Cable Selection Guide for Telecommunications

Cable selection for Telecommunications is mainly dependent upon the system into which the cable will be fitted.
In selecting a cable for a particular system a number of factors have to be considered, some of which are discussed below.

- System in which the cable will be installed
- Length of cable run
- Degree of electrical interference present along the route where the cable is installed
- Environmental conditions

System

Essentially two systems are relevant in the market, namely:

- **Plain Old Telephone Service (POTS)** which is a voice grade telephone service and operates within the frequency range 300 – 3400Hz. With this system data transmission is not possible.
- **Digital Subscriber Line (DSL)** is a technology that delivers broadband speeds, typically 8Mbps….up to 75Mbps dependent upon the system, as a result data transmission is possible.

Length of Cable Run

The selection of conductor size is largely dependent upon allowable Loop Resistance of the circuit. In addition other parameters such as Mutual Capacitance and Insulation losses must also be considered.

Electrical Interference

Electrical interference, often termed EMI, is an extremely complex subject and is perhaps the least understood. In this section no attempt will be made to provide complete solutions, however guidelines will be given.

Electrical interference is any spurious voltage or current arising from external sources that appears in the signal transmitting circuit. When this voltage becomes too large and the signal to noise ratio is exceeded, errors occur in the measurement/control circuit.

Sources of electrical interference can be categorised into three fields viz:

- Magnetic coupling from AC fields eg motors, power cables.
- Crosstalk coupling with adjacent circuits
- Direct coupling eg; earth current loops involving two or more earth points or a common return lead for more than one circuit.

Methods of minimising interference in transmission circuits are explained below:

- **Magnetic coupling**
  - ❖ Route cables away from AC fields or vica-versa; signal and power cables or wires **<u>should not</u>** be in the same conduit, tray or junction box.
  - ❖ Eliminate the source of interference.
  - ❖ Install cables in suitably earthed steel conduits or covered trays.

- **Crosstalk coupling**
  - ❖ Employ staggered twist lengths.

- **Direct coupling**
  - ❖ use a high quality insulation eg PE
  - ❖ reduce risk of moisture ingress into cables
  - ❖ earth screens at one point only
  - ❖ use one pair per circuit ie; avoid the use of "**<u>sharing</u>**" leads in different circuits.

Environmental Conditions Identification

- maximum operating conditions
- presence of chemicals/moisture
- abrasion and/or cut through resistance
- fire retardancy
- installation route ie; duct, direct burial, tray, aerial etc. (See table below.)

Direct Burial

Outer sheath material must be compatible with soil conditions.

Soil Containment	PVC	PE
Acids – diluted	E	E
Acids – Concentrated	G	G
Alcohols – aliphatic	G	E
Aldehydes	G	G
Bases/Alkali	E	E
Esters	N	G
Hydrocarbons – aliphatic	G	F
Hydrocarbons – aromatic	N	N
Hydrocarbons – halogenated	N	N
Ketones – aromatic	F	N
Oxidizing Agents - strong	G	F

Standard and Barrier Sheath Cables

Cable Design

CBI Telecom offers a broad range of telecommunication cables suitable for both indoor and outdoor installations. These products are available in a number of configurations each dependent upon the required application.

All cables are reviewed frequently to take advantage of developments in material technology.

Copper conductors are manufactured in six sizes each in a solid plain or tinned configuration . In addition copper clad steel is also utilised for subscriber drop connections.

Three type of insulation are used, PVC (hard grade) for short runs, polyethylene (PE) and cellular polyethylene for cables employed in longer routes or in cases where improved transmission performance is required. The use of cellular polyethylene is particularly suited to jelly filled cables without having to increase the insulation thickness.

In cases where screens are required the screening method used is aluminium/polyester foil tape applied with it's own bunched tinned copper drain conductor for ease of termination. Each tape is electrically isolated from the other and are applied with a suitable overlap in order to maintain 100% cover once the cable is bent following installation.

Constructions requiring further protection have the following options of armouring, namely;

- Steel wire armour
- Double steel wire armour (for shaft cables)
- Double steel tape armour

A barrier sheath construction is available in cases which moisture/chemical ingress is likely. In this case an aluminium co-polymer laminate tape is folded longitudinally around the cable core or bedded cable and the overlap sealed. A polyethylene sheath is then extruded over the tape providing a good bond. Selection of sheath material is dependent upon the area where the cable will be installed. In the case where fire retardancy is necessary the sheath shall be either black UV resistant, fire retardant PVC or LSZH otherwise black UV resistant PE shall be applied. Fire retardancy of the PVC or LSZH sheathed cable shall comply with IEC60332-3-24 Cat. C and are suitable for overhead rack and tray installations.

Packaging

All cables are supplied on sturdy non-returnable wooden cable drums constructed from timber which has been treated with a preservative. Both ends of the cable fitted with end caps to prevent moisture ingress to the cable. The free end of the cable is fastened to a drum flange to prevent uncoiling during transportation. Wooden lags are nailed side by side over the rims of the drum flanges to protect the cable. Steel strapping is then applied around the lags to keep them in place.

Transport

Drums must be transported in accordance with all the requirements of SANS 10198 – The selection, handling and installation of electric power cables of rating not exceeding 33kV.

Drums must only be rolled in the direction indicated by the arrow painted on the flange.. Preferably, drums must be moved by forklift or crane using a suitable steel shaft and slings with spreader to prevent damage to the flanges.

On no account should drums be laid flat on their flanges. Drums shall be secured to the truck with either suitable wooden chocks or slings or chains fed through the spindle holes in the drum flanges. Use must be made of a fork lift or crane to offload the drums from the truck. Drums should never be rolled off the truck onto the ground.

Storage

Always store drums with their flanges in a vertical position and adjacent drums with their flange(s) touching. If drums are stacked on top of one another, make sure that each end drum of the bottom row are suitably chocked. The storage surface should be hard and well drained. If a length of cable is cut from a drum, the end on the drum should be sealed again with an end cap to prevent moisture ingress.

Installation

All cables must be installed in accordance with SANS 10198 as far as it is applicable to telecommunication cables. Failure to do this will invalidate CBI Telecom Cables' product warranty.

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Conductor Size (mm)	Insulation Material	Nominal Mutual Capacitance (nF/km)	Minimum Insulation Resistance (MΩ.km)	Maximum DC Resistance (Ω/km)
0.40	Polyethylene	56.0	40 000	141.4 (145.64)
	Cellular polyethylene	56.0	40 000	
	Poly Vinyl Chloride	N/A	37.5	
0.50	Polyethylene	56.0 (41.0)	40 000	90.31 (93.21)
	Cellular polyethylene	56.0	40 000	
	Poly Vinyl Chloride	N/A	37.5	
0.60	Poly Vinyl Chloride	N/A	37.5	62.72 (64.72)
0.63	Polyethylene	56.0 (41.0)	40 000	56.64
0.90	Polyethylene	59.0 (41.0)	40 000	27.91 (28.77)
	Poly Vinyl Chloride	N/A	37.5	
1.25	Polyethylene	41.0	40 000	13.98
Note:	1. Mutual capacitance figures given in brackets are for twin junction cables. 2. DC resistance figures given in brackets are for tinned conductors.			