

<p>Issued 04-Apr-01</p> <p>Revised 16-Oct.-07</p>	<p>MATERIAL STANDARD ELECTRIC OPERATIONS ORGANIZATION</p> 	<p>M3904</p> <p>Revision #2 Page 1 of 8</p>
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M3904

\*\*\*\*Supersedes BECo Standard E2.12-2.14 and ComElectric Spec 7-0895\*\*\*\*

**THREE-PHASE DEADFRONT PAD-MOUNTED  
DISTRIBUTION TRANSFORMERS, LOOP & RADIAL FEED DESIGNS**

**1.0 General Requirements**

- 1.1 These specifications cover three-phase deadfront pad-mounted transformers, loop and radial feed designs, that shall be mineral oil filled, Class OA, 60 Hertz, 65°C average winding temperature rise.
  - 1.2 Transformers furnished under these specifications shall conform to the applicable portions of the latest version of IEEE/ANSI Standard C57.12.34, except where otherwise specified herein.
  - 1.3 Sound levels for transformers shall meet NEMA TR1, latest revision.
  - 1.4 No changes shall be made in any way that would affect agreement with these specifications after transformer designs have been approved by NSTAR Electric (the Company). No transformer shall be furnished or accepted unless the details of such proposed changes have first been submitted in writing and approved by the Company. Failure to comply with these terms may result in complete or partial removal from the approved supplier list.
  - 1.5 Any exceptions to these specifications shall be clearly indicated with price quotations. Approval drawings shall be submitted upon request.
  - 1.6 Unless otherwise specified on purchase order, transformer warranty must be for a minimum period of one year from date of installation or 18 months from the date of receipt, whichever occurs first. Written warranty policy must be on file with NSTAR Electric's Purchasing Department.
  - 1.7 All units shall have the following additional information on their nameplate: year of manufacture, total weight with oil and volume of oil (in gallons).
  - 1.8 All units shall meet the efficiencies in Table 2 of NEMA Publication TP-1, latest revision or DOE's final ruling of 10/12/07 as called for on the purchase order.
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1.9 NSTAR North and NSTAR South may be distinguished by primary voltage. The primary voltage for NSTAR North units is either 13800GY/7970 or 13800GY/7970 x 4160GY/2400. All other voltages are NSTAR South units.

## 2.0 Construction

- 2.1 For NSTAR North units, high voltage winding shall be delta.
- 2.2 The number, location and arrangement of the high voltage connectors and low voltage terminals shall be ANSI specific as shown in Figs 5-8. Low voltage terminals shall have staggered arrangement, with dimensions per Fig. 8(a).
- 2.3 For units sized 500 kVA and smaller, the impedance range shall be from 3.0 to 4.75%, including manufacturing tolerances.
- 2.4 High Voltage Bushings:
- A. High voltage connectors shall be externally clamped bushing wells with replaceable stud.
  - B. NSTAR North – 15 kV class bushing well inserts shall be installed and properly torqued into each bushing well.  
NSTAR South – Units with a primary voltage of 13200GY/7620, either straight or dual voltage, shall be provided with 15 kV class bushing well inserts, installed and properly torqued.
  - C. Inserts shall have grounding tabs bonded to tank ground connector using #14 AWG solid copper wire.
  - D. All NSTAR North units shall be arranged for loop feed. All NSTAR South units shall be either loop or radial feed arrangement as detailed in the ordering specifications on the purchase order.
  - E. For NSTAR South units: All HV bushings, regardless of primary voltage, shall be spaced for 15.2 kV.
- 2.5 Low Voltage Bushings:
- A. Low voltage neutral terminal to be a fully insulated terminal.
  - B. Low voltage line and neutral bushings must be furnished with “J” type, tinned copper spade terminals. Spades for units 150 kVA and below shall be 6-hole and for units 300 kVA and above shall be 10-hole.
  - C. Low voltage terminal supports for static loads shall be supplied for all kVA sizes.
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2.6 Wye-Wye connected units shall have the high-low neutral connection externally accessible/separable through a handhole (consistent with ANSI C57.12.34 sect 9.7.3.4).

2.7 Compartment sizes for NSTAR North units:

- A. HV compartment on units 500 kVA and below shall have a maximum width of 38”.
- B. HV/LV barrier shall terminate 18” from the bottom.

2.8 Coastal Zone Design transformers shall have tanks, sills, hinges, clamps and all other hardware fabricated of Type 304L stainless steel.

2.9 The paint color shall be Green (Munsell Notation 7GY3.29/1.5). Final finish shall exceed the requirements of ANSI C57.12.28 with a minimum dry film thickness of 4 mils on all surfaces and seams. All compartment and transformer surfaces in contact with the pad shall be treated to minimize corrosion and abrasion damage.

### 3.0 Accessories

3.1 All transformers with a 125 kV BIL primary winding (25 kV system) will have a 200A, under-oil loadbreak switch. The switch will be rotary type, hot-stick operable, and located in the primary compartment. A metallic nameplate shall identify each position. Radial transformers will have a two-position switch. Loop feed transformers will have two two-position switches for uninterrupted load transfer capabilities.

3.2 Tap changer: For NSTAR North, all units shall have an externally operated tap changer. Tap positions shall be 14400/14100/13800/13500/13200. Dual voltage units shall have taps only at the higher voltage. For NSTAR South, taps, if required, will be detailed in the ordering specifications on the purchase order.

3.3 All units will have an automatic pressure relief device with a minimum flow rate of 50 SCFM at 15-psi.

3.4 All units shall have a heavy-duty brass gate-type oil drain valve. An oil-sampling device shall be included in place of the drain plug.

3.5 Single voltage unit fusing: See following tables.

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**3.0 Accessories, cont'd**

- A. All NSTAR North units shall have a Bay-O-Net fuse in series with a partial range current limiting fuse (PRCLF).
- B. All NSTAR South units shall have a Bay-O-Net fuse in series with a PRCLF, unless otherwise specified. When PRCLF's are not used, an isolation link will be used in series with the Bay-O-Net.

**3.6 Dual voltage unit fusing: See following tables.**

- A. All NSTAR North units shall have a Bay-O-Net fuse in series with a partial range current limiting fuse. The units shall be shipped fused at the higher voltage. For coordination purposes, table shows Bay-O-Net fuse that will be used at lower voltage.
- B. All NSTAR South units shall be protected with a Bay-O-Net fuse in series with a PRCLF at the higher voltage and an isolation link at the lower voltage. Units shall not be shipped with fuse cartridge installed in the Bay-O-Net. Units shall be shipped with the fuse cartridges (not just the fuse links) for both voltage levels, secured in the primary compartment.

<b>22,860 GrdY/ 13,200 or 24,940 GrdY/14,400 Volts</b>	
<b>Size (kVA)</b>	<b>BAY-O-NET LINK</b>
75	3A (Cooper 358C03)
112.5	6A (Cooper 108C04)
150	8A (Cooper 358C05)
225	12A (Cooper 108C06)
300	15A (Cooper 108C07)
500	25A (Cooper 108C09)
750	40A (Cooper108C11)
1000	50A (Cooper 108C12)
1500	65A (Cooper 353C14)
2000	100A (Cooper 353C14)
2500	140A Cooper 353C17)

Table 1 – Bayonet Fusing NSTAR South (25 kV)

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**3.0 Accessories, cont'd**

<b>13,200 GrdY/ 7,620 Volts</b>	
<b>Size (kVA)</b>	<b>BAY-O-NET LINK</b>
75	8A (Cooper 358C05)
112.5	12A (Cooper 108C06)
150	15A (Cooper 108C07)
225	25A (Cooper 108C09)
300	25A (Cooper 108C09)
500	50A (Cooper 108C12)
750	65A (Cooper 353C14)
1000	65A (Cooper 353C14)
1500	100A (Cooper 353C14)
2000	140A (Cooper 353C17)
2500	125A (Cooper 4038361C05CB)

Table 2 – Bayonet Fusing NSTAR South (15 kV)

<b>3740GrdY/2160 or 4,160GrdY/2400 or 2,400 x 4,800 Volts (NSTAR South only)</b>	
<b>Size (kVA)</b>	<b>BAY-O-NET LINK</b>
75	25A (Cooper 108C09)
150	50A (Cooper 108C12)
300	65A (Cooper 353C14)
500	140A (Cooper 358C18CB)
750	140A (Cooper 358C18CB)

Table 3 – Bayonet Fusing NSTAR South (5 kV & Below)

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<b>8,320GrdY/4800 Volts (NSTAR South only)</b>	
<b>Size (kVA)</b>	<b>BAY-O-NET LINK</b>
75	12A (Cooper 108C06)
150	25A (Cooper 108C09)
300	50A (Cooper 108C12)
500	65A (Cooper 353C14)
750	140A (Cooper 358C18CB)

Table 4 – Bayonet Fusing NSTAR South (8.3 kV)

<b>13,800 GrdY/7,970 Volts or 4160 GrdY/2400X13,800 GrdY/7,970 Volts</b>		
<b>Size (kVA)</b>	<b>Phase-Grd Voltage</b>	<b>BAY-O-NET LINK</b>
75	<b>7970</b>	6A (Cooper 108C04)
112.5		12A (Cooper 108C06)
150		15A (Cooper 108C07)
300		25A (Cooper 108C09)
500		50A (Cooper 108C12)
750/1000		65A (Cooper 353C14)
1500		100A (Cooper 353C16)
2000		140A (Cooper 353C17)
2500		125A (Cooper 4038361C05CB)
112.5	<b>2400</b>	40A (Cooper 108C11)
150		50A (Cooper 108C12)
300		65A (Cooper 353C14)

Table 5 – Bayonet Fusing for NSTAR North

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3.7 Primary connected under oil, heavy duty MOV surge arresters meeting ANSI/IEEE C62.11, shall be provided on all single voltage units. Dual voltage units needing under oil arresters will have the requirement detailed in the ordering specifications on the purchase order.

Primary Voltage (Ph-Gnd kV)	Arrester Class (kV)
4.8	6
7.62	10
7.97	12
13.2 and 14.4	18

Table 6 – Under Oil Arrester Ratings

3.8 A means of containing the oil when bayonet fuses are operated shall be provided. This may be in form of a drip pan or drip cups.

3.9 All transformers 500 kVA and larger shall be equipped with oil level and oil temperature (with resettable maximum temperature indication) gauges.

3.10 All units must be supplied with two (2) company approved tank-grounding lugs that will accommodate a 4/0 AWG copper conductor.

#### 4.0 Labeling/Marking/Drawings

4.1 A PCB information statement will be placed either on the transformer's nameplate or on a separate distinct and equally durable label adjacent to the nameplate stating its PCB concentration as less than 2 PPM at the time of manufacture. In addition, a separate company approved, no-PCB label shall be affixed to the outside of the transformer. The label shall read "No-PCB Less than 2PPM" in bold-type white lettering on a green background.

4.2 A permanent bar code label meeting the latest revision of ANSI C57.12.35 shall be provided.

4.3 Each transformer shall be stenciled with numbers that identify the "KVA-CODE" of the transformer. This is in lieu of the "KVA" only stencil. The KVA-code shall be designated on the purchase order. Flat black, fade resistant

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paint shall be used. The lettering shall be approximately 2.5" high and will be located 3" from the top hinge, towards the handle, centered.

Stenciling Examples: 75-308, 150-338

- 4.4 The manufacturer shall install an external warning label (Electromark # BOS044-W-PT-A72) and two, internal danger labels (Electromark # BOS045-W-PT-112) Outer label shall be located on the door, adjacent to the handle. Inner labels shall be located on the back wall of the low voltage compartment and the front barrier or back wall of the high voltage compartment near the elbow terminations.
- 4.5 Two approved warning decals advising field personnel to vent transformer prior to operating bayonet fuses shall be installed and located on each unit as follows:
  - A. Under the bayonet fuse location and above the drip shield.
  - B. Adjacent to the pressure relief device.
- 4.6 Each transformer shall be marked with the cat id using durable, weather proof, UV resistant labels or painted stencils. The lettering shall consist of 1 inch high bold black characters. Cat id shall be located above the No PCB label.
- 4.7 All units 500 kVA and larger shall be shipped with one complete set of drawings and instruction manuals stored in the secondary compartment in a waterproof envelope.

## 5.0 Delivery

- 5.1 Unless otherwise specified on purchase order, all deliveries shall be made in an open top truck. All transformers shall be shipped secured to a wooden pallet unless their size prohibits it. The stacking of transformers may be cause for rejecting an entire shipment.
- 5.2 NSTAR South areas only require a 24-hour notification to the stockroom supervisor prior to delivery.
- 5.3 Transformers are subject to inspection by the Company upon delivery.

Approved by:           Amin Jessa            
Director, Distribution Engineering

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