



# APAR

Tomorrow's solutions today

## Optical Ground Wire (OPGW) Cable



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OPGW is one of the most reliable fiber optic medium for the telecom service providers, ISPs, Cable TVs, or other organizations who are involved in the transmission of one or more form of voice, data, video, text, messages, conferencing and telemetering kind of things. Installation became widespread in the year 1980. In 2000, around 60,000km OPGW was installed worldwide.

Many electric utilities are installing high capacity fiber optic cables and wires on their high voltage lines to satisfy their own internal communication needs and to gain additional revenues by leasing excess capacity to telecommunication network providers.

Overhead transmission power line corridors provide the telecommunications industry with cost-effective alternative routes and at the same time benefit the electric utilities by generating additional revenues using existing facilities. The inherent advantage of fiber optic technology as a means of communication is that fiber optics provides fixed link, point to point communications with a remarkably high capacity for carrying data.

APAR has developed technical expertise in fiber optic cables and proven its capabilities in manufacture of energy efficient bare overhead power conductors. APAR has integrated these core strengths in its comprehensive OPGW solution that includes Optical Fiber Composite Ground Wire and related hardware.

**Apar's OPGW & OFC are approved by BSNL, CACT, PGCIL and other Power and Telecom Utilities.**

### ADVANTAGES OF OPGW CABLES

- ✓ Fiber optic communication cables are neither subject to electromagnetic interference nor do they cause any interference.
- ✓ Aerial fiber optic cables and any related equipment can be electrically insulated from system components.
- ✓ The technology offers very long information transmission distances of up to 80 km (50 miles) without requiring the use of repeaters.

Fiber optic technology offers extremely high transmission capacity which can result in data transfer of information at rates of up to 3 gigabytes per second (Gbps)

An Optical fiber is composed of a light guiding core surrounded by cladding. Both the core and the cladding are typically made of high purity glass typically derived from doped germanium or pure silica. The core and the cladding are then surrounded by one or two protective coatings of Acrylate that improves the strength characteristics of the Optical fibers.

Two main types of Optical fiber exist : a) single mode; b) multi-mode. In a single mode Optical fiber, the fiber core is small enough that only one mode of light can travel through the core at any one time. In a multi-mode fiber, the fiber core is large enough that multiple modes of light can travel through the core at different paths and lengths. It should be noted that the attenuation of the signal in single mode is significantly lower than in multi-mode fibers.

When combined with a method of construction suitable to the high strength, high voltage environment of utility corridors, aerial fiber optic cables and wires provide superior performance and reliability in communication networks.

## CHARACTERISTICS OF OPTICAL FIBRES

Particulars	Unit	G 652 (DWSM-A,B,C,D)	G 655 (Non-zero dispersion shifted fibers)
Cladding diameter	µm	125 ± 1	125 ± 0.7
Cladding non-circularity	%	≤ 1.0	≤ 0.7
<b>Mode field diameter</b>			
at 1310 nm	µm	9.2± 0.4	-
at 1550 nm	µm	10.4 ± 0.8	9.6 ± 0.4
<b>Attenuation</b>			
at 1310 nm	dB/km	≤ 0.35	
at 1550 nm	dB/km	≤ 0.20	≤ 0.22
at 1625 nm	dB/km	-	≤ 0.24
<b>Chromatic dispersion</b>			
from 1285 to 1330 nm	ps/ (nm.km)	≤ 3.5	
at 1550 nm	ps/ (nm.km)	≤ 18	2.80 to 6.20
at 1460 nm	Ps/(nm.km)	-	-4.20 to 3.29
at 1625 nm			5.77 to 11.26
PMD (Polarization Mode Dispersion)	ps/√km	< 0.2	≤ 0.2
Cable cut -off Wavelength	nm	≤ 1260	≤ 1450

## OPGW CABLE WITH CENTRAL CORE ALUMINUM SHEATHED TUBE

OPGW cable with central core aluminum sheathed tube is made of polymer loose tubes and the outer layer can be a suitable combination of ACS and AA wires for the right ratings as required by the end-user.

### SINGLE LAYER CONSTRUCTION



In composite conductors a fiber cable unit containing the Optical fibers is either integrated or embedded into a conductor or ground wire. In voltages below 138-kV the composite conductor can also be a phase wire. However, usually the fiber unit containing the Optical fibers is placed inside the ground wire. OPGW can be a light weight ground wire designed to be used as a static wire replacement or it can be installed in addition to conventional ground wire. Currently, the number of Optical fibers that can be readily fitted into an OPGW aerial wire construction can reach up to 144 fibers. The metallic wires have to give the OPGW aerial cable enough conductivity to carry fault currents, and the strength to withstand mechanical stresses.

### DOUBLE LAYER CONSTRUCTION



The APAR-OPGW DOUBLE LAYER cables are used when the requirements are for a high ultimate load and/or high short-circuit current.

Hydrogen-absorbent optical core is constructed with required number of optical fibers covered with tubes with loose fiber protection and sealed with moisture-proof gel and whole setup is protected with thermal protection tape to absorb the increased temperature.

With choice of aluminum clad steel, aluminum alloy, galvanized steel wires Hydrogen-absorbent optical core is protected with extruded aluminum tube and surrounded with first layer with choice of aluminum clad steel, aluminum alloy, galvanized steel wires.

Further surrounded with second layer with choice of aluminum clad steel, aluminum alloy, galvanized steel wires for additional high ultimate load and/or high short-circuit current.

## OPGW CABLE WITH STAINLESS STEEL TUBE AND ALUMINUM CLAD STEEL TUBE



OPGW cable with stainless Steel and aluminum clad steel tube is available in fiber counts up to 48. The cable can be designed into single or dual layered construction in accordance to the mechanical and electrical requirements as per application needs of the end-user.

Due to its unique small size this becomes the perfect solution for overloaded towers with its small diameter and light weight construction. The fibers are protected from environmental conditions to ensure reliability and long life.

## HIGH STRENGTH OPGW CABLE

High strength OPGW cable is available up to 96 fibers making it suitable for application is high fiber count and super-high-voltage power lines. Steel tubes are stranded with Hi-strain steel wires to create a dual-layer design suitable for a range of high strength applications. The layer of Aluminum gives this product a high fault rating current values.

# PRODUCT DESCRIPTION

## TYPICAL DESIGNS OF SINGLE LAYER CONSTRUCTION CABLE:

Product Range	Fiber count (Max )	Diameter ( mm)	Weight (kg/Km)	UTS ( KN)	Short Circuit (KA <sup>2</sup> Sec )
OPGW 12[55,20]	12	10.0	349	55	20
OPGW 12[64,35]	12	11.6	412	64	35
OPGW 16[91,58]	16	12.8	580	91	58
OPGW 24[53,23]	24	10.3	347	53	23
OPGW 24[74,26]	24	10.9	416	74	26
OPGW 24[63,30]	24	11.2	386	63	30
OPGW 24[78,37]	24	11.6	498	79	38
OPGW 24[65,40]	24	11.9	409	65	40
OPGW 24[81,41]	24	12.0	500	81	41
OPGW 24[77,43]	24	12.5	467	77	43
OPGW 24[64,68]	24	13.2	475	64	68
OPGW 24[100,40]	24	13.5	572	100	40
OPGW 24[62,91]	24	14.0	490	62	91
OPGW 24[65,116]	24	14.6	523	65	116
OPGW 24[97,110]	24	15.0	670	97	110
OPGW 36[79,36]	36	11.8	484	79	36
OPGW 36[72,67]	36	12.7	503	72	67
OPGW 48[41,29]	48	11.0	316	41	29
OPGW 48[74,35]	48	11.7	471	74	35
OPGW 48[63,44]	48	12.4	429	63	44
OPGW 48[59,77]	48	13.3	450	59	77
OPGW 48[99,83]	48	13.7	610	90	83
OPGW 48[89,151]	48	16.0	696	89	151
OPGW 64[98,76]	64	15.1	650	98	76
OPGW 96[103,138]	96	16.2	719	103	138
OPGW 288[82,198]	288	20.8	789	82	198

**NOTE:** The designs above are only a sampling of the options available from APAR.  
Please contact us for a cable designed to your exact specifications.

# PRODUCT DESCRIPTION



## TYPICAL DESIGNS OF DOUBLE LAYER CONSTRUCTION CABLE:

Product Range	Fiber count (Max )	Diameter ( mm)	Weight (kg/Km)	UTS ( KN)	Short Circuit (KA <sup>2</sup> Sec )
OPGW 12[82,111]	12	15.3	600	82	111
OPGW 24[93,151]	24	15.9	645	93	151
OPGW 24[74,175]	24	16.6	585	74	175
OPGW 24[118,400]	24	19.0	860	118	400
OPGW 24[101,247]	24	17.7	744	101	247
OPGW 24[141,479]	24	20.7	1030	141	479
OPGW 32[102,237]	32	19.4	812	102	237
OPGW 36[188,212]	36	18.7	1161	188	212
OPGW 36[305,386]	36	22.0	1716	305	386
OPGW 48[92,122]	48	15.6	642	92	122
OPGW 48[88,278]	48	18.6	729	88	278
OPGW 48[147,201]	48	21.1	1065	147	501
OPGW 48[121,348]	48	19.4	892	121	348
OPGW 60[135,441]	60	20.6	999	135	441
OPGW 72[166,675]	72	22.9	1246	166	675
OPGW 96[158,826]	96	24.0	1277	158	826
OPGW 144[120,430]	144	22.4	1000	120	430

**NOTE:** The designs above are only a sampling of the options available from APAR.  
Please contact us for a cable designed to your exact specifications.

## TYPE TESTING

All types of OPGW cable are type tested and validated from internationally acknowledged independent test laboratory according to IEC 60794 and IEEE 1138 Standards.

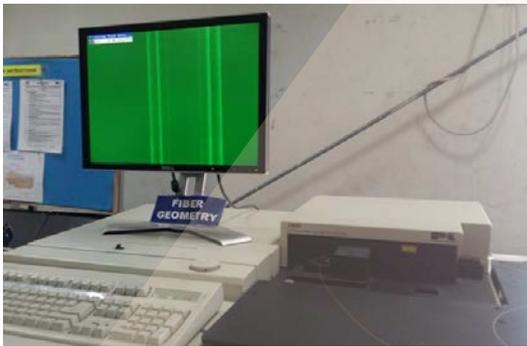
### ROUTINE TESTING

- Optical fiber attenuation coefficient
- Inspection of Wires before stranding
- Quality of Surface
- Direction of Outer layer
- Diameter of Cable
- Weight of Cable
- Packing Inspection

### FACTORY ACCEPTANCE TESTING

- Design Verification
- Optical fiber attenuation coefficient
- 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.

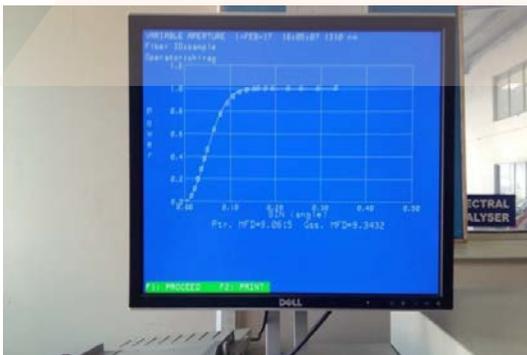
## INHOUSE OPGW TEST FACILITIES



**FIBER GEOMETRY**



**SPLICER**



**MFD**



**SPECTRAL ANALYZER + MFD**





**OTDR**



**MICROSCOPE**



**SHEAVE TEST**



**TENSILE TESTING MACHINE**



**REPEATED BEND TEST**



**VIBRATION TEST**



**TORSION TEST**



**CRUSH TEST**



**GALLOPING TEST**



**IMPACT TEST**

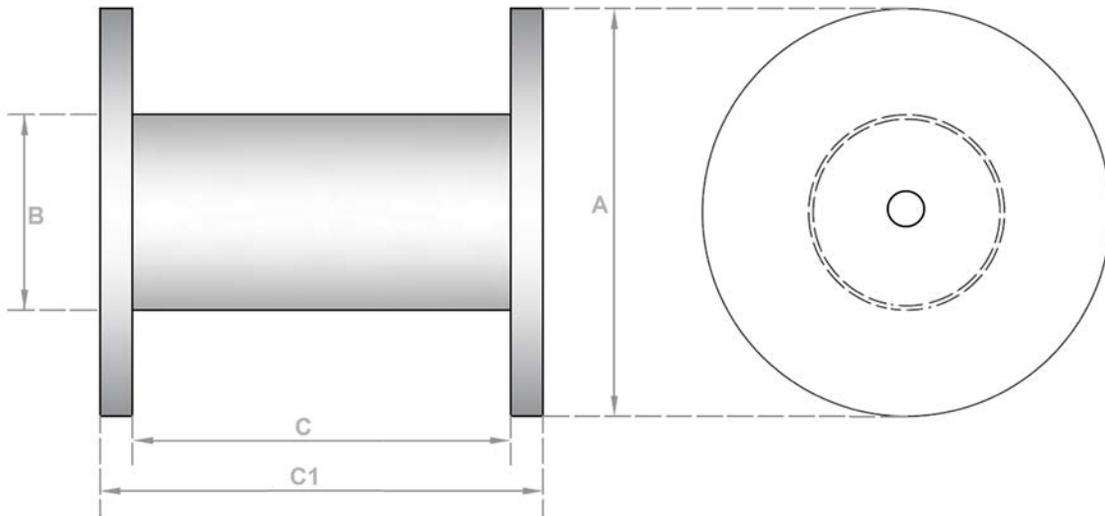
In order to ensure that the OPGW cables will operate successfully in a high voltage network, all aspects associated with the implementation of this technology must be correctly analyzed.

- ✓ Maintenance, providing the material required (instruments, repair units, etc.)
- ✓ Optimized design of cables.
- ✓ Project support (calculation of spans, drum lengths, etc.)
- ✓ Definition of optical fiber
- ✓ Supervision of installation, to ensure correct cable stringing and splicing
- ✓ Test certificates (measurement of fiber attenuation)

APAR has designed global pre-sales and after-sales services to optimize the installation, operation and maintenance of these networks.

# PACKAGING & DRUM

OPGW Cables can be supplied in Wooden, Steel and Hybrid drums (Steel frame & HDPE plastic). Both ends of cable shall be securely fastened to drum and sealed with a shrinkable sleeve. The required marking shall be printed with a laminated paper on the outsides of drum according to customer's requirement.

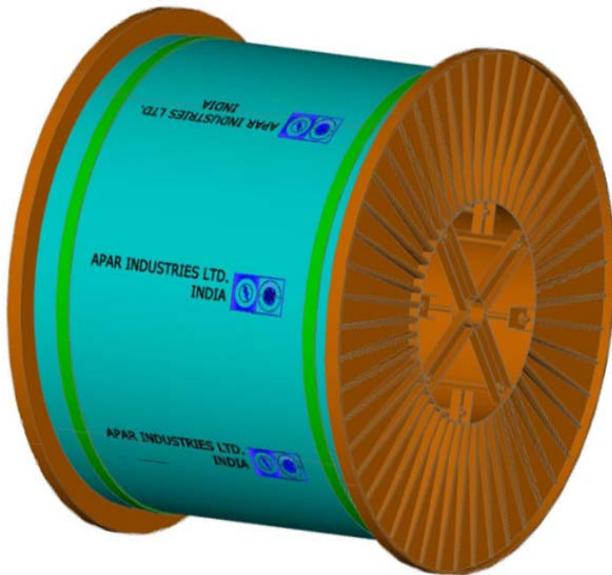


## Typical Drum Dimensions:

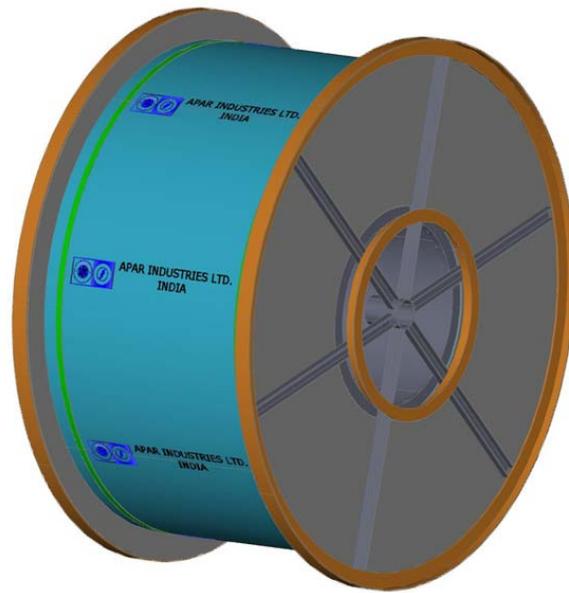
Cable Diameter (mm)	Standard length of Conductor (m)	Tolerance on Standard length (%)	Drum Dimensions			Volume in m <sup>3</sup>
			Flange "A" (mm)	Barrel "B" (mm)	Traverse "C" (mm)	
10.0	3000	± 2%	1120	550	600	0.591
	5000	± 2%	1270	550	600	0.760
	6000	± 2%	1220	550	915	1.069
11.0	3000	± 2%	1220	550	600	0.701
	5000	± 2%	1370	550	600	0.884
	6000	± 2%	1320	550	915	1.252
12.0	3000	± 2%	1220	600	915	1.069
	5000	± 2%	1320	600	915	1.252
	6000	± 2%	1425	600	915	1.459
13.0	3000	± 2%	1220	600	915	1.069
	5000	± 2%	1400	600	915	1.408
	6000	± 2%	1500	600	915	1.616
14.0	3000	± 2%	1320	650	915	1.252
	5000	± 2%	1500	650	915	1.616
15.0	3000	± 2%	1425	800	915	1.459
	4000	± 2%	1525	800	915	1.670
16.0	3000	± 2%	1500	800	915	1.616
	4000	± 2%	1600	800	915	1.839

Cable Diameter (mm)	Standard length of Conductor (m)	Tolerance on Standard length (%)	Drum Dimensions			Volume in m <sup>3</sup>
			Flange "A" (mm)	Barrel "B" (mm)	Traverse "C" (mm)	
17.0	3000	± 2%	1550	800	915	1.726
18.0	3000	± 2%	1600	800	915	1.839
19.0	3000	± 2%	1650	900	915	1.956
20.0	3000	± 2%	1725	900	915	2.137
21.0	3000	± 2%	1800	1000	915	2.327
22.0	3000	± 2%	1850	1000	915	2.458

## Photograph of Packed Drum for Reference

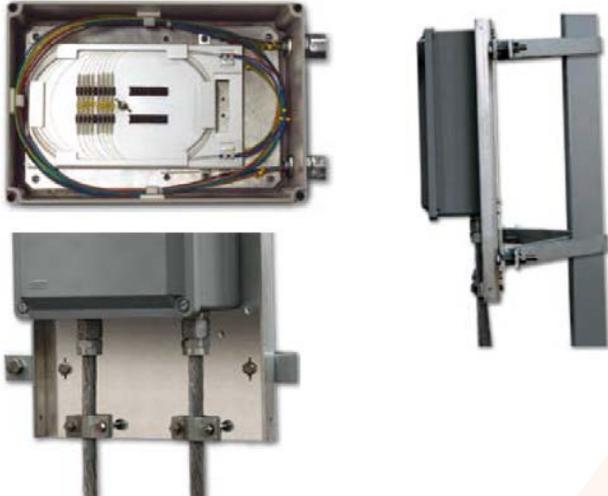


**Steel Drums**



**Hybrid Drums  
(Steel frame & HDPE plastic)**

# OPGW FITTINGS & HARDWARES



**Joint Boxes EWMJ, up to 96 splices**  
**Joint Boxes EWJ, up to 240 splices**



**Suspension assembly**



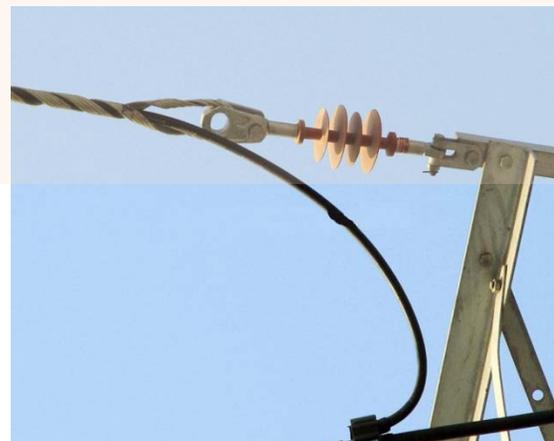
**Stockbridge Damper**



**Spiral Vibration Damper**



**Downlead clamp**



**Tension assembly**

