



**Optical Fiber Termination Kit
(Standard/Armoured Round Type Patch cord/Pigtail)**

1. General

- 1.1. This specification covers the requirement of the Optical Fiber Termination Kit to be supplied to TOT Public Company Limited (TOT).
- 1.2. The Optical Fiber Termination Kit hereinafter referred to as the "OFTK".
- 1.3. The OFTK that allows it to be rapidly and conveniently connected to FDF, OFCCC, ODP, SDP, ONU/ONT or other telecommunication equipment.
- 1.4. There are two different types of patch cord/pigtail. The first one is armoured patch cord/pigtail, using this type in some area where the patch cord or pigtail is expected to be bitten by rodent animal, and the second one is standard patch cord/pigtail (unarmoured)
- 1.5. This OFTK shall be designed under indoor and outdoor environmental conditions.
- 1.6. Abbreviation
 - FDF: Fiber Distribution Frame
 - OFCCC: Outdoor Fiber Cross-Connecting Cabinet
 - ODP: Optical Distribution Point
 - SDP: Splitter Distribution Point
 - ONU/ONT: Optical Network Unit/Optical Network Terminal
- 1.7. Full detail of this following information shall be provided in technical bidding proposal by the bidder.
 - 1.7.1. Product specification issued by manufacturer including specification of OFTK
 - 1.7.2. The material used and grade (or composite material) in detail for all components of product proposed.
 - 1.7.3. Test method and test report of all requirements of Sections 2, 3, 4 and 5 according to this specification.

2. Fiber and Fiber cord (Cable) Attributes

Unless otherwise specified, the fiber attributes and fiber cord (cable) attributes shall be accordance with Recommendation ITU-T G.657.B3

2.1. ITU-T G.657.B3 attributes

Item	Specification
Fiber attributes	
Fiber material	High-grade silica, compound silica glasses or equivalent material
Fiber primary protective material	UV curable acrylate, UV curable urethane, Epoxy acrylate or equivalent material,
Primary coating diameter	245 $\mu\text{m} \pm 0.5 \mu\text{m}$, according to EIA/TIA-455-173
Mode field diameter	8.6-9.2 $\mu\text{m} \pm 0.4 \mu\text{m}$, @1310 nm
Cladding diameter	125 $\mu\text{m} \pm 0.1 \mu\text{m}$
Core concentricity error	$\leq 0.5 \mu\text{m}$
Cladding non-circularity	$\leq 1.0 \%$
Macrobending loss radius 5 mm, 1 turn	$\leq 0.15 \text{ dB}$, @1550 nm
Proof stress	0.69 GPA
Fiber cord (Cable) attributes	
Cut-off wavelength	$\leq 1260 \text{ nm}$
Attenuation coefficient	
Maximum from 1310 nm to 1 625 nm	$\leq 0.40 \text{ dB/km}$
Maximum at 1383 nm $\pm 3 \text{ nm}$ after hydrogen ageing	$\leq 0.40 \text{ dB/km}$
Maximum at 1530-1565 nm	$\leq 0.30 \text{ dB/km}$
PMD _C	$\leq 0.50 \text{ ps/km}^{\frac{1}{2}}$

3. The OFTK Requirement

- 3.1. Fiber patch cord and pigtail definition
 - 3.1.1. A fiber optic patch cord is a fiber optic cord capped at each end with the SC/APC connectors.
 - 3.1.2. A fiber optic pigtail is a fiber optic cord capped at one end with the SC/APC connector and a length of exposed fiber at the other end.
- 3.2. One set of OFTK shall confine to its application and at least consist of the following items.
 - 3.2.1. Indoor use: either patch cord or pigtail and cable tie
 - 3.2.2. Outdoor use: either patch cord or pigtail, heat-shrinkable tube, reinforce metal heat-shrinkable splice protector and cable tie.
- 3.3. Fiber cord (cable) structure
 - 3.3.1. Armoured type

The protective armouring shall be applied under the strength member. The armouring shall typically be spiral stainless steel pipe grade 304. The thickness of the armoured shall be within minimum 0.15 ± 0.02 mm.

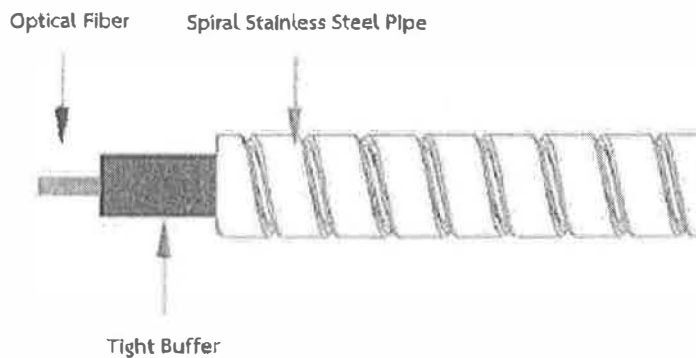
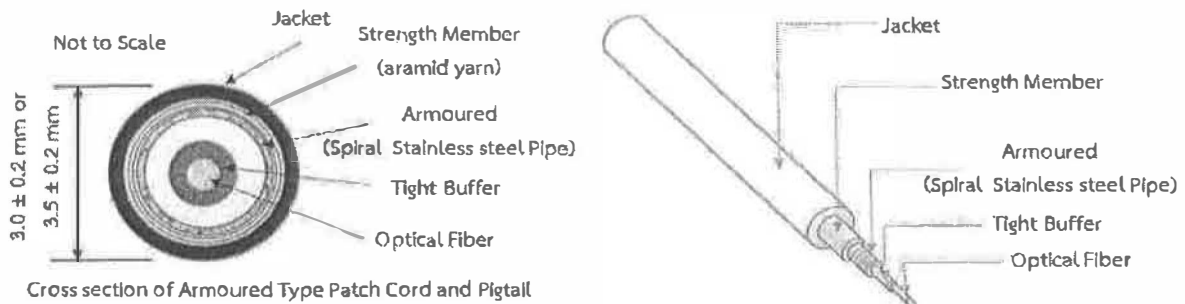


Figure 1 Structure of armoured type

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3.3.2. Standard type (unarmoured)

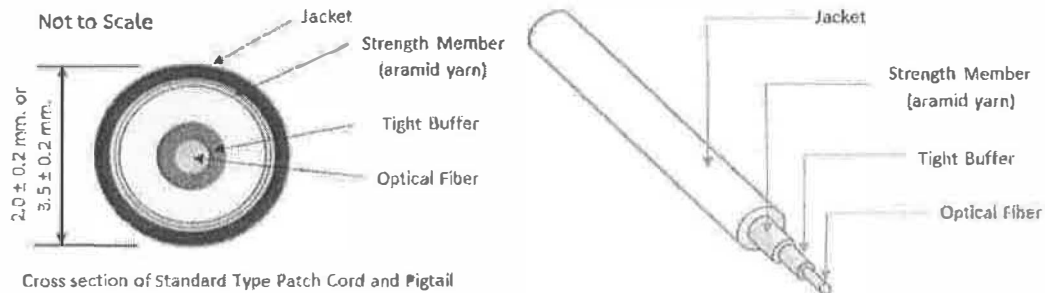


Figure 2 Structure of standard type (unarmoured)

3.3.3. Outer jacket

- 1) The outer jacket shall be made from Low Smoke Zero Halogen (LSZH) material filled with FR additive (Flame Retardant, IEC 60332-1).
- 2) Armoured type, the outer jacket color shall be Blue for indoor used and Black for outdoor used.
- 3) Standard type, the outer jacket color shall be Yellow for indoor used and Black for outdoor used.
- 4) The outer jacket diameter shall be 2.0 mm used for standard indoor use, 3.0 mm used for Armoured indoor use and 3.5 mm used for Standard/Armoured outdoor used.

3.3.4. Strength member

The strength member shall be the aramid yarn and shall be fully covered surrounding the armoured. The strength member shall be placed between the outer jacket and the spirally armoured, no adhesion to jacket or spiral armoured) as Figure 1.

3.3.5. Tight buffer

Jelly free, tight buffer \varnothing 900 μ m (0.9 mm), non-bucking, made from TPE (Thermoplastic elastomer) or PBT (Polybutylene terephthalate) or PA (Polyamide) or equivalent, filled with FR (Flame Retardant, IEC 60332-1).

3.4. Patch cord and pigtail connector.

- 3.4.1. The connector shall be assembled onto fiber cord and at least composed of connector body (housing), connector subassembly, strain relief crimp, ferrule and dust cap (cover).



3.4.2. Metallic materials

All metallic parts of connector shall be resistant to the corrosive influences they may encounter in normal use. No signs of corrosion shall be visible after 7 days exposure to non-acidic salt fog spray (5% NaCl, 35 °C) according to IEC 61300-2-26. If stainless steel used, it shall be made of 300 series stainless steel or better corrosion resistant material. The metallic parts of galvanized steel or other steel materials that have corrosion resistance property lower than 300 series stainless steel are not allowable.

3.4.3. Plastic materials

All plastic parts of the connector (except dust cap) shall be made from PBT Low Smoke Zero Halogen material filled with FR additive (Flame Retardant, UL94-V0) or equivalent plastic material.

3.4.4. Ferrule

The ferrule shall be made from zirconia ceramic.

3.5. Heat-shrinkable tube

3.5.1. The heat-shrinkable tube shall be suitable to apply for as follows:-

- 1) Drop cable and drop cable jointing: size \varnothing 3.5 mm conforming to TOT specification OES-004-049-xx (Optical Fiber Drop Cable (Round Type)), OES-004-055-xx (Armoured Optical Fiber Drop Cable (Armoured Round Type)), xx=latest issue.
- 2) Drop cable and pigtail jointing, size of drop cables shall be as paragraph 3.5.1 1) and pigtail size \varnothing 3.5 mm as mentioned in this specification.

3.5.2. The Heat-shrinkable tube shall be free of environmentally hazardous substances which effect to craftsman's health.

3.5.3. The Heat-shrinkable tube shall be an irradiated cross-linked, flexible polyolefin, thermally-stabilized, flexible heat-shrinkable tube with inner hot melt adhesive. The heat-shrinkable tube shall contain carbon black with 2-3% by weight in order to resist to UV light. The heat-shrinkable tube shall be Black color.

3.5.4. The Heat-shrinkable tube shall not shrink at temperature 70 °C when testing in a thermal chamber for 5 minutes.

3.5.5. The heat-shrinkable tube shall pass rating of 1. The fungus resistance shall be determined in accordance with ASTM G-21 latest issue.

3.5.6. The heat-shrinkable tube shall have a permanent marking which identified the manufacturer's name or trademark.

3.5.7. The dimensions of heat-shrinkable tube shall be as the Figure 3 and Table 1.

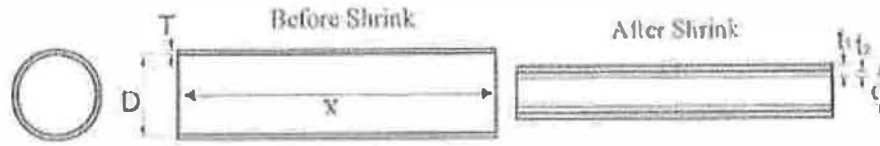


Figure 3 Heat Shrinkable tube

Before Shrink (mm)			After Shrink (mm)		
Inner Diameter (D)	Total Thickness (T)	Length (X)	Inner Diameter Min. Shrink Ratio (d)	Total Thickness (t1)	Adhesive Thickness (t2)
7.0-9.5	0.5-0.7	≥100	3:1	≥1.25	0.5-0.7

Table 1. Heat-shrinkable Tube Dimensions

- 3.6. The reinforce metal heat-shrinkable splice protector
- 3.6.1. The reinforcing metal heat-shrinkable splice protector shall be suitable for covering the fusion splicing point of fiber.
 - 3.6.2. The reinforce metal heat-shrinkable splice protector shall be durable and lasting protection of single fiber splices in field installations
 - 3.6.3. The reinforce metal heat-shrinkable splice protector is clear to allow viewing the color of the fiber after fusion splicing.
 - 3.6.4. The dimensions of reinforcing metal heat-shrinkable splice protector shall be as the Figure 4 and Table 2.
 - 3.6.5. Material
 - 1) Metallic material: Stainless steel reinforced metal rod
 - 2) Plastic material: Outer sleeve: PE
Inner sleeve: EVA

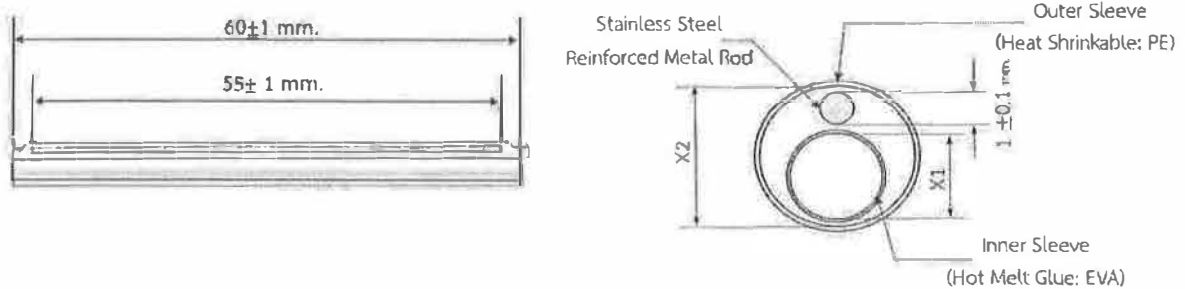


Figure 4 Reinforce metal heat-shrinkable splice protector

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Inner Sleeve (mm)		Outer Sleeve (mm)			
Before shrink		Before Shrink		After Shrink	
Inner Diameter (X1)	Total Thickness	Inner Diameter (X2)	Total Thickness	Inner Diameter Min Shrink Ratio	Total Thickness
4.0-4.2	≥ 0.3	4.8-5.0	≥ 0.25	2.0:1	≥ 0.55

Table 2. reinforce metal heat-shrinkable splice protector dimensions

4. Performance Requirements

Fiber Patch Cord and Pigtail Requirements

Test items	Conditions	Requirements	References
4.1 Insertion Loss (At each connector)	<ul style="list-style-type: none"> Source wavelength 1310 nm ± 10 nm 1490 nm ± 10 nm 1550 nm ± 10 nm 1625 nm ± 10 nm 	<ul style="list-style-type: none"> IL ≤ 0.2 dB 	IEC 61300-3-34 Method 2
4.2 Return Loss (At each connector)	<ul style="list-style-type: none"> Source wavelength 1310 nm ± 10 nm 1490 nm ± 10 nm 1550 nm ± 10 nm 1625 nm ± 10 nm 	<ul style="list-style-type: none"> RL ≥ 65 dB 	IEC 61300-3-6

5. Mechanical Requirements

5.1. Fiber Patch Cord and Pigtail Requirements

Test items	Conditions	Requirements	References
5.1.1. Appearance	<ul style="list-style-type: none"> Exam the product with the naked eye 	<ul style="list-style-type: none"> No deformation, crack, scratch, flaw, strain, looseness, and burr 	
5.1.2. Endurance	<ul style="list-style-type: none"> Mating and demating 500 times 	<ul style="list-style-type: none"> ΔIL ≤ 0.1 dB ΔRL ≤ 2 dB Appearance 	IEC-61300-2-2
5.1.3. Strip ability	<ul style="list-style-type: none"> Strip the outer jacket out of patch cord in one action (one time) Strip tight buffer tube out of fiber in one action (one time) Use commercially available tools 	<ul style="list-style-type: none"> Minimum length of the outer jacket shall be capable to be stripped to 1 meter Minimum length of the tight buff tube shall be capable to be stripped to 25 mm 	

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5.2. Heat-shrinkable Tube Requirements

Test items	Conditions	Requirements	References
Breaking strength (Min)	Speed 50 mm/min	276N	-
Elongation (Min)	Speed 50 mm/min	200%	-
Heat adhesion (Min)	Speed 50 mm/min	115N	5 specimens

6. Jacket marking

Each length marking interval approximately 1 meter, the identification marking shall be permanently identified as the followings:

- Manufacturer name or trademark.
- Date month and year (C.E) of fiber cord manufacturer of finished product manufacture.
- Type of fiber and jacket, O.D. such as SMOF LS-ZH-FR, 3.5 mm, G.657 B3, etc.

7. Packing and ordering information*

The OFTK shall be packed in a plastic bag (1 pc/Bag, 100 Bag/box) or equivalent and labeled to show the description, TOT Code, contract number, and name of supplier as same as labeling to show the description on the cardboard box.

The ordering information shall be as following in table below:-



TOT Code	Product Type	Fiber Cord Jacket Overall Diameters (mm)	Jacket Color	Connector Body and Boot Color	*Min. Length (M)	*HS Tube (Piece)	*RMHS Splice Protector (Piece)	Cable Tie (Piece)
	OFTK (Patch Cord Armoured Indoor Type)	3.0	Blue	Green	3	-	-	5
	OFTK (Patch Cord Armoured Outdoor Type)	3.5	Black	Green	3	3	3	5
	OFTK (Patch Cord Standard Indoor Type)	2.0	Yellow	Green	3	-	-	5
	OFTK (Patch Cord Standard Outdoor Type)	3.5	Black	Green	3	3	3	5
	OFTK (Pigtail Armoured Indoor Type)	3.0	Blue	Green	1.5	-	-	5
	OFTK (Pigtail Armoured Outdoor Type)	3.5	Black	Green	1.5	1	1	5
	OFTK (Pigtail Standard Indoor Type)	2.0	Yellow	Green	1.5	-	-	5
	OFTK (Pigtail Standard Outdoor Type)	3.5	Black	Green	1.5	1	1	5

* The other pigtail/patch cord lengths or its connector type shall be specified in the order.

* HS Tube: Heat-shrinkable tube

* RMHS Splice Protector: Reinforce metal heat-shrinkable splice protector

* For OFTK indoor type: the Reinforce metal heat-shrinkable splice protector and Heat-shrinkable tube shall not include in this kit, the reinforce metal heatshrinkable splice protector shall be provided by installer.

End of Specification