

1. Scope

- 1.1 This Material Standard covers the District's requirements for separable insulated loadbreak elbow connectors that are fully shielded, completely submersible, hotstick operable, and designed for energized loadmake/loadbreak on an underground power distribution system.
- 1.2 The elbow connectors will be used for terminating 15kV rated underground cables in a 60 hertz, 3-phase, 4-wire 12.47kV grounded-Y/7.2kV underground power distribution system. The elbow connectors must be suitable for subsurface and pad-mounted applications under the service conditions specified in IEEE Standard 386.
- 1.3 It shall be the responsibility of the elbow connector Manufacturer to ensure compatibility among all components of the elbow connector.
- 1.4 Upon the District's request, the Manufacturer shall provide sufficient notice to allow the District or the District's representative to inspect the manufacturing plant during elbow connector manufacture and to witness any tests, as specified herein. Opportunity for in-plant inspection shall be at the District's convenience.
- 1.5 The Special Provisions sheet will identify the cable size the elbow connectors are to be used on and the quantity of elbow connectors to be provided.

2. Material ID Numbers

This specification applies to the following District Material ID Numbers:

- | | |
|---------------|------------------------------------------------------------------------------------------------|
| 785347 | Loadbreak elbow kit for 2 AWG 7-strand compressed Al or Cu 175 mil insulated 15kV URD cable |
| 785355 | Loadbreak elbow kit for 1/0 AWG 19-strand compressed Al or Cu 175 mil insulated 15kV URD cable |

3. Reference Standard

Reference is made in this Material Standard to the following standard, the latest editions, amendments, and supplements of which shall apply, unless otherwise stated herein or in associated purchasing documents:

- | | |
|--------------------------|---------------------------------------------------------------------------------|
| IEEE Standard 386 | Separable Insulated Connector Systems for Power Distribution Systems Above 600V |
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4. Ratings and Characteristics

The elbow connectors shall have the following ratings and characteristics in accordance with IEEE Standard 386.

4.1 Voltage Ratings and Characteristics

Standard Voltage Class	15 kV
Phase-to-Ground Voltage Rating	8.3 kV rms
Phase-to-Phase Voltage Rating	14.4 kV rms
BIL and Full Wave Withstand Voltage	95 kV crest
AC 60 Hertz 1-Minute Withstand Voltage	34 kV rms
DC 15-Minute Withstand Voltage	53 kV
Minimum Partial Discharge Withstand Voltage	11 kV rms

4.2 Current Ratings and Characteristics

Continuous Current Rating	200A rms
Switching Current Rating	10 loadmake/loadbreak operations at 200A rms symmetrical at 14.4kV with 70 - 80 % lagging power factor.
Fault-Closure Current Rating	10,000A rms symmetrical at 14.4kV for 0.17 sec after 10 loadmake/loadbreak operations
Short-Time Current Rating	10,000A rms symmetrical for 0.17 sec and 3,500A rms symmetrical for 3.00 sec

5. Construction Requirements

5.1 All insulating and conducting rubber components of the elbow connector shall be molded of Ethylene Propylene Dione Monimer (EPDM) rubber. Painted or dipped shielding is not acceptable.

5.2 The compression connector component shall be a bimetallic (CopperTop) 3-inch long barrel type for #2 AWG 7-strand or 1/0 19-strand compressed aluminum and copper conductors as specified in the Special Provisions sheet. CopperTop connectors shall be color-coded with a protective end cap to denote conductor size as follows:

#2 AWG - red cap
1/0 AWG - yellow cap

5.3 The cable entrance of the molded rubber elbow component shall be sized to fit the over-insulation diameter range of #2 AWG 7-strand or 1/0 AWG 19-strand compressed aluminum and copper 175 mil 15kV insulated underground cable as specified in the Special Provisions sheet. The elbow connector/cable insulation interface shall be a watertight interference fit.

5.4 The loadbreak interface of the elbow connector shall be dimensioned to provide a watertight interference fit when installed on a mating bushing dimensioned in accordance with IEEE 386, Figure 5.

5.5 The elbow connector shall be provided with a field-replaceable tin-plated copper contact probe with an arc follower tip made of arc extinguishing material. The probe and tip shall be dimensioned in accordance with IEEE 386, Figure 6.

5.6 The elbow connector shall include a live-line-tool-compatible built-in stainless steel operating eye. The elbow connector and its operating eye shall satisfy the operating force criteria defined in IEEE 386, section 6.2.

5.7 A grounding tab shall be molded into the semi-conducting shield of the elbow connector to enable attachment of a #14 AWG copper concentric neutral wire.

5.8 The elbow connector shall be provided with a voltage test point and cap in accordance with IEEE 386, section 6.5.

5.9 The elbow shall be designed and constructed such that it can be installed onto a prepared cable end with only a moderate amount of force. No tools shall be required for installing the elbow onto the prepared cable end.

6. Kit Components

Each elbow connector kit shall contain one each of the following items packaged together in a sealed, clear plastic bag:

1. Molded rubber elbow connector body
2. Bimetallic (CopperTop) compression-type conductor connector
3. Tin-plated male contact probe
4. Contact probe installing wrench
5. Capsule of silicone grease
6. Complete instructions for installation of the elbow
7. Cable stripping template (can be included as part of the instruction sheet)
8. One of the following coldshrink sealing sleeve kits for cable jacket resealing:
 - 3M Part No. 8452
 - Elastimold Part No. 200ECS

Each coldshrink sealing sleeve kit must contain one sealing sleeve, mastic strips and installation instructions packaged together in a sealed, clear plastic bag. The sealing sleeve kit bag shall be packaged inside the elbow kit bag.

7. Interchangeability

Loadbreak elbow connectors and mating components and parts of different manufacture shall have complete interchangeability in accordance with IEEE 386, section 6.4.1.

8. Quality Control

The Manufacturer shall have and use a quality control program. Upon the District's request, the Manufacturer shall provide the District or its representative with documentation of its quality control process.

9. Testing

9.1 Production Tests

Each individual elbow connector shall be subjected to the production tests defined in IEEE 386, section 7.1.

9.2 Design Tests

Design tests shall be performed by the Manufacturer in accordance with IEEE 386, section 7.2 to demonstrate compliance of the design with IEEE 386.

9.3 Test Conditions

Tests performed as required by this Material Standard shall be conducted under the test conditions specified in IEEE 386, section 7.3.

9.4 Test Reports

At the District's request, the successful Bidder shall submit one copy of certified reports of all tests required by this Material Standard to the following address:

Snohomish County Public Utility District No. 1
Attn. Engineering Standards
P.O. Box 1107
Everett, WA 98206-1107

10. Identification

10.1 The following information shall be permanently and legibly marked on the elbow connector. The District prefers that this information be molded into the body of the elbow connector.

1. (1) Manufacturer's identification
 1. Company name or logo
 2. Part identification (part number)
 3. Date of manufacture
2. (2) Continuous current rating (200A)
3. (3) Maximum voltage rating (8.3/14.4kV)
4. (4) Cable insulation diameter range

10.2 To identify the elbow as having both a phase-to-ground and phase-to-phase voltage rating, the elbow connector shall be identified with a removable white band centered on a black stripe in accordance with IEEE 386, section 6.1 e) 2).

10.3 The following information shall be included on the label of the bag in which the elbow connector kit is packaged:

1. Manufacturer's identification
 1. Company name or logo
 2. Part identification (part number)
 3. Date packaged
2. Continuous current rating (200A)
3. Maximum voltage rating (8.3/14.4kV) or class (15kV)
4. Cable insulation diameter range

11. Packaging

11.1 The components of each elbow kit, as delineated in Section 6. of this Material Standard, shall be packaged together in one sealed, clear plastic bag. The elbow connector itself and the coldshrink sealing sleeve kit, may each be packaged in their own separate sealed plastic bag within the single kit bag.

11.2 Kits must be packaged together in bulk quantities as specified in the District's loadbreak elbow purchasing descriptions, which will be provided separately from this document.

11.3 Each elbow kit bag shall be labeled as stipulated in Section 10. of this Material Standard.

12. Inspection

The District reserves the right to inspect all elbow connector kits.

13. Rejection

Elbow connector kits not meeting the requirements of this Material Standard, or damaged in shipment, will be rejected and returned for replacement at the Supplier's expense.

14. Delivery

Unless otherwise directed in the Special Provisions sheet, loadbreak elbow connector kits shall be delivered to the District's Operations Center warehouse at:

1802 75th Street SW
Everett, WA 98203-6264

15. Evaluation of Bids

1. Base price and escalations
2. Delivery schedules
3. Past experience with Bidder and product
4. Conditions of warranty
5. Quality of workmanship
6. Adherence to this Material Standard
7. Ease of elbow installation on cable end

16. General Bidding Conditions

The attached General Bidding Conditions are made a part of this Material Standard.