



REQUEST FOR QUOTATION

<p>Contact person/Telephone Larry Waxman/201-395-3451</p>	<p>Collective# 0000039793 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 CABLE FOR PATH LOW VOLTAGE 480V FURNISH AND DELIVER PER ATTACHED SPECIFICATIONS NOTE: PATH WILL COLOR CODE THE CABLE.</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 480V CABLE _____</p> <p>=====</p> <p>NOTE: ALL PRICES QUOTED SHALL BE FIRM AND FIXED WITHOUT ADJUSTMENT FOR THE ENTIRE IRREVOCABLE BID</p>		
	PLEASE QUOTE FULLY DELIVERED PRICES	PAYMENT TERMS	Total Delivered Price

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
10/21/2014

Quantity	Description	Unit Price		Total	
	<p>PERIOD OF 90 DAYS AFTER THE BID OPENING DATE. ----- CABLE 480V ITEM. QUANTITY 5,265 FEET 5KV ELECTRICAL CABLE, TIMES \$ _____ PER FOOT EQUALS \$ _____.</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> <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>----- IN THE EVENT OF AN ORDER: Deliver all cable reels to 120 Academy Street, Jersey City.</p>				
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	<p>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</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 ...END...</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	480V Cables				
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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# 10096048
LV 522222

Bid 3978

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

GENERAL PROVISIONS

Scope:

As directed by PATH, furnish and deliver reels of cable for Low-Voltage Cables (480V). 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	4-1/C 500MCM & 1-1/C 1/0 G	480V	400 ft ea	480V MH76B/78B	16124
2	4-1/C 500MCM & 1-1/C 1/0 G	480V	460 ft ea	480V MH78B/80B	16124
3	4-1/C 500MCM & 1-1/C 1/0 G	480V	400 ft ea	480V MH80B/82B	16124
4	4-1/C 500MCM & 1-1/C 1/0 G	480V	265 ft ea	480V MH82B/82.5B	16124
5	4-1/C 500MCM & 1-1/C 1/0 G	480V	400 ft ea	480V MH82.5B/84B	16124
6	4-1/C 500MCM & 1-1/C 1/0 G	480V	525 ft ea	480V MH84B/86B	16124
7	4-1/C 500MCM & 1-1/C 1/0 G	480V	500 ft ea	480V MH86B/88B	16124
8	4-1/C 500MCM & 1-1/C 1/0 G	480V	400 ft ea	480V MH88B/90B	16124
9	4-1/C 500MCM & 1-1/C 1/0 G	480V	350 ft ea	480V MH90B/92B	16124
10	4-1/C 500MCM & 1-1/C 1/0 G	480V	360 ft ea	480V MH92B/92.5B	16124
11	4-1/C 500MCM & 1-1/C 1/0 G	480V	275 ft ea	480V MH92.5B/94.3B	16124
12	4-1/C 500MCM & 1-1/C 1/0 G	480V	330 ft ea	480V MH94.3B/96.5B	16124
13	4-1/C 500MCM & 1-1/C 1/0 G	480V	600 ft ea	480V MH96.5B/98B	16124

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
16120	Wires, Cables (600V or Less)	C 10/14/10	17 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 16120

WIRES, CABLES, SPLICES, TERMINATIONS (600 VOLTS OR LESS)

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section specifies requirements for wires, cables, splices, terminations, and appurtenances for electrical systems of 600 volts or less.

1.02 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Wires, cables, splices and terminations for wiring systems of 600 volts or less shall be furnished and installed in accordance with this Section, and as indicated on the Contract Drawings.
- B. Components of the wiring system of 600 volts or less shall also be manufactured and installed to meet all of the applicable requirements of NFPA 70 and all local codes.

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. B174 - Standard Specification for Bunch-Stranded Copper Conductors for Electrical Conductors
 - 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. E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials

- B. Association of American Railroads (AAR)
 1. RP585 – Wire and Cable Specification

- C. Insulated Cable Engineers Association (ICEA)
 1. S-73-532 – Standard for Control, Thermocouple Extension and Instrument Cable
 2. S-95-658 – Standard for Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy
 3. T-33-655 – Guide For Low Smoke, Halogen-Free Polymeric Jackets

- D. International Electrotechnical Commission (IEC)
 1. 331 – Fire-Resisting Characteristics of Electrical Cable

- E. International Organization for Standardization (ISO)
 1. 9001 – Quality Management Systems - Requirements

- F. Institute of Electrical and Electronics Engineers (IEEE)
 1. 837 – IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding
 2. 1202 – Standard for Flame Propagation Testing of Wire and Cable

- G. Military Specifications (MIL)
 1. MIL-DTL-24643 – General Specification for Cables and Cords, Electric, Low Smoke, for Shipboard Use

- H. Ministry of Defense, UK (DEF STAN)
 1. 02 - 713 - Determination of Toxicity Index of Products of Combustion From Small Specimens of Materials

- I. National Fire Protection Association (NFPA)
 1. 70 - National Electrical Code
 2. 130 – Standard for Fixed Guideway, Transit and Passenger Rail Stations
 3. 502 – Standard for Road Tunnels, Bridges and Other Limited Access Highways

- J. Underwriters Laboratories Inc. (UL)
 1. 44 - Thermoset-Insulated Wires and Cables
 2. 62 – Standard for Flexible Cords and Cables

3. 83 – Standard for Thermoplastic-Insulated Wires and Cables
4. 467 – Standard for Grounding and Bonding Equipment
5. 510 – Standard for Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
6. 854 – Standard for Service-Entrance Cables
7. 1581 – Reference Standard for Electrical Wires, Cables, and Flexible Cords
8. 1685 - Standard for Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables
9. 2196 – Test for Fire-Resistive Cables

1.05 SUSTAINABLE DESIGN REQUIREMENTS

- A. Not Applicable

1.06 QUALITY ASSURANCE

- A. Wires and cables that were manufactured more than two years prior to installation shall not be used in the Work of this Section.
- B. Tapes for splices or terminations shall be dated by the tape manufacturer to indicate that they were manufactured no earlier than six months prior to use in the Work of this Section.
- C. The cable manufacturer shall be ISO 9001/Q9001 certified for a Quality System for wire and cable manufacturing.
- D. All wires, cables, splices and terminations, for which there are established UL standards, shall bear the UL label.

1.07 SUBMITTALS

- A. Submit Catalog Cuts for the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of Division 1 - GENERAL PROVISIONS:
 1. Wires and cables for each type and size.
 2. Splice kit materials and installation procedures.
 3. Proof of cable or wire manufacturer ISO9001/Q9001 certification.
- B. Submit certified shop test reports for wires and cables.
- C. Submit field test results for wires and cables, including "Megger" readings with the test method used.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Single conductor wire or cable sizes No. 4/0 AWG and larger that are to be installed in the same raceway shall be multiplexed by the cable manufacturer prior to shipment. Cable assembly overall diameter shall be kept to a minimum.
- B. Wire and cable sizes No. 4/0 AWG and larger shall be provided with factory-applied caps unless otherwise shown on the Contract Drawings. End seals shall be heat-shrink, irradiated, modified polyolefin, and shall be sized for individual wires and cables.
- C. Store material in a clean, dry space and protect it from the weather.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements of this Section, provide wires, cables, wire and cable splicing, terminating and arcproofing materials of manufacturers as shown on the Contract Drawings.

2.02 WIRES AND CABLES

- A. General
 - 1. Definitions
 - a. Wire shall be defined as a solid or stranded conductor smaller than No. 6 AWG with or without insulation.
 - b. Cable shall be defined as a single conductor No. 6 AWG or larger, or two or more conductors of any size wire under a common covering.
 - 2. Locations, types, sizes and numbers of wires and cables are shown on the Contract Drawings. Where not indicated, provide proper wire and cable selection to comply with this section and NFPA 70 Standards.
 - 3. The wires and cables must be suitable for use in wet and dry locations, as applicable for the installation, with temperature ratings that correspond to the conditions of application. Wires and cables shall be suitable for installation indoors or outdoors, in conduits, trays, underground ducts or direct burial in earth, as applicable for the installation shown on the Contract Drawings, and as allowed by applicable codes and this Section.
 - 4. Unless otherwise indicated on the Contract Drawings, cable insulation shall be rated for conductor temperatures not exceeding 90 degrees C for normal operation, 130 degrees C for emergency overload conditions and 250 degrees C for short circuit conditions in accordance with ICEA standards S-95-658 and S-73-532. Temperature ratings shall be for both wet and dry locations.

5. Unless otherwise shown on the Contract Drawings, solid conductors shall be soft or annealed copper, conforming to ASTM B33 (tinned) or ASTM B3 (uncoated). Unless otherwise specified in this Section or unless otherwise shown on the Contract Drawings, stranded copper conductors shall be concentric stranding conforming to ASTM B 8.
6. Polyvinyl Chloride (PVC): PVC-insulated power wiring and items containing PVC shall not be installed in subway areas, railroad or vehicular tunnels, railroad stations, and areas defined on the Contract Drawings as subject to NFPA 130 or NFPA 502 jurisdiction.
7. Unless otherwise shown on the Contract Drawings, cable insulations and jackets designated as Low-Smoke, Zero-Halogen (LSZH) shall be thermoset, low-smoke, low-toxicity, non-halogen, flame retardant type and shall meet the following performance characteristics:
 - a. Cables shall pass the flame propagatory and smoke release criteria according to the test method of UL 1685.
 - b. The halogen content of 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 NES 713.
 - d. The cable jackets shall comply with ICEA T-33-655 for smoke generation.
 - e. The acid gas content of cable jackets shall not exceed a maximum of 3.0 percent according to the test method of MIL-DTL-24643.
8. Use the following additional performance characteristics for wires and cables that will be installed in subway areas, railroad or vehicular tunnels, railroad stations, and areas defined on the Contract Drawings as being under the jurisdiction of NFPA 130 or NFPA 502, where stringent flame retardant, low-smoke, low-toxicity, zero-halogen and good circuit integrity during a fire are required.
 - a. All insulated conductors shall be UL listed as type XHHW-2, in accordance with UL 44. In addition, all one-conductor cables shall be listed for and marked with the following UL designations: "VW-1," "LS" or "ST1" (limited smoke), "Oil and Gas Resistant," and for 1/0 and larger, "CT USE."
 - b. Single conductor wire and cable shall utilize thermoset Low-Smoke, Zero-Halogen, Cross-Linked Polyolefin insulation conforming to ICEA S-73-532 and S-95-658. The insulation shall be comprised of a single layer of homogeneous material. Jackets or other additional coverings shall not be allowed for single conductors because of the increase in cable size. All single conductor wires and cables shall follow the dimensional requirements of NFPA 70, Table 5.
 - c. Wires shall pass the flame propagatory criteria according to the test method of UL 1581 (VW-1).
 - d. The halogen content of both the wire and cable insulation and cable jacket(s) 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."

- e. The toxicity index of both the wire and cable insulation and cable jacket(s) shall not exceed 2.0 according to the test method of DEF STAN 02-713.
- f. The acid gas content of both wire and cable insulation and cable jacket(s) shall not exceed a maximum of 2.0 percent according to the test method of MIL-DTL-24643.
- g. The wire and cable insulation materials shall pass the smoke generation test in accordance with ASTM E662. All wires and cables shall pass the smoke release criteria according to the test method in UL 1685 for "LS" or "ST1" classification as "limited smoke." 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) 200
 - 3) Non-Flaming Avg. Ds (4 minutes) 50
 - 4) Non-Flaming Avg. Dm (20 minutes) 200
- h. All single conductor wires shall provide a minimum of 15 minute circuit integrity when tested in accordance with UL 2196. UL qualification is required and shall be predicated upon a No. 12 AWG sample in conduit without the water spray.
- i. Wires and cables shall pass the following flame propagation requirements:
 - 1) All single conductor wires and cables shall pass the "UL VW-1" vertical flame test, according to UL 1581.
 - 2) All single conductor wires and cables shall pass the vertical flame test stated in AAR RP583, paragraph 5.9.4.
- j. Water Resistance
 - 1) All wires and cables shall be rated for wet applications at 90 degrees C as defined by the requirements for type "XHHW-2" stated in UL 44 when tested in accordance with UL 1581.
 - 2) The mechanical water absorption of the insulation shall not be greater than 4 mg/sq. in. when tested in accordance with UL 1581.
 - 3) All wires shall be suitable for prolonged exposure to water by evidence of long term insulation resistance qualification testing in 90 degree C water. Testing shall be in accordance with UL 44 and UL 1581. After a minimum of one year exposure to 90 degree C water, the insulation resistance measurements must exceed an insulation resistance reading of 4.0 megohms/1000 ft. Sample used for testing shall be either 14 or 12 AWG with a nominal 30 mils of LSZH insulation.
- k. Overload Stability
 - 1) To ensure overload stability, all wires and cables shall pass the following tests defined in AAR Standard RP585:
 - a) Electrical Overload – Single Conductor (paragraph 5.9)
 - b) Bundle Overload (paragraph 5.9.1)
 - c) 125 degrees C Penetration Test (paragraph 5.9.2)

- l. The insulation shall demonstrate heat stability by retaining 95 percent of its original tensile strength and elongation values after aging seven days at 158 degrees C, as per AAR Standard RP585.
- m. Multi-Conductor Cables: Where multi-conductor cables are utilized, use the following additional criteria:
 - 1) Multi-conductor control cables shall utilize stranded class "B" or "C" conductors in accordance with ASTM B8. All conductors shall utilize thermoset low-smoke, zero-halogen cross-linked polyolefin insulation, conforming to ICEA standard S-95-658 and S-73-532, and be listed as type "XHHW-2." Insulated conductors shall be cabled with a suitable binder tape, and covered with a low-smoke, zero-halogen cross-linked polyolefin jacket. All cables shall be UL listed Type TC in accordance with UL 1277. All individual insulated conductors utilized in multi-conductor cables shall meet all of the requirements set forth in this Section for single conductor cables for subway areas, railroad or vehicular tunnels, railway stations and areas defined on the Contract Drawings as under the jurisdiction of NFPA 130 or NFPA 502, except that UL print is not required on the individual conductor insulation.
 - 2) The halogen content of the cable jacket(s) shall comply with 2.02.A.8.d of this Section.
 - 3) The toxicity index of the cable jacket(s) shall comply with 2.02.A.8.e of this Section.
 - 4) The acid gas content of the cable jacket(s) shall comply with 2.02.A.8.f of this Section.
 - 5) The cable jacket materials shall pass the smoke generation test in accordance with ASTM E662. Cable jacket when tested on a specimen of 80 mils thick slab shall not exceed the following values:
 - a) Flaming avg. DS (4 minutes): 50
 - b) Flaming avg. DM (20 minutes): 150
 - c) Non-Flaming avg. DS (4 minutes): 50
 - d) Non-Flaming avg. DM (20 minutes): 250
 - 6) All multi-conductor wire and cables shall provide a minimum of 15 minute circuit integrity when tested in accordance with IEC-331. Qualifications shall be predicated on a 2/C No.14 AWG sample tested at 240 Volts.
 - 7) All multi-conductor cables shall pass the UL vertical flame test criteria according to the test methods stated in UL 1685 for IEEE 1202 type of flame exposure. Test sample used shall be 2/c No.14 AWG.
 - 8) All multi-conductor wires and cable shall be listed for, and be marked with, the following UL designations on the cable jacket: "Type TC" (Tray Cable), "LS" or "ST1" (Limited Smoke), "Sun Res" (Sun Resistant) or "XHHW-2"/"90 degrees C Wet and Dry," "IEEE 1202."
9. Color-Coding for Power and Lighting Conductors

- a. Insulation or covering of wires and cables shall be factory color-coded by the use of colored compounds or coatings. The color-code shall be followed consistently throughout the performance of the Work.
 - b. Circuit identification for multi-conductor cable shall be accomplished by either Method 1 (colored compounds) or Method 3 (printed color designations) per ICEA with a K2 scheme, unless otherwise stated on the Contract Drawings.
 - c. Upon written request of the Contractor, the Engineer may permit the use of the following methods in lieu of the wire or cable manufacturer's color-coding, when limited quantities of wire and cable are involved, for sizes No. 8 AWG and larger.
 - 1) For dry locations only, spiral application of 3/4 inch wide, colored pressure sensitive plastic tape, half lapped for a distance of not less than six inches may be used. To prevent unwinding, the last two wraps of tape shall be applied with no tension.
 - 2) For wet or dry locations, application of three, 3/16 inch wide, colored, fungus-inert, self-extinguishing, self-locking, nylon cable ties spaced 3 inches apart may be used. The ties shall be snugly applied with a special tool or pliers, and any excess removed.
 - 3) Each wire and cable shall be color-coded at all terminal points, in all manholes, boxes, or other similar enclosures.
 - 4) Color markings shall be applied so as not to obliterate the manufacturer's identification markings.
10. Color code chart shall be as follows:

System Voltage	Conductor	
	208Y/120V	480Y/277V
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

B. General-Purpose Wires and Cables

1. Unless otherwise shown on the Contract Drawings, general purpose wires and cables shall be as follows:
 - a. General-purpose wires and cables shall be single conductor, ASTM B8, Class B stranded for sizes No. 8 AWG and larger, and solid for sizes No. 10 AWG and smaller.
 - b. Select from the following list of UL wire and cable types:
 - 1) Type XHHW: Flame retarding, Cross-linked-polyolefin insulation, conforming to UL 44, for dry locations only.
 - 2) Type XHHW-2: Flame retardant, Cross-linked-polyolefin insulation, conforming to UL 44, 90 degrees C wet and dry.
 - 3) Type THWN: Flame retardant, moisture and heat resistant thermoplastic insulation with a nylon jacket or equivalent; double-rated THHN-THWN gasoline-oil resistant II; conforming

to UL 83. The use of this cable shall be in accordance with the requirements of 2.02.A.6 of this Section.

- c. Type USE: Unless otherwise indicated, Type USE shall be the only wire and cable used for underground installations. Select from one of the following:

- 1) Heat and moisture resistant ethylene-propylene-rubber insulation with jacket of either cross-linked polyolefin or heavy duty thermosetting chlorosulphanated polyethylene or heavy-duty neoprene; multiple rated "USE-RHH-RHW"; conforming to ASTM D2802, ICEA S-95-658, UL 44 and UL 854.
- 2) One layer of low-smoke, zero-halogen thermosetting cross-linked polyolefin, Type RHW-2, 90 degrees C wet and dry.

C. Overhead Service Cables

1. Unless otherwise shown on the Contract Drawings, overhead service cables shall be two or more type SE, ASTM B8, Class B or Class C stranded, hard-drawn copper conductors, ethylene-propylene-rubber insulation, with heavy duty neoprene or heavy duty thermosetting chlorosulphonated polyethylene jacketed, marked "sunlight resistant," conforming to ASTM D2802, ICEA S-95-658, UL 44 and UL 854. Cable shall be factory assembled with copper-clad messenger.

D. Portable Cords Unless otherwise shown on the Contract Drawings, portable cords shall be as follows:

1. Type S shall be 60 degrees C rated, with heavy-duty thermosetting insulation and jacket, conforming to UL 62, 600-volt rated.
2. Type SO shall be oil resistant, 60 degrees C rated, with heavy-duty thermosetting insulation and jacket, conforming to UL 62, 600-volt rated.
3. Type G or Type W shall be 90 degrees C rated, with ethylene-propylene-rubber insulation and Hypalon jacket, 600-volt rated.
4. Special types shall be used only where shown on the Contract Drawings.

E. Lighting Fixture Wires

1. Unless otherwise shown on the Contract Drawings, lighting fixture wires shall be stranded only, and shall be Type SF-2, silicone rubber insulated conforming to UL 62.

F. Grounding Wires and Cables

1. Unless otherwise shown on the Contract Drawings, grounding wires and cables shall be as follows:
 - a. Insulated
 - 1) Solid for sizes No. 8 AWG and smaller; ASTM B8, Class B stranded for sizes No. 6 AWG and larger; and of the same insulation type as the power conductors.
 - 2) Covering shall be a continuous green color and conforming to ASTM B 33 and UL 44.

- b. Uninsulated
 - 1) General: Solid for sizes No. 8 AWG and smaller; ASTM B8, Class B stranded for sizes No. 6 AWG and larger.
 - 2) In raceways soft-drawn and conforming to ASTM B3.
 - 3) Direct buried or encased in concrete
- c. Soft-drawn, medium-hard-drawn, or hard-drawn and conforming to ASTM B1, B2 or B3, respectively.

G. Control Wires and Cables

- 1. Unless otherwise shown on the Contract Drawings, control wires and cables shall be as follows:
 - a. Single conductor wires and cables shall be ASTM B8, Class B stranded, type XHHW or XHHW-2 flame retardant, cross-linked-polyolefin insulation. Both shall conform to UL 44 and ICEA S-73-532.
 - b. Multiconductor cables shall be ASTM B8, Class B or Class C stranded, Control Cable Type B, conforming to ICEA S-73-532. Color-coded as per ICEA S-73-532. Method No. 1 for NFPA 70 applications (with white and green) or ICEA S-73-532 for paired conductor cables. Select from the following list of cable types.
 - 1) Individual ethylene-propylene rubber insulation with overall flame retardant, cross-linked-polyolefin jacket; conforming to ICEA S-73-532, UL 44 and UL 1581.
 - 2) Individual flame retardant, cross-linked-polyolefin insulation with and overall flame retardant, cross-linked-polyolefin jacket; conforming to ICEA S-73-532.

H. Switchboard Wires and Cables

- 1. Unless otherwise shown on the Contract Drawings, switchboard wires and cables shall be as follows:
 - a. Switchboard wires and cables shall be single conductor, ASTM B8, Class B stranded, except that for wires and cables crossing hinged joints and swinging panels and where "Extra Flexible" wire or cable is shown on the Contract Drawings, conductors shall be ASTM B174, Class K stranded.
 - b. Wires and cables shall be Type SIS, cross-linked-thermosetting-polyethylene insulation, conforming to ICEA S-73-532 or ICEA S-95-658, IEEE 383 and UL 44.

I. Cable Tags

- 1. Dry Locations
 - a. Fiberglass tags, 1/16 inch thick and 3/4 inch wide, indented with letters and numbers 5/16 inch high, with No. 14 AWG copper or nylon, weather-resistant cable ties.
 - b. Lighting branch circuit wiring and single conductor signal and control wiring may be identified with "Quiklables" manufactured by W. H. Brady Company, or approved equal.
- 2. Wet Locations

- a. Brass or stainless steel metal tags, No. 28 gauge and 3/4 inch wide, embossed with letters and numbers 5/16 inch high, with No. 14 AWG copper or nylon, weather-resistant cable ties, or stainless steel cable ties.

2.03 SPLICING, TERMINATING AND ARCPROOFING MATERIALS

A. General

1. 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 wire or cable itself.
2. 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.

B. Connectors

1. Subject to compliance with requirements of this Section, provide connectors of the following types:
 - a. Solderless, uninsulated, high conductivity, corrosion resistant, compression connectors conforming to UL 467 and IEEE 837;
 - b. Insulated, indenter type compression butt connectors;
 - c. Insulated, integral self-locking flexible shell, expandable spring connectors;
 - d. Uninsulated, indenter type compression pigtail connectors;
 - e. Welded type connectors.
2. For installations in subway areas, railroad stations, railroad or vehicular tunnels, or areas defined as subject to NFPA 130 or NFPA 502 jurisdiction, use flame-retardant type connectors.

C. Terminals

1. Subject to compliance with requirements of this Section, provide terminals of the following types:
 - a. Solderless, uninsulated, high conductivity, corrosion resistant, compression terminals conforming to UL 467 and IEEE 837;
 - b. Insulated, compression terminals;
 - c. Solderless, high conductivity, corrosion resistant, hex screw type, bolted terminals;
 - d. Welded type terminals.

D. Shrinkable Tubing

1. Subject to compliance with requirements of this Section, provide shrinkable tubing of the following types:
 - a. Either irradiated modified polyvinyl chloride or irradiated modified polyolefin heat shrinkable tubing;
 - b. Cold shrinkable tubing.

E. Tapes and Sealers

1. Vinyl Tapes:

- a. Flame-retardant, cold and weather-resistant, 3/4 inch or 1 1/2 inches wide, as required, and conforming to UL 510 and ASTM D3005.
 - 1) For interior, dry locations, provide 7 mil, conforming to ASTM D3005 (Type I); Scotch (3M) No. 33, or approved equal.
 - 2) For exterior or damp and wet locations, provide 8.5 mil, conforming to ASTM D3005 (Type II); Scotch (3M) No. 88, or approved equal.

2. Rubber Tapes:

- a. 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 (Grade A); Scotch (3M) No. 130C, or approved equal.

3. Insulating Putty

- a. Rubber-based, 125-mil elastic filler putty; 1-1/2 inches wide; Scotch (3M) Scotchfil, or approved equal.

4. Silicone Rubber Tapes

- a. 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

- a. Liquid applied fast-drying sealant; Scotch (3M) Scotchkote, or approved equal.

F. Resin Filled Splices

1. Epoxy Molded Type

- a. Two-piece, snap-together molded bodies, sized for wire or cable, with two-part low viscosity polyurethane insulating and sealing compound, rated for 600 volts, using crimp-type wire connector; Scotch (3M) No. 82-A1, 82-A2 or 82-A3 compound, or approved equal.

2. Re-Enterable Type

- a. Transparent, molded bodies clamped with stainless steel strain-relief bar and shield continuity connectors, sized for wire or cable, with loosely woven polyester spacer web and jelly-like urethane formulation for permanent re-entry capability; Scotch (3M) Nos. 78-R1 through 78-R5, with No. 2114 compound, or approved equal.

G. Arcproofing Materials

- 1. Fire resistant tapes shall be Scotch (3M) No. 77, or approved equal.
- 2. Glass cloth binding tapes shall be Scotch (3M) No. 69, or approved equal.

H. Special splicing materials and methods shall be as shown on the Contract Drawings.

2.04 FACTORY TESTS

- A. For quantities as shown on the Contract Drawings, regular dielectric-withstand and insulation-resistance in water tests for wires and cables shall be performed in accordance with UL44.
- B. Flame tests for wires and cables shall be performed in accordance with UL 1685, UL 2196 and AAR RP-585.
- C. The test results shall be certified for each reel/coil/box of wire or cable.
- D. Factory inspection and witnessing of tests by the Engineer shall be required for all wires and cables furnished under this Contract. The Engineer reserves the right to require additional testing, 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.

PART 3 - EXECUTION

3.01 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.

3.02 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.
 - 2. General Purpose Wires and Cables
 - a. Minimum wire or cable size shall be No. 12 AWG for light and power service.

- b. Wires or cables shall be at least No.10 AWG for the entire length of branch circuits, where distances to first outlets are as follows:
 - 1) 100 feet or more on 480Y/277 Volt systems.
 - 2) 70 feet or more on 208Y/120 Volt systems.
 - 3. Lighting Fixture Wires
 - a. For wiring within lighting fixtures only, where sizes No. 14 AWG or smaller are required, use Type SF-2 fixture hookup wire. Type SF-2 wire shall not be used for wiring end-to-end connected fluorescent fixtures.
 - b. For connecting lighting fixtures to branch circuit conductors, use low-smoke, zero-halogen XHHW for dry and XHHW-2 90 degrees C wet and dry for indoor applications. For outdoor applications, use RHW-2 or RHH-RHW-2, VW-1, 90 degrees C wet and dry.
- B. Grounding Wires and Cables
- a. Use bare, uninsulated wire and cable only where shown on the Contract Drawings or where approved by the Engineer.
 - b. Insulated grounding cable shall be of the type specified in this Section or as shown on the Contract Drawings.
2. Control Wires and Cables
- a. Control wires and cables shall not be smaller than No. 14 AWG unless otherwise shown on the Contract Drawings.
- C. Splicing and Terminating
1. General
- a. Splices shall be permitted with the Engineer's approval. Splicing and terminating shall be as specified in this Section. Details of special splicing and terminating shall be as shown on the Contract Drawings. Any splicing or terminating methods other than those specified below, for which the components are in accordance with the requirements of this Section, shall be submitted to the Engineer for approval.
2. General Purpose Wires and Cables
- a. Splices in dry locations for sizes No. 10 AWG and smaller: Splicing shall be completed using one of the following:
 - 1) Insulated, integral, self-locking flexible shell, expandable spring connectors shall be applied to the twisted conductors. Two, half-lapped layers of vinyl tape, extending to a distance of not less than one inch from the connector, shall be applied.
 - 2) Compression type, insulated butt connectors shall be applied to the butted conductors by means of an appropriate crimping tool, providing controlled indentation. Two, half-lapped layers of vinyl tape, extending to a distance of not less than one inch from the connector, shall be applied.
 - 3) Compression type, pigtail connectors shall be applied to the conductors by means of an appropriate crimping tool, providing controlled indentation. The connector shall be covered with a polyamide cap and two, half-lapped layers of vinyl tape,

- extending to a distance of not less than one inch from the connector, shall be applied.
- b. Splices in dry locations for sizes No. 8 AWG and larger, splicing shall be completed using all of the following:
 - 1) Connectors shall be split sleeve solderless type or solderless compression type.
 - 2) Fill indents of connectors with Scotchfil insulation putty.
 - 3) Apply rubber splicing tape equal to the original insulation rating.
 - 4) Apply two, half-lapped layers of vinyl tape, or a shrinkable tubing.
 - c. Splices in wet locations
 - 1) Same as dry locations specified in 3.02.C.2.a and 3.02.C.2.b, except that after vinyl tape is applied, cover with two coats of sealer or shrinkable tubing.
 - 2) Resin-filled splice shall be covered with two, half-lapped layers of vinyl tape and two coats of sealer or shrinkable tubing.
 - d. Terminations in dry locations for sizes No. 10 AWG and smaller:
 - 1) Terminations shall be compression terminals, insulated or uninsulated.
 - e. Terminations in dry locations for sizes No. 8 AWG through No. 3/0 AWG
 - 1) Ring tongue terminals shall be solderless, uninsulated compression crimp type.
 - 2) Ring tongue lugs shall be bolted hex screw type.
 - f. Terminations in dry locations for sizes No. 4/0 AWG and larger:
 - 1) Ring tongue terminals shall be solderless, uninsulated compression crimp type.
 - g. Terminations in wet locations:
 - 1) In addition to the dry location terminations specified in 3.02.C.2.d, 3.02.C.2.e and 3.02.C.2.f of this Section, cover the entire termination area with two, half-lapped layers of vinyl tape and apply two coats of sealer over the tape.
3. Overhead Service Cables
 - a. Splices and terminations in overhead service cables shall be the same as specified in 3.02.C.2.c and 3.02.C.2.g of this Section, as appropriate for overhead service conductor size.
 4. Portable Cords
 - a. Splices shall not be made in portable cords.
 - b. Terminations shall be made only at apparatus to be served or at branch circuit connection by means of any of the following:
 - 1) Insulated, integral, self-locking flexible shell, expandable spring, or crimp type connectors;
 - 2) Insulated, crimp type, compression connectors;
 - 3) Uninsulated, ring tongue terminals for connection to wire terminal strip block.
 5. Lighting Fixture Wires

- a. Connections to branch circuit and to fixture wiring shall be made by either insulated, integral, self-locking flexible shell, expandable spring, or crimp type connectors.
6. Grounding Wires and Cables
 - a. Splices and terminations shall be installed in accordance with the manufacturer's recommendations.
 - b. In hazardous or classified locations, splices and terminations shall be solderless high conductivity, corrosion resistant, compression type connectors and terminations shall be clamp type pressure connectors, suitable for such use.
 - c. All underground connections shall be covered with two coats of asphalt base paint.
 7. Control Wires and Cables
 - a. Splices shall be made in accordance with the requirements specified in this Section, and shall be enclosed in a re-enterable splicing case. Where shielded cable is shown on the Contract Drawings, the shielding shall be continued through the splice. Shields shall be grounded at one location only unless otherwise shown on the Contract Drawings.
 - b. Terminations shall be insulated, indenter type ring tongue terminals.
 8. Switchboard Wires
 - a. No splices are permitted.
 - b. Terminations shall be insulated, indenter type ring tongue terminals.
- D. Arcproofing
1. Arcproofing shall be applied where shown on the Contract Drawings.
 2. Arcproofing, which has been disturbed for any reason, shall be reinstalled as soon as possible after the disturbance.
 3. Arcproofing shall be installed as follows:
 - a. Wires and cables shall be grouped by circuit and arcproofing applied over the group of wires and 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 applied with opposing-lays.
 - c. Arcproofing shall be extended into the conduit opening or end bell of the raceway entering a handhole, manhole or box.
 - d. Arcproofing tape shall be 1 1/2 inches wide where the diameter of the individual cable, or of 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. Identification of Wires and Cables

1. Each wire and cable shall be identified by its circuit in all cabinets, boxes, manholes, handholes, wireways and other enclosures and access locations, and at all terminal points.
2. The circuit designations shall be as shown on the Contract Drawings. 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. Wires and cables that are arcproofed shall also be identified outside the applied arcproofing.

3.03 FIELD TESTS

- A. Test all wires and cables up to equipment installed under this Contract with a 1000-volt Megohmmeter. Furnish the Engineer with a copy of the "Megger" readings together with an outline of the method used. If, in the opinion of the Engineer, any reading is lower than that required by applicable codes, promptly replace the materials involved, at the Contractor's expense, and retest.

END OF SECTION