## 1. General

1.1 This specification covers the requirements for the supply of single-mode optical fiber cables.

1.2 Cable Description: NETSO Fiber cable possesses high tensile strength and flexibility in compactcable sizes. At the same time, it provides excellent optical transmission and physical performance.

1.3 Quality: Excellent quality control is achieved through intense in-house quality check and stringent audit acceptance by ISO 9001.

1.4 Reliability: Initial and periodic product qualification tests for performance and durability are performed rigorously to ensure product reliability.

1.5 Reference: The cable which NETSO Fiber offered are designed, manufactured and tested according to international standards as follows:

| | |
|---|---|
| **IEC 60793-1** | Optical fiber Part 1: Generic specifications |
| **IEC 60793-2** | Optical fiber Part 2: Product specifications |
| **ITU-T G.650** | Definition and test methods for the relevant parameters of single-mode fibers |
| **ITU-T G.652** | Characteristics of a single-mode optical fiber and cable |
| **EIA/TIA 598** | Color code of fiber optic cables |

## 2. Fiber characteristics

The optical fiber is made of high pure silica and germanium doped silica. UV curable acrylate material is applied over fiber cladding as optical fiber primary protective coating. The detail data of optical fiber performance are shown in the following table.The single mode optical fiber cable comply with the requirements of this specification and generally meet any latest relevant ITU-T Recommendation G.652D.

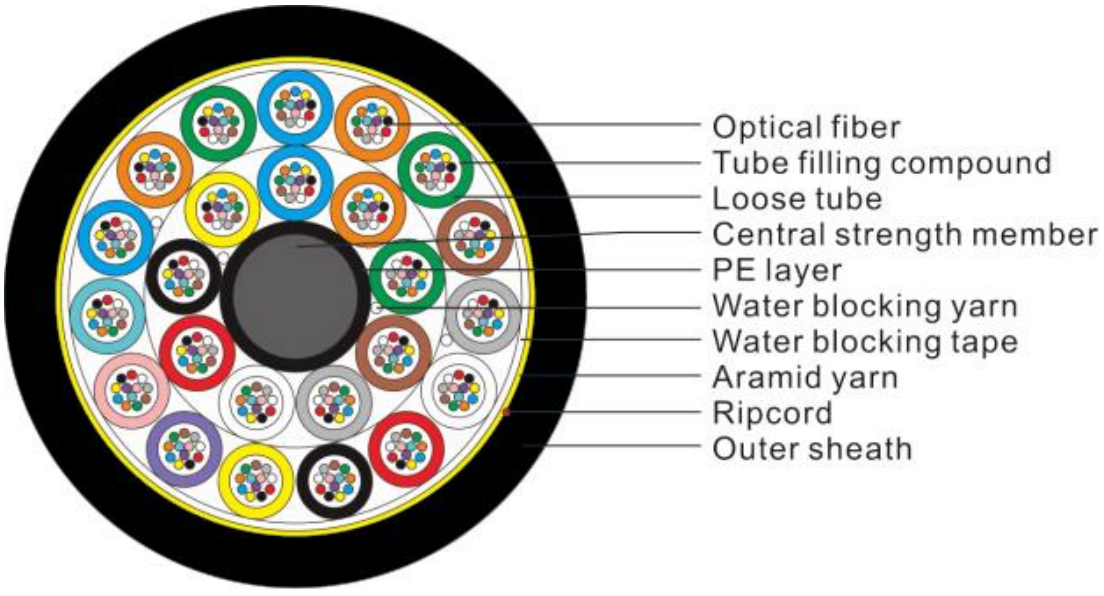
### 2.1 G.652D

| **Optics Specifications** | | **(G.652D)** |
|---|---|---|
| Attenuation(dB/km) | @1310nm | ≤0.34db/km |
| | @1383nm (after hydrogen aging) | ≤0.32db/km |
| | @1550nm | ≤0.20db/km |
| | @1625nm | ≤0.24db/km |
| Dispersion | @1285nm~1340nm | -3.0~3.0ps/(nm*km) |
| | @1550nm | ≤18ps/(nm*km) |
| | @1625nm | ≤22ps/(nm*km) |
| Zero-Dispersion wavelength | | 1300~1324nm |
| Zero-Dispersion slope | | ≤0.092ps/(nm$^2$*km) |
| Mode field diameter @ 1310nm | | 9.2±0.4μm |
| Mode field diameter @ 1550nm | | 10.4±0.8μm |
| PMD | Max. value for fiber on the reel | 0.2ps/km 1/2 |

| | | |
|---|---|---|
| | Max. Designed value for link | 0.08ps/km 1/2 |
| Cable cutoff wavelength,λ cc | | ≤1260nm |
| Effective group index(Neff)@1310nm | | 1.4675 |
| Effective group index(Neff)@1550nm | | 1.4680 |
| Macro-bend loss(Φ60mm,100 turns)@1550nm | | ≤0.05db |
| **Back scatter characteristic(@1310nm&1550nm)** | | |
| Point discontinuity | | ≤0.05db |
| Attenuation uniformity | | ≤0.05db/km |
| Attenuation coefficient difference for bi-directional measurement | | ≤0.05db/km |
| **Geometrical characteristics** | | |
| Cladding diameter | | 125±1μm |
| Cladding non-circularity | | ≤1% |
| Core/cladding concentricity error | | ≤0.4μm |
| Fiber diameter with coating(uncolored) | | 245±5μm |
| Cladding/coating concentricity error | | ≤12.0μm |
| Curl | | ≥4m |
| **Mechanical characteristic** | | |
| Proof test | | 0.69GPa |
| Coating strip force(typical value) | | 1.4N |
| Dynamic stress corrosion susceptibility parameter(typical value) | | ≥20 |
| **Environmental characteristics(@1310nm&1550nm)** | | |
| Temperature induced attenuation(-60~+85℃) | | ≤0.5dB/km |
| Dry heat induced attenuation(85±2℃,30days) | | ≤0.5dB/km |
| Water immersion induced attenuation(23±2℃,30days) | | ≤0.5dB/km |
| Damp heat induced attenuation(85±2℃,RH85%,30days) | | ≤0.5dB/km |

## 3. Optical Fiber Cable

### 3.1 Cross section



**Construction:**

1. Outer sheath (**HDPE, UV Resistant , Black color**)
2. Aramid yarn
3. Loose tube（PP） and filler
4. Fiber with tube filling compound
5. Central strength member (**FRP+PE**)
6. Water blocking system
7. Rip cord*2( Red color )

**3.2 Dimensions of cable constructions**

| | |
|---|---|
| Span (m) | 120 |
| Fiber count | 288 |
| Structure | 1+9+15 |
| Fibers per tube | 24 tubes * 12 fibers |
| Loose tube diameter(mm) | 2.0±0.1 |
| CSM diameter(mm) | 4.0±0.1 |
| Thickness of outer jacket (mm) | 1.8±0.1 |
| Cable diameter (mm) | 16.0±5% |
| Cable weigh (kg/km) | 205±15% |
| Operation temperature | -40℃～+70℃ |
| Installation temperature | -10℃～+50℃ |
| Transport and storage | -20℃～+70℃ |
| Minimum installation tension (N) | 3500 |
| Crush resistance: short/long term(N/10cm) | Short term:500;Long term:200 |
| Min. bending radius: Static/Dynamic | 10 x OD/ 20 x OD |
| Cable life span | 25 years |

The fibres shall be marked by a coloured coating with 12 different colors following the standard EIA/TIA598 as below :

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Blue | Orange | Green | Brown | Grey | White | Red | Nature | Yellow | Violet | Pink | Aqua |

## 4. Routine tests

The cable is in accordance with applicable standard of cable and requirement of customer. The following test items are carried out according to corresponding reference. (Sampling testing)

### 4.1 Optical fiber test:

| | |
|---|---|
| Mode field diameter | IEC 60793-1-45 |
| Core/clad concentricity | IEC 60793-1-20 |
| Cladding diameter | IEC 60793-1-20 |
| Cladding non-circularity | IEC 60793-1-20 |
| Attenuation coefficient | IEC 60793-1-40 |
| Chromatic dispersion | IEC 60793-1-42 |
| Cable cut-off wavelength | IEC 60793-1-44 |

### 4.2 Cable test:

#### 4.2.1Tension Loading Test

| | |
|---|---|
| Test Standard | IEC 60794-1-2 E1 |
| Sample length | No less than 50 meters |
| Load | tension load |
| Duration time | 1 minute |
| Test result | Additional attenuation:≤0.1dB after test |
| | No damage to outer jacket and inner elements |

#### 4.2.2 Crush/Compression Test

| | |
|---|---|
| Test Standard | IEC 60794-1-2 E3 |
| Load | Max. crush load |
| Duration time | 1 minute |
| Test number | 3 |
| Test result | Additional attenuation:≤0.1dB after test |
| | No damage to outer jacket and inner elements |

### 4.2.3 Impact Resistance Test

| | |
|---|---|
| Test Standard | IEC 60794-1-2 E4 |
| Impact energy | 1J |
| Radius | 300mm |
| Number of impacts | One in 3 different places spaced not less than 500 mm apart |
| Test result | No damage to outer jacket and inner elements |

### 4.2.4 Torsion/Twist Test

| | |
|---|---|
| Test Standard | IEC 60794-1-2 E7 |
| Sample length | 1m |
| Angles | ±180 degree |
| cycles | 10 |
| Test result | Additional attenuation:≤0.1dB after test |
| | No damage to outer jacket and inner elements |

### 4.2.5 Bend Test

| | |
|---|---|
| Test Standard | IEC 60794-1-2 E11A |
| Mandrel radius | 20 X diameter of cable |
| Turn number | 4 |
| Number of cycles | 3 |
| Test result | No damage to outer jacket and inner elements |

### 4.2.6 Repeated Bending Test

| | |
|---|---|
| Test Standard | IEC 60794-1-2 E6 |
| Bending radius | 20 X diameter of cable |
| Cycles | 25 cycles |
| Test result | Additional attenuation:≤0.1dB after test |
| | No damage to outer jacket and inner elements |

### 4.2.7 Temperature cycling Test

| | |
|---|---|
| Test Standard | IEC 60794-1-2 F1 |

| | |
|---|---|
| Temperature step | +20℃ →-20℃ →+70℃→20℃ |
| Time per each step | 12 hrs |
| Cycles | 2 |
| Test result | Attenuation variation for reference value (the attenuation to be measured before test at +20±3℃) ≤ 0.15dB/km @1550nm and reversible |

#### 4.2.8 Water penetration Test

| | |
|---|---|
| Test Standard | IEC 60794-1-2 F5 |
| Height of water column | 1m |
| Sample length | 3m |
| Test time | 24 hrs |
| Test result | No water leakage from the opposite of the sample |

## 5. Sheath marking


According to customer's request on cable mark.

## 6. PACKING AND DRUM

NETSO cables are coiled on Chinese fir made fumigation wooden drum. During transportation, right tools should be used to avoid damaging the package and to handle with ease.

Cables should be protected from moisture; kept away from high temperature and fire sparks; protected from over bending and crushing; protected from mechanical stress and damage.

| Cable type | Drum | | | | | |
|---|---|---|---|---|---|---|
| | Height (mm) | Width (mm) | Inner diameter (mm) | Length (m) | Weight (KGS) | Drum type |
| ADSS-288-120m | 1350 | 760 | 650 | 2175±1% | 510 | Fumigation wooden drum |

According to customer's request on drums and drum mark.