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SERIES L: CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT

Micro-trench installation technique

ITU-T Recommendation L.49

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Summary

This Recommendation describes the so-called micro-trenching technique, that allows installing underground cables at a shallow depth, in small grooves. The advantages of this technique over conventional cable laying technologies lie essentially in its speed of execution, lower cost, significantly lower environmental impact and limited disruption to road and, as a consequence of the previous items, easiness in obtaining permits for the occupation of public area.

Source

ITU-T Recommendation L.49 was approved by ITU-T Study Group 6 (2001-2004) under the ITU-T Recommendation A.8 procedure on 29 March 2003.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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Micro-trench installation technique

1 Scope

This Recommendation:

- gives advice on general requirements of the installation procedure;
- gives some application criteria.

2 Installation requirements

The micro-trenching technology shall be applied on routes that involve asphalted surfaces such as roads or sidewalks with a base of compact material (asphalt or concrete).

Its advantages over conventional cable laying technologies lie essentially in its speed of execution, major reduction in infrastructure deployment costs, and significantly lower impact on the environment and road traffic.

Protection against impact resulting from road repairing is not possible due to the shallow depths used in micro-trenching techniques. It is therefore essential to carefully plan the routes on which these techniques are to be used in order to provide long-term stability of the routes.

Micro-trenching is normally carried out by cutting a groove in the asphalt to a little depth (better if not less than 7 cm), but without penetrating past the asphalt layer. Care must be taken to avoid cutting entirely through the asphalt, as this could cause the pavement along the sides of the groove to crack or split.

This precaution must be borne in mind in all cases where there is no lateral protection on one or both sides of the groove which can prevent the asphalt layer from shifting, and particularly in cases where micro-trenching is performed along the edge of a road with no curb or sidewalk. In such cases, the groove shall normally be located at a suitable distance (e.g., at least one metre) from the edge of the road.

Groove width may vary (e.g., 10-15 mm) in accordance with the diameter of the cable laid.

The cable should meet exacting demands as to crush resistance and, in particular, temperature resistance, which is needed when sealing the cable in the groove with hot bitumen. The bitumen temperature during the sealing operation can reasonably vary between 100° C and 170° C.

The optical fibres are preferably enclosed in a metallic (e.g., copper) tube filled with a suitable filling compound and surrounded by a PE jacket. There are currently different cable types in use, containing different numbers of fibres and with different outside diameters.

The cable can be manufactured and supplied in long lengths; in city networks it is however often convenient to use short or matching lengths particularly for crossing under road or rail.

2.1 Preparatory steps

As is customary, a detailed survey of the route must be carried out, the purpose of which is to identify the work required to be done before starting cable installation operations. Such work could include, for instance, the preparation at bridges, or at road or rail crossings. Further, it is necessary to determine closure locations and section ends.

The route subsoil, i.e., asphalt thickness, road or sidewalk composition may have to be investigated by test drillings.

2.2 Groove cutting

Micro-trenching is performed using an asphalt cutting machine. Cutting speed will depend on the type of machine used. The route shall be free from sharp changes in direction. Where such changes are unavoidable, they shall be made by means of cuts angled as illustrated in Figure 1.

Figure 1/L.49 – Example of sharp change in route direction

2.3 Groove cleaning and drying

The following operations shall be carried out after cutting the groove:

– clean the groove with water under pressure;

– dry the groove using compressed air;

– further dry (e.g., oxidize) the groove with hot air using a suitable blowpipe.

2.4 Cable laying

The cable can be installed manually in the micro-trench, laying it gradually off the reel and into the bottom of the groove with the aid of a reel trolley.

While changes in direction are permissible, care must be taken not to exceed the minimum cable bend radius.

2.5 Cable protection

A retaining strip (e.g., an expanded polyethylene (PE) strip) shall be run into the groove, above the cable, to fix it in place inside the groove. The retaining strip shall then be covered by free-running, highly water-repellent filling materials (e.g., a rubber strip) whose dimension shall be slightly greater than groove cross-section. Each strip shall be fixed in place using a suitable roller.

In addition to securing the cable to the bottom of the groove, the primary function of these filler materials is to provide mechanical protection for the cable. The rubber strip also provides thermal protection.

2.6 Closing the cable groove

After the cable and protective strips have been installed, the groove shall be closed with hot liquid bitumen.

To ensure that the bitumen adheres to the side walls of the groove and creates an effective seal, a liquid bonding agent (primer) shall be first applied to the entire length of the groove and the groove edges.

Liquid bitumen shall be applied using an appropriately sized nozzle. This operation shall be performed in a way (e.g., two consecutive passes) to ensure that the groove is filled uniformly up to road level.

At the end of the operations described above, measurement shall be carried out (e.g., by means of a wheel track) in order to ensure that there are no uneven edges, steps or irregularities along the cable groove as a result of overfilling with liquid bitumen. These conditions must be maintained over a long period of time.

To ensure that the groove is correctly filled and sealed, the primer and bitumen shall be compatible.

2.7 Cable jointing

Suitable closures shall be used for jointing or branching the cable. These accessories are installed level with the surface of the road or sidewalk and shall be provided with a heavy-duty (vehicle-bearing) cover.

The said closures shall be installed in holes cut in the asphalt using a core-drilling unit whose diameter is suitable for the dimension of the closure.

If the closure (usually a branching closure) is installed at a later date, this has to be taken into account when the cable is laid. At the site for installing the closure, cable slack is laid out (e.g., in coils) and provisionally laid in pre-made grooves and covered over. When the closure will be installed, the cable shall be first exposed and then a hole shall be core-drilled, if not already done at the time of cable laying.

After the hole for the closure has been core-drilled, the closure is inserted in it provisionally to obtain the stripping dimensions for the cable ends.

To ensure correct standout, hole depth shall be established on the basis of closure height.

Once splicing operations have been completed, the closure shall be secured and sealed with liquid bitumen.

Air and water tightness shall be ensured by applying suitable accessories (e.g., heat-shrink tubes) to the exterior of all nozzles through which the cables pass.

When the cable installed in the micro trench has to be jointed with a conventionally installed cable using an existing closure not installed level with the surface (see also 3.1), appropriate accessories shall be used in order to ensure effective pneumatic sealing at the entrance holes of the closure.

2.8 Cable maintenance

In case of cable fault, it is necessary to replace the section of cable in which the fault was located, by installing a new cable. Once the fault has been located, the bitumen shall be removed from the groove by using a suitable tool (e.g., a hook) for a length of about 3 m at both sides of the fault (see Figure 2a). After having removed the protection strips, the old cable shall be cut and a sufficient length of fibres shall be stripped, to be jointed with the fibres of the new cable. The two cable joints shall be performed using two closures, that shall be installed at both ends of the repaired section (see Figures 2b and 2c). For closure and new cable installation, refer to clauses 2.3 to 2.7.

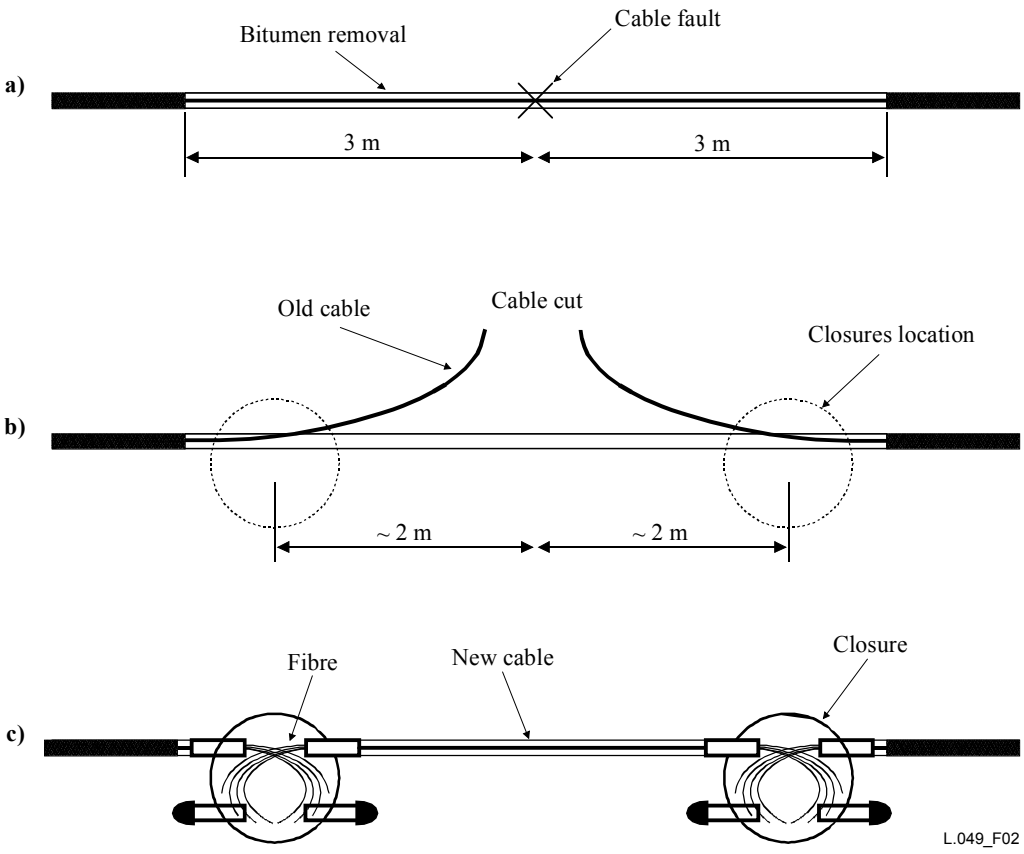

Figure 2/L.49 – Example of cable fault repairing

3 Application criteria

The micro-trenching cable laying technique is typically used for customer drop connection to the distribution network (connections to existing networks).

These connections shall normally be routed along two physically separate paths.

Protection from voltages induced by HT power lines and by AC power lines in the event of ground faults shall be provided in compliance with the existing standards.

3.1 Entry to manholes or chambers

The initial portion of the connection branched from the main distribution cable of the existing infrastructures and running from the prefabricated manhole or chamber until the entry point of customer premises shall be routed in a conventional trench capable of housing suitable ducts, in which cable shall be accommodated. At the entry point of customer premises, the trench shall rise gradually to the point of connection with the micro-trench. In cases where the two cables, needed to ensure two physically separated routes, are branched from the same closure, they shall be installed along the same route except in the section where the excavation rises to the point of connection: here, two separate routes (e.g., spaced at least 1 m apart) shall be used for the two micro-trenches.

3.2 Entry to buildings

Where cables installed in micro-trench enter inside buildings which are not already provided with flame resistant infrastructures for this purpose, the cables themselves shall be protected by means of suitable accessories (e.g., fireproof lagging or conduit) in compliance with the existing standards.

Cable shielding shall be connected to the main ground connection or to the main bonding conductor, where provided. Bonding connections shall be made by means of a cable with suitable cross-section directly connected to the main ground conductor.

3.3 Required documentation

In addition to the information which is normally required (cable route, type of installation, installation in road, sidewalk, etc.), cartographic documentation for cables installed using the micro-trenching technique shall also indicate reference depth relative to known datum points.

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