



**conEdison**

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**DISTRIBUTION ENGINEERING DEPARTMENT  
OVERHEAD STANDARDS AND PLANNING**

**EO-6229  
REVISION 8**

**INSTALLATION REQUIREMENTS FOR  
PADMOUNT TRANSFORMERS**

|                         |  |
|-------------------------|--|
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| <b>TARGET AUDIENCE:</b> | <b>REGIONAL ENGINEERING; REGIONAL CONSTRUCTION;<br/>ENERGY SERVICES; EH&amp;S</b>                      |
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## 1.0 PURPOSE

This specification provides installation requirements for single-phase and three-phase pad-mounted transformers for the Underground Residential Distribution (URD) system.

## 2.0 APPLICATION

This specification is applicable to all URD operating regions.

## 3.0 GENERAL

- 3.1 This specification serves as a companion to drawings [EO-16348-A](#) (for single-phase pad-mounted transformers), and [EO-13827-B](#) (for three-phase pad-mounted transformers).
- 3.2 Pad-mounted transformers have primary voltage ratings of 4kV, 13kV, 27kV, or 13/4kV dual-rated. The secondary voltage ratings are either 120V/208V or 277V/480V.
- 3.3 Three-phase pad-mounted transformers in the URD system are either Delta-Wye or Wye-Wye grounded configurations. Refer to Purchase and Test specification [EO-5015](#) for more details and features on three-phase pad-mounted transformers.
- 3.4 Refer to Purchase and Test specification [EO-5114](#) for details and features of single-phase pad-mounted transformers.
- 3.5 Refer to [EO-4999](#) for a list of pad-mounted transformers available for purchase, detailing equipment stock numbers, transformer kVA capacity, voltage ratings, tap changers, internal fusing, and switches.
- 3.6 Single and three-phase metal-enclosed pad-mounted transformers are typically dead-front designs. Live front designs are no longer being purchased, and no longer being installed in the system. Defective live front transformers should be replaced with current Company-approved dead-front transformers.

## 4.0 TRANSFORMER INSTALLATION REQUIREMENTS

### 4.1 GENERAL REQUIREMENTS

- 4.1.1 URD transformers can be installed in a loop or radial design. [EO-2083](#) provides definitions and requirements of radial and loop URD designs.
- 4.1.2 Pad-mounted transformer having a primary full load current less than or equal to 200 Amp are equipped with 200 Amp 35kV rated bushing wells and transformer voltage class specific loadbreak feedthrough inserts to enable radial or loop application. Refer to [EO-100501](#) for a list of approved feedthrough inserts and other transformer cable accessories and terminations. Refer to [EO-16248-B](#) for feedthrough insert installation instructions.
- 4.1.3 Three phase pad-mounted transformers that exceeds 200 Amp primary full load current are equipped with integral 600 Amp deadbreak primary bushings.
- 4.1.4 For 13kV feeder installation of 13/4kV dual voltage transformers equipped integral 600 Amp deadbreak primary bushings, 600 Amp to 200 Amp 15kV rated reducing tap plugs (C/S 571-9067) can be stacked onto the T-body elbow connectors (hammerheads) to create a second interface (200 Amp loadbreak) to allow for installation of 200 Amp loadbreak elbow connectors to pick up the next transformer in a loop or radial configuration.

**Note 1:** The 600 Amp to 200 Amp reducing tap plugs must be torqued to 50-60 Ft-Lbs. using the Elastimold torque tool **600-ATM C/S 057-2367**.

**Note 2:** The 600 Amp to 200 Amp 15kV rated tap plug reducer shall not be used for 4kV straight voltage transformer or the 4kV setting on a 13/4kV dual voltage transformer that exceeds 200 Amp primary full load current.

- 4.1.5** During the planning and preparation stage before field installation, final confirmation should ensure that the designated transformer's class code matches the class code noted on the layout. Refer to [EO-5015](#) the transformer's Purchase and Test specification for a list of class codes.
- 4.1.6** Prior to transportation and field installation, the transformer should be inspected according to the steps outlined in [EO-3115](#). This inspection includes a visual inspection. Transformers that do not meet acceptable visual standards, or do not pass electrical tests in accordance with [EO-3115](#) shall not be installed. Transformers found to be defective shall be tagged with a completely filled-out field return tag and follow the return process outlined in [EO-10301](#).
- 4.1.7** All transformer accessories (bushing inserts, load break, and non-load break elbows, elbow surge arrestors, grounding elbows, and live end caps) shall be rated appropriately for the intended feeder. The appropriate rating should be noted on the layout.
- 4.1.8** Before transformer energization, a final inspection should confirm that all tap settings, grounding, and protection equipment are installed as noted in the layout and according to [EO-2083](#) requirements.
- 4.1.9** Before energization of the transformer, remove the shipping lock from the Internal Fault Detector (IFD) by following the removal instructions noted on the IFD label.
- 4.1.10** Whenever possible, the front of transformer shall be positioned to face the street to enable visibility of the transformer's badging (vault designation and feeder number) and fault indicator light from the roadway.
- 4.1.11** Establish the transformer as a known point by running a tracing current (TC) continuity test according to [EO-4039](#), and attaching feeder and phase identification to elbow terminals as described in [EO-13827-B](#) for three-phase pad-mounted transformer and [EO-16348-B](#) for single phase pad-mounted transformer.

## 4.2 GROUNDING

4.2.1 All pad-mounted transformers shall be connected to ground rods in accordance with [EO-12181-B](#).

4.2.2 If the transformer's ground pads and/or studded bosses are not equipped with ground clamps, procure ground clamps (**C/S 571-0959**), and install the ground pads and studded bosses as needed. The ground clamps are used for connecting the ground rod's grounding cable, primary cables' concentric neutral, and elbow surge arrestors' ground lead.

## 4.3 PRIMARY FUSING

4.3.1 For 13/4kV dual-voltage transformers, an inspection shall be performed to confirm that the 8.3kV Bay-O-Net fuses are the correct ampacity rating for designated feeder voltage (13kV or 4kV) installation.

4.3.2 The Bay-O-Net fuse inspection is carried out by removing the Bay-O-Net fuses from its holder and checking that the part number marked on body of the Bay-O-Net fuse links corresponds to correct voltage and kVA application as specified in the Bay-O-Net fuses tables in [EO-100018](#).

4.3.3 Refer to [EO-100018](#) for list of all Bay-O-Net fuse part numbers and class & stock numbers.

4.3.4 Typically, 13/4kV dual-voltage transformers are shipped from the manufacturer with 8.3kV Bay-O-Net fuses, with ampacity for transformer operation at 13kV (7.6kV Phase Voltage). If the transformer is designated for a 4kV (2.4kV Phase Voltage) installation, the 8.3kV Bay-O-Net fuses shall be replaced with fuses which has ampacity rating for 4kV (2.4kV Phase Voltage) operation.

## 4.4 SECONDARY LIMITERS

4.4.1 Transformers equipped with field replaceable primary fuses, e.g., Bay-O-Net fuses, do not require limiters on the transformer's secondary spades. **Note:** If customer request limiters to be installed, the customer is responsible for installing a customer owned manhole with secondary limited crabs.

**4.4.2** Transformers NOT equipped with field replaceable primary fuses, e.g., Bay-O-Net fuses, the company will F&D limiter lugs up to the maximum secondary cable sets specified in section [4.8.6.1](#). The customer is responsible for installing a customer-owned manhole with secondary limited crabs if the required number of secondary cable sets exceeds the maximum allowed by section [4.8.6.1](#).

**4.4.3** When three or more sets of secondary cables are supplied and connected by Con Edison to the customer's service entrance disconnect, Con Edison will supply and install limiter lugs on each phase cable on the line side of the service entrance disconnect.

**4.4.4** When three or more sets of service cables are connected by the customer from the limited crab within the property line box to the customer service entrance disconnect, it is recommended that the customer install limiter lugs on the line side of the service entrance disconnect.

**4.4.5** Limiter shall not be installed on the secondary neutral spade.

**4.4.6** Class & Stock numbers for Lug to Cable and Cable to Cable Limiter are listed in the *Secondary Cable* section of [EO-2083](#).

#### **4.5 DE-ENERGIZED PRIMARY TAP CHANGER**

**4.5.1** The transformer's primary fixed tap changer setting shall match the setting noted on the layout. **Note:** Transformer must be de-energized for tap changer operation.

**4.5.2** Transformer are shipped with Tap changer set on the nominal primary voltage setting denoted by letter "C" or number "3" marking on the Tap Changer handle.

#### **4.6 TRANSFORMER STENCILS, LABELS, & IDENTIFICATION BADGE**

**4.6.1** Final visual inspection should confirm that all stencils on the transformer match details on the layout. Stencils include transformer class code, transformer's secondary rating (120/208 or 277/480) transformer's line-item number, etc.

**4.6.2** Verify that "CAUTION" "NOTICE", "WARNING", and "DANGER" transformer hazard labels are designed according to [EO-3101](#) and adhered to the low voltage compartment door according to [EO-3116](#).

**4.6.3** If any of the hazard labels are missing, damaged, or incorrect design, procure new label(s) using the class & stock number specified in [EO-3116](#) and adhere new label(s) to the transformer.

**4.6.4** Transformer shall be badge with assigned vault identification and feeder number as specified in [EO-6228](#).

**4.6.5** Primary incoming (101) and outgoing (102) cables shall be tagged with phase designation as specified in [EO-6228](#).

#### **4.7 PRIMARY CABLES**

**4.7.1** For primary cable type and size, refer to *Primary Cables and Terminals* section of [EO-2083](#).

**4.7.2** Fault indicator shall be installed on the primary cables according to instructions specified on Drawing No. [335556](#). For loop feed, fault indicator only required on the incoming feed (“101” primary legs). **Note:** Fault Indicators shall not be installed over the concentric neutral or the elbow’s capacitive test point.

**4.7.3** 200 Amp load break elbows terminals shall be prepared according to Drawing No. [325613](#).

**4.7.4** 600 Amp dead break bolted connection elbows (aka Hammerheads/ESNA) shall be prepared according to [EO-11024](#).

**4.7.5** Attach the primary cables concentric neutral to the ground clamps of the transformer and one strand of the neutral to grounding eye of the elbow terminals to allow discharge of static charge.

#### **4.8 SECONDARY CABLES**

**4.8.1** For secondary cable type and size, refer to *Secondary Cables* section of [EO-2083](#).

**4.8.2** Copper conductors shall be the standard for all secondary cables.

**4.8.3** Refer to [EO-6039](#) for secondary cable ampacity ratings.

**4.8.4** Connect the secondary cables to the transformer's secondary spades using appropriately sized NEMA-Type compression lugs. Refer to [EO-14929-C](#) for NEMA-Type compression lugs. **Note:** If using lug to cable limiter, the lug on the limiter is the connection to the transformer's secondary spade.

**4.8.5** Secondary cables can be extended using connectors specified in [EO-5403](#).

**4.8.6 THREE-PHASE PAD-MOUNTED TRANSFORMER SECONDARY**

**4.8.6.1** Depending upon field conditions and load requirements, the following maximum number of sets of 500kcmil copper or 750kcmil copper secondary cables shall apply:

| <b>Transformer kVA Size</b> | <b>Secondary Voltage</b> | <b>No. of Sets 500kcmil</b> | <b>No. of sets 750kcmil</b> |
|-----------------------------|--------------------------|-----------------------------|-----------------------------|
| 150                         | 208/120                  | 1                           | None                        |
| 300                         | 208/120                  | 2                           | None                        |
| 500                         | 208/120                  | 4                           | 3                           |
|                             | 480/277                  | 2                           | None                        |
| 750                         | 208/120                  | 6                           | 5                           |
|                             | 480/277                  | 3                           | 2                           |
| 1000                        | 208/120                  | 12                          | 10                          |
|                             | 480/277                  | 4                           | 3                           |
| 1500                        | 480/277                  | 6                           | 6                           |
| 2000                        | 480/277                  | 10                          | 8                           |
| 2500                        | 480/277                  | 10                          | 8                           |

**4.8.7 SINGLE-PHASE PAD-MOUNTED SECONDARY**

**4.8.7.1** One to Six Services – The size of the secondary cables shall depend upon the transformer size used. A maximum of six (6) sets of service lateral cables and two (2) street lighting cables can be used whenever a secondary splice box is not required. Refer to [EO-2083](#) for more information on single phase transformer connected services.

**4.8.7.2** Seven or More Services – When seven or more service lateral cables are required, the following secondary cable main sizes and sets can be applied when connecting from the

transformer to a secondary splice box adjacent to the transformer:

| Transformer Size (KVA) | Cable Size               |
|------------------------|--------------------------|
| 25                     | One 2/0 Cu per leg       |
| 50                     | One 4/0 Cu per leg       |
| 100                    | One 500 kcmil Cu per leg |
| 167                    | Two 500 kcmil Cu per leg |

#### 4.9 SERVICES

4.9.1 For requirements on service conductor size, service conduits, and splice boxes refer to Services section of [EO-2083](#).

4.9.2 For approved service cables and service connections refer to [EO-5403](#).

#### 4.10 SURGE ARRESTER

4.10.1 Elbow surge arrestors shall be installed on open points on loop configurations, end-of-line pad-mounted transformers in a radial configuration, and radial stand-alone transformers.

4.10.2 Transformers equipped with integral 600 Amp dead break primary bushings will require an Elbow Tap Plugs (600 Amp to 200 Amp reducing tap plugs) C/S 571-9067 stacked onto the T-body (hammerhead) elbow connectors to allow for installation of 200 Amp load break interface elbow surge arresters.

**Note:** The 600 Amp to 200 Amp reducing tap plugs must be torqued to 50-60 Ft-Lbs. using the Elastimold torque tool **600-ATM C/S 057-2367**.

4.10.3 Refer to [EO-100501](#) for Class & Stock numbers for 4kV, 13kV, 27kV pad-mounted transformer's cable terminals (elbows) and surge arrestors.

4.10.4 Refer to [EO-16898-B](#) for elbow arrestor installation instructions.

## 5.0 STRUCTURAL / CONSTRUCTION REQUIREMENTS

- 5.1 All cable shall be installed in ducts in accordance with [EO-6224](#). For conduit sealing requirements, refer to [EO-1100](#) and [EO-6217-C](#).
- 5.2 To avoid inductive heating of metal conduit, secondary phase cables (ΦA, ΦB, ΦC) and grounded-neutral cable shall be grouped together in a metal conduit, i.e., ΦA, ΦB, ΦC, & Neutral cables in the same metal conduit.
- 5.3 Three-phase pad-mounted transformers are typically installed on pre-cast or field-constructed concrete pads, refer to [EO-13775-B](#) for pad sizes.
- 5.4 For three phase pad-mounted transformer, conduit and pad installation shall be according to [EO-12482-B](#).
- 5.5 Single-phase pad-mounted ed transformers are typically installed on a fiberglass pad, refer to [Drawing 326199](#) for fiberglass pad size.
- 5.6 For single phase pad-mounted transformer, the box pad, and cables installation, refer to [EO-15351-B](#).
- 5.7 Pad construction for oil-filled transformers shall meet all clearance requirements in accordance with [EO-6242](#).
- 5.8 Pad-mounted construction is preferred over subsurface transformers. For subsurface transformer installations, installations on driveways and sidewalks shall be avoided. Subsurface transformers installed in driveways shall be installed with Company-approved grating covers and frames. Refer to [EO-12836-A](#) for subsurface transformer installation procedure.

## 6.0 REFERENCES

The following drawings and standards have been referenced within this specification.

| Number                     | Title  |
|----------------------------|--|
| <a href="#">EO-100018</a>  | Purchase Recommendation for Fuse Links, Current Limiting and Power Fuses Used on the 4kV, 15kV, and 27kV Non-Network Distribution System |
| <a href="#">EO-100501</a>  | Purchase Recommendation for 200 Amp & 600 Amp Cable Accessories & Terminations for Electric Distribution Systems                         |
| <a href="#">EO-12181-B</a> | Grounding for Padmounted Transformers and Switches   |
| <a href="#">EO-2083</a>    | Underground Residential Distribution (URD) System Design Procedure   |
| <a href="#">EO-3115</a>    | Pre-Installation Inspection and Testing of Radial Distribution Transformers  |
| <a href="#">EO-10301</a>   | Distribution Equipment Field Return Process  |
| <a href="#">EO-5015</a>    | Technical Specification for Three-Phase, Oil Filled, Metal   |

|                            |  |
|----------------------------|--|
|                            | Enclosed, Pad-Mounted Distribution Transformers  |
| <a href="#">EO-5114</a>    | Technical Specification for Single-Phase, Oil-Filled, Metal Enclosed, Pad-Mounted Distribution Transformers                                      |
| <a href="#">EO-6224</a>    | Trenching Requirements for Conduit and Equipment Structure for URD Electric System   |
| <a href="#">EO-6242</a>    | Clearance Requirements for Oil-Filled Padmount Transformer Near Building Doorways and/or Windowed Walls  |
| <a href="#">EO-100635</a>  | Purchase Recommendation For Box Pad Foundations For Single Phase   |
| <a href="#">326199</a>     | HL-45 Fiberglass Box Pad for Single-Phase Transformers   |
| <a href="#">EO-12482-B</a> | Conduit and Pad Installation for Three-Phase Padmounted URD Equipment  |
| <a href="#">EO-12836-A</a> | Installation of Residential Subsurface Transformer and Secondary Connectors  |
| <a href="#">EO-13775-B</a> | Concrete Pad for Three-Phase Padmounted Transformers   |
| <a href="#">EO-13827-B</a> | Installation Procedure for 4kV,13kV, and 27kV Loop or Radial Dead Front Padmounted Transformers  |
| <a href="#">EO-15351-B</a> | Installation of Box Pad, Splice Box and Cables for Single Phase Padmounted Transformer (URD)   |
| <a href="#">EO-16248-B</a> | Installation of Loadbreak Feed-Thru Bushing Insert   |
| <a href="#">EO-16348-A</a> | Typical URD System Installation of Single-Phase 2.4kV and 7.6kV and Dual Ratio 2.4kV/7.6kV, Single- Phase Padmounted Transformers                |
| <a href="#">EO-16898-B</a> | Installation of Plug-in Type Elbow Arrester on 2.4kV and 7.6kV Padmounted URD Transformer on Loop & Radial Systems                               |
| <a href="#">EO-4039</a>    | Padmount Transformer (URD) Use Of Certification, Registered, Defective Equipment, Cable Information And Blue Tags                                |
| <a href="#">EO-3101</a>    | Purchase Requirements for Equipment Safety Labels and Warning Tags   |
| <a href="#">EO-3116</a>    | Purchase Recommendations and Placement of Equipment Safety Labels and Warning Tags   |
| <a href="#">EO-6228</a>    | Identification And Badging of Urd Equipment (Subsurface and Padmount Equipment)  |
| <a href="#">EO-5403</a>    | Underground Copper and Aluminum Service Connections  |
| <a href="#">EO-6039</a>    | Standard Ampacity Ratings For 600 Volt A.C. Underground Service Cables in Ducts, And Service Take-Offs from Multi-Bank Transformer Installations |
| <a href="#">EO-11024</a>   | Richards Cold Shrink 600 Amp Elbows (AKA Hammerheads/ESNAS) Rated 5-27 kV  |
| <a href="#">EO-1100</a>    | Sealing Of Service Ducts, Entrances, And Bus Openings in Electrical Distribution Structures  |
| <a href="#">EO-15351-B</a> | Installation of Box Pad, Splice Box, and Cables for Single Phase padmount Transformers (URD)   |
| <a href="#">EO-6217-C</a>  | Method of Sealing Phase Grouped Cables and conduits for Services, MHs, and Vaults  |
| <a href="#">335556</a>     | Installation of Time-Current Automatic Reset-Fault Indicators for 4kV and 13kV URD system  |

|                            |   |
|----------------------------|---|
| <a href="#">325613</a>     | Assembly and Installation of Elbow terminals for 4kV, 13kV, and 27kV Dead Front Pad Mount Transformer               |
| <a href="#">EO-14929-C</a> | NEMA-Type Compression Lugs, Copper & Aluminum   |
| <a href="#">EO-16898-B</a> | Installation of Plug-In Type Elbow Arrester on 2.4kV & 7.6kV Pad Mounted U.R.D Transformer on Loop & Radial Systems |
| <a href="#">EO-4999</a>    | Non-Network Transformer Catalog   |

## 7.0 REVISION SUMMARY

### **REVISION 8:**

1. Re-arranged, renamed, and added sections for clarity and logical flow. Changes are shaded in grey.
2. Under 3.0 General section:
  - Added reference to EO-4999 Non-Network Transformer Catalog.
3. Under 4.1 General Requirements section:
  - Clarified the application of 200 Amp bushing well and 600 Amp dead break bushings.
  - Updated the return process for defective transformers.
  - Added instruction to remove IFD shipping lock prior to transformer energization.
  - Added preference for the front of the transformer to face the roadway.
  - Added establishing of the transformer as a known point by performing tracing current test.
4. Under 4.2 Grounding section:
  - Added installation of the ground clamps as required.
5. Under 4.3 Primary Fusing section
  - Clarified Bay-O-Net fuse rating inspection for dual voltage transformers.
  - Added reference to EO-100018 for Bay-O-Net fuse part numbers.
6. Under 4.4 Secondary Limiters section:
  - Added limiter class & stock.
  - Added requirement for secondary limiter for transformers without primary fusing.
  - Added no limiter required for neutral secondary spade.
  - Added requirement for limiter installation on the line side of the customer service entrance disconnect when three or more sets of secondary cables are supplied and connected by ConED.
  - Added recommendation for limiter installation on the line side of the customer service entrance disconnect when three or more sets of service cables are supplied and connected by customer from the property line box.
7. Under 4.5 De-energized Primary Tap changer section:
  - Added safety note to de-energize transformer prior to tap changer operation.
8. Under 4.6 Transformer Stencils, Labels, & Identification badge section:
  - Added requirement for the hazard labels.
  - Added requirement for vault and feeder identification badges.
9. Under 4.7 Primary cable section:

- Added cable type and size requirement.
  - Added requirement for fault indicator on primary elbow connectors.
  - Added preparation specifications for 200 Amp load break elbow connector and 600. Amp dead break elbow connector.
  - Added installation of the concentric neutral to ground clamp.
10. Under 4.8 Secondary Cables section:
- Added cable type and size requirement.
  - Added specification EO-6039 for secondary cable ampacity rating.
  - Added specification EO-14929-C for NEMA-type secondary cable lug and connectors.
  - Added table for the maximum number of sets of 500kcmil & 750kcmil copper secondary cables per kVA size and secondary voltage for three phase pad-mounted transformers.
  - Added table for default number of secondary cable sets for single-phase pad-mounted transformers.
11. Added 4.9 Services section.
12. Added 4.10 Surge Arrester section.
13. Under 5.0 Structural/Construction requirements
- Added phased grouped requirement for secondary cables in metal conduits.
  - Added specifications for conduits sealing.
  - Added specifications for the installation of box pad and cables for single phase transformers.
14. Added several reference specifications.