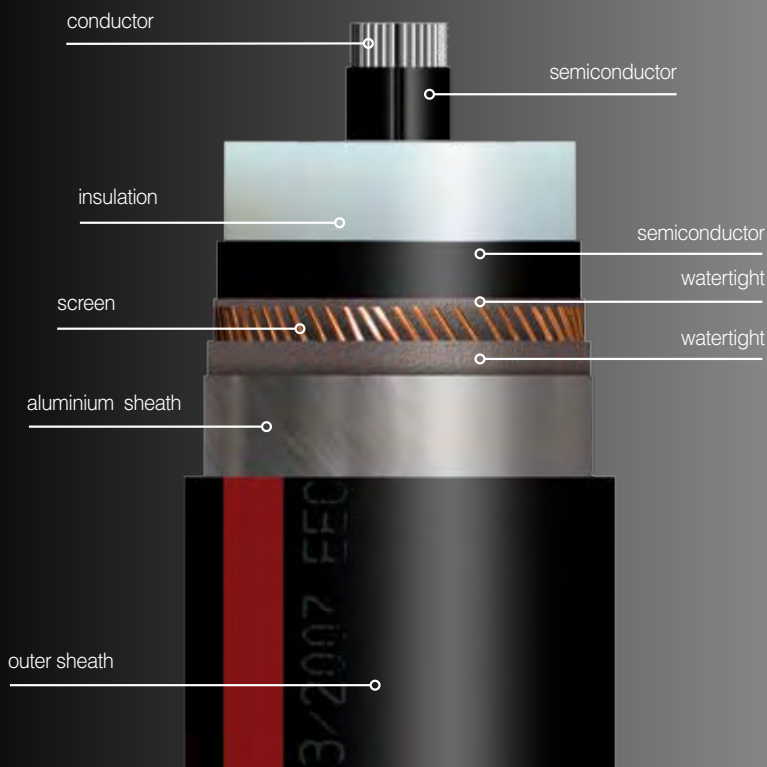
Smoke opacity test

After over 40 years of activity, we have entered a new market segment by starting producing high voltage cables up to 220 kV. In collaboration with our suppliers of new generation joints and terminals we are able to supply turnkey projects: design, production, installation and maintenance.

- Aluminium or copper conductor up to 1600 mm², stranded round or Milliken type, also watertight.
- Insulation: XLPE super-clean dry curing and cooling or HEPR.
- Technology: CCV catenary line.
- Screen: thermo-sealed or welded laminated aluminium or copper composite copper wires and laminated aluminium or copper. We can design screens with an electromagnetic field value close to zero.
- Sheath: HDPE, MDPE, LSZH.

high voltage cables up to 220 kV

superconducting cables



While investigating new cables for power transport, we have realized a superconductor prototype and the accessories necessary for its installation.

Superconductivity is the elimination of the electrical resistance in the flow of current. A highly innovative technology applied also to electrical infrastructure for power generators and transportation of electricity. The various applications of superconductors include also power cables for energy distribution. The advantage of superconductivity is a great increase in current carrying capacity according to the size of the conductor, with practically no losses. Tratos Cavi has designed and produced a prototype of superconductor cable cooled with liquid nitrogen (77 Kelvin equivalent to -196° C) and related accessories.



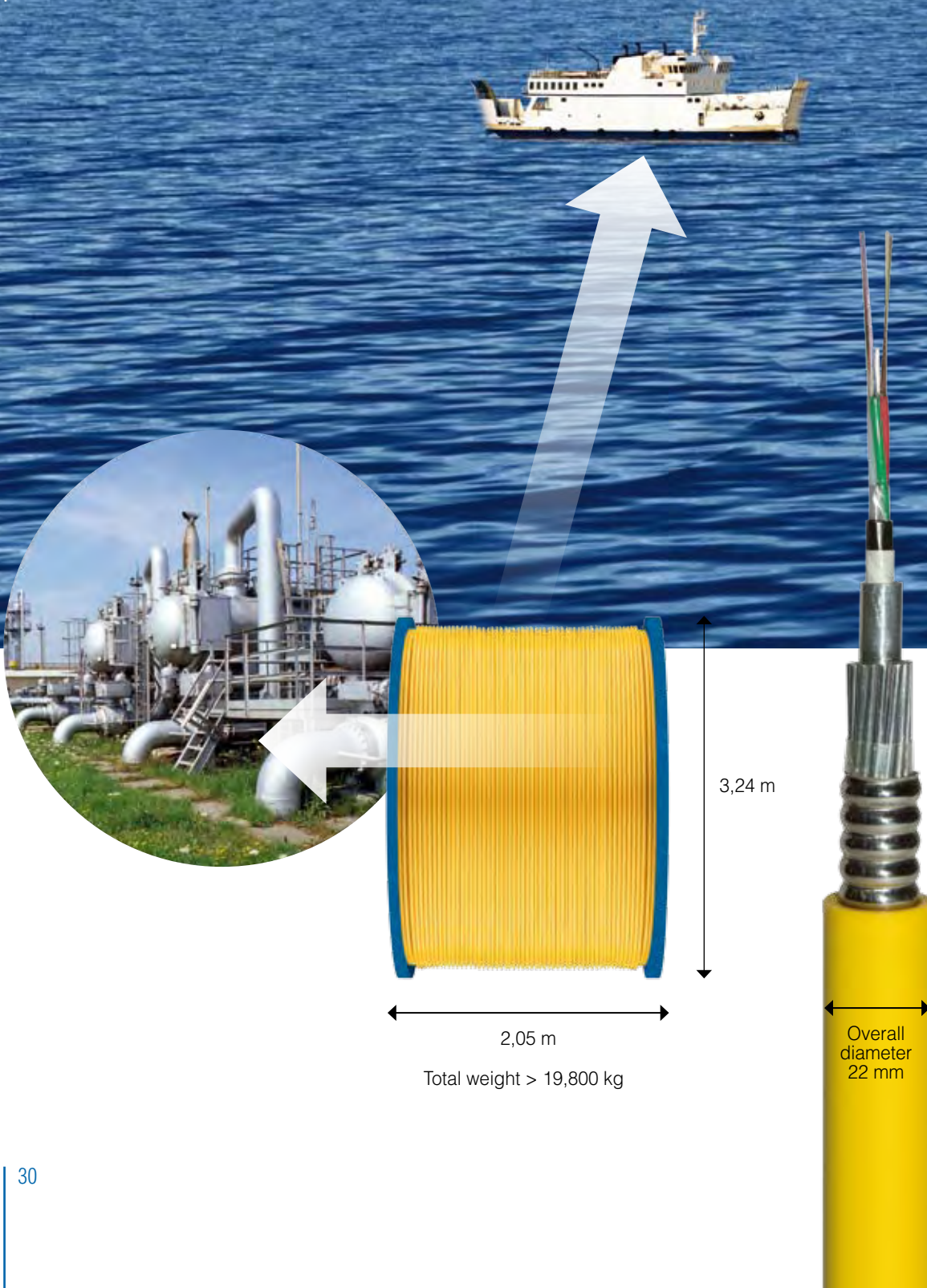
For the first time we have manufactured a single optical cable over 19 km long to be laid undersea.

We have managed to produce it thanks to the recently built new production site and the installation of new armouring and sheathing plants and winding structures able to contain reels with a flange diameter of up to 4 m.

This production process has involved the plant for over six months, with 3 shifts per day and the constant engagement of a production team of over 40 people.

This cable connects a mooring in the upper part of the Adriatic Sea for ships transporting liquid gas to an inland re-gasification centre, covering a distance of over 19 km.

undersea optical cable



These supplies are used for umbilical cords assembly, through a foreign partner.

research & development

This cable was used to transport signals and supplied in one single unprecedented length 5,600 m. It is made up of four groups with a central supporting element; each group is made up of four conductors with a section of 2.5 mm² with special torsion, compression and traction resistance features. Resistance to traction is obtained by using layers of Kevlar yarns applied with special technologies. All cable components, apparently simple and standard, are the result of long and thorough research, tests and changes made during the different productions realized by Tratos Cavi over the last few years.

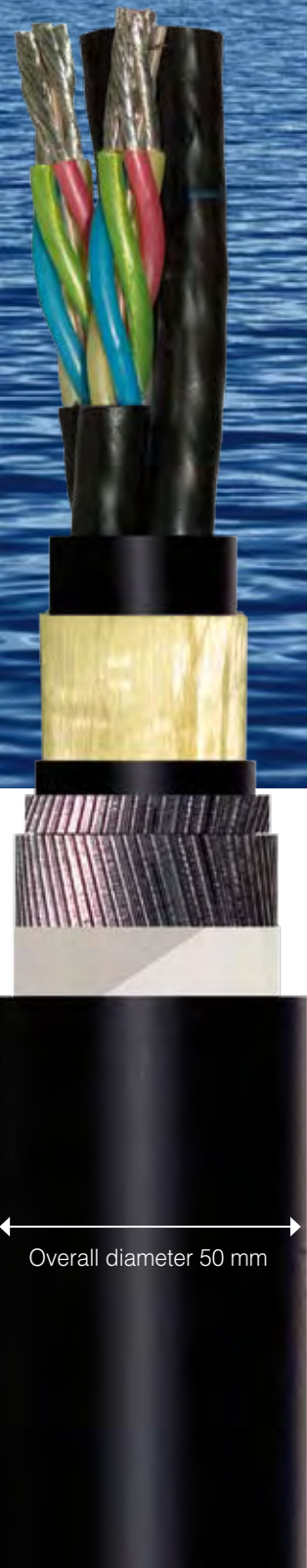
cable for umbilical applications



2,40 m

6,00 m

Total weight > 25,000 kg



Overall diameter 50 mm

certification bodies



The International Certification Network



Lloyd's Register Group



Istituto Marchio di Qualità



British approval service for cables



Verband Der Elektrotechnik



Loss Prevention Certification Board



Centro Elettrotecnico Sperimentale Italiano



Registro Italiano Navale



Centro di certificazione e Analisi comportamentale



GOST Russian Certificate of Conformity



Certificado de registro de empresa



Laboratoire Central des Industries Electriques

Tratos Cavi S.p.A. reserves the right to change
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