

CITY OF AUSTIN ELECTRIC UTILITY DEPARTMENT

PURCHASE SPECIFICATION

FOR

CABLE, URD, 15-35KV, POWER

| DATE | PREPARED BY | ISSUANCE/REVISION | APPROVAL PROCESS SUPV. / MANAGER. |
|------------|--------------------------|-------------------|--------------------------------------|
| 03/25/98 | George M. Martinez, P.E. | Revision | Clint Rogas / Herman Millician |
| 07/10/98 | George M. Martinez, P.E. | Revision | Clint Rogas / Herman Millician |
| 01/08/99 | George M. Martinez, P.E. | Revision | Clint Rogas / Herman Millician |
| 01/26/2000 | Steven Booher | Revision | |
| 07/30/2015 | Brantley Gosey | Revision | Michael Pittman |
| 10/21/2015 | Brantley Gosey | Revision | |
| 12/07/2015 | Brantley Gosey | Revision | |
| 04/26/2016 | Brantley Gosey | Revision | Michael Pittman |
| 10/16/2019 | Julius Heslop | Revision | Michael Pittman |

| <i>REASON FOR REVISION</i> | <i>AFFECTED PARAGRAPHS</i> |
|--|--|
| 1/26/2000: Changed part of section to read: The maximum ground fault current is 7000 Amperes (A) for a phase-to-ground fault and 15,000 A for a phase-to-phase fault for a maximum of ten cycles | Section 3.2 |
| 7/30/2015: Clearly defined concentric neutral for 15 kV cable | Section 3.2, 3.3 |
| 10/21/15: Added impacted AE Item Numbers | Section 6.8 |
| 12/07/15: Update Cable and Reel Size Attachment | Attachment 1 |
| 04/26/16: General updates and improvement | Section 2.1, 2.4, 4.3, 4.4, 4.5.1, 4.5.2, 4.6, 4.7, 4.8, 4.9, 5.1.1, 6.2.4, 6.3, 6.5, Attachment 1 |
| 10/16/19: Update Reel per Length Attachment | Attachment 1 - Table 1 |

This specification, until rescinded, shall apply to each future purchase and contract for the commodity described herein.
Retain for future reference.

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PURCHASE SPECIFICATION
FOR
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1.0 SCOPE AND CLASSIFICATION

1.1 Scope

The City of Austin (COA) requires a qualified Manufacturer to supply EPR (Ethylene-Propylene Rubber) insulated, medium voltage, 15 kV - 35 kV single conductor shielded power cable.

1.2 Classification

1.2.1 The voltage class shall be 15 kV (133 % insulation level) through 35 kV (100 % insulation level).

1.2.2 Conductor sizes shall be #2 AWG through 1000 kcmil.

1.2.3 Cable shall be designed for installation in underground conduit.

2.0 APPLICABLE STANDARDS

The latest revision of the following standards:

- 2.1 AEIC CS8 - Specification for Extruded Dielectric Shielded Power Cables Rated 5 through 46 kV
- 2.2 ASTM B496 - Soft or Annealed Copper Wire
- 2.3 ASTM B8 - Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft
- 2.4 ICEA S-94-649 - Standard for Concentric Neutral Cables Rated 5 through 46 kV
- 2.5 ICEA P-45-482 - Short Circuit Performance of Metallic Shields and Sheaths on Insulated Cable
- 2.6 NEMA WC26 - Wire and Cable Packaging

3.0 PERFORMANCE REQUIREMENTS

3.1 Cable shall be guaranteed to withstand copper temperatures not to exceed the following:

3.1.1 90°C (194°F) for normal operating conditions;

3.1.2 130°C (266°F) not to exceed 1500 cumulative hours during the life of the cable

3.1.3 250°C (482°F) under short circuit conditions

3.2 The 35 kV cable will be installed on a three phase (3Ø) 34,500 Volt wye system with the neutral grounded through a resistor. Three single phase cables (3Ø system) will be installed in a single duct. The maximum ground fault current is 7000 Amperes (A) for a phase-to-ground fault and 15,000 A for a phase-to-phase fault for a maximum of ten cycles. The line to ground voltage on the unfaulted phases may reach line to line values underground fault conditions. All three phase cable shall have a one-third or reduced concentric neutral. All single phase cable shall have a full concentric neutral.

3.3 The 15 kV cable will be installed on a three phase (3Ø) 12,470 Volt wye system with the neutral solidly grounded. The maximum ground fault current is 15,000 A phase-to-ground and phase-to-phase for a maximum of eight cycles. All three phase cable shall have a one-third or reduced concentric neutral. All single phase cable shall have a full concentric neutral.

4.0 MATERIAL REQUIREMENTS

4.1 Cable Design

- a) Single conductor
- b) #2 AWG to 1000 kcmil
- c) Compact copper conductor (with moisture barrier compound for 35kV only)
- d) Thermosetting extruded strand shield compatible with EPR
- e) Insulated with heat, moisture and ozone resisting EPR (Ethylene-Propylene Rubber) compound
- f) Insulation shielding shall consist of extruded semiconducting thermoset material.
- g) Copper shielding wire
- h) LLDPE (Linear Low Density Polyethylene) jacket

4.2 Conductors

Compact strands shall be made of a combination of soft or annealed copper.

4.3 Stranding

Compact Round Wire concentric-lay-stranded copper conductors in accordance with ASTM B8. Conductors utilized with 35 kV rated cable shall be manufactured with water blocking components.

4.4 Conductor Shielding

Conductor shielding shall be a smooth electrode consisting of an extruded layer of black, semiconducting, thermosetting compound with thermal characteristics equal to or better than those of the insulation and which is compatible with EPR. The outer surface shall be cylindrical and firmly bonded to the overlying insulation. The extruded shield shall be easily removable from the conductor. The thickness of the extruded layer shall be in accordance with Table 3-1 and clause 3.2.1 (Reduced Extruded Shield Thickness) of ICEA S-94-649.

4.5 Insulation

4.5.1 The insulation shall be a flexible thermosetting dielectric compound based on an ethylene propylene elastomer. The insulation shall be compounded by the cable manufacturer in its own facility using a closed system.

4.5.2 Thickness

For the 15 kV (133% insulation level) the nominal insulation thickness shall be 220 mils with a minimum point thickness of 210 mils and a maximum point thickness of 250 mils. For the 35 kV (100% insulation level) the nominal insulation thickness shall be 345 mils with a minimum point thickness of 330 mils and a maximum point thickness of 375 mils.

4.6 Insulation Shielding

A semiconducting thermoset insulation shield material compatible with the insulation and with a volume resistivity at 90°C not exceeding 500 Ω -m, as per ICEA S-94-649. The insulation shield shall be easily strippable, that is, the minimum allowable shield stripping tension shall be 6 lbs., and the maximum allowable shield stripping tension shall be 18 lbs.

4.7 Wire Shield System

The wire shield system shall consist of nine (9) or more copper wires wound helically over a semiconducting thermoset insulation shield. The uncoated copper wires shall be in accordance with ASTM B3. The cable shall be designed with the copper wires in contact with the underlying semiconducting layer. The total cross-sectional area shall be capable of carrying the system fault currents specified in Paragraph 3.2 and Paragraph 3.3 of this specification using the calculation method of ICEA P-45-482.

4.8 Jacket

The jacket material shall be LLDPE (Linear Low Density Polyethylene). The minimum wall thickness of the extruded to fill jacket shall be in accordance with Table 7-10 of ICEA S-94-649.

4.9 Cable Jacket Identification

The outer surface of all jackets shall be ink printed with the information required in the AEIC CS8 and ICEA S-94-649 specifications. The jacket of one single conductor of a paralleled reel and all single conductor reels shall have ink or hot foil indent printed sequential footage markings every 2 feet.

The markings on the cable jacket shall be readily legible throughout the operational life of the cable.

4.10 Packaging

The packaging of the power cables shall be in accordance with NEMA WC26. The cable reel size and cable lengths shall be as shown on Table 1 (Attachment 1). The cables shall be shipped only on returnable steel reels.

4.11 Manufacturing Process

A triple head or closed triple tandem extrusion process shall be used in the manufacturing of this cable. The extruded conductor shield and EPR insulation shall be bonded together during vulcanization to present a virtual corona-free cable core, at essentially the same time an extruded insulation shield shall be applied over the clean, smooth EPR insulation surface.

5.0 TEST REQUIREMENTS

5.1 All cables shall be tested in accordance with ICEA and AEIC test procedures.

5.2 Cable Test Reports

5.1.1 All production tests required by AEIC CS8 and ICEA S-94-649 shall be performed

5.1.2 Certified cable test reports shall be provided for each shipping reel.

5.1.3 Only certified cable test reports of the shipping reels, will be accepted by the AE Standards Supervisor.

5.1.4 ALL CERTIFIED TEST REPORTS, SHALL BE SENT TO THE AE STANDARDS SUPERVISOR, PRIOR TO SALE OF THE CABLE. FAILURE TO PRODUCE TEST REPORTS PRIOR TO SALE WILL RESULT IN THE AUTOMATIC REJECTION OF THE CABLE.

6.0 OTHER REQUIREMENTS

6.1 Cable Design

6.1.1 The Manufacturer shall send hard copy design drawings of the cable described herein, to the AE Standards Supervisor for approval, upon completion of any revision of the drawings and when requested by Austin Energy in the month of January each year, regardless, of whether, the cable design has changed.

6.1.2 The cable design drawings shall indicate detailed dimensions and material properties.

6.1.3 Prior to any changes in cable design, the Cable Manufacturer shall notify the AE Standards Supervisor. The Cable Manufacturer can make cable design changes, only upon receiving a written approval from the AE Standards Supervisor.

6.2 Cable Inspection & Samples

Austin Energy reserves the right to carry out random testing of cables supplied. The cable samples will be tested by the City of Austin personnel for compliance to this specification.

6.2.1 AE will contact the Cable Vendor to schedule the cutting of cable samples. Each cable sample shall be a minimum of 30 inches long. The Cable Vendors will be notified five (5) business days, prior to a visit by Austin Energy personnel, to witness the samples cut from the cable reels.

- 6.2.2 The cables shall be cut by the Cable Vendor's personnel, in the presence of City of Austin personnel.
- 6.2.3 It is the responsibility of the Cable Vendor's personnel to secure the cable reels for shipment, after the cable samples are cut. City of Austin personnel will not cut any cable samples.
- 6.2.4 Notification of Cable Test
- a) City of Austin personnel will require ten (10) business days, to carry out all necessary testing of the cable samples, collected from the Cable Vendor's site.
 - b) UPON COMPLETION OF THE CABLE TESTS, THE CABLE VENDOR WILL BE NOTIFIED BY EMAIL. ONLY CABLES APPROVED BY AUSTIN ENERGY WILL BE ACCEPTED FOR SALE TO THE COA EUD. THE CABLE VENDOR CANNOT SELL TO AUSTIN ENERGY CABLE NOT APPROVED BY AUSTIN ENERGY.**
 - c) If the cables fail the tests conducted by City of Austin personnel, the Cable Vendor will be notified by the City of Austin Engineer and appropriate actions will be taken, inclusive of "non-acceptance" of the cable by the City.
- 6.2.5 Prior to accepting a contract Austin Energy shall receive a full test report from a reputable domestic testing lab on subject product(s). The lab shall not be affiliated directly with the manufacturer of subject product(s). Tests performed on product(s) shall be according to (ANSI STD). Test results shall indicate the exact product number that the tests were performed on. In addition to initial testing prior to accepting contract, Austin Energy reserves the right to require testing at any time during the term of the contract, and maintains the ability to nullify contract if lab results are not received within a reasonable time from or if lab results are determined unsatisfactory by Austin Energy.

6.3 AE Standards Supervisor
Austin Energy
4411-B Meinardus Drive
Austin, TX 78744

6.4 The Cable Manufacturer shall have twenty (20) years (minimum) experience in manufacturing medium-voltage cable.

6.5 Material Compatibility

The extruded strand shield, EPR insulation, extruded insulation shield and jacket shall all be compatible with each other. The Cable Manufacturer shall provide the City of Austin Engineer, data showing this material compatibility.

6.6 AMENDMENT

Notice is hereby given to Cable Manufacturer and Manufacturer understands that City of Austin field personnel are not authorized to amend, revise or waive this specification or the standard terms. No "work order", "receipt" or similar Manufacturer-prepared document shall be effective to amend, revise or waive these specifications or the City of Austin's Standard Terms and conditions. In the event of any conflict between this specification and the City of Austin's Standard Terms and Conditions, the provisions of this specification shall govern.

6.7 AE item numbers impacted by this specification include, but are not limited to the following:

1696
1697
1698
1644
1649
1422
19558
1649
1650
1882

ATTACHMENT 1

TABLE 1

CABLE AND REEL SIZE

| <u>CABLE</u> | <u>MAXIMUM REEL SIZE</u> | <u>CONDUCTOR DESCRIPTION</u> | <u>LENGTH PER REEL</u> |
|----------------|--------------------------|------------------------------|--------------------------------|
| 1000 KCM/15 KV | 90.0" F X 50.25" OAW | SINGLE CONDUCTOR | 1600 TO 1800 FT. |
| 500 KCM/15 KV | 90.0" F X 50.25" OAW | SINGLE CONDUCTOR | 3600 CIRCUIT FT./3600 FT TOTAL |
| 500 KCM/15 KV | 90.0" F X 50.25" OAW | THREE CONDUCTOR | 1200 CIRCUIT FT./3600 FT TOTAL |
| 250 KCM/15 KV | 90.0" F X 50.25" OAW | THREE CONDUCTOR | 1200 CIRCUIT FT./3600 FT TOTAL |
| #2 AWG/15 KV | 90.0" F X 50.25" OAW | THREE CONDUCTOR | 1200 CIRCUIT FT./3600 FT TOTAL |
| 1/0 AWG/15 KV | 90.0" F X 50.25" OAW | THREE CONDUCTOR | 1200 CIRCUIT FT./3600 FT TOTAL |
| 500 MCM/35 KV | 90.0" F X 50.25" OAW | THREE CONDUCTOR | 1200 CIRCUIT FT./3600 FT TOTAL |
| 350 KCM/35 KV | 90.0" F X 50.25" OAW | THREE CONDUCTOR | 1200 CIRCUIT FT./3600 FT TOTAL |
| 1/0 AWG/35 KV | 90.0" F X 50.25" OAW | THREE CONDUCTOR | 1200 CIRCUIT FT./3600 FT TOTAL |

NOTE: ALL CABLE LENGTHS ARE MINIMUM
 ALL CABLE REELS MUST HAVE A 5 ¼" ARBOR
 MAXIMUM REEL SIZE: "F" REPRESENTS FLANGE SIZE; "OAW" REPRESENTS THE
 OVERALL WIDTH OF THE REEL