



**CITY OF LOMPOC**  
**UTILITIES DEPARTMENT**  
**ELECTRICAL DIVISION**  
**SPECIFICATION NO. ELE-102**

**PADMOUNTED TRANSFORMERS 12kV**  
**AND DUAL VOLTAGE RADIAL FEED**

**MAY 2010**

## SPECIFICATION NO. ELE-102

### SPECIFICATIONS PADMOUNTED TRANSFORMERS 12kV AND DUAL VOLTAGE RADIAL FEED

#### DIVISION 1 – GENERAL REQUIREMENTS

##### 1-1 GENERAL

Electrical design and materials shall conform to the latest EEI-NEMA and ANSI Standards for Oil-Filled Equipment. It is the intent of these specifications to describe equipment of the best design and construction, for the service for which it is intended.

##### 1-2 TESTS

Transformers shall receive and pass at least the following tests in accordance with the Applicable ANSI and NEMA Standards.

- |     |                       |     |                                    |
|-----|-----------------------|-----|------------------------------------|
| (1) | Load and no-load loss | (5) | Applied and induced potential test |
| (2) | Exciting current      | (6) | Impulse voltage test               |
| (3) | Polarity check        | (7) | Tank pressure test                 |
| (4) | Ratio check           |     |                                    |

##### 1-3 GUARANTEE

The manufacturer shall guarantee all equipment delivered under these specifications against any and all defects in material and/or workmanship for a period of at least one year from date of acceptance. The manufacturer shall rectify all such defects by repair or replacement at his own expense and assume responsibility for associated shipping costs.

##### 1-4 TECHNICAL INFORMATION

The following specifications shall be met:

1. Insulation level: 95 kv BIL (min)
2. Insulation rating: 65° C rise.
3. Ground Lines: Two (2) ground lugs (one for primary side and one for Secondary) which accept a range of #4 to 1/0 AWG copper shall be provided.
4. Paint: All exterior surfaces shall be painted Munsell 7GY3.29/1.5 (Olive) green (or approved equal), using a system of coordinated and thoroughly tested materials and application techniques that will assure long life. Special attention shall be given to welds, seams, edges and rough spots. Painting shall meet requirements of ANSI Standards C57.12.28 latest revision.

## DIVISION 1 – GENERAL REQUIREMENTS (Cont.)

5. Lifting Lugs: Lifting lugs shall be provided on the tank and shall be located in such a way to avoid interference between lifting slings and any attachments on the transformer and to avoid scratching the transformer coating.
6. Tanks: Tanks shall be tested at a pressure equal to or greater than the maximum operating pressure and for a sufficient period of time to insure that all welds are free from leaks. Tank and radiator construction shall be consistent with good manufacturing and design practices prevalent in the transformer industry, and together they should contribute to a high quality product.
7. Nameplates: Stainless steel or anodized aluminum nameplate shall be securely attached to the transformer by means of metal screws, rivets or similar mechanical device(s). The letters and numbers shall be stamped or engraved on the nameplate. The nameplate shall include the words, “Fluid is less than one p.p.m. PCB”, refer to Section 1-6. The instruction nameplate shall contain the information specified in Section 5.12 of ANSI Standard C57.12.00, latest revision.
8. Sound Level: The sound level shall be equal to or better than EEI-NEMA Standards.

### 1-5 LOSSES

Losses will be considered in the evaluation of this bid as follows:

- No-load (core) loss @ \$6.34/watt.
- Load (winding) loss @ \$4.31/watt.

The cost of losses will be added to the equipment price (bid price) F.O.B. Lompoc, including maximum escalation, to determine the evaluated low bid of vendor otherwise meeting these specifications. All bidders shall supply the following guaranteed loss data for use in the evaluation, in addition to other data listed in the specifications:

1. No-load losses in watts at rated secondary voltage.
2. Load losses in watts at rated secondary voltage and rated load. The standard reference temperature for load loss shall be 85°C.
3. Upon requests, furnish certification/statement of the guaranteed loss measurement error of the test equipment and measurement method to be used, including the basis for determination of the accuracy of the test equipment and measurement method.

## DIVISION 1 – GENERAL REQUIREMENTS (Cont.)

The successful bidder shall supply a certified test report of actual losses of the unit(s) to be supplied. The no-load and load losses for each group (type and size) of transformer(s) will be averaged separately within their respective categories (no-load and load losses). If the averaged tested no-load (core) and/or load (winding) losses of the transformer group exceed the watt losses quoted in the proposal, the contract price shall be reduced by the above amounts per watt of actual group averaged no-load and/or actual load loss in excess of that quoted in the proposal. No-load loss penalties will be evaluated separately from load loss penalties. No additional payment will be made to the manufacturer or bidder for actual losses lower than the losses quoted in the proposal.

Certified test report of losses shall be submitted by the manufacturer prior to or at the time of shipment of the transformer.

### 1-6 PCB CONTENT

Transformer fluid shall be guaranteed to contain less than one p.p.m. by weight (mg/kg) polychlorinated biphenyls (PCB). Certified test report of PCB content shall be produced upon request. The transformer nameplate to include the words, "Fluid is less than one p.p.m. PCB".

### 1-7 DIMENSIONS

The overall dimensions of the units (height, width, depth – height only for single-phase units) will be considered in the evaluation of this bid.

### 1-8 LABELING

The units are to be shipped without the Safety Labels per NEMA No. 260-1982. The City will affix it's personalized "Mr. Ouch" labels.

### 1-9 PADMOUNTED EQUIPMENT ENCLOSURES

#### A. General

1. A typical padmounted equipment enclosure consists of a surrounding case of housing for equipment to prevent unauthorized access to protect people against accidental contact of energized parts and protect equipment against weather hazards. The enclosure is mounted on a pad, above ground level, and may be ventilated to permit circulation of air. The enclosure shall meet the Western Underground Committee Standards for pad mounted transformers.
2. Entry into the enclosure shall be through either access door(s) or hood(s) as specified.

## DIVISION 1 – GENERAL REQUIREMENTS (Cont.)

### B. Structural Strength and Integrity Test:

The structural strength and integrity test shall comply with the latest NEMA and ANSI Standards for testing, design and enclosure security.

### C. Construction:

#### 1. The construction shall be such that:

- a. It prevents the entry of foreign objects, such as sticks rods or wires.
- b. It inhibits dismantling of the equipment
- c. It is free of areas which could provide access by forcing techniques.
- d. Panels shall be fastened or hinged to resist disassembly, breakings or prying open from the outside. Normal entry shall be possible only with the use of proper access tools. Latches and other provisions for locking hinged panels shall be furnished.
- e. There shall be no exposed screws, bolts or other fastening or hinging devices that are externally removable (with the exception of pentahead bolts provided for extra security) that would provide access to energized parts of the enclosure.

#### 2. Three Phase transformer tank and enclosure shall be constructed of minimum 14-gauge steel. The radiator to be constructed of minimum 18 gauge steel. The transformer tank base and the cabinet base (all parts which contact the ground) shall be make from a minimum of two inches high stainless steel (AISI series 300 or 400) or corrosion proof composite material approved by the City of Lompoc.

#### 3. SINGLE PHASE FULL STAINLESS STEEL CONSTRUCTION

The single-phase transformer tank and enclosure shall be constructed of minimum 14-gauge stainless steel (AISI series 300 or 400). The radiator to be constructed of minimum 18-gauge stainless steel. The hood of single-phase transformers shall be hingeless and made of the same SS material mentioned above. All materials attached to the tank or enclosure shall be the same SS material mentioned above or a City of Lompoc approved corrosion resistant equal.

## DIVISION 1 – GENERAL REQUIREMENTS (Cont.)

4. In addition to the regular locking provisions, all access doors shall be secured by a recessed, captive, pentahead bolt which threads into a nut with a blind hole. A pentahead bolt shall be considered “captive” when the retention scheme will prevent it from being readily removed during normal operation of the door(s) or the hood(s). The recess is to be nonrotating. The dimensions of the pentahead bolt and nonrotating recess shall comply with Figure 1 of the ANSI C57.12.28-latest version. If all doors can be secured with a single bolt, one bolt will be sufficient.
5. Each latched door shall be latched at a minimum of three points. In addition to the three-point latching, one pentahead bolt shall be coordinated with the latch and padlock to prevent unlatching and insertion of the padlock into the hasp when and until the bolt head is completely seated. Low profile cabinets, with access hoods, need only padlock and pentahead bolt provisions, and shall be coordinated to prevent insertion of the padlock into the hasp until the bolt head is completely seated.
6. The padlocking device shall be so designed and located as to resist prying or breaking off by screwdrivers, wrecking bars, tire irons, single-socket lug wrenches, or other readily accessible tools.
7. The edges of the access doors or hoods shall be formed to provide:
  - a. A close-fitting mating surface, with internal insertion-prevention lip that will be shaped to prohibit entry or prying by screwdrivers, wrecking bars, tire irons, single-socket lug wrenches, or other readily accessible tools.
  - b. A rigid panel which, in conjunction with a handle-linkage-latching mechanism with three (or more) point latching, will resist bending in the event that sufficient force is applied to distort the compartment or compartment door(s) and permit prying access to the door edges.
8. Hinge pins shall be passivated AISI (American Institute of Steel Industries) Type 304 stainless steel, or approved equal
9. If a handhole cover is exposed, it shall be secured against tampering by some means accessible only from the inside of the compartment.
10. The bottom edge of the enclosure shall provide for flush mounting on a flat, rigid, mounting surface to prevent wire entry into the compartment.

## DIVISION 2 – SINGLE PHASE (12KV)

### 2-1 GENERAL

Transformer enclosures to be in conformance with Division 1 of this specification and be of the low-profile design, maximum height for 75 KVA and below shall be 28", and for 100 KVA and above shall be 33". The access door shall open to the top 180° and be removable. The design shall be dead front, feed through. Cables shall enter and leave the transformer from below through openings in a pad. The front plate of the transformer tank shall be constructed (reinforced) in such a manner that tank pressure does not cause any reduction in clearances between the energized parts and grounded surfaces, i.e. deflection resulting in spades and bushing moving toward the sides of the door.

The Bay-O-Net fuse shall be positioned in such a way that the fuse assembly can be inserted and locked in any position without interfering with the closed door. The oil drip plates should be welded to transformer tank or otherwise permanently secured to the tank. Fastening of the oil drip plate and/or the fuse insertion restrictive device with a "U" clamp around the molded outer tube assembly is not acceptable.

### 2-2 BLUSHING HEIGHTS

Primary and secondary bushing heights shall comply with the latest revisions of NEMA TRI and ANSI C57.12.25-latest version Standards, Type 2 Arrangement Figure 2(b).

### 2-3 STANDARD ACCESSORIES

In addition to that specified in Division 1, transformers shall be provided with the following:

1. Pressure relief valve, Qualitrol 202-030-01, or approved equal.
2. Low voltage terminals, 4-hole in-line spade type (all insulated), which may be rotated to allow convenient connection of cables.
3. Oil filler and drain plugs.
4. 2 parking stands for high-voltage terminations. Pre-approved arrangements.
5. Two (2) high-voltage universal bushing wells and two (2) load break bushing insert.
6. Sidewall-mount Bay-O-Net fuse assembly with molded outer tube flapper valve type (RTE /Cooper Catalog #4000361C99FV) and isolation link, or approved equal; and oil drip plate below fuse holder entrance. Fuse element not to be installed, but supplied in a bag attached to fuse holder handle.

## PADMOUNTED TRANSFORMERS

### DIVISION 2 – SINGLE PHASE 12Kv (continued)

#### 2-4 RATINGS AND DESIGN

1. Dead front with two (2) universal bushing wells and load Break bushing inserts.
2. Voltage: 12,000 volts Delta primary to 240/120 volts secondary, unless specified otherwise on proposal form.
3. No taps.
4. Single phase, 60Hz OISC.
5. Transformers shall be provided with RTE /Cooper Bay-O-Net dual sensing #400358C or approved equal fuse links in accordance with Table I.
6. KVA rating to be as specified on proposal form.

PADMOUNTED TRANSFORMERS

DIVISION 2 – SINGLE PHASE 12Kv (continued)

TABLE I

FUSE LINKS  
FOR 12KV

Single Phase		
Transformer KVA	Link	
	Designation	Rating (Amp)
	Dual Sensing 4000358 ( )	
10	C03	3
15	C03	3
25	C05	8
37.5	C08	15
50	C08	15
75	C10	25
100	C10	25
167	C12	50

DIVISION 3 – THREE PHASE 12Kv

3-1 GENERAL

Enclosure to be in conformance with Division 1 of the specification Maximum transformer height shall not exceed values listed in Table A below:

TABLE A

<u>TRANSFORMER KVA</u>	<u>MAXIMUM HEIGHT</u>
300 KVA and below.....	65”
500 KVA.....	75”
750 KVA and above.....	90”

High and low voltage sections shall be separated and the low voltage door shall be equipped with a locking handle, and in addition, the doors so arranged that access to the high voltage compartment can be gained only after opening the low voltage door; doors shall be removable. Cables shall enter and leave the compartment sections from below, through openings in a concrete pad.

The oil drip plates shall be welded to transformer tank or otherwise permanently secured to the tank. Fastening of the oil drip plate and/or the fuse insertion restrictive device with a “U” clamp around the molded outer tube assembly is not acceptable.

3-2 BUSHING HEIGHTS

Primary and secondary bushing locations and heights shall comply with the latest revisions of NEMA TR1 and ANSI C57-12.26-1992 Standards Fig. 1 and Fig. 4 (a) latest revision for primary and staggered low-voltage terminal arrangement.

3-3 STANDARD ACCESSORIES

In addition to that specified in Division 1 transformers shall be provided with the following:

1. Pressure relief valve: Qualitrol 202-030-01, or approved equal.
2. Four (4) low voltage bushing spades (4-hole NEMA [square-] on 300 KVA and below; 6-hole or more NEMA [square-] on 500 KVA and above.
3. Liquid level gauge, drain valve with sample valve and oil filler plug. Drain valve to be located in the high-voltage compartment.
4. Parking stands for each high-voltage elbow terminator.

### Division 3 – THREE PHASE 12kV (continued)

5. Universal bushing wells, for high-voltage terminations and load break bushing inserts.
6. Bay-O-Net fuse assemblies with molded outer tube, flapper valve type (RTE /Cooper Catalog #4000361C99FV) and isolation link, or approved equal. Fuse elements not to be installed, but to be supplied in a bag attached to fuse holder handle.

### 3-4 RATINGS AND DESIGN

1. Dead front, radial feed design with three (3) universal bushing wells and load break bushing inserts.
2. 12,000-volt Delta-connected primary, unless specified otherwise on proposal form.
3. No taps.
4. Three phase, 60 Hz, OISC.
5. All units shall be equipped with:
  - a. On-Off loadbreak, gang-operated, oil-immersed switch.
  - b. Switch handle with eye for operation with hot stick shall be located in high-voltage compartment.
6. Transformers shall be provided with RTE /Cooper Bay-O-Net dual sensing #4000358C or current sensing #4000353C or approved equal fuse links in accordance with Table II.
7. Secondary voltage rating to be as specified on proposal form.
8. KVA ratings to be as specified on proposal form.

Division 3 – Three Phase 12kV (continued)

TABLE II

FUSE LINKS

<b>12,000-Volt Delta THREE PHASE</b>		
Transformer KVA	Link	
	Designation	Rating (Amp)
	Dual Sensing 4000358 ( )	
75	C05	8
112.5	C08	15
150	C08	15
225	C10	25
300	C10	25
500	C12	50
	Current Sensing 4000353 ( )	
750	C14	65
1000	C16	100
1500	C17	140

Division 4 – Dual Voltage

4-1 GENERAL

Transformer to meet all requirements of division 3 of these specifications except for the primary voltage to be 12,000V X 4,160V Delta. A Tap Change Switch with eye for operation with hot stick (Shotgun stick) shall be located within the enclosure compartment.

4-2 FUSING

Appropriately sized fuse elements for both voltages must be supplied. See Table III or IV for applicable fuse elements.

TABLE III

**FUSE LINKS**  
**FOR 4KV SINGLE-PHASE**

<b>Single Phase</b>		
Transformer KVA	Link	
	Designation Link	Rating (Amp)
	Dual Sensing 4000358 ( )	
10	C08	15
15	C10	25
25	C12	50
37.5	C12	50
	Current Sensing 4000353 ( )	
50	C14	65
75	C16	100
100	C16	100
167	C17	140

DIVISION 4 – DUAL VOLTAGE (continued)

TABLE IV

**FUSE LINKS**  
**FOR 4KV THREE-PHASE**

<b>4160-Volt Delta THREE PHASE</b>		
<b>Transformer KVA</b>	<b>Link</b>	
	<b>Designation</b>	<b>Rating (Amp)</b>
	Dual Sensing 4000358 ( )	
45	C10	25
75	C12	50
112.5	C12	50
	Current Sensing 4000353 ( )	
150	C16	100
225	C16	100
300	C17	100
500	C17	140
750	C17	140