- shock or vibration.

- voltage proof test;

- capacitance between pairs of terminals.

5.Requirements for cable termination devices

5.1Electrical characteristics of terminations

The main electrical characteristics specified in most of the administrations for termination devices are:

- dielectric strength;

- insulation resistance;

- reflection index (coaxial only);

- contact resistance.

These characteristics are different for coaxial pair terminations, long distance symmetric pair cables and local symmetric pair cables.

5.2Environmental requirements of terminations

The requirements should be specified at least for 20 years of field operation in stationary use at partially weather-protected locations. The IEC Standards should be followed:

- temperature cycling, lower and upper limits;

- change of temperature;

- damp heat, steady state;

- standard climatic sequence;

    1. dry heat,

    2. damp heat, cyclic,

    3. cold,

    4. damp heat, cyclic,

- gas-tightness;

In addition to the above, terminating equipment will be required to satisfy the following test requirements:

- cold;
- dry heat;
- damp heat;
- accelerated damp heat;
- vibration;
- storage;
- mould growth;
- corrosion test;
- robustness of terminals.

Safety

Terminating systems will need to be designed with safety and security in mind. To this end, designs should:

-minimize likelihood of unintended electrical contact and/or accidental dislocation of wires;

-use plastic materials with an oxygen index of at least 28 determined in accordance with international standards;

-use plastic materials which do not emit hazardous fumes or smoke when heated;

-avoid sharp corners and edges.

Electrical

All the terminating blocks should have good electrical characteristic in order to minimize the risk of personal injury to staff, customers and
public from electrical causes arising from the installation, operation, and maintenance of the devices.

If necessary recommend good values for:

- insulation resistance;

- circuit paralleling;

- earthing points or buses;

- ratio of O/G to I/C circuit terminating capability of at least two;

- multi-point pair access connection (plugs and leads);

- colour coding of special circuits;

- fanning strips and jumper guides;

- permanent circuit indentification numbering;

- good visibility.

Technical requirements

The design, construction and materials utilized in the terminating device must provide for an expected service life of up to 40 years. Devices must be compatible with the existing MDF construction and utilization practices, interchangeable with the existing termination devices, and maintain or increase current circuit density per unit area.

The line side terminals shall be required to terminate the existing range of copper external cable conductors extending from 0.32 mm to 0.90 mm diameter plastic insulated with solid or cellular forms of insulation. The equipment side terminals shall be required to terminate the existing range of copper internal cable conductors.

Reliable retermination of conductors in the order of 100 to 200 times over the life of the system shall be possible. Prior termination of larger conductors shall not affect the subsequent termination of a second thinner wire.

The lineside terminating device on which line cables terminate should allow for the installation and acceptance testing of external cables. (Current automatic simultaneous access, via the MDF termination, to all pairs in each 100 or different pair terminating unit.)

Terminating equipment shall be able to withstand the effects of normal concentrations of moisture, sodium chloride, hydrogen sulphide, sulphur dioxide, ammonium chloride and formic acid which may penetrate or originate in buildings.

Terminating equipment shall be expected to operate satisfactorily in temperatures ranging from -10^{o}C to 50^{o}C with daily ambient fluctuations of up to 15^{o}C. Upper temperature limits shall be assumed to prevail for 25% of total time. Yearly average relative humidity of 75% is to be assumed with maximum values not exceeding 95%.

This termination is made by means of plastic bodies connectors without U-element contacts, and are used for protection of unused conductors in a pedestal or splice closure.

2.2Termination types for coaxial conductors

- Connectors types

Coaxial pairs are terminated in connectors mounted on a metallic diaphragm for the access to the repeater housing of the terminal equipment.

The connector splices the stiff coaxial tube to the flexible one into the housing or exchange and is provided itself with a device for pneumatic insulation.

- Direct joint type

Sometimes, a joint between air core tube and flexible coaxial cable are made.

3.Termination use

The types of termination are used in different devices for terminating cables in all their applications: main distribution frame, regenerating equipments, cabinets, terminal boxes and subscriber's premises.

These devices present some physical characteristics very different in every country, although their technical features (electrical and environmental requirements) are very similar.

4.Requirements for MDF terminating devices

The basic requirements of the exchange MDF terminating device include the provision for:

- fixed termination of external cable conductors, in multipair units (usually 100), and associated jumper cross-connection leads;

- ease of termination, and retermination where necessary, of cable and jumper cross-connection conductors;

- over voltage protection by add-on or plug in of triode gas protectors;

- circuit isolation by insertion or removal of an appropriate device;

- independent circuit accessing and testing, for equipment and line sides;

The electric conducting parts of terminating devices will be of metal such as copper, brass or other similar alloys suitably plated to resist corrosion and other environmental effects and provide good electrical connection, either by contact, pressure, soldering or wrapping.

Various insulating materials, (Plastic extrusions and resin moulding) provide the mechanical mounting and electrical insulation of the metallic components.

2.Termination types

2.1Termination types for symmetric pair conductors

- Wire-wrapping type

In this type, the conductor is wire-stripped and cut inserted in a wire-wrap tool and wire-wrapped around the terminal point.

- Solder-on type

In this type, the conductor is wire-stripped and cut inserted in terminal slot and soldered.

- Wrap and solder type

In this type, after wrapping, the conductor is soldered to the cut end of a terminal.

- Binder post type

There are different forms of this type.

a) By means of screws.

The conductor is wire-stripped, cut and fastened with screws by means of a screw driver.

b) By means of nuts.

Consist of a fixed threaded brass post containing a washer and a threaded hex nut. The conductors are terminated between the washers.

- Insulation displacement contact (IDC) type

In this type, generally the conductor is installed and pressed into a U-element contact by means of a special tool.

The U-element contact has different forms and is applied mostly to the terminal devices.

- Termination for unused conductors

Recommendation L.9

METHODS OF TERMINATING METALLIC TABLE CONDUCTORS

1.General

Metallic cable conductor terminations are installed at various locations within the cable network. The type of terminal and termination device utilized in these locations is dependent on various factors relating to the specific installation:

- type of cable and conductor being terminated;
- location and purpose of the termination;
- number or quantity of terminations required;
- type of service or transmission link involved;
- flexibility and protection requirements.

Basically, all exchange, repeater (amplifier or regenerator), and major cross-connection point terminations are of the "fixed" type utilizing wrapping, soldering or insulation displacement connection (IDC) techniques.

Local distribution and customer terminations utilize a mixture of "fix" and "temporary" (screw terminal) type terminations depending on individual conditions. Where required, over-voltage protection may be provided as an integral component of the terminating device or a separate "add-on" facility.

Within a cable network, two methods of terminating cables are available. These may generally be referred to as the direct and indirect methods.

Direct termination implies that the conductors associated with a particular cable are connected directly to the terminal forming the "end" of the cable circuit, e.g. the cable conductor and terminal are directly coupled.

Indirect termination implies that the cable conductor is connected to the end terminal via a device that incorporates a performed or manufactured termination.

Direct terminations are usually utilized in end terminals such as at the exchange MDF and customer premises, although some direct terminations are used in the customer distribution cable area. In most other mid-point terminations, (distribution cabinets and pillards, repeater housings and termination points for trunk carrier and coaxial cables), indirect terminations utilizing devices with pre-terminating tail cables are spliced into the basic bearer cables.