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No significant increase of volume resistivity of P-Laser semiconductive compounds were evidenced due to mechanical bending, thermal cycles and water absorption

### **TECHNOLOGY A. One shot production line**

P-Laser production line is an innovative plant, designed for manufacturing medium voltage power cables.

Cables are produced by an uninterrupted process that comprises two main areas: insulation line and protection line, as shown in Figure 7

Insulation line is based on triple extrusion for the manufacturing of internal semiconductive layer, insulation and external semiconductive layer. HPTE insulating material is manufactured internally, specifically for this purpose. Unlike XLPE cables, that require a catenary line with a pressurized vulcanization vessel, P-Laser cables are manufactured with HPTE, therefore do not need any crosslinking step.

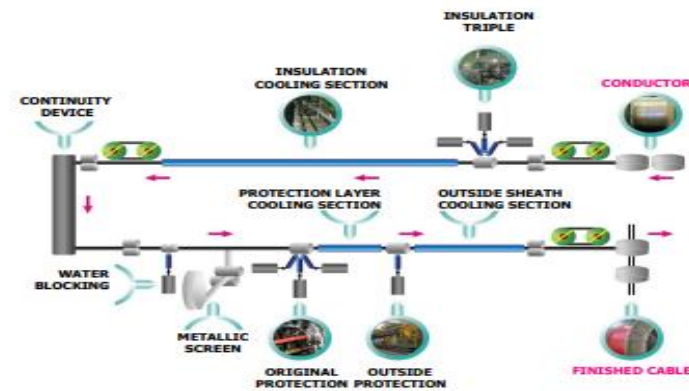


Fig. 7 Layout of P-Laser MV production line

This is evidenced in Fig. 7, showing that insulation and semiconductive extruders are installed directly on the same floor of the whole line. Immediately downstream of these extruders it is possible to observe in the picture the cooling system, since there is no vulcanization.



Fig. 8 No vulcanization line: cooling system device is installed after triple extrusion.

P-Laser cables are not subjected to degassing treatments, since this process is not accompanied by methane emission.

Cables can go therefore directly to the application of protection layers just in one shot, as evidenced in Fig. 7.

The protection layer usually comprises water blocking tapes, an electrical shield and an external polymeric sheath. However P-Laser MV production line is very versatile and allows introducing in the manufacturing program also an expanded polymeric layer for further mechanical protection.



Fig. 9 One shot production: from conductor to finished cable without any interruption

Figure 9 shows one of the most relevant aspects of P-Laser MV production line of this facility: on the right hand side it is possible to see the drum of conductor, while on the left hand side the finished cable is collected.

The whole production is carried out in one shot, without any interruption and without any intermediate treatment (degassing or steam curing).

### **Cable main characteristics and benefits**

P-Laser cables main properties are summarized in Table IV. Good thermo-mechanical characteristics of HPTE are reflected in the properties of P-Laser cables that, in spite of thermoelectricity of materials, show equivalent, or even better, properties with respect to those of XLPE cables. The excellent electrical performances of P-Laser cables are evidenced by high lightning impulse breakdown strength at 95°C, ranging from 120 kV/mm to 130 kV/mm. Also dielectric losses of currently used HPTE are very low, with a value of  $3 \times 10^{-4}$ , that is fully satisfying for MV applications but it is promising also in view of the development of HVAC P-Laser power cables. P-Laser cables are qualified according to CEI Italian Standard [8]. Benefits of P-Laser cables are summarized in Table V. P-Laser technology offers a better service to customers, such as shorter delivery times, and improved cable performances, in particular high reliability and better thermo-mechanical properties. The on line protection of cable core is also a valuable aspect of P-Laser MV production process, since any damages of cables during drums movement is avoided. Cable cores are directly protected by sheaths thanks to continuous production line. More than 3000 km of P-Laser MV cable were produced up to now, as a confirmation of market response to this new technology.

### **Environmental impact**

P-Laser technology offers an efficient manufacturing process, characterized by lower power consumption, with energetic benefits. The absence of any degassing treatments avoids emissions in atmosphere, with a lower environmental impact of the whole process. Moreover, P-Laser production of MV power cables requires a compact manufacturing site, with lower soil occupation. Full recyclability of polymeric materials is also a valuable property of P-Laser technology.

## **CONCLUSION**

P-Laser is a breakthrough in power cable systems, based on material, process and product innovation. The insulating material is a new thermoplastic compound, High Performance Thermoplastic Elastomer (HPTE) that was developed in Prysmian together with semiconductive compounds. P-Laser cable, based on HPTE, is produced in one shot process, including insulation and protection phases, from the conductor to the finished cable. P-Laser is now a commercial product with more than 3000 km of cable produced and sold up to now to different utilities.

## **References :**

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