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## ingle Mode Fiber Patch Cord and Pigtail (SC/APC, LC/APC)

### 1. General :

- 1.1 This specification covers the requirements of the standard patch cord and pigtail to be supplied to TOT Public Company Limited (TOT). The patch cord shall be applied in passive optical network (PON) such as FTTx namely Fiber To The Home (FTTH), Fiber To The Curb (FTTC) etc., which used for optical fiber jumpering between FDF (Fiber Distribution Frame) on patching panel and equipment. The pigtail application shall be used to splice at non-connector end with incoming cable and the another end of pigtail coupling with connector shall be terminated to patching panel of FDF.
- 1.2 The patch cord and pigtail shall be designed under indoor environmental condition which used in TOT exchange or building. The primary design consideration of the cable shall protect the optical fiber from environmental and mechanical stresses. The patch cord and pigtail required as this specification shall be in accordance with Figure 1 to 10.
- 1.3 Abbreviation; SC/APC : Subscription channel Connector / Angle polished

Physical Contact.



LC/APC : Lucent / Angle polished Physical Contact.



- 1.4 Full details of this following information shall be provided in technical bidding proposal by bidder, Failure in this section 1.4 the proposal shall be disqualified.

## Spec. Patch Cord and Pigtail SC/APC & LC/APC

- Product specification issued by manufacturer including specification of fiber cord, pigtail, connector kit etc.
- The material used and grade (or composite material) in detail for all components of product proposed.
- Test method and test data of all requirements of sections 2, 3 and 4 according to this specification

### 2. Specific Requirements

The patch cord and pigtail shall composed of fiber cord (cable) and connector kit assemblies as shown in Figure 1 to Figure 11.

#### 2.1 Fiber Cord requirements

##### 2.1.1 Fiber Characteristics

All fiber characteristics of the fiber cord shall be, at least, in accordance with the ITU-T Recommendation G.652.D or G657A2, TOT specification no OES-004-030-XX (latest issue) Single Mode Optical Fiber Cable and shall be as follows.

Cladding Diameter  $125\mu\text{m} \pm 1\mu\text{m}$

Core-Clad Concentricity Error:  $\leq 0.5 \mu\text{m}$

Cladding Non-Circularity:  $\leq 1.0\%$

Mode Field Diameter @ 1310 nm:  $9.2 \mu\text{m} \pm 0.4\mu\text{m}$

Cable Cut-Off Wavelength ( $\lambda_{cc}$ ):  $\leq 1260 \text{ nm}$

Attenuation Coefficient:

$\leq 0.35 \text{ dB/km @ } 1310 \text{ nm}$

$\leq 0.35 \text{ dB/km @ } 1383 \text{ nm}$

$\leq 0.24 \text{ dB/km @ } 1490 \text{ nm}$

$\leq 0.21 \text{ dB/km @ } 1550 \text{ nm}$

$\leq 0.23 \text{ dB/km @ } 1625 \text{ nm}$

PMD coefficient :  $\leq 0.2 \text{ ps} / \sqrt{\text{km}}$

Maximum Attenuation with –

Macrobending 2 turns 30 mm radius :  $\leq 0.10 \text{ dB @ } 1550$

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### 2.1.2 Fiber Cord Physicals

#### Structure & Materials :

Outer jacket and boot: Polymer or polyethylene (PE) filled with FR (Flame Retardant, UL94-V0), LS(Low Smoke) and ZH(Zero Halogen or Halogen Free), Fiber cord jacket overall diameter of FC, SC and LC shall be 2.4mm, 2.0mm and 0.9mm respectively, Boot shall be designed to be applicable for cord strain relief.

Jacket Color : Yellow

Boot Color : see section 6 packing and ordering information

Strain relief : Aramid yarns (fully completely cover around the tight buffer, no adhesion to jacket or buffer tube), as Fig.1

Tight buffer tube : Jelly free, tight buffer tube  $\Phi$  900 $\mu$ m (0.9mm), non-bucking, made from TPE (Thermo plastic elastomer) or PBT (Polybutylen terephthalate) or PA (Polyamide) or equivalent, filled with FR (Flame Retardant, UL94-V0), in Yellow Color.

### 2.2 Connector Kit Assembly Requirements

Connector kit assembly shall be at least composed of followings:

SC/APC, LC/APC : connector body (housing), connector Subassembly, strain relief crimp, ferrule and Dust cap (cover).

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Note : In case of duplex connector (SC, LC), the Connector body (housing) shall be duplex clip Connector.

### 2.2.1 Materials

#### 1) Metallic materials

All metallic parts of connector kit assembly 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 resistance material. The metallic part of galvanized steel or other steel materials that have corrosion resistance property lower than 300 series stainless steel are not allowable.

#### 2) Plastic materials

All plastic parts of connector kit assembly (except dust cap) shall be made of flame retardant material with flammability rating of V-0 according to UL 94 standard.

### 2.2.2 Specific materials

#### 1) SC/APC, LC/APC

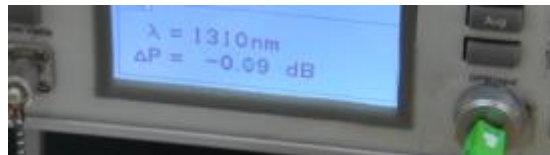
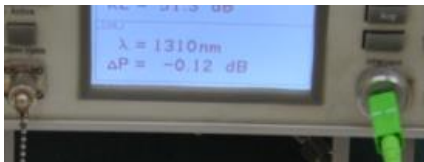
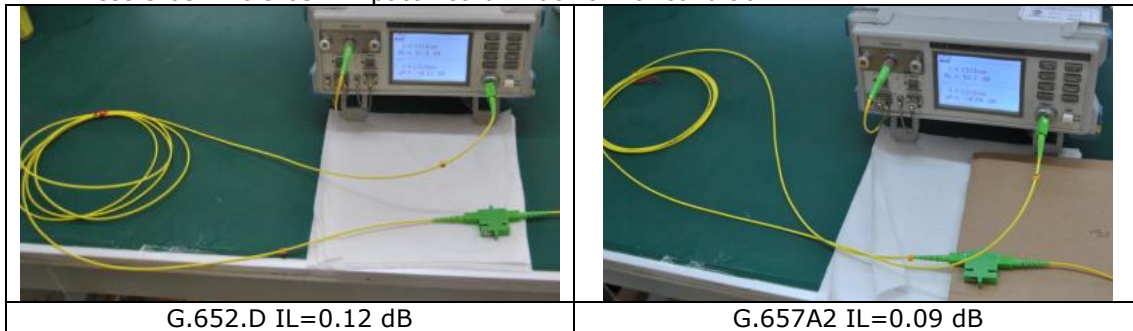
Connector body : PBT material with Flame Retardant UL94-VO or equivalent plastic material.  
Ferrule : Zirconia Ceramic

## 3. Performance Requirements

| Test item                           | Conditions   | Requirements  | References                 |
|-------------------------------------|--|---|----------------------------|
| 3.1 Insertion Loss (connector only) | <ul style="list-style-type: none"><li>Source wavelength<br/>1310 nm ± 10nm<br/>1490 nm ± 10 nm<br/>1550 nm ± 10 nm<br/>1625 nm ± 10 nm</li></ul> | <ul style="list-style-type: none"><li>IL ≤ 0.2 dB</li></ul> | IEC 61300-3-34<br>Method 2 |
| 3.2 Return Loss                     | <ul style="list-style-type: none"><li>Source wavelength<br/>1310 nm ± 10nm<br/>1490 nm ± 10 nm<br/>1550 nm ± 10nm<br/>1625 nm ± 10 nm</li></ul>  | <ul style="list-style-type: none"><li>RL ≥ 60 dB</li></ul>  | IEC 61300-3-6              |

### 2.2 Test G.652.D&G.657A2 IL change:

2.21 Test G.652.D&G.657A2 patch cord IL at normal condition.



## 4. Mechanical Requirements

The propose single mode fiber patch cord and pigtail in this specification shall be in accordance with section 3.1 to 3.6 which all tests in section 3.1 to 3.6 shall be run in sequence. Unless otherwise specified, the measurement of insertion loss (IL) and return loss (RL) shall be tested at 1310 nm  $\pm$  10 nm, 1490 nm  $\pm$  10 nm, 1550 nm  $\pm$  10 nm and 1625 nm  $\pm$  10 nm

## Spec. Patch Cord and Pigtail SC/APC & LC/APC

| Test Item                          | Conditions  | Requirements   | References    |
|------------------------------------|---|--|---------------|
| 4.1 Appearance                     | <ul style="list-style-type: none"> <li>* Exam the product with the naked eye</li> </ul>   | <ul style="list-style-type: none"> <li>* No deformation, crack, scratch, flaw, stain, looseness and burr.</li> </ul>                                     | -             |
| 4.2 Tensile Strength               | <ul style="list-style-type: none"> <li>* Patch cord maximum tensile strength: 70 N</li> <li>• Pigtail maximum tensile strength: 5 N</li> <li>• Rate : 0 N to full load in 15 sec</li> <li>• Point of application: 500 mm from plug</li> <li>• Duration: 1 minute</li> </ul> | <ul style="list-style-type: none"> <li>* <math>\Delta IL \leq 0.2</math> dB</li> <li>* <math>\Delta RL \leq 2</math> dB</li> <li>• Appearance</li> </ul> | IEC-61300-2-4 |
| 4.3 Endurance                      | <ul style="list-style-type: none"> <li>• Mating and demating 500 times</li> </ul>   | <ul style="list-style-type: none"> <li>* <math>\Delta IL \leq 0.2</math> dB</li> <li>* <math>\Delta RL \leq 2</math> dB</li> <li>• Appearance</li> </ul> | IEC-61300-2-2 |
| 4.4 Strength of Coupling Mechanism | <ul style="list-style-type: none"> <li>* Patch cord maximum tensile strength: 40 N</li> <li>• Rate: 0 N to full load in 15 sec</li> <li>• Point of application: 500 mm from plug</li> <li>• Duration: 1 minute</li> </ul>   | <ul style="list-style-type: none"> <li>* <math>\Delta IL \leq 0.2</math> dB</li> <li>* <math>\Delta RL \leq 2</math> dB</li> <li>• Appearance</li> </ul> | IEC-61300-2-6 |
| 4.5 Torsion                        | <ul style="list-style-type: none"> <li>• Maximum load: 15 N for patch cord and 2 N for pigtail</li> <li>• Cable clamp distance: 200 mm from the tip</li> <li>• Torsion: <math>+180^\circ/-180^\circ</math></li> <li>• Cycles: 25</li> </ul>                                 | <ul style="list-style-type: none"> <li>* <math>\Delta IL \leq 0.2</math> dB</li> <li>* <math>\Delta RL \leq 2</math> dB</li> <li>• Appearance</li> </ul> | IEC-61300-2-5 |

|                   |  |   |   |
|-------------------|--|---|---|
| 4.6 Strippability | <ul style="list-style-type: none"> <li>• Strip the outer jacket out of patch cord in one action (one time)</li> <li>* Strip tight buffer tube out of fiber in one action (one time)</li> <li>* Use commercially available tools</li> </ul> | <ul style="list-style-type: none"> <li>* Minimum length of the outer jacket shall be capable to be stripped to 1 meter</li> <li>• Minimum length of the tight buffer tube shall be capable to be stripped to 25 mm</li> </ul> | - |
|-------------------|--|---|---|

## Spec. Patch Cord and Pigtail SC/APC & LC/APC

### 5. MARKING

5.1 The patch cord shall be marked on the connector or the boot or the fiber cord (jacket) with manufacturer's name or trademark.

5.2 The patch cord jacket shall be provided length marking at intervals of approximately 1 meter along the whole patch cord length. The accuracy of the measurement of length marking shall be held within the limits of  $\pm 1\%$

5.3 The patch cord jacket identification marking.

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

- Manufacturer name or trade mark
- Date month and year (C.E) of fiber cord manufacture or finished product manufacture.
- Type of fiber and jacket, O.D. such as SMOF...PE-FR-LS-ZH, O.D, etc.

5.4 For traceability purpose, necessary information shall be placed on the patch cord for instance:- the trace label etc.

### 6. PACKING AND ORDERING INFORMATION

| TOT Code | Product Type              | Boot Color     | Min. Length(M) | Packing               |
|----------|---------------------------|----------------|----------------|-----------------------|
| 10059602 | SC to SC Patch Cord (APC) | Green          | 3              | 1 pc/Bag, 100 bag/box |
| 10059603 | SC to SC Patch Cord (APC) | Green          | 5              | 1 pc/Bag, 60 bag/box  |
| 10059604 | SC to SC Patch Cord (APC) | Green          | 10             | 1 pc/Bag, 40 bag/box  |
| 10059605 | SC to SC Patch Cord (APC) | Green          | 15             | 1 pc/Bag, 30 bag/box  |
| 10059606 | SC to SC Patch Cord (APC) | Green          | 20             | 1 pc/Bag, 20 bag/box  |
| 10059607 | SC to SC Patch Cord (APC) | Green          | 30             | 1 pc/Bag, 15 bag/box  |
| 10059608 | SC to SC Patch Cord (APC) | Green          | 40             | 1 pc/Bag, 10 bag/box  |
| 10059609 | LC to LC Patch Cord (APC) | Black          | 3              | 1 pc/Bag, 100 bag/box |
| 10059610 | LC to LC Patch Cord (APC) | Black          | 5              | 1 pc/Bag, 60 bag/box  |
| 10059611 | LC to LC Patch Cord (APC) | Black          | 10             | 1 pc/Bag, 40 bag/box  |
| 10059612 | LC to LC Patch Cord (APC) | Black          | 15             | 1 pc/Bag, 30 bag/box  |
| 10059613 | LC to LC Patch Cord (APC) | Black          | 20             | 1 pc/Bag, 20 bag/box  |
| 10059614 | LC to LC Patch Cord (APC) | Black          | 30             | 1 pc/Bag, 15 bag/box  |
| 10059615 | LC to LC Patch Cord (APC) | Black          | 40             | 1 pc/Bag, 10 bag/box  |
| 10059616 | SC to LC Patch Cord (APC) | Green to Black | 3              | 1 pc/Bag, 100 bag/box |
| 10059617 | SC to LC Patch Cord (APC) | Green to Black | 5              | 1 pc/Bag, 60 bag/box  |
| 10059618 | SC to LC Patch Cord (APC) | Green to Black | 10             | 1 pc/Bag, 40 bag/box  |

## Spec. Patch Cord and Pigtail SC/APC & LC/APC

|          |                                  |                |    |                      |
|----------|----------------------------------|----------------|----|----------------------|
| 10059619 | SC to LC Patch Cord (APC)        | Green to Black | 15 | 1 pc/Bag, 30 bag/box |
| 10059620 | SC to LC Patch Cord (APC)        | Green to Black | 20 | 1 pc/Bag, 20 bag/box |
| 10059621 | SC to LC Patch Cord (APC)        | Green to Black | 30 | 1 pc/Bag, 15 bag/box |
| 10059622 | SC to LC Patch Cord (APC)        | Green to Black | 40 | 1 pc/Bag, 10 bag/box |
| 10059623 | SC to SC Patch Cord Duplex (APC) | Green          | 3  | 1 pc/Bag, 50 bag/box |
| 10059624 | SC to SC Patch Cord Duplex (APC) | Green          | 5  | 1 pc/Bag, 30 bag/box |
| 10059625 | SC to SC Patch Cord Duplex (APC) | Green          | 10 | 1 pc/Bag, 20 bag/box |
| 10059626 | SC to SC Patch Cord Duplex (APC) | Green          | 15 | 1 pc/Bag, 15 bag/box |
| 10059627 | SC to SC Patch Cord Duplex (APC) | Green          | 20 | 1 pc/Bag, 10 bag/box |

| TOT Code | Product Type                     | Boot Color     | Min. Length(M) | Packing              |
|----------|----------------------------------|----------------|----------------|----------------------|
| 10059628 | SC to SC Patch Cord Duplex (APC) | Green          | 30             | 1 pc/Bag, 7 bag/box  |
| 10059629 | SC to SC Patch Cord Duplex (APC) | Green          | 40             | 1 pc/Bag, 5 bag/box  |
| 10059630 | LC to LC Patch Cord Duplex (APC) | Black          | 3              | 1 pc/Bag, 50 bag/box |
| 10059631 | LC to LC Patch Cord Duplex (APC) | Black          | 5              | 1 pc/Bag, 30 bag/box |
| 10059632 | LC to LC Patch Cord Duplex (APC) | Black          | 10             | 1 pc/Bag, 20 bag/box |
| 10059633 | LC to LC Patch Cord Duplex (APC) | Black          | 15             | 1 pc/Bag, 15 bag/box |
| 10059634 | LC to LC Patch Cord Duplex (APC) | Black          | 20             | 1 pc/Bag, 10 bag/box |
| 10059635 | LC to LC Patch Cord Duplex (APC) | Black          | 30             | 1 pc/Bag, 7 bag/box  |
| 10059636 | LC to LC Patch Cord Duplex (APC) | Black          | 40             | 1 pc/Bag, 5 bag/box  |
| 10059637 | SC to LC Patch Cord Duplex (APC) | Green to Black | 3              | 1 pc/Bag, 50 bag/box |
| 10059638 | SC to LC Patch Cord Duplex (APC) | Green to Black | 5              | 1 pc/Bag, 30 bag/box |
| 10059639 | SC to LC Patch Cord Duplex (APC) | Green to Black | 10             | 1 pc/Bag, 20 bag/box |
| 10059640 | SC to LC Patch Cord Duplex (APC) | Green to Black | 15             | 1 pc/Bag, 15 bag/box |
| 10059641 | SC to LC Patch Cord Duplex (APC) | Green to Black | 20             | 1 pc/Bag, 10 bag/box |



## Spec. Patch Cord and Pigtail SC/APC & LC/APC

|          |                                  |                |     |                       |
|----------|----------------------------------|----------------|-----|-----------------------|
| 10059642 | SC to LC Patch Cord Duplex (APC) | Green to Black | 30  | 1 pc/Bag, 7 bag/box   |
| 10059643 | SC to LC Patch Cord Duplex (APC) | Green to Black | 40  | 1 pc/Bag, 5 bag/box   |
| 10059644 | SC Pigtail (APC)                 | Green          | 1.5 | 1 pc/Bag, 100 bag/box |
| 10059645 | SC Pigtail (APC)                 | Green          | 3   | 1 pc/Bag, 50 bag/box  |
| 10059646 | SC Pigtail (APC)                 | Green          | 5   | 1 pc/Bag, 30 bag/box  |
| 10059647 | LC Pigtail (APC)                 | Black          | 1.5 | 1 pc/Bag, 100 bag/box |
| 10059648 | LC Pigtail (APC)                 | Black          | 3   | 1 pc/Bag, 50 bag/box  |
| 10059649 | LC Pigtail (APC)                 | Black          | 5   | 1 pc/Bag, 30 bag/box  |

The other lengths shall be specified on order.

Note : The patch cord and pigtail should not be used for length longer than 40 meters and 5 meters respectively. The FDF tie with indoor optical fiber cable shall be applied for the patch cord length longer than 40 meters. Since the pigtail cord covered by tight buffer tube so that the whole length of pigtail shall be installed in the enclosure such as in fiber distribution box or in the same sub rack shelf of FDF etc.

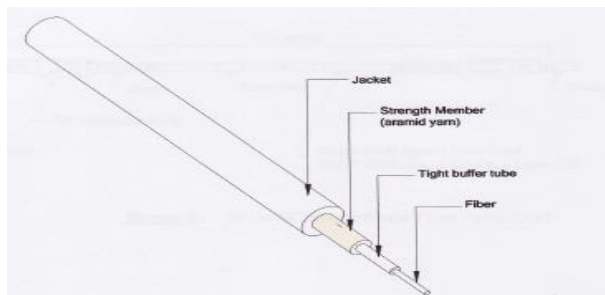


Fig. 1 Cable Structure of Single Mode Fiber Patch Cord

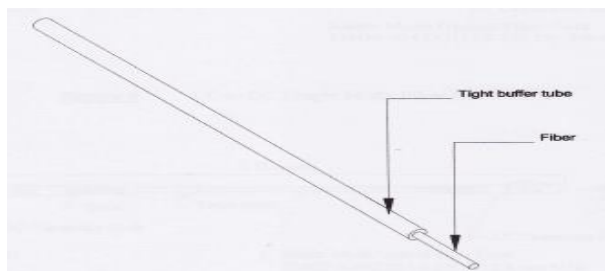


Fig. 2 Cable Structure of Single Mode Fiber Pigtail

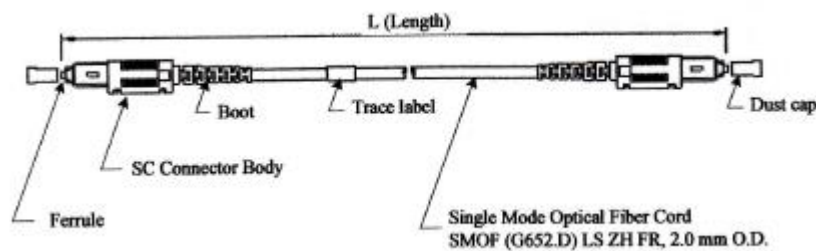


Fig. 3 SC to SC Single Mode Fiber Patch Cord

## Spec. Patch Cord and Pigtail SC/APC & LC/APC

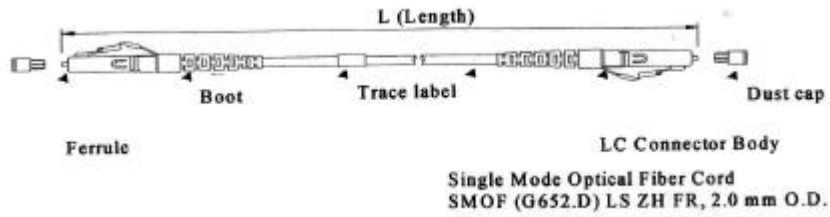


Fig. 4 LC to LC Single Mode Fiber Patch Cord

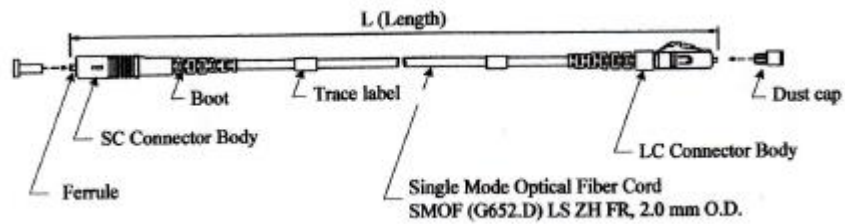


Fig. 5 SC to LC Single Mode Fiber Patch Cord

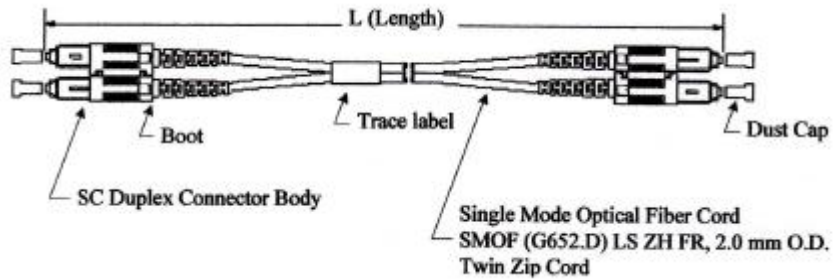


Fig. 6 SC to SC Single Mode Fiber Patch Cord Duplex

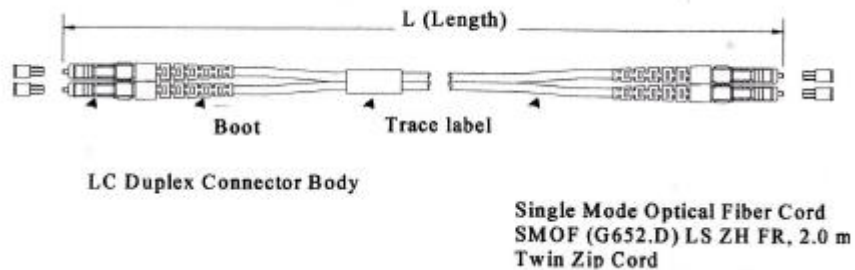


Fig. 7 LC to LC Single Mode Fiber Patch Cord Duplex

## Spec. Patch Cord and Pigtail SC/APC & LC/APC

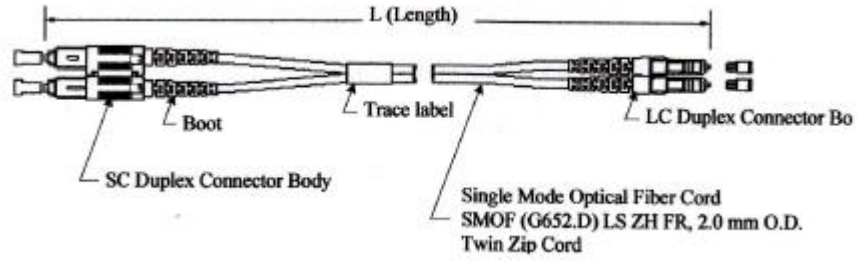


Fig. 8 SC to LC Single Mode Fiber Patch Cord Duplex

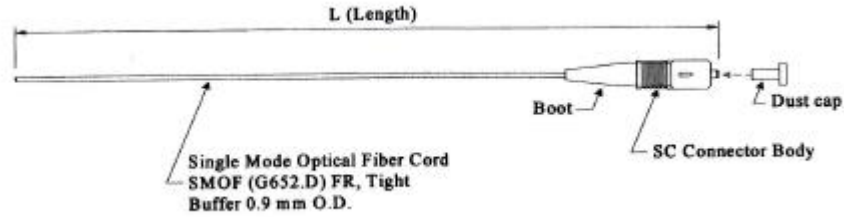


Fig. 9 SC Single Mode Fiber Pigtail

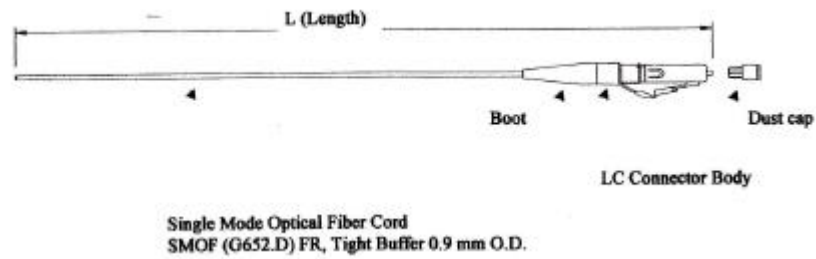


Fig. 10 LC Single Mode Fiber Pigtail

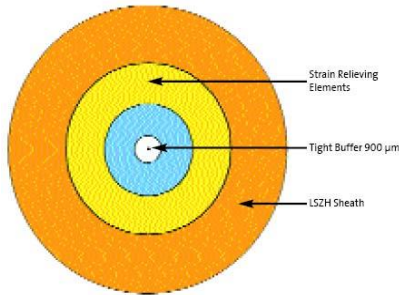


Fig.11

### CABLE FOR ASSEMBLIES

#### Applications

Simplex bulk cabling for cable assembly manufacturing operations is designed with 900 µm tight buffers for direct assembly of single-fiber connectors.

#### Features

- Utilizes 900 µm Tight-buffered fibers with TB4 , TB3 coating, enabling easy stripping Flame-retardant jacket.
- Cables meet the application requirements of the National Electrical Code® (NEC®Article 770) and are listed Jelly free
- All-dielectric cable construction requires no grounding or bonding
- Jacket - OFNR (PVC Flame-retardant to IEC 60 332-3 , FRNC (Flame-retardant to IEC 60 332-3 and noncorrosive to IEC 60754-2) , LSZH (Low-smoke to IEC 61034 and zero-halogen
- Overall diameter 3.0 , 2.4 .2.0 mm
- Yellow jacket ( single mode ) , Orange ( multimode )
- Strain relief - Aramid Yarns around tight buffer , no adhesion to jacket of buffer tube

Optical Fiber, continually pushing single-mode fiber to new performance levels., As the first manufacturer to upgrade standard single-mode fiber worldwide, we're providing our customers with greater value today and in the future., optical fiber is: Incompliance with or exceeding the industry's most stringent requirements, including: ITU-T G.652 (all tables) , IEC Specifications 60793-2-50 Type B1.3 , TIA/EIA 492-CAAB , Telcordia's GR-20