Central Aluminum Cladding Stainless Steel Optical Unit OPGW

Technical Specification for Optical Fiber Composite Overhead Ground Wires

1. SCOPE

This technical specification covers the structure, mechanical, physical, electrical performance, and optical fiber requirements for Optical Fiber Composite Overhead Ground Wires (OPGW), which is made of aluminum-clad steel wire (ACS) and stainless steel tube containing optical fiber unit for use as overhead ground wire and telecommunication.

2. STANDARDS

Unless otherwise specified in this specification, all requirements for individual wires and completed conductor shall be mainly in accordance with the following standard specifications.

Optical fiber cables——Aerial Optical Cables Along Electrical Power Lines					
Aluminum Magnesium-Silicon Alloy Wire for Over-Head Line Conductors					
Generic Specifications, Optical Fibers					
Product specifications, Optical Fibers					
Generic Specification, Optical Fiber Cables					
Generic Specification Basic optical cable test procedures					
Round Wire Concentric Lay Overhead Electrical Standard Conductors					
Aluminum-Clad Steel Wire for Electrical Purposes					
Electrical Mechanical and Physical Requirements and Test Methods of Optical Ground Wire					
(OPGW)					
Definition and test method for the relevant parameters of single-mode fibers					
Characteristics of a Single-Mode Optical Fibers					
Characteristics of Non-Zero Dispersion-Shifted Single-Mode Optical Fibers					
Standard Construction of Composite Fiber Optic Overhead Ground Wires(OPGW) for use on					
Electric Utility Power Lines					
Standard Specification for Aluminum-Alloy 6201-T81 Wire for Electrical Purposes					
Standard Specification for Hard-Drawn Aluminum-Clad Steel Conductors					
Specification for Concentric-Lay-Stranded Aluminum-Clad Steel					
Conductors					
Standard Test Procedures for Optic Fibers, Cables, Transducers, Sensors, Connecting and					
Terminating Devices and other Fiber Optic Components					
Generic Specification for Optical Waveguide Fibers					
Sectional Specification for Fiber Optic Communication Cables for Outside Aerial Use					
or ANSI/EIA 359-A-1984. ⁶ Color Code of Fiber Optic Cables					
Quality Management Systems					
Environmental Management Systems					

3. Optical and mechanical characteristics of fiber

Fiber parameters: G.652D

Construction				
Mode Field Diameter @ 1310 n	$9.2\pm0.4~\mu m$			
Mode Field Diameter @ 1550 n	m	$10.4 \pm 0.8 \ \mu m$		
Cladding diameter		$125.0 \pm 1 \ \mu m$		
Core/cladding concentricity error	or	$\leq 0.6 \ \mu m$		
Cladding non-circularity		≤ 1.0 %		
Refractive index profile		Step		
Design		Matched cladding		
Primary coating material		UV curable acrylate		
Primary coating Diameter		$250 \pm 15 \ \mu m \ (colored)$		
Optical Characteristics				
	@ 1310nm	$\leq 0.36 \text{ dB/km}$		
Attenuation	@ 1383± <mark>3</mark> nm	$\leq 0.34 \text{ dB/km}$		
	@ 1550nm	$\leq 0.22 dB/km$		
	@ 1288 ~ 1339nm	\leq 3.5 ps/nm·km		
Dispersion	@ 1550nm	$\leq 18 \text{ ps/nm} \cdot \text{km}$		
Zero dispersion wavelength		1300 – 1324 nm		
Dispersion slope at zero dispers	ion wavelength	$\leq 0.092 \text{ ps/nm}^2 \cdot \text{km}$		
Cabled cut-off wavelength (λcc)	≤ 1260 nm		
Polarization mode dispersion lin	$\leq 0.2 \text{ ps/}\sqrt{\text{km}}$			
Mechanical Characteristics				
Proof stress level	≥0.69 GPa			
The loss increase of 100 turns of fiber loosely wound with		≤0.05dB (at 1550nm)		
25mm radius				
Effective group index of refract	1.4677 (at 1310nm)			
Effective group index of refract	1.4682 (at 1550nm)			

4. Structure and Specification of OPGW

4.1 16fibers OPGW

- 4.1.1 Cable type: OPGW-24G652D-80
- 4.1.2 Cross section of OPGW



		Material	No.	Material	No.	Materia	ıl Dia.	
Structure	Fiber	G.652D	24	G.655	0			
	Center	SUS Tube	1	Fibers all	24	Diameter	4.00mm	
	Layer 1	23%AS wire	6			Diameter	3.95mm	

	According to IEC, IEEE, DL/T 832-2003, GB/T 7424.4-2003 standards	
Tashuisal Data	Stranded :core, layer1	
Technical Data	Stranding direction of outer layer is right hand (Z-stranding)	
	Cable diameter	11.8mm

	Cable Weight	488kg/km
	Supporting Cross Section	79.41mm ²
	Section of AS Wire	75.40mm ²
	Section of AA Wire	0 mm^2
	Ultimate Tensile Strength(UTS)	85.2kN
	Rated Tensile Strength(RTS)	80.7kN
	Modulus of Elasticity(E-Modulus)	150.0kN/mm ²
	Thermal Elongation Coefficient	13.0×10 ⁻⁶ /K
	Permissible Maximum Working Stress(40%RTS long term)	32.3kN
	Everyday Stress(EDS)(18%~25%RTS)	14.5~20.2kN
	Maximum strain stress(70%RTS)	48.4kN
	DC Resistance	1.018 ohm/km
	Short Time Current (0.3s, 40° C \sim 300 $^{\circ}$ C)	11.94kA
	Short Time Current Capacity I ² t	42.8kA ² • s
	Minimum Bending Ra(Installation:	25D
	Operation:	15D
	Ratio between Pull and Weight	12.8km
Temperature	Installation	-30°C∼+70°C
Range	Transportation and Operation	-40°C~+80°C

4.1.3 Color of the fiber

Fiber Colors

NO.	1	2	3	4	5	6	7	8	9	10	11	12
Color	Blue	Orange	Green	Brown	Slate	White	Red	Nature	Yellow	Purple	Pink	Aqua
ack ring r	nark (10	0mm pi	tch)									
NO.	13	14	15	16	17	18	19	20	21	22	23	24
Color	Blue	Orange	Green	Brown	Slate	White	Red	Nature	Yellow	Purple	Pink	Aqua
	NO. Color ack ring r NO. Color	NO. 1 Color Blue ack ring mark (10 NO. 13 Color Blue	NO. 1 2 Color Blue Orange ack ring mark (100mm pi NO. 13 14 Color Blue Orange	NO.123ColorBlueOrangeGreenack ring mark (100mm pitch)NO.131415ColorBlueOrangeGreen	NO. 1 2 3 4 Color Blue Orange Green Brown ack ring mark (100mm pitch) NO. 13 14 15 16 Color Blue Orange Green Brown	NO.12345ColorBlueOrangeGreenBrownSlateack ring mark (100mm pitch)NO.1314151617ColorBlueOrangeGreenBrownSlate	NO.123456ColorBlueOrangeGreenBrownSlateWhiteack ring mark (100mm pitch)NO.131415161718ColorBlueOrangeGreenBrownSlateWhite	NO.1234567ColorBlueOrangeGreenBrownSlateWhiteRedack ring mark (100mm pitch)NO.13141516171819ColorBlueOrangeGreenBrownSlateWhiteRed	NO.12345678ColorBlueOrangeGreenBrownSlateWhiteRedNatureack ring mark (100mm pitch)NO.1314151617181920ColorBlueOrangeGreenBrownSlateWhiteRedNature	NO.123456789ColorBlueOrangeGreenBrownSlateWhiteRedNatureYellowack ring mark (100mm pitch)NO.131415161718192021ColorBlueOrangeGreenBrownSlateWhiteRedNatureYellow	NO. 1 2 3 4 5 6 7 8 9 10 Color Blue Orange Green Brown Slate White Red Nature Yellow Purple ack ring mark (100mm pitch) NO. 13 14 15 16 17 18 19 20 21 22 Color Blue Orange Green Brown Slate White Red Nature Yellow Purple	NO. 1 2 3 4 5 6 7 8 9 10 11 Color Blue Orange Green Brown Slate White Red Nature Yellow Purple Pink ack ring mark (100mm pitch) NO. 13 14 15 16 17 18 19 20 21 22 23 Color Blue Orange Green Brown Slate White Red Nature Yellow Purple Pink MO. 13 14 15 16 17 18 19 20 21 22 23 Color Blue Orange Green Brown Slate White Red Nature Yellow Purple Pink Mo. Mo M

5.TEST AND INSPECTION

The OPGW cable shall successfully pass the following tests which don't must been chosen all. The following test items shall be carried out in according to corresponding reference.

No	Item	Reference				
OPGW tests						
1	Cutoff wavelength	IEEE Std 1138				
2	Water ingress test	IEEE Std 1138				
3	Seepage of flooding compound	IEEE Std 1138				
4	Short circuit test	IEEE Std 1138				
5	Aeolian vibration test	IEEE Std 1138				
6	Sheave test	IEEE Std 1138				
7	Crush test	IEEE Std 1138				
8	impact test	IEEE Std 1138				
9	Creep test	IEEE Std 1138				
10	Stress-strain test	IEEE Std 1138				
11	Temperature cycling	IEEE Std 1138				
12	Strain margin test	IEEE Std 1138				
13	Galloping test	IEEE Std 1138				
14	Lightning test	IEEE Std 1138				
Fiber tests						
1	Attenuation variation with wavelength	IEEE Std 1138				
2	Attenuation with bending	IEEE Std 1138				
3	Temperature cycling	IEEE Std 1138				
4	Attenuation at the water peak	IEEE Std 1138				
Field acceptance tests						

1	Fiber continuity	IEEE Std 1138
2	Attenuation	IEEE Std 1138
3	Fiber length	IEEE Std 1138

6. PACKING AND SHIPPING

The OPGW shall be tightly and uniformly wound on a strong wood-iron reel which conforms to ANSI/AA 53-1981 or equal. The reel shall be lagged with stout wood-iron battens so as to prevent the OPGW from damage in ordinary shipping, handling, storage and stringing operations.

Fig. 3. Drawing of Reel



According to length of cable, we choose different type reel (D,d,b,w1,w2) for loading cable. **7.INSTALLATION RECOMMENDATIONS**

6.1Installation procedure

It is recommended that IEEE Std 524-1992 and our company recommended procedures be used for the installation of OPGW.

----- End of technical specification ------