





## INTRODUCTION

TELE-FONIKA Kable S.A. is the biggest cable producer in Central and Eastern Europe. In terms of sales, it is Europe's fourth biggest cable manufacturer and is noted as one of the world's largest suppliers of high voltage cables and systems.

The company was founded in 1992 and is presently one of the biggest private enterprises operating in Poland.



The present position of the company is the result of dynamic development supported by the realization of investment projects in 1994-2003, including the purchase of Krakowska Fabryka Kabli SA (1998) and Elektrim Kable SA (2002).

Tele-Fonika Kable S.A. offers design, delivery, execution and tests of complete High Voltage Cable Systems. Our high position has been built thanks to continuous research and development as well as state-of-the-art production machinery and top quality materials. We co-operate with the best suppliers of HV cable accessories so that we can assure operational reliability of power supply. Our product, deliveries and solidity of installation present the highest quality standards that fulfil the most demanding needs of our customers. Our systems have a strong support from our engineering staff from the High Voltage Cable System Department.

A Research and development program in the range of preparation and testing of cable systems was initiated in



1988, when the first CCV line of Nokia-Mailleffer was installed in our Bydgoszcz factory. After achieving positive results from the testing of the system according to IEC 60840 at Power Institute in Warsaw, the first line of 110 kV was built for Power Plant in Warsaw Area in 1992.

In the next stage, the production range was extended to include EHV cables up to 400 kV and conductor cross-section up to 2000 mm<sup>2</sup>.

The last investment was realized in 2003, when the completely new MV & HV Department was built in Bydgoszcz factory. It was equipped with state-of-the-art XLPE insulation line as well as screening and jacketing lines.

## QUALITY MANAGEMENT SYSTEM

TELE-FONIKA Kable S.A. has established, documented and implemented the Quality Management System

according to the ISO 9001:2000 standard as well as the Environmental Protection System according to the ISO 14001:2004 standard.

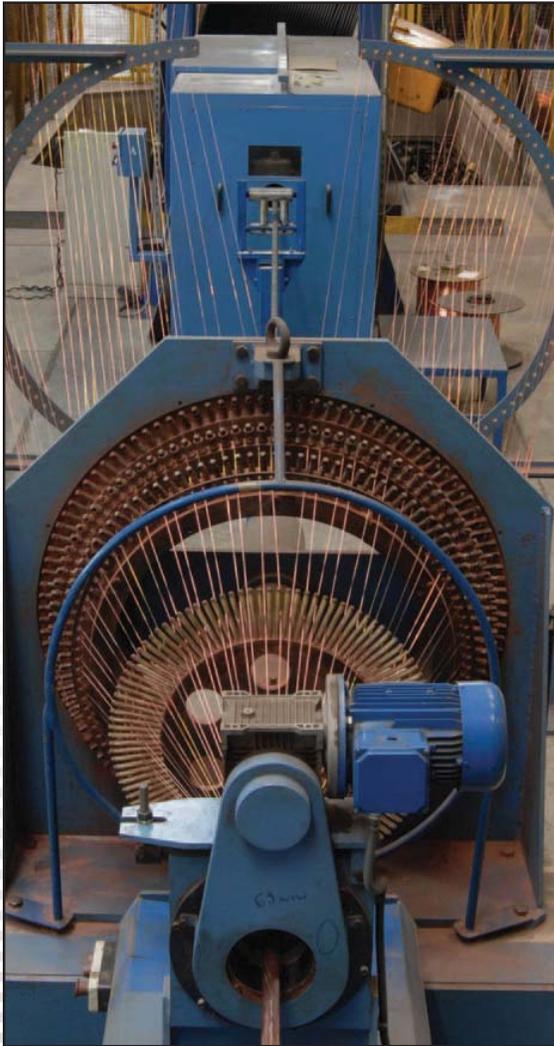
The management system covers the entire organisational structure of the Company, supporting the division of tasks, responsibilities and competences, and the breakdown of processes and resources, making it possible to maintain effective quality and environmental management.

Customer requirements are studied and care is taken to ensure that they are fulfilled through the provision of products that are in accordance with previously agreed specifications, of the highest quality, safe to use, reliable and delivered on time.

Operational control in the integrated management system allows the Company to function in an environmentally safe way. It also ensures realisation of the environmental policy and the execution of accepted objectives and tasks.







We constantly strive to improve our activities and processes having in mind the highest quality of our products, customer satisfaction, professionalism and environmentally friendly operations.

## PRODUCTION PROCESS

### THE CONDUCTOR

Round, stranded copper or aluminium conductor designed to achieve specific cross-section, resistance

and outer diameter, optionally with longitudinal water barrier.

Conductors with cross-section  $>1000 \text{ mm}^2$  are produced as segmented conductors.

### INSULATING OF PHASE CONDUCTOR

In the insulation process polyethylene is delivered to extruders from the specially prepared clean room, in which air circulation takes place by means of special filters that ensure the level of air cleanliness. The transportation of semi-conductive and insulating materials is by means of separated tracks. Additionally the insulating polyethylene dosing system is completed by a device that removes dust, non-dimensional granules, etc.

### MATERIAL HANDLING SYSTEM

System of feeding the materials to clean the PE insulating components to production of high-voltage cables. The cleaning of XLPE granules by means of an air separator unit, consisting of magnetic separator, ionizer and cascade-air sorter. A magnetic separator shows a strong magnetic field; in addition all metallic impurities, when they are present in plastic, stick very strongly to it.

During the pneumatic transport granules are loaded electrostatically so that no dust adheres to their surface. Ionizer effectively reduces accumulated load so that dust cannot be blown. The removing of dust is additionally aided mechanically by repeated padding granules in the cascade-air sorter.

Triple extrusion process of insulation material (semi-conductive inner screen, insulation, semi-conductive outer screen) over a phase conductor is realized in one operation with continuous on-line control of the important parameters of each layer as thickness, centricity and ovality.

#### EXTRA HEAT TREATMENT

To avoid “the leakage of insulation” effect, that may appear during the production of high-voltage cables with high diameter coefficient (outer diameter of insulation/ diameter of phase conductor) and to ensure the ovality and centricity of cables, the EHT system is used on CCV lines. The solution relies on injection of inert gas directly behind the crosshead that extrudes three layers of insulation. It causes the reduction of stickiness of the outer layer of insulation and consequently reduces “the leakage of insulation”. Cross-linking and cooling the polyethylene takes place in a nitrogen atmosphere.

#### RELAXATION SYSTEM DURING ROL PRODUCTION

Specific volumes of plastics are reduced by a decrease in temperature. This dependence on temperature causes uneven mechanical tensions inside insulation of cable. During the cooling process of the insulating system of cables there are tensions resulting from the uneven crystallization of material. A direct relaxation method is used on lines to minimize mechanical tensions in XLPE insulation and to reduce its longitudinal return shrinkage. The system is based on an additional heating zone in the central cooling section of the continuous vulcanization line.

#### DEGASSING OF CABLE INSULATION FROM THE DERIVATIVES OF CROSS-LINKING PROCESS

To ensure the controlled conditions of degassing of high-voltage cable insulation, the heating chambers are used. The result of cross-linking process is decomposition of cross-linking factor (peroxide) that generates by-products like aceto-phenone, methane, methyl styrene, etc. In thermally controlled conditions the insulated conductors are subjected to slow degassing process. The time of keeping insulated conductors in degassing chambers is a func-

tion of temperature and thickness of insulation. The degree of degassing of insulation is controlled on measurement area.

#### SCREENING

Applying on insulated conductor:

- semi-conductive tape (with the function of humidity blockade in water-blocked cables)
- metallic screen of Cu wires and separate Cu tape
- separating tape (with the function of humidity blockade in water-blocked cables)

#### EXTRUSION OF OUTER SHEATH

Extrusion – on cable core – outer PVC, PE or LSOH sheath. In case of cables sealed radially – additionally Al/ Cu tape covered with copolymer is applied longitudinally on a cable core. As a result of the extrusion of the sheath there is a durable bonding of tape with the outer sheath

#### HV LABORATORY

To ensure the possibility of testing HV and EHV cables and cable accessories, a HV laboratory was built and equipped with state-of-the-art devices. The range of equipment in our HV laboratory enable us to perform the routine as well as type tests up to 400kV.

#### QUALITY EVIDENCE

Every complete system is type tested under supervision of a representative of an independent laboratory and in cases of positive results, it receives confirmation of technical properties and can be used in power networks. Those tests ensure full compatibility of cables and accessories and guarantee high quality and a durability in operation without breakdown.

