

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

L.208

(08/2019)

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

Optical infrastructures – Infrastructure including node
elements (except cables)

**Requirements for passive optical nodes–
Fibre distribution box**

Recommendation ITU-T L.208

ITU-T L-SERIES RECOMMENDATIONS

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

OPTICAL FIBRE CABLES	
Cable structure and characteristics	L.100–L.124
Cable evaluation	L.125–L.149
Guidance and installation technique	L.150–L.199
OPTICAL INFRASTRUCTURES	
Infrastructure including node elements (except cables)	L.200–L.249
General aspects and network design	L.250–L.299
MAINTENANCE AND OPERATION	
Optical fibre cable maintenance	L.300–L.329
Infrastructure maintenance	L.330–L.349
Operation support and infrastructure management	L.350–L.379
Disaster management	L.380–L.399
PASSIVE OPTICAL DEVICES	L.400–L.429
MARINIZED TERRESTRIAL CABLES	L.430–L.449

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T L.208

Requirements for passive optical nodes – Fibre distribution box

Summary

Recommendation ITU-T L.208 refers to a fibre distribution box (FDB) deployed as a passive optical node in indoor or outdoor environments. It details the FDB housing, FDB fibre management system, cable attachment and termination system, and specifies the mechanical and environmental characteristics.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T L.208	2019-08-29	15	11.1002/1000/14030

Keywords

Enclosures, fibre distribution boxes, interconnection, outside plant, passive optical nodes.

* 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>.

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/>.

© ITU 2019

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

Table of Contents

	Page
1 Scope.....	1
2 References.....	1
3 Definitions	3
3.1 Terms defined elsewhere	3
3.2 Terms defined in this Recommendation.....	3
4 Abbreviations and acronyms	3
5 Conventions	3
6 Characteristics of fibre distribution boxes	3
6.1 General requirements.....	3
6.2 FDB housing.....	4
6.3 FDB fibre management system (organizer system)	5
6.4 Cable attachment and termination system.....	6
7 Performance evaluation test program	6
8 Sample preparation	7
Annex A – Performance evaluation criteria.....	8
A.1 Sealing and visual evaluation	8
A.2 Optical evaluation.....	8
Annex B – Performance test program for indoor non-temperature controlled and outdoor above ground FDBs	10
B.1 Mechanical and sealing evaluation.....	10
B.2 Optical evaluation.....	12
Appendix I – Product characterization checklist	14
Appendix II – Indian experience.....	17
II.1 Introduction	17
II.2 Different types of FTDB	17
II.3 Attributes of FTDB.....	20
Bibliography.....	22

Introduction

Fibre distribution boxes (FDBs) are widely used for protection of interconnection points between multi-fibre distribution cables and drop cables in access networks. The boxes along with internal functional assemblies can be referred to as fibre distribution boxes. An FDB comprises a mechanical structure (FDB housing) for mechanical protection and environmental sealing of internal systems, an FDB fibre management system for guiding, storing and managing the fibres and fibre connections inside the node, and a cable attachment and termination system for attaching and terminating cable ends of multi-fibre distribution cables and drop cables. A fibre distribution box will:

- work as a fibre distribution area near the users in access network;
- protect the fibres, fibre interconnections and optical devices from indoor environment or outdoor environment at above ground level, usually mounted on wall or pole;
- provide for the organization of the fibre interconnections, passive devices and the storage of fibre overlength (excess fibre length);
- provide electrical bonding and grounding of the metal parts of the cable sheath and strength members.

Recommendation ITU-T L.208

Requirements for passive optical nodes – Fibre distribution box

1 Scope

This Recommendation provides the requirements of a fibre distribution box (FDB) and the means for characterization and evaluation of the performance of an FDB according to the principles of [ITU-T L.200]. This includes mechanical performance, sealing performance and optical stability of the product which simulate the effect of environmental factors or interventions related to network maintenance and reconfiguration. It contains a basic test program for the box which is globally applicable. Additional requirements may be agreed upon between customer and supplier to reflect local or special conditions. All functions and features that a product may contain should be reflected in the mix of test samples that are subjected to the test program.

This Recommendation:

- refers to an FDB as a passive optical node in an access network;
- details the characteristics and requirements of the housing, the FDB fibre management system and the cable attachment and termination system;
- specifies mechanical and environmental characteristics of the FDB;
- specifies characteristics of the FDB fibre management system;
- provides a test plan for the performance evaluation of FDB used in indoor non-temperature controlled (IN) or outdoor above ground (OA) (See [ITU-T L.200]);
- discusses the simulation of the effect of interventions related to network maintenance and reconfigurations;
- provides a checklist for a systematic product characterization according to [ITU-T L.200].

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 G.652] Recommendation ITU-T G.652 (2016), *Characteristics of a single-mode optical fibre and cable*.
- [ITU-T G.657] Recommendation ITU-T G.657 (2016), *Characteristics of a bending-loss insensitive single-mode optical fibre and cable*.
- [ITU-T K.11] Recommendation ITU-T K.11 (2009), *Principles of protection against overvoltages and overcurrents*.
- [ITU-T K.47] Recommendation ITU-T K.47 (2012), *Protection of telecommunication lines against direct lightning flashes*.
- [ITU-T L.200] Recommendation ITU-T L.200/L.51 (2003), *Passive node elements for fibre optic networks – General principles and definitions for characterization and performance evaluation*.

- [ITU-T L.361] Recommendation ITU-T L.361/L.64 (2012), *ID tag requirements for infrastructure and network elements management*.
- [IEC 60529] IEC 60529 (2013), *Degrees of protection provided by enclosures (IP Code)*.
- [IEC 60950-1] IEC 60950-1 (2013), *Information technology equipment – Safety – Part 1: General requirements*.
- [IEC 61300-2-1] IEC 61300-2-1 (2009), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-1: Tests – Vibration (sinusoidal)*.
- [IEC 61300-2-4] IEC 61300-2-4 (2019), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-4: Tests – Fibre or cable retention*.
- [IEC 61300-2-5] IEC 61300-2-5 (2009), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-5: Tests – Torsion*.
- [IEC 61300-2-9] IEC 61300-2-9 (2017), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-9: Tests – Shock*.
- [IEC 61300-2-12] IEC 61300-2-12 (2009), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-12: Tests – Impact*.
- [IEC 61300-2-22] IEC 61300-2-22 (2007), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-22: Tests – Change of temperature*.
- [IEC 61300-2-26] IEC 61300-2-26 (2006), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-26: Tests – Salt mist*.
- [IEC 61300-2-33] IEC 61300-2-33 (2012), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-33: Tests – Assembly and disassembly of fibre optic mechanical splices, fibre management systems and closures*.
- [IEC 61300-2-34] IEC 61300-2-34 (2009), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-34: Tests – Resistance to solvents and contaminating fluids of interconnecting components and closures*.
- [IEC 61300-2-37] IEC 61300-2-37 (2016), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-37: Tests – Cable bending for fibre optic closures*.
- [IEC 61300-3-1] IEC 61300-3-1 (2005), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-1: Examinations and measurements – Visual examination*.
- [IEC 61300-3-3] IEC 61300-3-3 (2009), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-3: Examinations and measurements – Active monitoring of changes in attenuation and return loss*.
- [IEC 61300-3-28] IEC 61300-3-28 (2012), *Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 3-28: Examinations and measurements – Transient loss*.

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 FDB fibre management system (organizer system): The whole of means and features that guide, protect and store fibres, connectors and passive optical components inside the fibre distribution box (FDB), at any location where they are not protected by the cable sheath. In an FDB, the optical fibres are properly managed and guided from where cables enter the node until their exit.

3.2.2 fibre distribution box: A protective housing with an integrated fibre management system to protect the interconnection points between multi-fibre distribution cables and drop cables in an access network.

3.2.3 protective housing: Protective housing refers to the outer shell of a fibre distribution box (FDB), not including the fibre management system or the cable attachment and termination system. Its main functions are protection and sealing of its contents.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

FDB	Fibre Distribution Box
FDH	Fibre Distribution Hub
FTDB	Fibre Termination and Distribution Box
IN	Indoor non-temperature controlled
IP	Ingress Protection
MDUB	Multi Dwelling Unit Box
ME	Multiple Element (mass storage)
OA	Outdoor Above ground
SC	Single Circuit
SE	Single Element
SF	Single Fibre
SR	Single Ribbon
WDM	Wavelength-Division Multiplexing

5 Conventions

None.

6 Characteristics of fibre distribution boxes

6.1 General requirements

Each FDB should comply with the general requirements as listed in clause 8 of [ITU-T L.200].

6.2 FDB housing

The following should be considered:

- dimensional compatibility to internal contents and installation site should be considered. A box is considered to be small, low weight and easy to be installed by one person without the need of special lifting equipment;
- the FDB housing should be re-openable for installation, maintenance or reconfiguration. Access to the product can be achieved by removing a cover or hinging a door. Hinging doors or covers should have a sufficient opening angle to allow reconfigurations, additions or replacements of fibre management system parts or modules. Typically, an angle of 110 degrees is considered sufficient;
- after being installed (with possible secondary protections), the FDB's housing protection level should comply with the requirements of ingress protection (IP) 30 or higher degrees in [IEC 60529] for IN applications, or comply with the requirements of IP 54 or higher degrees for OA applications;
- the FDB housing can be made from metal, engineering plastic, sheet moulding compound (SMC), sheet-form glass-fibre reinforced polyester material processed by compression moulding) or other suitable materials;
- the metallic parts of the FDB housing should be electrically bonded and grounded;
- the housing should allow access of cable ends of one or more multi-fibre distribution cables. If the fibres of drop cables are to be terminated inside the housing, the housing should also allow access of the drop cables. In cases where pre-terminated drop cables are used, the housing should allow the entry of connectors through the drop cable entry ports. If the fibres of the drop cables are terminated outside the housing, the housing should allow for installations of adapters and hardened connectors (water and dust tight connectors) on the housing. The apertures between cables or adaptors and the housing should allow sealing by proper materials to ensure the sealing performance. If used with mid-span applications, the housing should allow entry and storage of the uncut loose tubes;
- depending on installation styles, the housing allows the mounting on walls or poles. Accessories may be required for installations, and a same housing can be installed in various styles by changing accessories;
- if the housing is limited for use in certain applications and environments in the network, any limitations should be clearly indicated to the user. The detailed characterization of features and compatibility of an FDB can be done using the checklist in Appendix I;
- the housing should be made of materials which comply to local safety regulations. For OA applications, all polymeric materials that are exposed to the environment should be sufficiently resistant to fungi; materials that will be exposed to solar radiation should be UV resistant; metallic parts should be corrosion resistant when exposed to the salt mist test;
- if requested by a customer, the housing has provisions for secure lock and key to restrict access to authorized personnel;
- if requested by a customer, a theft proof mounting system has to be provided;
- if requested by a customer, multiple compartments with separate and restricted access have to be provided. This type of FDB can be used in cases that multiple operators share the subscriber drop cables. The separated compartments should be independently lockable and easy to identify.

6.3 FDB fibre management system (organizer system)

The FDB fibre management system is an integral part of the FDB. The system comprises:

- one or more sheets or trays that have means for routing and holding fibre interconnections, fibre overlength, pigtails or drop cables in an orderly manner, and should minimize fibre strain and control fibre bend radius;
- interconnection interface between fibres of distribution cables and fibres of drop cables. It can be patch panels, splitters or wavelength-division multiplexing (WDM) components with adaptors inside the housing, or adaptors located on the housing;
- structures that have means for holding possible passive components, such as splitters, and WDM components.

Compatibility and features of FDB fibre management system can be listed by using the checklist in Appendix I. The desired optical stability type can be selected according to [ITU-T L.200].

6.3.1 Characteristics of the FDB fibre management system

The functions of the FDB fibre management system are:

- to provide means for routing, storing and protecting fibres, fibre interconnections, uncut loose tubes or other passive devices in a predetermined order;
- to provide means for installation and reconfiguration of fibre circuits;
- to separate circuits up to a certain degree as defined in [ITU-T L.200]. This will limit the risk of interruption of traffic to those fibres that belong to the same group of circuits (see [ITU-T L.200]: single fibre (SF), single circuit (SC), single ribbon (SR), single element (SE), multiple element (ME)). For an FDB, separation degree higher than SE is preferred;
- to provide means for storing the fibre overlength required for jointing and for possible re-jointing in the future;
- to ensure that the fibre bend radius should not be less than 30 mm in general applications with [ITU-T G.652] fibres. A minimum bend radius of 20 mm can be agreed upon between customer and supplier (in order to maintain mechanical reliability and minimize losses in the network, the cumulative length of fibre, exposed to this smaller bend radius should be limited to less than 2 m per fibre link). In case of [ITU-T G.657] fibres, smaller bend radius is allowed (see [b-ITU-T G-Sup.59] for guidance on optical fibre and cable reliability);
- to provide an identification method for the location of the connections and stored fibre interconnections, allowing correct access to these connectors and stored fibre interconnections during maintenance and reconfiguration. A sort of labels on optical connectors (including optical adapters and plugs, etc.) can be useful to provide easy identification. The use of QR codes or electronic IDs is optional and should comply with the requirements of [ITU-T L.361].

The materials used for making the management system should be compatible with the other materials in the FDB and the degreasing agents as recommended in the installation instructions.

6.3.2 Configurations of FDB fibre management system

The trays or sheets of FDB fibre management system may be configured in several ways:

- lateral sliding from a frame – similar to removing a book from a shelf;
- rotation about a hinge – similar to turning a page in a book;
- lifting from a stack – similar to lifting a book from a stack; or
- other possible configurations.

All movements of the FDB fibre management system should proceed in a predetermined way in order to avoid uncontrolled movements or bends in the fibres which can cause optical losses or interruption of traffic during and after manipulations.

If required by local regulations, the FDB fibre management system could be divided into multiple subsystems and stored in separate compartments in the housing so that multiple telecommunication operators can share the subscriber drop cables.

6.4 Cable attachment and termination system

The following characteristics of cable attachment and termination system should be considered:

- the system should allow for attachment of cable ends of multi-fibre distribution cables. If the fibres of drop cables are to be terminated inside the housing, the system should also allow for attachment of the drop cables. Normally, the parts for attachment of the distribution cables and the parts for attachment of the drop cables are separated and have various design;
- the system should allow for good bonding and grounding for metallic elements of cables, while the cable metallic elements should be insulated to other metallic parts of the box. The method of achieving electrical continuity will vary with the type of cable sheath and the type and location of the strength members. Further information is given in [ITU-T K.11], [ITU-T K.47] and [IEC 60950-1];
- the system should be installed near the cable entry points in the FDB, normally the lower section of the box inner housing;
- the system should allow the addition or removal of cables without interruption to service on other cables;
- the materials used in the system should be compatible with the other materials in the FDB and the degreasing agents recommended in the installation instructions.

7 Performance evaluation test program

The complete test program for an FDB consists of:

- a basic test program for the applicable environment (see Annexes A and B);
- a number of additional requirements according to local standards when necessary (see [ITU-T L.200] and the checklist in Appendix I).

For specific products, alternative test conditions to those given in Annex B may be agreed between customer and supplier.

Tests should be executed according to [IEC 61300-2] test methods where available.

The performance test program of an FDB should:

- evaluate the product for two groups of criteria: mechanical and sealing evaluation and optical stability (see annex A);
- simulate the effects of exposure to:
 - the environment in which it will be installed;
 - an intervention at the node.
- simulate installation or maintenance conditions;
- evaluate all available features of the product.

When an FDB is suitable for both environments IN and OA, it should pass the most severe conditions of either environment. As an alternative, the tests that are different for each of these environments may be duplicated at both settings.

Two types of optical stability can be selected (see clause 6.2.1 of [ITU-T L.200]). For products that may be subject to an intervention on a live network, dynamic optical stability is recommended.

8 Sample preparation

A representative number of test samples is to be prepared, taking into account the following parameters:

- all product features and compatibility (see checklist in Appendix I);
- applicable sizes of cables;
- sealing performance test samples should be installed at:
 - $-5\text{ }^{\circ}\text{C}$, room temperature or $+45\text{ }^{\circ}\text{C}$ for OA applications;
 - room temperature for IN applications;
- optical performance test samples should be installed at room temperature for OA and IN;
- for mechanical evaluation, a fresh sample should be prepared for each different test; if a failure occurs when consecutive testing is applied on the same sample, the failed test may be repeated on a fresh sample.

Appendix I of [ITU-T L.200] illustrates how optical test samples can be prepared. Due to their complexity, consecutive testing on the same sample is most practical.

Annex A

Performance evaluation criteria

(This annex forms an integral part of this Recommendation.)

A.1 Sealing and visual evaluation

The performance evaluation criteria should be assured during or after tests in Annex B.

A.1.1 Sealing performance

International standard: [IEC 60529]

Conditions: Conditions according to protection degree of the box:

IP 30 or higher for IN;

IP 54 or higher for OA

Requirement: Meet the requirements of the protection degree of the box:

IP 30 or higher for IN;

IP 54 or higher for OA

A.1.2 Visual examination

International standard: [IEC 61300-3-1]

Conditions: Examination of product with the unaided naked eye.

Requirement: No defects and physical damages that would affect product performance.

A.2 Optical evaluation

NOTE 1 – All optical losses indicated are referenced to the initial optical signal at the start of the test.

NOTE 2 – An "incoming fibre" is defined as a part of an optical circuit containing the fibre entering the product, spliced to a fibre leaving the product. One optical circuit can contain many "incoming fibres". Light will sequentially flow through all the "incoming fibres".

NOTE 3 – Fibre type used for single mode: [ITU-T G.652] D fibre. The applications with other fibre types (for example, [ITU-T G.657] fibre) will be qualified by similarity since most fibre types are equal or less sensitive to bending compared to the [ITU-T G.652] D fibre fibres.

A.2.1 Change in insertion loss (attenuation) (static optical stability)

International standard: [IEC 61300-3-3] Method 1

Conditions: Source wavelength: 1310, 1550 and 1625 nm.

Requirement: **If only splices are part of the optical path:**

$\Delta IL \leq 0.2$ dB (1310/1550 nm) per incoming fibre during the test (excursion loss);

$\Delta IL \leq 0.5$ dB (1625 nm) per incoming fibre during the test (excursion loss);

$\Delta IL \leq 0.1$ dB (1310/1550/1625 nm) per incoming fibre after the test (residual loss).

If optical connectors are part of the optical path:

$\Delta IL \leq 0.2$ dB (1310/1550 nm) per incoming fibre during the test (excursion loss);

$\Delta IL \leq 0.5$ dB (1625 nm) per incoming fibre during the test (excursion loss);

$\Delta IL \leq 0.2$ dB (1310/1550/1625 nm) per incoming fibre after the test (residual loss).

If other passive optical components are part of the optical path, the above-mentioned change in attenuation values should be increased with the maximum allowed change in attenuation value specified for this passive optical component. For wavelength selective components the test wavelength might have to be changed to the operating wavelength(s) of the component(s).

A.2.2 Transient loss (dynamic optical stability)

International standard: [IEC 61300-3-28]

Conditions: Source wavelength: 1310, 1550 and 1625 nm. Measurements at 1550 nm and 1625 nm are particularly important for dynamic transient loss. 1310 nm is optional, subject to agreement between customer and supplier), unpolarized; detector bandwidth: (0-1500) Hz.

Requirement: **If only splices are part of the optical path:**

$\Delta IL \leq 0.5$ dB (1310/1550 nm) during the test measured in the life circuit (transient loss);

$\Delta IL \leq 1.0$ dB (1625 nm) during the test measured in the life circuit (transient loss);

$\Delta IL \leq 0.1$ dB (1310/1550/1625 nm) after the test in the life circuit (residual loss).

If optical connectors are part of the optical path:

$\Delta IL \leq 0.5$ dB (1310/1550 nm) during the test measured in the life circuit (transient loss);

$\Delta IL \leq 1.0$ dB (1625 nm) during the test measured in the life circuit (transient loss);

$\Delta IL \leq 0.2$ dB (1310/1550/1625 nm) after the test in the life circuit (residual loss).

If other passive optical components are part of the optical path, the above-mentioned loss values should be increased with the maximum allowed change in attenuation value specified after test for this passive optical component. For wavelength selective components the test wavelength might have to be changed to the operating wavelength(s) of the component(s).

Annex B

Performance test program for indoor non-temperature controlled and outdoor above ground FDBs

(This annex forms an integral part of this Recommendation.)

For tests in this annex, the test settings are applicable for both environments IN and OA unless specifically marked. All testing is at room temperature unless otherwise stated. When sealing performance evaluation for dust and water ingress is required, it can be performed after all related tests have been finished, instead of after each of the tests. The performance criteria of visual examination, sealing performance, static and dynamic optical evaluation are in accordance with Annex A, if not otherwise specified in this Annex. For optical evaluations in clause B.2, the requirements for static or dynamic optical stability is to be agreed upon between customer and supplier, and the appropriate optical performance criteria are to be selected accordingly.

B.1 Mechanical and sealing evaluation

B.1.1 Cable retention force (IN and OA)

International standard: [IEC 61300-2-4]

Conditions: Install cables of appropriate type on the FDB;
Load: $D \times 10$ N (maximum 500 N) per cable for multi-fibre distribution cables, where D is the cable outer diameter in millimetres;
25 N per cable for drop cables.
Test time:
1 hour per cable for multi-fibre distribution cables;
1 min per cable for drop cables.

Performance criteria: Visual appearance

B.1.2 Cable bending (IN and OA)

International standard: [IEC 61300-2-37]

Conditions: Bending angle $\pm 30^\circ$ or maximum bending force 500 N is reached;
Point of application: 400 mm from end of seal. For cables with a very rigid construction (e.g., slotted core cables, armoured cables), the clamping distance may need to be increased to 1000 mm;
Keep angle for 5 minutes at each extreme position;
Number of cycles: 5 per cable

Performance criteria: Visual appearance

B.1.3 Cable torsion (IN and OA)

International standard: [IEC 61300-2-5]

Conditions: Install cables of appropriate type on the FDB;
Torsion angle $\pm 90^\circ$ or maximum torque 50 Nm is reached;
Torque application: 400 mm from the cable entry of the FDB. For cables with a very rigid construction (e.g., slotted core cables, armoured cables), the clamping distance may need to be increased to 1000 mm;
Duration at extreme position: 5 minutes;
Number of cycles: 5 per cable

Performance criteria: Visual appearance

B.1.4 Impact (IN and OA)

- International standard: [IEC 61300-2-12] Method B
- Conditions: Impact tool: steel ball;
Weight: 1 kg;
Drop height: 0.2 m for IN;
1 m for OA;
Test temperatures: room temperature for IN;
(-15 ± 2) °C and ($+45 \pm 2$) °C for OA;
Location: centre of the top, and centre of front;
Number of impacts: 1 per location per test temperature.
- Performance criteria: Sealing performance: visual examination, no evidence of cracks and deformations, surface protective layer (if there is) does not fall off, scratches in surface can be ignored.

B.1.5 Temperature cycling (IN and OA)

- International standard: [IEC 61300-2-22]
- Conditions (see Note): Lowest/highest temperature: (-10 ± 2) °C / ($+60 \pm 2$) °C for IN;
(-40 ± 2) °C / ($+65 \pm 2$) °C for OA;
Humidity: uncontrolled;
Dwell time: 4 hours;
Transition: 1 °C/minute;
Number of cycles: 5 cycles for IN;
12 cycles for OA

- Performance criteria: Sealing performance: visual appearance

NOTE – Temperature ranges for temperature cycling are recommended for global usage. Adaptations to specific local conditions can be agreed between customer and supplier. Humidity could also be considered.

B.1.6 Re-entries (IN and OA)

- International standard: [IEC 61300-2-33]
- Conditions: Open the box and gain access to fibres and splices at each re-entry;
Aging between each re-entry: at least one thermal cycle (see B.1.5);
Number of re-entries: 5.
- Performance criteria: Sealing performance: visual appearance

B.1.7 Salt mist (OA)

- International standard: [IEC 61300-2-26]
- Conditions: Exposure to a salt mist of 5% NaCl in water;
Test temperature: ($+35 \pm 2$) °C;
Duration: 5 days
- Performance criteria: Visual appearance: no evidence of corrosion

The salt mist test can be selectively performed on components, parts and materials that are at potential risk of corrosion, instead of the whole FDB.

B.1.8 Resistance to aggressive media (OA, as needed)

International standard: [IEC 61300-2-34]

Conditions: Exposure to: HCl at pH 2;
NaOH at pH 12;
Duration: 5 days

Performance criteria: Visual appearance: no evidence of corrosion, swelling or cracks.

The resistance to aggressive media test can be selectively performed on components, parts and materials that are at potential risk corrosion, instead of the whole FDB.

B.2 Optical evaluation

Construction of optical samples is according to Appendix I of [ITU-T L.200].

B.2.1 Intervention at a node (IN and OA)

International standard: [IEC 61300-2-33]

Conditions: Execute all manipulations that will normally occur for this product during an intervention after initial installation. A List of typical manipulations can be found in Appendix II of [ITU-T L.200].

Performance criteria: Visual appearance;
Static: change in attenuation (residual loss);
Dynamic: transient loss

B.2.2 Vibration (IN and OA)

International standard: [IEC 61300-2-1]

Conditions: Sweep range: (5-500) Hz sinusoidal at 1 octave/minute;
Crossover frequency: 9 Hz;
– amplitude below 9 Hz: 1.5 mm for IN;
3.5 mm for OA.
– acceleration above 9 Hz: 5 m/s² (~0.5 g) for IN;
10 m/s² (~1 g) for OA.
Direction: 3 mutually perpendicular axes;
Duration: 10 cycles (5-500-5 Hz)/axis

Performance criteria: Visual appearance;
Static: change in attenuation (residual loss);
Dynamic: transient loss

B.2.3 Shock (IN and OA)

International standard: [IEC 61300-2-9]

Conditions: Wave form: half sine;
Duration: 11 milliseconds;
Acceleration: 150 m/s² (~15g);
Direction: 3 mutually perpendicular axes;
Number of shocks: 3 up and 3 down per axis

Performance criteria: Visual appearance;
Static: change in attenuation (residual loss);
Dynamic: transient loss

B.2.4 Temperature cycling (IN and OA)

International standard: [IEC 61300-2-22]

Conditions (See Note): Lowest/highest temperature: $(-10 \pm 2) ^\circ\text{C} / (+60 \pm 2) ^\circ\text{C}$ for IN;
 $(-40 \pm 2) ^\circ\text{C} / (+65 \pm 2) ^\circ\text{C}$ for OA;

Humidity: uncontrolled;

Dwell time: 4 hours;

Transition: $1 ^\circ\text{C}/\text{minute}$;

Number of cycles: 5 cycles for IN;
12 cycles for OA

Performance criteria: Visual appearance;

Static: change in attenuation (excursion and residual loss)

NOTE – Temperature ranges for temperature cycling are recommended for global usage. Adaptations to specific local conditions can be agreed between customer and supplier. Humidity could also be considered.

Appendix I

Product characterization checklist

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

This checklist facilitates the systematic characterization of the features and capabilities of a fibre distribution box. It reflects the parameters that are described in [ITU-T L.200]. It may be useful for preparation of the products' test program as well as product description for tenders and purchasing specifications, comparison of different or competitive products and creation of commercial information and ordering guides.

Product name:

Material of FDB housing

- Metal
- SMC
- Other:

Application environment(s) (see clause 7.1 of [ITU-T L.200])

- IN Indoor non-temperature controlled level
- OA Outdoor above ground level
- E Extreme (describe differences versus a basic environmental class)

IP protection class

- IP 30
- IP 54
- Other:

Optical functionality and compatibility (see clause 6 of [ITU-T L.200])

– ***optical stability level:***

- Static
- Dynamic (transient free)

– ***wavelength*** (see clause 6.3 of [ITU-T L.200])

- 1310 nm
- 1550 nm
- 1625 nm
- Other:

– ***cable construction*** (see clause 6.1.1 of [ITU-T L.200])

- Loose buffer tube
- Micro-sheath
- Central core
- Slotted core
- Blown fibre
- Break out cable
- Interfacility cable
- Other:

– ***fibre type, fibre grouping, fibre coating*** (see clause 6.1.2 of [ITU-T L.200])

- Single mode
 - Bend in-sensitive single mode fibre
- Ribbon 4
- R8
- R12
- R24
- Other:
- Primary coated (~250 µm)
- Secondary coated (~900 µm)

– ***passive devices*** (see clause 6.1.3 of [ITU-T L.200]):

- Splice type: Fusion
 Mechanical (brand/type):
- Splice protector type:
 - Heatshrink (min/max dimensions):
 - Mechanical (brand/type):
- Connectors: specify brand/type:
- Branching devices: (describe type, split ratio etc.):
- Delivered as preassembled/prefibred modules yes no
- Other passive devices: (describe)
- Delivered as preassembled/prefibred modules yes no

– ***fibre storage and separation level*** (see clause 6.2.2 of [ITU-T L.200])

	Circuit separation level				
	ME	SE	SR	SC	SF
<input type="checkbox"/> Uncut fibre (looped fibre)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Splices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Passive optical components	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> Other:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Appendix II

Indian experience

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

II.1 Introduction

This appendix gives examples of typical fibre termination and distribution box (FTDB) to provide management of optical fibres, cables, and optical splitter assemblies for interconnection points between feeder and distribution cables or between distribution and drop cables in FTTx network. The FTDB provides facilities for reconfiguration of fibres, network expansion, testing and store extra length of fibres, un-cut loose tube, and pigtailed and have provision for cable termination and sealing requirements.

II.2 Different types of FTDB

Based on location of installation, number of fibres to be spliced and/or connected, following types of FTDB [b-TEC/GR/TX/FTB] are defined:

– **Type-II: Multi dwelling unit box – Indoor (MDUB-I)**

This type of wall mountable box is typically installed on a wall of a building to cater to a small cluster of subscribers and to connect drop and distribution cables. The fibres of incoming cables are distributed into outgoing cables either by direct splicing or by splicing with pigtail and patching with pre-polished connectors or by pre-connectorized cables. The box has the provision to hold splices and connector adapters. Suitable identification labelling is provided on the box. The box may have provision to accommodate secondary splitter (cassette or bare).

– **Type-III: Multi dwelling unit box – Outdoor (MDUB-O)**

This type of wall or pole mountable box is typically installed outdoors to cater a small cluster of single residential units or small buildings and to connect drop and distribution cables. The fibres of incoming cables are distributed into outgoing cables either by direct splicing or by splicing with pigtail and patching with pre-polished connectors or by pre-connectorized cables. The box has the provision to hold splices and connector adapters. Suitable identification labelling is provided on the box. The box may have provision to accommodate secondary splitter (cassette or bare).

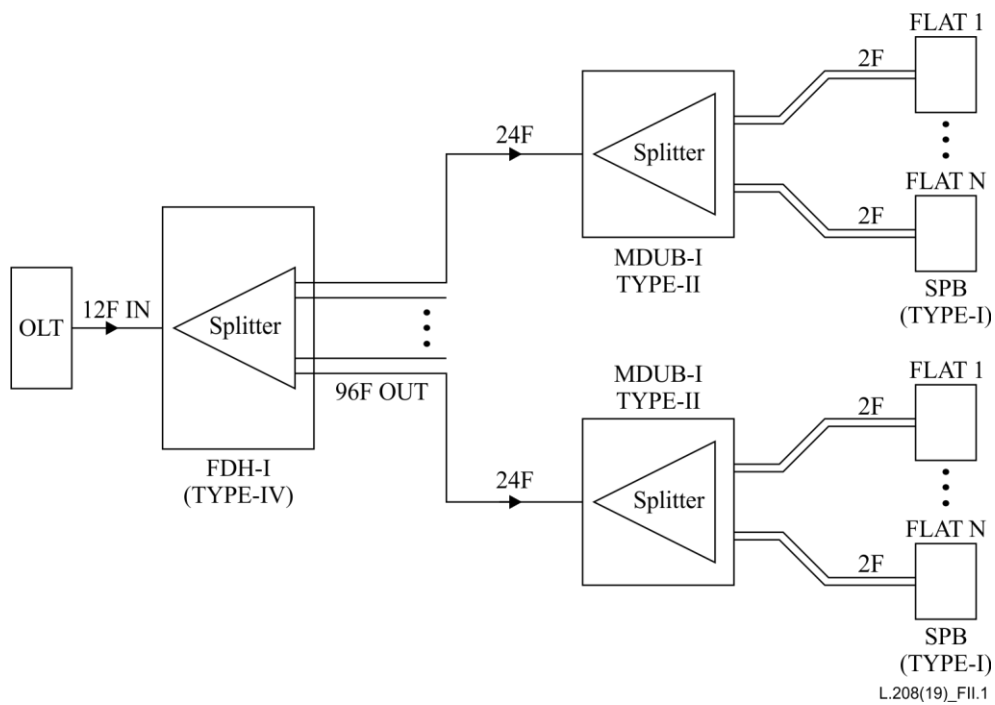
– **Type-IV: Fibre distribution hub – Indoor (FDH-I)**

This type of wall mountable box is typically installed in the basement of a building to connect feeder and distribution cables through optical splitters in a FTTx network application. The box has the provision to hold splices, connector adapters and splitters. The entire internal assembly allows simultaneous access of all the elements depending on where they are terminated/connected. Suitable identification labelling is provided on the box.

– **Type-V: Fibre distribution hub – Outdoor (FDH-O)**

This type of wall or pole mountable box is typically installed in the outside plant (OSP) environment for connecting optical cables and splitters. The box is to facilitate fibre serving area that includes mid-rise buildings, single residential unit and MDU structures. The box has the provision to hold splices, connector adapters and splitters. The entire internal assembly allows simultaneous access of all the elements depending on where they are terminated/connected. Suitable identification labelling is provided on the box.

Figure II.1 shows a typical example of distribution on a building floor.



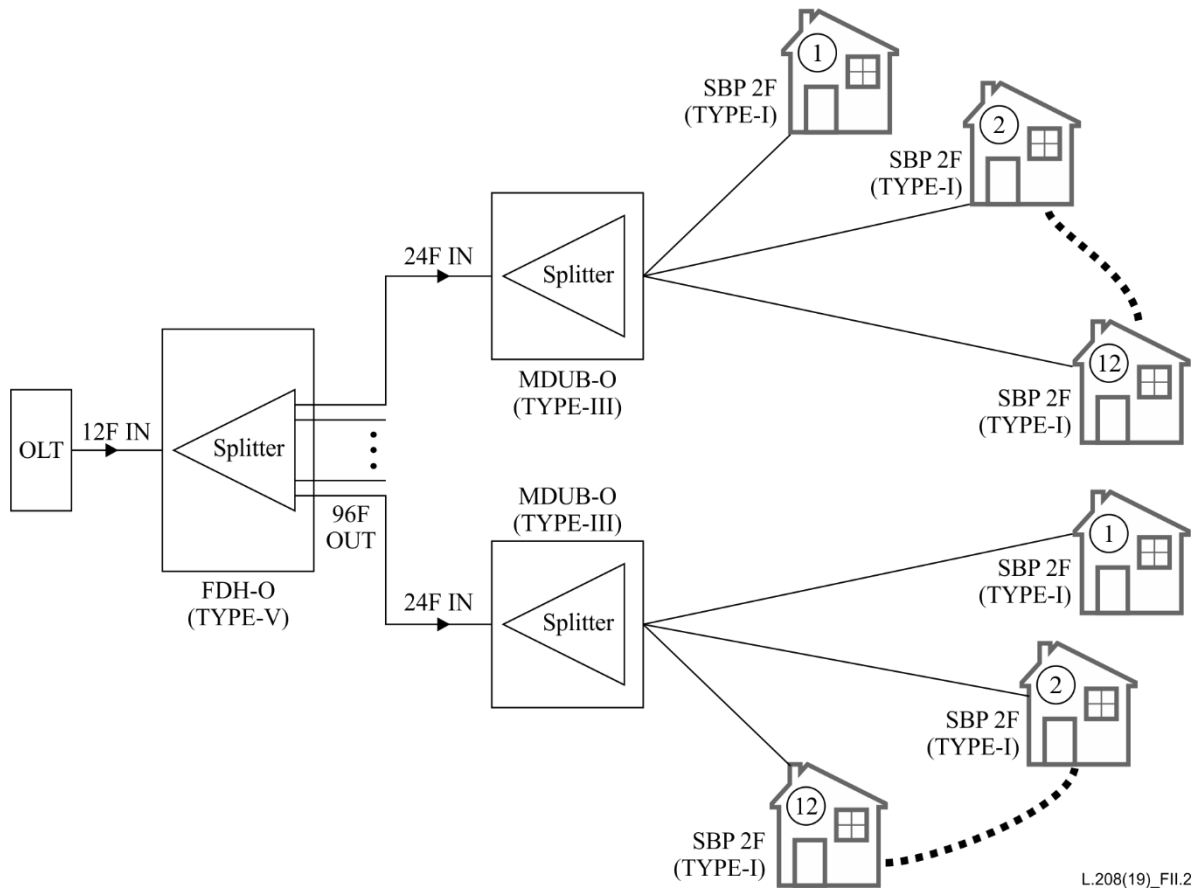
NOTE 1 – In the above diagram, MDUB-I (Type-II) shows 12 outgoing cables of 2F. It can be any combination of cables depending on the actual site requirements provided the total number of outgoing fibres does not exceed 24.

NOTE 2 – The FDH-I (Type-IV) will house splitter modules. It will have 12 incoming fibres and up to 96 outgoing fibres.

NOTE 3 – TYPE-I is subscriber premises box (SPB), which is out of scope of this Recommendation.

Figure II.1 – Typical example of distribution on a building floor

Figure II.2 shows a typical example of distribution on a single residential unit cluster.



L.208(19)_FII.2

- NOTE 1 – In the above diagram, MDUB-O (Type-III) shows 12 outgoing cables of 2F. It can be any combination of cables depending on the actual site requirements provided the total number of outgoing fibres does not exceed 24.
- NOTE 2 – The FDH-O (Type-V) will house splitter modules. It will have 12 incoming fibres and up to 96 outgoing fibres.
- NOTE 3 – TYPE-I is Subscriber Premises Box (SPB), which is out of scope of this document.

Figure II.2 – Typical example of distribution on a single residential unit cluster

Figure II.3 shows typical examples of FDBs used as FDH and MDUB for low fibre density applications.



Figure II.3 – Typical examples of fibre distribution boxes used as FDH and MDUB for low fibre density applications

II.3 Attributes of FTDB

Various attributes are listed in Table II.1 to specify different types of FTDBs.

Table II.1 – Attributes of FTDB

SN	Attributes	Type X
1	Material of construction (PC, ABS, PC+ABS, CRCA, SMC) PC = Polycarbonate PP = Polypropylene ABS = Acrylonitrile butadiene styrene SMC = Sheet molding compound CRCA = Cold rolled close annealed	User to specify
2	IP rating (as per [IEC 60529]) IP 55, IP 65	IP 55 for IN and IP 65 for OA
3	Installation location (indoor/outdoor/both)	User to specify
4	Fixture type (wall mount/pole mount/both)	User to specify
5	UV proof	For OA
6	Color of the box	User to specify
7	Fireproof (Yes/No)	User to specify

Table II.1 – Attributes of FTDB

SN	Attributes	Type X
8	Operating temperature	–5 to + 55 °C for OA and IN
9	Length (mm) without entry/exit ports	User to specify
10	Width (mm)	User to specify
11	Depth (mm)	User to specify
12	Minimum thickness of the box body (mm)	User to specify
13	Cover flip type (hinge/push/slotting, etc.)	User to specify
14	Location of fixture point	User to specify
15	Number of incoming cables	User to specify
16	Diameter of incoming cable (mm)	User to specify
17	Fibre count of incoming cable	User to specify
18	Number of tubes in incoming cable	User to specify
19	Fibres/tube in incoming cable	User to specify
20	Length of tubes to be stored from entry cable	Minimum 1 meter
21	Number of tubes to be dropped from incoming cable	User to specify
22	Number of fibres to be dropped from incoming cable	User to specify
23	Number of outgoing cables	User to specify
24	Diameter/dimension of outgoing cable (mm)	User to specify
25	Fibre count of outgoing cable	User to specify
26	Number of tubes in outgoing cable	User to specify
27	Fibres/tube in outgoing cable	User to specify
28	Length of tubes/fibres/buffered fibres/drop cable to be stored from exit cable	Minimum 1 meter
29	Number of splitters	User to specify
30	Ratio of splitters (1:8/1:16/1:32/2:8/2:16/2:32, etc.)	User to specify
31	Splitter type (bare/cassate)	User to specify
32	Type of connectors in the splitter (in case of cassette splitter)	User to specify
33	Input/output length of pigtails in splitter in case of bare splitter	User to specify
34	Input/output length of buffered fibre in splitter in case of bare splitter	User to specify
35	Number of splice trays required	User to specify
36	Maximum splice capacity	User to specify
37	Maximum splice capacity per tray	User to specify
38	Provision for mid-span of cable (Yes/No)	User to specify
39	Maximum patching capacity	User to specify
40	Box security provision	User to specify

Bibliography

- [b-ITU-T G-Sup.59] Recommendation ITU-T G-Sup.59 (2016), *Guidance on optical fibre and cable reliability*.
- [b-TEC/GR/TX/FTB] *Generic Requirements (GR) for Fibre Termination and Distribution Box (For FTTH Applications)*, Telecommunications Engineering Centre (Department of Telecommunications), Govt. of India.

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series D	Tariff and accounting principles and international telecommunication/ICT economic and policy issues
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	Environment and ICTs, climate change, e-waste, energy efficiency; 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	Telephone transmission quality, telephone installations, local line networks
Series Q	Switching and signalling, and associated measurements and tests
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, next-generation networks, Internet of Things and smart cities
Series Z	Languages and general software aspects for telecommunication systems