Spec No.: ZTT 18-88240

TECHNICAL SPECIFICATION

Optical Ground Wire

Version	Date	Prepared	Reviewed	Approved
A	June 30, 2018	Linda	Lemon	Felix

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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

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

1.4 Reliability

ZTT 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 ZTT 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 598 B	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 FIBER

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.

Optical fiber uses special spun device successfully controlled the value of PMD, and makes sure that it can keep stable in cabling.

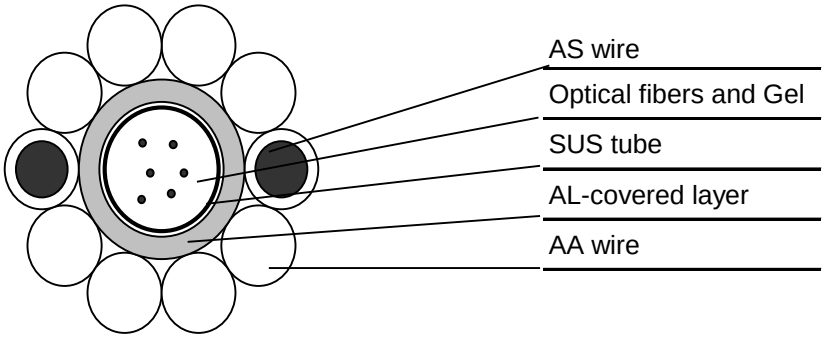
G.652D Fiber in cable

Category	Description	Specifications
		After cabling
Optical Specifications	Attenuation @1310 nm	≤ 0.36 dB/km
	Attenuation @1550 nm	≤ 0.22 dB/km
	Zero Dispersion Wavelength	1300~1324 nm
	Zero Dispersion Slope	0.073~0.092 ps/nm^2·km
	PMD Link value	≤0.2 ps/√km
	Cable Cutoff Wavelength (λ_{cc})	≤1260 nm
	Macro bending Loss (100 turns; Φ50 mm) @1550 nm (100 turns; Φ50 mm) @1625 nm	 ≤ 0.05 dB ≤ 0.10 dB
	Mode Field Diameter @1310 nm	9.2±0.4μm
Dimensional Specifications	Cladding Diameter	125 ±0.7μm
	Core/clad concentricity error	≤0.6μm
	Cladding Non-Circularity	≤1%
Mechanical Specifications	Proof stress	≥0.69Gpa

3. CABLE STRUCTURAL DRAWING

ZhongTian	Type 1	Serial No:	ZTT2018-88240
	OPGW Cable Specifications	Bid No:	OPGW

Cable Type: **OPGW - 48G652-AST-65 [24.1;43.7]** ELNR.:10 009 91



		Material	No	Material	No.	Material Dia.	
OPGW Structure	Fiber	G.652	48				
	US Tube	SUS	1			SUS outer-Dia.	3.50 mm
	AL-tube		1	Inner-Dia.	3.70	Outer-Dia.	5.80 mm
	Layer1	20.3%AS wire	2	AA wire	8	Diameter	2.50 mm

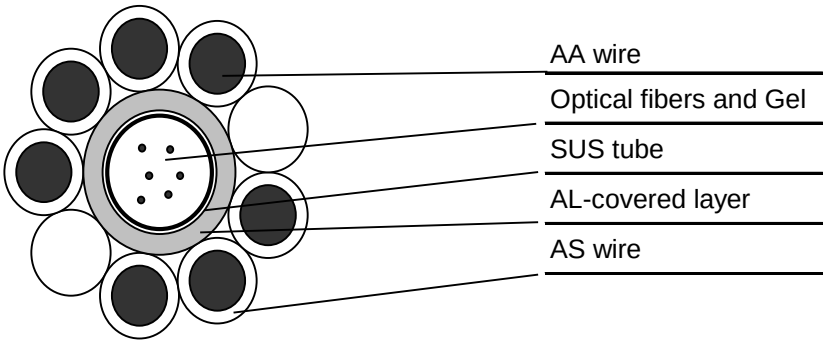
Technical Data	according to IEC60794-4-1, IEEE-1138 standards Stranding direction of outer layer is right hand(Z-Stranding)			
	Cable Diameter			10.80 mm
	Cable Weight			241 kg/km
	Supporting Cross Section			64.8 mm^2
	Section of AS Wire	9.82 mm^2		
	Section of AA Wire	39.27 mm^2		
	Section of AL Tube	15.67 mm^2		
	Rated Tensile Strength (RTS)			24.1 kN
	Modulus of Elasticity (E-Modulus)			77.5 kN/mm^2
	Thermal Elongation Coefficient			19.8 $\times 10^{-6}/℃$
	Permissible Maximum Working Stress (40% RTS)			148.8 N/mm^2
	Everyday Stress（EDS) (16%~25% RTS)		59.5	~93 N/mm^2
	DC Resistance			0.538 Ω/km
	Short Time Current	(1s)		6.6 kA
	Short Time Current Capacity	(20℃~200℃)		43.7 kA^2S
	Minimum Bending Radius：	Installation：		216 mm
		Operating：		162 mm
Temperature Range:	Installation			-10℃ ~ +50 ℃
	Transportation and Operation			-40℃ ~ +80 ℃

Remarks: All Sizes and Values are Nominal Values
Diameter Tolerance: ±1%； Weight Tolerance: ±2%；

Rev. ZTT-TD	Designer	linda.cai	Authorized	Lemon Lu	2018/6/30

ZhongTian	Type 2	Serial No:	ZTT2018-88240
	OPGW Cable Specifications	Bid No:	OPGW

Cable Type: **OPGW - 48G652-AST-81 [67.2;55.2]** ELNR.: 10 009 92



		Material	No	Material	No.	Material Dia.	
OPGW Structure	Fiber	G.652	48				
	US Tube	SUS	1			SUS outer-Dia.	3.50 mm
	AL-tube		1	Inner-Dia.	3.70	Outer-Dia.	6.00 mm
	Layer1	20.3%AS wire	7	AA wire	2	Diameter	3.00 mm

Technical Data	according to IEC60794-4-1, IEEE-1138 standards			
	Stranding direction of outer layer is right hand(Z-Stranding)			
	Cable Diameter			12.00 mm
	Cable Weight			435 kg/km
	Supporting Cross Section			81.1 mm^2
	Section of AS Wire	49.48 mm^2		
	Section of AA Wire	14.14 mm^2		
	Section of AL Tube	17.52 mm^2		
	Rated Tensile Strength (RTS)			67.2 kN
	Modulus of Elasticity (E-Modulus)			122.2 kN/mm^2
	Thermal Elongation Coefficient			14.9 $\times 10^{-6}/℃$
	Permissible Maximum Working Stress (40% RTS)			331.1 N/mm^2
	Everyday Stress（EDS) (16%~25% RTS)		132.4 ~206.9	N/mm^2
	DC Resistance			0.616 Ω/km
	Short Time Current	(1s)		7.4 kA
	Short Time Current Capacity	(20℃~200℃)		55.2 kA^2S
	Minimum Bending Radius：	Installation：		240 mm
		Operating：		180 mm
Temperature Range:	Installation		-10℃ ~ +50 ℃	
	Transportation and Operation		-40℃ ~ +80 ℃	

Remarks: All Sizes and Values are Nominal Values
Diameter Tolerance: ±1%； Weight Tolerance: ±2%；

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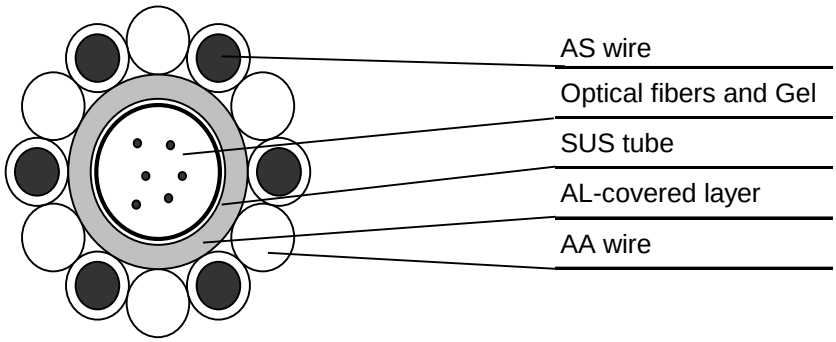
ZTT 中天科技 ZhongTian	Type 3	Serial No:	ZTT2018-88240
	OPGW Cable Specifications	Bid No:	OPGW

Cable Type: **OPGW - 96G652-AST-84 [46.2;60.4]** ELNR.: 10 009 93



		Material	No	Material	No.	Material Dia.	
OPGW Structure	Fiber	G.652	96				
	US Tube	SUS	1			SUS outer-Dia.	4.50 mm
	AL-tube		1	Inner-Dia.	4.70	Outer-Dia.	7.40 mm
	Layer1	20.3%AS wire	6	AA wire	6	Diameter	2.50 mm

Technical Data	according to IEC60794-4-1, IEEE-1138 standards Stranding direction of outer layer is right hand(Z-Stranding)			
	Cable Diameter			12.40 mm
	Cable Weight			382 kg/km
	Supporting Cross Section			84.6 mm^2
	Section of AS Wire	29.45 mm^2		
	Section of AA Wire	29.45 mm^2		
	Section of AL Tube	25.66 mm^2		
	Rated Tensile Strength (RTS)			46.2 kN
	Modulus of Elasticity (E-Modulus)			96.1 kN/mm^2
	Thermal Elongation Coefficient			17.1 $\times 10^{-6}/℃$
	Permissible Maximum Working Stress (40% RTS)			218.4 N/mm^2
	Everyday Stress（EDS) (16%~25% RTS)		87.4	~136.5 N/mm^2
	DC Resistance			0.467 Ω/km
	Short Time Current	(1s)		7.8 kA
	Short Time Current Capacity	(40℃~200℃)		60.4 kA^2S
	Minimum Bending Radius：	Installation：		248 mm
		Operating：		186 mm
Temperature Range:	Installation		-10℃ ~ +50 ℃	
	Transportation and Operation		-40℃ ~ +80 ℃	

Remarks: All Sizes and Values are Nominal Values

Diameter Tolerance: ±1%； Weight Tolerance: ±2%；

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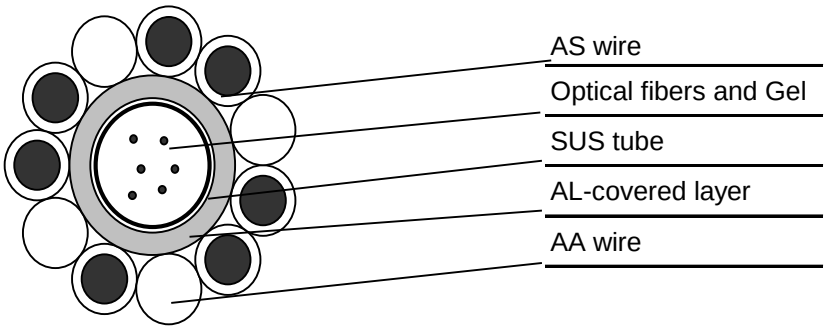
ZhongTian	Type 4	Serial No:	ZTT2018-88240
	OPGW Cable Specifications	Bid No:	OPGW

Cable Type: **OPGW - 96G652-AST-109 [71.3;96.1]** ELNR.: 10 009 94



		Material	No	Material	No.	Material Dia.	
OPGW Structure	Fiber	G.652	96				
	US Tube	SUS	1			SUS outer-Dia.	4.50 mm
	AL-tube		1	Inner-Dia.	4.70	Outer-Dia.	7.90 mm
	Layer1	20.3%AS wire	7	AA wire	4	Diameter	3.00 mm

Technical Data	according to IEC60794-4-1, IEEE-1138 standards Stranding direction of outer layer is right hand(Z-Stranding)			
	Cable Diameter			13.90 mm
	Cable Weight			529 kg/km
	Supporting Cross Section			109.4 mm^2
	Section of AS Wire	49.48 mm^2		
	Section of AA Wire	28.27 mm^2		
	Section of AL tube	31.67 mm^2		
	Rated Tensile Strength (RTS)			71.3 kN
	Modulus of Elasticity (E-Modulus)			106.3 kN/mm^2
	Thermal Elongation Coefficient			16.1 $\times 10^{-6}/℃$
	Permissible Maximum Working Stress (40% RTS)			260.7 N/mm^2
	Everyday Stress（EDS) (16%~25% RTS)		104.3	~163 N/mm^2
	DC Resistance			0.392 Ω/km
	Short Time Current	(1s)		9.8 kA
	Short Time Current Capacity	(40℃~200℃)		96.1 kA^2S
	Minimum Bending Radius：	Installation：		278 mm
		Operating：		208 mm
Temperature Range:	Installation		-10℃ ~ +50 ℃	
	Transportation and Operation		-40℃ ~ +80 ℃	

Remarks: All Sizes and Values are Nominal Values

Diameter Tolerance: ±1%； Weight Tolerance: ±2%；

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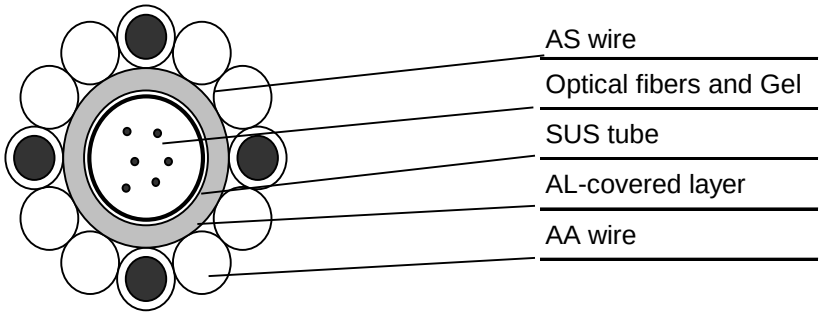
ZhongTian	Type 5	Serial No:	ZTT2018-88240
	OPGW Cable Specifications	Bid No:	OPGW

Cable Type: **OPGW - 144G652-AST-105 [47.1;92.3]** ELNR.: 10 009 95



		Material	No	Material	No.	Material Dia.	
OPGW Structure	Fiber	G.652	144				
	US Tube	SUS	1			SUS outer-Dia.	5.20 mm
	AL-tube		1	Inner-Dia.	5.40	Outer-Dia.	8.30 mm
	Layer1	20.3%AS wire	4	AA wire	8	Diameter	2.80 mm

Technical Data	according to IEC60794-4-1, IEEE-1138 standards Stranding direction of outer layer is right hand(Z-Stranding)		
	Cable Diameter		13.90 mm
	Cable Weight		384 kg/km
	Supporting Cross Section		105.1 mm^2
	Section of AS Wire	24.63 mm^2	
	Section of AA Wire	80.46 mm^2	
	Rated Tensile Strength (RTS)		47.1 kN
	Modulus of Elasticity (E-Modulus)		85.1 kN/mm^2
	Thermal Elongation Coefficient		18.5 $\times 10^{-6}/℃$
	Permissible Maximum Working Stress (40% RTS)		179.3 N/mm^2
	Everyday Stress（EDS) (16%~25% RTS)	71.7	~112.1 N/mm^2
	DC Resistance		0.366 Ω/km
	Short Time Current	(1s)	9.6 kA
	Short Time Current Capacity	(40℃~200℃)	92.3 kA^2S
	Minimum Bending Radius：	Installation：	278 mm
		Operating：	208 mm
Temperature Range:	Installation		-10℃ ~ +50 ℃
	Transportation and Operation		-40℃ ~ +80 ℃

Remarks: All Sizes and Values are Nominal Values

Diameter Tolerance: ±1%； Weight Tolerance: ±2%；

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4. COLOR IDENTIFICATION OF FIBER IN OPGW

4.1 Color code of fiber in OPGW shall be identified referring to the following table:

Typical number of fiber: 48

Remark	Fiber No. & Color					
Without Color Ring	**1**	**2**	**3**	**4**	**5**	**6**
	Blue	Orange	Green	Brown	Gray	White
	7	**8**	**9**	**10**	**11**	**12**
	Red	Nature	Yellow	Violet	Pink	Aqua
With S150 Color Ring	**13**	**14**	**15**	**16**	**17**	**18**
	Blue	Orange	Green	Brown	Gray	White
	19	**20**	**21**	**22**	**23**	**24**
	Red	Nature	Yellow	Violet	Pink	Aqua
With S120 Color Ring	**25**	**26**	**27**	**28**	**29**	**30**
	Blue	Orange	Green	Brown	Gray	White
	31	**32**	**33**	**34**	**35**	**36**
	Red	Nature	Yellow	Violet	Pink	Aqua
With S90 Color Ring	**37**	**38**	**39**	**40**	**41**	**42**
	Blue	Orange	Green	Brown	Gray	White
	43	**44**	**45**	**46**	**47**	**48**
	Red	Nature	Yellow	Violet	Pink	Aqua

Typical number of fiber: 96

Remark	Fiber No. & Color					
Without Color Ring	**1**	**2**	**3**	**4**	**5**	**6**
	Blue	Orange	Green	Brown	Gray	White
	7	**8**	**9**	**10**	**11**	**12**
	Red	Nature	Yellow	Violet	Pink	Aqua
With S150 Color Ring	**13**	**14**	**15**	**16**	**17**	**18**
	Blue	Orange	Green	Brown	Gray	White
	19	**20**	**21**	**22**	**23**	**24**
	Red	Nature	Yellow	Violet	Pink	Aqua
With S120 Color Ring	**25**	**26**	**27**	**28**	**29**	**30**
	Blue	Orange	Green	Brown	Gray	White
	31	**32**	**33**	**34**	**35**	**36**
	Red	Nature	Yellow	Violet	Pink	Aqua
With S90 Color Ring	**37**	**38**	**39**	**40**	**41**	**42**
	Blue	Orange	Green	Brown	Gray	White
	43	**44**	**45**	**46**	**47**	**48**
	Red	Nature	Yellow	Violet	Pink	Aqua
With S60 Color Ring	**49**	**50**	**51**	**52**	**53**	**54**
	Blue	Orange	Green	Brown	Gray	White
	55	**56**	**57**	**58**	**59**	**60**
	Red	Nature	Yellow	Violet	Pink	Aqua
With D160 Color Ring	**61**	**62**	**63**	**64**	**65**	**66**
	Blue	Orange	Green	Brown	Gray	White
	67	**68**	**69**	**70**	**71**	**72**
	Red	Nature	Yellow	Violet	Pink	Aqua
With D120 Color Ring	**73**	**74**	**75**	**76**	**77**	**78**
	Blue	Orange	Green	Brown	Gray	White
	79	**80**	**81**	**82**	**83**	**84**
	Red	Nature	Yellow	Violet	Pink	Aqua
With D80 Color Ring	**85**	**86**	**87**	**88**	**89**	**90**
	Blue	Orange	Green	Brown	Gray	White
	91	**92**	**93**	**94**	**95**	**96**
	Red	Nature	Yellow	Violet	Pink	Aqua

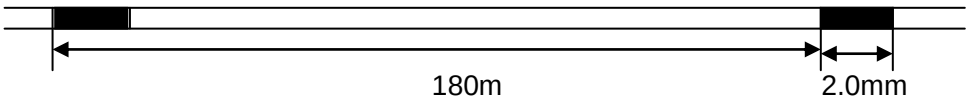
Typical number of fiber: 144

Remark	Fiber No. & Color					
Without Color Ring	**1**	**2**	**3**	**4**	**5**	**6**
	Blue	Orange	Green	Brown	Gray	White
	7	**8**	**9**	**10**	**11**	**12**
	Red	Nature	Yellow	Violet	Pink	Aqua
With S180 Color Ring	**13**	**14**	**15**	**16**	**17**	**18**
	Blue	Orange	Green	Brown	Gray	White
	19	**20**	**21**	**22**	**23**	**24**
	Red	Nature	Yellow	Violet	Pink	Aqua
With S150 Color Ring	**25**	**26**	**27**	**28**	**29**	**30**
	Blue	Orange	Green	Brown	Gray	White
	31	**32**	**33**	**34**	**35**	**36**
	Red	Nature	Yellow	Violet	Pink	Aqua
With S120 Color Ring	**37**	**38**	**39**	**40**	**41**	**42**
	Blue	Orange	Green	Brown	Gray	White
	43	**44**	**45**	**46**	**47**	**48**
	Red	Nature	Yellow	Violet	Pink	Aqua
With S90 Color Ring	**49**	**50**	**51**	**52**	**53**	**54**
	Blue	Orange	Green	Brown	Gray	White
	55	**56**	**57**	**58**	**59**	**60**
	Red	Nature	Yellow	Violet	Pink	Aqua
With S60 Color Ring	**61**	**62**	**63**	**64**	**65**	**66**
	Blue	Orange	Green	Brown	Gray	White
	67	**68**	**69**	**70**	**71**	**72**
	Red	Nature	Yellow	Violet	Pink	Aqua
With S30 Color Ring	**73**	**74**	**75**	**76**	**77**	**78**
	Blue	Orange	Green	Brown	Gray	White
	79	**80**	**81**	**82**	**83**	**84**
	Red	Nature	Yellow	Violet	Pink	Aqua
With D200 Color Ring	**85**	**86**	**87**	**88**	**89**	**90**
	Blue	Orange	Green	Brown	Gray	White
	91	**92**	**93**	**94**	**95**	**96**
	Red	Nature	Yellow	Violet	Pink	Aqua

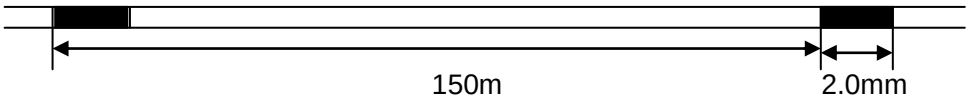
Remark	Fiber No. & Color					
With D160 Color Ring	**97**	**98**	**99**	**100**	**101**	**102**
	Blue	Orange	Green	Brown	Gray	White
	103	**104**	**105**	**106**	**107**	**108**
	Red	Nature	Yellow	Violet	Pink	Aqua
With D120 Color Ring	**109**	**110**	**111**	**112**	**113**	**114**
	Blue	Orange	Green	Brown	Gray	White
	115	**116**	**117**	**118**	**119**	**120**
	Red	Nature	Yellow	Violet	Pink	Aqua
With D80 Color Ring	**121**	**122**	**123**	**124**	**125**	**126**
	Blue	Orange	Green	Brown	Gray	White
	127	**128**	**129**	**130**	**131**	**132**
	Red	Nature	Yellow	Violet	Pink	Aqua
With D40 Color Ring	**133**	**134**	**135**	**136**	**137**	**138**
	Blue	Orange	Green	Brown	Gray	White
	139	**140**	**141**	**142**	**143**	**144**
	Red	Nature	Yellow	Violet	Pink	Aqua

Color ring method:

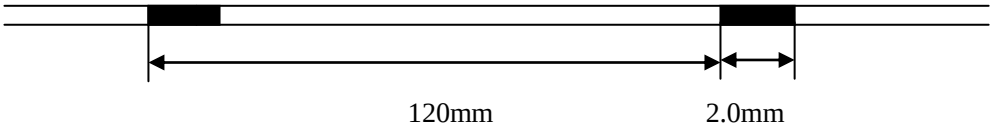
S180：Use single black color ring on the fiber surface with 180mm alternation：



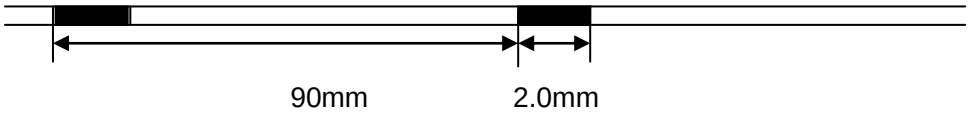
S150：Use single black color ring on the fiber surface with 150mm alternation：



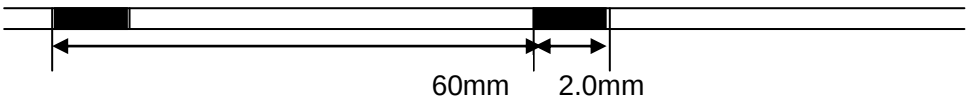
S120：Use single black color ring on the fiber surface with 120mm alternation：



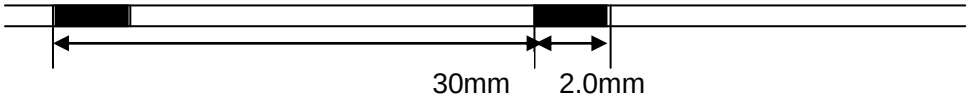
S90：Use single black color ring on the fiber surface with 90mm alternation：



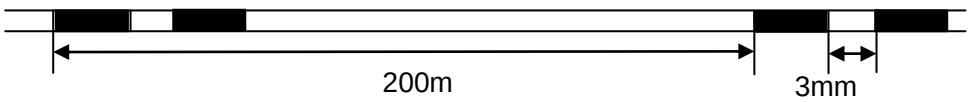
S60：Use single black color ring on the fiber surface with 60mm alternation：



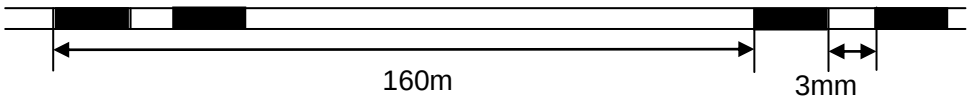
S30：Use single black color ring on the fiber surface with 30mm alternation：



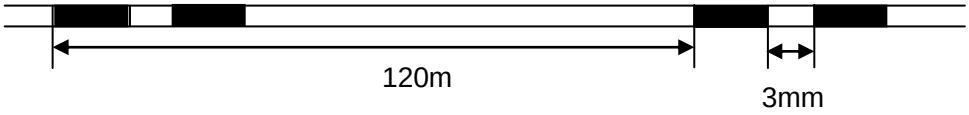
D200：Use double black color ring on the fiber surface with 200mm alternation：



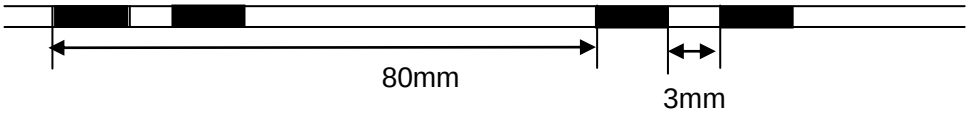
D160：Use double black color ring on the fiber surface with 160mm alternation：



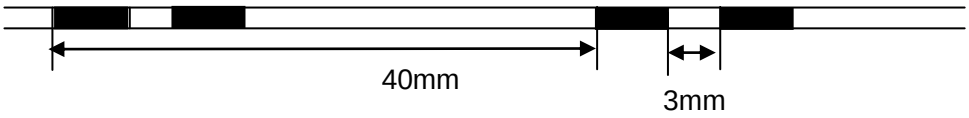
D120：Use double black color ring on the fiber surface with 120mm alternation：



D80：Use double black color ring on the fiber surface with 80mm alternation：



D40：Use double black color ring on the fiber surface with 40mm alternation：



5. TEST REQUIREMENTS FOR OPGW

5.1 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 one sample 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.

5.2 Test items

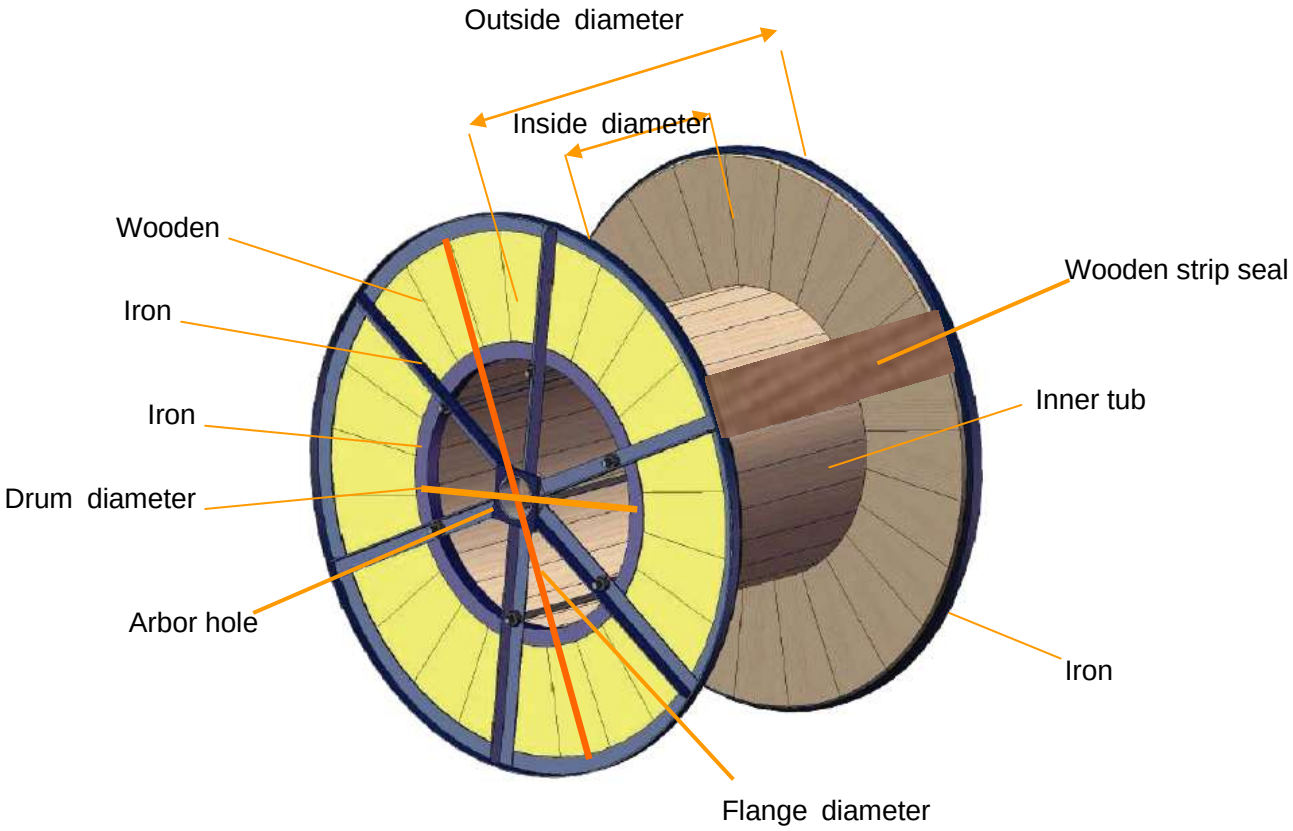
The following table shows that the test items will be carried out according to corresponding references.

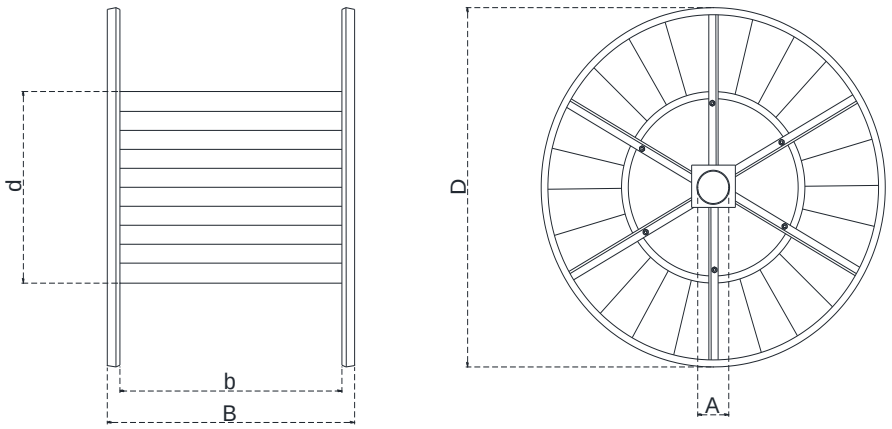
	Routine	FAT	Type Test	Test Procedure
Test on fibers				
Mode field diameter				IEC 60793-1-45
Geometric parameter				IEC 60793-1-20
Attenuation (OTDR)	●	●		IEC 60793-1-40
Chromatic dispersion				IEC 60793-1-42
Cut-off wavelength (cable cut off)				IEC 60793-1-44
Test on wires before stranding				
Diameter	●	●		IEC61232/ IEC60104
Tensile strength	●	●		IEC61232/ IEC60104
Stress at 1% extension（Only ACS wire）	●	●		IEC61232
Elongation at break	●	●		IEC61232/ IEC60104
Wrapping test（Only AA wire）	●	●		IEC60104
Conductivity	●	●		IEC61232/ IEC60104
Thickness of Al-cladding (Only ACS wire)	●	●		IEC61232
Torsion test （Only ACS wire）	●	●		IEC61232
Tests on OPGW				
Quality of surface	●	●		IEC 60794-4-10
Direction of lay outer	●	●		IEC 60794-4-10
Lay length	●	●		IEC 60794-4-10
Diameter of cable	●	●		IEC 60794-4-10
Weight of Cable	●	●		IEC 60794-4-10
DC-resistance			●	IEC 60794-4-10
Breaking strength test		●	●	IEC 60794-4-10
Stress Strain Test			●	IEC 60794-4-10
Tensile performance test			●	IEC 60794-4-10
Sheave test			●	IEC 60794-4-10
Aeolian vibration simulation			●	IEC 60794-4-10
Galloping test			●	IEC 60794-4-10
Creep test			●	IEC 60794-4-10
Temperature cycle test			●	IEC 60794-4-10
Water penetration			●	IEC 60794-4-10
Short circuit current test			●	IEC 60794-4-10
Lightning test			●	IEC 60794-4-10

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

6. PACKING AND DRUM

OPGW shall be wound round a non-returnable wooden drum or iron-wooden drum. Both ends of OPGW shall be securely fastened to drum and sealed with a shrinkable cap. The required marking shall be printed with a weatherproof material on the outsides of drum according to customer's requirement.





Cable Diameter (mm)	Drum Length (m)	Drum Dimensions & Weights					
		D	b	B	d	A	weight
		cm	cm	cm	cm	cm	kg
10.5-11.0	2000	120	90	110	80	10.5±0.5	150
	3000	120	90	110	80	10.5±0.5	150
	4000	130	90	110	80	10.5±0.5	170
	5000	140	90	110	80	10.5±0.5	190
12.0-12.5	2000	120	90	110	80	10.5±0.5	150
	3000	130	90	110	80	10.5±0.5	170
	4000	140	90	110	80	10.5±0.5	190
	5000	150	90	110	80	10.5±0.5	210
13.0-14.5	2000	130	90	110	80	10.5±0.5	170
	3000	140	90	110	80	10.5±0.5	190
	4000	150	90	110	80	10.5±0.5	210
	5000	160	90	110	80	10.5±0.5	240