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

Safety practice for outdoor installations

ITU-T Recommendation L.63

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Safety practice for outdoor installations

Summary

This Recommendation has the objective to establish safety practices for personnel and operations to provide protection against fire in outdoor telecommunications installations and in shared infrastructures.

Source

ITU-T Recommendation L.63 was approved on 7 October 2004 by ITU-T Study Group 6 (2001-2004) under the ITU-T Recommendation A.8 procedure.

FOREWORD

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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.

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Safety practice for outdoor installations

1 Scope

The objective of this Recommendation is to provide guidance to administrations on safety practice for personnel and fire protection for outdoors telecommunications installations such as duct systems, manholes, tunnels, aerial, underground and buried networks, subscribers, equipments for outside plant, and networks in sewage infrastructures.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

– ITU-T Recommendation K.11 (1993), *Principles of protection against overvoltages and overcurrents.*

– ITU-T Recommendation K.13 (1988), *Induced voltages in cables with plastic-insulated conductors.*

– ITU-T Recommendation K.25 (2000), *Protection of optical fibre cables.*

– ITU-T Recommendation K.26 (1988), *Protection of telecommunication lines against harmful effects from electric power and electrified railway lines.*

– ITU-T Recommendation K.51 (2000), *Safety criteria for telecommunication equipment.*

– ITU-T Recommendation K.58 (2003), *EMC, resistibility and safety requirements and procedures for co-located telecommunication installations.*

– ITU-T Recommendation K.59 (2003), *EMC, resistibility and safety requirements and procedures for connection to unbundled cables.*

– ITU-T Recommendation K.64 (2004), *Safe working practices for outside equipment installed in particular environments.*

– ITU-T Recommendation L.20 (1996), *Creation of a fire security code for telecommunication facilities.*

– ITU-T Recommendation L.21 (1996), *Fire detection and alarm systems, detector and sounder devices.*

– ITU-T Recommendation L.22 (1996), *Fire protection.*

3 Construction infrastructure

For the purpose of this Recommendation, the construction infrastructure is considered to be any of the following outdoor installations associated with the outside plant.

3.1 Duct systems

In selecting permanent locations for underground structures, future road developments and plans of others utilities should be considered.

Manholes should be located away from road intersections, for safety of workers and the public.

Use bottom ducts first, use outside ducts first.

In the construction or maintenance of duct lines, the projects must first be analysed for compliance with all the security procedures demanded by the administration for workmanship, and full planning information along the route to be constructed or renewed.

Complete design plans should be obtained of all the existing installations, including topological and soil information; in addition, safety and signalling supplies and standard shoring and mechanical equipment should be made available.

In the case of existing water, fuel, gas or energy distribution systems, the required safety procedures must be observed, in particular the depths demanded for each administration.

The use of ducts and spacers constructed of polyvinyl chloride (PVC) or polyethylene (PE) and, if possible, concrete is recommended.

When conducting work on any installation, safety procedures must be followed regarding:

– trench depth;
– local conditions;
– construction site signalling.

3.2 Cable tunnels

Normally cable tunnels are used inside telephone exchange buildings. Safety systems are normally fitted to guard against smoke and fire; they are controlled by detectors and alarms (visible and/or audible), and are complemented by fire extinguishers, gas detectors that are installed in the tunnel and ducts. These systems should be properly monitored.

Detection systems that are electrically powered should use low voltages, to prevent the risk of explosion, mainly associated with the risk of gases in the tunnels.

All safety equipment must be routinely inspected. In the case of tunnels where there exists shared infrastructure, each company should label its own installations; the appropriate separation distances should be respected.

In the case of tunnels where cables are to be located next to installations carrying gas or gasoline, or sharing infrastructure, it is recommended that alarm devices be used to monitor for the presence of smoke, gas or gasoline.

In cable tunnels, cables should be filled, and grounded using the same point of ground as the central office. All underground splices must be filled, and bonded to the vault ground.

3.3 Manholes

When opening manholes, the following considerations are recommended:

– check for the presence of water, gasoline, fuel, etc. when opening the manhole;
– perform basic gas detection tests;
– wait a minimum of 10 minutes before entering;
– keep gas detectors operational, if possible, while working inside;
– keep an audible alarm system activated;

– use only equipment with low voltage and low current, if possible;
– avoid remaining inside the enclosure for protracted periods;
– always keep a means of rapid exit (stairs) from the chambers available;
– never work alone;
– use an alarm system with external signalling;
– in rainy weather, take measures to prevent water entering the enclosure;
– if mains power is used, overcurrent and overvoltage protection is required;
– cable pressure meters shall be fitted at the entrances to all manholes.

3.4 Sewage infrastructure installations

In sewage installations, cables and components must be manufactured so as to protect workers against the risk of contamination.

The rules established by the health and environmental administrations to this effect must be observed.

All workers must be briefed by health and environment specialists.

Further study is required into the effects of the harsh environment present in sewage installations.

4 Outside plant network

4.1 Aerial network

Aerial telecommunication cables should incorporate the following fire safety measures:

– Cable sheaths should be manufactured of a material that is not flame propagating and has low smoke and zero halogen emissions, for use in environments of great agglomeration of people, such as subway or train stations.
– When designing the installation of the cables or wires, the distance of separation from energy networks and the maximum dip of the cable or wire in relation to the ground must be respected.
– The ground points must be independent of electrical energy network.
– Verify the levels of voltage that may be present.
– It is NOT recommended to plan or install equipment that needs grounding on poles where there are energy network ground points.

4.2 Buried network

The minimum depth of buried cables is typically 1.20 m.

Buried cables may be protected against lightning strikes by the installation of a copper conductor or steel wire of 6 mm², installed approximately 600 mm above the cable. An indication band (warning tape) should be buried 200 mm above the cable.

Along the installation route, the presence of buried cables can be indicated with signs. For better protection, splices must be located where they will be readily accessible.

This type of installation requires an effective monitoring system with a view to assisting in the localization of damages.

5 Outside plant equipment

Some equipment is installed in outside plant units, such as subscriber multiplex, DSLAMs, amplifiers for CATV, subscriber equipment, HDSL modems, optical distribution frames, main distribution frames, and SDH MUXes. They should be protected by remote safety and fire control systems.

6 Shared infrastructure

In the case of shared infrastructure, fire-fighting and safety systems need to be carefully planned so as to avoid mutual interference.

The use of differentiated protection makes it possible for each operator's worker to work in safety, and provide the appropiate level of protection in each case.

A minimum distance between infrastructures must be observed.

Appendix I

Ukraine experience

Fire safety in the duct system

Introduction

This appendix contains information about the duct system in Ukraine, as well as accepted fire safety measures in the duct system.

I.1 Duct system of Ukraine

The communication duct system consists of buried ducts and different types of inspection facilities (e.g., manholes, collectors, tunnels and cable chambers).

The buried ducts contain bundles of conduits or multihole blocks. The maximum capacity of the duct system is 48 or 60 conduits. The distance between inspection pits is 150 m.

The duct materials are concrete, asbestos, polyethylene, steel and ceramic (Figure I.1).

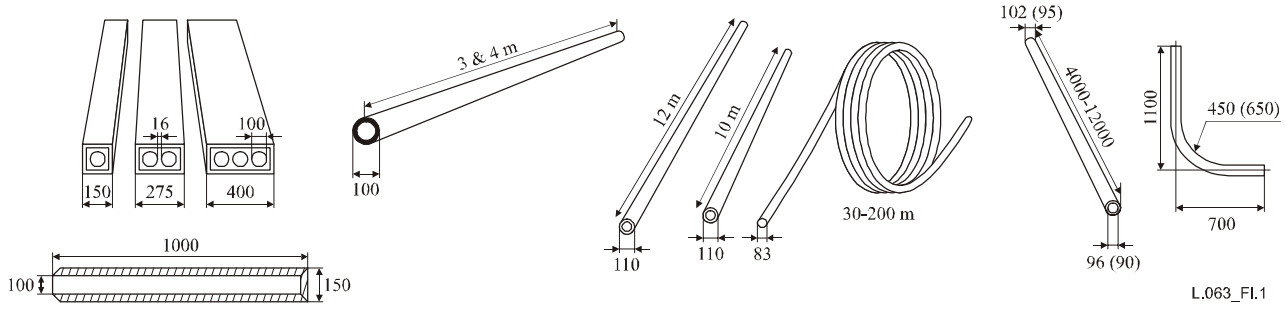

Figure I.1 – Different types of duct (concrete, asbestos, polyethylene, steel)

The oldest design uses concrete conduits. The rectangular blocks, one metre in length, have one, two or three holes (of 100 mm diameter). The separate blocks are placed end to end and joined by means of mortar.

The most widespread type of design uses asbestos ducts. The separate ducts, three to six metres in length, have an inside diameter of 100 mm. They are joined by means of mortar or collar joints.

However, the use of asbestos ducts is dangerous for the health of construction and maintenance personnel. Therefore, it is advised not to use this kind of material in the construction of new duct systems.

Recently, polyethylene ducts have come into use in big cities. The separate HDPE ducts have a length of 8 to 12 m, and an outside diameter of 110 mm. The ducts are joined by welding or using collar joints.

Short lengths of steel tube are used where ducts enter buildings. They are also used in free-flowing ground. The ducts have a length of 4 to 12 m and an inside diameter of 90 to 96 mm. Steel-to-steel joints are welded, while joints with asbestos ducts are made by means of mortar.

Ceramic ducts are used very rarely, being confined to acidic soils. Duct sections are 0.9 m long and have an inside diameter of 100 mm.

The main type of inspection facility is the manhole. Manholes may be of brick or reinforced concrete construction; some are manufactured in one piece. Three types of manholes are used: in-line, angle, and splitter (Figure I.2).

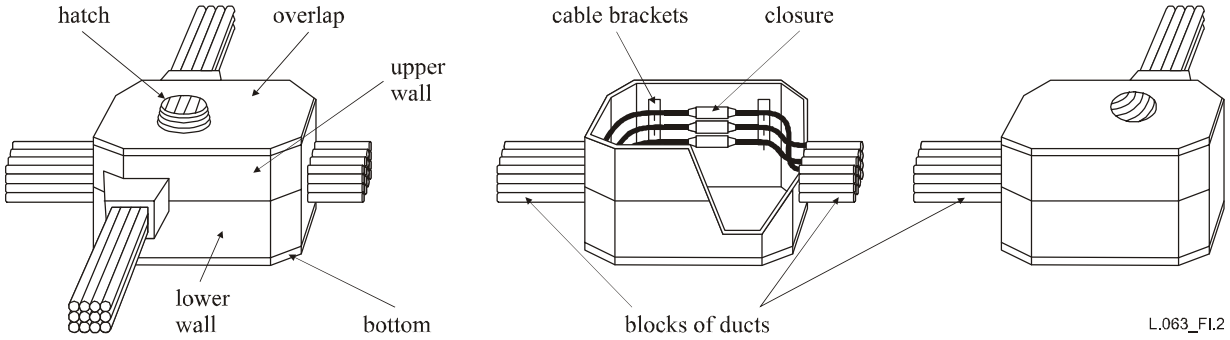

Figure I.2 – Building blocks of a communication duct

The most widespread design is a reinforced concrete manhole consisting of the lower wall ring with a base, and the upper wall ring with overlap.

Brick manholes are less reliable, being more permeable for gases and water. On the other hand, brick construction can be used to build a manhole of any shape and dimensions desired. This is important where the duct system is being built near utilities or buildings.

Cast-iron hatches provide for access to the manhole (Figure I.3). The inlet diameter is 600 mm. The hatch consists of a cast frame and upper cover, and a steel lower cover. The lower cover has a fitting for a lock. Both covers have fittings to allow a check for gas to be made without opening either cover. The mass of the hatch is 138 kg (heavy type) or 82 kg (light type).

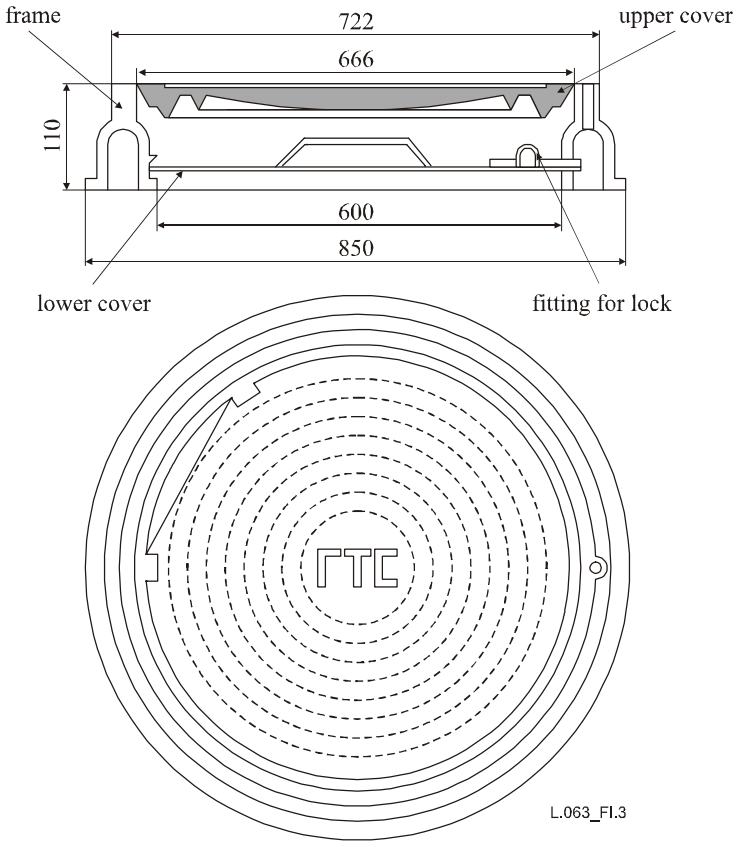

Figure I.3 – Cast hatch

Inside the manholes, cables are positioned on brackets (Figure I.4).

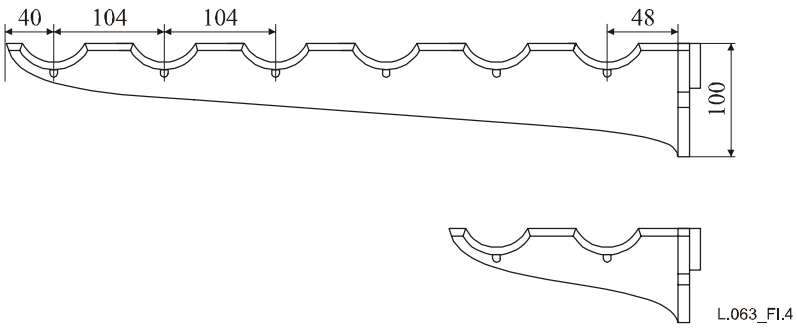

Figure I.4 – Cable brackets

The collector (Figure I.5) is a shared underground enclosure for components of different services (communication cables, electric power cables, hot-water pipes, steam conduits, pneumatic systems, sanitary drain pipelines and low-pressure gas pipelines).

Collectors are situated 1-1.2 m below ground. The inside dimensions are: width 1.7-2.7 m, height 1.8-3.0 m.

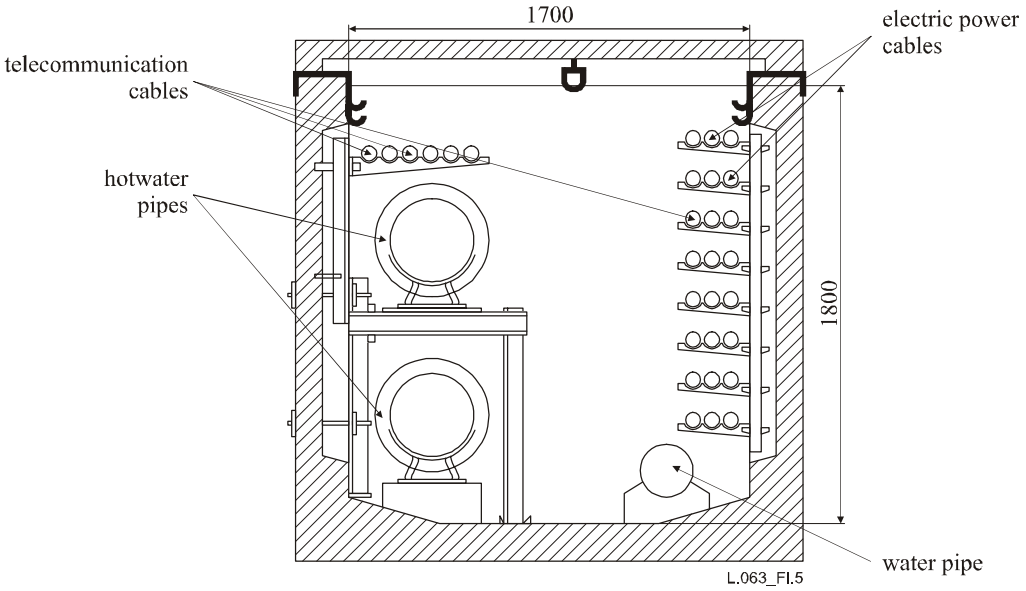

Figure I.5 – Underground collector

In some cities the communication optical fibre cables are installed in subway tunnels. Special brackets are used. Inside the passenger stations, cables are laid under the platform; they are led into the tunnel through vertical well holes. Inside those holes, cables are attached to walls by special metal clamps.

I.2 Fire safety in manholes, collectors and tunnels

Before undertaking any work in manholes and collectors, a gas analyser is used to check for gas. If gas is detected, electrical fans are used to provide forced ventilation. In the absence of gas, natural ventilation through the open ducts is sufficient.

Special copper-covered tools are provided for operating the manhole cover. In winter, if the cover freezes to the frame of the hatch, hot sand is to be used for opening the manhole cover.

For operating in the manhole, a crew of at least two workers should be used. One worker should always stay outside the manhole.

Lighting in manholes and collectors should be by means of low voltage (12V) systems. Low-voltage or portable batteries may also be used.

It is forbidden to have an open flame in manholes and collectors.

Contact with power cables is strictly forbidden; this includes a ban on putting any tools or materials on these cables.

In tunnels, only special fire-retardant cables should be used. These cables may use PVC, LS0H or other non-inflammable sheaths. In subway tunnels, heat sensor units are installed. Heat sensors and smoke sensors are installed in each station. Fire hydrants and hand-operated carbon dioxide fire extinguishers are also installed in each station.

Appendix II

Brazilian experience

Safety of personnel for installation in infrastructures of power lines distribution

The following points are excerpts from the relevant Brazilian regulations.

- It is recommended not to install telephones cables on the same infrastructure as electric power installations with a voltage higher than 75 kV.
- It is recommended that telephones networks not be routed in parallel with electric power network lines with a nominal voltage higher than 35 kV.
- The ground resistance must not exceed 13 Ω.
- The following distances between networks are recommended:

Voltage (V)	Minimum distance (m)
Up to 600	0.60
from 600 to 15 000	1.30
from 15 000 to 35 000	1.80
from 35 000 to 70 000	2.20

- Crossings of telephone networks and electrical power networks of up to 70 kV must observe a 90º±15° angle.
- Crossings of telephone networks and electrical power networks with voltage between 35 kV and 70 kV should have the messenger grounded on both sides of the power line, with a maximum ground resistance of 30 Ω.

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