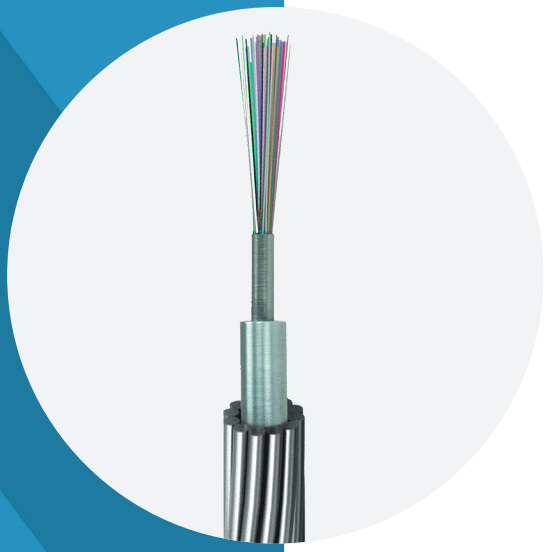


CENTRAL TUBE OPGW CABLE

AR-1-CT-OPGW-107.6KN-36F-G652D

1. GENERAL

1.1. SCOPE

This specification covers Optical Ground Wire Cables (OPGW) for the installation on high voltage overhead power lines. The cable contains optical fibers for data transmission and telecom purposes and is installed instead of a ground wire.

The specification describes the basic design of an OPGW-cable with its main components: the fibers, the optical fiber unit and the cable armoring. Furthermore this specification contains information concerning the quality assurance during manufacturing, the final acceptance tests, the type tests and the packaging. Any technical data mentioned in this product specification serve for describing the product only and should not be understood as an assurance of properties.

1.2. CABLE DESCRIPTION

Cable which has the dual performance functions of a conventional ground wire with telecommunication capabilities.

1.3. QUALITY

Ensures a continuing level of quality in our cable products through several quality control programs including ISO 9001.

1.4. RELIABILITY

Ensures product reliability through rigorous qualification testing of each product family. Both initial and periodic qualification testing are performed to assure the cable's performance and durability in the field environments.

1.5. REFERENCE

The cable which 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.652	Characteristics of a single-mode optical fiber cable
ITU-T G.655	Characteristics of a non-zero dispersion-shifted single-mode optical fiber and cable

EIA/TIA 598B	Color code of fiber optic cables
IEC 60794-4-10	Aerial optical cables along electrical power lines – Family specification for OPGW
IEC 60794-1-2	Optical fiber cables-Part 1-2: Generic specification-Basic optical cable test procedures
IEEE1138-2009	IEEE Standard for testing and performance for optical ground wire (OPGW) for use on electric utility power lines
IEC 61232	Aluminum – clad steel wire for electrical purposes
IEC 60104	Aluminum magnesium-silicon alloy wire for overhead line conductors
IEC 61089	Round wire concentric lay overhead electrical stranded conductors

2. OPTICAL FIBRE

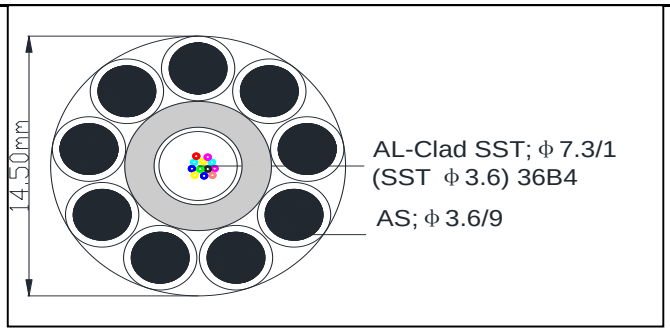
Optical Fibres supplied in this specification meet the requirements of ITU-T G.652.D

Category	Description	Specification
		After cable
TRANSMISION SPECIFICATION	Attenuation @ 1310 nm	≤ 0,344 dB/Km
	Attenuation @ 1383 nm	≤ 0,344 dB/Km
	Attenuation @ 1550 nm	≤ 0,214 dB/Km
	Attenuation @ 1625 nm	≤ 0,234 dB/Km
	Attenuation VS wavelength (Range 1285-1330 nm / Ref 1310 nm)	≤ 0,03 dB/Km
	Attenuation VS wavelength (Range 1525-1575 nm / Ref 1550 nm)	≤ 0,02 dB/Km
	Point discontinuity @ 1310 nm	≤ 0,05 dB
	Point discontinuity @ 1550 nm	≤ 0,05 dB
	Zero dispersion Wavelength	1300 - 1324 nm
	Zero dispersion slope	0,092 ps/ (nm2 · Km)
	Chromatic Dispersion @ 1310 nm	≤ /3.2/ ps/ (nm · Km)
	Chromatic Dispersion @ 1550 nm	≤ 17 ps/ (nm · Km)
	Chromatic Dispersion @ 1625 nm	≤ 22 ps/ (nm · Km)
	PMD (individual in fiber)	≤ 0,2 ps / Km½
	Cable cut off Wavelength	≤ 1260 nm

OPTICAL SPECIFICATION	Mode field diameter	(8.8~9.5 µm)
	Mode field diameter	(10,4 µm ± 0,5 µm)
	Macro bending loss (100 turns / 50 mm diameter / 1550 nm)	≤ 0,05 dB
	Macro bending loss (100 turns / 60 mm diameter / 1625 nm)	≤ 0,05 dB
GEOMETRICAL SPECIFICATION	Cladding diameter	(125 µm ± 1 µm)
	Core/Clad concentricity	≤ 0,5 µm
	Cladding non circularity	≤ 1%
	Coating diameter	(242 µm ± 5 µm)
	Coating/Cladding concentricity	≤ 12 µm
ENVIRONMENTAL SPECIFICATION	Temperature dependence (- 60 °C to 85 °C)	≤ 0,05 dB/km
	Temperature Humidity Cycling (- 10 °C to 85 °C up to 98% RH)	≤ 0,05 dB/km
	Water immersion (23 °C ± 2 °C)	≤ 0,05 dB/km
	Heat aging (85 °C ± 2 °C)	≤ 0,05 dB/km
	Damp heat (85 °C at 85% RH)	≤ 0,05 dB/km

3. CONSTRUCTURE AND SPECIFICATIONS FOR OPGW

1、Structure Drawing



2、Specifications

Layer	Name	Conductivity	Amount	Diameter(mm)	
Center layer	AL Tube	61.0%	1	wire diameter	3.8/7.3
	SST Tube	--	1	wire diameter	3.60
1st layer	AS	20.3%	9	wire diameter	3.60
	AS	20.3%	0	wire diameter	3.60
No	Items	Unit	Requirements	Designed value	
1	Cable diameter	mm		14.5	
2	Cable unit weight	kg/km		719	
3	Carrying area	mm^2		122.1	
4	AL/AS/AA area	mm^2		30.5/91.6/0	
5	Outer layer direction			Right hand	

3、Technical parameter

No	Technical parameter	Unit	Requirements	Designed value
				Refer to IEC standard
1	Ultimate tensile strength(UTS)	kN		114.5
2	Rated tensile Strength (RTS)	kN		107.6
3	Elasticity coefficient	kN/mm^2		135.3
4	Thermal expansion coefficient	$10^{-6}/℃$		14.0
5	EDT (18%~25%RTS) everyday tension	N/mm^2		158.7~220.4
6	MAT (40%RTS) Maximum allowable tension	N/mm^2		352.6
6	Ultimate Exceptional Stress(70%RTS)	N/mm^2		617.0
7	20℃ DC resistance	Ω/Km		0.466
8	Short-circuit current(1s，40℃～200℃)	kA		9.64
9	Short-circuit current capacity(40℃～200℃)	$kA^2 \cdot s$		92.8
10	Min bending radius	mm		290/217.5
11	Installation temperature range	℃		-10~+50
12	Transportation/operation temperature range	℃		-40~+80

4、Fiber chromatogram

color / No	Blue、Orange、Green、Brown、Grey、White、Red、Origin、Yellow、Violet、Pink、Aqua
1-36	G.655(Full chromatogram+Full chromatogramS0+Full chromatogramS00)

Note: S0 represent the fibers with black tracer

4. TEST REQUIREMENTS FOR OPGW

4.1. GENERAL

There are different test series to assure the quality of OPGW:

- Routine test (in–process testing according to internal quality plan)
- Factory acceptance test (FAT, witnessed by customer)
- Type test (only in case of a basic new design, repetition in exceptional cases)

OPGW tests shall be in accordance with applicable standards or agreements between purchaser and manufacturer.

As a general rule the tests will be performed according IEC 60794-4-10.However, if necessary tests can be done according to IEEE Std1138.

Type test

Type test may be waived by submitting maker's certificate of the similar product performed in an internationally acknowledged independent test organization or laboratory. If type test should be performed, it will be carried out according to an extra type test procedure reached to an agreement between purchaser and manufacturer.

Routine test

The optical attenuation coefficient on all production cable lengths is measured according to IEC 60793-1-CIC (Back-scattering technique, OTDR). Standard single-mode fibers are measured at 1310nm and at 1550nm. Non-zero dispersion shifted single–mode (NZDS) fibers are measured at 1550nm.

Factory test

Factory acceptance test is carried out on two samples per order in the presence of the customer or his representative. The requirements for quality characteristics are determined by relevant standards and agreed quality plans.

The following table shows that the test items shall be carried out according to corresponding references.

	Routine	FAT	Type Test	Test Procedure
Test on fibers				
Mode field diameter				IEC 60793-1-45
Geometric parameter				IEC 60793-1-20
Attenuation (OTDR)	√	√		IEC 60793-1-40
Test on fibers				IEC 60793-1-42
Test on fibers				IEC 60793-1-44

Notes: The mark "√" means different test items which belongs to different test series.