ZTT GROUP

Established in 1992, ZTT started from optical fiber communications. ZTT was listed on Shanghai Stock Exchange (SSE) in 2002 (Stock Code in SSE: 600522), and issued the shares known as the "First Shares for Special Optical Fiber & Cable". Now ZTT has developed a diversified industries of telecom, power grid, marine system, renewable energy, new materials, etc.

Awarded for national innovative enterprise, Jiangsu province outstanding private enterprise, Top-500 Enterprise in China, China Quality Award, Gold-medal listed company, ZTT Group is now hosting 76 subsidiary companies and over 16,000 employees, with the deployment of Beijing Headquarters, Nantong New Headquarters, and Rudong Headquarters, as well as 54 offices and 10 marketing centers set up overseas, and 6 overseas plants operated in India, Brazil, Indonesia, Morocco, Turkey and Germany. ZTT has exported products to 160 countries and regions and has broken through the US$ 10.82 billion marks in revenue in 2020.

OPGW/OP-PC/ADSS

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2021.7

ZTT is specialized in research, development, production, marketing, service and support of special optical fiber cables for electrical power lines, e.g. OPGW, OPPC, ADSS and stainless steel tube series for sensor and detector.

ZTT establishes the largest OPGW manufacturing base in the world. It is the one who first imported 6 world-level first-class complete stainless steel tube production lines, 4 world-level loose tube stranded aluminum tube production lines and 20 world-level special OPGW cage stranding production lines. It forms about 70,000km annual output and becomes a professional company which has the biggest OPGW output and satisfies different customers' requirements with quickest delivery time.

The OPGW, OPPC, ADSS and other special power optic cables provided by ZTT are comprehensively used in optical fiber communication industry of power grid net work and telecommunication. Furthermore, the cables, which its total amount is over 550,000km, have been sold to more than130 countries and regions , such as India, Poland, Thailand, Vietnam, Spain, South Africa, Ethiopia, Zimbabwe, Indonesia and so on. The research and application of OPGW, OPPC and other special power optic cables are in a leading position in the world. It has made such many new technical records as large cross-section, big cores, large capacity, long span, ice resistance, sand, lightning resistance and ultra high voltage.

ZTT will consistently serve the telecommunication and power grid industry relying on its sales & services network in China and all over the world.

Type of Special optical fiber cables for electrical power lines

- OPGW(Optical Fiber Composite Overhead Ground Wire)

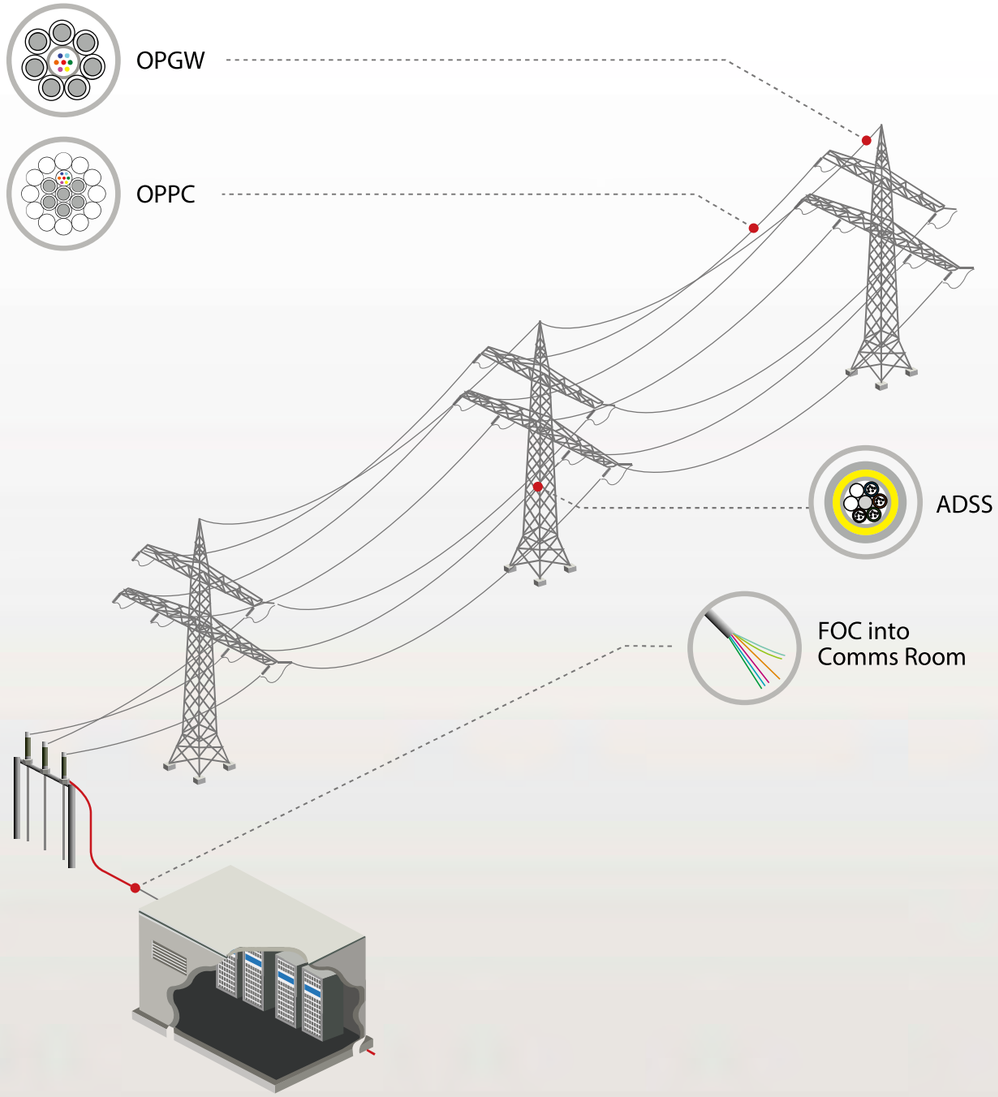
  OPGW cables have the dual functions of ground wire with communication capabilities.

- OPPC(Optical Fiber Composite Phase Conductor)

  OPPC cables have the dual functions performance functions of phase conductors with communication capabilities.

- ADSS(all-dielectric self-supported cable)

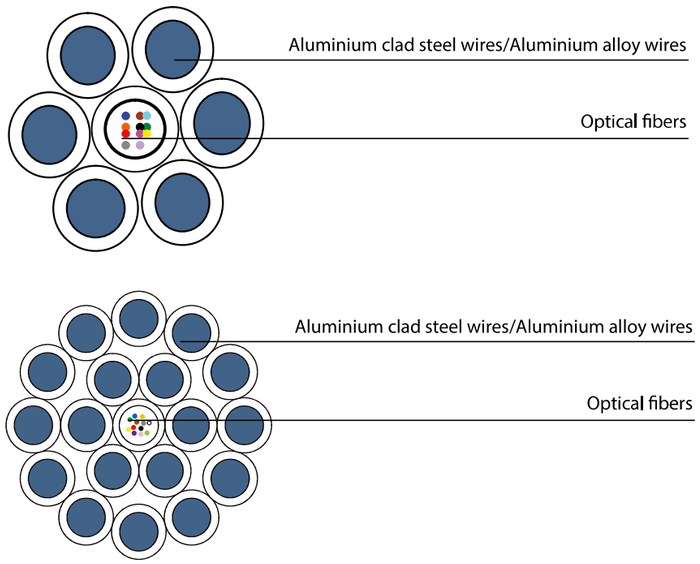
  ADSS cables are a kind of non-metal optical fiber cables suspended directly between two points without any supporting elements.



Typical Designs of Central Stainless Steel Tube OPGW

Central Tube OPGW
Single/Double Armour layers

The central stainless steel tube is surrounded by single or double layers of aluminium clad steel wires(ACS) or mix ACS wires and aluminium alloy wires.



Characteristic and Application

- Small cable diameter and short-circuit current capacity, light weight.
- The stainless steel tube can form a suitable primary fiber excess length.
- The OPGW has slightly worse tensile, torsion and crush resistance performance.
- Apply to the transformation of old lines.

Typical Parameters:

Single Layer

ZTT Standard	Fiber Count(Max)	Diameter (mm)	Weight (kg/km)	RTS (kN)	Short Circuit (kA^2s)
OPGW-32[40.6;4.7]	12	7.8	243	40.6	4.7
OPGW-42[54.0;8.4]	24	9.0	313	54.0	8.4
OPGW-42[43.5;10.6]	24	9.0	284	43.5	10.6
OPGW-54[67.8;13.9]	36	10.2	394	67.8	13.9
OPGW-54[55.9;17.5]	36	10.2	356	55.9	17.5
OPGW-61[73.7;17.5]	48	10.8	438	73.7	17.5
OPGW-61[55.1;24.5]	48	10.8	358	55.1	24.5
OPGW-68[80.8;21.7]	54	11.4	485	80.8	21.7
OPGW-75[63.0;36.3]	60	12.0	459	63.0	36.3
OPGW-76[54.5;41.7]	60	12.0	385	54.5	41.7
OPGW-79[51.2;49.5]	72	12.3	403	51.2	49.5

Double Layers

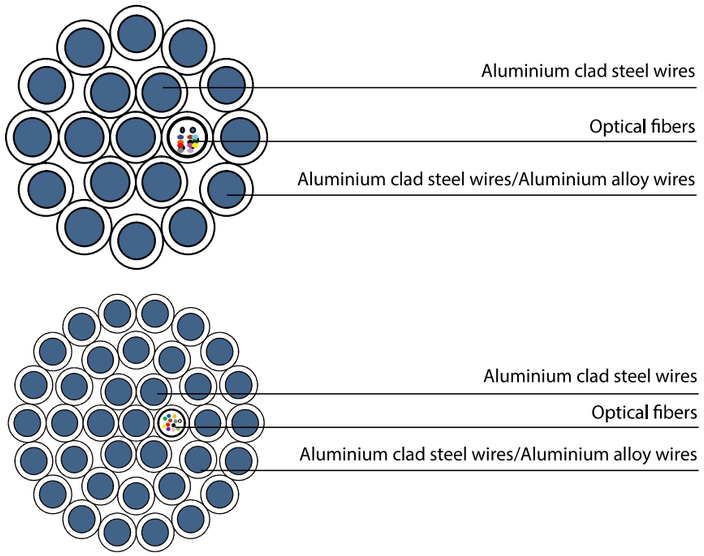
ZTT Standard	Fiber Count(Max)	Diameter (mm)	Weight (kg/km)	RTS (kN)	Short Circuit (kA^2s)
OPGW-96[121.7;42.2]	12	13.0	671	121.7	42.2
OPGW-127[141.0;87.9]	24	15.0	825	141.0	87.9
OPGW-127[77.8;128.0]	24	15.0	547	77.8	128.0
OPGW-145[121.0;132.2]	28	16.0	857	121.0	132.2
OPGW-163[138.2;183.6]	36	17.0	910	138.2	183.6
OPGW-163[99.9;213.7]	36	17.0	694	99.9	213.7
OPGW-183[109.7;268.7]	48	18.0	775	109.7	268.7
OPGW-183[118.4;261.6]	48	18.0	895	118.4	261.6

** The above designs are ZTT's typical options,and ZTT can provide any specific cable according to your requirement.*

Typical Designs of Stranded Stainless Steel Tube OPGW

OPGW With Stranded Layers, Single Tube And Multitube Are Available
Double /Three Armour Layers

The stainless steel tube is stranded by double or three layers of aluminium clad steel wires(ACS) or mix ACS wires and aluminium alloy wires.



Characteristic and Application

- larger cable diameter and much more fiber count.
- larger tensile strength and fault current capacity to reach a better balance of electrical and mechanical performance.
- The amount of Stainless Steel Tube could be 1, 2 or 3 (max. at present).
- Optimum stranding design to reach a suitable secondary fiber excess length.
- The stranded layers could be double layers or three layers, the stranded wires could be AS wires with/or AA and Al wires.

Typical Parameters:

Double Layers

ZTT Standard	Fiber Count(Max)	Diameter (mm)	Weight (kg/km)	RTS (kN)	Short Circuit (kA^2s)
OPGW-89[55.4;62.9]	24	12.6	381	55.4	62.9
OPGW-91[53.6;66.4]	24	12.7	377	53.6	66.4
OPGW-110[90.0;86.9]	24	14.0	600	90.0	86.9
OPGW-104[64.6;85.6]	28	13.6	441	64.6	85.6
OPGW-127[79.0;129.5]	36	15.0	537	79.0	129.5
OPGW-137[85.0;148.5]	36	15.6	575	85.0	148.5
OPGW-145[98.6;162.3]	48	16.0	719	98.6	162.3
OPGW-164[100.2;214.8]	48	17.1	687	100.2	214.8
OPGW-120[70.0;117.6]	72	15.0	509	70.0	117.6
OPGW-137[79.7;152.2]	96	16.0	574	79.7	152.2
OPGW-174[98.6;246.5]	128	18.2	724	98.6	246.5

Three Layers

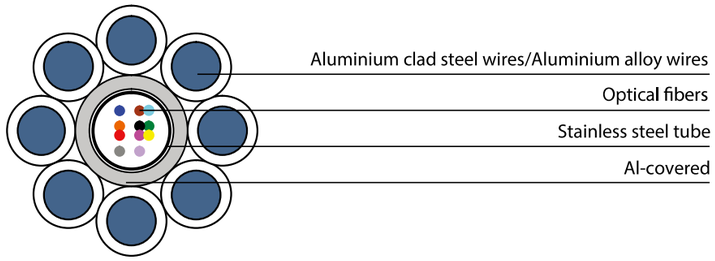
ZTT Standard	Fiber Count(Max)	Diameter (mm)	Weight (kg/km)	RTS (kN)	Short Circuit (kA^2s)
OPGW-232[343.0;191.4]	28	20.15	1696	343.0	191.4
OPGW-254[116.5;554.6]	36	21.0	889	116.5	554.6
OPGW-347[366.9;687.7]	48	24.7	2157	366.9	687.7
OPGW-282[358.7;372.1]	96	22.5	1938	358.7	372.1

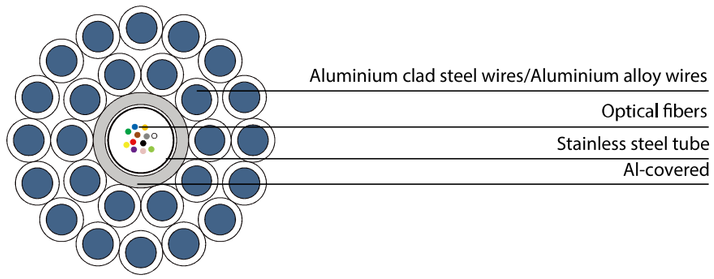
** The above designs are ZTT's typical options,and ZTT can provide any specific cable according to your requirement.*

Typical Designs of Central Al-covered Stainless Steel Tube OPGW

Central Al-covered stainless steel tube OPGW
Single/Double Armour Layers

The central Al-covered steel tube is surrounded by single or double layers of aluminium clad steel wires(ACS) or mix ACS wires and aluminium alloy wires.





Characteristic and Application

- Al-covered Stainless Steel tube design increases the cross section of AL, to reach a better fault current and lightning resistance performance.
- Good anti-corrosion performance.
- Apply to the transmission line which requires small diameter and large fault current.

Typical Parameters:

Single Layer

ZTT Standard	Fiber Count(Max)	Diameter (mm)	Weight (kg/km)	RTS (kN)	Short Circuit (kA^2s)
OPGW-78[78.7;37.6]	24	11.6	498	78.7	37.6
OPGW-77[63.6;41.6]	28	11.6	451	63.6	41.6
OPGW-77[78.6;36.2]	28	11.6	496	78.6	36.2
OPGW-111[58.9;103.7]	48	13.8	511	58.9	103.7
OPGW-187[75.3;308.2]	48	18.0	679	75.3	308.2
OPGW-81[63.2;46.7]	48	11.9	458	63.2	46.7
OPGW-74[68.5;36.4]	60	11.4	444	68.5	36.4
OPGW-84[42.4;59.9]	60	12.1	383	42.4	59.9
OPGW -95 [95.8;54.8]	72	13.2	597	95.8	54.8
OPGW - 131 [65.9;146.4]	72	15.2	593	65.9	146.4
OPGW -90 [90.0;50.6]	96	13.0	563	90.0	50.6
OPGW – 144 [110.3;150.8]	96	15.8	781	110.3	150.8

Double Layers

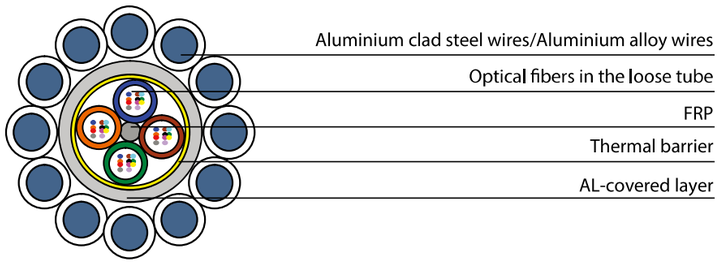
ZTT Standard	Fiber Count(Max)	Diameter (mm)	Weight (kg/km)	RTS (kN)	Short Circuit (kA^2s)
OPGW-191[110.8;296.0]	24	18.0	809	110.8	296.0
OPGW-146[84.3;172.0]	28	15.8	625	84.3	172.0
OPGW-146[72.7;177.4]	28	15.8	591	72.7	177.4
OPGW-199[115.3;322.2]	48	18.4	845	115.3	322.2
OPGW-226[128.6;414.2]	60	19.7	954	128.6	414.2
OPGW -166 [96.2;224.8]	72	17.1	778	96.2	224.8
OPGW -203 [118.7;336.1]	96	19.0	959	118.7	336.1

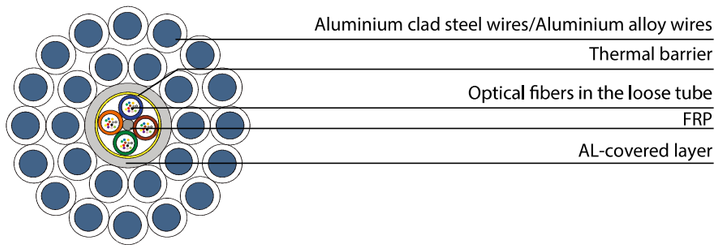
** The above designs are ZTT's typical options,and ZTT can provide any specific cable according to your requirement.*

Typical Designs of Aluminum Tube OPGW

Aluminium tube OPGW
Single/Double Armour Layers

The Aluminium tube is surrounded by single or double layers of aluminium clad steel wires(ACS) or mix ACS wires and aluminium alloy wires.





Characteristic and Application

- Good anti-corrosion performance.
- Material and structure are uniform, good resistance to vibration fatigue.
- Short circuit current has small effect on the optical fiber transmission properties.
- Good anti-lightning performance.

Typical Parameters:

Single Layer

ZTT Standard	Fiber Count(Max)	Diameter (mm)	Weight (kg/km)	RTS (kN)	Short Circuit (kA^2s)
OPGW-81[73.9;43.6]	24	12.5	488	73.9	43.6
OPGW-86[76.8;49.5]	24	12.8	510	76.8	49.5
OPGW-103[93.8;68.9]	24	13.8	611	93.8	68.9
OPGW-85[76.8;46.8]	32	12.8	509	76.8	46.8
OPGW-85[50.5;54.5]	32	12.8	445	50.5	54.5
OPGW-112[106.7;80.0]	36	14.7	688	106.7	80.0
OPGW-112[86.0;90.3]	48	14.7	627	86.0	90.3
OPGW-112[62.7;104.5]	48	14.7	498	62.7	104.5
OPGW-122[65.6;123.9]	48	15.2	534	65.6	123.9
OPGW-132[121.0;108.7]	60	16.0	810	121.0	108.7
OPGW-132[63.9;148.0]	60	16.0	545	63.9	148.0
OPGW-135 [99.8;132.2]	72	16.3	751	99.8	132.2
OPGW-146 [109.0;154.9]	96	17.1	813	109.0	154.9

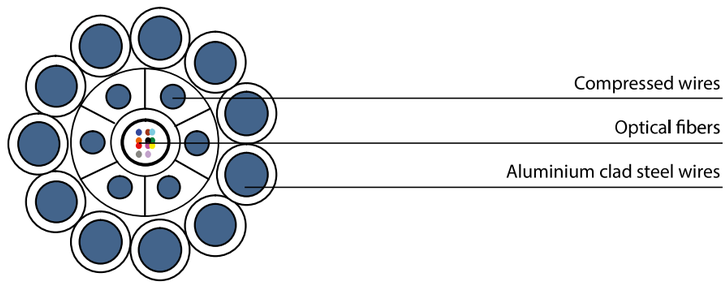
Double Layers

ZTT Standard	Fiber Count(Max)	Diameter (mm)	Weight (kg/km)	RTS (kN)	Short Circuit (kA^2s)
OPGW-174[101.0;247.7]	24	17.7	744	101.0	247.7
OPGW-244[141.2;479.7]	24	20.7	1030	141.2	479.7
OPGW-249[147.0;501.4]	48	21.1	1065	147.0	501.4
OPGW-207[121.8;348.1]	48	19.4	892	121.8	348.1
OPGW-233[135.8;441.9]	60	20.6	999	135.8	441.9
OPGW-289 [166.4;675.0]	72	22.9	1246	166.4	675.0
OPGW-314 [158.7;826.4]	96	24.0	1277	158.7	826.4

** The above designs are ZTT's typical options,and ZTT can provide any specific cable according to your requirement.*

Typical Designs of Lightning Resistant Central Stainless Steel Tube OPGW with Compressed Wires

The central stainless steel tube is surrounded by double layers of aluminium clad steel wires(ACS),the inner layer aluminium clad steel wires are compressed,the outer layer aluminium clad steel wires are all compressed or all round.



Characteristic and Application

- Compressing round AS wires into sector AS wires during stranding.
- Compared with round AS wires stranding, sector AS wires stranding can increase the cross section and fault current capacity while the cable diameter is the same.
- Compared with round AS wires stranding, sector AS wires stranding can dramatically increase the diameter of outer wires to enhance the lightning performance.
- Apply to the transmission line which requires small diameter and large fault current.
- Apply to heavy thunderstorm areas.

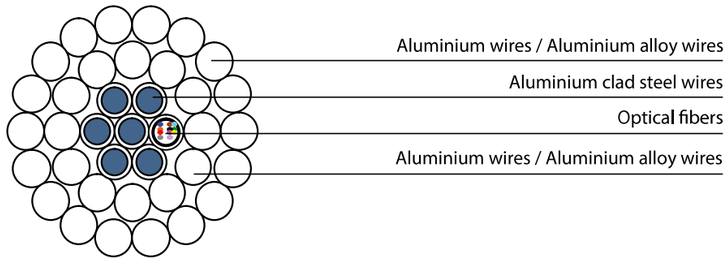
Typical Parameters:

ZTT Standard	Fiber Count(Max)	Diameter (mm)	Weight (kg/km)	RTS (kN)	Short Circuit (kA^2s)
OPGW-YS/138-147.9	30	15.2	680	89.0	147.9
OPGW-YS/159-196.3	30	16.2	780	102.5	196.3
OPGW-YS/115-97.1	36	14.0	610	81.3	97.1
OPGW-YS/128-121.0	36	14.8	671	89.8	121.0
OPGW-YS/150-168.1	36	16.0	777	104.2	168.1
OPGW-YS/132-135.2	48	15.0	652	85.1	135.2
OPGW-YS/151-177.0	48	16.0	742	97.4	177.0
OPGW-YS/133-138.1	48	15.0	658	86.0	138.1
OPGW-YS/145-164.3	48	15.7	716	93.8	164.3

** The above designs are ZTT's typical options,and ZTT can provide any specific cable according to your requirement.*

Typical Designs of OPPC

The Aluminium tube is surrounded by single or double layers of aluminium clad steel wires(ACS) or mix ACS wires and aluminium alloy wires.



Characteristic and Application

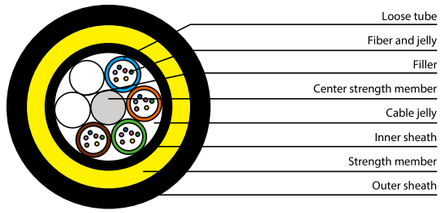
- Replacing one or several wires of the traditional conductor with stainless steel tube and strand the tube with AS/steel wires and AL/AA wires.
- Replacing one of the three phase conductors with OPPC, thus to form a transmission line which consists of one OPPC and two phase conductors.
- Mechanical and electrical performance can match the adjacent two phase conductors.
- OPPC can meet durative high temperature resistant which verified by Temperature Cycling test and Short Current test.
- OPPC is applied to middle & high voltage power lines without ground wires such as 10kV, 35kV, 66kV and so on.
- Telecommunications for middle & high voltage power lines in urban and rural areas; Providing optical cables for building distribution automation station.

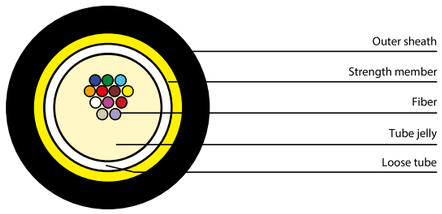
Typical Parameters:

ZTT Standard	Fiber Count(Max)	Diameter (mm)	weight (kg/km)	RTS (kN)	Current Carrying Capacity(A)		
					40-70℃	40-80℃	40-90℃
OPPC-70/10	16	11.75	281	24.3	216	262	299
OPPC-110/25	16	15.4	494	45.7	299	364	418
OPPC-150/25	16	17.4	598	52.8	351	430	495
OPPC-185/25	16	19.0	695	58.5	395	486	561
OPPC-70/40	24	13.6	460	57.7	234	284	325
OPPC-95/20	24	14.0	402	37.0	264	321	368
OPPC-85/20	24	13.5	376	34.4	254	308	353
OPPC-120/25	24	15.9	523	49.0	308	376	432
OPPC-150/35	24	17.6	641	64.5	348	427	492
OPPC-210/35	24	20.4	812	74.3	424	524	605
OPPC-185/45	28	19.65	797	79.6	398	491	567
OPPC-230/40	36	21.8	949	87.7	455	563	652
OPPC-240/55	48	22.5	1037	102.5	467	580	672
OPPC-90/50	48	16.1	651	82.0	281	344	395

**The above designs are ZTT's typical options,and ZTT can provide any specific cable according to your requirement.*

All-dielectric Self-supporting Aerial Installation Cable —ADSS





Characteristic and Application

- ADSS are mainly installed at existing 220kV or lower voltage power lines.
- Layer or central tube design.
- Aramid yarn is used as the strength member to assure the tensile and strain performance, and Du Pont is our only partner.
- Outer sheath can be classified into PE and Tracking resistance PE to correspond the space potential below and more than 12kV.
- ADSS(stranded layer type)maximum fiber count: 312.
- ADSS(stranded layer type)maximum span can be up to 1500m.

Typical Parameters:

Stranded Layer Type

ZTT Standard	Weather conditions	Max Span (m)	RTS (kN)	MAT (kN)	Crush (N/10cm)	Weight(kg/km)		Diameter (mm)
						PE	AT	
ADSS-24B1-100m	Temperature range: -40~+70℃ Max.ice thickness: 5mm Max wind speed: 25m/s	100	8.5	3.4	2200	124	133	11.6
ADSS-24B1-200m		200	15.3	6.1	2200	131	139	12.0
ADSS-24B1-300m		300	20.4	8.2	2200	136	145	12.3
ADSS-24B1-400m		400	25.5	10.2	2200	141	150	12.5
ADSS-24B1-500m		500	30.6	12.2	2200	146	156	12.8
ADSS-24B1-600m		600	39.1	15.6	2200	166	176	13.8
ADSS-24B1-700m		700	45.9	18.4	2200	179	190	14.2
ADSS-24B1-800m		800	52.7	21.1	2200	186	197	14.5
ADSS-24B1-900m		900	59.5	23.8	2200	192	204	14.8
ADSS-24B1-1000m		1000	66.3	26.5	2200	197	209	15.1
ADSS-24B1-1100m		1100	71.4	28.6	2200	202	214	15.3
ADSS-24B1-1200m		1200	76.5	30.6	2200	215	226	15.5
ADSS-24B1-1500m		1500	90.0	36.0	2200	230	245	16.1

Central Tube Type

ZTT Standard	Weather conditions	Max Span (m)	RTS (kN)	MAT (kN)	Crush (N/10cm)	Weight(kg/km)		Diameter (mm)
						PE	AT	
ADSS-X-24B1-50m	Temperature range: -40~+70℃ Max.ice thickness: 5mm Max wind speed: 25m/s	50	5.0	2.0	2200	55	59	8.0
ADSS-X-24B1-100m		100	7.5	3.0	2200	57	61	8.2
ADSS-X-24B1-200m		200	12.5	5.0	2200	65	70	8.6

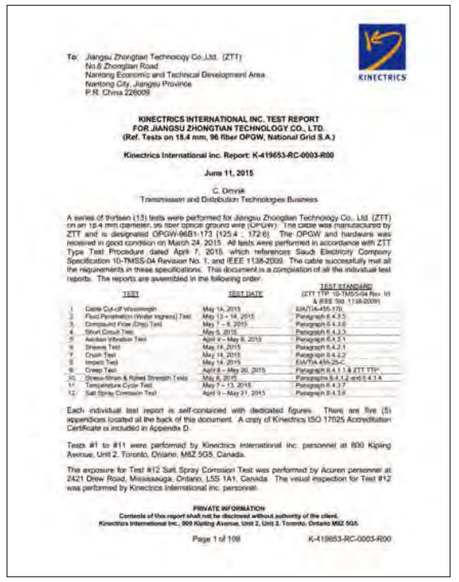
** The above designs are ZTT's typical options,and ZTT can provide any specific cable according to your requirement.*

WCA Certificates

ISO Certificates

ZTT has established a complete, advanced quality inspection center of controlling raw materials and product quality. To ensure high quality of OPGW, ZTT always selects raw materials from international and domestic famous brands. ZTT also has received certifications of ISO9001 and ISO14001.

Test Report



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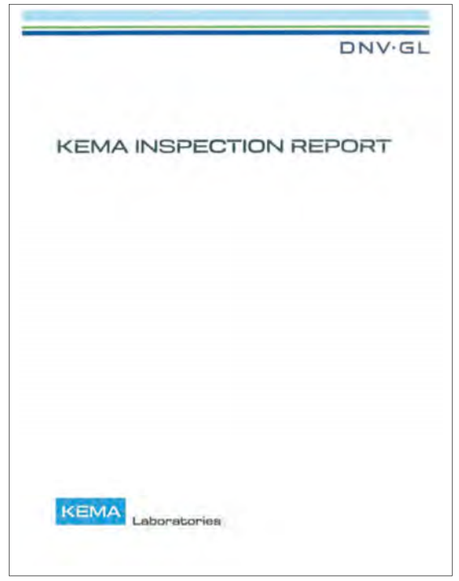


KEMA

CEPRI

TICW

Testing

Type Testing

All types of our OPGW/OPPC cable have passed respective type tests from internationally acknowledged independent test laboratory according to IEC 60794 and IEEE 1138. If you want any information of the type test report, please contact us.

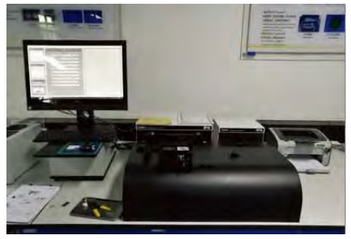
Routine Testing

Optical fiber attenuation coefficient (OTDR)
Inspection of wires before stranding
Quality of surface
Direction of outer layer
Diameter of cable
Weight of cable
Packing inspection

Factory Acceptance Testing

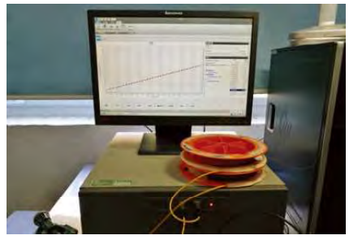
Design
Optical fiber attenuation coefficient (OTDR)
Mode Field Diameter of optical fiber
Cladding Diameter of optical fiber
Cladding non-circularity of optical fiber
Visual inspection of the cable elements
Lay length of outer layer
Diameter of cable
Weight of cable
Breaking strength of cable

Test Facilities



Optical Fiber Analysis System

Optical Time Domain Reflectometer



Chromatic Dispersion Test

Tensile Strength Test Equipment

DC Resistance Test

Tension test instrument for wires

Impact Test Instrument

Crush Test Instrument

Temperature Cycling Test chamber

ZTT has passed the test by authoritative institutions at home and abroad. The authoritative institutions include Quality Supervision & Inspection Center of Optical Communication Products, Ministry of Information Industry of P.R.C, Shanghai Electric Cable Research Institute, State Grid Electric Power Research Institute, U.S. PLP Company Laboratory, Canada KINECTRICS Company, JEN—Polish National Power Laboratory and KEMA.

References

Overseas Reference

Country	Total Length	Maximum Voltage
India	117023 km	±800 kV
Pakistan	5358 km	500 kV
Thailand	6887 km	±660 kV
Indonesia	6968 km	500 kV
Malaysia	6275 km	275 kV
Ethiopia	6387 km	500 kV
South Africa	4282 km	765 kV
Kenya	3866 km	500 kV
Kazakhstan	1713 km	500 kV
Uzbekistan	915 km	500 kV
Chile	3660 km	500 kV
Ecuador	2743 km	500 kV
America	2372 km	345 kV
Poland	7407 km	400 kV
Finland	1259 km	400 kV
Australia	2715 km	330 kV

From 2002 till now, the total global online operation length is more than 540,000km. OPGW of ZTT has been sold to more than 120 countries and regions.

Outstanding Projects

Three Ultra Project

China 400kV
Qinghai Golmud to Tibet Lhasa ±400kV DC networking project
Ultra-long distance:1400km
Ultra-low temperature:-60℃
Ultral-low loss:≤0.18dB/km

High voltage

China ±1100 kV
Changji to Guquan ±1100 kV DC UHV Transmission Line Project
China 1000 kV
Southeast Shanxi province Nanyang to Jingmen AC UHV test example project
China ±800 kV
Hami South to Zhengzhou ±800 kV DC UHV Transmission Line Project

Large cores

Canada 230 kV
230kV Henvey Inlet Wind Transmission Line Project
OPGW: 144cores G.652
Saudi Arabia 115 kV
Southern Area Oil Operation (SAOO) Power System Reliability Improvement Portion-115 kV OHTL (Shedgum & Uthmaniyah Area)
OPGW: 96cores G.652
Spain 220 kV
ENDESA GE NNJ001-OPGW Project
OPGW: 96cores G.652
Peru 22.9 kV
22.9kV Quellaveco
OPGW: 192cores G.652

Large span

China 220 kV
Zhoushan connect network with continent power transmission line project Luotou channel large span, span length: 2756m
China ±800 kV
Xiangjiaba to Shanghai DC UHV power transmission example project Xinjiyang—Yangtze River large span, span length: 2052m
India 400 kV
River Crossing and Anchor Towers for Haldia TPP-Subhasgram 400kV D/C Line, span length: 1572m.
Highest Power Transmission Tower: 236m
The Wind Pressure is more than 226.8kg/m²(60m/s)

Large temperature variation

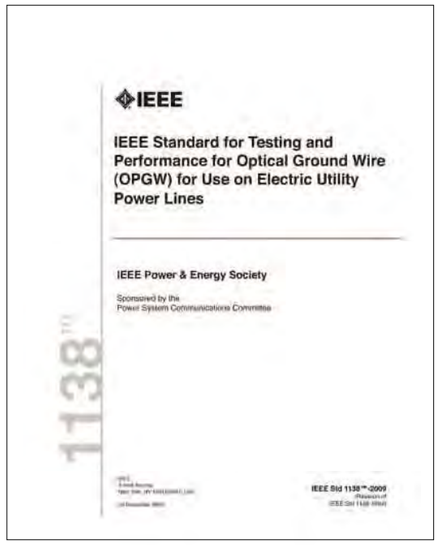
China 220 kV
Xinjiang Tuokexun—Ku'erle power transmission line OPGW: -50℃~ +40℃
China ±400 kV
DC net–connected project from Ge'ermu Qinghai to Lhasa Tibet
(-60℃ ~ +65℃, the highest elevation is 5300m, very low loss, very long distance but no relay project), totally 620km, (contains 32 cores、24cores)
Kazakhstan 110kV
110KV Aktyubinskaya SS- KPP 110KV ASF Transmission line（-60℃）24cores，2.96km
Mongolia 110 kV
Mongolia Transmission Line -40℃ ~ +35℃

Lightning resistance

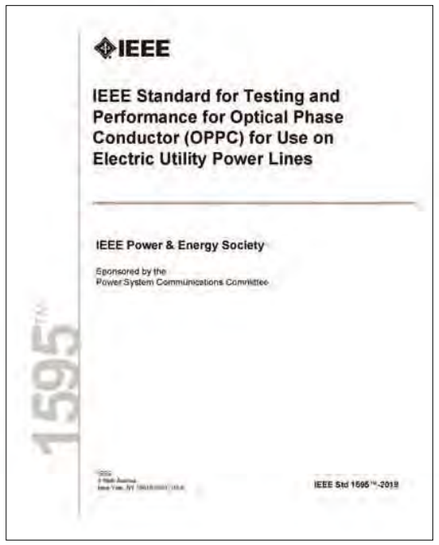
China 220 kV
Hainan 220kV Guantang—Yazaitang power transmission line
OPGW: Annual average thunderstorm day 120days

IEEE

As one of the IEEE members, ZTT is participating in the revision of IEEE 1138 OPGW standard, and also is the drafter of IEEE 1595 OPPC standard.



Participate in the revision of IEEE 1138-2019 OPGW



Drafter of IEEE 1595 OPPC standard

Installation and After-sale Service

ZTT have a rich experience on installation of OPGW and OPPC cable, and we can provide the service for our customers.

OPGW cable Laying

Joint box Installation

OPGW cable String