



CITY OF LOMPOC
UTILITIES DEPARTMENT ELECTRICAL
DIVISION SPECIFICATION - ELE-PAD-12kV

PADMOUNTED TRANSFORMERS 12kV
THREE PHASE
SINGLE PHASE

December 2019

**SPECIFICATIONS
PADMOUNTED TRANSFORMERS 12kV
AND DUAL VOLTAGE RADIAL FEED – STAINLESS STEEL**

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 their own expense and assume responsibility for associated shipping costs, material costs and labor costs. All materials used for the manufacture of the distribution transformer must be new – no previously used or refurbished elements are acceptable.

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 (coated) Munsell 7GY3.29/1.5 (Olive) green (or approved equal), using a system of coordinated and thoroughly tested materials and application techniques that will ensure 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: Tank must be **completely** manufactured of Stainless Steel. Tanks shall be tested at a pressure equal to or greater than the maximum operating pressure and for a sufficient period of time to ensure that all welds are free from leaks. Tank and radiator construction shall be stainless steel and shall be consistent with good manufacturing and design practices prevalent in the transformer industry, and together they should contribute to a high quality product. No portion of the tank or protruding appurtenances shall trap or hold water.
7. Nameplates: Stainless steel 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. For an example of nameplate color contrast, please see appendix A-Figure 1.
8. Sound Level: The sound level shall be equal to or better than NEMA TR 1 -2013 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.)

4. Transformers shall conform to dates and respective efficiency levels for liquid-immersed distribution transformers per “10 CFR Part 431.196 – Energy conservation standards and their effective dates (CFR>Title 10>Chapter II>Subchapter D>Part 431> Subpart K> Section 431.196).

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 at the time of shipment of the transformer. The transformer nameplate **shall** 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. 260-1996 (2004). The City will affix its 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 against accidental contact of energized parts and to protect equipment against weather hazards. The enclosure is mounted on a pad, above ground level, and may be ventilated to permit circulation of air.

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.

1. FULL STAINLESS STEEL CONSTRUCTION

The transformer tank and enclosure shall be constructed of minimum 14-gauge stainless steel. The radiator shall be constructed of minimum 18 gauge stainless steel. All stainless steel material shall be AISI series 300, Austenitic grade, non-magnetic.

DIVISION 1 – GENERAL REQUIREMENTS (Cont.)

2. 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 the ANSI C57.12.28 standard. If all doors can be secured with a single bolt, one bolt will be sufficient. For an example of the requested elements, refer to Appendix A – Figure 2 and Figure 3.
3. 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.
4. 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.
5. 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.
6. Hinge pins shall be AISI (American Institute of Steel Industries) Type 304 stainless steel, or approved equal
7. If a hand-hole cover is exposed, it shall be secured against tampering by some means accessible only from the inside of the compartment.
8. 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 1 – GENERAL REQUIREMENTS (Cont.)

1-10 SUBMITTALS

1. All proposals shall include the data as requested in Division 1, section 1-5 for evaluation. Supplied data shall remain in effect for the duration of any contract.
2. Certified test report of losses shall be submitted by the manufacturer prior to or at the time of shipment of the transformer. Any equipment ordered and delivered **will not be evaluated** for acceptance without the certified test reports.
3. Within thirty (30) calendar days after the award of order or contract, the manufacturer shall furnish for review by the City, two full sets of outline, nameplate, and any other drawings as required.
 - a. Each set shall include a copy of the transmittal letter, a drawing list by the manufacturer's drawing number and titles of all drawings and any other pertinent document to be evaluated by the City of Lompoc.
 - b. Within twenty working days after their receipt, the City will return to the Manufacturer, one set of the drawings furnished for review. Comments, if any, will be in writing. The review or waiver of review of drawings shall in no way relieve the manufacturer of his obligation to furnish apparatus in conformance with this specification.
 - c. Approved drawings (by the City) shall remain in effect for the duration of any contract unless otherwise revised and agreed upon with the City and the Manufacturer.

1-10 ACCEPTANCE

The City shall not be deemed to have accepted the apparatus until it has made sufficient evaluation and tests to enable it to determine that the apparatus meets all of the requirements of said Specifications. Such tests shall be made within sixty days from the date the apparatus is delivered. The conditions of any tests shall be mutually agreed upon and the Manufacturer shall be notified of and may be represented at all tests that may be made. If inspection and/or tests show the apparatus or any part thereof not to be represented and/or contracted for, the City may refuse to accept it, but the Manufacturer shall have a reasonable time within which to correct the apparatus at his own expense.

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 35”, and for 100 kVA and above shall be 36”. The footprint dimensions cannot exceed 36” wide by 40” deep. 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 BUSHING HEIGHTS

Primary and secondary bushing heights shall comply with ANSI C57.12.25-1990 Standard, Type 1 arrangement (Figure 1(b) on ANSI C57.12.25 – 1990).

2-3 STANDARD ACCESSORIES

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

1. On-Off load-break, gang-operated, oil-immersed switch with switch handle with eye for operation with hot stick shall be located in the high voltage compartment.
2. Each transformer shall be equipped with a non-resettable device which detects and provides external indication of internal transformer faults, and also incorporates pressure relief functionality. The approved device is manufactured by IFD Corporation or approved equal.
3. Low voltage terminals, 4-hole in-line spade type (all insulated), which may be rotated to allow convenient connection of cables.
4. Oil filler and drain plugs.
5. Two parking stands for high-voltage terminations. Pre-approved arrangements.
6. Two (2) high-voltage universal bolted bushing wells and two load-break bushing inserts designed for 15kV rating.

DIVISION 2 – SINGLE PHASE 12kV (Cont.)

7. 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

2-4 RATINGS AND DESIGN

1. Dead front with two (2) universal bushing wells and load Break bushing inserts.
2. Voltage: 12kV ph-ph Delta primary to 240/120 volts secondary, unless specified otherwise on proposal form.
3. No taps.
4. Single phase, 60Hz Oil Immersed Self-Cooled (OISC).
5. Transformers shall be provided with RTE /Cooper Bay-O-Net dual sensing #4000358CXX or approved equal fuse links in accordance with Table I.
6. kVA rating to be as specified on proposal form.

TABLE I
FUSE LINKS FOR 12 kV

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

DIVISION 3 – THREE PHASE 12kV (continued)

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 FOOTPRINT</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 at a slight angle 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 ANSI C57-12.26-1992 Fig. 1 for primary and Fig. 4 (a) for secondary 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 on 300 kVA and below; 6-hole or more NEMA on 500 kVA and above. For 750 kVA and above, insulated bushing supports shall be installed as depicted in Appendix A – Figure 4.
3. Liquid level gauge, drain valve with sample valve and oil filler plug. Drain valve to be located in the high-voltage compartment.

DIVISION 3 – THREE PHASE 12kV (continued)

4. Parking stands for each high-voltage elbow terminator.
5. Universal bushing bolted wells, for high-voltage terminations and load break bushing inserts designed for 15kV rating.
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 bolted wells and load break bushing inserts.
2. 12kV phase-phase Delta-connected primary, unless specified otherwise on proposal form.
3. No taps.
4. Three phase, 60 Hz, Oil Immersed Self-Cooled (OISC).
5. All units shall be equipped with On-Off load-break gang-operated, oil-immersed switch with 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 #4000358CXX 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

| 12,000 V ph-ph Delta THREE PHASE | | |
|---|--------------------------------|--------------|
| Transformer kVA | Link | |
| | Dual Sensing 4000358 () | Rating (Amp) |
| 50 | C03 | 3 |
| 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 | C16 | 100 |
| 2000 | C17 | 140 |

DIVISION 3 – THREE PHASE 12kV (continued)

Appendix A



Figure 1 - Nameplate color scheme – Black background



Figure 2 - Exterior configuration of locking mechanism

DIVISION 3 – THREE PHASE 12kV (continued)



Figure 3 - Interior Configuration of Locking Mechanism



Figure 4 - Insulated paddle support for transformer secondary