JEA Fulton Cut Replacement

Project No. 8007890

SPECIFICATION FOR FIBER OPTIC GROUND WIRE (OPGW)
FC-TLN-OPG-SP

Jacksonville Electric Authority
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Revision History

Rev	Date	Description
0	2024-10-03	Issued for 60% Review
1	2024-11-18	Added Project Specific Criteria
2	2025-01-24	Added specific reel lengths
3	2025-03-11	Revised 3.1.1 RHL to LHL
4	2025-03-24	Revised section 7.2.2
5	2025-04-03	Modified Section 1; added Section 8.4; added Section 10

Table of Contents

1. SCOPE

This specification covers the construction, performance, acceptance criteria, test requirements, and shipping for Fiber Optic Ground Wire (OPGW). The OPGW has the dual performance functions of a standard ground wire with telecommunications capabilities.

The OPGW shall be AlumaCore AC-125/726

2. APPLICABLE STANDARDS

2.1 ASTM B398 - Standard Specification for Aluminum-Alloy 6201-T81 Wire for Electrical Purposes

2.2 ASTM B415 - Standard Specification for Hard-Drawn Aluminum-Clad Steel Wire

2.3 ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

2.4 TIA-598-C - Optical Fiber Cable Color Coding

2.5 IEEE 1138-2021 - Standard for Testing and Performance of Optical Ground Wire (OPGW) for use on Electric Utility Power Lines

3. GENERAL REQUIREMENTS

3.1 Lay

3.1.1 The direction of lay of the outside layer of aluminum wire shall be left-hand. The direction of lay of the aluminum and core wires shall be reversed in successive layers.

3.1.2 The makeup and lay of the outside layer of aluminum wire strands shall be such as to not have the tendency to untwist or spring apart when cut.

4. DETAILED REQUIREMENTS

4.1 Fiber Requirements

4.1.1 Individual fiber attenuation limits shall be no greater than 0.35dB/km @ 1310 nm and not greater than 0.22 dB/km @ 1550 nm.

4.1.2 No fiber splices are allowed in a continuous reel of cable.

4.1.3 The maximum point discontinuity shall be no greater than 0.1 dB and only one is allowed per cable.

4.1.4 The fibers shall be protected by a 304 grade stainless steel, gel-filled, loose tube (SSLT) or aluminum pipe. The gel shall prohibit any moisture ingress and be fully compatible with all components that it comes in contact.

4.2 Wire Requirements

4.2.1 All wire shall conform to the specifications referenced above.

4.2.2 All loose tubes used to house fiber shall conform to the specifications referenced above.

4.2.3 The wires shall be 6201-T81 aluminum alloy and 20.3% IACS aluminum-clad steel in conformance with the above specifications.

4.3 Non-Specular OPGW:

4.3.1 When requested, the OPGW shall be non-specular and conform to ASTM B979.

4.3.2 The outer surface of the OPGW is to be treated to give a uniform non-reflecting, non-lustrous, smooth surface finish with an average maximum diffuse reflectivity of not more than 32%.

5. PROJECT SPECIFIC REQUIREMENTS

The requirements listed below are specific to the JEA Fulton Cut Rebuild Project No. 8007890.

5.1 Minimum fiber count shall be 72.

5.2 Mechanical and electrical criteria:

Climatic condition	250B: Light	NESC level
	250C: 145 MPH	(or ice thickness, wind stress, and safety factors)
	1926 ft	Maximum span
	60.5' @ 60 deg. F	Initial sag (if necessary)
	74.2' @ 120 deg. F	Maximum sag (if necessary)
Acceptable range of breaking strength	34,882	Ultimate Tension (lbs.)
Short-circuit rating	155	$kA^2 \cdot s$

6. CABLE CONSTRUCTION

6.1 The OPGW must feature fiber protected by hermetically sealed, gel-filled stainless steel loose tubes (SSLT).

6.2 The tubes or pipe will be integrated with aluminum alloy and/or aluminum-clad steel wires to form the cable.

6.3 The fibers shall be distinguished in groups of twelve based on the latest version of TIA/EIA – 598A, Color Coding of Fiber Optic Cable. If there are 24 fibers in a buffer tube fibers 13-24 shall follow the same color code except be distinguished by a series of black bands. The cable manufacturer is required to provide this color scheme to the user in a specification sheet prior to purchase.

6.4 The surface of the OPGW shall be free from points, sharp edges, abrasions, or other departures from smoothness or uniformity of surface contour. The cable shall also be free of excessive amounts of die grease, metal particles, dirt, or other foreign matter.

Inspections and tests required by this specification shall be made by the Supplier or his sub-supplier prior to shipment.

7. INSPECTION, TEST, AND DOCUMENTATION

7.1 Inspection:

7.1.1 Inspections and tests required by this specification shall be made by the Supplier or his sub-supplier prior to shipment.

7.1.2 The timing, sample sizes, and frequency of inspections and tests shall be in accordance with industry standards unless otherwise specified.

7.1.3 If requested, electronic certified inspection and test reports containing the data needed to show conformance and other required documentation shall be emailed to material shipment to:

One set sent to:

Jason Rinehart <rineja@jea.com>

7.1.4 Suppliers-certified documents and reports shall include, as a minimum:

7.1.4.1.1 Cross sectional diagram of the cable.

7.1.4.1.2 Individual wire size and type

7.1.4.1.3 Fiber tube housing size

7.1.4.1.4 Overall cable diameter

7.1.4.1.5 Total wire area

7.1.4.1.6 Rated breaking strength (RBS)

7.1.4.1.7 Unit weight

7.1.4.1.8 Coefficient of thermal expansion

7.1.4.1.9 Modulus of elasticity

7.1.4.1.10 DC resistance at 20 degrees C

7.1.4.1.11 Rated fault current including both initial ambient and final maximum temperatures (kA2 t)

7.1.4.1.12 Minimum bending radius

7.1.4.1.13 Sag chart number

7.2 Testing:

7.2.1 Optical Acceptance Testing: Attenuation testing shall be performed on each fiber on each individual reel to verify compliance with the attenuation limits given at paragraph 2b above. The testing shall be bi-directional and each test recorded for a given fiber. For each reel, a certified test report giving the results of this testing shall be supplied by the manufacturer. A copy shall be attached to each reel. An electronic copy in PDF format shall be sent by email to the project engineer as specified in the Task Order.

7.2.2 Fiber Strain Margin: The successful bidder shall provide test data showing that the cable (or one of a similar design) meets the requirements of section 6.4.1.3 of IEEE std 1138-2021.

7.2.3 Galvanic Corrosion: If the cable is manufactured of dissimilar metals, such as aluminum and steel, manufacturer must provide documented test results that no galvanic corrosion will occur when the cable is exposed to a seawater environment for an extended period of time.

7.3 Documentation

The manufacturer shall also supply drawings and specifications for all suspension and termination hardware required for installation on an overhead electric transmission line. The specifications shall include but not be limited to the following:

- Detail drawings showing front and side view of each item.
- Dimensions of hardware including but not limited to bolts, bolt holes, clevis pins, or other devices used to attach the cable to the structure.
- Rated strength of the fitting.
- Type of material for the hardware, bolt or other device.
- Weight of the hardware assembly.

8. PACKAGING, MARKING AND SHIPPING

8.1 OPGW shall be shipped on steel reels meeting the requirements of the Aluminum Association and NEMA WC26.

8.1.1 Reels shall be supplied with nominal wire lengths within a plus or minus tolerance of 5%.

8.1.2 If specified at time of order, matched sets of reels can be supplied with a maximum variation between lengths not to exceed 100 feet. The reels shall be identified by the manufacturer as matched sets.

8.1.3 Returnable reels are to be metal only. Minimum Arbor hole of 5.25" shall be supplied. Reels in excess of 10,000 pounds gross weight shall have their arbor holes reinforced to prevent them from going out of round. Reels that do not meet “Reel Designation” for individual OPGW will be rejected. OPGW shall be furnished in one continuous length per reel.

8.1.4 Reels are to conform to the Aluminum Association packaging recommendations and JEA regulations.

8.2 Each reel shall be marked clearly in weatherproof marking ink with the following information:

8.2.1 Shipping address and purchase order number

8.2.2 Supplier’s name

8.2.3 Size, measured length in feet, and description of OPGW

8.2.4 Net, gross, and tare weights in pounds

8.3 Each reel of OPGW shall be protected against physical damage such as nicks, scars, or abrasions during handling and movement.

8.3.1 The OPGW shall be tightly and uniformly spooled on the reel.

8.3.2 Any portion of the reel that comes in contact with the OPGW's surface shall be suitably covered with a moisture-resistant material.

8.3.3 OPGW shall be layer wound on the reel to prevent excessive OPGW movement.

8.3.4 OPGW ends shall be suitably secured to the reel flange.

8.3.5 The outer OPGW layer shall be wrapped with a solid weather resistant material. Acceptable materials include:

8.3.5.1 Shrink wrap plastic covering that does not contain PVC.

8.3.5.2 Paper board cover to protect OPGW during shipment. The paper board shall be bound with weather-resistant non-corrosive straps or tape.

8.3.6 Upon request, wood lagging shall be supplied.

8.4 Delivery Instructions

The project is located within Duval County in Jacksonville, FL. The project spans the St. Johns River just east of I-295 Beltway and the Dames Point Bridge.

Northbank (Blount Island/ JaxPort)

Delivery Address: 0 William Mills Street, Jacksonville FL 32226

Delivery Instructions: The Northbank of the project is located on Blount Island which is primarily the jurisdiction of the international marine port JaxPort. JEA has a transmission line right of way within the property. If delivery is through the transmission right-of-way, only contractor coordination is required. If delivery is through JaxPort, TWIC credentials are required to access through secure perimeter.

9. REEL LENGTHS

The following project-specific OPGW reel lengths shall be provided:
Project Name: JEA Fulton Cut Replacement
Project Number: 8007890

A total of 60,700 linear feet of OPGW shall be ordered using (7) seven reels:
Reel 1, circuit 918: 9,400 feet
Reel 2, circuit 840: 9,500 feet
Reel 3, circuit 926: 9,250 feet
Reel 4, circuit 938: 9,250 feet
Reel 5, circuit 934: 9,100 feet
Reel 6, circuit 935: 9,200 feet
Surplus: 5,000 feet

10. WIRE CUT SHEET

www.aflglobal.com

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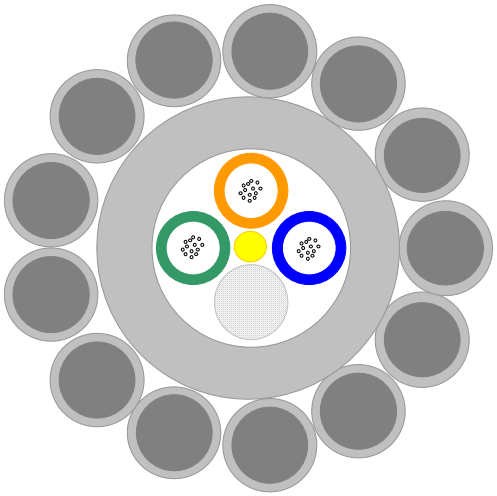
AlumaCore Optical Ground Wire

Additional Resources



AC-125/726

72 Singlemode

Component Details					
Component	**#**	**OD**		**Area**	
CENTER					
Aluminum Pipe	1	11.45 mm	0.4508 in	56.40 mm²	0.0874 in²
LAYER 1 - LEFT HAND LAY					
Aluminum Clad Steel (20.3% IACS)	13	3.50 mm	0.1378 in	125.07 mm²	0.1939 in²

* - Cross Section drawing shown is representative.

Standards	
Designed and Manufactured in accordance with the following:	
Fiber	. *Single-mode: ITU-T G.652D/G.657.A1*
Cable	. *IEEE 1138, IEC 60794-4*
Color Code	. *ANSI/EIA 359-A, TIA 598-D, IEC 60304*
Aluminum Clad Steel Wires	. *ASTM B415*

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Mechanical / Electrical Details

Calculated Breaking Load	153	kN	34,304	lbs
Maximum Cable Design Tension	122	kN	27,443	lbs
Approximate Cable Diameter	18.45	mm	0.726	in
Total Cross-Sectional Area	181.48	mm²	0.2813	in²
Approximate Cable Weight	1,027	kg/km	3,645	lbs/mile
Modulus of Elasticity	12,948	kg/mm²	18,415	kpsi
Coefficient of Linear Expansion	1.43E-05	1/°C	7.93E-06	1/°F
Sag10™ Chart Number	1-1453		1-1453	
Calculated DC Resistance (20°C)	0.2986	Ohms/km	0.4805	Ohms/mile
Short Circuit Rating	230	(kA)²•sec	230	(kA)²•sec
Short Circuit Ambient Temperature	40	°C	104	°F
Short Circuit Duration 1 sec	15.2	kA	15.2	kA

Optical Details

Attenuation Characteristics for Singlemode Fiber

Max Individual

0.35 dB/km 1310 nm
0.22 dB/km 1550 nm

96 Fiber Loose Tube Design (4 - 24 fiber units)

Unit	Fiber Type	Fiber Count
Blue	Singlemode	24
Orange	Singlemode	24
Green	Singlemode	24
	Filler	N/A
	Total Fiber Count	72

Standard Fiber Color Code

Fiber	1	2	3	4	5	6	7	8	9	10	11	12
Color	Blue	Orange	Green	Brown	Slate	White	Red	Black	Yellow	Violet	Rose	Aqua

Designs with more than 12 fibers per tube will use the standard color code and binders for identification of the fibers.

Installation and Handling Recommendations

Installation and cable preparation procedures are outlined in the AFL documents listed below. Contact AFL to request copies.

Recommended Installation Procedures for Composite Optical Ground Wire

Installation Instructions for Installing Optical Ground Wire in an AFL Splice Enclosure

Fiber Optic Cable Receiving, Handling and Storage.

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Quick Reference Installation Notes

Approximate Cable Diameter	18.45	mm	0.726	in
Operating Temperature	-40 to 85	°C	-40 to 185	°F
Maximum Stringing Tension (at tensioner)*	3,112	kgf	6,861	lbs
Minimum Bull Wheel Diameter	130	cm	51	in
Stringing Sheave Diameter**	74	cm	29	in
Minimum Bending Radius				
Cable				
Static (No load)	28	cm	11	in
Dynamic (under tension)	37	cm	15	in
Fiber				
Static (No load)	3.8	cm	1.5	in
Buffer Tube				
Static (No load)	8.0	cm	3.0	in

* - The stringing tension is always measured at the tensioner side. In general the maximum stringing tension should be approximately half of the maximum sagging tension and should never exceed 20% RBS of the OPT-GW.

** - The value indicated is for the first and last structures of the pull and is based on 40 times the diameter of the OPT-GW. Smaller diameters can be used at tangent structures. Reference AFL's installation instructions for more details.

Reference AFL's "Recommended Installation Procedures for Composite Optical Ground Wire" for detailed installation instructions.

Shipping Reels

Reel Type	*FL*	*TR*	*DR*	*OW*	*Tare*	*FL*	*TR*	*DR*	*OW*	*Tare*	*Capacity*	
	(cm)				*(kgs)*	*(in)*				*(lbs)*	*(meters)*	*(feet)*
Wood	152	91	91	107	245	60	36	36	42	540	2,580	8,460
Wood	168	91	91	107	260	66	36	36	42	573	3,420	11,220
Wood	183	91	91	107	300	72	36	36	42	662	3,420	11,220
Wood	213	97	89	112	416	84	38	35	44	917	3,420	11,220
Steel	152	81	81	97	156	60	32	32	38	344	2,650	8,690
Steel	183	91	102	107	245	72	36	40	42	540	4,280	14,040
Steel	213	114	107	130	351	84	45	42	51	774	6,020	19,750

FL - Flange Diameter; TR - Inside Traverse Width; DR - Drum Diameter; OW - Outside Overall Width

Minimum Arbor Hole Diameter: Wood: 3-1/8in (7.9cm)
Steel: 3-1/4in (8.2cm)

Maximum lengths shown are the longest lengths that AFL offers. Longer lengths may be possible.

Ordered lengths should include a distribution of lengths, i.e., all reels cannot be ordered at the maximum. A typical reel length distribution is as follows:

6000m – 7000m ~ 15% of reels
4500m – 6000m ~ 55% of reels
2500m – 4500m ~ 25% of reels
<2500m ~ 5% of reels

Wood reels with flex-wrap covering are standard. Non-returnable steel reels and/or wood lagging are available upon request. Additional reel sizes may be available upon request.

Steel reels are recommended for long term storage. Reference AFL's "Fiber Optic Cable Receiving, Handling and Storage" document for additional information.

Reel dimensions are typical and subject to availability at the time of shipment.

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Electrical Characteristics

Composite DC Resistance	[20°C]	0.2986	Ohms/km	0.4805	Ohms/mile
Geometric Mean Radius		0.72	cm	0.0236	feet
Inductive Reactance	[60 Hz frequency]	0.2826	Ohms/km	0.4548	Ohms/mile
[one foot (0.3048 meter) spacing]					
	[50 Hz frequency]	0.2355	Ohms/km	0.3790	Ohms/mile
Capacitive Reactance	[60 Hz frequency]	0.1670	MOhms·km	0.1038	MOhms·mile
[one foot (0.3048 meter) spacing]					
	[50 Hz frequency]	0.2004	MOhms·km	0.1245	MOhms·mile

Composite Coefficient of Thermal Resistance 0.00367 (1/°C)

Temperature		DC Resistance		AC Resistance	
(°C)	(°F)	(Ohms/km)	(Ohms/mile)	(Ohms/km)	(Ohms/mile)
20	68	0.2986	0.4805	0.3046	0.4902
25	77	0.3041	0.4894	0.3102	0.4992
30	86	0.3096	0.4982	0.3158	0.5082
35	95	0.3150	0.5070	0.3213	0.5172
40	104	0.3205	0.5158	0.3269	0.5262
45	113	0.3260	0.5247	0.3325	0.5351
50	122	0.3315	0.5335	0.3381	0.5441
55	131	0.3370	0.5423	0.3437	0.5531
60	140	0.3425	0.5511	0.3493	0.5621
65	149	0.3479	0.5599	0.3549	0.5711
70	158	0.3534	0.5688	0.3605	0.5801
75	167	0.3589	0.5776	0.3661	0.5891
80	176	0.3644	0.5864	0.3717	0.5981
85	185	0.3699	0.5952	0.3773	0.6071
90	194	0.3753	0.6040	0.3828	0.6161
95	203	0.3808	0.6129	0.3884	0.6251
100	212	0.3863	0.6217	0.3940	0.6341
105	221	0.3918	0.6305	0.3996	0.6431
110	230	0.3973	0.6393	0.4052	0.6521
115	239	0.4027	0.6482	0.4108	0.6611
120	248	0.4082	0.6570	0.4164	0.6701
125	257	0.4137	0.6658	0.4220	0.6791
130	266	0.4192	0.6746	0.4276	0.6881
135	275	0.4247	0.6834	0.4332	0.6971
140	284	0.4302	0.6923	0.4388	0.7061
145	293	0.4356	0.7011	0.4443	0.7151
150	302	0.4411	0.7099	0.4499	0.7241

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PLS-CADD Inputs

☐ Use simplified elastic cable model (no creep, no coefficient)

Name

Description: AFL OPGW DNO-13101 AC-125/726

Cross section area (in^2): 0.2813 Unit weight (lbs/ft): 0.690

Outside diameter (in): 0.726 Ultimate tension (lbs): 34,304

Temperature at which strand data below obtained (deg F): 68

Number of independent wires: 1

(above should be 1 unless cables are separated by spacers)

Outer Strands

Final Modulus of elasticity (psi/100): 181800

Thermal expansion coeff. (/100 deg F): 0.000810

Polynomial coefficients (all strains in %)

	A0	A1	A2	A3	A4
Stress-strain	-741.6	153409.5	24905.2	-173608	146956
Creep	-1004	130712.4	-114782.1	223783	-161047

Core Strands (if different from outer strands)

Final Modulus of elasticity (psi/100):

Thermal expansion coeff. (/100 deg F):

Polynomial coefficients (all strains in %)

	A0	A1	A2	A3	A4
Stress-strain					
Creep					

Thermal Rating Properties

Resistance at two different temperatures

Resistance (Ohms/mile): 0.4894 at (deg F): 77

Resistance (Ohms/mile): 0.5776 at (deg F): 167

Emissivity coefficient: 0.5

Solar absorption coefficient: 0.5

* Outer strands heat capacity (Watt-s/ft-deg F):

* Core heat capacity (Watt-s/ft-deg F):

Generate Coefficients from points on stress-strain curv | OK | Cancel

* These two fields do not need to be entered for OPGW - intentionally left blank.