



REQUEST FOR QUOTATION

<p>Contact person/Telephone Larry Waxman/201-395-3451</p>	<p>Collective# 0000039794 Bid Due Date 10/22/2014 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 1B61 SERIES. DC TRACTION POWER 2000KCMIL 2KV. 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 _____ =====</p> <p>NOTE: ALL PRICES QUOTED SHALL BE FIRM AND FIXED WITHOUT ADJUSTMENT FOR THE ENTIRE IRREVOCABLE BID PERIOD</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.

Signed _____ Date _____
Firm Name _____



REQUEST FOR QUOTATION

Bid Due Date
10/22/2014

Quantity	Description	Unit Price		Total	
	<p>OF 90 DAYS AFTER THE BID OPENING DATE.</p> <p>-----</p> <p>CABLE DC POWER 2000KCMIL 2KV ITEM. QUANTITY 11,245 FEET 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>====</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> <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</p>				
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	<p>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 Authority (PA) by the day before bid opening for awards not exceeding \$1,000,000. My firm was certified as a _____ on _____.</p> <p>QUESTIONS ONLY CONTACT: LARRY WAXMAN TEL: 201 395 3451 OR EMAIL: Lwaxman@panynj.gov</p>				
	<p>PLEASE QUOTE FULLY DELIVERED PRICES</p>	<p>PAYMENT TERMS</p>		<p>Total Delivered Price</p>	

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	<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>Traction Power Cables (650VDC - 1B61)</p>		
<p>PLEASE QUOTE FULLY DELIVERED PRICES</p>		<p>PAYMENT TERMS</p>	<p>Total Delivered Price</p>

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Signed _____ Date _____
 Firm Name _____

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.

**FURNISH AND DELIVER DC TRACTION CABLES
FOR THE PORT AUTHORITY TRANS-HUDSON CORPORATION**

*10096065
Rid 39794*

GENERAL PROVISIONS

Scope:

As directed by PATH, furnish and deliver reels of cable for DC traction power. 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	2000 kcmil	2KV	430 ft ea	1B61 MH64B/66B	16122
2	2000 kcmil	2KV	470 ft ea	1B61 MH66B/68B	16122
3	2000 kcmil	2KV	470 ft ea	1B61 MH68B/70B	16122
4	2000 kcmil	2KV	500 ft ea	1B61 MH70B/72B	16122
5	2000 kcmil	2KV	560 ft ea	1B61 MH72B/74B	16122
6	2000 kcmil	2KV	300 ft ea	1B61 MH74B/76B	16122
7	2000 kcmil	2KV	400 ft ea	1B61 MH76B/78B	16122
8	2000 kcmil	2KV	460 ft ea	1B61 MH78B/80B	16122
9	2000 kcmil	2KV	400 ft ea	1B61 MH80B/82B	16122
10	2000 kcmil	2KV	265 ft ea	1B61 MH82B/82.5B	16122
11	2000 kcmil	2KV	400 ft ea	1B61 MH82.5B/84B	16122
12	2000 kcmil	2KV	525 ft ea	1B61 MH84B/86B	16122
13	2000 kcmil	2KV	500 ft ea	1B61 MH86B/88B	16122
14	2000 kcmil	2KV	400 ft ea	1B61 MH88B/90B	16122
15	2000 kcmil	2KV	350 ft ea	1B61 MH90B/92B	16122
16	2000 kcmil	2KV	360 ft ea	1B61 MH92B/92.5B	16122
17	2000 kcmil	2KV	275 ft ea	1B61 MH92.5B/94.3B	16122
18	2000 kcmil	2KV	330 ft ea	1B61 MH94.3B/96.5B	16122
19	2000 kcmil	2KV	600 ft ea	1B61 MH96.5B/98B	16122
20	2000 kcmil	2KV	550 ft ea	1B61 MH98B/100B	16122
21	2000 kcmil	2KV	400 ft ea	1B61 MH100B/102B	16122
22	2000 kcmil	2KV	225 ft ea	1B61 MH102B/102.5B	16122
23	2000 kcmil	2KV	200 ft ea	1B61 MH102.5B/104B	16122
24	2000 kcmil	2KV	175 ft ea	1B61 MH104B/106B	16122
25-26	2000 kcmil	2KV	2 @ 450 ft ea	1B61 Sub # 1 Connect	16122
27-30	2000 kcmil	2KV	3 @ 400 ft ea	1B61 33rd St Connect	16122

Total Reels: 30 -

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
16122	DC Traction Power Cable	C03/20/08	11 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.

SECTION 16122
CABLES, SPLICES, TERMINATIONS (DC TRACTION POWER CABLE)

100 96065
B1 139797

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for cables, splices, terminations and appurtenances for D.C. traction cables.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. The cables and installation materials shall be designed, manufactured, tested and installed in accordance with the latest revisions of the Referenced Standards and this Section. Where a discrepancy exists between standards, the more stringent requirements shall apply.

1.03 RELATED SECTIONS

- A. None

1.04 REFERENCES

- A. ASTM International (ASTM)
1. B1 - Standard Specification for Hard-Drawn Copper Wire
 2. B2 - Standard Specification for Medium-Hard-Drawn Copper Wire
 3. B3 - Standard Specification for Soft or Annealed Copper Wire
 4. B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
 5. B33 - Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes
 6. B189 - Standard Specification for Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes
 7. D2802 - Standard Specification for Ozone-Resistant Ethylene-Alkene Polymer Insulation for Wire and Cable
 8. D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape
 9. D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes
 10. E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials

- B. Ministry of Defense Standards (DEF STAN), UK
 - 1. 02-713 - Determination of the Toxicity Index of the Products of Combustion From Small Specimens of Materials
- C. Insulated Cable Engineers Association (ICEA)
 - 1. T-33-655 – Low Smoke, Halogen-Free Polymeric Jackets
 - 2. ICEA S-95-658 Standard for Non-shielded Power Cables rated 2000 volts or less for the Distribution of Electrical Energy
- D. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
 - 1. 48 - Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV
 - 2. 383 - IEEE Standard for Qualifying Class 1E Electric Cables and Field Splices for Nuclear Power Generating Stations
 - 3. 404 - Standard for Cable Joints for Use With Extruded Dielectric Cable Rated 5000-138 000 V and Cable Joints for Use With Laminated Dielectric Cable Rated 2500-500 000 V
 - 4. 837 - Standard for Qualifying Permanent Connections Used in Substation Grounding
- E. Military Specifications (MIL)
 - 1. MIL-DTL-24643 – General Specification for Cables and Cords, Electric, Low Smoke, for Shipboard Use
- F. National Fire Protection Association (NFPA)
 - 1. 70 - National Electrical Code
 - 2. 130 - Standard for Fixed Guideway Transit and Passenger Rail Systems
 - 3. 258 - Research Test Method for Determining Smoke Generation of Solid Materials
- G. National Electrical Manufacturers Association (NEMA)
 - 1. WC 70 – Non-Shielded Power Cable 2000 V or Less
 - 2. WC 71 – Standard for Nonshielded Cables Rated 2001-5000 Volts for Use in the Distribution of Electric Energy
 - 3. WC 74 – 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy
- H. Underwriters Laboratories Inc. (UL)
 - 1. 44 - Thermoset-Insulated Wires and Cables
 - 2. 467 – Standard for Grounding and Bonding Equipment
 - 3. 510 – Standard for Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape

4. 1685 – Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
5. 1581 – Reference Standard for Electrical Wires, Cables, and Flexible Cords

1.05 SUSTAINABLE DESIGN REQUIREMENTS

- A. None

1.06 QUALITY ASSURANCE

- A. The manufacturer shall have a minimum of three 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. Tests requiring certified reports and those requiring factory or field inspection shall be conducted and reported to the Engineer in conformance with standards herein specified.
- C. Cables that have been manufactured more than two years prior to installation shall not be used in the Work of this Section.
- D. Tapes for splices or terminations shall be dated by the tape manufacturer to indicate that they have been manufactured no longer than six months prior to use in this Work of this Section.

1.07 SUBMITTALS

- A. Submit the following in accordance with the requirements of Shop Drawings, Catalog Cuts, and Samples of Division I - "GENERAL PROVISIONS"
 1. Catalog Cuts shall be provided for the following but not limited to:
 - a. D.C. traction power cable(s)
 - b. Connectors and terminators
 - c. Splices
 - d. Pulling devices and end seals
 2. Working drawings shall be submitted for the calculations installation sequence. Drawings shall include pulling tensions and sidewall pressure calculations of all cable pulls, including identification of manhole locations with splices and manholes which will be "pulled through" without splicing.
 3. Submit certified shop tests reports of cable.
 4. Submit field test results of cables, including "Megger" readings with the method used.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Store material in a clean, dry space and protect from weather.

- B. Unless otherwise shown on the Contract Drawings, cables shall be provided with factory fitted pulling devices and end caps to prevent the entrance of moisture into the cable.
- C. Cable reel sizes shall be limited to the maximum dimensions shown on the Contract Drawings.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. List of acceptable manufacturers is shown on Contract Drawings.

2.02 CABLES

A. General

1. Locations, types, sizes and numbers of cables are shown on the Contract Drawings.
2. Unless otherwise shown on the Contract Drawings, solid conductors shall be soft or annealed copper, conforming to ASTM B33 (tinned), ASTM B189 (lead or lead alloy coated or lead alloy coated), or ASTM B3 (uncoated).
3. The conductor insulation shall be either low smoke, zero halogen Ethylene Propylene Rubber (EPR) with overall jacket or Low Smoke Zero Halogen Cross-linked Polyolefin (LSZH XLPO) insulation without overall jacket conforming to ICEA S95-658.
4. Cable jackets over EPR insulation shall be thermoset, low smoke, low toxicity, non-halogen, flame retardant cross-linked polyolefin.
5. Cable jacket and insulation materials, and cable construction as a whole, shall meet the following performance characteristics:
 - a. Cables shall pass the flame propagatory criteria according to the test method of UL 1685.
 - b. The halogen content of the cable jackets shall not exceed 0.2 percent according to the test method of MIL-DTL-24643. The Authority classifies 0.2 percent or less halogen content as "non-halogen."
 - c. The toxicity index of cable jackets shall not exceed 2.0 according to the test method of DEF STAN 02-713.
 - d. The cable insulation and jacket materials shall comply with ICEA T-33-665 for smoke generation.
 - e. The acid gas content of cable jackets shall not exceed a maximum of 2.0 percent according to the test method of MIL-DTL-24643.
 - f. The cable insulation and jacket materials shall pass the smoke generation test in accordance with ASTM E662. Cable insulation and jacket materials when tested on a specimen of 80 mils thick slab shall not exceed the following values:

	<u>EPR</u>	<u>LSZH XLPO</u>
1) Flaming Avg. DS (4 minutes)	100	50
2) Flaming Avg. Dm (20 minutes)	200	150
3) Non-Flaming Avg. Ds (4 minutes)	100	50
4) Non-Flaming Avg. Dm (20 minutes)	350	250

g. For non-jacketed (single layer XLPO) insulation design cable insulation material shall pass the smoke generation test in accordance with ASTM E662. Wire and cable insulation when tested on a specimen of 80 mils thick slab shall not exceed the following values:

- 1) Flaming Avg. Ds (4 minutes) 50
- 2) Flaming Avg. Dm (20 minutes) 150
- 3) Non Non-Flaming Avg. Ds (4 minutes) 50
- 4) Non Flaming Avg. Dm (20 minutes) 250

6. Pulling Devices and End Seals

- a. Unless otherwise shown on the Contract Drawings, cables shall be provided with factory fitted pulling devices and end caps to be used shall be submitted to the Engineer for approval.
- b. For pulling tensions up to 1000 pounds per grip, basket grips may be utilized.
- c. All cables shall be end-sealed, at both ends of each length, with a heat-shrinkable cap to prevent the entrance of moisture.

7. Identification

- a. The following information shall be durably printed on the jacket surface and repeated at intervals not exceeding 24 inches:
 - 1) Manufacturer's Name
 - 2) Manufacturing Plant No.
 - 3) No. of Conductors
 - 4) Size of Conductors
 - 5) Insulation Material and thickness
 - 6) Jacket Material LS-Non-Hal/No acid
 - 7) 2000 volts (rated voltage)
 - 8) DC Traction Power Cable
 - 9) Sequential Footage
 - 10) Date of Manufacture
 - 11) UL Listing ("Type RHW-2" along with "CT Use" & "LS" designations)
 - 12) Property of PATH
- b. Each reel shall carry a tag identifying the manufacturer, cable type, size, voltage and length of cable on reel.

B. Jacketed, Single Conductor D.C. Traction Power Cable

1. Voltage ratings shall be for 2,000 volts D.C. continuously, rated for 90 degree C operations, and capable of withstanding frequent spikes of 3,000 volts as is typical to occur in an electrical railroad system.
2. General Construction

- a. Copper conductor, (bare, lead or tin coated,) Class B or Class C stranded as shown on the Contract Drawings in accordance with ASTM B8 and ASTM B33.
- b. An opaque separating tape shall be applied over the conductor that shall prevent migration of the insulation into the conductors, so as to aid in stripping for terminating.
- c. The insulation shall be low smoke, zero halogen ethylene propylene rubber, concentricity extruded over the screen. The insulation thickness shall be 0.140 inches and the thickness at any point shall not be less than 90 percent of that value. The insulation shall otherwise conform to NEMA WC 70, WC 71 and WC 74. The insulation shall also conform to ASTM D 2802 and ICEA S-95-658, Type II of these standards
- d. The EPR insulated conductor shall be covered with an oil-resistant, flame retardant, low smoke, non-halogenated cross-linked polyolefin jacket. The jacket material shall meet or exceed the physical requirements of ICEA S-95-658. The minimum jacket thickness at any point shall be not less than 90 percent of the average jacket thickness as required by this specification. The average jacket thickness shall be 65 mils for 500 kcmil and 95 mils for 2000 kcmil.
- e. This cable must be UL listed as Type RHW-2, 90C wet and dry per UL standard 44. Cables must also bear the "LS" and "CT USE" UL designations.

C. Non-Jacketed, Single conductor D.C. Traction Power Cable

- 1. Voltage ratings shall be for 2,000 volts D.C. continuously, rated for 90 degree C operations, and capable of withstanding frequent spikes of 3,000 volts as is typical to occur in an electrical railroad system.
- 2. General Construction
 - a. Copper conductor, in accordance with ASTM B 8 and ASTM B 33.
 - b. An opaque separating tape shall be applied over the conductor that shall prevent migration of the insulation into the conductors, so as to aid in stripping for terminating. The successful manufacturer of the cable shall be permitted to omit the separating tape if they can demonstrate (with samples and prior application on the railroad) to PATH that their process prevents migration of the insulation into the conductors. Approval must be obtained prior to bidding.
 - c. Insulation: Low smoke zero halogen cross linked polyolefin insulation; 0.105 inches for 500 Kcmil and 0.140 inches for 2000 kcmil with the thickness at any point shall not be less than 90 percent.

D. Size:

- 1. Cable size shall be 500 kcmil or 2000 kcmil as indicated on the contract drawings. For 500 kcmil cable, conductors shall be 127 strands, and for 2000 kcmil cable, conductors shall be Class C 169 strand. The stranding requirements for 500 kcmil cable are not an ASTM standard stranding, but are specified to provide for flexible construction. The extra flexible strand can use if approved by the engineer.

E. 2000 Volt Track Breaker Control Cable

1. Multi conductor control cable shall utilize class B strand in accordance with ASTM B8. All individual conductors shall utilize thermoset, low smoke, zero halogen cross linked polyolefin insulation conforming to ICEA S95-658 and be listed as Type RHW-2.
2. The insulated conductors shall be cabled with a suitable binder tape and covered with a low smoke zero halogen, black cross linked polyolefin overall jacket. Circuit identification shall be either Method 1 (colored compounds) or Method 3 (printed color designation) per ICEA with a K2 color scheme unless otherwise noted on the contract drawings.
3. Individual insulated conductors and jacket of the multi-conductor cables, shall meet all of the requirements of the Section 16120 entitled Wires, Cables, Splices, Terminations (600 Volts or less), paragraph 5 (except that conductors must be 2000 V rated and be UL listed as RHW-2 in lieu of XHHW-2).

F. Cable Splicing, Terminating and Arcproofing Materials

1. Tapes for splices or terminations shall be dated by the tape manufacturer to indicate that they have been manufactured no longer than six months prior to use in the Work of this Section.
2. All splicing, terminating and arcproofing materials shall be compatible, so that no one material will adversely affect the physical or electrical properties of any other, or of the cable itself.
3. Splicing materials shall conform to the following:
 - a. Connectors shall be as follows:
 - 1) Uninsulated split sleeve solder connectors shall be high conductivity, corrosion-resistant type.
 - 2) Uninsulated solderless, comparison connectors shall be conductivity cooper or bronze, corrosion resistant type.
 - 3) Uninsulated solderless bolted connectors shall be high conductivity cooper or bronze, corrosion-resistant type.
 - 4) Welded type connectors.
 - b. Terminals
 - 1) Uninsulated solder terminals shall be high conductivity, corrosion resistant type.
 - 2) Uninsulated solderless compression terminals shall be high conductivity, corrosion-resistant type.
 - 3) Uninsulated solderless, bolted terminals shall be high conductivity cooper or bronze, corrosion-resistant type.
 - c. Shrinkable Tubing
 - 1) Heat shrinkable tubing shall be irradiated modified polyolefin.
 - 2) Cold shrinkable tubing.
 - d. Tapes and Sealers
 - 1) Vinyl Tape - Flame-retardant, cold and weather-resistant, 3/4 inch and 1-1/2 inch wide, as required, and conforming to UL 510 and ASTM D3005.
 - a) For interior, dry locations provide 7 mils conforming to ASTM D3005 (Type I); Scotch (3M) No. 33, or approved equal.

- b) For exterior or damp and wet locations provide 8.5 mils conforming to ASTM D3005 (Type II); Scotch (3M) No. 88, or approved equal.
- 2) 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) as shown on the Contract Drawings or approved by the Engineer, conforming to ASTM D4388; Scotch (3M) No. 130C, or approved equal.
- 3) Insulating Putty - Rubber-based, 125 mil elastic filler putty; 1-1/2 inches wide; Scotch (3M) Scotchfil, or approved equal.
- 4) Silicone Rubber Tapes - Inorganic silicone rubber, 12 mil 130 degrees C rated, anti-tracking, self-fusing tape; 1 inch wide; Scotch (3M) No 70, or approved equal.
- 5) Sealer - Liquid applied fast-drying sealant; Scotch (3M) Scotchkote, or approved equal.
- e. Solder
 - 1) Solder used on solder type connectors or terminals shall be 50 Tin/50 Lead.
 - 2) Flux used when soldering conductor connectors shall be of a non-corrosive and non-acid type.
- f. Arcproofing Material
 - 1) Fire resistant tape shall be Scotch (3M) No. 77, or approved equal.
 - 2) Glass, cloth binding tape shall be Scotch (3M) No. 69, or approved equal.
- g. Special splicing materials and methods shall be as shown on the Contract Drawings.
- h. Cable Tags - Stainless steel metal tags, No. 28 gauge and 3/4-inch wide, embossed with letters and numbers 5/16-inch high, fastened to the cable at both ends of tags with 1/16-inch diameter monel wire or stainless steel cable tags.

2.03 TESTS

A. Shop Tests

1. Unless otherwise shown on the Contract Drawings, regular AC and DC dielectric withstand and insulation-resistance tests shall be performed for all cable in accordance with NEMA WC 70, WC 71 and WC 74. Both tests shall be performed with cable submerged in a tank of water.
2. Flame tests for cables shall be performed in accordance with IEEE 383.
3. Smoke generation tests for cables shall be performed in accordance with ASTM E662.
4. Halogen content test shall be performed in accordance with MIL-DTL-24643.
5. Toxicity index test shall be performed in accordance with DEF STAN 02-713.
6. The flame, smoke generation, halogen content and toxicity index tests shall be performed per cable production run as long as the same batch of compound is

being used. A minimum of two tests shall be performed for each. Test samples as chosen by the Engineer.

7. The test results shall be certified and submitted to the Engineer for each reel of cable.
8. Factory inspection and witnessing of tests by the Engineer shall be required for all cables furnished under this Contract. The Engineer reserves the right to revise the shop test schedule, or to waive factory inspection or witnessing of tests. The Contractor shall notify the Engineer 14 days in advance of the scheduling of such factory tests.
9. The cost of the shop tests shall be borne by the Contractor.

B. Independent Laboratory Tests

1. If required by contract drawing the following tests shall be performed in conformance with NEMA or ICEA standards:
 - a. Regular AC and DC dielectric-withstand and insulation resistance.
 - b. Dissection and dimensional analysis.
 - c. Microscopic examination for voids, contaminants and protrusions.
 - d. Hot creep test to determine state of cure of insulation.
 - e. Any other additional tests that the Authority may require in order to ensure the quality of the cable.
2. In the event that the cable does not conform and is rejected by the Authority, the cost of the independent lab test to test replacement cable shall be borne by the Contractor.
3. The independent laboratory, selected by the Authority, will provide the Authority and manufacturer with all test results in writing within 14 days after receiving cable test specimens.

PART 3 - EXECUTION

3.01 PREPARATION

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

3.02 INSTALLATION

A. Cable Installation

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

- c. Before splicing or terminating cables, make a thorough inspection to determine that water has not entered the cables or that the 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. Unless otherwise noted herein or on the Contract Drawings, or where the Contractor submits pulling tension and sidewall pressure calculations and they are approved by the Engineer, all D.C. traction power cable shall be spliced in each chamber or manhole through which they pass. 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.

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 no less than three years experience in this type of work.
- 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. Splices shall conform to IEEE 404 and shall:
 - 1) Meet the full electrical and physical integrity of the cable construction, including voltage rating, ampacity and type of waterproofing;
 - 2) Conform to the cable manufacturer's requirements and recommendations.

C. Arcproofing

- 1. All D.C. traction power cables in splice chambers or manholes or other points of access including equipment shall be arc proofed.
- 2. Arcproofing that has been disturbed for any reason shall be reinstalled as soon as possible after the disturbance.
- 3. Arcproofing shall be installed as follows:
 - a. Cables shall be grouped by circuit and arcproofing applied over the group of cables comprising one circuit. Splices shall be arcproofed individually and the taping shall join with and be overlapped by the group taping.
 - b. Arcproofing shall be applied in two wrappings of half-lapped tape, bound with glass cloth tape applied at the ends of the fire resistant tape and at intervals not to exceed 24 inches along the entire length of the cables. The two wrappings shall be wrapped with opposing-lays.

- c. Arcproofing shall be extended into the conduit opening or end bell of the raceway entering a splice chamber, manhole, junction box or other points of access.
- d. Arcproofing tape shall be 1-1/2 inches wide where the diameter of the individual cable, or the circumscribed circle for the circuit group, is less than 1-3/4 inches. For larger diameters, the tape shall be 3 inches wide.
- e. Arcproofing shall be performed by trained workers with three years of experience in this type of work.

D. Identification of Cables

- 1. Each cable shall be identified by its circuit in all junction boxes, manholes, splice chambers or other points of access, and at all termination points.
- 2. The circuit designations shall be as shown on the Contract Drawings. Tags shall be attached to 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. Cables that are arcproofed shall be identified outside the applied arcproofing.
- 5. Cable tags shall be stainless steel metal tags, gauge and 3/4-inch wide, embossed with letters and numbers 5/16-inch high, fastened to the cable at both ends of tags with 1/16-inch diameter monel metal wire or stainless cables ties.

3.03 FIELD TESTS

- A. A copy of all test reports, together with an outline of the test method used, shall be given to the Engineer. If, in the opinion of the Engineer, the tests do not meet the requirements of good practice or codes, the Contractor shall promptly replace, at his own expense, the material or equipment involved, or, by other approved means, remediate his work so that subsequent tests will indicate compliance with acceptable standards.
- B. Should the foregoing tests reveal any defects, Contractor shall promptly correct such defects and rerun the tests until the entire installation is satisfactory to the Engineer in all aspects.

END OF SECTION