वर्गीय आवश्यकताओं के लिए मानक

टीईसी 72050:2021

STANDARD FOR GENERIC REQUIREMENTS

TEC 72050:2021

फाइबर ऑप्टिक नेटवर्क टर्मिनल बॉक्स (फॉट)

FIBRE OPTIC NETWORK TERMINAL BOX (FONT)

ISO 9001:2015

दूरसंचार अभियांत्रिकी केंद्र

खुर्शीदलाल भवन, जनपथ, नई दिल्ली-110001, भारत

TELECOMMUNICATION ENGINEERING CENTRE

KHURSHID LAL BHAWAN, JANPATH, NEW DELHI–110001, INDIA

www.tec.gov.in

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FOREWORD

Telecommunication Engineering Centre (TEC) is the technical arm of Department of Telecommunications (DOT), Government of India. Its activities include:

- Framing of TEC Standards for Generic Requirements for a Product/Equipment, Standards for Interface Requirements for a Product/Equipment, Standards for Service Requirements & Standard document of TEC for Telecom Products and Services
- Formulation of Essential Requirements (ERs) under Mandatory Testing and Certification of Telecom Equipment (MTCTE)
- Field evaluation of Telecom Products and Systems
- Designation of Conformity Assessment Bodies (CABs)/Testing facilities
- Testing & Certification of Telecom products
- Adoption of Standards
- Support to DoT on technical/technology issues

For the purpose of testing, four Regional Telecom Engineering Centers (RTECs) have been established which are located at New Delhi, Bangalore, Mumbai, and Kolkata.

ABSTRACT

This Standard for Product/Equipment describes the requirements of a combined housing for 'Fibre Optic Network Terminal' to keep active elements like ONT, battery and its charge controller (power supply) as well as passive elements like fibre patch panel, splitters and fibre splice tray in a single box, instead of having multiple boxes for active and passive elements separately. This standard will be especially helpful to service providers for FTTx applications in areas where ownership, space, safe custody and availability of power supply source are hurdles to deployment.

CONTENTS

HISTORY SHEET

S.No	Standard for No.	Title	Remarks
1.	TEC 72050:2021	Standard for Generic Requirements for “Fibre Optics Network Terminal Box (FONT)”	Issue 1

REFERENCE

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this standard are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below.

[ITU-T K.34]	Recommendation ITU-T K.34 (2003), Classification of electromagnetic environmental conditions for telecommunication equipment – Basic EMC Recommendation.
[ITU-T K.35]	Recommendation ITU-T K.35 (2018), Bonding configurations and earthing at remote electronic sites.
[ITU-T K.44]	Recommendation ITU-T K.44 (2016), Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents – Basic Recommendation.
[ITU-T K.45]	Recommendation ITU-T K.45 (2008), Resistibility of telecommunication equipment installed in the access and trunk networks to overvoltages and overcurrents.
[ITU-T K.48]	Recommendation ITU-T K.48 (2006), EMC requirements for telecommunication equipment – Product family Recommendation.
[ITU-T K.50]	Recommendation ITU-T K.50 (2018), Safe limits of operating voltages and currents for telecommunication systems powered over the network.
[ITU-T K.51]	Recommendation ITU-T K.51 (2016), Safety criteria for telecommunication equipment.
[ITU-T K.55]	Recommendation ITU-T K.55 (2002), Overvoltage and overcurrent requirements for insulation displacement connectors (IDC) terminations.
[ITU-T K.64]	Recommendation ITU-T K.64 (201699), Safe working practices for outside equipment installed in particular environments.

[ITU-T K. 90/250]	Recommendation ITU-T K.250/90 (2012), Optical access network topologies for broadband services
[ITU-T K.69]	Recommendation ITU-T K.69 (2006), Maintenance of protective measures.
[ITU-T L.200/L.51]	Recommendation ITU-T L.200 (2003), Passive node elements for fibre optic networks – General principles and definitions for characterization and performance evaluation.
[ITU-T L.204/L.70]	Recommendation ITU-T L.204 (2007), Managing active electronics in the outside plant.
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[IEC 60068-1]	IEC 60068-1 (2013), Environmental testing – Part 1: General and guidance
[IEC 60068-2-5]	IEC 60068-2-5 (2018), Environmental testing - Part 2-5: Tests - Test S: Simulated solar radiation at ground level and guidance for solar radiation testing and weathering.
[IEC 60068-2-10]	IEC 60068-2-10 (2005), Environmental testing - Part 2-10: Tests - Test J and guidance: Mould growth.
[IS/IEC 60529]	IEC 60529 (2013), Degrees of protection provided by enclosures (IP Code).
[IEC 60825-1]	IEC 60825-1:2014, Safety of laser products - Part 1: Equipment classification and requirements
[IS 14624-2/IEC 60825-2]	IS 14624 (Part 2) : 2012/ IEC 60825-2:2005, Safety of laser products — Part 2: Safety of optical fibre communication systems
[IS 13252-1/IEC 60950-1]	IS 13252 (Part 1) : 2010/ IEC 60950-1:2005, Information technology equipment – Safety – Part 1: General requirements.

[IEC 60950-21]	IEC 60950-21 (2002), Information technology equipment – Safety – Part 21: Remote power feeding.
[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 (1995), Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-4: Tests – Fibre/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 61300-2-10]	IEC 61300-2-10 (2012), Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-10: Tests – Crush resistance.
[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 61300-2-48]	IEC 61300-2-48 (2009), Fibre optic interconnecting devices and passive components – Basic test and measurement procedures – Part 2-48: Tests – Temperature-humidity cycling.
[IEC 61300-2-56]	IEC 61300-2-56 (2020), Fibre optic interconnecting devices and passive components - Basic test and measurement procedures - Part 2-56: Tests - Wind resistance of mounted housing.
[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 changes in attenuation and return loss (multiple paths).
[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.
[IS 17050/IEC 62262]	IS 17050:2018/ IEC 62262: 2002, Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code).

[IEC 62368-1]	IEC 62368-1:2018, Audio/video, information and communication technology equipment - Part 1: Safety requirements.
[ISO 4892-2]	ISO 4892-2 (2013), Plastics. Methods of exposure to laboratory light sources. Xenon-arc lamps
[ISO 4892-3]	ISO 4892-3 (2016), Plastics. Methods of exposure to laboratory light sources. Fluorescent UV lamps
ISO 9001-2015	Quality management systems — Requirements
TEC 11016:2016 (Old No TEC/SD/DD/EMC-221/05/OCT-16)	Electromagnetic Compatibility Standard for telecommunication Equipment
TEC 38020:2015 (Old No TEC-GR-RS-WIF-002-02-DEC-15)	Wi-Fi Access Point
TEC 89020:2011 (Old No TEC/GR/TX/PTS-01/03/JAN-2011)	Optical Fibre Splice Protection Sleeves

CHAPTER-1

1.0 Introduction:

1.1 This Standard for Product/Equipment describes the requirements of a combined housing for 'Fibre Optic Network Terminal' (henceforth to be referred as FONT) to keep active elements like ONT, battery and its charge controller (power supply) as well as passive elements like fibre patch panel, splitters and fibre splice tray in a single box, instead of having multiple boxes for active and passive elements separately. This standard will be especially helpful to service providers for FTTx applications in areas where ownership, space, safe custody and availability of power supply source are hurdles to deployment.

1.2 The FONT should have two cabins with independent doors. The active elements cabin should have provision for natural ventilation required for active elements in addition to sealing against ingress of dust and liquid which is required for both the cabins. The passive element cabin should have the features of a standard FDB (Fibre Distribution Box).

The FONT comprises of:

i. A mechanical structure (box housing) for mechanical and environmental protection of active and passive elements with provisions for thermal management/ventilation of active elements and sealing of internal systems,

ii. A simple fibre management system for guiding and managing the fibres and fibre connections inside the box,

iii. A cable attachment and termination system for attaching and terminating cable ends,

Mechanical and environmental characteristic and evaluation of performance should comply with the provisions of [ITU-T L.200/L.51] for passive element cabin and [ITU-T L.204/L.70] for active element cabin.

1.3 This standard specifies the optical, mechanical, thermal and environmental performance requirements of a fibre optics network terminal box for FTTx networks in indoor and outdoor applications. The FONT provides:

i. Facilities for mounting and protection of stored fibres, connectors, splices, splitter, electronics (ONT/CPE), power supply, batteries and external network test interface ENTI (optional).
ii. An access to the electrical / optical data, CATV, antenna and telephone output cables
iii. A protected fibre management system for storing fibres, splitters, connectors, and splices.
iv. Sealing of input, output and optical and electrical cables.
v. Thermal management and ventilation.
vi. Electrical powering.
vii. Separate access to the active and passive elements.

This standard also gives a checklist for a systematic product characterization.

2.0 Definitions

2.1. Terms defined elsewhere:

This standard uses the following terms defined elsewhere:

2.1.1. IP 40 [IS/IEC 60529]: Enclosures protected against ingress of 1 mm objects.

2.1.2. IP 55 [IS/IEC 60529]: Enclosures protected against dust and resistant to spray of water from all directions.

2.1.3. **Active electronics [ITU-T L.204/L.70]**: Electronics requiring a source of electricity (other than the actual signal) in order to execute its function.

2.1.4. **Temperature-hardened equipment [ITU-T L.204/L.70]**: Electronic equipment that has been designed or adapted to operate in outdoor temperature conditions (e.g., from –40°C to +65°C).

2.2. Terms defined in this standard:

This standard defines the following terms:

2.2.1 **Fibre management system**: system to control fibre routing from the incoming to the out-going fibres, containing one or more splice cassettes and additional functional elements which provides a means for routing, storing and protecting of fibre splices, connectors or other passive optical devices in a predetermined order.

2.2.2 External network test interface (ENTI):

Test point which defines the service maintenance boundary of an access network at which external service provision may be assessed and which can be associated with protection devices.

2.2.3 Microduct system:

System that provides for routing air blown fibres or microduct fibre units, between hollow conduits (microducts), and interconnects the microducts by use of pneumatic connectors, tube welding, crimp connectors or push on connectors.

3.0 Functional requirements

3.1. Box design:

FONT is a single wall box for indoor and vented dual wall box for outdoor with natural convection for ventilation. For detailed thermal design and other options, ITU-T L.204/L.70 may be referred.

In general, active elements require more maintenance effort than passive elements due to the need for intervention related to the powering of the electronics, customer end issues, potential pollution of ventilation systems and damage (accidental or intentional). Keeping the above aspect in mind two cabins with independent locking system is recommended. Active and Passive elements mounted in the box need to be packaged properly to protect its content from the influences of the environment. Internal connection points between active and passive cabin and between electronics and battery needs to be sealed in the same manner as applicable to inlet and outlet. Ventilation for escape of hydrogen gases from battery needs to be provided.

It is recommended to minimize the risk of blocking the air intake openings (e.g., due to application of stickers or publicity posters) by the design of the box. The thermal design of the active element cabin of the box should meet active element's operational temperature, climate and dissipated heat requirements.

As remote boxes can reside at unprotected places, they are exposed to accidental or deliberate damage. For certain locations, extra resistance to vandalism and unauthorized intrusion may be recommended. This can be obtained by applying

stronger materials and construction as well as eliminating protruding parts or openings on the outside of the enclosure.

Some typical example of FONT is given in Appendix-I.

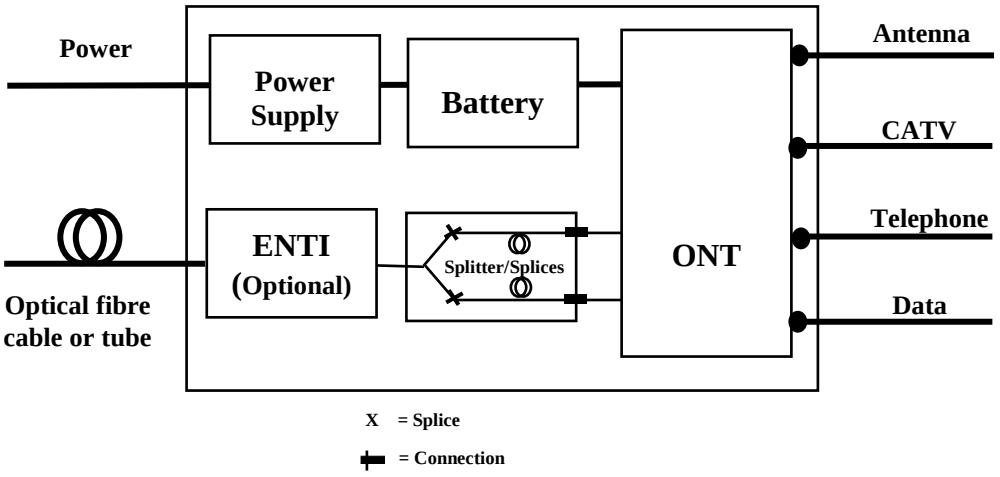


Figure – 1 Example of combined fibre distribution and terminal

3.2. Environments:

Box is expected to be deployed in any of the following environments.

i. IC: Indoor in controlled temperature environment.
ii. IN: Indoor in non-temperature-controlled environment.
iii. OA: Outdoor above ground level (aerial), mounted on a wall or pole
iv. OG: Outdoor at ground level, installed in a box or pedestal, standing on the ground, with a base that may reside partially underground.

Compared to passive network elements (e.g., as described in [ITU-T L.200/L.51] on passive optical nodes), a certain amount of heat is generated inside the box by the electronics therefore proper ventilation should be ensured as detailed in [ITU-T L.204/L.70].

3.3. Operational temperature ranges of the electronics:

For indoor in controlled temperature environments (IC), operational temperature ranges of electronics mounted in the box is 0°C to +45°C.

For outdoor applications and indoor non-temperature-controlled environments (IN, OA and OG) it is recommended to use "temperature-hardened equipment" with an operational temperature range of at least –40°C to +65°C, or to the max operating conditions of the electronics.

3.4. Sealing against ingress of solids and fluids:

For indoor applications (IC or IN), the minimum recommended protection level against ingress of objects is IP 40. For box above or at ground level (OA and OG), the minimum recommended protection level against ingress of objects and water is IP 55 according to IS/IEC 60529.

For box at ground level (OG), it is recommended to provide a separation plate with cable entrance seals to avoid intrusion of dirt, water, rodents or insects.

3.5. Material requirement:

All materials that are likely to come in contact with personnel should meet appropriate local health and safety regulations. Box materials should be compatible with each other and with the materials of the cables and/or microducts. All components of the box should be resistant to solvents and degreasing agents that are typically used to clean and degrease fibres and cables.

Metallic parts should be resistant to the corrosive influences they may encounter during the lifetime of the product. The box should be resistant to the most common aggressive agents as they may occur in the environments.

All materials should be resistant to micro-organisms (fungi/bacteria).

In addition, for outdoor applications above or at ground level (OA and OG), all external polymeric materials, including surface coatings, should be resistant to UV light radiation.

3.6. Mechanical protection requirement:

The box should be resistant to the mechanical loads and influences that it may encounter in the environment.

For box above or at ground level (IC, IN, OA and OG):

i. A minimum recommended protection level against impact of IK 9 according to IS 17050/IEC 62262 or 10 J according to [IEC 61300-2-12] method B;

ii. The boxes (OA, OG), including fixation system, should resist loads induced by wind.

iii. Boxes should be resistant to vibration and shock.

iv. Cables must be properly attached to resist axial tension, flexure and torsion loads that may occur during typical installation, operation and maintenance.

v. Proper attachment should be provided for active and passive elements to have enough rigidity to resist displacement that may occur during typical installation and maintenance.

3.7. Optical stability requirements:

Optical nodes, that are intended as network flexibility points, shall be re-entrable and adaptable or expansible. The circuits that remain live during such an intervention shall not be disturbed. This functionality shall be guaranteed in all conditions of the environment, in which the node will reside.

Two types of optical stability can be selected (see clause 6.2.1 of [ITU-T L.200/L.51]).

a) Static optical stability

The static optical stability of a live node at rest can be evaluated by measuring the difference in attenuation of the circuits before and after an exposure (= Residual loss). It includes monitoring (at regular time intervals) during slow variations of environmental parameters (= excursion loss).

b) Dynamic optical stability

Dynamic optical stability reflects the behaviour of the optical circuits during an intervention at a node of which at least some of the fibres remain live. It will measure sudden variations (= transient losses) in a circuits' attenuation level during:

i) Manipulation of the entire node and its organizer system;

ii) Access to adjacent circuits stored in the same network node;

iii) Sudden effects induced by the external environment (e.g., vibration, shock).

The requirements for static or dynamic optical stability are to be agreed between customer and supplier.

3.8. Antenna requirements:

The box may house WiFi / Wireless transmitting antenna, if asked by purchaser. The placement and mounting of antenna will be suitably arranged in such order that it does not alter the desired field strength and radiation pattern of antenna.

3.9. Electrical powering:

The electronics of active elements need to be powered with electricity. This can be achieved via connection to power grid, solar system, batteries or reverse power feeding methods.

4.0 Safety

4.1. Electrical safety:

IEC 62368-1 [replaced IS 13252-1/IEC 60950-1] is a basic reference for safety of telecommunications equipment. In all cases, active electronics must comply with locally applicable electrical safety requirements. This may include electrical insulation, grounding, fuses, current loss switches, etc.

In case remote line powering is applied, it should comply with [ITU-T K.50], [ITU-T K.51] and [IEC 60950-21].

The safe working practices described in [ITU-T K.64] should be followed when work is carried out on outside plant electronic equipment.

4.2. Laser safety:

Since the box should house active optical devices, it should comply with IEC60825-1 and IS 14624-2/IEC 60825-2 for optical safety requirements.

Note: This test shall be applicable if laser components are directly mounted in the box.

4.3. Electromagnetic compatibility:

4.3.1. Environmental EMC classification:

Active elements should not be a source of undesired electromagnetic emission. Electronic equipment should meet the requirements of TEC standard No. TEC 11016:2016 (Old No. TEC/SD/DD/EMC-221/05/OCT-16). In any case, all regional or local regulations are to be applied.

4.3.2. Earthing and bonding:

The bonding conditions and earthing should follow ITU-T K.35.

4.3.3. Resistibility (overvoltage/overcurrent conditions):

Electronics installed in the box should meet the requirements of ITU-T K.45, ITU-T K.44 describes the resistibility test setups to be used.

If protection components such as surge protective devices (SPDs) are used, termination modules should meet the requirements of ITU-T K.90/K.250.

5.0 Performance evaluation test programme:

The performance test programme of a FONT should:

i. Evaluate the product for mechanical, sealing, solar radiation-thermal management, and optical stability (see Annexure A);
ii. Simulate the effects of exposure to:
   a. The environment in which it will be installed,
   b. An intervention at the box;
iii. Simulate installation or maintenance conditions;
iv. Evaluate all available features of the product.

When a FONT is suitable for both outdoor above ground (OA) and outdoor ground level (OG) environments (see [ITU-T L.200/L.51]), 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/L.51]). For products that may be subject to an intervention on a live network, dynamic optical stability is recommended when no disturbance in transmission is required in the existing live circuits.

5.1. Sample preparation

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

i. All product features and compatibility (see checklist in Appendix II);
ii. Applicable sizes of cables;
iii. Sealing performance test samples should be installed at −5°C and +45°C;

iv. Optical performance test samples should be installed at room temperature;

v. 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/L.51] illustrates how optical samples can be prepared. Due to their complexity, consecutive testing on the same sample is most practical.

6.0 Engineering requirements:

6.1. The Fibre Optic Network Terminal Box shall be manufactured as per the latest state of art technology.

6.2. The box shall be of compact design and its construction shall be inherently robust and rigid for all conditions of operation, adjustment, replacement, storage and transport. It should be made of fire retarding material for indoor application and heat resistance material for outdoor applications.

6.3. The Box shall be able to work in saline atmosphere in coastal areas and should be protected against corrosion.

6.4. The Box shall be accessible for operation, installation, testing and easy handling from the front side.

6.5. The box shall be wall mountable /floor mountable/pole mountable (as applicable), using anchor bolts.

6.6. The powder coating painting (70-100 micrometer thickness) shall be provided (wherever applicable). The painting shall be of good quality.

6.7. The box shall be supplied with the adaptors and pigtails pre-fixed in their positions. The adaptors positions shall be clearly and permanently marked.

6.8. All adaptors shall be provided with dust protection caps.

6.9. Important Do’s and Don’ts about the operation of the equipment shall be clearly indicated at a convenient place on the equipment.

6.10. Cable glands and grommets shall be provided to protect insect and water entry.

6.11. Post installation suitable sealant shall be used to protect the gaps in cable entry / gaps created between multiple cables.

7.0 Quality requirements:

7.1. The Fibre Optic Network Terminal Box shall be manufactured in accordance with international quality standards ISO 9001-2015 for which the manufacturer should be duly accredited.

7.2. The box shall be designed & manufactured to have a life guarantee of at least 25 years, without maintenance.

8.0 Marking on body of the fibre optic network terminal box:

8.1. The following information shall be provided by marking on Fibre Optic Network Terminal Box:

a. Manufacturer's name & date / year of production.

b. Model no.

c. Serial No/Batch no.

Note: Other information covered in checklist of appendix-II.

9.0 Documentation:

9.1. Technical literature in English or Hindi, along with detailed drawings of all the assemblies and parts, shall be provided. All aspects of installation, operation and maintenance shall be covered in the manuals. The soft copy as well as hard copy of the manuals shall also be provided. The manuals shall include the following details

a) Safety measures to be observed in handling the optical fibre termination box.

b) Precautions for operation and maintenance

c) Illustration of internal and external parts.

d) List of the parts including their source and ordering information for all the replaceable parts.

9.2. Each Fibre Optic Network Terminal Box shall be supplied along with small booklet giving the installation method etc. by illustration to help the installer.

9.3. Each Fibre Optic Network Terminal Box shall be supplied along with a test report.

10.0 **Accessories:** The supplier shall provide one complete set of all the necessary accessories required for satisfactory and convenient operation/ installation of the equipment.

S. No	Item	Quantity
i.	Protection Sleeves GR No. TEC/GR/TX/PTS-01/03/JAN-2011	As per fibre count in cable + 50%
ii.	Cable Tie	12 nos. of required length
iii.	Tissue / Lens paper Size 3”x 4”	100 nos
iv.	Isopropyl lab grade	100 ml
v.	PVC adhesive tape (5mm x 10 mm)	1 No
vi.	Velcro tape(To hold the cassettes assembly)	As per the requirement
vii.	Identification rings for Cable/fibres/pig tails	As per the requirement
viii.	Transport Tube	As per the requirement
ix.	Any other item required for installation and assembly	As per the requirement

CHAPTER-2

11.0 Information for the procurer of product: Following guidelines are for the reference of the purchaser only, and are not to be tested during type approval process

11.1 The manufacturer/supplier shall furnish the list of recommended spares.

11.2 The supplier shall have maintenance/repair facility in India.

11.3 Length of splice protection sleeve (41±1mm or 45 ±1 mm or 61±1mm) shall be decided by the purchaser.

11.4 Purchaser can add requirement of thermostat for temperature monitoring purposes and SPD for transient/surge protection at the incoming power supply terminals to protect all active electronics.

11.5 Provision/Space for accommodating thermostat /SPD on box may be specified by purchaser.

11.6 The requirement of a door sensor to monitor access of the box may be added by purchaser. (Clause 3.1).

11.7 Purchaser can add requirement for making suitable arrangement on box for wi-fi antenna without affecting field strength and radiation pattern. (Clause 3.8)

ANNEXURE-A

Performance evaluation criteria

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

A.1 Mechanical, Sealing and Thermal management evaluation

The performance evaluation criteria should be satisfied during or after performing the tests specified in Annexure B.

A.1.1 Sealing performance

International Standard:	[IS/IEC 60529].
Conditions:	Conditions according to protection degree of the box (IP 40 for IC, IN and IP55 for OG,OA).
Requirement:	Meet the requirements of the protection degree of the box

A.1.2 Visual examination

International Standard:	[IEC 61300-3-1].
Conditions:	Examination of product with the unaided naked eye.
Requirement:	No defects or physical damages that would affect product performance.

A.1.3 Solar radiation-thermal management

International Standard:	[IEC 60068-2-5] Test S
Conditions:	At ambient temperature of 50 °C
Sun load:	1120 W/m² (IR radiation)

Maximum air speed in the climatic chamber:	0.1 m/s
Power dissipation:	X watt
Requirement:	Temperature at air intake of electronic equipment in box remains below maximum operating temperature of the electronics.

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 with nominal mode field diameter between 9.0 µm and 9.2 µm. The applications with other fibre types (e.g., ITU-T G.657 fibre) will be qualified by similarity since most fibre types are equally or less sensitive to bending compared to ITU-T G.652.D fibre.

A.2.1 Static stability test - Measurement of change in insertion loss (attenuation):

International Standard:	[IEC 61300-3-3] Method 1.
Conditions:	Source wavelength: 1 310 nm, 1 550 nm and 1 625 nm

Requirement:	**If only splices are part of the optical path**: ∆IL ≤ 0.2 dB (1 310 nm/1 550 nm) per incoming fibre during the test (excursion loss); ∆IL ≤ 0.5 dB (1 625 nm) per incoming fibre during the test (excursion loss); ∆IL ≤ 0.1 dB (1 310 nm/1 550 nm/1 625 nm) per incoming fibre after the test (residual loss). **If optical connectors are part of the optical path**: ∆IL ≤ 0.2 dB (1 310 nm/1 550 nm) per incoming fibre during the test (excursion loss); ∆IL ≤ 0.5 dB (1 625 nm) per incoming fibre during the test (excursion loss); ∆IL ≤ 0.2 dB (1 310 nm/1 550 nm/1 625 nm) per incoming fibre after the test (residual loss). **If optical splitter is part of the optical path**: ∆IL ≤ 0.5 dB (1 310 nm/1 550 nm) per incoming fibre during the test (excursion loss); ∆IL ≤ 0.8 dB (1 625 nm) per incoming fibre during the test (excursion loss); ∆IL ≤ 0.5 dB (1 310 nm/1 550 nm/1 625 nm) per incoming fibre after the test (residual loss).

A.2.2 Dynamic stability test - Measurement of transient loss (attenuation):

International Standard:	[IEC 61300-3-28].

Conditions:	Source wavelength: 1 310 nm, 1 550 nm and 1 625 nm (measurements at 1 550 nm and 1 625 nm are particularly important for dynamic transient loss. 1 310 nm is optional, subject to agreement between customer and supplier), unpolarised; Detector bandwidth: (0-1 500) Hz.
Requirement:	If only splices are part of the optical path: ΔIL ≤ 0.5 dB (1 310 nm/1 550 nm) during the test measured in the life circuit (transient loss); ΔIL ≤ 1.0 dB (1 625 nm) during the test measured in the life circuit (transient loss); ΔIL ≤ 0.1 dB (1 310 nm/1 550 nm/1 625 nm) after the test in the life circuit (residual loss). If optical connectors are part of the optical path: ΔIL ≤ 0.5 dB (1 310 nm/1 550 nm) during the test measured in the life circuit (transient loss). ΔIL ≤ 1.0 dB (1 625 nm) during the test measured in the life circuit (transient loss). ΔIL ≤ 0.2 dB (1 310 nm/1 550 nm/1 625 nm) after the test in the life circuit (residual loss). If optical splitter is part of the optical path: ΔIL ≤ 0.5 dB (1 310 nm/1 550 nm) per incoming fibre during the test (excursion loss). ΔIL ≤ 1.0 dB (1 625 nm) per incoming fibre during the test (excursion loss). ΔIL ≤ 0.5 dB (1 310 nm/1 550 nm/1 625 nm) per incoming fibre after the test (residual loss).

ANNEXURE-B

Performance test programme for box

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

For tests in this annex, the test settings are applicable for boxes used in both environments outdoor and indoor environments unless specifically marked. All testing is performed 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 doing these acceptance checks after each of the tests. In optical evaluations in clause B.2, the requirements for static or dynamic optical stability are to be agreed between customer and supplier, and the appropriate optical performance criteria are to be selected accordingly.

B.1 Mechanical, Sealing and Thermal management evaluation

B.1.1 Static load (crush test) on the top of box (for OA & OG)

International Standard: Conditions:	[IEC 61300-2-10] Vertical load (N): 1750 (Pa) × Box width (m) × Box depth (m) and minimum 500 Application: uniformly distributed on the top surface Test time: 10 min.
Performance criteria:	Sealing performance (Annexure A.1.1); Visual examination(Annexure A.1.2)

B.1.2 Static load on box door (optional) (for OA & OG)

International Standard:	[IEC 61300-2-10]
Conditions:	Vertical load: 200 N

	Point of application: far end of the top of opening door, at the most extreme point that creates the highest moment Test time: 10 min
Performance criteria:	Sealing performance (Annexure A.1.1); Visual examination(Annexure A.1.2)

B.1.3 Resistance to side load (for OA & OG)

International Standard:	[IEC 61300-2-56]
Conditions:	Fully equipped box and in installed condition Force (N) = 500 (Pa) × Width (m) × Height (m) Point of application: half way between attachment points and most extreme point located away from attachment points. Direction: in the axis that will generate the highest moment, performed in the two directions. Duration: 5 s
Performance criteria:	Sealing performance (Annexure A.1.1); Visual examination(Annexure A.1.2)

B.1.4 Impact

International Standard:	[IEC 61300-2-12] Method B
Conditions:	Impact tool: Steel ball

	Mass: 1 kg Drop height: 1 m Test temperatures: (−15 ± 2) °C and (+45 ± 2) ºC; Location: at the centres of the box at 0° (the centre of the front door), 90º, 180º, 270º around the longitudinal axis, and on top of the box. Centre of the top and centre of the front for rectangular box. Number of impacts: one per location.
Performance criteria:	Sealing performance (Annexure A.1.1); Visual examination(Annexure A.1.2) No evidence of cracks and deformations, surface protective layer (if there is one) does not fall off, scratches on surface can be ignored

B.1.5 Cable bending

International Standard:	[IEC 61300-2-37]
Conditions:	Bending angle ±30° or maximum bending force 500 N is reached Point of application: 400 mm from the cable entry of the box. For cables with a very rigid construction (e.g., slotted core cables, armoured cables), the clamping distance may need to be increased to 1 000 mm. Keep angle for 5 min at each extreme position. Number of cycles: five per cable
Performance criteria:	Visual examination(Annexure A.1.2)

B.1.6 Cable torsion

International Standard:	[IEC 61300-2-5]
Conditions:	Install cables of appropriate type on the box Torsion angle ±90° or maximum torque 50 Nm is reached Torque application: 400 mm from the cable entry of the box. 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 min Number of cycles: five per cable
Performance criteria:	Visual examination(Annexure A.1.2)

If the performance of the cable attachment and termination system is not influenced by other components, the system can be taken down from the box to do the test.

B.1.7 Cable retention force

International Standard:	[IEC 61300-2-4]
Conditions:	Install cables of appropriate type on the box Load per cable: *D*/45 mm × 500 N (maximum 500 N), where *D* is the cable outer diameter in millimetres Microduct tubes: 10 N Test time: 1 h per cable
Performance criteria:	Visual examination(Annexure A.1.2)

If the performance of the cable attachment and termination system is not influenced by other components, the system can be taken down from the box to do the test.

B.1.8 Temperature cycling (for IN, OA & OG)

International Standard:	[IEC 61300-2-22]
Conditions (see Note):	Lowest/highest temperature: (−40/+70 ± 2) °C Humidity: uncontrolled Dwell time: 4 h Transition: 1 °C/min Number of cycles: 12
Performance criteria:	Sealing performance (Annexure A.1.1); Visual examination(Annexure A.1.2)

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. If considered, temperature-humidity cycle test to be performed according to [IEC 61300-2-48].

B.1.9 Re-entries

International Standard:	[IEC 61300-2-33]
Conditions:	Open all box doors to maximum angle and close at each re-entry Aging between each re-entry: at least one thermal cycle (see clause B.1.8) Number of re-entries: five
Performance criteria:	Sealing performance (Annexure A.1.1); Visual examination(Annexure A.1.2)

B.1.10 Salt mist

International Standard:	[IEC 61300-2-26]
Conditions:	Exposure to a salt mist of 5% NaCl in water Test temperature: (+35 ± 2) °C Duration: 5 days
Performance criteria:	Visual examination(Annexure A.1.2): 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 box.

B.1.11 Solar radiation – Thermal management (for OA & OG)

International Standard:	[IEC 60068-2-5] Test S
Conditions:	At ambient temperature of 50 °C
Sun load:	1120 W/m²(IR radiation)
Maximum air speed in the climatic chamber:	0.1 m/s
Power dissipation:	X watt
Duration:	Until temperature equilibrium
Performance criteria:	Temperature at air intake of electronic equipment in box remains below Y°C (Note 1)

NOTE – Maximum air temperature Y inside the box should correspond to the maximum operating temperature of the electronics in the box. For temperature-hardened equipment, this should be a maximum of 65 °C.

B.2 Optical evaluation

Construction of optical samples is according to Appendix I of [ITU-T L.200/L.51].

B.2.1 Intervention at the box

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/L.51]
Performance criteria:	Visual examination(Annexure A.1.2), Static stability test - Measurement of change in insertion loss (attenuation) (Annexure A.2.1), Dynamic stability test - Measurement of transient loss (attenuation) (Annexure A.2.2).

B.2.2 Vibration

International Standard:	[IEC 61300-2-1]
Conditions:	Sweep range: (5-500) Hz sinusoidal at 1 octave/min Crossover frequency: 9 Hz Category IN and IC: – amplitude below 9 Hz: 1.5 mm – acceleration above 9 Hz: 5 m/s^2 (~0.5*g*) Category OA: – amplitude below 9 Hz: 3.5 mm – acceleration above 9 Hz: 10 m/s^2 (~1*g*) Direction: three mutually perpendicular axes Duration: 10 cycles (5-500-5) Hz/axis
Performance criteria:	Visual examination(Annexure A.1.2),

	Static stability test - Measurement of change in insertion loss (attenuation) (Annexure A.2.1), Dynamic stability test - Measurement of transient loss (attenuation) (Annexure A.2.2).

B.2.3 Shock

International Standard:	[IEC 61300-2-9]
Conditions:	Wave form: Half sine Duration: 11 ms Acceleration: 150 m/s^2 (~15*g*) Direction: three mutually perpendicular axes Number of shocks: three up and three down per axis
Performance criteria:	Visual examination(Annexure A.1.2), Static stability test - Measurement of change in insertion loss (attenuation) (Annexure A.2.1), Dynamic stability test - Measurement of transient loss (attenuation) (Annexure A.2.2).

B.2.4 Temperature cycling

International Standard:	[IEC 61300-2-22]
Conditions (see Note):	Lowest/highest temperature: (−40/+65 ± 2) °C Humidity: uncontrolled Dwell time: 4 h Transition: 1 °C/min Number of cycles: 12
Performance criteria	Visual examination(Annexure A.1.2), Static stability test - Measurement of change in insertion loss (attenuation) (Annexure A.2.1).

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. If considered, temperature-humidity cycle test to be performed according to [IEC 61300-2-48].

B.3 Material evaluation

The material evaluation of polymer materials is typically performed on molded slabs.

B.3.1 UV light resistance

International Standard:	[ISO 4892-3]
Conditions:	Lamp type: 1A (UVA-340) Exposure: Cycle 1, alternating UV and condensation cycles - UV: 8 h at (+60 ± 3) °C - Condensation: 4 h at (+50 ± 3) °C (dark) Duration: 2160 h
Performance criteria:	The effect of UV light shall be determined by measuring a suitable property (e.g. tensile strength and elongation at yield) both before and after exposure of the material slabs. The average change in mechanical characteristics of the tested material slabs shall be less than 20%.

Note - The UV resistance of the polymeric surface coatings or paints on the external metallic parts can be tested according to ISO 4892-2.

B.3.2 Mould growth (fungus resistance)

International Standard:	[IEC 60068-2-10]

Conditions:	Strains: as specified in [IEC 60068-1] Test J Inoculation conditions: - Temperature (29 ± 1) °C - Relative humidity: 90 %RH Duration : 28 days
Performance criteria:	The effect of mould growth is determined by measuring a suitable property (e.g. tensile strength and elongation at yield) both before and after exposure of the material slabs. The average change in mechanical characteristics of the tested material slabs should be less than 20%.

B.3.3 Resistance to aggressive media

International Standard:	[IEC 61300-2-34]
Conditions:	Exposure to: HCl at pH 2 and NaOH at pH 12 Duration: 5 days
Performance criteria:	Visual examination(Annexure A.1.2): No evidence of corrosion, swelling or cracks

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

B.4 Antenna parameter test on Box with antenna:

Standard:	TEC 38020:2015 (Old No TEC-GR-RS-WIF-002-02-DEC-15)
Test	Clause 3.6 of TEC 38020:2015

Performance criteria:	Test parameters of antenna does not alter after mounting in box vis-a vis without mounting in the box.

APPENDIX I

Illustrations of FONT structure

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

Figure I.1 –Example of Horizontally Splitted Box

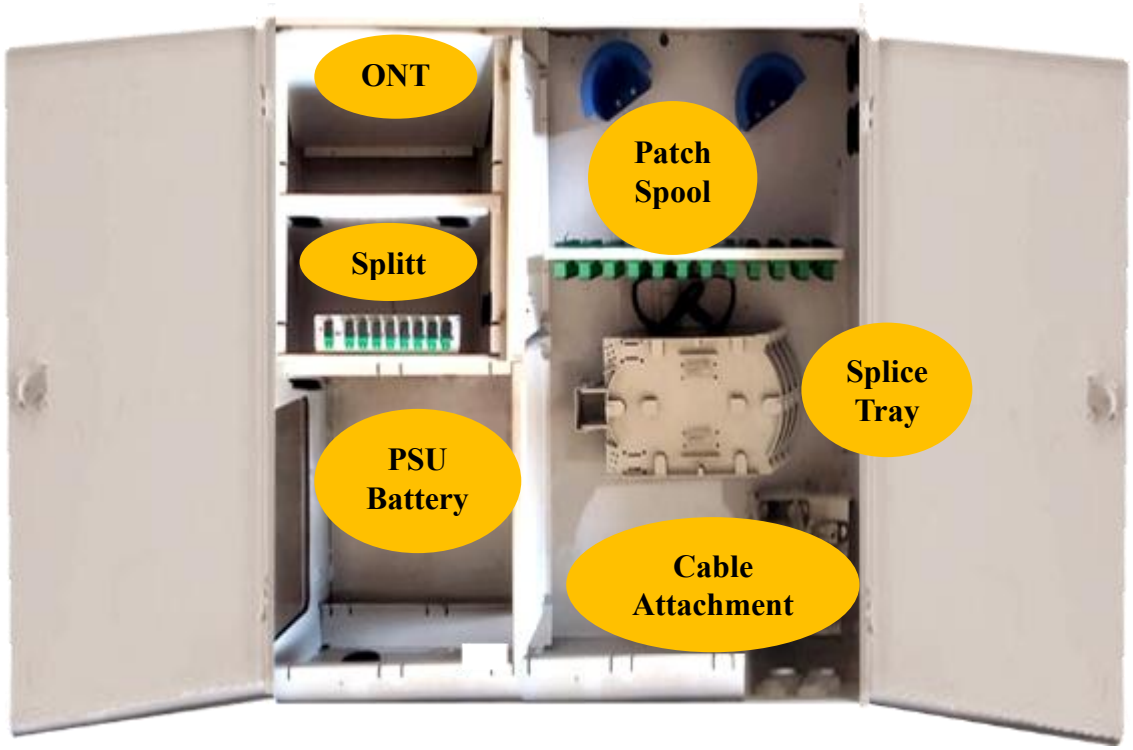


Figure I.2 –Example of Vertically Splitted Box

Specification of Typical FONT

Outer Dimensions		Height 700mm, Width 600mm, Depth 250mm, +/- 5% with provision of ventilation
Constructed from		Powder-Coated CRCA Steel Sheet (minimum 1.6mm thick)
Ingress Protection (IP)		IP-55 for OA, IP 30 for IN
Mounting Method		Wall Mounting using M8 Expansion Bolts (4 Nos.)/poles with suitable clamps
Hinged Front Door		Front Door with Transparent Window for monitoring CCU & ONT
Provisions for (Within)	a	Patch Panel to Splitter/ONT Connectivity using SC-APC Patch Cord (2 Meter length)
	b	Splitter to ONT Connectivity using SC-APC Patch Cord (2 Meter length)
	c	CCU to ONT Connectivity using Copper Cable
	d	CCU to Battery Connectivity using Copper Cable
	e	Mechanical holding of Battery, CCU, Splitter & ONT
OFC Entry Ports (Bottom)	a	96F /48F Ribbon OFC Diameter 18mm/16mm Nom. (2 Nos.) with suitable Cable Glands.
	b	24F OFC Diameter 13mm Nom. (2 Nos.) with Rubber Grommets (ID 13mm), which can be opened as per requirement in future.
Patch Cord Ports (Bottom)	c	24 x 3mm SC-APC Patch Cords (4 Nos.) with Rubber grommets, which can be opened as per requirement in future.
Provisions (on Top)	a	Entry of Power Cable to CCU/ONT (Rubber Grommets to be provided)

b Entry of Data Cable to ONT (Rubber Grommets to be provided)

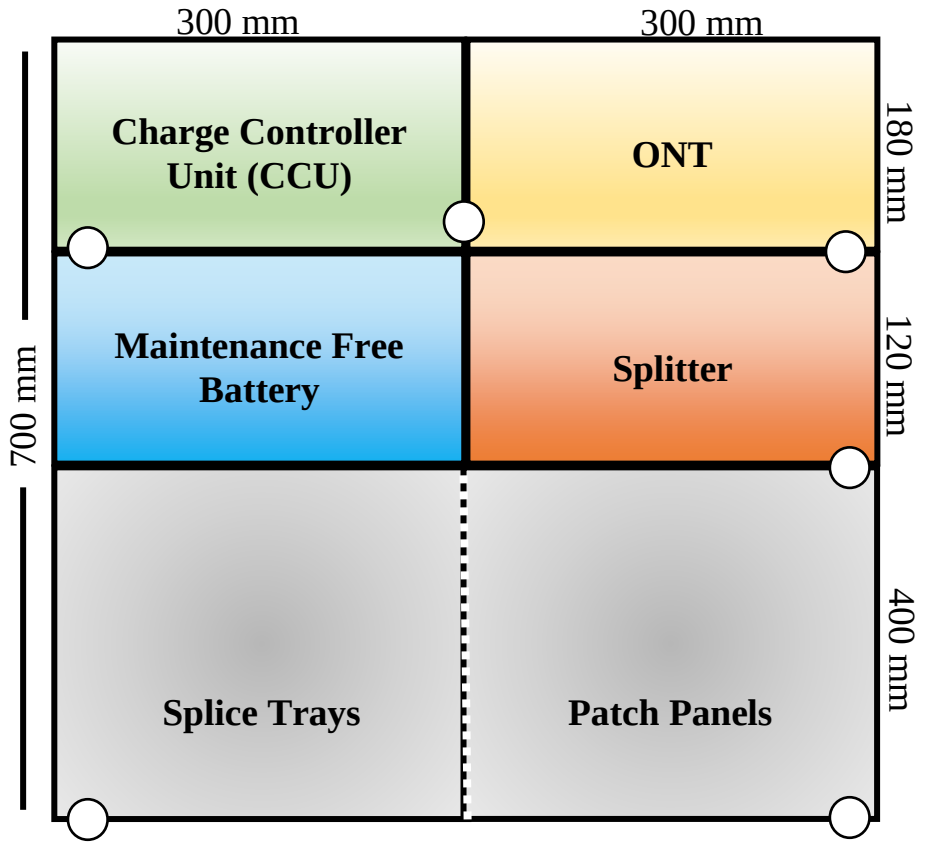


Figure I.3 Schematic diagram of a typical FONT

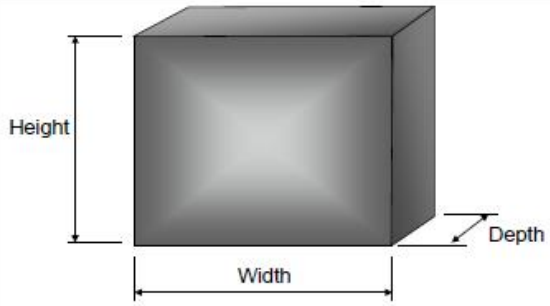
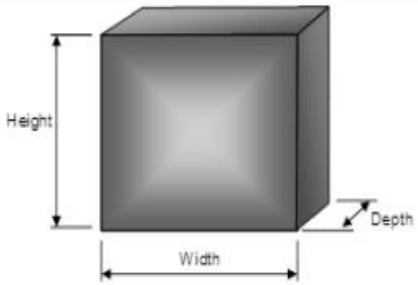
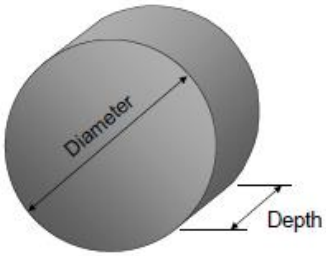
Shape		Maximum outline dimensions
Rectangular shape		Width: 300 mm Height: 150 mm Depth: 100 mm
Square shape		Width: 210 mm Height: 210 mm Depth: 50 mm
Circular		Diameter: 250 mm Depth: 100 mm

Figure I.4 Examples of different shape and dimension of a typical FONT

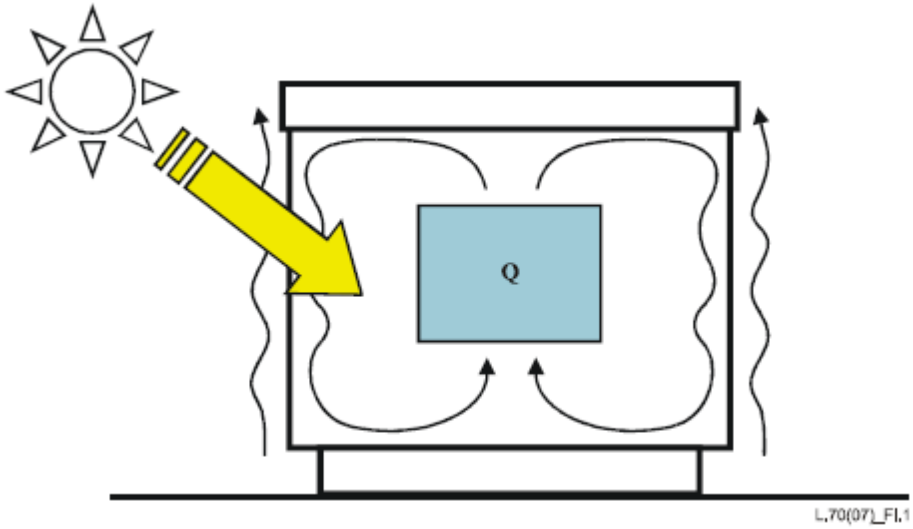


Figure I.5 Examples of Single wall, natural convection of a typical FONT

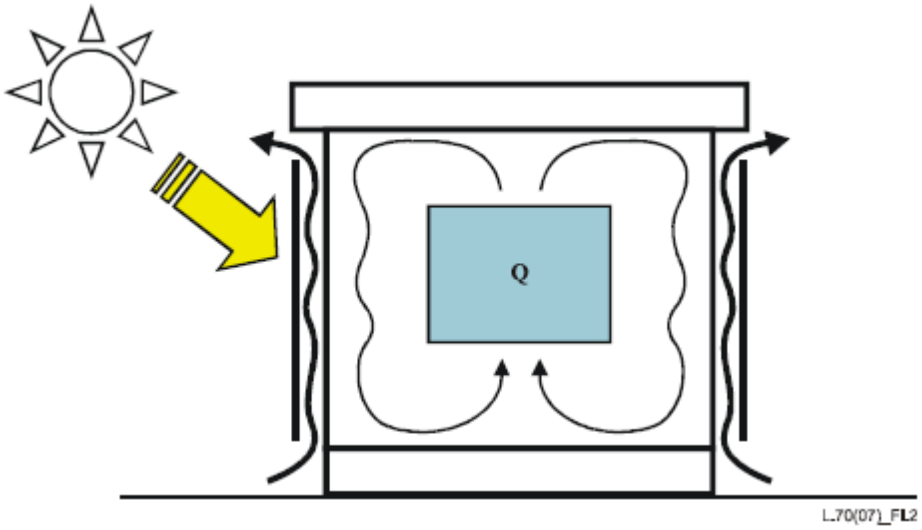


Figure I.6 Examples of Dual wall, natural convection of a typical FONT

APPENDIX II

Product characterization checklist

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

This checklist facilitates the systematic characterization of the features and capabilities of a fibre optic network terminal box. It may be useful for preparation of the test programme of products as well as product descriptions for tenders and purchasing specifications, comparison of different or competitive products and creation of commercial information and ordering guides.

Product name: Fibre Optic Network Terminal Box (FONT)

Material of box housing

☐ Metal

☐ SMC

☐ Other: …….....

Application environment(s)

☐ IC Indoor temperature controlled

☐ IN Indoor temperature uncontrolled

☐ OA Above ground level

☐ OG Outdoor ground level

☐ E Extreme (describe differences versus a basic environmental class)

Ingress protection (IP) protection class

☐ IP40

☐ IP55

☐ IP …

☐ Other: …….....

Optical functionality and compatibility

– *optical stability level:*

- ☐ Static
- ☐ Dynamic (transient free)

– *wavelength*

- ☐ 1 310 nm
- ☐ 1 550 nm
- ☐ 1 625 nm
- ☐ Other: …….....

– *cable construction*

- ☐ Loose buffer tube
- ☐ Micro-sheath
- ☐ Central core
- ☐ Slotted core
- ☐ Blown fibre
- ☐ Break out cable
- ☐ Interfacility cable
- ☐ Optical Power Ground Wire (OPGW) cable
- ☐ Other: .....

– *fibre type, fibre grouping, fibre coating*

- ☐ Multimode
- ☐ Single mode
- ☐ Single 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/L.51]):

☐ Splice type: ☐ Fusion

☐ Mechanical (brand/type): .....

☐ Splice protector type:

☐ Heat shrink (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
☐ Uncut fibre (looped fibre)	☐	☐	☐	☐	☐
☐ Splices	☐	☐	☐	☐	☐
☐ Passive optical components	☐	☐	☐	☐	☐
☐ Other:	☐	☐	☐	☐	☐

Additional or special requirements and features

– *storage/transport conditions*

☐ Normal: public transport – indoor storage

☐ Special handling/transport: .....

☐ Special storage: .....

– *additional (conditional) requirements*

☐	Bullet/shotgun proof	according to: .....
☐	Earthquake resistance	according to: .....
☐	Freeze-thaw resistance	according to: .....
☐	Fire-related performance	according to: .....
☐	Fire retardancy	according to: .....
☐	Halogen free	according to: .....
☐	Low smoke emission	according to: .....
☐	Electrical grounding and shield continuity	according to: .....
☐	Current surge	according to: .....
☐	Insulation resistance	according to: .....
☐	Contact resistance	according to: .....
☐	Rodent resistance	according to: .....
☐	Termite resistance	according to: .....
☐	Steam resistance	according to: .....
☐	Cable blocking	according to: .....
☐	Other:	according to: .....

ABBBREVIATIONS

APC	Angle Polished Connector
CCU	Charge Controller Unit
CPE	Customer Premises Equipment
CRCA	Cold Rolled Close Anneal
ENTI	External Network Test Interface
EMC	Electromagnetic Compatibility
FDB	Fibre Distribution Box
FMS	Fibre Management System
FONT	Fibre Optic Network Terminal
FTTx	Fibre to the x
IC	Indoor Controlled Environment
IEC	International Electrotechnical Commission
IP	Ingress Protection (rating)
IN	Indoor Un-controlled Environment
ITU	International Telecommunication Union
OA	Outdoor Above Ground Level (Aerial)
OFC	Optical Fibre Cable
OG	Outdoor Ground Level
ONT	Optical Network Terminal
OPGW	Optical Power Ground Wire
PSU	Power Supply Unit
SC	Square Connector
SMC	Sheet Molding Compound
SPD	Surge Protective Device