

## 1 Product Description

This specification covers the general requirements and performance of cable, which RZ offered including optical characteristics, mechanical characteristics and geometrical characteristics and etc.

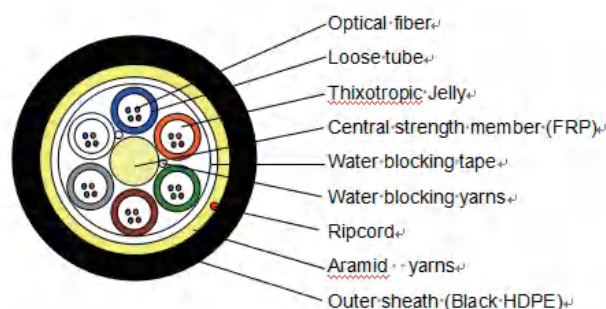
## 2 OPTICAL FIBER

Optical fiber characteristics (FPC G.652D FIBER)

| Category                  | Description                               |              | Specifications                         |
|---------------------------|-------------------------------------------|--------------|----------------------------------------|
|                           |                                           |              | G.652D                                 |
| Optical Specifications    | Attenuation                               | @1310nm      | $\leq 0.36 \text{ dB/km}$              |
|                           |                                           | @1383nm      | $\leq 0.32 \text{ dB/km}$              |
|                           |                                           | @1550nm      | $\leq 0.25 \text{ dB/km}$              |
|                           |                                           | @1625nm      | $\leq 0.27 \text{ dB/km}$              |
|                           | Attenuation discontinuity                 |              | $\leq 0.05 \text{ dB}$                 |
|                           | Attenuation vs. Wavelength                | @1285~1330nm | $\leq 0.05 \text{ dB/km}$              |
|                           |                                           | @1525~1575nm | $\leq 0.05 \text{ dB/km}$              |
|                           | Zero Dispersion Wavelength                |              | 1300~1324nm                            |
|                           | Zero Dispersion Slope                     |              | Max. $0.092 \text{ ps}/(\text{nm.km})$ |
|                           | Dispersion                                | @1310nm      | $\leq 3.5 \text{ ps/nm.km}$            |
|                           |                                           | @1550nm      | $\leq 18 \text{ ps/nm.km}$             |
|                           | Cable Cutoff Wavelength( $\lambda_{cc}$ ) |              | $\leq 1260 \text{ nm}$                 |
| Geometric Specifications  | PMD                                       |              | $\leq 0.20 \text{ ps/km}^{1/2}$        |
|                           | Effective Group Index of Refraction       | @1310nm      | 1.4675                                 |
|                           |                                           | @1550nm      | 1.4681                                 |
|                           | Mode Field Diameter                       | @1310nm      | $9.2 \pm 0.4 \mu\text{m}$              |
|                           |                                           | @1550nm      | $10.4 \pm 0.6 \mu\text{m}$             |
|                           | Cladding Diameter                         |              | $125 \pm 0.7 \mu\text{m}$              |
|                           | Cladding Non-Circularity                  |              | $\leq 1\%$                             |
|                           | Coating Diameter                          |              | $243 \pm 7 \mu\text{m}$                |
|                           | Coating/Cladding Concentricity Error      |              | $\leq 8 \mu\text{m}$                   |
|                           | Core/Cladding Concentricity Error         |              | $\leq 0.8 \mu\text{m}$                 |
| Mechanical Specifications | Proof Test level                          |              | $\geq 1.0\%$                           |
|                           | Fiber Curl Radius                         |              | $\geq 4.0 \text{ m}$                   |
|                           | Peak Coating Strip Force                  |              | $1.3 \sim 8.9 \text{ N}$               |

### 3 OPTICAL CABLE

#### 3.1 Construction of cable



| Cable type                     |             | 6/12/24/36                              | 48   | 72   |
|--------------------------------|-------------|-----------------------------------------|------|------|
| element                        |             | 6                                       |      | 8    |
| Central Strength Member        | Material    | Fiberglass Reinforce with Plastic (FRP) |      |      |
|                                | Diameter    | 2.2                                     |      | 2.3  |
| Loose Tube                     | Material    | Polybutelene Terephthalate (PBT)        |      |      |
|                                | Diameter    | 2.0                                     |      | 2.2  |
|                                | Fibers/Tube | 6                                       | 8    | 12   |
| Filling compound in loose tube | Material    | Thixotropic jelly                       |      |      |
| Water blocking                 | Material    | Water blocking yarn and tape            |      |      |
| Strength Member                | Material    | Aramid yarns                            |      |      |
| Outer Sheath                   | Material    | Black HDPE                              |      |      |
|                                | Thickness   | Aramid yarns                            |      |      |
| Outer Sheath                   | Material    | Black HDPE                              |      |      |
|                                | Thickness   | Normal: 1.6mm                           |      |      |
| Outer Diameter                 | mm          | 9.9                                     | 10.0 | 10.5 |
| Cable Weight                   | kg/km       | 77                                      | 79   | 87   |
| Short term tensile             | N           | 2200                                    |      |      |

#### 3.2 Fiber coding, The color coding of the optical fiber shall be in accordance with Table 3.2.1

| No. of fiber   | 1    | 2      | 3      | 4      | 5    | 6     |
|----------------|------|--------|--------|--------|------|-------|
| Color of fiber | Blue | Orange | Green  | Brown  | Grey | White |
| No. of fiber   | 7    | 8      | 9      | 10     | 11   | 12    |
| Color of fiber | Red  | Black  | Yellow | Violet | Pink | Aqua  |

Table 3.2.2: Identification of optical tube

| No. of tube   | 1    | 2      | 3      | 4      | 5    | 6     |
|---------------|------|--------|--------|--------|------|-------|
| Color of tube | Blue | Orange | Green  | Brown  | Grey | White |
| No. of tube   | 7    | 8      | 9      | 10     | 11   | 12    |
| Color of tube | Red  | Black  | Yellow | Violet | Pink | Aqua  |

Table3.2.3: Make-up of cable, No. of Fibers in each Tube

| No. of Fibers | No. of Tube |              | 1    | 2      | 3     | 4     | 5    | 6     | 7   | 8     |
|---------------|-------------|--------------|------|--------|-------|-------|------|-------|-----|-------|
| 6B1           | 1           | Tube color   | Blue | F      | F     | F     | F    | F     |     |       |
|               |             | No. of fiber | 6    |        |       |       |      |       |     |       |
| 12B1          | 2           | Tube color   | Blue | Orange | F     | F     | F    | F     |     |       |
|               |             | No. of fiber | 6    | 6      |       |       |      |       |     |       |
| 24B1          | 4           | Tube color   | Blue | Orange | Green | Brown | F    | F     |     |       |
|               |             | No. of fiber | 6    | 6      | 6     | 6     |      |       |     |       |
| 36B1          | 6           | Tube color   | Blue | Orange | Green | Brown | Grey | White |     |       |
|               |             | No. of fiber | 6    | 6      | 6     | 6     | 6    | 6     |     |       |
| 48B1          | 6           | Tube color   | Blue | Orange | Green | Brown | Grey | White |     |       |
|               |             | No. of fiber | 8    | 8      | 8     | 8     | 8    | 8     |     |       |
| 72B1          | 6           | Tube color   | Blue | Orange | Green | Brown | Grey | White |     |       |
|               |             | No. of fiber | 12   | 12     | 12    | 12    | 12   | 12    |     |       |
| 96B1          | 8           | Tube color   | Blue | Orange | Green | Brown | Grey | White | Red | Black |
|               |             | No. of fiber | 12   | 12     | 12    | 12    | 12   | 12    | 12  | 12    |

Note: "F" means the white filler

## 4 TEST REQUIREMENTS

| No | Item         | Test standard  | Method                                                                                  | Acceptance criteria                                                                               |
|----|--------------|----------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 1  | Tensile test | IEC-60794-1-E1 | -Max. Tensile strength<br>-Sample length:50 meters<br>-Time: 10minutes;                 | -Fiber strain at maximum Load: max. 0.33%<br>-Attenuation increase $\leq$ 0.10dB                  |
| 2  | Crush test   | IEC-60794-1-E3 | -Load:1000N<br>-Time: 5minutes<br>-Length: 100mm<br>- Position: One point and one time  | -No splits or cracks in the outer jacket;<br>-Attenuation increase $<$ 0.10dB                     |
| 3  | Impact test  | IEC-60794-1-E4 | -Impact energy: 450g<br>- Height:1 meter<br>-Impact points: 1<br>--Number of impacts: 5 | -No splits or cracks in the outer jacket<br>-Attenuation increase $\leq$ 0.10dB (after the test)  |
| 4  | Torsion test | IEC-60794-1-E7 | -1m cable length with 150N weight<br>- $\pm 180^\circ$ , 10 cycles                      | - No splits or cracks in the outer jacket<br>-Attenuation increase $\leq$ 0.10dB (after the test) |

|   |                          |                  |                                                                                                                                                                                                                                                                        |                                                                                                                                                 |
|---|--------------------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 5 | Repeated bending         | IEC-60794-1-E6   | -Radius=20×cable outer diameter<br>-1m cable length with 150N weight,25 cycles                                                                                                                                                                                         | - No splits or cracks in the outer jacket<br>-Attenuation increase $\leq 0.10\text{dB}$ (after the test)                                        |
| 6 | Temperature cycling test | IEC-60794-1-F1   | -Temperature step: $+20^{\circ}\text{C} \rightarrow -40^{\circ}\text{C} \rightarrow +60^{\circ}\text{C} \rightarrow -40^{\circ}\text{C} \rightarrow +60^{\circ}\text{C} \rightarrow +20^{\circ}\text{C}$<br>-Time per each step: 12 hrs<br>-Number of cycles: 2 cycles | -Attenuation variation for reference value(the attenuation to be measured before test at $+20\pm 3^{\circ}\text{C}$ ) $\leq 0.10\text{dB/km}$ , |
| 7 | Cable bending test       | IEC 60794-1-E11B | -Diameter of mandrel : 20×diameter of cable<br>- Number of cycles:1 cycle                                                                                                                                                                                              | Change of attenuation shall not be greater than 0.1dB.<br>No fiber break and no cable damage.                                                   |
| 8 | Water penetration test   | IEC-60794-1-F5   | -Water height: 1m<br>-Sample length:3m<br>-Duration of test: 24hrs                                                                                                                                                                                                     | -No water leakage at the end of the sample                                                                                                      |
| 9 | Drip test                | IEC-60794-1-E14  | -Five 0.3m samples suspended vertically in a climate chamber, raised temperature to $+70^{\circ}\text{C}$                                                                                                                                                              | -No filling compound shall drip from tubes after 24 hr                                                                                          |

## 5 PACKING AND DRUM

5.1 The cable is wound on a non-returnable wooden drum. Both ends of cable are securely fastened to drum and sealed with a shrinkable cap to prevent ingress of moisture. The following information shall be marked on the outer sheath of the cable at an interval of about 1 meter.

- Cable type and number of optical fiber
- Manufacturer name
- Month and Year of Manufacture
- Cable length

The sequential number of the cable length shall be marked on the outer sheath of the cable at an interval of  $1\text{meter} \pm 1\%$ .

5.2 Drum marking, Each side of every wooden drum shall be permanently marked in a minimum of 2.5~3 cm high lettering with following:

- Manufacture name and logo
- Cable length
- Cable type and number of fibers
- Roll way
- Gross and net weight

-End of Specification-