



REQUEST FOR QUOTATION

<p>Contact person/Telephone Larry Waxman/201-395-3451</p>	<p>Collective# 0000039790 Bid Due Date 10/21/2014 Bids must be received no later than 11:00 AM on the above Bid Due Date.</p> <p>Deliver Goods/Services To: Path Attn: John Brunetto Academy Street Jersey City NJ 07302</p>
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Quantity	Description	Unit Price	Total
	<p>ELECTRICAL CABLES FOR PATH MEDIUM VOLTAGE 5KV AND 15KV FURNISH AND DELIVER PER ATTACHED SPECIFICATIONS NOTE: PATH WILL COLOR CODE EXTERIOR OF CABLES.</p> <p>QUOTE FOB DELIVERED PRICING ON ALL ITEMS.</p> <p>IN THE EVENT OF AN ORDER ADVISE DELIVERY IN _____ DAYS A.R.O.</p> <p>DELIVERY SCHEDULE: Delivery of all cables within 10 weeks of authorized Purchase Order, DRAWING APPROVAL AND INSPECTION BY PATH is desired.</p> <p>WITH BID RESPONSE ADVISE CABLES TO BE OFFERED: MANUFACTURER: _____ PLANT LOCATION: _____ MAKE/MODEL/PART NUMBER 5KV CABLE _____ AND MANUFACTURER: _____ PLANT LOCATION: _____ MAKE/MODEL/PART NUMBER 15KV CABLE _____ =====</p>		
	<p>PLEASE QUOTE FULLY DELIVERED PRICES</p>	<p>PAYMENT TERMS</p>	<p>Total Delivered Price</p>

This Quotation is subject to the terms and conditions set forth on the back page hereof. Bidder is advised to read these before signing.

We have read the instructions and, if favored with an order, we agree to furnish the items enumerated herein at the prices and under the conditions indicated.

Signed _____
 Firm Name _____
 Telephone number _____ Date _____
 Fax Number _____
 Federal Taxpayer ID _____

**Bidder
 Must
 Sign
 In
 Two
 Places**

NOTICE TO BIDDERS: Unless the following term of assurance that the above offer is irrevocable is signed, the offer submitted herein shall not be deemed to be complete.

The foregoing offer shall be irrevocable for 90 days after the date on which The PORT AUTHORITY TRANS-HUDSON CORPORATION opens this proposal.

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 Firm Name _____



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Bid Due Date
10/21/2014

Quantity	Description	Unit Price		Total	
	<p>NOTE: ALL PRICES QUOTED SHALL BE FIRM AND FIXED WITHOUT ADJUSTMENT FOR THE ENTIRE IRREVOCABLE BID PERIOD OF 90 DAYS AFTER THE BID OPENING DATE.</p> <p>-----</p> <p>CABLE 5KV ITEM. QUANTITY 7,715 FEET 5KV ELECTRICAL CABLE, TIMES \$ _____ PER FOOT EQUALS \$ _____.</p> <p>CABLE 15KV ITEM. QUANTITY 3,350 FEET 15KV ELECTRICAL CABLE, TIMES \$ _____ PER FOOT EQUALS \$ _____.</p> <p>-----</p> <p>ALL PRICES SHALL BE FOB DELIVERED ON A FLAT BED TRUCK INCLUDING NON-RETURNABLE WOOD REELS, TESTING, DRAWINGS ETC.</p> <p>=====</p> <p>===== CABLE MUST BE DELIVERED ON NON-RETURNABLE WOOD REELS TOTAL CABLE TOLERANCE: MINUS ZERO (0) / PLUS 5% / TOTAL RUN. REELS TOLERANCE MINUS ZERO (0) / PLUS 5% FEET PER REEL.</p>				
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	<p>BIDDERS ARE INSTRUCTED TO INCLUDE WITH YOUR BID RESPONSE TWO COPIES OF CATALOG CUTS/SPECIFICATIONS/DRAWINGS FOR PORT AUTHORITY / PATH REVIEW AND APPROVAL.</p> <p>-----</p> <p>IN THE EVENT OF AN ORDER: Deliver all cable reels to 120 Academy Street, Jersey City. Contact Mike Brady at 201-216-6985 or John Brunetto at 201-216-6969 for coordinating deliveries. Provide hydraulic or similar hoisting machine capable of unloading all reels. Reels unloaded by Vendor or a representative under the direction and supervision of designated PATH staff. Provide a minimum of two weeks notice for the scheduled delivery dates. ...END...</p> <p>PLEASE FOLLOW RETURN TO BID INSTRUCTIONS. REPLY ONLY ON PATH / PA REQUEST FOR QUOTATION FORM AS ATTACHING YOUR COMPANY'S TERMS & CONDITIONS MAY CAUSE YOUR BID TO BE DEEMED NON RESPONSIVE AND OR DELAY AN AWARD ISSUED.</p> <p>A price preference of 10 % is available for NY/NJ Minority and Women Business Enterprises (M/WBE) or 5% for NY/NJ Small Business Enterprises (SBE) certified by the Port</p>				
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Quantity	Description	Unit Price		Total	
	Authority (PA) by the day before bid opening for awards not exceeding \$1,000,000. My firm was certified as a _____ on _____. QUESTIONS ONLY CONTACT: LARRY WAXMAN TEL: 201 395 3451 OR EMAIL: Lwaxman@panynj.gov				
	<p style="text-align: center;">PLEASE QUOTE FULLY DELIVERED PRICES</p>	<p>PAYMENT TERMS</p>	<p>Total Delivered Price</p>		

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Quantity	Description	Unit Price		Total	
	<p>This is a Formal Bid Invitation Mail Sealed Bids to:</p> <p>The Port Authority of NY & NJ Attn: Bid Custodian Procurement Department 2 Montgomery Street, 3rd Floor Jersey City, NJ 07302</p> <p>by the date and time listed above, where it will be publicly opened and read.</p> <p>Bids are only accepted Monday through Friday, excluding Port Authority holidays, between the hours of 8 A.M. & 5 P.M., via regular mail, express delivery service or hand delivery.</p> <p>If you do not use or have an envelope provided, you must clearly mark the outside envelope/package with 'BID ENCLOSED' and show the company name, address, as well as Bid number and Due date as stated on this bid document.</p> <p>A valid photo id is required to gain access into the building, to attend the bid opening or hand deliver a bid.</p>				
1 LOT	<p>5KV Cables</p>				
<p>PLEASE QUOTE FULLY DELIVERED PRICES</p>		<p>PAYMENT TERMS</p>		<p>Total Delivered Price</p>	

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10/21/2014

Quantity	Description	Unit Price		Total	
1 LOT	15KV Cables				
PLEASE QUOTE FULLY DELIVERED PRICES		PAYMENT TERMS		Total Delivered Price	

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TERMS AND CONDITIONS

1. The Port Authority (PA) reserves the right to request information relating to seller's responsibility, experience and capability to perform the work.
2. Unless otherwise provided, complete shipment of all items must be in one delivery FOB delivery point. Payment will not be made on partial deliveries unless authorized in advance by the party to be charged and the discount, if any, will be taken on the total order.
3. PA payment terms are net 30 days. Cash discounts for prompt payment of invoices may be taken but will not be considered in determining award, except in the case of tie bids.
4. Separate unit and total FOB delivered prices must be shown.
5. Sales to the PA and to PATH are currently exempt from New York and New Jersey State and local taxes and generally from federal taxation. The seller certifies that there are no federal, state, municipal or any other taxes included in the prices shown hereon.
6. The PA shall have the absolute right to reject any or all proposals or to accept any proposal in whole or part and to waive defects in proposals.
7. Unless the phrase "no substitute" is indicated, bidder may offer alternate manufacturer / brands, which shall be subject to Port Authority approval. Please indicate details of product being offered with bid.
8. Acceptance of seller's offer will be only by Purchase Order Form signed by the PA. No change shall be made in the agreement except in writing.
9. If the seller fails to perform in accordance with the terms of this purchase order, the PA may obtain the goods or services from another contractor and charge the seller the difference in price, if any, a reletting cost of \$100, plus any other damages to the PA.
10. Upon request, sellers are encouraged to extend the terms and conditions of any terms agreement with the PA to other government and quasi-government entities by separate agreement.
11. By signing this quotation or bid, the seller certifies to all statements on Form PA 3764A regarding non-collusive bidding; compliance with the PA Code of Ethics; and the existence of investigations, indictments, convictions, suspensions, terminations, debarments and other stated occurrences to assist the PA in determining whether there are integrity issues which would prevent award of the contract to the seller. The PA has adopted a policy set forth in full on PA 3764A, that it will honor a determination by an agency of the State of New York or New Jersey that a bidder is not eligible to bid on or be awarded public contracts because the bidder has been determined to have engaged in illegal or dishonest conduct or to have violated prevailing wage legislation. The Terms and Conditions of PA 3764A apply to this order. A copy can be obtained by calling (201) 395-3405 or at <http://www.panynj.gov/business-opportunities/become-vendor.html>
12. The vendor may subcontract the services or use a supplier for the furnishing of materials required hereunder to such persons or entities as the Manager, Purchasing Services may from time to time expressly approve in writing. All further subcontracting shall also be subject to such approval.
13. The successful bidder (vendor) shall not issue nor permit to be issued any press release, advertisement, or literature of any kind, which refers to the Port Authority or that goods will be, are being or have been provided to it and/or that services will be, are being or have been performed for it in connection with this Agreement, unless the vendor first obtains the written approval of the Port Authority. Such approval may be withheld if for any reason the Port Authority believes that the publication of such information would be harmful to the public interest or is in any way undesirable.
14. Neither the Commissioners of the Port Authority, nor Directors of PATH, nor any of them, nor any officer, agent or employee thereof, shall be charged personally by the Contractor with any liability, or held personally liable to the Contractor under any term or provision of this Agreement, or because of its execution or attempted execution, or because of any breach, or attempted or alleged breach, thereof.

B# 10096047 MV 5/15
BID# 39790

**FURNISH AND DELIVER MEDIUM-VOLTAGE CABLES
FOR THE PORT AUTHORITY TRANS-HUDSON CORPORATION**

GENERAL PROVISIONS

Scope:

As directed by PATH, furnish and deliver reels of cable for Medium-Voltage Cables (5KV and 15KV). All cable shall be in compliance with all General Provisions and with the attached reference Technical Specifications.

Furnish and deliver the following assortment of Cable reels:

Reel#	Cable Size	Rated Voltage	Reel Lengths	Reel Name	PA Spec
1	*	5KV	400 ft ea	AF5 MH76B/78B	16124
2	*	5KV	460 ft ea	AF5 MH78B/80B	16124
3	*	5KV	400 ft ea	AF5 MH80B/82B	16124
4	*	5KV	265 ft ea	AF5 MH82B/82.5B	16124
5	*	5KV	400 ft ea	AF5 MH82.5B/84B	16124
6	*	5KV	525 ft ea	AF5 MH84B/86B	16124
7	*	5KV	500 ft ea	AF5 MH86B/88B	16124
8	*	5KV	400 ft ea	AF5 MH88B/90B	16124
9	*	5KV	350 ft ea	AF5 MH90B/92B	16124
10	*	5KV	360 ft ea	AF5 MH92B/92.5B	16124
11	*	5KV	275 ft ea	AF5 MH92.5B/94.3B	16124
12	*	5KV	330 ft ea	AF5 MH94.3B/96.5B	16124
13	*	5KV	600 ft ea	AF5 MH96.5B/98B	16124
14	*	5KV	550 ft ea	AF5 MH98B/100B	16124
15	*	5KV	400 ft ea	AF5 MH100B/102B	16124
16	*	5KV	225 ft ea	AF5 MH102B/102.5B	16124
17	*	5KV	200 ft ea	AF5 MH102.5B/104B	16124
18	*	5KV	175 ft ea	AF5 MH104B/106B	16124
19-20	*	5KV	2 @ 450 ft ea	AF5 Sub # 1 Connect	16124
21	**	15KV	400 ft ea	2SF-7N-3 MH76B/78B	16124
22	**	15KV	460 ft ea	2SF-7N-3 MH78B/80B	16124
23	**	15KV	400 ft ea	2SF-7N-3 MH80B/82B	16124
24	**	15KV	265 ft ea	2SF-7N-3 MH82B/82.5B	16124
25	**	15KV	400 ft ea	2SF-7N-3 MH82.5B/84B	16124
26	**	15KV	525 ft ea	2SF-7N-3 MH84B/86B	16124
27	**	15KV	500 ft ea	2SF-7N-3 MH86B/88B	16124
28	**	15KV	400 ft ea	2SF-7N-3 MH88B/90B	16124

* See PA Specification 16124, PSC-C 09/30/14, Part 2.02.A.1.a

** See PA Specification 16124, PSC-C 09/30/14, Part 2.02.A.1.b

General Notes.

1. This PO is solely for furnishing and delivering of cable specified. There are no cable terminations or connectors, being furnished.
2. Cable Reel dimensions cannot exceed 66 inches in diameter and 44 inches in depth.

3. Cable Length tolerances -0% to +5% of the lengths indicate for each reel of cable.
4. Vendor shall unload all cable reels onto PATH storage location at 120 Academy Street Jersey city, NJ
5. All cable reels shall have an approved pulling device installed and an approved cable end seal cap as specified in the Technical Specifications.
6. All Reels shall be of wood construction and be non returnable
7. For all Technical Specifications attached, wherever the term "Contract Drawings" is shown, replace this term with "General Provisions"
8. PATH shall be afforded the opportunity to witness factory testing.

Attached Technical Specifications:

PA Spec #	TITLE	DATE	PAGES
16124	Quadruplexed Medium Voltage Shielded Power Cable	PSC-C 09/30/14	16 Pages

Manufacturers

List of acceptable manufacturers, or approved equal, are:

- The Okonite Company
- Rockbestos, Inc
- Draka Cableteq, Inc

Delivery

Deliver all cable reels to 120 Academy Street, Jersey City. Contact Mike Brady at 201-216-6985 or John Brunetto at 201-216-6969 for coordinating deliveries. Provide hydraulic or similar hoisting machine capable of unloading all reels. Reels unloaded by Vendor or a representative under the direction and supervision of designated PATH staff. Provide a minimum of two weeks notice for the scheduled delivery dates.

Schedule

Delivery of all cables within 10 weeks of authorized Purchase Order is desired.
Indicate delivery lead-time in the bid.

Bidders Notes:

The Total delivered price shall include (but not be limited to) cable, reels, inspections, shipping, and delivery FOB delivery point.

DIVISION 16

SECTION 16124

QUADRUPLEXED MEDIUM VOLTAGE SHIELDED POWER CABLE

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for wires, cables, splices, terminations and appurtenances for electrical systems of medium voltage: 15,000 volts and 35,000 volts.

1.02 REFERENCES

The following is a listing of the publications referenced in this Section:

American Society for Testing and Materials (ASTM)

- | | |
|-------------|--|
| ASTM B 1 | Hard-Drawn Copper Wire |
| ASTM B 2 | Medium-Hard-Drawn Copper Wire |
| ASTM B 3 | Soft or Annealed Copper Wire |
| ASTM B 8 | Concentric-Lay Stranded Copper Conductor, Hard, Medium-Hard, or Soft |
| ASTM B 29 | Pig Lead |
| ASTM B 33 | Tinned Soft or Annealed Copper Wire for Electrical Purposes |
| ASTM B 189 | Lead-Coated and Lead-Alloy Coated Soft Copper Wire for Electrical Purposes |
| ASTM B496 | Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors |
| ASTM E662 | Test Method for Specific Optical Density of Smoke Generated by Solid Materials |
| ASTM D 1373 | Medium-Voltage Rubber Insulating Tape |
| ASTM D 2802 | Ozone-Resistant Ethylene-Propylene-Rubber Insulation for Wire and Cable |

Association of Edison Illuminating Companies (AEIC)

- | | |
|-------------|--|
| AEIC CS-6 | Ethylene-Propylene-Rubber Insulated Shielded Power Cable Rated 5 through 69 KV |
| AEIC CS8-00 | Extruded Ethylene-Propylene-Rubber Insulated Shielded Power Cable Rated 5 through 46KV |

Federal Specifications (FS)

HH-I-553 Insulation Tape, Electrical (Rubber, Natural and Synthetic)

Insulated Cable Engineers Association (ICEA)

ICEA S-97-682 Standard for Utility Shielded Power Cable Rated 5KV through 46KV

ICEA-S93-639 Extruded Ethylene-Propylene-Rubber Insulated 5KV through 46KV Shielded Power Cable for the Transmission and Distribution of Electrical Energy

ICEA T-26-465 Guide for Frequency of Sampling Extruded Dielectric Power, Control, Instrumentation, and Portable Cables for Test

ICEA T-30-520 Guide for Conducting Vertical Tray Flame Test

ICEA T-27-581 Standard Test Methods for Extruded Dielectric Power, Control, Instrumentation & Portable Cables for Test

Institute of Electrical and Electronics Engineers (IEEE)

IEEE 48 High Voltage AC Cable Terminators, Test Procedure and Requirements

IEEE 383 Type Test of Class 1E Electric Cables, Field Splices and Connections for Nuclear Power Generating Stations

IEEE 404 Standard for Type Test of Cable Joints for Use with Extruded Dielectric Cable Rated 5,000 through 46,000 Volts, and Cable Joints for Use with Laminated Dielectric Cable Rated 2,500 through 500,000 Volts

IEEE 1202 Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies

National Fire Protection Association (NFPA)

NFPA 70 National Electrical Code

NFPA 258 Standard Research Method for Determining Smoke Generation of Solid Materials

NFPA 130 Standard of Fixed Guideway Transit Systems

OSHA Occupation Safety and Health Administration

Underwriters Laboratories Inc. (UL)

UL 44 Rubber-Insulated Wires and Cables

UL 510 Insulating Tape

UL 1072 Medium Voltage Cable

UL 1581 Reference Standard for Electrical Wires, Cables, and Flexible Cords.

UL 1685 Standard for Safety Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Wires, cables, splices and terminations for medium voltage shall be furnished and installed in accordance with this Section and as specified on the Contract Drawings.
- B. Components of the medium voltage system, manufactured, supplied and installed, shall comply with the requirements of NFPA 70, all local codes, and the requirements of OSHA.

1.04 QUALITY ASSURANCE

- A. The manufacturer shall have had a minimum of ten (10) years experience in manufacturing cable of the type and size described herein and the Contractor shall have the manufacturer provide a list of installations and contracts for which he has produced such materials.
- B. Test requiring certified reports and those tests requiring factory or field inspection shall be conducted and reported to the Engineer in conformance with standards specified in this Section.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Multiple single conductor cables are to be installed as one cable assembly. Single conductor cables shall be paralleled by cable manufacturer prior to shipment.
- B. Cable reels shall be made of wood and non-returnable. The cable length per reel and reel flange diameter shall be determined by contractor.
- C. Store material in a clean dry space and protect it from the weather.

1.06 SUBMITTALS

See Appendix A.

PART 2. PRODUCTS

2.01 MANUFACTURERS

Provide wires, cables, splices and terminations, and ancillary equipment, in compliance with the requirements of this section, and as shown on the Contract Drawings.

2.02 MATERIALS

A. WIRES AND CABLES

- 1. Locations, types, sizes and numbers of wires and cables are shown on the Contract Drawings. The specific requirements for 5KV, 15KV and 35KV cables as follow:

- a. 5KV cable shall be of a quadruplexed construction. The individual conductor shall include (3) - 5KV 133% insulation level #2 AWG 90°C phase conductors plus (1) - #8 AWG 90°C 600 volts ground conductor.
 - b. 15KV cable shall be of a quadruplexed construction. The individual conductor shall include (3) - 15KV 133% insulation level 4/0AWG 90°C phase conductors plus (1) - 1/0AWG 90°C 600 volts ground conductor.
 - c. 35KV cable shall be of a quadruplexed construction. The individual conductor shall include (3) - 35KV 100% insulation level 2/0AWG 90°C phase conductors plus (1) - 1/0AWG 90°C 600 volts ground conductor.
 - c. Overall diameters of cables 35KV, 15KV, and 5KV shall be not exceed the allowable (NFPA 70) limits for installation in 5 inch and 4 inch trade size conduits or ducts.
2. The cable assembly shall conform to AEIC CS8-00, ICEA S-93-639, and UL 1072.
 - a. The conductors shall be soft or annealed copper conforming to ANSI/ASTM B33 tinned, ANSI/ASTM B3 if uncoated. Conductors shall be concentric stranded as per ANSI/ASTM B8 or compact stranded per ANSI/ASTM B496.
 - b. The cable assembly shall be suitable for prolonged use in wet areas.
 3. Wires and cables which have been manufactured more than six months prior to the date of purchase order shall not be used in the work of this section.

B. PHASE CONDUCTOR

1. Voltage Rating – as indicated, suitable for three phase, 60-Hertz systems.
2. Conductor Screen – The conductor screen shall be an extruded ethylene propylene rubber semi-conducting thermoset compound that is compatible with the insulation. The nominal thickness shall be 15 mils and be referenced to ICEA S-97-682 “Standard for Utility Shielded Power Cables rated 5kV through 46kV.”
3. Insulation – The insulation shall be ethylene-propylene-rubber (EPR), 133% insulation level or 100% insulation level as specified, conforming to AEIC No. CS8-00, ICEA S-93-639, NFPA 130 Section B-2.5.3.2, ASTM D 2802 of this specification. The ethylene content of the elastomer used in the insulation compound shall not exceed 72% by weight of ethylene nor shall the insulation compound contain any more than 0% polyethylene.
4. Insulation Screen – The insulation screen shall be an extruded semi-conducting thermoset compound that is compatible with the insulation. The screen thickness is based on insulation diameter and shall be as per ICEA S-97-682 Table 5-1.
5. Shielding Tape – The extruded insulation screen shall be covered with a bare copper tape. It shall be applied helically with a 25% nominal overlap.
6. Jacket – The jacket material shall be thermoset non-halogen, low smoke, flame retardant and meet or exceed the physical properties in accordance with ICEA S-93-639, 5-46kV shielded power cable. The jacket shall be composed of an extruded thermoset cross-linked polyolefin. Representative test data for the cable as defined in this standard shall be attached to the quotation verifying compliance with the IEEE 383 Flame Test.

7. The conductor screen, ethylene-propylene insulation and the insulation screen shall be triple-tandem extruded.
8. All insulation shall also conform to Article 310 of NFPA 70 and be moisture and heat resistant types carrying temperature ratings corresponding to the conditions of application and in no case lower than 90°C (194°F).
9. General Construction
 - a. Conductor – Copper, Class B stranded type concentric stranded or compact round conductor
 - b. Extruded semi-conducting thermoset EPR compound for the conductor screen
 - c. Insulation
 - d. Extruded semi-conducting thermoset EPR compound for the insulation screen
 - e. 5 mil Copper Shielding Tape, 25% overlap
 - f. Separator Tapes
 - g. Jacket – Extruded thermoset Cross-linked polyolefin Jacket

C. GROUND CONDUCTOR

1. General Construction
 - a. Conductor – Copper, Class B1 concentric strands
 - b. Insulation – Ethylene Propylene rubber as per ICEA S-93-639 and UL44.
 - c. Jacket – Extruded thermoset Cross-linked polyolefin as per ICEA S-05-658.

D. WIRE and CABLE CONSTRUCTION

Wire and cable for use in power circuits and control circuits to related emergency devices shall be listed as being resistant to the spread of fire and shall have reduced smoke emissions. Cable shall be permitted to be listed by any of the following methods:

1. The cable does not spread fire to the top of the tray in the vertical-tray flame test in UL 1581, Section 1160, and the cable exhibits a specific optical density of smoke at 4 minutes into the test that does not exceed 200 in the flaming mode or 75 in the non-flaming mode when tested in according with ASTM E 662.
2. The cable exhibits damage (char length) that does not exceed 1.5 m (4.9 ft) when the vertical flame test, with cable in cable trays, is performed as described in CSA C22.2 No. 0.3, and the cable exhibits a specific optical density of smoke at 4 minutes into the test that does not exceed 200 in the flaming mode or 75 in the non-flaming mode when tested in according with ASTM E 662.
3. The cable is listed as limited smoke cable (/LS) by meeting the cable damage height, total smoke released, and peak smoke release rate criteria required when tested in the vertical tray flame test in UL 1685. The following performance criteria shall be met when testing according to UL 1685:
 - a. When testing in the UL vertical tray flame exposure:
 - (1) The cable damage height shall be less than 2.44 m (8 ft) when measured from the bottom of the cable tray.

- (2) The total smoke released shall not exceed 95 m^2 (1023.6 ft^2)
 - (3) The peak smoke release rate shall not exceed $0.25 \text{ m}^2/\text{s}$ ($2.7 \text{ ft}^2/\text{s}$).
- b. Alternatively, when testing in the IEEE 1202 flame exposure:
- (1) The cable damage height shall be less than 1.5 m (4.9 ft) when measured from the lower edge of the burner face..
 - (2) The total smoke released shall not exceed 150 m^2 (1615 ft^2)
 - (3) The peak smoke release rate shall not exceed $0.40 \text{ m}^2/\text{s}$ ($4.3 \text{ ft}^2/\text{s}$).
4. The cable is listed as having fire-resistant characteristics capable of preventing the carrying of the fire from floor to floor, by being capable of passing the requirements of the ANSI/UL 1666, and the cable exhibits a specific optical density of smoke at 4 minutes into the test that does not exceed 200 in the flaming mode or 75 in the non-flaming mode when tested in according with ASTM E 662.
 5. The cable is listed as having adequate fire-resistant and low smoke-producing characteristics, by having a flame travel distance that does not exceed 1.52 m (5 ft), generating a maximum peak optical density of smoke of 0.5 and a maximum average optical density of smoke of 0.15 when tested in accordance with NFPA 262.

E. Pulling Devices and End Seals

1. Wires and cables shall be provided with factory fitted pulling devices and end caps.
2. For pulling tensions up to 1,000 pounds per grip, basket grips may be utilized.
3. All wires and cables shall be end sealed, at both ends of each length, with either a solder-wiped seal or a heat-shrinkable cap, to prevent the entrance of moisture.
4. The quadruplexed cable assembly shall be provided with a compression type pulling eye. This common pulling eye shall have a compression sleeve attachment that fits over the cable ends for the purpose of pulling a quadruplexed cable assembly. Acceptable manufacturer is Utilities Industries, Inc (PULL-CON products) or Engineer approval equal. Trailing ends of conductors shall be provided with thick walled heat shrinkable end caps.

F. IDENTIFICATION

1. The following information shall be durably printed on the jacket surface and repeated at intervals not exceeding 24 inches:
 - Manufacturer's Name
 - Manufacturing Plant No.
 - No. of Conductors
 - Size of Conductors
 - Insulation material and Thickness
 - Jacket material LS-Non-Halogen
 - Rated Voltage (15,000 volts or 35,000 volts as appropriate)
 - Sequential Footage
 - Date of Manufacture

UL Listing

Property of PATH

2. Each phase of the cable shall also be identified by printing Phase "A", Phase "B", and Phase "C" respectively.
3. Each reel shall carry a tag identifying manufacturer, cable type, size, voltage and length of cable on reel.

G. PHYSICAL AND ELECTRICAL CHARACTERISTICS OF ETHYLENE PROPYLENE

When samples from completed cables are tested, the vulcanized ethylene propylene rubber (EPR) insulation shall meet the following guaranteed values:

1. Properties tested for control of Product	<u>Guaranteed Values</u>
a. Typical Requirements – Unaged	
(1) Tensile Strength, minimum at Room Temp.	1200 psi (8.3 N/mm ²)
(2) Elongation, % minimum	250
(3) 200% Modulus, minimum	1000 psi (6.9 N/ mm ²)
b. Aging Requirements After 168 hours at <u>136°C</u>	
(1) Tensile Strength, % of unaged, minimum	90
(2) Elongation, % of unaged, minimum	85
c. Insulation Resistance Constant (k), minimum	50,000
d. Degree of Cure	
(1) Heat Distortion, 1 hour at 121°C, Maximum	10.0
(2) Hot Creep & Set	
(a) Hot Creep, % Elongation, maximum	50.0
(b) Set, % maximum	5.0
2. Properties, demonstrated by qualification testing, that are inherent to the formulation.	
a. Physical Requirement-Unaged	
100% Hot Modulus, at 130°C, minimum	200 psi (1.4 N/mm ²)
b. Aging Requirements After 168 hours at 150°C	
(1) Tensile Strength, % of unaged, minimum	90
(2) Elongation, % of unaged, minimum	85
c. Ozone Resistance	
After 24 hours at 0.025 to 0.030%	No Cracks
d. Electrical Characteristics	
(1) SIC at 80 V/mil at 15.6°C maximum	1.0
(2) % Power Factor at 15.6°C and 80 V/mil, maximum	0.5
(3) After 24 hours water immersion at 90°C	

(a) Dielectric Constant, SIC, 80 V/mil. maximum		3.0		
(b) Power Factor, PF %		1.5		
(4) After 26 hours water immersion at 90°C				
(a) Dielectric Constant, SIC, 80 V/mil, maximum		3.1		
(b) Power Factor, PF %		1.5		
(c) Stability Factor (PF at 80-40 V/mil), maximum		0.2		
e. Mechanical Water Absorption				
7 days at 70°C, maximum		5.0 mg/in ² (0.77 mg/cm ²)		
)				
f. Smoke Generation Uncorrected During First 4 Min. and Within 20 Min. of Test.				
	<u>4 Min. Flaming</u>	<u>4 Min. Non-Flaming</u>	<u>20 Min. Flaming</u>	<u>20 Min. Non-</u>
	<u>Flaming</u>			
	100	75	200	350

H. PHYSICAL AND ELECTRICAL CHARACTERISTICS OF THE THERMOSET XLPO JACKET

When tested in accordance with ICEA and UL requirements the XLPO jacket shall meet the guaranteed values below:

1.	Properties tested for control of Product	<u>Guaranteed Values</u>
a.	Physical Requirements – Unaged	
	(1) Tensile Strength, Minimum	1700 psi (11.8 N/mm ²)
	(2) Elongation at Rupture, % minimum	160
b.	Aging Requirements	
	(1) Air Oven Test at 121°C for 168 hours	
	(a) Tensile Strength, % of unaged value, Minimum	60
	(b) Elongation, % of unaged, Minimum	60
	(2) Oil Immersion, at 121°C for 18 hours	
	(a) Tensile Strength, % of unaged value, Minimum	60
	(b) Elongation, % of unaged value, Minimum	50
2.	Properties, demonstrated by qualification testing, that are inherent to the formulation.	
a.	Aging Requirements	
	(1) Air Oven Test at 100°C for 168 hours	
	(a) Tensile Strength, % of unaged value, Minimum	100
	(b) Elongation, % of unaged value, Minimum	75
	(2) Air Oven Test at 150°C for 168 hours	

- b. All materials for making splices and terminations shall be specifically designed for use with the type of wire or cable, insulation and installation and operating conditions of the specific application.
 - c. Splices and terminations shall be supplied as complete kit assemblies with all components and detailed installation instructions. Splices and terminations for medium voltage cables shall be cold shrink type manufactured by 3M.
 - d. Connectors used with conductors with strand filled semiconducting blocking compound shall be crimp type. Otherwise, connectors shall be solder type.
2. Subject to compliance with requirements of this Section, provide connectors of the following types:
- a. Split-sleeve, solder, high conductivity, corrosion resistant connectors;
 - b. Solderless, uninsulated, high conductivity, corrosion resistant, compression connectors conforming to UL 467 and IEEE 837;
 - c. Welded type connectors.
3. Terminals
- a. Subject to compliance with requirements of this Section, provide terminals of the following types:
 - (1) Solder terminals shall be high conductivity, corrosion resistant type;
 - (2) Solderless, uninsulated, high conductivity, corrosion-resistant compression terminals conforming to UL 467 and IEEE 837;
 - (3) Welded type terminals.
4. Shrinkable Tubing
- a. Subject to compliance with requirements of this Section provide shrinkable tubing of the following types:
 - (1) Either irradiated modified polyvinyl chloride or irradiated modified polyolefin heat shrinkable tubing.
 - (2) Cold, shrinkable tubing.
5. Tapes and Sealers
- a. Vinyl Tapes: Flame-retardant, cold and weather-resistant, 3/4 inch and 1 1/2 inches wide, as required, and conforming to UL 510 and ASTM D3005.
 - (1) For interior, dry locations, provide tape 7 mils thick, conforming to ASTM D3005 (Type I).
 - (2) For exterior or damp and wet locations, provide tape 8.5 mil thick, conforming to ASTM D3005 (Type II).
 - b. Rubber Tapes: Ethylene-propylene, rubber-based, 30-mil splicing tape, rated for 130 degrees C operation; 3/4 inch and wider (1, 1 1/2, 2 inches) or as shown on the Contract Drawings, or as approved by the Engineer.
 - c. Insulating Putty: Rubber-based, 125-mil elastic filler putty; 1-1/2 inches wide; Scotch (3M) Scotchfil, or approved equal.

- d. Silicone Rubber Tapes: Inorganic silicone rubber, 12-mil 130 degrees C rated, anti-tracking, self-fusing tape; 1 inch wide.
- e. Sealer: Liquid applied, fast-drying sealant; Scotch (3M) Scotchkote, or approved equal.
- 6. Binding wire shall be uninsulated, tinned copper.
- 7. Lead sleeve shall be 5/32 inches thick, commercially and chemically pure, and shall conform to ICEA S-97-682 and ASTM B29.
- 8. Solder
 - a. Solder used on the shielding braids of any cable shall be 50 percent tin/50 percent lead.
 - b. Solder used for wiping the lead splice sleeve to the lead sheath of any cable shall be 40 tin/60 lead, Class A.
 - c. Flux used when soldering conductor connectors or shielding tapes and shielding braids shall be of a non-corrosive and non-acid type.
- 9. Insulating compound shall be installed in all lead-covered splices and all potheads.
- 10. For arcproofing materials, refer to Section 16128.
- 11. Ground Straps Flexible, tinned copper braid, equivalent to #6 AWG.
- 12. Special splicing materials and methods shall be as shown on the Contract Drawings.

PART 3. EXECUTION

3.01 EXAMINATION

- A. Inspect all wire, cables, equipment and accessories prior to installation. Replace any damaged items.

3.02 PREPARATION

- A. Prior to pulling wires and cables, clean raceway systems of all foreign matter and perform all operations necessary so as not to cause damage to wires and cables while pulling.
- B. Prior to pulling wires and cables into underground conduit systems, place a feeding tube approved by the Engineer at the entrance end of such systems.

3.03 INSTALLATION

A. WIRE and CABLE INSTALLATION

- 1. General
 - a. Keep wires and cables dry at all times.
 - b. Seal wire and cable ends with watertight end seals if splicing or terminating does not follow at once.

- c. Before splicing or terminating wires and cables, make a thorough inspection to determine that water has not entered the wires and cables or that the wires and cables have not been damaged.
- d. Use adequate lubrication when installing cables in conduits or raceways. Any pulling compounds shall be compatible with the finish of the wires and cables furnished.

B. SPLICES and TERMINATIONS

1. General

- a. All medium voltage wires and cables shall be spliced in each manhole through which they pass, unless otherwise specified in this Section or otherwise shown on the Contract Drawings, or unless the Contractor submits pulling tension and sidewall pressure calculations and they are approved by the Engineer. Sufficient slack shall be provided for several resplicings.
- b. Any splicing or terminating methods other than those required by this Section, for which the components are in accordance with the requirements of this Section, shall be submitted to the Engineer for approval.
- c. All cables shall be checked for phase identification before and after terminations have been made. All phase discrepancies shall be corrected.

2. Insulated Wires and Cables

- a. Splices and terminations shall be completed by workmen trained and experienced in the type of cable and the voltage class specified in this Section, with not less than 3 years experience in this specialty type of work, and who perform similar splices and terminations on a regular basis.
- b. Where required by the Engineer, sample splices shall be demonstrated to the Engineer by each splicer performing the Work of this Section. The sample shall be provided to the Engineer after completion of the demonstration.
- c. Terminations using stress-relief cones, which conform to Class 1, IEEE 48 shall be made in accordance with the cable manufacturer's recommendations.
- d. Splices shall conform to IEEE 404 and shall:
 - (1) meet the full electrical and physical integrity of the wire and cable construction, including voltage rating, ampacity, BIL, and type of waterproofing;
 - (2) conform to the wire and cable manufacturer's requirements and recommendations.
- e. For cable where moisture is present, each such cable shall be nitrogen-purged to remove all moisture. The purging procedure shall be submitted to the Engineer for approval.
 - (1) All terminators shall include a lead-wiping collar or adaptor and all splices shall be lead-sleeve, wiped construction.
 - (2) For each splice using filling compound shall be air-tested, prior to filling with insulating compound. The air-testing procedure shall be submitted to the Engineer for approval.

- (3) All splices shall be inspected and approved by the Engineer prior to pouring insulating compound into sleeve casing and overall vinyl taping.
 - (4) Where cable is jacketed over the lead sheath, apply two half-laps of vinyl tape over other complete splice.
- f. Where splices or terminations are on the Electrical Utility Company (Utility) side of incoming service equipment, the splices or terminations shall be of the type and style approved by the Utility and shall be submitted to the Utility for approval.
3. Grounding Wires and Cables
- a. Splices and terminations shall be installed in accordance with the manufacturer's written recommendations.
 - b. In hazardous or classified locations, splices and terminations shall be solderless, high conductivity, corrosion-resistant, compression type connectors.
 - c. All underground connections shall be covered with two coats of asphalt base paint.
 - d. Each splice shall be bonded to ground, using a flexible ground strap, 2 feet long, not less than #6 AWG or equivalent size.

C. ARCPROOFING

For arcproofing of cables, see Section 16128, of the Specification.

D. IDENTIFICATION of WIRES and CABLES

1. Each wire and cable shall be identified by its circuit in all cabinets, boxes, manholes, handholes, wire ways, and other enclosures, and at all terminal points.
2. The circuit designations shall be as shown on the Contract Drawings. Cable tags shall be attached to wires and cables in such a manner as to be readily visible.
3. The tag ties shall be wrapped around all conductors comprising the circuit or feeder to be identified.
4. Cable tags shall be stainless steel metal, no. 28 gauge and 3/4-inch wide, embossed with letter and numbers 5/16-inch high, fastened to the cable at both ends of tags with nominal 1/16-inch diameter monel metal wires or stainless steel cable ties.
5. Wires and cables that are arcproofed shall be identified outside the applied arcproofing.

E. FIELD TESTS

1. Medium Voltage Shielded Power Cables
 - a. After installation and before they are placed in service, run direct current voltage tests in accordance with AEIC CS 6, paragraphs K.2 and K.3, on all shielded cables.

- b. A copy of all test reports, together with an outline of the test method used, shall be submitted to the Engineer for review.
2. Ground Wires and Cables
 - a. Ground wires and cables shall be tested to prove continuity and proper connections to equipment and ground rods.
 - b. The Contractor shall certify all field testing and shall submit the test results to the Engineer for approval.

F. FACTORY TESTS

The following tests shall be performed, in the presence of the Engineer, on the completed cable assembly or samples of the cable, as required, prior to acceptance by the Engineer and approval for shipment. The values to be achieved shall be either as required by the specific standard or as shown in this specification.

1. Perform AC and DC dielectric-withstand and insulation resistance in water tests for all cable, in accordance with ICEA S-93-639.
2. Perform Unaged Physical Requirement test in accordance with ICEA S-93-639.
3. Perform Aging Requirement Testing in accordance with ICEA S 93-639 (121⁰C test).
4. Perform Degree of Cure Testing in accordance with ICEA S-93-639.
5. Cable tests in accordance with AEIC CS-6.
6. Perform Oil Immersion Testing in accordance with ICEA S-63-639.

The Engineer reserves the right to acquire additional testing, or to waive factory inspection or witnessing of tests. The contractor shall notify the Engineer 14 calendar days in advance of the performance of such factory tests. The cost of the factory tests shall be borne solely by the Contractor.

G. QUALIFICATION (CERTIFICATION) TESTS

The Vendor shall submit certification to the Engineer that the following tests were completed and that the values obtained meet or exceed those shown in this specification.

1. Ozone Resistance Testing
2. Mechanical Water Absorption Testing
3. Electrical Characteristic Testing (Water Immersion)
4. Scrape Abrasion Testing
5. Oxygen Index Testing
6. Copper Mirror Corrosion Testing
7. Acid Gas Generation Testing
8. Specific Surface Resistivity Testing
9. Vertical Tray Flame Testing

10. Smoke Generation Testing
11. Halogen Content Testing
12. Toxicity Index Testing

H. INDEPENDENT LABORATORY TESTS

Unless otherwise shown on the Contract Drawings, submit a 2'-0" sample from 25% of the shipping reels to an independent laboratory approved by the Engineer for the following tests which shall be performed in accordance with AEIC and ICEA standards.

1. A.C. Voltage Breakdown Tests
2. Adhesion of Insulation Shield to Insulation
3. Volume Resistivity of Conductor Shield to Insulation Shield
4. Dissection and Dimensional Analysis
5. Microscopic examination for voids, contaminants, and protrusions
6. Hot Creep Test to determine state of cure of insulation
7. Partial Discharge (DC) measurements
8. Dissipation factor of cable insulation
9. Impulse breakdown tests

In the event that the cable does not conform to this specification and is rejected by the Engineer, the cost of the independent lab testing shall be borne by the Contractor.

3.04 ADJUSTMENTS

- A. Should the test results reveal any defects, promptly correct such defects and rerun the tests until the entire installation is satisfactory to the Engineer in all aspects.

END OF SECTION

SECTION 16124

QUADRUPLXED MEDIUM VOLTAGE SHIELDED POWER CABLE

APPENDIX 'A'

SUBMITTAL REQUIREMENTS

- A. Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts and Samples", of Division 1 - General Provisions:
 - a. Catalog cuts for quadruplexed cable construction, providing details on Medium Voltage Cable(s) and Ground Wire(s).
 - b. Catalog cut for pulling devices and end seals.
- B. Submit certified factory test reports for wires and cables.
- C. Submit certified qualification test reports for wires and cables.
- D. Submit certified independent laboratory test reports for wires and cables.
- E. Submit field test results for wires and cables, including all test data and methodology.

END OF APPENDIX "A"