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TL 9000
ISO 9001
ISO 14001
OHSAS 18001

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Specification

For

Optical Fiber
Central Loose Tube
Flat Drop Cable / Toning Wire



1. SCOPE

This specification covers the general requirements for fiber optic drop cables.

2. OPTICAL FIBER

The optical, geometrical, mechanical and environmental performance of the optical fiber shall be in accordance with Table 1 ~ Table 2 below.

Table 1. Performance of The Single Mode Fiber (ITU-T G. 652D)

ITEMS		UNITS	SPECIFICATION
Attenuation at 1310/1383/1550nm		dB/km	$\leq 0.35 / \leq 0.35 / \leq 0.25$
Chromatic Dispersion		ps/nm.km	≤ 3.5 at 1285nm ~ 1330nm ≤ 18 at 1550nm
Zero Dispersion Wavelength		nm	1300 ~ 1324
Zero Dispersion Slope		ps/nm ² .km	≤ 0.092
Cable PMD (PMD ₀)		ps/√km	≤ 0.2 (20 section link)
Cut-off Wavelength (λ_{cc} , Cabled fiber)		nm	≤ 1260
Attenuation vs. Bending	R30mm x 100 ¹	dB	≤ 0.1 at 1625nm
Mode Field Diameter		μm	9.2 ± 0.4 at 1310nm 10.4 ± 1.0 at 1550nm
Core/Cladding Concentricity Error		μm	≤ 0.5
Cladding Diameter		μm	125 ± 0.7
Cladding Non-circularity		%	≤ 1.0
Coating Diameter		μm	245 ± 10
Proof Test		Gpa	≥ 0.69

Table 2. Performance of The Single Mode Fiber (ITU-T G. 657A)

ITEMS		UNITS	SPECIFICATION	
			G.657.A1	G.657.A2
Attenuation at 1310/1383/1550nm		dB/km	$\leq 0.35 / \leq 0.35 / \leq 0.25$	
Chromatic Dispersion		ps/nm.km	≤ 3.5 at 1285nm ~ 1330nm ≤ 18 at 1550nm	
Zero Dispersion Wavelength		nm	1300 ~ 1324	
Zero Dispersion Slope		ps/nm ² .km	≤ 0.092	
Cable PMD (PMD ₀)		ps/√km	≤ 0.2 (20 section link)	
Cut-off wavelength (λ_{cc})		nm	≤ 1260	
Attenuation vs Bending at 1550/1625nm	R15mm x 10	dB	$\leq 0.25 / \leq 1.0$	$\leq 0.03 / \leq 0.1$
	R10mm x 1	dB	$\leq 0.75 / \leq 1.5$	$\leq 0.1 / \leq 0.2$
	R7.5mm x 1	dB	-	$\leq 0.5 / \leq 1.0$
Mode Field Diameter at 1310nm		μm	8.9 ± 0.4	8.6 ± 0.4
Core/Cladding Concentricity Error		μm	≤ 0.5	
Cladding Diameter		μm	125 ± 0.7	
Cladding Non-circularity		%	≤ 1.0	
Coating Diameter		μm	245 ± 10	
Proof Test		Gpa	≥ 0.69	

¹ Radius 30mm with 100 turns

3. CABLE CONSTRUCTION

The construction of the cable shall be in accordance with Table 3 below.

Table 3. Construction of the Cable

ITEMS		DESCRIPTION	
Number of Fibers		Up to 12	24
Loose Buffer Tube	Material	PBT	
	Color	Natural	
	Filling Compound	Thixotropic Gel Compound	
	Diameter	Nom. 2.0mm	Nom. 3.0mm
Strength Member		2 × FRP (Fiber Reinforced Plastic)	
Water Blocking Material		Water Blocking Yarn	
Outer Jacket		Black HDPE	
Toning Wire		Copper wire (1 x 24 AWG)	

4. FIBER IDENTIFICATION

Table 4. The Color Code of the Individual Fibers

No.	Color	No.	Color
1	Blue	13	Blue / Dot Marking
2	Orange	14	Orange / Dot Marking
3	Green	15	Green / Dot Marking
4	Brown	16	Brown / Dot Marking
5	Slate	17	Slate / Dot Marking
6	White	18	White / Dot Marking
7	Red	19	Red / Dot Marking
8	Black	20	Natural / Dot Marking
9	Yellow	21	Yellow / Dot Marking
10	Violet	22	Violet / Dot Marking
11	Rose	23	Rose / Dot Marking
12	Aqua	24	Aqua / Dot Marking

***Dot marking color: Black**

5. PHYSICAL / MECHANICAL / ENVIRONMENTAL PERFORMANCE AND TESTS

5.1 Temperature Range

- Storage/Shipping temperature range: -40 to 70 °C
- Installation temperature range: -30 to 70 °C
- Operating temperature range: -40 to 70 °C

5.2 Mechanical and Environmental Performance of the Cable

The mechanical and environmental performance of the cable shall be in accordance with Table 5 below. Unless otherwise specified, all attenuation measurements required in this section shall be performed at 1550nm.

Table 5. The Mechanical and Environmental Performance of the Cable

ITEMS	TEST METHOD AND ACCEPTANCE CRITERIA				
Tensile Strength	<ul style="list-style-type: none"> ▪ Test method: TIA/EIA-455-33B <ul style="list-style-type: none"> - Mandrel diameter: $\leq 40D$ (D = cable diameter) or Max.300mm - Installation tensile load: 1,350N (300lbf) for 1 hour - Residual tensile load: 400 N (90lbf) for 10 mins ▪ Acceptance Criteria <ul style="list-style-type: none"> - Fiber strain: $\leq 0.6\%$ for installation tensile load - Attenuation increment: ≤ 0.40 dB for residual tensile load - No jacket cracking and fibre breakage 				
Compressive Loading Resistance Test	<ul style="list-style-type: none"> ▪ Test method: TIA/EIA-455-41A <ul style="list-style-type: none"> - Load: <table border="1" data-bbox="595 1361 1267 1473"> <thead> <tr> <th data-bbox="595 1361 932 1435">Short term (For 1min)</th> <th data-bbox="932 1361 1267 1435">Long term (For 10min)</th> </tr> </thead> <tbody> <tr> <td data-bbox="595 1435 932 1473">100N/cm</td> <td data-bbox="932 1435 1267 1473">50N/cm</td> </tr> </tbody> </table> - No. of point: 1 point ▪ Acceptance Criteria <ul style="list-style-type: none"> - Attenuation Increment: <ul style="list-style-type: none"> \leq Reversible after the short term load ≤ 0.40 dB during the long term load - No jacket cracking and fibre breakage 	Short term (For 1min)	Long term (For 10min)	100N/cm	50N/cm
Short term (For 1min)	Long term (For 10min)				
100N/cm	50N/cm				
Impact resistance	<ul style="list-style-type: none"> ▪ Test method: TIA/EIA-455-25C <ul style="list-style-type: none"> - Impact Energy: 2.94N.m (2kg x 150mm) - No. of impact per point: 1 times at 3 points each ▪ Acceptance Criteria <ul style="list-style-type: none"> - Attenuation Increment: ≤ 0.40 dB after the test - No jacket cracking and fiber breakage 				

ITEMS	TEST METHOD AND ACCEPTANCE CRITERIA
Cyclic Flexing	<ul style="list-style-type: none"> ▪ Test method: TIA/EIA-455-104A <ul style="list-style-type: none"> - Sheave diameter: 20D (D = cable diameter) - Flexing speed: Minimum 30 cycles/minute - No. of flexing cycles: 25 cycles ▪ Acceptance Criteria <ul style="list-style-type: none"> - Attenuation Increment: ≤ 0.40 dB after the test - No jacket cracking and fiber breakage
Torsion	<ul style="list-style-type: none"> ▪ Test method: TIA/EIA-455-85A <ul style="list-style-type: none"> - Cable length twisted: 2m - No. of twist cycles: 10 cycles - Twist angle: ± 180° ▪ Acceptance Criteria <ul style="list-style-type: none"> - Attenuation Increment: ≤ 0.40 dB after the test - No jacket cracking and fiber breakage
Temperature Cycling	<ul style="list-style-type: none"> ▪ Test method: TIA/EIA-455-3B <ul style="list-style-type: none"> - Temperature cycling schedule : 23°C → -40°C → 70°C → -40°C → 70°C - Soak time at each temperature: 8hours ▪ Acceptance Criteria <ul style="list-style-type: none"> - Attenuation increment: ≤ 0.40 dB/km
Water Penetration	<ul style="list-style-type: none"> ▪ Test method: TIA/EIA-455-82C <ul style="list-style-type: none"> - Length of specimen: 3m - Height of pressure head: 1m - Test time: 24 hours ▪ Acceptance Criteria <ul style="list-style-type: none"> - No leakage through the open cable end

6. PACKING AND MARKING

6.1 Cable Marking

The sheath shall be marked with white characters at intervals of 1 meter(or Two Feet) with following information. Other marking is also available if requested by customer.

- 1) Cable Type
- 2) Fiber Counts
- 3) Name of the Manufacture
- 4) Year of Manufacture
- 5) Length marking

6.2 Cable Packing

6.2.1 Standard length of the cable shall be 2,000m. Other cable length is also available if requested by customer.

6.2.2 Each length of the cable shall be wound on a separate wooden reel.

6.2.3 Both ends of the cable shall be sealed with suitable plastic caps to prevent the entry of moisture during shipping, handling and storage.

6.2.4 The cable ends shall be securely fastened to the reel to prevent the cable from becoming loose in transit or during placing operations.

6.2.5 Circumference battens or wood-fiber board shall be secured with bands to protect the cable during normal handling and shipping.

6.3 Cable Reel

6.3.1 Details given below shall be distinctly marked on a weather proof materials on both outer sides of the reel flange

- 1) Purchaser's name
- 2) Cable length in meters
- 3) Cable type and fiber counts
- 4) Gross weight in kilogram
- 5) Reel number
- 6) Year of manufacture
- 7) Drum rolling direction

* Other shipping mark is also available if requested by customer.

6.3.2 The cable shall be wound on the reel designed to prevent damages during shipment and installation.

6.3.3 The arbor holes provided in the reels shall be at least 65 mm and at most 120 mm in diameter.

7. HEALTH, SAFETY AND ENVIRONMENT

7.1 ROHS DIRECTIVE

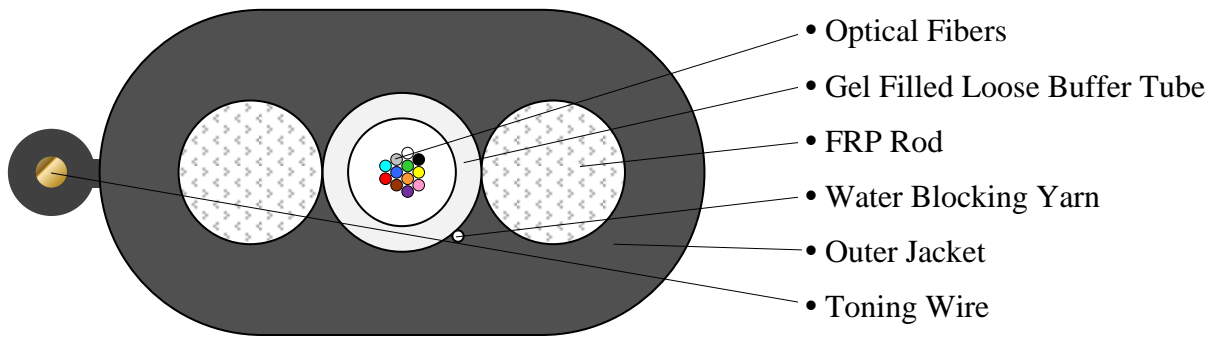
All cables and any associated packing and labeling materials shall meet RoHS (Restriction of the Use of certain Hazardous Substances) regulations as appropriate.

7.2 ISPM 15

All wooden packing materials shall meet ISPM (International Standards for Phytosanitary Measures) regulations as appropriate.

8. CROSS-SECTIONAL DRAWING OF CABLE

Example for 12F Cable



- Not to scale -

No. of Fibers	Cable Diameter (± 0.3mm)	Approx. Cable Weight(kg/km)	Min. Bending Radius (mm)	
			No Load	Under Load
Up to 12	4.3 × 10.1	42	80	160
24	4.3 × 10.1	41	80	160

*Actual values for cable weight and diameter may deviate from the calculated values given in the table above.

= End of Specification =