13-SDMS-06

REV. 00

MATERIAL SPECIFICATION

FOR

PASSIVE OPTICAL FIBER DISTRIBUTION COMPONENTS

CONTENTS

1 Scope

This document specifies the minimum technical requirements for design, engineering, construction, manufacture, inspection, testing and performance of the passive components used to manage the distribution and termination of fiber optic cables used in Distribution FTTx network deployments within Saudi Electricity Company (SEC).

The fiber optic distribution components may be installed at various locations within the FTTx network, including but not limited to buildings and collocation centres, equipment racks, street or pole mounted cabinets and customer premises.

The fiber optic distribution components covered by the Specification include:

- Optical Distribution Frames
- Fiber Optic Joint Closures
- Optical Splitters
- Fiber Termination Box (FTB)
- Fiber Distribution Cabinet (FDC) or Distribution Box (FDB)

Each component is further described under the individual requirements sections in this Specification.

2 Applicable Codes and Standards

This Distribution Material Standard Specification shall be read in conjunction with the latest revision of Distribution General Specification 01-SDMS-01 which shall be considered as an integral part of this standard.

The latest revision/amendments of the following codes and standards shall apply to the equipment/material covered in this Specification and shall be considered as forming an integral part of this Specification

IEC 60874-1	Fiber Optic Distribution components –Connector for optical fibers & cables – Generic Specifications
IEC 61300-2	Fiber Optic Distribution components - Basic Test & Measurement Procedures;
IEC 61300-3	Fiber Optic Distribution components - Examinations & Measurements for Attenuation, Return & Transient losses requirements.
IEC 61753-1	Fiber Optic Distribution Components Performance Standard - General and Guidance for Performance Standards
IEC 61754	Fiber Optic Connector Interfaces - General & Guidance

	Related IEC 61754 (Part 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 15, 16, 18, 19 & 20) for 'Connectors Family'
IEC 61755	Fiber Optic Connector Optical Interfaces consisting of: IEC 61755-2-1: Optical Interface Standard Single Mode Non-Angled Physically Contacting Fibers IEC 61755-2-2: Optical Interface Standard Single Mode Angled Physically Contacting Fibers IEC 61755-3-1: Optical interface 2.5mm & 1.25mm diameter cylindrical full zirconia PC ferrule, single mode fiber IEC 61755-3-2: Optical interface 2.5mm & 1.25mm diameter cylindrical full zirconia PC ferrule for 8 degree angled-PC single mode fiber
IEC 60529	Degrees of Protection Provided by Enclosures (IP Code)
GR 1209-Core	Generic Requirements for Passive Optical Components
GR1221-Core	Reliability Requirements for Passive Optical Components

3 Definitions & Abbreviations

3.1 Definitions

3.1.1 Outside (External): Component installed in the outdoor environment or as part of the FTTx outside plant including any components contained within footway chambers, carriageway chambers or other outdoor enclosures or cabinets which do not have specific measures for managing exposure to the outdoor ambient temperature, humidity, wind, rain and dust etc.

3.1.2 Indoor (Internal): Components installed for operation within a building or a cabinet/enclosure that provides protection from the environment and specific control of ambient temperature and humidity

3.2 Abbreviations and Acronyms

Abbreviations and acronyms used in this Specification shall have the following meanings:

APC	Angled Polished Connectors/Angled Physical Contact
BFOC	Bayonet Fiber Optic Connector
EIA/TIA	Electronics Industries Alliance/Telecom Industries Association
ETSI	European Telecommunications Standards Institute
FBT	Fusion Bionic Taper splitter
FC	Ferrule Connector or Fiber Channel
FC/SPC	Ferrule Connector with super polish quality
FC/UPC	Ferrule Connector with ultra-polish quality

FDC	Fiber Distribution Cabinet
FDH	Fiber Distribution Hub
FOCIS	Fiber Optic Connector Intermateability Standard
FTTH	Fiber to the home
FTTI	Fiber to the internet
FTTP	Fiber to the premises
FTTX	Fiber to the terminal
LC	Lucent Connectors, Little or Local Connector
LSZH	Low Smoke Zero Halogen
MIC	Media Interface Connectors
MPO/MTP	Multiple Fiber Push On/Pull Off
MT	Mechanical Transfer
MU	Miniature Unit
ODF	Optical Distribution Frame
OFNG	Optical Fiber Non-Conductive, General Use
OFNP	Optical Fiber Non-Conductive, Plenum
OFNR	Optical Fiber Non-Conductive, Riser
PC	Plugged Connectors/Physical Contact
PLC	Planar light wave circuit
PON	Passive Optical Network
RoHS	Restrictions on Hazardous Substances
SC	Square/Standard/Subscriber Connector
SDM	Splice and Distribution Module
ST	Straight Tip
UPC	Ultra-Polished Connectors/Ultra Physical Contact
OPGW	Optical Ground Wire (fiber optic cable)
ADSS	All Dielectric Self Supporting (fiber optic cable)

4 General Requirements

4.1 These General Requirements apply to all fiber optic distribution components covered by this Specification.

4.2 The fiber optic connectivity components shall be compatible with SEC Distribution installation standards where provided and with telecommunications industry best practices.

4.3 Any alternative proposals for type approval and acceptance testing will be subject to technical evaluation by SEC to ensure satisfactory compliance with the material and product qualities implied by this specification.

4.4 Optical components and materials , splitters, connectors and fiber shall conform to this specification and relevant standards over the range of optical wavelengths from 1260nm to 1625nm. However, component design should also take account of future requirements to extend operating wavelength to 1675nm. Suppliers shall provide information on the likely change in performance of components when used at wavelengths greater than 1625nm supported by test data.

4.5 The fiber optic distribution components shall be able to be efficiently handled and managed during termination, splicing, routing, securing and storage.

4.6 All metallic parts, where applicable shall be corrosion-proof.

4.7 Notwithstanding the requirements of this Specification, all materials and components shall be of high quality design, workmanship and finish

4.8 Where applicable, all connectors and any other interfaces to optical fibers shall be fitted with a protective dust cap or coating at the point of manufacture and/or upon satisfactory completion of testing.

4.9 Suppliers shall provide to SEC a comprehensive manufacturer's drawing or set of specifications for each proposed distribution component, fully dimensioned and describing the materials and construction used. The manufacturers drawing and specification shall also reference compliance to the relevant industry standards.

4.10 Manufacturers design approval and factory test results shall be provided for each design of each component offered according to this specification.

4.11 Dimensions where specified are provided for guidance only. The dimensions of manufacturers proposed materials shall be provided to SEC for review and approval.

4.12 In addition to drawings and test data suppliers shall submit at least ten (10) verifiable references where each proposed item or component is used in a live, operational situation.

4.13 All materials used in the manufacture of the components shall be non-toxic and dermatologically safe and shall be chemically and biologically inert over the full environmental range. The presence of any hazardous materials must be clearly identified on the manufacturers drawings.

4.14 Unless otherwise specified, fiber optic distribution components for indoor and external installation shall be operate within specification over the full range of operating temperature and humidity as detailed in Table 1.

4.15 Unless otherwise specified, Enclosures for fiber optic distribution components shall provide the minimum degree of ingress protection detailed in Table 1 in accordance with IEC 60529.

4.16 All optical connectors supplied either individually or attached to any product described by this specification shall be at least grade B to provide guaranteed limits for optical link budget.

4.17 Where applicable, all distribution components in particular ODFs and Terminal Boxes shall be scalable to allow the gradual growth of fibers, splices, splitters and other components. Where possible capacity expansion should be achieved through the installation of modules into existing cabinets etc.

4.18 Suppliers scalability proposals shall take account of the need to minimise the amount of additional installation work and splicing and shall not require the need to re-splice any existing installation.

Table 1 – Environmental operating range

	External (outdoor) Installations	Internal (indoor) Installations
Operating Ambient Temperature	-10°C to +70°C	-0°C to +55°C
Maximum Relative Humidity	100%	
Minimum Ingress Protection	IP55, for above ground IP68, for underground	IP55

5 Optical Distribution Frames

5.1 Definition:

5.1.1 An Optical Distribution Frame provides a means of terminating and managing effectively the individual fibers within one or more fiber optic cables and facilitating interconnection with other fiber optic cables and components. Typically, an ODF will be used within a building or a telecommunications facility to terminate the optical fibers of cables in the outside plant and connecting them with other active and passive devices within the facility by means of interconnection components e.g. patch cords and pigtails cross connects.

5.1.2 The ODF will typically consist of:

a) An enclosure or cabinet to house and protect the fibers, splices and connections
b) Integrated cable management and protection.
c) A system to organise, identify and make available individual fibers for interconnection

5.1.3 The ODF may also include the ability to house additional passive components such as optical splitters and WDMs within the ODF enclosure. This should be easily integrated in cassettes in a plug-in format that avoids re-splicing of fibers in the future.

5.1.4 SEC FTTx deployments may specify different types of ODF depending upon each specific application as outlined in Table 2 and illustrated in Figure 1. The requirements of this Specification apply to all ODF types.

Table 2 Optical Distribution Frames

Standalone Optical Distribution Frame	Floor or wall mounted standalone cabinet typically used to manage large numbers of incoming optical fibers on multiple cables. This type of ODF will typically be specified for telecoms collocation or data centre facilities
Wall Mounted ODF	A standalone ODF, typically wall mounted for managing smaller cables and/or fiber counts.
Rack Mounted ODF	Optical management and distribution modules for mounting in a standard ETSI or 19-inch rack. A rack mounted fitted with connectors may also serve as Patch Panel.

5.2 Requirements

5.2.1 ODF components for rack mounting shall be fully enclosed modules conforming to IEC 60297 or equivalent and suitable for installation into standard ETSI or 19 inch racks.

5.2.2 Main frame of ODF shall be made of cold rolled steel with minimum thickness of 2 mm. Except for electrical grounding points, all metallic surfaces shall be powder coated as per manufacturers specification or in a RAL colour specified by SEC.

5.2.3 Floor or wall mounted ODFs shall be fitted with front and rear doors in either solid steel, perforated steel, steel frame tempered glass or steel frame acrylic glass. Doors shall be equipped with RS or CB type security locking system.

5.2.4 Floor mounted (cabinet) type ODF shall fit within a standard footprint of 600x300 mm (doors closed) and shall be more than 2200 mm in height.

5.2.5 A full-size cabinet ODF shall be capable of accommodating at least 1,000 SC/APC patches or at least 2,000 LC/APC patches.

5.2.6 The ODF shall be based on modular system, with each basic element (module) consisting of 24 SC/APC or 48 LC/APC) connections.

5.2.7 The ODF shall allow all internal functional parts to be accessed and allow all installation activities to be achieved from the front of the unit. Access shall be facilitated using "swing out" or "slide out" drawers and modules ass appropriate.

5.2.8 The design of the drawer shall guarantee free movement and sliding without any impact on active services or existing patch cords.

5.2.9 The ODF shall contain features for complete cable routing and management within the ODF including measures to ensure that bends in fiber optic cables, pig-tail cables, patch cables and individual fibers are maintained within the limits stated in Table 3.

5.2.10 Large ODF frames should facilitate connection of any port to any other port within the different frames, using specific patch cords lengths and without a requirement for cable raceways or any external routing or cross connects.

Table 3 – ODF minimum bend radius

	Minimum bend radius
Fiber optic cable	Maximum of 30mm or 10x cable outside diameter
Patch cable and Pigtails	
Individual Fibers	≥30 mm

5.2.11 The ODF shall provide flexibility in the positioning of cable entries into the ODF. In general, it should be possible to arrange cable entries at the top, bottom and sides of the unit.

5.2.12 The ODF shall be provided with appropriate fiber organisers and splice cassettes to with sufficient capacity to terminate and manage fiber counts up to and including the maximum stated capacity of the ODF. Individual splice organisers/cassettes must be readily accessible through a suitable swing-out or slide-out system (para 5.2.7).

5.2.13 Where specified by SEC, the ODF shall have facility to locate and mount other passive optical components that may need to be spliced directly to the optical fibers. This may include, but should not be limited to optical splitters and DWDM lambda combiners. Where this facility is specified, the ODF shall accept components with both fiber ribbon connections and individual fiber connections.

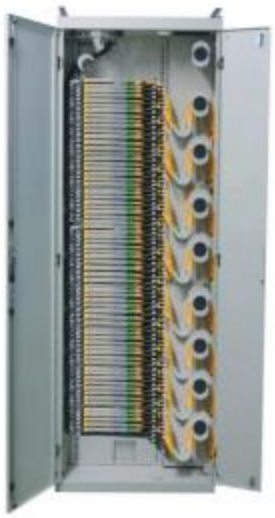
5.2.14 ODFs shall be capable of accepting Pigtail cables terminated which may be terminated with a range of connectors with various form factors. For Floor/Wall mounted units it should be possible to accommodate different connectors within a single ODF frame. For rack mounted components ODF modules may be proposed for different connectors but connector types will not be mixed within a module.

5.2.15 The ODF shall be provided with grounding points enabling all metallic parts within the ODF to be connected to the electrical earth.

5.2.16 The ODF shall be provided with a means of labelling all fiber incoming fiber cables and the designation of each fiber and splice. Labels shall be clearly visible and man-readable with the ODF frame/cabinet opened up.

5.2.17 The ODF shall not hinder or prevent the insertion OTDR signals.

Figure 1 Typical ODF Types



Large/Cabinet

Wall Mount

Rack Mount

6 Fiber Optic Joint Closures

6.1 Definition:

6.1.1 A Fiber Optic Joint Closure provides a means of providing in line connections between fiber optic cables. Typically, the joint closures are part of the Outside Plant and will be located in joint chambers, street cabinets or other flexibility points.

6.1.2 Joint closures will be used to:

d) Join to lengths of fiber optic cable.

e) Split a high fiber count cable into one or more separate cables with a smaller fiber count.

6.1.3 Joint closures will typically contain fiber organisers and splice cassettes. In some instances, joint closures may also be specified to house additional passive fiber optic components such as optical splitters.

6.1.4 Different types of joint closure are required depending upon the application. Without limitation, this Specification applies to joint closures as associated components suitable for providing in-line, breakout and flexibility joints in;

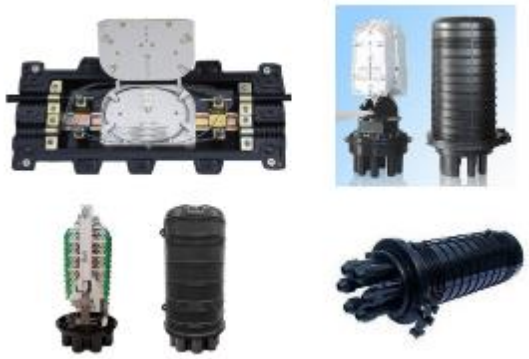
a) Non-metallic fiber optic cables in underground ducts and chambers

b) Overheard ADSS cables

c) Transitions between overhead OPGW cables and the non-metallic Approach Cables used transition between OPGW spans and other parts of the FTTx network.

6.1.5 Examples of non-metallic joint closures are shown in Figure 2. Note: Non-metallic joint closures are not suitable for jointing OPGW cables or providing transitions between OPGW cables and other cables.

Figure 2 Dome and In-Line Joint Closures – Illustrative Examples



6.2 Requirements for Non-Metallic Closures

6.2.1 Both In-Line and Dome type closures will be deployed by SEC depending upon the application.

i) Dome type closures shall be supplied for underground (manhole) installation. Proposed dome closures shall also be suitable for pole mounting above ground.

ii) In-Line closures shall be supplied for deployment above ground on flat surfaces (e.g. facades), pole mounting or directly on compatible supported overhead lines.

6.2.2 Closure housings shall be manufactured from glass reinforced plastic or Polypropylene and shall be designed and fabricated to provide a secure, stable, pressure-tight, birefringence free fiber optic jointing mechanism.

6.2.3 Joint closures shall be designed for continuous operation over the full temperature and humidity range specified in Table 1.

6.2.4 The assembled closure shall provide ingress protection to IP68, tested at 20KPa 2m water head. Ingress protection shall be independent of the number and size of cable entries or the number of fiber optic cables installed.

6.2.5 Closure materials shall be UV stable in terms of mechanical integrity and performance and the colour and finish of the materials. The effect of UV exposure shall be determined according to ASTM G154 (cycle 1), based upon a suitable mechanical property (e.g. tensile strength / impact strength) both before and after exposure.

6.2.6 Closure housings shall be constructed to withstand handling during transport and installation and shall allow repeated opening and closing of the housing without any degradation in the performance or integrity of the component.

6.2.7 Closure housings shall be provided with mounting lugs to facilitate secure mounting of the closure to a suitable fixed structure at the intended installation location. Installation locations for joint closures may include, without limitation:

a) Mounting frames within underground joint chambers.
b) Concrete electricity poles
c) Steel electricity poles or gantries

6.2.8 The supplier shall propose the mounting hardware (or mounting kits) required to securely mount the joint closure components. Ideally there should be based upon single universal mounting bracket, that allows aerial, pedestal or underground mounting without the need to order multiple separate parts.

6.2.9 It shall be possible to open and re-close/re-seal the closure shall multiple times. Opening and closing a properly installed closure shall not;

i) Deform or cause damage to the closure housing
ii) Affect the housing mechanisms and seals
iii) Adversely affect the ingress protection afforded by the closure, or
iv) Disturb installed fiber optic cables, uncut fibers or splices.

6.2.10 Opening and re-sealing of the closure shall require the use of simple, general purpose hand tools. Re-sealing of the closure shall be achieved without the use of any mastic tapes, heat shrink materials, adhesives or any other such materials or methods.

6.2.11 Joint closure components shall be readily compatible with a range of fiber optic cable sizes and fiber counts in accordance with SEC specifications. Proposed product shall not impose any limits on SEC to deploy fiber optic cables in accordance with SEC specifications.

6.2.12 Cable entries shall be sized and fitted with grommets suitable for all cable sizes compatible with the cable port. Blanking plugs shall be provided to seal unused ports. Sufficient grommets and blanking plugs shall be provided with each closure to accommodate all pre-configured (express) and "knock-out" cable entries. All cable grommets and seals shall be mechanical and shall allow for easy opening and re-sealing. Sealing of cable ports and grommets shall be achieved using simple general-purpose tools and shall not require the use of additional sealing materials.

6.2.13 Cable entries shall be provisioned with suitable clamps to secure cables fully prevent movement of installed fiber optic cables.

6.2.14 Closures shall be fitted with a fiber and splice management system that will typically consist of stacked fiber/splice cassettes. The fiber/splice management system shall ensure that the minimum bend radius of individual fibers and/or loose tubes is ≥30 mm.

6.2.15 Splice management shall be fitted with a means to label and identify each cassette.

6.2.16 Where specified, the joint closure and splice management shall be capable of accommodating optical splitters with splice-able fiber pigtails. Both ribbon style and individual fiber devices shall be accommodated.

6.2.17 The installation of splitters in the closure shall not be achieved in a way that would reduce the overall splice capacity of the closure.

6.3 Requirements for Metallic Closures

6.3.1 Metallic closures shall be used for all joints involving OPGW cables and shall be suitable for installation above ground on electricity poles and towers.

6.3.2 Closure housings shall be manufactured from aluminium alloy, galvanized steel & acid-proof stainless steel and shall be designed and fabricated to provide a secure, stable, pressure-tight, birefringence free fiber optic jointing mechanism.

6.3.3 Joint closures shall be designed for continuous operation over the full temperature and humidity range specified in Table 1.

6.3.4 The assembled closure shall provide ingress protection to IP68. Ingress protection shall be independent of the number and size of cable entries or the number of fiber optic cables installed.

6.3.5 Metallic joint closures will typically be mounted on steel electricity poles or lattice towers. Closures shall be provided with appropriate mounting hardware to securely attach the closure and fiber optic cables to the supporting structure. Mounting hardware shall be made of aluminium, galvanised steel or stainless steel with stainless steel fastenings.

6.3.6 Metallic joint closures shall provide comply with all other requirements as specified in paragraphs 6.2.10 to 6.2.16.

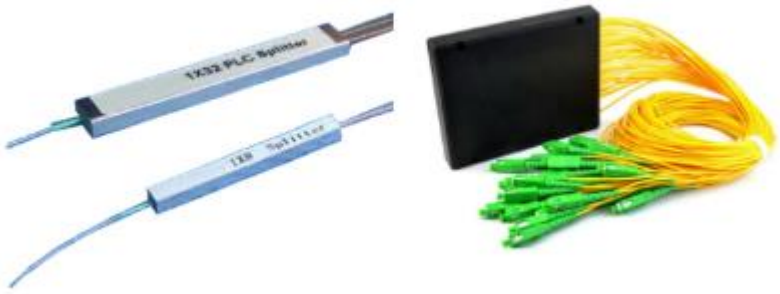
7 Optical Splitters

7.1 Definition

7.1.1 A fiber optic splitter is a passive optical device which splits an optical signal into several parts by a fixed ratio. The entire optical signal present at the input to the splitter is also present at all outputs from the splitter but with the optical power at each output attenuated according to the split ratio.

7.1.2 Splitters are available in various sizes and configurations. Illustrative examples of passive optical splitters are shown in Figure 3.

Figure 3 Optical Splitters - Illustrative Examples



7.2 Requirements

7.2.1 Unless otherwise specified, all optical splitters components shall use the Planar Lightwave Circuit construction.

7.2.2 The construction, performance and reliability of optical splitters shall comply with the requirements Telcordia GR 1209-Core and Telcordia GR1221-Core or equivalent, with reference to:

a) Component design and construction
b) Alignment
c) Curing
d) Packaging

7.2.3 Mechanical Shock, Vibration and Thermal Shock for these optical splitters shall be as per GR 1221-Core Recommendation

7.2.4 High Temperature Storage (Dry), High Temperature Storage (Damp), Low Temperature Storage, Temperature Cycling and Cyclic Moisture Resistance of these Optical Splitters shall be as per GR 1221-Core standard.

7.2.5 The supplier shall propose components with 1:N or 2:N split ratios where N=2, 4, 8, 16, 32 or 64.

7.2.6 Splitters shall be optimised for use in GPON passive optical networks and shall support both Type A and Type C protection architectures.

7.2.7 Maximum Optical Insertion Loss of 1:N optical splitters shall not exceed ($0.8+3.4\ Log_2N$) (where N = output ports). For 2:N splitters, the maximum optical insertion loss shall not exceed ($1.0 + 3.4\ log_2N$).

7.2.8 Uniformity and Polarization Dependent Loss of splitters shall be in accordance with GR 1209

7.2.9 Optical Band Pass characteristic shall be in accordance with ITU L41 Recommendation

7.2.10 Splitters shall be available in different form factors compatible with:

a) Integration into Optical Distribution Frames, cabinets or FDH enclosures. Cassette type form factor with connectorised inputs/outputs.
b) Rack mounting into standard 19-inch racks as part of a rack mountable ODF or patch panel arrangement. Cassette type form factor with connectorised inputs/outputs..
c) Integration into dome and/or in line joint closures with options for both connectorised and pigtail versions.

7.2.11 Splitters shall be supplied with pigtail fiber connections according to requirements. Pigtails may be specified wither as bare fiber or connectorised.

7.2.12 Bare fiber connections shall be 250 µm fiber directly compatible with G.652D and G.657A1 fibers

7.2.13 Connectorised pigtails shall consist of 900 µm tight buffered fiber terminated in a connector to include options for LC/APC and SC/APC. UPC connectors shall not be supplied on optical splitters.

7.2.14 Splitters without connectors shall be provided with input/output fiber pigtails with each pigtail at least 1.5m length.

8 Fiber Termination Box (FTB)

8.1 Fiber Termination Box (FTB) shall be able to provide a high-density wall mounted solution for next generation fiber networks, which aims to provide and manage maximum numbers of fiber termination in a limited space. The FTB is intended to provide a means of connecting end users within a building without the need for additional splicing or specialised labour.

8.2 FTB shall allow for wall mounting or pole mounting with minimal mounting hardware or hardware variants.

8.3 FTB components shall be proposed in variants suitable for indoor and outdoor installation.

8.4 The material used in construction of FTB shall be UV stable in terms of mechanical integrity and performance and the colour and finish of the materials. The effect of UV exposure shall be determined according to ASTM G154 (cycle 1), based upon a suitable mechanical property (e.g. tensile strength / impact strength) both before and after exposure.

8.5 FTB provided for outdoor use shall provide ingress protection to IP68.

8.6 The FTB shall contain mechanisms for cable, fiber and splice management within the unit. FTBs containing splices shall accommodate splice protectors in the range 40-60 mm.

8.7 FTB shall be capable of accommodating passive optical components (optical splitters and adapters) as required.

8.8 FTB shall ensure fiber bend radius can be maintained at greater than or equal to 30mm.

8.9 FTB shall be offered in different sizes/capacities from 4 to 24 ports.

8.10 FTB shall be secure and shall be provided with a tamper proof locking mechanism

8.11 FTB shall have easy access to cables, pigtails and patch cords during installation, maintenance and/or upgrade

9 Fiber Distribution Cabinet (FDC) or Fiber Distribution Hub (FDH)

9.1 Definition

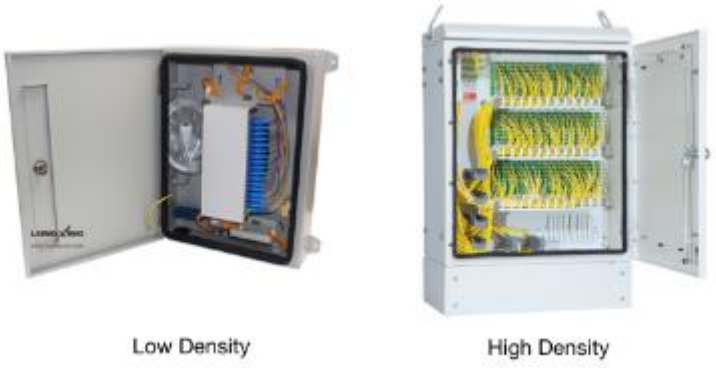
9.1.1 The Fiber Distribution Cabinet (FDC) or Fiber Distribution Hub (FDH) is an enclosure containing a small ODF or other fiber jointing mechanism and is used to provide an above ground flexibility point for the jointing, splitting and distribution of fiber optic cables. Typically, the FDC/FDH will be found at the interface between the distribution cables in the FTTx network and the final drop cables connecting to the end user's premises.

9.1.2 FDC/FDH are generally available in different sizes capable of handling different cables and fiber counts. For SEC applications, the FDC/FDH components will generally be located outdoors however, indoor units may also be specified to provide in-building fiber flexibility points.

9.1.3 The FDC/FDH components described in this specification shall contain passive fiber optic components only

9.1.4 Illustrative examples of FDH cabinets are shown in Figure 4.

Figure 4 Fiber Distribution Hub - Illustrative Example



9.2 Requirements

9.2.1 FDC shall be constructed for wall mounted outdoor use and suitable for operation over the full range of environmental conditions encountered in Saudi Arabia

9.2.2 FDC shall be designed for continuous operation over the full temperature and humidity range specified in Table 1.

9.2.3 The assembled closure shall provide ingress protection according to Table 1. Ingress protection shall be independent of the number and size of cable entries provided, the number of cable entries utilised or the fiber optic cables installed.

9.2.4 FDH shall be constructed of aluminium, stainless steel and galvanized-steel.

9.2.5 Where necessary, the FDC shall constructed in such a manner and/or be provided with passive mechanisms to ensure the temperature inside the enclosure to does not exceed the overall operating temperature range for the enclosure, the fibers and fiber management systems or any other passive optical components contained within the enclosure.

9.2.6 FDH shall have graffiti-resistant and solar-reflective polyester epoxy outdoor paint, with DIN50939 chromating (where required).

9.2.7 FDC shall have humidity absorbent interior paint which traps humidity on the inner surface of the roof

9.2.8 FDC shall have special texture on all doors and panels which resists adhesives and prevents unauthorised stickers, labels and posters from adhering to the external surfaces of the FDH.

9.2.9 FDC shall have anti-vandal construction, and a robust stainless-steel locking system.

9.2.10 The FDH shall be fitted with necessary cable, fiber and splice management systems consistent with the fiber management requirements in sections 5.2 and 6 of this specification.

10 Typical Dimensions

The dimensions given in Table 4 are for guidance only. The dimensions of manufacturers proposed material shall be supplied to SEC as part of the manufacturers drawings and shall be subject to SEC approval.

Table 4 Distribution Components - Typical Dimensions

Material	W(mm)	D (mm)	H (mm)	Diameter (mm)	Weight (kg)
ODF cabinet floor mount	1200	300	2200		
ODF rack module 24/48 port (1U per module)					
Joint Closure Small (up to 96 or 144 fibre)	483			205	2.7
Joint Closure Large (>144 fibre)	760			293	9.1
PLC Splitter: Plug-in type 1:2	Dimensions matched to manufacturer specific ODF/FDH proposals				
PLC Splitter: tube type 250µm (excl pigtail length)	54			3.8	
PLC Splitter: tube type 900µm (excl pigtail length)	60			3.0	
PLC Splitter: tube type 250µm field installable (excl pigtail length)	55	7.5	6.8		
FTB outdoor (up to 12-fibre)	180	72	264		1.0
FDH Wall/Pole/Floor mount 72 fibre	530	370	530		16.0
FDH Wall/Pole/Floor mount 144 fibre	530	370	740		23.0

11 Testing and inspection

11.1 Type (Design) Approval

11.1.1 The following type (design) approval tests shall be conducted in accordance with relevant IEC Standards or other equivalent ITU-T & EIA/TIA Standards. The appropriate tests shall be applied to each fiber optic distribution component described in this specification.

i. Vibration (Sinusoidal) Test to IEC 61300-2-1.
ii. Mating Durability Test to IEC 61300-2-2.
iii. Fiber/Cable Retention Test to IEC 61300-2-4.
iv. Torsion/Twist Test to IEC 61300-2-5.
v. Tensile Strength of Coupling Mechanism Test to IEC 61300-2-6.
vi. Shock Test to IEC 61300-2-9.
vii. Crush Resistance Test to IEC 61300-2-10.
viii. Axial Compression Test to IEC 61300-2-11.
ix. Impact Test to IEC 61300-2-12.
x. Cold Test to IEC 61300-2-17.
xi. Dry Heat – High Temperature Endurance Test to IEC 61300-2-18.
xii. Damp Heat (Steady State) Test to IEC 61300-2-19.
xiii. Composite Temperature/Humidity Cyclic Test to IEC 61300-2-21.
xiv. Change of Temperature Test to IEC 61300-2-22.
xv. Sealing Test of Non-Pressurized Closures of Fiber Optic Devices to IEC 61300-2-23.
xvi. Salt Mist Test to IEC 61300-2-26.
xvii. Dust Laminar Flow Test to IEC 61300-2-27.
xviii. Industrial Atmosphere (Sulphur Dioxide) Test to IEC 61300-2-28.
xix. Low Air Pressure Test to IEC 61300-2-29.
xx. Assembly & Disassembly Test of Closures to IEC 61300-2-33.
xxi. Resistance to Solvents & Contaminating Fluids of Interconnecting Closures & Components to IEC 61300-2-34.
xxii. Cable Bending Test for Fiber Optic to IEC 61300-2-37.
xxiii. Sealing Test of Pressurized Fiber Optic Closures to IEC 61300-2-38.
xxiv. Test of Static Side Load for Connectors to IEC 61300-2-42.
xxv. Test for Flexing of Strain Relief of Fiber Optic Devices to IEC 61300-2-44.
xxvi. Durability Test by Water Immersion to IEC 61300-2-45.
xxvii. Damp Heat Cyclic Test to IEC 61300-2-46.
xxviii. Temperature Humidity Cycling Test to IEC 61300-2-48.
xxix. Fiber Optic Connector Proof Test with Static Load- Single Mode & Multi-Mode IEC 61300-2-50.

11.1.2 For each fiber optic distribution component, the supplier shall provide to SEC a certified report of the tests carried out on each design and the results of each test.

Table 5 Application of Tests

Reference	Test	ODF	Joint Closures	Optical Splitters	FTB	FDH / FDC
IEC 61300-2-1	Vibration (sinusoidal)	✓	✓	✓	✓	✓
IEC 61300-2-2	Mating durability	✓		✓	✓	✓
IEC 61300-2-4	Fiber/Cable retention	✓	✓		✓	✓
IEC 61300-2-5	Torsion/Twist		✓	✓	✓	✓
IEC 61300-2-6	Tensile strength of coupling mechanism		✓	✓	✓	✓
IEC 61300-2-9	Shock test	✓	✓	✓	✓	✓
IEC 61300-2-10	Crush resistance	✓	✓	✓	✓	✓
IEC 61300-2-11	Axial compression		✓		✓	✓
IEC 61300-2-12	Impact	✓	✓	✓	✓	✓
IEC 61300-2-17	Cold	✓	✓	✓	✓	✓
IEC 61300-2-18	Dry Heat – High temperature endurance	✓	✓	✓	✓	✓
IEC 61300-2-19	Damp heat (steady state)	✓	✓	✓	✓	✓
IEC 61300-2-21	Composite temperature/humidity cyclic	✓	✓	✓	✓	✓
IEC 61300-2-22	Change of temperature	✓	✓	✓	✓	✓
IEC 61300-2-23	Sealing Test of Non-Pressurized Closures				✓	✓
IEC 61300-2-26	Salt mist					
IEC 61300-2-27	Dust laminar flow					
IEC 61300-2-28	Industrial Atmosphere (Sulphur Dioxide)		✓		✓	✓
IEC 61300-2-29	Low Air Pressure		✓		✓	✓
IEC 61300-2-33	Assembly & Disassembly Test of Closures		✓		✓	✓

Reference	Test	ODF	Joint Closures	Optical Splitters	FTB	FDH / FDC
IEC 61300-2-34	Resistance to Solvents & Contaminating Fluids of Interconnecting Closures & Components	✓	✓		✓	✓
IEC 61300-2-37	Cable Bending Test for Fiber Optic	✓	✓	✓		
IEC 61300-2-38	Sealing Test of Pressurized Fiber Optic Closures		✓			
IEC 61300-2-42	Test of Static Side Load for Connectors	✓	✓	✓	✓	✓
IEC 61300-2-44	Test for Flexing of Strain Relief of Fiber Optic Devices	✓	✓	✓	✓	✓
IEC 61300-2-45	Durability Test by Water Immersion		✓			
IEC 61300-2-46	Damp Heat Cyclic Test	✓	✓	✓	✓	✓
IEC 61300-2-48	Temperature Humidity Cycling Test	✓	✓	✓	✓	✓
IEC 61300-2-50	Fiber Optic Connector Proof Test with Static Load- Single Mode & Multi-Mode	✓		✓	✓	✓

12 Packaging and Marking

12.1 All product shall be individually shall be individually packed and wrapped in a protective re-sealable plastic and placed in a box together with any required test results or inspection data. The quantity of product in each shipping carton shall be either;

i. Specified by SEC through the contract or purchase order, or
ii. Proposed by the supplier for approval by SEC.

12.2 Each individual package and multi-packed carton shall be marked in Arabic and English on at least two sides of the package with the information stated in Table 6. The package markings shall also include a standard QR code with the same information.

Table 6 Packaging Information

Parameters	Requirements
Company	SEC Distribution
Category	Fiber Optic Components
Item description	Description of the fiber optic distribution component
DMSS document Number	DMSS ”xxxxxxx”
Manufacturer Name	“xxxxxxxx”
Manufacturer Part Number	“xxxxxxx”
SEC Part Number	xxxx
Type Approval Certificate Number	00/00
SEC Contract/PO Number	"xxxxxxxx"
Manufacturer Order Number	"xxxxxxxx"
Production Date (mmm-yyyy)	"Month - Year"
Items Quantity	(Numbers) Each
Weight (Kg)	"xxxxxxxx" kg

TECHNICAL DATA SCHEDULE

FIBER OPTIC DISTRIBUTION COMPONENTS

Enquiry No. _____ **Item No. _____**

*= Values to be provided by vendor

Ref. No.	Description	Unit	Specified Values	Vendor Proposed Values
3.0	**APPLICABLE CODES AND STANDARDS**			
	Applicable industry standards (for each design)		*	
4.0	**DESIGN REQUIREMENTS**			
4.1	**General Requirements**			
	Description of component	ODF, Joint, Splitter, FTB, FDH?	*	
	Manufacturers drawings with dimensions		*	
	Samples of proposed material		*	
	Type (design) approval tests and standards		*	
5.2	**Optical Distribution Frame**			
	Configuration	Wall, rack, cabinet?	*	
	Materials			
	Dimensions	w x h x d (mm)	*	
	Total capacity (number of splices/patches)		*	
	Number of splices/patches per module		*	
	Max number of modules		*	
	Splice and cable management system		*	
	Can accommodate cassette	Yes/no		

TECHNICAL DATA SCHEDULE

FIBER OPTIC DISTRIBUTION COMPONENTS

Enquiry No. _____ **Item No. _____**

*= Values to be provided by vendor

Ref. No.	Description	Unit	Specified Values	Vendor Proposed Values
	(connectorised) components (splitters, WDM)			
	Can accommodate pigtail components (splitters, WDM)	Yes/no		
6.2 & 6.3	**Joint Closures**			
	Component type	Dome, In-line, Other	*	
	Materials used		*	
	Dimensions	w x h x d (mm)		
	Mounting options and hardware		*	
	Cable entries and cable sizes accommodated	list	*	
	Number of cassettes		*	
	Splice capacity per cassette		*	
	Can accommodate splitters?	Yes/no	*	
	Splitter mounting arrangement (if applicable)		*	
7.2	**Optical Splitters**			
	Component type	FBT, PLC	*	
	Dimensions (for each split ratio if different)	w x h x d (mm)		
	Materials used		*	
	Form factor	Cassette(module), Mini-module, tube-type		

TECHNICAL DATA SCHEDULE

FIBER OPTIC DISTRIBUTION COMPONENTS

Enquiry No. _____ **Item No. _____**

*= Values to be provided by vendor

Ref. No.	Description	Unit	Specified Values	Vendor Proposed Values
	Range of splits available (1:N)	list	*	
	Range of splits available (2:N)	list	*	
	Connector options	list	*	
	Insertion loss (for each split ratio) @1330nm @1550nm @1625nm @1650nm	db	*	
	Return loss (connector variants) @1330nm @1550nm @1625nm @1650nm	db	*	
	Lead or pigtail outside diameter	µm	*	
	Lead or pigtail length	mm	*	
8	**Fiber Termination Box (FTB)**			
	Type	Indoor, outdoor	*	
	Ingress Protection	Indoor: IP55 Outdoor: IP68	*	
	Mounting			
	Dimensions	w x h x d (mm)		
	Materials used		*	

TECHNICAL DATA SCHEDULE

FIBER OPTIC DISTRIBUTION COMPONENTS

Enquiry No. _____ **Item No. _____**

*= Values to be provided by vendor

Ref. No.	Description	Unit	Specified Values	Vendor Proposed Values
	Number of input cable ports?		*	
	Fiber optic cables sizes accommodated?	List	*	
	Number of output ports		*	
	Output connector types		*	
	Can accommodate splitter(s)?		*	
	Splitter types?		*	
9.2	**Fiber Distribution Hub**			
	Type	Indoor, outdoor	*	
	Mounting	Wall, cabinet(floor), pole		
	Ingress Protection	Indoor: IP55 Outdoor: IP68	*	
	Mounting			
	Dimensions	w x h x d (mm)		
	Materials used		*	
	Number of cable ports?		*	
	Fiber optic cables sizes accommodated?	List	*	
	Fiber management		*	
	Splice management		*	
	Number of splice cassettes			
	Max number of splices			

TECHNICAL DATA SCHEDULE

FIBER OPTIC DISTRIBUTION COMPONENTS

Enquiry No. _____ **Item No. _____**

*= Values to be provided by vendor

Ref. No.	Description	Unit	Specified Values	Vendor Proposed Values
	Can accommodate splitter(s)?		*	
	Splitter types?		*	