

Electric Power Cables

This invention relates to electric power cables of the kind having at least one metallic conductor, usually a conductor screen of semiconductive material, and insulation
5 all enclosed in an earth screen comprising wires or narrow tapes and an external sheath comprising polymeric material which will usually (but not necessarily) form the exposed surface of the cable.

In most environments, it is desirable, if not essential,
10 that the sheath is more effectively watertight than can be achieved with polymeric material alone, and attempts have thus been made to follow the practice used in communications cables of including a metal/plastics laminate foil beneath the main body of the sheath, so as to become bonded to it,
15 normally when the main polymeric body is extruded. It is difficult, with such structures, to design a sheath in which the laminate foil remains intact when the cable is subjected to the impact tests specified by Standards Authorities and customers, as the laminate tends to be driven into the gaps
20 between the wires or tapes of the screen and to split along resulting crease lines.

The cable in accordance with the present invention is characterised by a sheath construction comprising a first extruded polymeric layer which encloses the earth screen of
25 the cable without filling the gaps between the components thereof (the wires or strips), a second extruded polymeric layer enclosing the first and between them and bonded to both of them a moisture barrier laminate comprising a metal foil layer coated on each of its major faces with a polymeric
30 material compatible with the material of the extruded layer it contacts.

Preferably the extruded polymeric layers are of the same material, or at least adhesively compatible materials, and the both faces of the laminate are coated with a single polymeric material which is the same as or compatible with the material(s) of the extruded layers, so that the laminate may self-bond where its edges overlap.

More specifically, we prefer that the two extruded layers of the sheath and the coating on each face of the laminate are all of polyethylene, or alternatively all of polyvinyl chloride or all of an "LSF" composition based on ethylene-vinyl acetate copolymer or an ethylene-propylene rubber (in each case with conventional additives).

The laminate is preferably longitudinally applied, but could be helically lapped if desired.

Preferably the insulation of the cable is of a polymeric material, such as crosslinked polyethylene or ethylene-propylene rubber, and in this case the conductor screen is preferably of carbon-loaded polymeric material and the earth screen preferably includes an inner layer of carbon-loaded conductive polymeric material, in addition to the wires or strips of metal.

Preferably the gaps between the wires or strips of the earth screen are waterblocked by applying water-swellaable tapes under and/or over them, or in other known ways.

Preferably at least one semiconductive water-swellaable tape is applied under the wires or tapes and at least one insulating water-swellaable tape over the top of them. A waterblocking tape applied over the wires or tapes may facilitate ensuring that the first extruded layer of the sheath does not fill the gaps between them. Other suitable tapes could be used for this purpose if desired.

Because the laminate is bonded to both the adjacent extruded polymeric layers, no water leakage path is formed adjacent either of its faces and the laminate is given strong and resilient mechanical support, while the inner extruded
5 layer can deform under impact to penetrate (temporarily at least) between the wires or tapes of the earth screen to absorb impact with minimal distortion of the laminate.

The invention will be further described, by way of example, with reference to the accompanying drawings in which
10 Figure 1 is a diagrammatic cross-section of one form of single-core cable in accordance with the invention and Figure 2 is an enlargement of the portion of Figure 1 enclosed by the box II.

The cable of the example has a stranded plain annealed
15 copper conductor 1, a semiconductive conductor screen 2 applied over a binder tape 2A, crosslinked polyethylene insulation 3 and a dielectric screen comprising an inner semiconducting layer 4 (which may be "fully bonded" or "strippable") and a layer of copper wires 5, all of which are
20 conventional. A semiconducting water-swellable tape 6 under the wires and an insulating water-swellable tape 7 over them provide longitudinal water-blocking for the gaps between the wires. In accordance with the invention, this conventional part of the cable 1 is enclosed in a sheath comprising a
25 first extruded layer of polyethylene 8, a longitudinally applied tape 9 with a central layer 10 of aluminium coated on both sides with polyethylene 11,11, and a second extruded layer of polyethylene 12. The conditions and die dimensions for the extrusion of the first layer of the sheath are such
30 that the layer is "tubed" and does not embed the wires of the screen to any substantial extent. The temperature at which

this second layer is applied is high enough to ensure that the laminate is adhesively bonded not only to the second polyethylene layer but to the first as well.

In a particular example constructed as just described, a
5 copper conductor of 300mm^2 (made up of 59 round wires each
2.6mm in diameter) is covered with a conventional
semiconducting screen material to a nominal radius of 25.3mm.
The crosslinked polyethylene insulation has a radial
thickness of 18.9mm and a tensile strength of 17MPa measured
10 according to ISO 527 in the fully-crosslinked state using an
extension rate of 250mm/min and the screen comprises a layer
1.0mm thick of a conventional fully-bonded screen composition
and 69 soft annealed copper wires each 1.78mm in diameter.
The inner and outer layer of the sheath have thickness of
15 2.9mm and 7.4mm respectively and both are made of a
thermoplastic polyethylene cable-sheathing composition with a
tensile strength of 20MPa measured according to ASTM D638,
while the laminate has an aluminium base layer 0.2mm thick
and a coating of polyethylene 0.050mm thick on each side; it
20 is 230mm wide and applied longitudinally so that its edges
overlap by a minimum of 5mm. This cable not only passes the
impact test specified by CIGRE specification WG 21.14
(Elektra no.141, April 1992) using an impacting weight of 5kg
in the form of a 90° wedge with 2mm tip radius dropped from a
25 height of a metre, but still shows no substantial damage if
the height is increased to 2m.



CLAIMS

- 1 An electric power cable having at least one metallic conductor, optionally a conductor screen of semiconductive material, an insulation, all enclosed by an earth screen
- 5 comprising wires or narrow tapes, and an external sheath comprising polymeric material characterised by a sheath construction comprising a first extruded polymeric layer which encloses the earth screen of the cable without filling the gaps between the components thereof (the wires or
- 10 strips), a second extruded polymeric layer enclosing the first and between them and bonded to both of them a moisture barrier laminate comprising a metal foil layer coated on each of its major faces with a polymeric material compatible with the material of the extruded layer it contacts.
- 15 2 A cable as claimed in claim 1 in which the extruded polymeric layers of the sheath are of the same material and both faces of the laminate are coated with a single polymeric material which is the same as or compatible with the material(s) of the extruded layers.
- 20 3 A cable as claimed in claim 1 in which the extruded polymeric layers of the sheath are of different but adhesively compatible materials and both faces of the laminate are coated with a single polymeric material which is compatible with the material(s) of the extruded layers.
- 25 4 A cable as claimed in claim 1 in which the two extruded layers of the sheath and the coating on each face of the laminate are all of
- (a) polyethylene,
 - (b) polyvinyl chloride or
 - 30 (c) an "LSF" composition based on ethylene-vinyl acetate copolymer or an ethylene-propylene rubber,



in each case with conventional additives.

5 A cable as claimed in any one of claims 1-4 in which the laminate is longitudinally applied.

6 A cable as claimed in any one of claims 1-5 in which the
5 insulation of the cable is of a polymeric material.

7 A cable as claimed in any one of claims 1-6 in which the gaps between the wires or strips of the earth screen are waterblocked.

8 A cable as claimed in any one of claims 1-6 in which the
10 gaps between the wires or strips of the earth screen are waterblocked by applying water-swella-
ble tapes under and/or over them.

9 A cable as claimed in claim 8 in which at least one semiconductive water-swella-
ble tape is applied under the
15 wires or tapes and at least one insulating water-swella-
ble tape over the top of them.