INTERNATIONAL TELECOMMUNICATION UNION

ITU-T L.3

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANTS

ARMOURING OF CABLES

ITU-T Recommendation L.3

(Extract from the *Blue Book*)

NOTES

1 ITU-T Recommendation L.3 was published in Volume IX of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Recommendation L.3

ARMOURING OF CABLES

(Mar del Plata, 1968; modified at Melbourne, 1988)

1 Type of armouring

1.1 The most common forms of armouring are:

a) *Tape armouring* – This consists of overlapping steel tape or tapes, applied in helical form with a short lay, over the cable sheath.

b) *Wire armouring* – This is formed from round, flat or trapezoidal steel wires applied helically around the cable sheath with a relatively long lay.

1.2 These two types of armouring are used in combination with other protective layers (jute, plastic) for constructional or mechanical reasons, or for protection against corrosion.

2 Choice of armouring

In deciding whether or not to use armouring and in choosing between the various types of construction, very careful consideration should be given to the local conditions of installation, such as:

a) whether the cables are laid in duct or direct in the soil;

b) whether the cables are laid in a trench alongside a road or on private land;

c) what material is used for the cable sheath;

d) whether other cables are or may be laid along the same run;

e) the nature of the soil: rocky, sandy, corrosive or not; presence of micro-organisms;

f) the depth of the trench, which in any case should not be less than 50 cm, and for large cables 80 cm;

g) the risk of induction;

h) the risk of attack by rodents or insects;

i) the degree of exposure to lightning;

j) whether the size and importance of the link justifies special precautions, in which case steel-wire armouring provides additional protection, particularly in manholes;

k) whether a long draw-in is required, e.g. crossings under rivers (as cases of this are infrequent, no need is envisaged for a new design of land cable incorporating a central strain wire).

3 Protection provided

With cables laid directly in the soil, armouring contributes to safe installation and reliability of operation by ensuring protection of the cables against:

a) mechanical damage caused by stones and excavation equipment or tools;

b) rodents and insects;

c) chemical or electrolytic corrosion;

d) effects of atmospheric discharges;

e) indication phenomena due to the proximity of power lines.

4 Tape armouring

Tape armouring is to be preferred for protection against damage by pointed digging tools, sharp stones, etc. It is also useful for providing magnetic screening for circuits within the cable, for which wire armouring is much less effective, because the air gaps between the individual steel wires, which are arranged circumferentially around the cable, greatly reduce the magnetic coupling between the armoured sheath and the conductors within the cable.

5 Wire armouring

Wire armouring gives considerable additional tensile strength to a cable and is useful where pulling-in stresses are high (long draw-in) or where high stresses arise from conditions of use, for example where there is ground subsidence in mining districts and where cables are run in water and bogs or in shafts leading to deep level locations.

6 General type of armouring

For cables with a metallic sheath of lead or aluminium, the type of armouring in most common use consists of two helical windings of steel tape between layers of impregnated paper and jute with an external protection of jute yarn or other fibre. This type of armouring ensures good protection in all five cases listed in § 3 above.

For plastic-sheathed cables, a light armouring may be used, formed of metallic tapes (steel, aluminium or copper) between two coverings of plastic material (polyethylene or PVC). Cables of this design are protected chiefly against the hazards mentioned in 3b) and 3c) above and to a certain extent against hazards 3a) and 3d) above.

7 Armouring for main cables

The major cables in a long-distance network are certainly best protected by a watertight metallic sheath and the conventional armouring described above but the price of such protection is relatively high.

The cost of cables can be reduced by using a thin welded-steel sheath protected against corrosion by a bituminous compound and a plastic covering. This protects the cable, though to a lesser degree, against hazards 3a), b), c), d) above; some protection against induction may be obtained by inserting conductor elements or copper or aluminium bonds under the steel sheath.

8 Through-connection of armouring

In case long-distance cables or similar cables are provided with metal armouring, this should be through-connected electrically at the splicing points. This should be done to obtain maximum protection against the effects of atmospheric discharges and protection against induction.

Metal armouring on cables forming part of the distribution network should also be through-connected in case such protection is needed.

In case metal-armoured cables are also provided with a metal sheath, it may be desirable to through-connect the sheath and the armouring electrically at the splicing and/or repeater points. This should be done to neutralize any differences in potential between the armouring and metal sheath, and to obtain maximum protection against magnetic interference. Through-connection may create corrosion problems, which will usually reduce the lifetime of the metal armouring.

9 Omission of armouring

On directly buried cables, metal armouring can be dispensed with in case the cable is provided with a strong plastic sheath, for example of polyethylene. A further prerequisite is that the soil and laying conditions should be favourable.

Additional protection, for example of optical fibre cables, may be obtained by providing the cable sheath with an external layer of polyamide (thickness 0.4 - 0.5mm). This has a favourable effect as a wearing surface when drawing the cable over long distances. Moreover, the layer gives a certain degree of protection against light mechanical attacks.

10 Corrosion considerations – cables with metal sheaths

Both tape and wire armouring are useful in mitigating corrosion attack; largely because they tend to keep the impregnated coverings lying beneath them in good order and so safeguard the metal sheath from the effects of differential aeration, etc.

11 Rodents and insects

Damage from rodents and insects to direct buried cables may be high in some areas. In those locations, it may be advisable to consider the application of some type of armouring. For detailed information regarding armour protection against rodent and/or insect attack, the reader is directed to Part IV-B, Chapter II of the CCITT manual *Outside plant technologies for public networks*, mentioned in Recommendation L.1.

12 Tropical countries

In tropical countries special attention must be paid to §§ 6 and 7 above and to the danger from micro-organisms.

In general, it is safe to dispense with armouring only when:

- cable is laid in duct;
- no magnetic screening is required, or where this is provided by some other metallic layer included for the purpose;
- when there is no risk of corrosion or where corrosion protection is provided by some other layer included for this purpose;
- in the case of directly buried cables, where the soil is homogeneous and contains no flints or rocks likely to damage the cable, and where there is no danger of damage by rodents and insects.

However, special local conditions may still make armouring necessary, even in the above cases.