International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

L.78

Amendment 1

(06/2010)

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

Optical fibre cable construction for sewer duct applications

Amendment 1: New Appendix III – Italian experience: Construction of special optical fibre cables for extreme applications in sewer ducts

Recommendation ITU-T L.78 (2008) – Amendment 1

ITU-T

ITU International Telecommunication Union

Recommendation ITU-T L.78

Optical fibre cable construction for sewer duct applications

Amendment 1

New Appendix III – Italian experience: Construction of special optical fibre cables for extreme applications in sewer ducts

Summary

Amendment 1 of Recommendation ITU-T L.78 provides an new appendix describing the Italian experience related to "optical fibre cable construction for sewer duct applications". This appendix may be useful for readers who intend to install optical fibre cables into specific sewer ducts (e.g., high water pressure and corrosive materials).

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T L.78	2008-05-29	6
1.1	ITU-T L.78 (2008) Amend. 1	2010-06-11	15

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). 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

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

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

CONTENTS

Recommendation ITU-T L.78

Optical fibre cable construction for sewer duct applications

Amendment 1

New Appendix III – Italian experience: Construction of special optical fibre cables for extreme applications in sewer ducts

(This appendix does not form an integral part of this Recommendation)

III.1 General design of the cable

The cable should not be considered as a reinforced cable, based on the normal stranded plastic loose tube, but a new "concept cable". The fibres are inside stranded stainless steel loose tube (SSLT) laser welded, which guarantees maximum robustness and corrosion resistance. The above-mentioned construction concept is very important in order to achieve the mechanical performance required for such an application. Tensile performance as well as crush resistance and flexibility are the main parameters to take into account while using this cable. Water penetration (especially inside sewer pipes) is also a very important issue, which should be treated in a proper way.

III.2 Description of cable structure

– Central element made of high galvanized steel wire(s).

– Optical core: 4 to 48 fibres in each stainless steel loose tube, each filled with a non-hygroscopic jelly compound. 1 to 9 stainless steel loose tubes are stranded with high galvanized steel wires.

– Protection: Special polymer (filling compound) injected around the high galvanized steel wires.

– Mechanical protection: high galvanized steel wires preformed and stranded according to cable design.

– External sheath: special polymer, 2.2 mm thick, which turns slippery at the contact with liquids, in order to enhance debris transit.

III.3 Main performance characteristics of the cable

– Very high tensile strength, e.g., 290 kN for 144 fibres.

– Extremely high crush resistance of up to 4'000 N/cm (depending on construction).

– Small cable diameter, e.g., 14.2 mm for 24 fibres, 22 mm for 144 fibres, 30 mm for 432 fibres.

– Small bending radius: 15 times the cable diameter.

– Excellent chemical resistance to sewage and other chemicals.

– Absolutely protected against rodents.

– Resistant to high pressure water jet cleaning of sewers.

– Free of residual torque or stress, due to preformed stranded construction (no bending memory effect).

– The cable is installed using conventional techniques, e.g., by pulling. There is no need for special investments or expensive installation with robots.

– Sufficient cable weight in water allows the cable to be laid directly on the bottom of the sewer, without any fixing point.
– No problems with different thermal dilatation by using stainless steel loose tubes and steel wires.
– Excellent resistance to water penetration due to a thick sheathing, special filling compound and a stainless steel loose tube with jelly filling.
– Sheath material becomes slippery in contact with water to facilitate the debris transit.

III.4 Benefits of using this cable

– Easy and fast installation using conventional cable deployment equipment.
– Fixing of the cable is not necessary since the cable positions itself straight on the bottom, and is sufficiently strong and heavy to remain in this place.
– There is very little interference with traffic when deploying this cable.
– The cable withstands sewer cleaning with high pressure water jets, hence it must not be removed.

III.5 Fibres

– The fibres are in accordance with ITU-T recommendations.
– The cable can be equipped with ITU-T G.652, ITU-T G.655, ITU-T G.656 or any other type of telecommunication fibre as well as hybrid solutions.
– Maximum number of fibres: 432 with 9 stainless steel loose tubes (SSLT).

III.5.1 Fibre identification

– The fibre count within a SSLT varies from 4 to 48, the number of SSLT from 1 to 9, depending on customer specification and detailed construction.
– The SSLT are marked with tracer tape for identification.
– The fibres inside the SSLT are identified by colours:
  • Fibres 1-12 are identified by 12 different colours.
  • Fibres 13-48 are identified by using black ring markings in different numbers and distances together with the fibre colouring as for fibres 1-12 (exception: black colour is replaced by transparent), see Table III.1.
– The colour code can be adapted according to customer requirements.

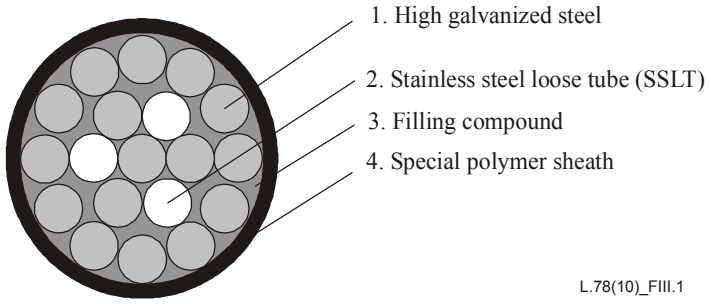

Figure III.1 – Example construction for optical fibre cables for extreme applications in sewers or water conduits

Table III.1 – Standard colour code of identification

No. Fibres	Colour
1, 13, 25, 37	Red
2, 14, 26, 38	Green
3, 15, 27, 39	Yellow
4, 16, 28, 40	Blue
5, 17, 29, 41	White
6, 18, 30, 42	Violet
7, 19, 31, 43	Orange
8, 20, 32, 44	Black, transparent
9, 21, 33, 45	Grey
10, 22, 34, 46	Brown
11, 23, 35, 47	Pink
12, 24, 36, 48	Aqua

Table III.2 – Mechanical characteristics of the cable

	Standard	Nominal values	Example for 144 fibers
Diameter (mm)		14.2-30	22.4
Estimated weight (kg/m)		0.54-2.77	1.56
Minimum bending radius (mm)	[IEC 60794-1-2], E11A	$15 \times d$ with tensile load: $20 \times d$	336 448
Tensile performance (kN)	[IEC 60794-1-2], E1B	89-535	296
Crush resistance (N/cm)	[IEC 60794-1-2], E3	800-4000	4000
Temperature cycling	[IEC 60794-1-2], F1	–40-+60°C	–40-+60°C

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	**Construction, installation and protection of cables and other elements of outside plant**
Series M	Telecommunication management, including TMN and network maintenance
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Terminals and subjective and objective assessment methods
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks, open system communications and security
Series Y	Global information infrastructure, Internet protocol aspects and next-generation networks
Series Z	Languages and general software aspects for telecommunication systems

Printed in Switzerland
Geneva, 2010