



**THE PORT AUTHORITY OF NY & NJ**

2 Montgomery Street, 3rd Floor, Jersey City, NJ 07302

### REQUEST FOR QUOTATION

Contact person/Telephone  
Larry Waxman/201-395-3451

Collective# 0000035288  
Bid Due Date 11/13/2013  
Bids must be received no later than 11:00 AM on the above Bid Due Date.

Deliver Goods/Services To:  
John F Kennedy International Airport  
Building No. 14 - Stockroom  
Jamaica NY 11430

| Quantity | Description   | Unit Price           | Total                        |
|----------|---|----------------------|------------------------------|
|          | <p>ELECTRICAL CABLES FOR JFK INTL AIRPORT<br/>TWO DIFFERENT CABLE ITEMS<br/>PER PORT AUTHORITY THIRTEEN (13)<br/>PAGE SPECIFICATION: DIVISION 16 SECTION 16121<br/>AND TWO (2) DRAWINGS.</p> <p>ALL ITEMS QUOTED ARE FOB DELIVERED.</p> <p>NOTE:<br/>ALL PRICES QUOTED SHALL BE FIRM AND FIXED<br/>WITHOUT<br/>ADJUSTMENT FOR THE ENTIRE IRREVOCABLE BID<br/>PERIOD<br/>OF 90 DAYS AFTER THE BID OPENING DATE.</p> <p>ALL BIDDERS SHALL INDICATE WITH ITS BID RESPONSE<br/>THE FOLLOWING INFORMATION:</p> <p>IN THE INVENT OF AN ORDER ADVISE DELIVERY<br/>IN DAYS _____ A.R.O.</p> <p>STOCK ITEM CS100010 CABLE 500MCM<br/>MANUFACTURER NAME: _____<br/>MANUFACTURER PLANT LOCATION: _____<br/>MANUFACTURER PART NUMBER: _____</p> |                      |                              |
|          | <b>PLEASE QUOTE FULLY DELIVERED PRICES</b>  | <b>PAYMENT TERMS</b> | <b>Total Delivered Price</b> |

**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 of New York and New Jersey opens this proposal.

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| Quantity | Description   | Unit Price               |                              | Total |  |
|----------|---|--------------------------|------------------------------|-------|--|
|          | STOCK ITEM CS100015 CABLE 350MCM<br>MANUFACTURER NAME: _____<br>MANUFACTURER PLANT LOCATION: _____<br>MANUFACTURER PART NUMBER: _____<br>-----<br>DRAWING AND SPECIFICATIONS SUBMITTAL SHALL BE<br>REQUIRED WITHIN THREE (3) BUSINESS DAYS FROM<br>NOTICE BY THE PROCUREMENT DEPARTMENT FOR<br>REVIEW AND APPROVAL.<br>-----<br>STOCK ITEM CS100010 CABLE 500MCM<br>QUANTITY 6,600 FEET ELECTRICAL CABLE. TIMES<br>\$ _____ PER FOOT EQUALS \$ _____.<br><br>STOCK ITEM CS100015 CABLE 350MCM<br>QUANTITY 3,600 FEET ELECTRICAL CABLE. TIMES<br>\$ _____ PER FOOT EQUALS \$ _____.<br><br>-----<br>ALL PRICES SHALL BE FOB DELIVERED ON A FLAT BED<br>TRUCK<br>INCLUDING NON-RETURNABLE STEEL REELS, TESTING,<br>DRAWINGS ETC.<br>=====<br>=====<br>CABLE MUST BE DELIVERED ON NON-RETURNABLE<br>STEEL REELS<br>TOTAL CABLE TOLERANCE: MINUS ZERO (0) / PLUS 5% / |                          |                              |       |  |
|          | <b>PLEASE QUOTE FULLY DELIVERED PRICES</b>  | <b>PAYMENT<br/>TERMS</b> | <b>Total Delivered Price</b> |       |  |

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| Quantity | Description   | Unit Price                  |  | Total                               |  |
|----------|---|-----------------------------|--|-------------------------------------|--|
|          | <p>TOTAL RUN.<br/>REELS AT 600 FEET PER REEL TOLERANCE:<br/>MINUS ZERO (0)/PLUS FIVE (5)% /REEL.</p> <p>PLEASE FOLLOW RETURN TO BID INSTRUCTIONS.<br/>REPLY IF POSSIBLE ONLY ON PATH/PA REQUEST FOR<br/>QUOTATION FORM AS ATTACHING YOUR COMPANY'S<br/>TERMS&amp;CONDITIONS MAY CAUSE YOUR BID TO BE<br/>DEEMED NON RESPONSIVE AND OR DELAY AN AWARD<br/>ISSUED.</p> <p>QUESTIONS ONLY CONTACT:<br/>LARRY WAXMAN<br/>TEL: 201 395 3451 OR<br/>EMAIL: Lwaxman@panynj.gov</p> |                             |  |                                     |  |
|          | <p><b>PLEASE QUOTE FULLY DELIVERED PRICES</b></p>   | <p><b>PAYMENT TERMS</b></p> |  | <p><b>Total Delivered Price</b></p> |  |

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| Quantity | Description  | Unit Price               |                              | Total |  |
|----------|--|--------------------------|------------------------------|-------|--|
|          | <p>This is a Formal Bid Invitation<br/>Mail Sealed Bids to:</p> <p>The Port Authority of NY &amp; NJ<br/>Attn: Bid Custodian<br/>Procurement Department<br/>2 Montgomery Street, 3rd Floor<br/>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. &amp; 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> |                          |                              |       |  |
| 6,600 FT | <p>CS0100010</p> <p style="text-align: center;"><b>PLEASE QUOTE FULLY DELIVERED PRICES</b></p>   | <b>PAYMENT<br/>TERMS</b> |                              |       |  |
|          |  |                          | <b>Total Delivered Price</b> |       |  |

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Firm Name \_\_\_\_\_



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| Quantity | Description  | Unit Price                  |  | Total                               |  |
|----------|--|-----------------------------|--|-------------------------------------|--|
|          | CABLE, 500MCM, 5KV, FLAT STRAP CABLE- TRIPLEXED CONDUCTOR WITH A #4/0 COPPER GROUND. CABLE MUST BE DELIVERED ON NON-RETURNABLE STEEL REELS. NOT LESS THAN 600 FT PER REEL. CABLE ENDS TO BE SEALED AND HAVE PULLING EYES ATTACHED. PER PA SPEC SECTION 16121 (N4/4/06), KERITE CATALOG NUMBER 350X05-CH230 OR APPROVED EQUAL.  |                             |  |                                     |  |
| 3,600 FT | <p>CS0100015</p> <p>CABLE, 350MCM, 5KV, FLAT STRAP CABLE- TRIPLEXED CONDUCTOR WITH A #4/0 COPPER GROUND. CABLE TO BE ON NON-RETURNABLE STEEL REELS. NOT LESS THAN 600 FT PER REEL. CABLE ENDS TO BE SEALED AND HAVE PULLING EYES ATTACHED. PER PA SPEC SECTION 16121 (N4/4/06), KERITE CATALOG NUMBER 335X05-CH230 OR APPROVED EQUAL.</p> <p>QUOTE FOB DELIVERED PRICING ON ALL ITEMS.<br/>           ++++++</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</p> |                             |  |                                     |  |
|          | <p><b>PLEASE QUOTE FULLY DELIVERED PRICES</b></p>  | <p><b>PAYMENT TERMS</b></p> |  | <p><b>Total Delivered Price</b></p> |  |

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| Quantity | Description  | Unit Price           |  | Total                        |
|----------|--|----------------------|--|------------------------------|
|          | exceeding \$1,000,000. My firm was certified as a<br>_____ on _____. |                      |  |                              |
|          | <b>PLEASE QUOTE FULLY DELIVERED PRICES</b>                           | <b>PAYMENT TERMS</b> |  | <b>Total Delivered Price</b> |

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## TERMS AND CONDITIONS

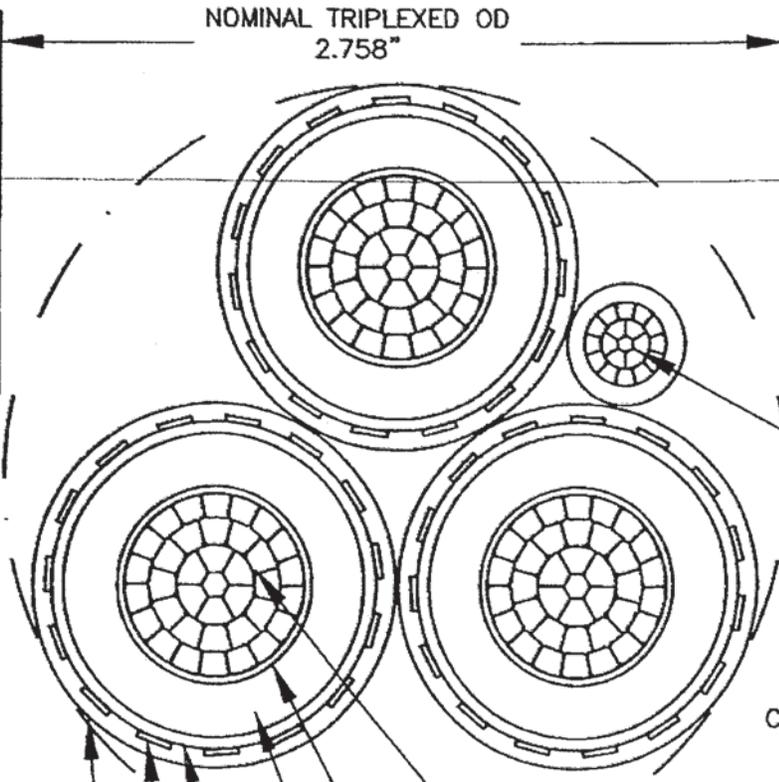
1. The Port Authority (PA) reserves the right to request information relating to seller's responsibility, experience and capability to perform the work.
2. Unless otherwise provided, complete shipment of all items must be in one delivery FOB delivery point. Payment will not be made on partial deliveries 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.

EXAMPLE  
CS0100010

# 35288

10/22/13 ✓

**INSTALLATION PARAMETERS**  
 3/C MAX PULLING TENSION W/PULLING EYE CONNECTED DIRECTLY TO COPPER CONDUCTORS = 10,000 LBS  
 3/C MAX ALLOWABLE SIDEWALL PRESSURE = 1000 LBS PER FOOT OF RADIUS



**RATINGS**  
 105C - CONTINUOUS  
 140C - EMERGENCY  
 250C - SHORT CIRCUIT  
 5 KV, 133% INSUL LEVEL  
 8 KV, 100% INSUL LEVEL

**MATERIAL LEGEND**  
 EPR-ETHYLENE PROPYLENE RUBBER  
 SC-SEMICONDUCTING  
 PE-POLYETHYLENE

#4/0 AWG COMPACT ROUND COPPER GROUND WIRE COVERED WITH 0.055" GREEN X-OLENE (XLP) INSULATION, NOMINAL OD=0.596"

CABLE WEIGHT = 7.144 LBS./FT.

- 500 MCM COMPACT ROUND COPPER CONDUCTOR
- EXTRUDED SEMICONDUCTING CONDUCTOR SCREEN (SC-EPR)
- 0.115" NOMINAL (0.110" MIN POINT) OKOGUARD (EPR) INSULATION, NOMINAL OD = 1.009"
- 0.024" EXTRUDED SEMICONDUCTING INSULATION SCREEN (SC-EPR) NOMINAL OD = 1.069"
- 18 - 0.150" X 0.020" FLAT TINNED COPPER STRAPS (68,755 CMIL AREA), EQUIVALENT TO #2 AWG CONDUCTOR
- 0.050" NOMINAL (0.045" MIN POINT) OKOLENE (LOW DENSITY PE) JACKET, SEQUENTIAL PRINT 1/C ONLY, PRINT PHASE ID, 1/C NOMINAL OD = 1.219"

PORT AUTHORITY OF NY & NJ  
 OKONITE PC# 140-23-9076  
 SPEC: 16121 N 4/4/06

3/C TRIPLEXED 500 C/R CU, OKOGUARD, 18-150 X 20 CU STRAPS, 4/0 GRD OKOLENE 5KV

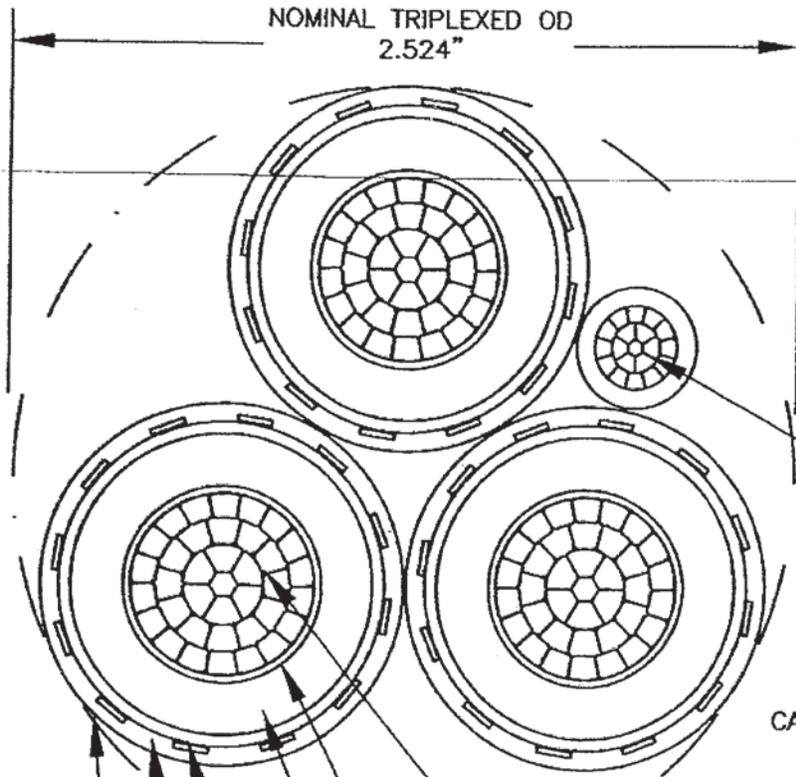
|   |               |                   |                   |
|---|---------------|-------------------|-------------------|
| <b>THE OKONITE COMPANY</b><br>RAMSEY, N.J. U.S.A. | DATE 02/14/12 | SCALE NTS         | REVISIONS 3/23/12 |
|   | DR. JZJR      | APP. JVF          | DRAWING NUMBER    |
|   | DISK OET      | EST. NUMBER 92651 | <b>CS-13277</b>   |

EXAMPLE  
 CS0100015

#35288  
 10/24/13 ✓

**INSTALLATION PARAMETERS**

3/C MAX PULLING TENSION W/PULLING EYE CONNECTED DIRECTLY TO COPPER CONDUCTORS = 8,400 LBS  
 3/C MAX ALLOWABLE SIDEWALL PRESSURE = 1000 LBS PER FOOT OF RADIUS



**RATINGS**

105C - CONTINUOUS  
 140C - EMERGENCY  
 250C - SHORT CIRCUIT  
 5 KV, 133% INSUL LEVEL  
 8 KV, 100% INSUL LEVEL

**MATERIAL LEGEND**

EPR-ETHYLENE PROPYLENE RUBBER  
 SC-SEMICONDUCTING  
 PE-POLYETHYLENE

#4/0 AWG COMPACT ROUND COPPER GROUND WIRE COVERED WITH 0.055" GREEN X-OLENE (XLP) INSULATION, NOMINAL OD=0.596"

CABLE WEIGHT = 5.542 LBS./FT.

- 350 MCM COMPACT ROUND COPPER CONDUCTOR
- EXTRUDED SEMICONDUCTING CONDUCTOR SCREEN (SC-EPR)
- 0.115" NOMINAL (0.110" MIN POINT) OKOGUARD (EPR) INSULATION, NOMINAL OD = 0.892"
- 0.024" EXTRUDED SEMICONDUCTING INSULATION SCREEN (SC-EPR) NOMINAL OD = 0.952"
- 12 - 0.175" X 0.025" FLAT TINNED COPPER STRAPS (66.845 CMIL AREA), EQUIVALENT TO #2 AWG CONDUCTOR
- 0.050" NOMINAL (0.045" MIN POINT) OKOLENE (LOW DENSITY PE) JACKET, SEQUENTIAL PRINT 1/C ONLY, PRINT PHASE ID, 1/C NOMINAL OD = 1.112"

**PORT AUTHORITY OF NY & NJ**  
**OKONITE INQUIRY NEW YORK 22-30034 (R8), ITEM #2**  
**SPEC: 16121 N 4/4/06**

3/C TRIPLEXED 350 C/R CU, OKOGUARD, 12-175 X 25 CU STRAPS, 4/0 GRD OKOLENE 5KV

**THE OKONITE COMPANY**  
 RAMSEY, N.J. U.S.A.

|               |                   |                 |
|---------------|-------------------|-----------------|
| DATE 02/07/13 | SCALE NTS         | REVISIONS       |
| DR. NV        | APP. JZJR         | DRAWING NUMBER  |
| DISK OET      | EST. NUMBER 17444 | <b>CS-19646</b> |

# 35288  
10/22/13

N 4/4/06

DIVISION 16

SECTION 16121

WIRES, CABLES, SPLICES, TERMINATIONS

(MEDIUM VOLTAGE: 601 VOLTS TO 34,500 VOLTS, INCLUSIVE)

PART 1. GENERAL

1.01 SUMMARY

This Section specifies requirements for wires, cables, splices, terminations and appurtenances for electrical systems of medium voltage: 601 volt to 34,500 volts, inclusive.

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 Conductors, Hard, Medium-Hard, or Soft      |
| <del>ASTM B 29</del>   | <del>Pig Lead</del>  |
| 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 |
| <del>ASTM D-1373</del> | <del>Medium-Voltage Rubber Insulating Tape</del>                           |
| 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 |
|-----------|--|

Federal Specifications (FS)

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

Insulated Cable Engineers Association (ICEA)

ICEA S-68-516 Ethylene-Propylene-Rubber Insulated Wire and Cable for the  
Transmission and Distribution of Electrical Energy

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 837 Standard for Qualifying Permanent Connections Used in Substation  
Grounding

National Fire Protection Association (NFPA)

NFPA 70 National Electrical Code

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

OSHA Occupation Safety and Health Administration

Underwriters Laboratories Inc. (UL)

UL 44 Rubber-Insulated Wires and Cables

UL 467 Grounding and Bonding Equipment

UL 510 Insulating Tape

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

**1.03 DESIGN AND PERFORMANCE REQUIREMENTS**

- A. Wires, cables, splices and terminations for medium voltage: 601 Volts to 34,500 Volts, inclusive, 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. Wires and cables that have been 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 have been manufactured no longer than six months prior to use in the Work of this Section.

## 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Where multiple single conductor cables are to be installed as one cable, single conductor cables shall be paralleled by cable manufacturer prior to shipment. Cable assembly overall diameter shall be kept to a minimum.
- B. 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.
2. Unless otherwise shown on the Contract Drawings, solid conductors shall be soft or annealed copper, conforming to ASTM B 33 (tinned), ASTM B 189 (lead-coated or lead alloy coated), or ASTM B 3 (uncoated).
3. Pulling Devices and End Seals
  - a. Wires and cables shall be provided with factory fitted pulling devices and end caps unless otherwise shown on the Contract Drawings. Shop drawings showing the 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 wires and cables shall be end-sealed, at both ends of each length. Lead cable shall be solder-wiped sealed with a heat-shrinkable cap, to prevent the entrance of moisture.
  - d. Lead-sheathed cables shall be provided with either compression type or solder-wiped style pulling bolts or eyes on the leading end of each conductor, or on the overall assembly. The pulling device shall be installed and fitted with either solder-wipe or heat-shrinkable sleeve to prevent the entrance of moisture.

4. Wires and cables shall be identified in accordance with AEIC CS 6. Outer jacket shall be printed with manufacturer's identification, type of insulation, size of conductor, rated voltage, year of manufacture, insulation thickness and UL listing. Each reel shall carry a tag identifying manufacturer, cable type, size, voltage and length of cable on reel.

---

In addition, on each single conductor cable when shipped triplexed or paralleled, there shall be a unique series of "111" or "222" or "333" respectively per phase or leg to identify the phase connection.

5. Grounding Wires and Cables

Unless otherwise shown on the Contract Drawings, grounding conductors shall be as follows:

- a. Insulated

- (1) Solid for sizes #8 AWG and smaller, Class B stranded for sizes #6 AWG and larger, 600 volt rated, XHHW or RHW.
- (2) Covering shall be a continuous green color and conform to ASTM B 33 and UL 44.

- b. Uninsulated

- (1) Solid for sizes #8 AWG and smaller, Class B stranded for sizes #6 AWG and larger.
- (2) In raceways  
Soft-drawn and conforming to ASTM B 3.
- (3) Direct buried or encased in concrete  
Soft-drawn, medium-hard-drawn or hard-drawn and conforming to ASTM B 1, B 2 or B 3, respectively.

6. Medium Voltage Flat Strap Cable, (FSC).

- a. Flat Strap Cable shall be used for all underground and outdoor locations unless otherwise shown on the Contract Drawings.
- b. Jacketed, single conductor cable.

- (1) Voltage rating shall be as shown on the Contract Drawings.

- (2) Insulation

Insulation shall be Ethylene-Propylene-Rubber (EPR). Cables shall conform to AEIC CS-6, ASTM D-2802 and ICEA S-68-516.

- (3) General Construction

In cross section from center to circumference, jacketed, single conductor cable shall consist of the following:

- (a.) Copper conductor shall be annealed, uncoated, compressed round strand or compact round strand when shown on the Contract Drawings.
- (b.) Extruded conductor shielding;
- (c.) Insulation shall be EPR, 133 percent insulation level;

- (d.) Extruded semiconducting insulation shielding;
- (e.) Flat strap neutral shall consist of tin coated, annealed flat copper wires per ASTM B272, helically applied over the insulation shield. The edges of the straps shall be rounded. The equivalent conductor size shall be #2 AWG unless otherwise shown. It shall cover not less than 80% of the insulation-shielding surface;
- (f.) Jacket of linear low-density polyethylene (LLDPE) in accordance with ASTM D1248. The jacket thickness shall be 50 mils and shall conform to IPCEA and UL standards. For cable used for indoor locations, jacketing material shall be selected to receive the UL label for tray use;
- (g.) Maximum outside diameter shall be as shown on the Contract Drawings;
- c. Assembly
  - Unless otherwise shown on the Contract Drawings, cables shall be triplexed at the factory prior to shipping.
- 7. Medium Voltage Lead-sheathed Cables (For Exterior and Underground Use)
  - a. Lead-Sheathed Cable shall only be used where specifically shown on the Contract Drawings.
  - b. Jacketed, Single Conductor Cable
    - (1) Voltage ratings shall be as shown on the Contract Drawings.
    - (2) Insulation
      - Insulation shall be ethylene-propylene-rubber (EPR). Cables shall conform to AEIC CS-6, ASTM D 2802 and ICEA S-68-516.
    - (3) General Construction
      - In cross section from center to circumference, jacketed, single conductor cable shall consist of the following:
        - (a.) Copper conductor, annealed, uncoated, Class B stranded or compact strand or sector, as shown on the Contract Drawings;
        - (b.) Extruded conductor shielding;
        - (c.) Insulation shall be EPR, 133 percent insulation level;
        - (d.) Extruded EPR, semi-conducting, insulation shielding;
        - (e.) Lead sheath overall;
        - (f.) Jacket of black polyethylene, polyvinyl chloride, or as shown on the Contract Drawings.
        - (g.) Maximum outside diameter shall be as shown on the Contract Drawings.
  - c. Jacketed, Three Conductor Cable
    - (1) Voltage ratings shall be as shown on the Contract Drawings.
    - (2) Insulation
      - EPR insulated cables shall conform to AEIC CS-6 and ASTM D 2802, ICEA S-68-516.

(3) General Construction

In cross section from center to circumference, jacketed, single conductor cable shall consist of the following:

- (a.) Three insulated, shielded conductors, each with:
  - i. Copper conductor, uncoated, Class B stranded or compact strand or sector;
  - ii. Extruded conductor shielding;
  - iii. Insulation shall be EPR, 133 percent insulation level;
  - iv. Extruded, semi-conducting, insulation shielding;
  - v. Copper shielding tape, 5-mil, spirally wrapped with 12.5 percent overlap.
- (b.) Ground conductors and fillers as necessary to provide an overall round cross section;
- (c.) Tape binder over the three insulated, shielded conductors;
- (d.) Lead sheath overall;
- (e.) Jacket of black polyethylene, polyvinyl chloride, or as shown on the Contract Drawings.
- (f.) Maximum outside diameter shall be as shown on the Contract Drawings.

8. Medium Voltage Cables (For Interior Use)

a. Jacketed, Single Conductor Cable

- (1) Voltage ratings shall be as shown on the Contract Drawings.
- (2) Insulation

Insulation shall be Ethylene-propylene-rubber (EPR). Insulated cables shall conform to AEIC CS-6, ASTM D 2802 and ICEA S-68-516.

(3) General Construction

In cross section from center to circumference, jacketed, single conductor cable shall consist of the following:

- (a.) Copper conductor, uncoated, Class B stranded or compact strand or sector, as shown on the Contract Drawings;
- (b.) Extruded conductor shielding;
- (c.) Insulation shall be EPR, 133 percent insulation level;
- (d.) Extruded EPR, semi-conducting, insulation shielding;
- (e.) Tinned copper braided shield, 85% minimum coverage, or copper shielding tape, 5-mil, spirally wrapped with 12.5 percent overlap;
- (f.) Jacket of flame retardant, low smoke chemically cross-linked polyolefin (XLPO), or chlorosulfonated polyethylene (CSP), or as shown on the Contract Drawings.
- (g.) Maximum outside diameter shall be as shown on the Contract Drawings.

b. Jacketed, Three Conductor Cable

- (1) Voltage ratings shall be as shown on the Contract Drawings.

(2) Insulation

EPR insulated cables shall conform to AEIC CS 6 and ASTM D 2802, ICEA S-68-516.

(3) General Construction

In cross section from center to circumference, jacketed, three conductor cable shall consist of the following:

- (a.) Three insulated, shielded conductors, each with:
  - i. Copper conductor, uncoated, Class B stranded or compact strand or sector;
  - ii. Extruded conductor shielding;
  - iii. Insulation shall be EPR, 133 percent insulation level;
  - iv. Extruded, semi-conducting, insulation shielding;
  - v. Tinned copper braided shield, 85% minimum coverage, or copper shielding tape, 5-mil, spirally wrapped with 12.5 percent overlap.
- (b.) Ground conductors and fillers as necessary to provide an overall round cross section;
- (c.) Tape binder over the three insulated, shielded conductors;
- (d.) Jacket of flame retardant, low smoke chemically cross-linked polyolefin (XLPO), or chlorosulfonated polyethylene (CSP) or as shown on the Contract Drawings.
- (e.) Maximum outside diameter shall be as shown on the Contract Drawings.

9. 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 nominal 1/16-inch diameter monel metal wire or stainless steel cable ties.

10. 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.
- (3) Splices and terminations shall be supplied as complete kit assemblies with all components and detailed installation instructions. Unless otherwise shown on the Contract Drawings, splices and terminations for medium voltage cables shall be heat-shrink polymeric type as manufactured by Raychem.

- b. Connectors  
Subject to compliance with requirements of this Section, provide Split-sleeve, solder, high conductivity, corrosion resistant connectors.
- c. Terminals  
Subject to compliance with requirements of this Section, provide Solder type, high conductivity, corrosion resistant terminals.
- d. Shrinkable Tubing  
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.
- e. Tapes and Sealers
  - (1) 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 D 3005.
    - (a) For interior, dry locations, provide Tape 7 mils thick, conforming to ASTM D 3005 (Type I).
    - (b) For exterior or damp and wet locations, provide tape 8.5 mils thick, conforming to ASTM D 3005 (Type II).
  - (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) or as shown on the Contract Drawings, or as approved by the Engineer, conforming to ASTM D 1373 and Federal Specification HH-I-553 (Grade A).
  - (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.
  - (5) Sealer  
Liquid applied, fast-drying sealant; Scotch (3M) Scotchkote, or approved equal.
- f. Binding wire shall be uninsulated, tinned copper.
- g. Lead sleeve shall be 5/32 inches thick, commercially and chemically pure, and shall conform to ICEA S-68-516 and ASTM B 29.
- h. Solder

- (1) Solder used on the shielding braids of any cable shall be 50% Tin / 50% Lead.
- (2) Solder used for wiping the lead splice sleeve to the lead sheath of any cable shall be 40 Tin/60 Lead, Class A.
- (3) Flux used when soldering conductor connectors or shielding tapes and shielding braids shall be of a non-corrosive and non-acid type.

- i. Insulating compound shall be installed in all lead-covered splices and all potheads.
- j. Arcproofing Material  
For arcproofing materials, refer to Section 16128 of the Specification.
- k. Ground Straps  
Flexible, tinned copper braid, equivalent to #6 AWG.
- l. 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.
- 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.
- 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. 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 be identified outside the applied arcproofing.

E. Field Tests

1. Medium Voltage Shielded 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

- 1. 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 UL 44.
- 2. The following tests for wires and cables shall be performed and certified reports of these tests shall be submitted to the Engineer:
  - a. Flame tests in accordance with IEEE 383 (were applicable).
  - b. Jacket tests in accordance with ICEA 5-68-516.
  - c. Cable tests in accordance with AEIC CS-6.
- 3. The test results shall be certified for each shipping reel of wire or cable.

4. 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.

G. Independent Laboratory Test

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1. Unless otherwise shown on the Contract Drawings, submit a 2'-0" sample from 25% of the shipping reels to an independent laboratory for the following tests which shall be performed in accordance with AEIC and ICEA standards.
  - a. A.C. Voltage Breakdown Tests
  - b. Adhesion of Insulation Shield to Insulation
  - c. Volume Resistivity of Conductor Shield to Insulation Shield
  - d. Dissection and Dimensional Analysis
  - e. Microscopic examination for voids, contaminants, and protrusions
  - f. Hot Creep Test to determine state of cure of insulation
  - g. Partial Discharge (DC) measurements
  - h. Dissipation factor of cable insulation
  - i. Impulse breakdown tests.

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 16121

### WIRES, CABLES, SPLICES, TERMINATIONS

(MEDIUM VOLTAGE: 601 VOLTS TO 34,500 VOLTS, INCLUSIVE)

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#### 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:
  - 1. Shop Drawings  
Submit Shop Drawings for the installation sequence, pulling tensions and sidewall pressure of all wire and cable pulls, including identification of manhole or pullbox locations with splices.
  - 2. Catalog Cuts
    - a. Medium Voltage Cable(s)
    - b. Ground Wire(s)
    - c. Terminators
    - d. Splices
    - e. Pulling Devices and End Seals
- B. Submit certified shop test reports for wires and cables.
- C. Submit field test results for wires and cables, including all test data and methodology.
- D. Submit nitrogen purge procedure for moisture laden wires and cables.

END OF APPENDIX "A"

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