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ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

L.59

Amendment 1
(07/2015)

SERIES L: ENVIRONMENT AND ICTS, CLIMATE CHANGE, E-WASTE, ENERGY EFFICIENCY; CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF OUTSIDE PLANT

Optical fibre cables for indoor applications

Amendment 1: New appendix on low friction indoor cable and wiring (Japanese experience)

Recommendation ITU-T L.59 (2008) – Amendment 1

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Recommendation ITU-T L.59

Optical fibre cables for indoor applications

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New appendix on low friction indoor cable and wiring (Japanese experience)

Summary

Amendment 1 to Recommendation ITU-T L.59 (2008) provides information on the Japanese experience of low friction indoor cable and wiring.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T L.59	2004-09-06	6	11.1002/1000/7381
2.0	ITU-T L.59	2008-01-08	6	11.1002/1000/9325
2.1	ITU-T L.59 (2008) Amd. 1	2015-07-03	15	11.1002/1000/12578

* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

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Recommendation ITU-T L.59

Optical fibre cables for indoor applications

Amendment 1

New appendix on low friction indoor cable and wiring (Japanese experience)

1 Clause 4

Add the following abbreviations in the appropriate alphabetical order.

FTTH	Fibre To The Home
IDF	Intermediate Distribution Frame
MDF	Main Distribution Frame
MDU	Multi Dwelling Unit
OLT	Optical Line Terminal
SP	Splitter module Part

2) Appendix IV

Add Appendix IV after Appendix III.

Appendix IV

Low friction indoor cable and wiring (Japanese experience)

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

IV.1 Introduction

Low friction indoor cable is widely used for multi dwelling unit (MDU) wiring in Japan. Clauses IV.2 to IV.5 describe the fibre to the home (FTTH) configuration for MDUs, problems of conventional wiring and their solution in Japan.

IV.2 Configuration of FTTH for MDUs

The basic configuration of the optical access network in Japan is shown in Figure IV.1. Two types of topology are employed according to the type of user, namely passive double star or single star topology. (1) For home users, a 4-branch optical splitter module part (SP) is installed in the central office and an 8-branch SP is installed on the user side. (2) By contrast, a 32-branch SP (or a combination of one 4-branch SP and four 8-branch SPs) is installed in MDU units such as apartment houses, condominiums and office buildings. As a result, 32 users share an optical line terminal (OLT), and 32 users share a fibre. A configuration consisting of the single star topology with a media converter is widely used to provide MDUs with FTTH services. For a medium-sized MDU, SPs are installed in a main distribution frame (MDF) and effective wiring approaches involve using a star configuration from an SP installed in an MDF to each unit according to demand as shown in Figure IV.2. This approach makes it easy to manage such operations as a change of service.

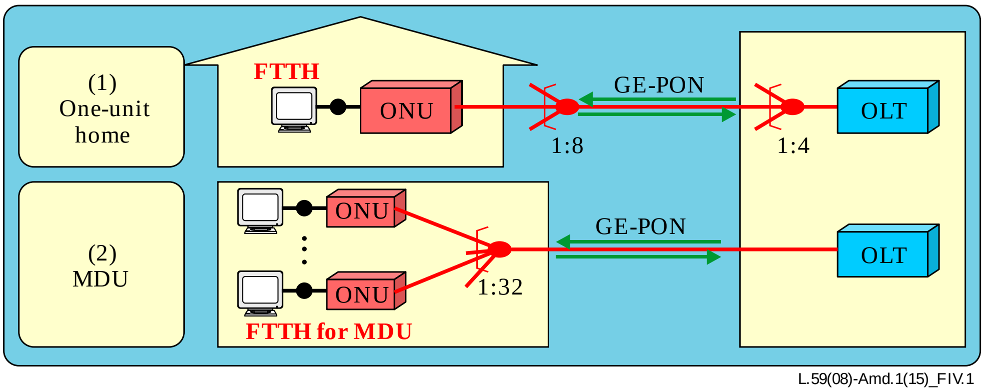

Figure IV.1 – Configuration of the optical network

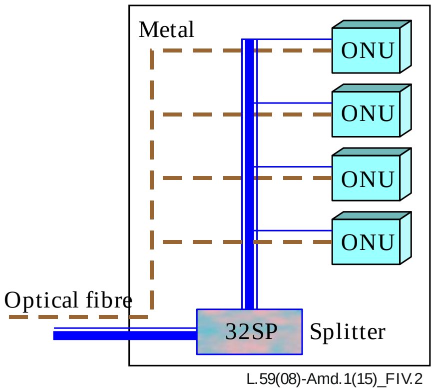

Figure IV.2 – Topology of wiring inside an MDU

IV.3 Problems of conventional wiring

Figure IV.3 shows MDF or intermediate distribution frame (IDF) boxes and conduits in an existing MDU. Copper facilities have already been installed and the space available for optical fibre wiring is very limited. Moreover, conduits have a small diameter and there are no free conduits.

Existing copper cable with a diameter of more than 10 mm is usually installed in conduits. However, cable installation is difficult when a conduit is curved, because the cable diameter is large. If optical indoor cable for each unit is required, additional conduits and cabinet boxes would have to be installed due to the lack of space, and this would be both time consuming and costly. To expand FTTH to existing MDUs, it was necessary to develop effective wiring techniques for using the free space in existing conduits and the confined space of an MDF.

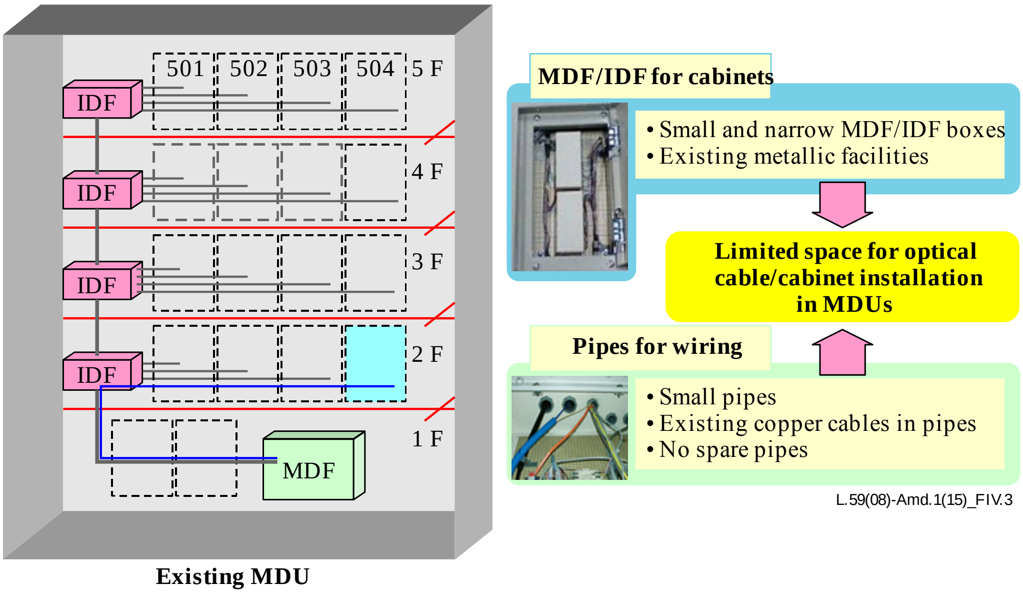

Figure IV.3 – Indoor cable wiring problems with existing MDUs

IV.4 Conventional indoor cable

The most widely used installation method for a conventional indoor cable (hereinafter, "conventional cable") in Japan, as shown in Figure IV.4, is described below.

1) Insert a lead wire into a conduit and connect a cable to its head.

2) Pull the lead wire to install the cable and then disconnect it.

If a conventional cable is installed with existing copper cables, strong traction-tension is needed to pull it, because of the friction drag imposed by the cable surface. When there are several conventional cables, the traction-tension limit means that installation is impracticable. Volatility is high even though a lubricant is applied to the surface of the cable to reduce friction to facilitate cable installation. Moreover, existing cables may be dragged along during installation. In fact, careful attention must be paid to cable installation and removal from a conduit when troubleshooting.

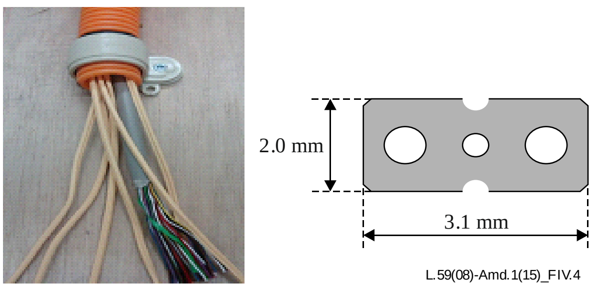

Figure IV.4 – Image of conventional cable

IV.5 Low friction indoor cable

IV.5.1 Functions expected with new cable

To make it possible to wire all units, three main technical problems have to be overcome.

1) Reducing cable size

   Installing cables for all units into existing conduit

2) Achieving low cable friction

   Reducing the traction-tension

3) Adjusting appropriate cable bending rigidity

Resistance to buckling when pushing and flexibility for passing through bent parts of the conduit

IV.5.2 Design

Figure IV.5 shows the small size, low friction and appropriately rigid indoor cable (hereinafter, "low friction cable") and Figure IV.6 shows an example of the test method setup for the measurement of friction coefficient. The size of its cross-section is about half of that of conventional cable. The friction coefficient is less than 0.25, which is about one-fifth of that of conventional cable. Bending rigidity of low friction cable is about double that of conventional cable. The friction coefficient of low friction cable is much lower than that of conventional cable to which lubricant has been applied. Furthermore, the friction coefficient of the low friction cable is maintained over time. In addition, the required cable characteristics, which are the same as those of conventional cable, are realized.

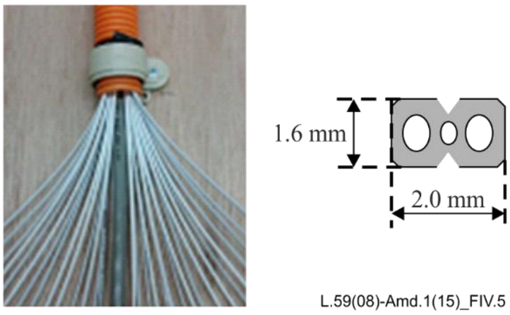

Figure IV.5 –Low friction cable

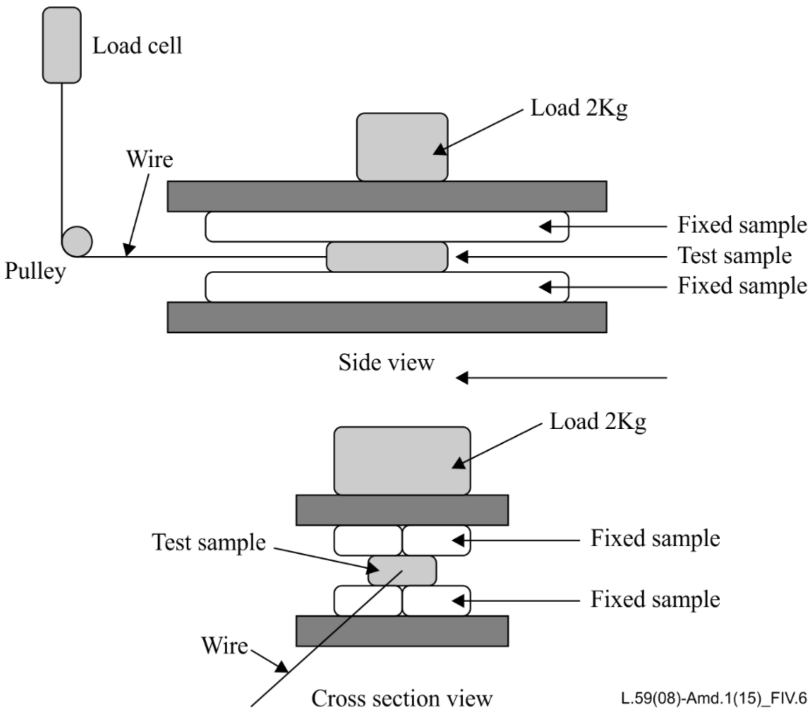

Figure IV.6 – Test method setup for the measurement of friction coefficient

IV.5.3 Effect of low friction indoor cable

The difference in the numbers of conventional and low fiction cable that can be installed is shown in Table IV.1. Three times as many low friction cables can be installed in the space of conventional cables. Thirty low friction cables can be installed in an existing 22 mm conduit with an 8.6 mm copper cable as shown in Figure IV.5.

Table IV.1 – Numbers of installed conventional vs. low friction cables

	Diameter of conduit		
	16 mm	**22 mm**	**28 mm**
Conventional cable	4	8	15
Low friction cable	12	30	over 35
NOTE 1 – Conventional cable: installed without lubricant. NOTE 2 – Copper cable, diameter of 8.6 mm, is already installed.			

The low friction reduces the pulling tension and shortens the installation time. Figure IV.7 presents a comparison of pulling tension and installation time of the low friction cables vs. conventional cables. It is possible to pull the cable with about one-tenth of the usual tension, and also the installation time becomes about one-fifth of the conventional installation time. Additionally, it is possible to remove the low friction cables without disturbing the existing cables, because the low friction characteristics remain.

A new installation method is also established that involves pushing the cable into a conduit rather than using a pulling wire. Figure IV.7 shows that the installation time is reduced by about one-third compared with the conventional method, when the conduit condition is good. This is because the conventional method requires two steps, whereas the new insertion method requires only one.

In addition, the pushing method may make it possible to insert a cable into a conduit that has sustained damage, such as a dented portion that is preventing the insertion of a new cable. There are cases where it is impossible to insert a new cable into an existing conduit with the conventional method. However, it is possible with the new method.

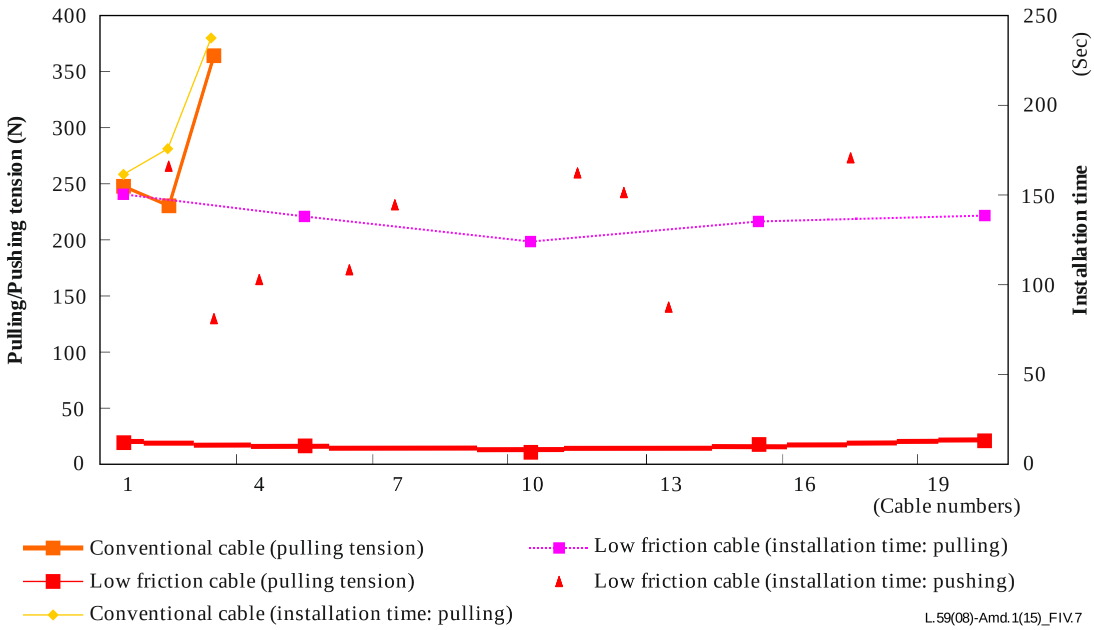

Figure IV.7 – Installation results examples of conventional cable and low friction cable in a 22 mm conduit

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