**THE PORT AUTHORITY** OF NY & NJ

4 World Trade Center, 150 Greenwich Street,21st Floor,New York, NY 10007



Date 04/12/2016

# REQUEST FOR QUOTATION

Vendor No.

Contact person/Telephone/Email
Larry Waxman/212-435-4639/lwaxman@panynj.gov

**Collective# / RFQ Number / Bid Due Date**
0000045762 / / 05/03/2016
Bids must be received no later than 11:00 AM on the above Bid Due Date.

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

| Quantity | Description | Unit Price | Total |
|---|---|---|---|
| | ELECTRICAL CABLES 4 TYPES FURNISH AND DELIVER ON "NON -RETURNABLE STEEL REELS".TO JFK INTERNATIONAL AIRPORT. SEE ATTACHED SPECIFICATIONS SECTIONS 16121 AND 16129. THIS IS A SECTION BID SEE SELECTED PARAGRAPHS.<br><br>WITH BID RESPONSE ADVISE ELECTRICAL CABLE(S)TO BE OFFERED IN THE EVENT OF AN ORDER:<br><br>SECTION I.<br>STOCK ITEM CS0100010 CABLE 500MCM<br>MANUFACTURER:_____.<br>PLANT LOCATION:_____<br>MAKE/MODEL/PART NUMBER:_____.<br><br>STOCK ITEM CS0100015 CABLE 350MCM<br>MANUFACTURER:_____.<br>PLANT LOCATION:_____<br>MAKE/MODEL/PART NUMBER:_____.<br><br>STOCK ITEM CS0100012 CABLE 750MCM<br>MANUFACTURER:_____.<br>PLANT LOCATION:_____<br>MAKE/MODEL/PART NUMBER:_____. | | |
| | PLEASE QUOTE FULLY DELIVERED PRICES | PAYMENT TERMS | Total Delivered Price |

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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

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**THE PORT AUTHORITY** OF NY & NJ
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Date 04/12/2016

# REQUEST FOR QUOTATION

RFQ Number / Bid Due Date
6000124119 / 05/03/2016

Vendor No.

| Quantity | Description | Unit Price | Total |
|---|---|---|---|
| | SECTION II<br>STOCK ITEM CS0100011 CABLE 2/0 #4AWG<br>MANUFACTURER:_____.<br>PLANT LOCATION:_____<br>MAKE/MODEL/PART NUMBER:_____.<br><br>BIDDERS ARE TO INCLUDE WITH YOUR BID RESPONSE TWO COPIES OF CATALOG CUTS/SPECIFICATIONS/DRAWINGS FOR PORT AUTHORITY REVIEW AND APPROVAL. INDICATE STOCK ITEM NUMBER ACCORDINGLY.<br><br>NOTE: THAT ALL REELS ARE TO BE "NON -RETURNABLE STEEL".<br><br>NOTE: BIDDER(S) ARE TO QUOTE NOT MORE THAN TWO (2) DECIMAL PLACES TO THE RIGHT OF THE DECIMAL POINT. IN THE EVENT THAT THIS REQUIREMENT IS NOT FOLLOWED THE PORT AUTHORITY WILL NOT CONSIDER ANY VALUES PAST THE SECOND DECIMAL POINT AND DEFAULT TO TWO DECIMAL POINTS. THE PORT AUTHORITY WILL NOT ROUND UP OR DOWN AN VALUES.<br>EXAMPLE OF TWO DECIMAL POINTS: $123.45 | | |
| | PLEASE QUOTE FULLY DELIVERED PRICES — PAYMENT TERMS | Total Delivered Price | |

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Date 04/12/2016

# REQUEST FOR QUOTATION

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6000124119 / 05/03/2016

Vendor No.

| Quantity | Description | Unit Price | Total |
|---|---|---|---|
| | QUOTE FOB DELIVERED PRICING ON ALL ITEMS.<br>IN THE EVENT OF AN ORDER ADVISE DELIVERY<br>IN _____ DAYS A.R.O.<br><br>BIDDERS ARE INSTRUCTED TO INCLUDE WITH YOUR BID<br>RESPONSE TWO COPIES OF CATALOG<br>CUTS/SPECIFICATIONS/DRAWINGS FOR PORT<br>AUTHORITY / PATH REVIEW AND APPROVAL.<br><br>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.<br><br>ALL PRICES SHALL BE FOB DELIVERED ON A FLAT BED<br>TRUCK, CABLE AND REELS TO BE MARKED WITH PO#,<br>REEL NUMBER, MANUFACTURER, FEET PER REEL ON<br>THE NON-RETURNABLE STEEL REELS, TESTING,<br>DRAWINGS ETC.<br><br>CABLE MUST BE DELIVERED ON NON-RETURNABLE<br>STEEL REELS.<br><br>TOTAL CABLE TOLERENCE FOR ITEMS CS0100010,<br>CS0100011. | | |
| | **PLEASE QUOTE FULLY DELIVERED PRICES** PAYMENT TERMS | Total Delivered Price | |

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# REQUEST FOR QUOTATION

RFQ Number / Bid Due Date
6000124119 / 05/03/2016

Vendor No.

| Quantity | Description | Unit Price | Total |
|---|---|---|---|
| | CS0100015 AND CS0100012:<br>MINUS ZERO (0) / PLUS 5% / TOTAL RUN.<br>REELS TOLERANCE MINUS ZERO (0) / PLUS 5% FEET PER REEL.<br><br>PLEASE FOLLOW RETURN TO BID INSTRUCTIONS.<br>REPLY ONLY ON P.A./PATH REQUEST FOR QUOTATION FORM<br>AS ATTACHING YOUR COMPANY'S TERMS & CONDITIONS MAY<br>CAUSE YOUR BID TO BE DEEMED NON RESPONSIVE AND OR<br>DELAY AN AWARD ISSUED.<br><br>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_____.<br><br>NOTE TO BIDDERS:<br>It is the intent of the Port Authority of New York and New Jersey (the "Port Authority") to award an order to one Bidder per section based on the total estimated FOB delivered price per all items in that section. However, the Port Authority shall have the absolute right to reject any or all bids or to accept any bid in whole or in part and to waive defects in bids.<br><br>PLEASE QUOTE FULLY DELIVERED PRICES | PAYMENT TERMS<br><br>Total Delivered Price | |

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Vendor No.

| Quantity | Description | Unit Price | Total |
|---|---|---|---|
| | The purchase of electrical cables will be awarded by Section as further described below in the "Evaluation of Bids". This may result in the award of up to two (2) purchase orders to different Bidders. However, it is also possible that the same bidder be awarded both sections if the bidder is the lowest responsive responsible respondent for each section.<br><br>Evaluation of Bids<br>The Bidder is permitted to submit bids on one or both sections contained in RFQ Pricing Sheets. The award for each individual Section will be based upon the following:<br><br>Section I: The lowest responsive responsible Bidder with the lowest Total Estimated FOB delivered price for all three items will be considered the low Bidder for Section I.<br><br>Section II: The lowest responsive responsible Bidder with the lowest Total Estimated FOB delivered price for the one item will be considered the low Bidder for this Section II.<br><br>SECTION I ITEMS:<br>STOCK ITEM CS0100010 CABLE 500MCM,<br>STOCK ITEM CS0100015 CABLE 350MCM AND<br>STOCK ITEM CS0100012 CABLE 750MCM.<br><br>SECTION II ITEM:<br>STOCK ITEM CS0100011 CABLE 2/0 #4AWG | | |
| | PLEASE QUOTE FULLY DELIVERED PRICES — PAYMENT TERMS | Total Delivered Price | |

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4 World Trade Center, 150 Greenwich Street,21st Floor,New York, NY 10007


Date 04/12/2016

# REQUEST FOR QUOTATION

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6000124119 / 05/03/2016

Vendor No.

| Quantity | Description | Unit Price | Total |
|---|---|---|---|
| | QUESTIONS ONLY CONTACT:<br>LARRY WAXMAN<br>TEL: 212 435 4639 OR<br>EMAIL: Lwaxman@panynj.gov<br><br>SUMMARY RECAP TOTAL FOB DELIVERED PRICE<br>FOR SECTIONS I AND II.<br><br>SECTION I ITEMS:<br>STOCK ITEM CS0100010 CABLE 500MCM,<br>STOCK ITEM CS0100015 CABLE 350MCM AND<br>STOCK ITEM CS0100012 CABLE 750MCM.<br>TOTAL FOB DELIVERED PRICE:$_____.<br><br>SECTION II ITEM:<br>STOCK ITEM CS0100011 CABLE 2/0 #4AWG<br>TOTAL FOB DELIVERED PRICE:$_____. | | |
| | PLEASE QUOTE FULLY DELIVERED PRICES | PAYMENT TERMS<br>Total Delivered Price | |

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| Quantity | Description | Unit Price | Total |
|---|---|---|---|
| | This is a Formal Bid Invitation<br>Mail Sealed Bids to:<br><br>The Port Authority of NY & NJ<br>Attn: Bid Custodian<br>Procurement Department<br>4 World Trade Center<br>150 Greenwich Street, 21st Floor<br>New York, NY 10007<br><br>by the date and time listed above, where it will be publicly opened and read.<br><br>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.<br><br>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. Express carrier deliveries by commercial vehicles can be made via vendors approved by Silverstein Properties, the 4 World Trade Center (4WTC) Property Manager, through the Vehicle Security Center (VSC). Presently, UPS is the only delivery vendor with approved recurring delivery times. There is extensive security at the World Trade Center Site. Individuals must present a valid government-issued photo ID | | |
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Vendor No.

| Quantity | Description | Unit Price | Total |
|---|---|---|---|
| | to enter 4 WTC. Individuals without packages or carrying small packages or boxes that can be conveyed by hand or on a hand truck may enter through the lobby. All envelopes, packages and boxes may be subject to additional security screening.<br>There is no parking available at 4 WTC/150 Greenwich Street, and parking in the surrounding area is extremely limited.<br><br>A valid government-issued photo ID is required to gain access into the building to attend the bid opening or hand deliver a bid.<br><br>Bids that are not received by the bid custodian by the scheduled bid opening date will be considered late. | | |
| 7,200 FT | CS0100010<br>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.<br>PER PA SPEC SECTION 16121 (N4/4/06) | | |
| | PLEASE QUOTE FULLY DELIVERED PRICES — PAYMENT TERMS | Total Delivered Price | |

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| Quantity | Description | Unit Price | Total |
|---|---|---|---|
| 3,600 FT | CS0100011<br>CABLE, 2/0 FOR AIRFIELD. #4AWG COMPACT ROUND COPPER GROUND WIRE COVERED WITH 0.045 GREEN X-OLENE (XLP) INSULATION. NOMINAL OD 0.311". CABLE MUST BE DELIVERED ON NON-RETURNABLE STEEL REELS. NOT LESS THAN 600 FT PER REEL. PER PA SPEC SECTION 16129.<br>RATING: 105C CONTINUOUS.140C EMERGENCY 250C SHORT CIRCUIT<br>5KV 133% INSULATION 8KV 100% INSULATION | | |
| 7,200 FT | CS0100015<br>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) | | |
| 7,200 FT | CS0100012<br>CABLE, 750 MCM, 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. | | |
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Vendor No.

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| | PER PA SPEC SECTION 16121 (N4/4/06) | | |
| | PLEASE QUOTE FULLY DELIVERED PRICES — PAYMENT TERMS | Total Delivered Price | |

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Firm Name_____

PA280/9-03

# TERMS AND CONDITIONS

1. The Port Authority (PA) reserves the right to request information relating to seller's responsiblity, 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 (212) 435-4600 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.

SAP 10107036
BID# 48762-
Bid Section I N 4/4/06
CS0100010 500 MCM
CS0100015 350 MCM
CS0100012 750 MCM

**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 |
| ASTM B 29 | Pig Lead |
| ASTM B 33 | Tinned Soft or Annealed Copper Wire for Electrical Purposes |
| ASTM B 189 | Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes |
| ASTM D 1373 | Medium-Voltage Rubber Insulating Tape |
| ASTM D 2802 | Ozone-Resistant Ethylene-Propylene-Rubber Insulation for Wire and Cable |
| | Association of Edison Illuminating Companies (AEIC) |
| AEIC CS-6 | Ethylene-Propylene-Rubber Insulated Shielded Power Cable Rated 5 through 69 KV |
| | 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, ASTMD-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, helicaly 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 thick, mils 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 appllicable).

   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

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)

## APPENDIX "A'"

## SUBMITTALS

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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C-S 01/00011 2/0 4AWG
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# DIVISION 16

# SECTION 16129

# TAXIWAY/RUNWAY WIRES AND CABLES

## PART 1. GENERAL

### 1.01 SUMMARY

This Section specifies requirements for wires, cables, splices, terminations and accessories, for airfield construction.

### 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 | Specification for Hard-Drawn Copper Wire |
| ASTM B 2 | Specification for Medium-Hard-Drawn Copper Wire |
| ASTM B 3 | Specification for Soft or Annealed Copper Wire |
| ASTM B 8 | Specification for Concentric-Lay Stranded Copper Conductors, Hard, Medium-Hard, or Soft |
| ASTM B 33 | Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes |
| ASTM D 2802 | Standard Specification for Ozone-Resistant Ethylene-Propylene-Rubber-Insulation for Wire and Cable |
| | Federal Aviation Administration, Advisory Circular (FAA-AC) |
| 150/5345-7 | Underground Electrical Cables for Airport Lighting Circuits (FAA Specification L-824B) |
| 150/5340-19 | Taxiway Centerline Lighting System |
| 150/5345-26 | Specification for Plug and Receptacle Cable Connectors (FAA Specification L-823) |
| | Federal Specifications (FS) |
| SS-S-1401 | Sealing Compound, Hot Applied For Concrete and Asphalt Pavements |
| | Insulated Cable Engineers Association (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 383 | Type Test of Class 1E Electric Cables, Field Splices and Connections for Nuclear Power Generating Stations |

Underwriters Laboratories, Inc. (UL)

| | |
|---|---|
| UL 44 | Rubber Insulated Wires and Cables |
| UL 83 | Thermoplastic-Insulated Wires and Cables |

1.03 QUALITY ASSURANCE

A. Tests requiring certified reports and those requiring factory witness or field inspection shall be conducted and reported to the Engineer in conformance with those standards specified in this Section.

B. Installations shall comply with the standards of the Federal Aviation Administration (FAA) where applicable.

C. Wires and cables that have been manufactured more than two years prior to installation shall not be used in the work of this Section.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Where multi-conductors 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 from weather.

1.05 SUBMITTALS

See Appendix "A" for submittal requirements.

## PART 2. PRODUCTS

2.01 MATERIALS

A. General

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. All electrical materials and equipment for which there are established UL standards, shall bear the UL label.

B. 600 volt Insulated Wires and Cables

1. Power Wires and Cables

Type THWN - Secondary Series Lighting wire and cable shall be single conductor, Class C stranded, double rated THHN-THWN, thermoplastic insulated and nylon jacketed, gasoline and resistant and conform to UL 83.

2. 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.

(2) Insulation shall be a continuous green color, double rated THHN-THWN thermoplastic insulated and nylon jacketed, gasoline and oil resistant and conform to UL 83.

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.

C. 5000 volt Insulated Wires and Cables

Primary Series Lighting Cable shall be Non-Shielded 5000 Volt Rated, Type 'B', Single Conductor, Coated Copper, Class C, 19 Strands, Ethylene-Propylene-Rubber Insulated (ASTM D-2802 and ICEA S-68-516) and Chlorinated Polyethylene Jacket. The cable shall comply with FAA-AC 150/5345-7 and shall be approved under FAA Specification No. L-824B. Where indicated on the contract drawings, two cables shall be paralleled. (Identify one of the two cables with a yellow stripe.)

2.02 SPLICING AND TERMINATING MATERIALS

A. General

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. Power Wire and Cable Splices

1. Connector shall be insulated compression (indenter) type as specified on the contract drawings.

2. Silicone Sealant shall be as specified on the contract drawings.

3. Heat Shrinkable Tubing shall be either irradiated modified polyvinyl-chloride or irradiated polyolifin as specified on the contract drawings.

C. Secondary Series Lighting Cable Connectors

Double Pole plug and receptacle connectors for the secondary series lighting system shall comply with FAA-AC 150/5345-26 and shall be approved under FAA Specification No. L-823 in accordance with Figure No. 15. Plug and receptacles shall be as specified on the contract drawings.

D. Series Lighting Cable Connectors

Single Pole plug and receptacle connectors for the primary series lighting cable system shall comply with FAA-AC 150/5345-26 and shall be approved under FAA Specification No. L-823 in accordance with Figure No. 6. Plug and receptacles shall be as specified on the contract drawings. Coordinate the connector size for use with the cable.

E. Cable Tags

Stainless steel metal tags, No. 25 gauge, and 3/4 inch wide, embossed with letters and numerals 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.

F. Hot Rubberized Asphalt Sealer shall be the hot poured type conforming to Federal Specification SS-S-1401 Sealer.

2.03 SHOP TESTS

A. General

1. Factory or in-plant and independent laboratory tests shall be in conformance with the applicable standards and as specified in this Section. All testing, and the results thereof shall be certified, in writing, to the Engineer.

B. Factory or In-Plant Tests

1. 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 factory tests as required, or to waive factory inspection or witnessing of tests.
2. The Contractor shall notify the Engineer 14 days in advance of such factory tests.
3. 600 Volt Insulated Wires and Cables
   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 UL 44.
   b. Flame tests for wires and cables shall be performed in accordance with IEEE 383.
4. 5000 Volt Insulated Wires and Cables
   a. Tests for wires and cables shall be in accordance with FAA-AC 150/5345-7 and ICEA S-68-516.

C. Independent Laboratory Tests

1. The following tests shall be performed by an independent test laboratory:

a. Specific Surface Resistivity

The specific surface resistivity of the cable jacket shall have a value greater than 200,000 Megohms under all of the following conditions:

(1) As manufactured.

(2) After immersion in tap water at 30 Degrees Celsius for 28 days with measurements performed after the first day and then every week.

(3) After immersion in a 50/50 solution of potassium acetate (KAc) deicer and tap water at 30 Degrees Celsius for 28 days with measurements performed after the first day and then every week.

b. The values of specific surface resistivity obtained in 2.03 C.1.a shall be plotted to demonstrate stability over time.

c. Drip Track Resistance

Using apparatus described in ASTM Standard D2303, the cable jacket shall pass the following test;

(1) No. of Samples: 6 - after immersion for 28 days in KAc/H2O solution

(2) Wetting Solution: 50/50 KAc/water

(3) Wetting Rate: 0.2 cm3/minute

(4) Applied Voltage Steps: 100 Volts/30 minutes

(5) Initial Tracking Voltage: >1000 Volts (Median Value)

Airport lighting cables that satisfy the above requirements should bear the following jacket printing;

"Cable Manufacturer" FAA-L-824 Type B MOD A

d. Certification and test required under Section 2.03 C shall be performed by an independent test laboratory. Submit qualifications and the test procedure of the test lab for approval prior to testing.

e. Testing shall not be required for a previously certified cable if successful testing has been performed by the same manufacturer for the identical cable using identical materials. The certified test data shall be submitted for approval.

## PART 3. EXECUTION

### 3.01 PREPARATION

A. Inspect the raceways and conduits prior to installation of wires and cables and notify the Engineer in writing in the event of finding conditions that would prevent the proper installation of materials using the methods specified in this Section.

B. Prior to pulling wires and cables, clean the raceway systems of all foreign matter and perform all operations necessary so as not to cause damage to wires and cables while pulling.

C. 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

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.

2. General Purpose Wires and Cables

a. For the connection of taxiway and runway lights to secondaries of isolating transformers.

b. Leave sufficient slack in each cable, but in no case less than:

(1) Three feet in base cans

(2) Six feet in light boxes

3. 5000 Volt Series Lighting Cables

a. For connection of the airport Constant Current Regulator output to the primaries of the isolating transformers.

b. Leave sufficient slack in each cable, but in no case less than:

(1) Fifteen feet in manholes

(2) Ten feet in handholes

(3) Ten feet in lightboxes

(4) Six feet in base cans

B. Connections and Terminations

1. General Purpose Wires and Cables

After the cable has been installed, the connections and terminations shall be installed in accordance with the manufacturer's instructions.

2. 5000 Volt Series Lighting Cables

a. Connections to Transformers

(1) At each isolating transformer for runway and taxiway lights and taxiway signs and as shown on the Contract Drawings, the primary connectors shall consist of an assembly of L-823 Single Pole Plug and Receptacle cable connectors, and heat shrinkable insulation tubing.

(a.) Heat shrinkable insulation tubing shall be 13 inches minimum length and its interior shall be coated with elastic mastic to assure a watertight seal after shrinking.

(b.) Heat shrinkable insulation tubing may be installed in three sections to accommodate a connector that is not uniform in shape. The lengths of the sections shall be two at six inches long and one at eight inches long.

(2) After the cable has been installed, the connectors shall be installed on the ends of the Series Lighting Cable in accordance with the manufacturer's instructions.

(a.) The receptacle shall be installed at one end of the cable and the plug at the other end to establish a continuous plug and receptacle sequence through the wiring system and its associated isolating transformers.

(b.) Precautions shall be taken to release trapped air when inserting the plug in the receptacle. After the joint has been made and wiped clean of excess jelly, a heat shrinkable insulation tube shall be applied over the plug and receptacle in accordance with the manufacturer's recommendations and as approved by the Engineer.

b. Connections

(1) Where the Primary Series Lighting Cables are run through or into taxiway light boxes, handholes, or manholes, without connection to an isolating transformer, a plug and connector type installation as described immediately above, shall be used.

(2) The maximum lengths of uncut wires and cables shall depend on the lengths of the wire and cable that can be installed without damage.

C. Identification of Wires and Cables

1. Each wire and cable shall be identified by its circuit in all cabinet boxes, manholes, handholes, wireways and other enclosures or 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. Wire and Cable tags shall be fastened to both ends of the series lighting wires and cables.

3.03 FIELD TESTS

In addition to other tests that may be required in other Sections, the Contractor shall perform the following field tests in the presence of the Engineer, to demonstrate the reliability of the electrical installation.

A. Tests on the cables shall be made in accordance with the FAA-AC 150/5340-19.

B. All series lighting cables and circuits shall be tested with a 5000-volt megohm meter. The following test procedure shall be performed on all series lighting circuits:

1. Each single conductor 5000 volt insulated cable from the regulator to the first isolation transformer: Insulation value shall not be below RCI, computed as by the following formula.

$$RCI = \frac{8 \times 106 \text{ (Megohms)}}{Lci}$$

Where Lci is the length of the single conductor cable under test in feet.

2. The remaining portion of circuit from the first isolation transformer to the last isolation transformer shall have an insulation value of not less than Ris, computer by the following formula.

$$\frac{1}{Ris} = \frac{Nit}{2000 \text{ Megohms}} + \frac{Ns}{4000 \text{ Megohms}}$$

Where Nit is the number of isolation transformers, Ns is the number of slices.

3. Each single conductor 5000 volt insulated cable from the last isolation transformer to the regulator: Insulation value shall not be below Rc2, computed as by the following formula:

$$Rc2 = \frac{8 \times 106 \text{ (Megohms)}}{Lc2}$$

Where Lc2 is the length of the single conductor cable under test in feet.

4. The complete circuit after all splices are completed must have an insulation value of not less than Rt, computed by the following formula:

$$\frac{1}{Rt} = \frac{1}{Ris} + \frac{1}{Rci} + \frac{1}{Rc2}$$

Test shall use the step voltage method, using a minimum of 3 voltage levels; 1000 volts, 2500 volts and 5000 volts. Sufficient time shall be allowed for charging currents to subside. Minimum insulation values shall be met at any and all voltage levels. A written record of all tests shall be furnished to the Engineer before acceptance of the insulation. Tests shall be performed by qualified personnel and strict adherence to requirements of the Port Authority and the manufacturer of the equipment. All safety and operating rules shall be strictly observed and enforced.

C. After the installation has been completed, the Contractor shall successfully operate all electrical equipment for a continuous 24-hour period.

D. Unless otherwise shown on the Contract Drawings, all labor, materials and power required for the above tests shall be furnished by the Contractor. Only power for the operating test will be furnished by the Authority.

E. Should the foregoing 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.

F. If any defects in existing equipment or materials are disclosed by the foregoing tests, the Contractor shall so notify the Engineer. After verification by the Engineer, and upon the Engineer's written order, the Contractor shall correct the installation to the extent directed by the Engineer. Any work so ordered by the Engineer and performed by the Contractor in connection with replacing of existing defective equipment or materials shall be compensated for in accordance with the clause of the Form of Contract entitled "Compensation for Extra Work." Damage to existing equipment or materials caused by the Contractor's acts or omissions shall be repaired at the Contractor's cost.

END OF SECTION

## SECTION 16129

## TAXIWAY/RUNWAY WIRES AND CABLES

## APPENDIX "A"

## SUBMITTALS

Submit the following in accordance with the requirements of "Shop Drawings, Catalog Cuts, and Samples" of DIVISION 1 - GENERAL PROVISIONS:

A. Catalog Cuts

1. Primary Series Lighting Cable
2. Primary Series Lighting Cable Connections and Terminations
3. Secondary Series Lighting Cable
4. Secondary Series Lighting Cable Splices
5. Grounding Cable
6. Single Pole Plug Connector
7. Double Pole Plug Connector
8. Flanged Receptacle Connector
9. Cable Tags
10. Sealer

B. Certified factory or in-plant test reports for wires and cables.

C. Certified independent laboratory test report for wires and cables.

D. Field Test reports for wires and cables, including all test data and methodology.

END OF APPENDIX "A"