

# **Bid Documents and Specification**

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## **Jefferson County Public Utility District Distribution System Transformers**

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**December 2021**

**Bid# 2021-010**

**Revision 040521**

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## NOTICE TO BIDDERS

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### NOTICE TO BIDDERS:

Jefferson County Public Utility District No. 1 (PUD) in Port Townsend, WA invites sealed bids to be received at the Operations Center of the District until **3:00 pm PST on January 19, 2022** for **Distribution System Transformers including Single Phase Padmount, Three Phase Padmount and Single Phase Polemount RUS Approved Transformers (126 total)** in accordance with the bid documents. The District will evaluate bids on the basis of each transformer type (Single Phase Pad Mount, Three Phase Pad Mount and Single Phase Pole Mount.). The District reserves the right to award separate Contracts for each transformer type.

Prospective bidders are hereby notified that they are solely responsible for ensuring timely delivery of their bid to the District on or before the bid submission date and time indicated. Bids received on time will be publicly opened and read aloud.

Sealed proposals are to be delivered to:

Attention: Alyson Dean, Purchasing Agent  
Jefferson County PUD  
310 Four Corners Road  
Port Townsend, WA 98368

Bids may also be emailed to [adean@jeffpud.org](mailto:adean@jeffpud.org).

Instructions, specifications and proposal blanks will be on file in the office of Jefferson County Public Utility District, where they may be consulted or secured for the purpose of bidding.

### BID SECURITY:

A certified check, bank cashier's check or bid bond executed by a State licensed surety company made payable to Jefferson County Public Utility District No 1 is required with each bid in the amount equal to five percent (5%).

### REJECTION OF BIDS:

Jefferson County Public Utility District reserves the right to reject any or all bids or to waive any formality or technicality in any bid in the interest of the District.

### PUBLIC RECORDS ACT:

The District is subject to the disclosure obligations of the Washington Public Records Act of RCW 42.56. The Bidder expressly acknowledges and agrees that its Bid and any information Bidder submits with its Bid is subject to public disclosure pursuant to the Public Records Act or other applicable law and the District may disclose Bidder's proposal and/or accompanying information at its sole discretion in accordance with its obligations under applicable law.

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## INSTRUCTIONS TO BIDDERS

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### 1. Scope of Contract

Bidder shall be fully responsible for all labor, material and equipment necessary for complete construction of the equipment as required in the Contract Documents.

### 2. Specifications, Other Bid Documents

Specifications and other bidding documents may be obtained at the time and place indicated on the Notice to Bidders. Bidders shall comply with all conditions stipulated in such bidding documents.

### 3. Proposals

Before submitting a Proposal, each bidder shall carefully examine the Bid Documents, shall fully inform themselves as to all Specification and Bid requirements; and shall include in the Proposal the cost of all items required by the Bid Documents. If the bidder observes that portions of the Contract Documents are at variance with applicable laws, codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the Engineer and the necessary changes shall be accomplished by Addendum.

- a. The Proposal shall be prepared on forms as found in this specification.
- b. Bids will bear no marks, erasures, or writing changes, other than those provided or required.
- c. No verbal or telephone bid modifications or cancellations will be considered.
- d. The bidder guarantees there shall be no revisions or withdrawal of bid amount for a period of 45 days after bid opening.
- e. Bids shall be signed by a Principal duly authorized to make contracts.
- f. Bid proposals shall reflect the cost of all work required by the bid documents, plus additions, deletions, or modifications required by addenda issued prior to bid opening.
- g. Bids shall be submitted in opaque envelopes and/or email that bear bidders name, and be sealed and addressed to:

Attention: Alyson Dean, Purchasing Agent  
Jefferson County PUD  
310 Four Corners Road  
Port Townsend, WA 98368  
Email: [adean@jeffpud.org](mailto:adean@jeffpud.org)

All bids shall be clearly marked "Bid Proposal – Distribution Transformer Supply" as indicated in Section 1, paragraph 1.3.

- h. Bid opening time and date is as per the Notice to Bidders found in this Bid Document.
- i. It is the bidder's sole responsibility to see that the bid is received at the proper time and place. Any bid received after scheduled bid opening will be considered non-responsive.
- j. Prior to the bid opening, bidders may withdraw a bid by written request or by reclaiming bid envelopes.

### 4. Interpretation of Specifications

- a. If any person or entity contemplating submitting a bid is in doubt as to the meaning of any part of the specifications or other Bid Documents, such person shall submit to the Engineer a request for an interpretation or correction thereof.
- b. Request for such clarifications must be in the office of the Engineer a minimum of three (3) days prior to bid opening.
- c. The person or entity submitting the request will be responsible for its prompt delivery.
- d. Any interpretation of the proposed documents will be made only by Addenda duly issued and a copy of such Addenda will be mailed or delivered to each person or entity receiving a set of documents.
- e. Verbal instructions or interpretations will have no validity, regardless of source. Neither the Owner nor the Engineer will be responsible for any other explanations or interpretations of the proposed documents.

**5. Addenda**

Any Addenda issued during the time of bidding shall become part of the documents provided to the bidders for the preparation of the bid, shall be covered in the bid, and shall be made a part of the Bidding Documents.

**6. Award of Contract**

- a. The Contract will be awarded as soon as possible to the bidder that meets the following criteria: (1) ability to meet specifications as stipulated in Bid Evaluation information as required in Part 1 – General Requirements 1.4 (2) lowest, responsible bidder based on lowest combination of base bid and acceptable alternates; (3) provided the bid is reasonable and is in the interests of the Owner to accept. The Owner reserves the right to waive any technicalities or formalities in any bid or in the bidding.

**7. Withdrawal of Bids**

Bids may be withdrawn on written request received from bidders prior to the time fixed for opening. Negligence on the part of the bidder in preparing the bid confers no right for the withdrawal of the bid after it has been opened.

**8. Public Records ACT**

The District is subject to the disclosure obligations of the Washington Public Records Act of RCW 42.56. The Bidder expressly acknowledges and agrees that its Bid and any information Bidder submits with its Bid is subject to public disclosure pursuant to the Public Records Act or other applicable law and the District may disclose Bidder’s proposal and/or accompanying information at its sole discretion in accordance with its obligations under applicable law.

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## SECTION 1 – GENERAL REQUIREMENTS

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### 1.1.1 SCOPE

- A. The purpose of this bid document and specification is to furnish the specific data and requirements pertaining to the purchase, design, inspection, shipment, service engineering, and the testing of all distribution transformers as specified herein to be purchased by Jefferson County Public Utility District “District”.
- B. The Bids will be for furnishing distribution transformers in accordance with the Bid and Specification Documents.

### 1.1.2 CORRESPONDENCE

- A. All bids shall be addressed to:  
Alyson Dean, Purchasing Agent  
Jefferson County PUD  
310 Four Corners Road  
Port Townsend, WA 98368  
Email: [adean@jeffpud.org](mailto:adean@jeffpud.org)
- B. Technical questions shall be addressed to:  
Jimmy Scarborough, Engineer  
Jefferson County PUD  
310 Four Corners Road  
Port Townsend, WA 98368  
Email: [jscarborough@jeffpud.org](mailto:jscarborough@jeffpud.org)

### 1.1.3 BID PROPOSAL

- A. Firm prices shall be quoted and the bid shall delineate escalation factors, if any. The Bidder's proposal shall not include sales or use taxes.
- B. **The Purchaser reserves the sole right without cause to accept or reject any or all bids, or any portion thereof.**
- C. All bids shall be marked: “**Distribution Transformer Bid# 2021-010**”
- D. A certified check, bank cashier check or bid bond executed by a State licensed surety company made payable to Jefferson County Public Utility District No 1 is required with each bid in the amount equal to five percent (5%).
- E. The Purchaser reserves the right to waive minor irregularities or minor errors in any proposal if it appears to the Purchaser that such irregularities or errors were made inadvertently. Any such irregularities or errors so waived must be corrected in the Proposal in which they occur prior to the execution of any contract which may be awarded thereon.
- F. **The District will evaluate Bids on the basis of each transformer type (Single Phase Pad Mount, Three Phase Pad Mount and Single Phase Pole Mount). The District reserves the right to award separate contracts for each transformer type.**
- G. Bidder shall supply one (1) copy of proposals if hard copies are submitted. E-mailed bids are acceptable.
- H. All Bidders will be notified of any changes in the specifications in addendum letters. Receipt of addendum letters must be acknowledged in the bid proposal.

#### 1.1.4 BID EVALUATION

- A. The Purchaser will consider the prices and delivery dates as only two elements making up the total value of the material to be purchased. In order to properly evaluate other factors, we request the Bidder to provide answers to the following questions in his proposal:
1. The District will evaluate Bids on the basis of each transformer type.
  2. Where is the nearest factory authorized repair shop capable of repairing equipment of the size and type proposed?
  3. Please list any other information or features that you feel should be considered in the evaluation of these proposals.
- B. Other items which will be considered in the bid evaluation are:
1. The Bidder's past performance(s) in providing equipment and meeting quoted deliveries.
  2. The Bidder's past ability and willingness to solve problems that have arisen in a satisfactory and complete manner.
  3. The Bidder's deviations from the specifications.
  4. Warranties. (Standard and Extended)
  5. Manufacturer's cancellation policy.

#### 1.1.5 PURCHASE ORDER

- A. It is anticipated that a purchase order will be issued to the successful Bidder(s) within thirty **(30) days** after the due date for the receipt of the proposals.

#### 1.1.6 DELIVERY AND SHIPPING

- A. Delivery dates shall be provided by the bidder. Date of shipment shall be indicated by the Bidder, based upon prompt receipt of all necessary information. The date of shipment shall be defined as the date the bill of lading is signed by the carrier.
- B. Any change in the delivery date shall be reported immediately by telephone, followed by a written confirmation and explanation thereof. The delivery date shall be extended for the period of any reasonable delay due exclusively to causes beyond the control and without the fault of the bidder.
- C. Shipping shall be to the District's warehouse at:
- 310 Four Corners Road  
Port Townsend, WA 98368
- D. The title to the material furnished hereunder shall pass to the District at the destination point.
- E. On the same day that any shipment to the District is originated, a transmission, including the following, shall be forwarded to the District:
1. Packing List
  2. Bill of Lading
  3. Packing list shall also accompany each shipment.

- F. The Purchaser shall be notified as to the whereabouts of the transformers 48 hours prior to their schedule arrival at the destination point. Bidder shall pay any costs associated with unloading in the event that the transformers are not on site at this notified time.
- G. Delivery Shall be Monday through Friday between the hours 8:30 a.m. to 1:00 p.m. Pacific time. Failure to deliver prior to 1:00 p.m. will not guarantee unloading until the next day. On a Friday, delivery after 1:00 p.m., will not guarantee unloading until the following Monday. Layover costs will be paid by the Contractor.

#### 1.1.7 INVOICING

- A. Invoices shall be submitted in triplicate form to:

Mr. Alyson Dean, Purchasing Agent  
Jefferson County PUD  
310 Four Corners Road  
Port Townsend, WA 98368

[accountspayable@jeffpud.org](mailto:accountspayable@jeffpud.org)

#### 1.1.8 PAYMENT

- 1. Upon the shipment of any equipment hereunder, the Vendor shall submit to the District a detailed invoice in duplicate of the equipment shipped. After delivery of the equipment the District shall make payment therefore to the Contractor.

#### 1.1.10 CANCELLATION

- A. In the event the Purchaser shall be required, or deems it advisable, to suspend or terminate the work being performed pursuant to this Specification, the Purchaser may do so at any time by written notice to the Seller. In such cases, the Seller would take whatever action with respect to work in process as would minimize its claim against the Purchaser. The Purchaser would pay the Seller a reasonable suspension or termination charge for all disbursements or expenses which the Seller has incurred or become obligated for prior to the date of notice of cancellation, less the reasonable resale value of the materials, equipment, and apparatus which shall have been obtained or ordered to become an integral part of the work, and excluding any allowance for anticipated profits on the unperformed portion of the work. Reimbursement portions of this section would not apply to cancellations caused by design changes by the Manufacturer not authorized by the Purchaser or caused by delivery of material beyond the quoted delivery date(s) not authorized by the Purchaser.

#### 1.1.9 EXCEPTIONS

- A. Any exceptions to this Specification shall be clearly stated in the Bidder's proposal. The fact that there are exceptions will not necessarily preclude the selection of the Bidder's proposal. Any exceptions will be itemized in the evaluation of the proposal. If no exceptions to this Specification are taken by the Bidder, this shall also be clearly stated.
- B. Alternative offerings will be considered, but they must clearly be indicated as alternatives.

#### 1.1.10 WARRANTY

- A. Manufacturer shall warrant to District that the Transformers to be furnished hereunder shall be of the highest quality and free from defects in material, workmanship, and title and will be of the kind designated in the pertinent purchase order. The Manufacturer's warranty shall be effective for a minimum period of eighteen (18) months after the date of shipment to Districts or twelve (12) months after energization, whichever occurs first. Terms of Manufacturer's warranty shall be included in the bid proposal and will be a criterion for evaluation of the proposal.



- B. The manufacturer shall guarantee that all transformers furnished under this specification are of first class material and workmanship throughout, that they have been tested in accordance with this specification, and that the results of the tests comply with the requirements of this specification, and, in lieu of other claims against it, agrees to replace or repair:
  - 1. Any transformer found to be defective in material or workmanship or found not to be in compliance with the requirements of this specification before or during installation of the transformer.
  - 2. Any transformer failing during normal and proper use within the manufacturer's guarantee period which shows defects of material or workmanship.

#### 1.1.11 STANDARDS

- A. Unless otherwise stated, the latest revisions of the standards of ANSI, NEMA, IEEE, ASTM, NEC, and UL, shall be met in design, testing, and manufacture of the transformers covered by this Specification. In the event a conflict occurs between these codes and the specifications which will follow, the more stringent requirements shall govern.
- B. Transformers provided shall conform to Rural Utility Services (RUS) requirements and listed in the "Informational Publication 202-1 – List of Materials".
- C. Transformers provided shall conform to DOE 2016 Efficiency Standards.

#### 1.1.12 INSPECTION

- A. A representative of the District shall be allowed free access at all reasonable times to the Manufacturer's shops and those of his suppliers for inspection of the equipment, or any of its parts, and to obtain information on the progress of the work. Any work or material found to be defective or which does not meet the requirements of this Specification may be rejected and shall be replaced by the Manufacturer at his own expense. Such inspection, however, shall not relieve the Manufacturer from responsibility for the quality and correctness of the work.

#### 1.1.13 FIELD ENGINEERING AND TESTING

- A. The transformers shall be assembled and tested at the factory for satisfactory alignment, operation and electrical integrity.
- B. All transformers shall be tested in accordance with the latest IEEE Standards and as indicated in C57.12.90.
- C. Test reports shall be provided for transformers supplied under this specification.
- D. Field tests at time of installation shall be made at the expense of the District. If for any reason whatsoever the equipment furnished and installed hereunder, does not meet in any respect the warranties hereof and/or the performance specified by the Bidder in the proposal, and it becomes necessary for the Manufacturer to make alterations for the purpose of meeting those warranties and/or performances, additional tests required to show the effects of such alterations shall be performed at the expense of the Manufacturer.

#### 1.1.14 DRAWINGS AND DESCRIPTIONS

- A. The following drawings and descriptions shall accompany the Bidder's proposal:
  - 1. General arrangement drawings showing the overall dimensions and relative location of all principal parts including high and low voltage cabinet arrangement.
  - 2. General description of type of materials used for the principal parts.
  - 3. General description of the construction including drawings, photographs, or cuts which show the general construction.
  - 4. General description and diagrams showing the equipment mounting and handling facilities and clearance requirements.
- B. For each Transformer type supplied, The Contractor shall furnish to the District:
  - 1. One (1) set of certified, reproducible drawings on CD in AutoCAD 2010 format.
  - 2. Installation, Operations, and Maintenance Manuals.

3. Equipment Specification Sheets and Parts Lists.
  4. Recommended spare parts list.
  5. Preventative maintenance procedures and schedule of procedures recommended.
- C. In addition, Manufacturer shall ship one (1) complete set of equipment drawings; Installation, Operations and Maintenance Manuals; and Specification Sheets, Test Reports, and Parts Lists with each transformer. This material shall be enclosed in a weather-proof package securely attached to the unit and protected from loss or damage.
- D. The drawing list shall include, at the minimum, the following:
1. Outline.
  2. Name Plate.
  3. High and low voltage compartment details (pad mount transformers).
  4. Location of Bushings.
  5. Location and identification of all accessories.
  6. Weight of total assembled transformer and gallons of oil.

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## SECTION 2 - DIVISION 1 – SINGLE-PHASE PADMOUNTED DISTRIBUTION TRANSFORMER

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### 2.1.1 GENERAL

- A. This specification outlines the electrical characteristics and the mechanical features of single-phase, 60 Hz, oil filled padmounted, deadfront compartmental-type distribution transformers with separable insulated high voltage connectors.
- B. Quantity and ratings of Single-Phase Pad Mount Transformers, as listed in Table 1 and in this specification, shall be supplied on a quarterly basis, as listed.

**Table 1**

<b>SINGLE-PHASE PADMOUNTED DISTRIBUTION TRANSFORMER</b>				
<b>Bid Item</b>	<b>KVA</b>	<b>Primary Voltage</b>	<b>Secondary Voltage</b>	<b>Quantity Purchase</b>
1	25	7200	120/240	60
2	50	7200	120/240	10

### 2.1.2 STANDARDS

- 1. All transformers shall be constructed and tested in accordance with the latest revision of IEEE C57.12.00, C57.12.38, C57.12.90, C57.12.28, C57.12.29 and the applicable NEMA standards.
- 2. Transformers provided shall conform to Rural Utility Services (RUS) requirements and listed in the “Informational Publication 202-1 – List of Materials”
- 3. Transformer shall meet the DOE 2016 Efficiency Standards.
- 4. No used or remanufactured material or components will be acceptable.
- 5. Western Underground Committee Standards.

### 2.1.3 RATINGS

#### A. KILOVOLT AMPERE RATINGS

- 1. The standard kVA ratings shall be one of the following:
  - (a) 25kVA, 50kVA, 75kVA, and 167kVA as required in Table 1.
- 2. These standard kVA ratings are continuous and based on not exceeding either a 65°C average winding temperature rise or an 80°C hot spot temperature rise. The temperature rise of the insulating oil shall not exceed 65°C when measured near the top of the tank.

#### B. VOLTAGE

- 1. The high voltage rating shall be 12470Y/7200 volts. The low voltage rating shall be 240/120 volts, 3 bushing. Unless otherwise directed by the District.

#### C. TAP RATINGS

- 1. No Taps Required.

D. BASIC IMPULSE INSULATION LEVEL

1. The basic impulse insulation level (BIL) shall be 95 kV.

2.1.4 CONSTRUCTION

A. GENERAL

1. All transformers shall consist of a transformer tank and a high and low-voltage cable termination compartment. These components shall be assembled as an integral, tamperproof and weatherproof unit for mounting on a pad. The transformer shall meet the requirements for tamper resistance as set forth by the Western Underground Committee. There shall be no exposed bolts, screws or other fastening devices which are externally removable. There shall be no openings through which foreign objects such as wires or rods might be inserted to contact live parts.
2. Transformers shall comply with the requirements of IEEE C57.12.28.

B. HIGH AND LOW-VOLTAGE COMPARTMENT

1. Access to the high and low-voltage compartment shall be through a hinged door suitable for locking with a padlock.
2. The high-voltage segment of the compartment shall contain the high voltage terminations, be provided with an elbow accessory parking stand. High voltage will be of the loop type configuration.
3. The low-voltage segment of the compartment shall contain the low-voltage terminations.

C. TANK

1. All transformer tanks shall have sealed tank construction and sufficient strength to withstand a pressure of 7 PSI gage without permanent distortion.
2. A tank that has sealed tank construction is one that seals the tank from the atmosphere.
3. The tank shall remain effectively sealed for a top oil temperature range of -5°C to 105°C.

D. MAIN COVER

1. Welded main cover construction shall be provided.
2. The main door shall be secured with a penta-head fastening bolt and locking provisions as required by IEEE C57.12.28. Door fastening hardware shall be made of stainless steel or silicon bronze

E. LOW-VOLTAGE TERMINATIONS

1. The electrical characteristics of the completely assembled low-voltage terminations shall be:
  - (a) Insulation Class - 1.2 kV.
  - (b) BIL - 30 kV.
  - (c) One minute withstand - 10 kV.
2. The terminals of the low-voltage terminations shall be as shown in Figure 7 of IEEE C57.12.38-2014. Requested stud mount termination for 25kVA :CMC# RLSS500-4I, Polaris# PSMTLSC500-4I or match item and for 50kVA and above: CMC# RLSS500-6I, Polaris# PSMTLSC500-6I or match item.
  - (a) **If addition of stud mount termination causes delay in production, clarification shall be made to waive installation.**
3. The number location and arrangement of the low-voltage terminations shall be as shown in Figure 4 of IEEE C57.12.38-2014.
4. All low-voltage terminations shall be externally bolted to facilitate field replacement.

## F. HIGH-VOLTAGE TERMINATIONS

1. All high-voltage terminations shall be 15 kV class bushings or wells and inserts suitable for use with 15 kV class loadbreak elbow connectors respectively.

NOTE: All loadbreak bushing inserts shall be provided with the transformer.

2. All high-voltage terminations shall be externally bolted to facilitate field replacement.
3. **The high voltage terminations shall be of the loop configuration.**
4. The number, location and arrangement of the high-voltage terminations shall be as shown in Figure 4 of IEEE C57.12.38-2014.

## G. NEUTRAL CONNECTIONS

1. The H2 end of the high-voltage winding shall be connected to the transformer tank internally and this connection shall be securely grounded to the tank and shall be independent of all other connections.
2. The low voltage neutral shall be a fully insulated bushing. A stainless-steel ground pad shall be provided on the outer surface of the tank. A removable ground strap shall be provided and connected between the low-voltage neutral bushing and the ground pad.

## H. CORE AND WINDINGS

1. The core shall be constructed of high-grade, grain oriented, silicon steel laminations, with high magnetic permeability. Core construction shall include step-lap mitered joints to keep core losses, excitation current and noise level at a minimum.
2. The core shall be clamped and braced to resist distortion caused by short-circuit stresses or transportation handling and to prevent the shifting of core laminations.
3. Copper or aluminum winding conductors are acceptable.
4. The core shall be manufactured from burr-free, grain-oriented silicon steel.
5. Core losses shall be minimized by the core material and core construction.

## I. INSULATION

1. The coil shall be insulated with B-stage, epoxy coated, diamond patterned, insulating paper, which shall be thermally cured under pressure to ensure proper bonding of conductor to paper.
2. Insulating/cooling fluid within the tank shall be electrical grade mineral oil.
3. All fluids shall be certified and indicated on the nameplate to be less than 1 part/million PCB content.

## J. GROUND CONNECTION

1. The tank shall have two welded stainless-steel ground pads attached on the secondary side of the tank near the bottom of the tank clear of secondary bushings and attached conductors.
2. The grounding pads shall be free of paint and shall be 7/16-inch-deep and threaded for a 1/2" 13 NC grounding stud or connector.

## 2.1.5 ACCESSORY EQUIPMENT

### A. HIGH-VOLTAGE PROTECTIVE FUSES

1. All transformers shall be equipped with an externally removable, oil immersed, expulsion fuse, in a loadbreak bayonet suitable for hot stick operation. This fuse shall be in series with an under oil partial range current limiting fuse. The fuses shall be coordinated to ensure that the current limiting fuse will only operate on faults internal to the transformer. The current limiting fuse used shall have an interrupting rating of 50,000 amperes (minimum) symmetrical.

B. PRESSURE RELIEF DEVICE

1. Each transformer shall be equipped with a self-actuating pressure relief device to relieve slow pressure buildup and to automatically vent when pressure reaches +/- 10 PSIG and recloses when pressure falls to +/- 6 PSI.

C. ROLLING, LIFTING, AND MOUNTING FACILITIES

1. The transformer base shall be arranged for rolling to two directions - parallel to and at right angles to one side of the transformer.
2. The transformer shall be equipped with lifting provisions of adequate strength and size and arranged on the transformer to permit lifting of the completely assembled and oil filled unit.
3. An internal flange shall be provided at the base of the high and low-voltage compartment to provide means for mounting the transformer on a pad.

D. INSTRUCTIONAL NAMEPLATE

1. An instruction nameplate shall be located in the low-voltage segment of the high and low voltage compartment and shall be readable with cables in place.
2. If the nameplate is mounted on a removable part, the manufacturer's name and the transformer serial number shall be permanently affixed to a non-removable part.
3. The instructional nameplate shall conform to Section 9.4 of American National Standard Publication C57.12.00 latest revision.

2.1.6 TESTING

- A. All transformers shall be tested in accordance with the requirements of IEEE C57.12.90 latest revision. All transformers shall be capable of withstanding short circuit tests.

- B. All units shall be tested for the following:

- (a) No-Load (85°C or 20°C) losses at rated current
- (b) Total (85°C) losses at rated current
- (c) Percent Impedance (85°C) at rated current
- (d) Excitation current (100% voltage) test
- (e) Winding resistance measurement tests
- (f) Ratio tests using all tap settings
- (g) Polarity and phase relation tests
- (h) Induced potential tests
- (i) Full wave and reduced wave impulse test

- C. All transformers shall meet or exceed DOE-2016 efficiency and loss standards.

2.1.7 FINISH

- A. The paint system shall meet or exceed the requirements of IEEE C57.12.28.
- B. The transformer shall be given a durable, corrosion resistant, Munsell 7GY3.29/1.5 green outdoor finish.
- C. All transformer surfaces in contact with the pad shall be designed or treated to minimize corrosion.
- D. NEMA safety standard "DANGER - HIGH VOLTAGE" decals shall be provided on the outside front top center of each transformer. A similar decal shall also be provided on the inside compartment lid.
- E. The transformer kVA shall be indicated in permanent 3" high yellow on black letters on the outside lower left corner of each transformer.
- F. District five-digit transformer number shall be indicated in permanent 3" high yellow on black numbers on the upper right corner of each transformer. Starting number sequence will be indicated on Purchase Order.

#### 2.1.8 SHIPPING AND LABELING INSTRUCTIONS

- A. Transformers shall be shipped on pallets.
- B. A shipping tag indicating kVA size, manufacturer, voltage ratings, serial number and purchase order number shall be attached to all transformers

#### 2.1.9 LOSS CRITERIA

- A. All transformers shall meet or exceed DOE-2016 efficiency and loss standards.
- B. Transformers that do not meet the loss requirements shall not be accepted.
- C. All actual tested loss data and statement of compliance with DOE 2016 will be transmitted to the District within 5 days after shipment of the transformers.

#### 2.1.10 VENDOR EVALUATION

- A. Vendor evaluations, as well as adherence to loss criteria, will be used to determine the low bidder. Delivery dates will be of prime concern during the bid evaluation.

#### 2.1.11 EXCEPTIONS

- A. Any exceptions to this specification shall be clearly delineated in the bidders proposal on a clearly indicated "Exception Sheet".

#### 2.1.12 WARRANTY

- A. Manufacturer shall warrant to District that the apparatus or services to be furnished hereunder shall be of the highest quality and free from defects in material, workmanship, and title and will be of the kind designated in the pertinent purchase order. The Manufacturer's warranty shall be effective for a minimum period of eighteen (18) months after the date of shipment to the District or twelve (12) months after energization, whichever occurs first. Terms of Manufacturer's warranty shall be included in the bid proposal and will be a criterion for evaluation.
- B. The manufacturer shall guarantee that all transformers furnished under this specification are of first class material and workmanship throughout, that they have been tested in accordance with this specification, and that the results of the tests comply with the requirements of this specification, and, in lieu of other claims against it, agrees to replace or repair:
  - 1. Any transformer found to be defective in material or workmanship or found not to be in compliance with the requirements of this specification before or during installation of the transformer.
  - 2. Any transformer failing during normal and proper use within the manufacturer's guarantee period which shows defects of material or workmanship.

#### 2.1.13 APPROVED MANUFACTURER

- A. The following are approved manufacturers for transformers to be supplied for the project:
  - 1. All RUS Approved Manufacturers

END DIVISION 1

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## SECTION 2 - DIVISION 2 – THREE PHASE PADMOUNTED DISTRIBUTION TRANSFORMER

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### 2.2.1 GENERAL SCOPE

- A. This specification outlines the electrical characteristics and the mechanical features of deadfront outdoor three-phase, 60 Hz, oil immersed, self-cooled pad-mounted, compartmental-type distribution transformers with separable insulated high voltage connectors.
- B. Quantity and ratings of Three-Phase Pad Mount Transformers, as listed in Table 2 and this specification Division, shall be supplied quarterly, as listed.

**Table 2**

<b>THREE-PHASE PADMOUNTED DISTRIBUTION TRANSFORMER</b>				
<b>Item</b>	<b>KVA</b>	<b>Primary Voltage (Gnd-Y)</b>	<b>Secondary Voltage (Gnd-Y)</b>	<b>Quantity Purchase</b>
3	150	7200	277/480	1

### 2.2.2 STANDARDS

- A. Transformers provided shall conform to Rural Utility Services (RUS) requirements and be listed in the RUS “Informational Publication 202-1 – List of Materials”. Transformers shall be constructed and tested in accordance with the latest revision of IEEE C57.12.90, and the applicable NEMA standards.
- B. All transformers shall be constructed and tested in accordance with the latest revision of IEEE C57.12.90, and the applicable NEMA standards.
- C. All characteristics, definitions, and terminology, except as specifically covered in this specification, shall be in accordance with the latest revision of the following ANSI/IEEE, NEMA, and Department of Energy standards.
  1. C57.12.00: IEEE Standard for Standard General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers.
  2. C57.12.28: Padmounted Equipment – Enclosure Integrity.
  3. C57.12.29: IEEE Standard for Pad Mount Equipment – Enclosure Integrity for Coastal Environments.
  4. C57.12.34: IEEE Standard Requirements for Padmounted, Compartmental Type, Self-Cooled, Three-Phase Distribution Transformers (2500 kVA and Smaller) – High Voltage: 34500 Grdy/19920 Volts and Below; Low Voltage: 480 Volt 2500 kVA and Smaller (Issued in March 2005 – Combines C57.12.22 and C57.12.26).
  5. C57.12.90: IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and IEEE Guide for Short-Circuit Testing of Distribution and Power Transformers.
  6. C57.91: Guide for Loading Mineral-Oil-Immersed Transformers.
  7. NEMA TR 1-2013: Transformers, Regulators and Reactors, Table 0-2 Audible Sound Levels for Liquid-Immersed Power Transformers.
  8. NEMA 260-1996 (2004): Safety Labels for Padmounted Switchgear and Transformers Sited in Public Areas.
  9. CFR Part 431: Department of Energy – Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule.
- D. Transformers shall meet the DOE 2016 Efficiency Standards.



E. No used or remanufactured material or components will be acceptable.

### 2.2.3 RATINGS

#### A. VOLTAGE AND KILOVOLT-AMPERE RATINGS

1. The standard kVA ratings shall be one of the following:
  - (a) 45kVA and 300kVA as listed in Table 2.
2. These standard kVA ratings are continuous and based on not exceeding either a 65°C average winding temperature rise or an 80°C hot spot temperature rise. The temperature rise of the insulating oil shall not exceed 65°C when measured near the top of the tank.

#### B. VOLTAGE

1. The high voltage rating shall be 12470Gnd-Y/7200 volts. The low voltage rating shall be 208Y/120 V or 480Y/277 V as required, unless otherwise directed and approved by the District.

#### C. TAP RATINGS

1. The transformers shall be equipped with: (2) 2-1/2 percent taps above and (2) 2-1/2 percent taps below normal voltage. All taps shall be full capacity taps.
2. Tap changing to be through the wall in the high voltage connection compartment for external to tank adjustment.
3. Taps shall have the positions of the changer clearly marked to indicate actual voltage on the primary, or as a % of above and below normal primary voltage.
4. Taps shall be operable only with the transformer de-energized.

#### D. BASIC IMPULSE INSULATION LEVEL

1. The basic impulse insulation level (BIL) shall be 95 kV.

#### E. SEISMIC REQUIRMENTS

1. The transformers shall be designed to withstand the magnitude of seismic loads established by the IBC, Chapter 16 with the following values:

Site Class D

- (1)  $S_S=1.276$  g  $S_{MS}=1.276$  g  $S_{DS}=0.851$  g
- (2)  $S_1=0.517$  g  $S_{M1}=0.776$  g  $S_{D1}=0.517$  g

### 2.2.4 CONSTRUCTION

#### A. GENERAL

1. All transformers shall consist of a transformer tank and a high- and low-voltage cable termination compartment. These components shall be assembled as an integral, tamperproof and weatherproof unit for mounting on a pad. The transformer shall meet the requirements for tamper resistance as set forth by the Western Underground Committee. There shall be no exposed bolts, screws or other fastening devices which are externally removable. There shall be no openings through which foreign objects such as wires or rods might be inserted to contact live parts.
2. Transformers shall comply with the requirements of IEEE C57.12.28.

#### B. TANK

1. Transformer tank shall be suitable for outdoor installation. The tank shall be of a construction that effectively seals the tank interior from the atmosphere but will allow entry for service.

2. Construction of the seal shall maintain the integrity of the seal over an operating oil temperature range of -5°C to 105°C.
3. Tank construction shall be such that it has sufficient strength to withstand a pressure of 7 psi gage without permanent distortion.

C. HIGH- AND LOW-VOLTAGE COMPARTMENTS

1. The high- and low-voltage cable terminating compartment shall:
  - (a) Be compartmentalized into high-voltage and low-voltage segments by a suitable barrier.
  - (b) Include two doors, one for the high-voltage segment and one for the low-voltage segment. These doors shall have stainless steel hinges and pins and three-point latching with provisions for padlocking. Unlocking the padlock shall permit access to the low-voltage segment of the terminating compartment only. Access to the high-voltage segment of the terminating compartment shall not be attained until an additional fastening device has been released.
  - (c) Meet the dimensional requirements of Figure 12 of IEEE C57.12.34 latest revision.
  - (d) Cabinet shall be minimum 24" depth.
  - (e) The high-voltage compartment shall be equipped with accessory elbow parking stands for each elbow.

D. TERMINATION ARRANGEMENT AND DIMENSIONS

1. The termination arrangements and dimensions of Figures 8, 12, and 14 of IEEE C57.12.34 latest revision shall be applicable to this specification.

E. HIGH-VOLTAGE TERMINATIONS

1. Configuration - **The configuration of the high-voltage terminations shall be Loop Feed (Figure 16 of IEEE C57.12.34-2015).**
2. Type - The high-voltage terminations shall be 15 kV class bushing wells with bushing well inserts installed. Inserts to be suitable for use with 15 kV class loadbreak elbow connectors respectively. The continuous current rating shall be 200 A.

NOTE: All loadbreak bushing inserts shall be provided with the transformer.

F. LOW-VOLTAGE TERMINATIONS

1. The terminals of all low-voltage terminations shall be threaded studs as shown in Figure 20 of IEEE C57.12.34-2015.
2. The terminals of the low-voltage terminations shall be as shown in Figure 19 of IEEE C57.12.34-2015. The manufacturer shall provide all screw on spades.
  - (a) **If addition of stud mounted terminations causes a delay in production, clarification shall be made to waive installation.**
  - (b) Bushing supports shall be provided for transformers requiring 10 or more connections holes, or less per manufacturers requirements.
3. Configuration - The configuration of the low-voltage terminations shall be as shown in Figure 8A (staggered) of IEEE C57.12.34-2015.
4. Secondary low-voltage bushings shall include a full capacity neutral (grounded conductor) bushing.
5. The electrical characteristics of the completely assembled low-voltage bushing and termination shall be:
  - (a) Insulation Class: 1.2 kV
  - (b) BIL: 30 kV
  - (c) One Minute Withstand: 10 kV
6. Internal connections to the secondary bushings shall be by lugs welded to the secondary conductor and bolted to the bushing stud.

G. FUSING EQUIPMENT

1. Transformers shall be equipped with externally removable, oil immersed, expulsion fuses in loadbreak bayonets in series with under oil partial range current limiting fuses.
2. All under oil fuses shall be easily accessible through a large "hand hole" in the high voltage compartment. The hand hole shall be large enough and placed in such a location that all internal fusing elements will be "within" the hand hole area. In no case shall the hand hole be smaller than 10 inches by 12 inches unless approved in writing by the District. The hand hole cover shall be tamper-resistant and its locking device shall be accessible from inside the high voltage or low voltage transformer compartment.
3. The transformer shall be equipped with an under oil partial range current limiting fuse. The bayonet expulsion fuses and backup current limiting fuses shall be coordinated to ensure that the current limiting fuse will only operate on faults internal to the transformer. The current limiting fuse used shall have an interrupting rating of 50,000 Amp (Minimum) symmetrical.

H. CORE AND WINDINGS

1. All wye-wye connected transformers shall have four- or five-legged core construction or shall otherwise include provisions to prevent excessive tank heating. The core construction or other provisions for preventing tank heating shall be adequate for unbalanced loading conditions of one or more of the primary phases of the transformer being energized from the same source.
2. The core shall be clamped and braced to resist distortion caused by short-circuit stresses or transportation handling and to prevent the shifting of core laminations.
3. The core and coil shall be vacuum processed to ensure maximum penetration of insulating fluid into the coil insulation system. While under vacuum, the windings will be energized to heat the coils and drive out moisture, and the transformer will be filled with preheated filtered degassed insulating fluid. The core shall be manufactured from burr-free, grain-oriented silicon steel and shall be precisely stacked to eliminate gaps in the corner joints. The coil shall be insulated with B-stage, epoxy coated, diamond pattern, insulating paper, which shall be thermally cured under pressure to ensure proper bonding of conductor and paper. Coils may be either aluminum or copper.
4. Copper or aluminum winding conductors are acceptable.
5. The core shall be manufactured from burr-free, grain-oriented silicon steel.
6. Core losses shall be minimized by the core material and core construction.
7. Transformers shall be equipped with a common H<sub>0</sub>X<sub>0</sub> bushing with a copper grounding strap to the transformer case.

I. INSULATION

1. The coil shall be insulated with B-stage, epoxy coated, diamond patterned, insulating paper, which shall be thermally cured under pressure to ensure proper bonding of conductor to paper.
2. Insulating/cooling fluid within the tank shall be electrical grade mineral oil.
3. All fluids shall be certified and indicated on the name plate to be less than 1 part/million PCB content.
4. Fluids other than mineral oil shall have submitted with the quotation complete chemical and electrical characteristics and a statement of being non-PCB.

J. GROUNDING

1. The tank shall have a welded stainless-steel ground pads attached on the primary and secondary side of the tank near the bottom of the tank clear of the bushings and attached conductors (two pads total).
2. The grounding pads shall be free of paint and shall be 7/16-inch-deep and threaded for a 1/2" 13 NC grounding stud or connector.

K. ACCESSORIES

1. IEEE C57 12.34 standard accessories shall be provided.
2. The transformer shall be equipped with a complete set of standard accessories, including:
  - (a) Four lifting lugs.
  - (b) Bolted-on terminal compartment (24" min. depth) with removable front sill.
  - (c) Hinged, lift-off cabinet doors.
  - (d) Interlocked hex-head bolt/padlock handle operates a cam assembly that is part of the 3-point door latching mechanism.
  - (e) Tank ground pads (1 in HV, 1 in LV).
  - (f) One ½" penta-head bolt must be removed from the flange formed on the steel high/low barrier before the HV door can be opened.
  - (g) Non-corrosive nameplate.
  - (h) Fill plug.
  - (i) Drain plug.
  - (j) Removable neutral ground strap.
  - (k) NEMA safety labels.
  - (l) Compartment Weather Cover
    - (1) Hinged to allow vertical access or clearance for replacement of the bayonet fuses.
    - (2) Sloped to shed water.
    - (3) Can be lifted easily into place and secured with a single supporting arm.
    - (4) Requires no additional hold-down hardware.
  - (m) Miscellaneous Options
    - (1) Drain valve and sampling device.
    - (2) Gauges – No Gauges Required.
3. PRESSURE RELIEF DEVICE
  - (a) Each transformer shall be equipped with a self-actuating pressure relief device to relieve slow pressure buildup and to automatically vent when pressure reaches +/- 10 PSIG and recloses when pressure fails to +/- 6 PSI.
4. MOUNTING AND LIFTING
  - (a) Mounting shall be suitable for concrete pad mounting. Provide suitable anchorage brackets for seismic site.
  - (b) The tank shall have lifting provisions of adequate strength, size, and arrangement on the transformer to permit lifting the transformer in an upright position when filled with insulating fluid.
5. HIGH VOLTAGE SWITCHES
  - (a) As a bid adder, for transformers rated 300 kVA or larger provide 630A, in-oil, Sectionalizing Loadbreak switches.
  - (b) The high voltage load break sectionalizing switches are to be contained inside the transformer tank and be oil submersed.
  - (c) The load break switch shall provide isolation to the transformer windings.
  - (d) The operation handle of the high voltage load break switch shall be located in the high voltage section and shall be suitable for hot stick operation. The position of the switch (Open or Closed) shall be clearly marked.

- (1) Voltage rating of load break switch: 15,000 volts, 95kV BIL.
- (2) Load break Capabilities: 630 RMS amperes at 0.75 power factor lagging.
- (3) Fault Withstand: 12.5kA RMS, 2 seconds duration.

#### 2.2.5 FINISH

- A. The paint system shall meet or exceed the requirements of IEEE C57.12.28.
- B. The transformer shall be given a durable, corrosion resistant, nonchalking, green outdoor finish capable of meeting or exceeding EEI finishing requirements.
- C. All transformer surfaces in contact with the pad shall be designed or treated to minimize corrosion.
- D. The transformer shall be painted with a green (Munsell 7GY3,29/1.5) finish.
- E. NEMA safety standard "DANGER - HIGH VOLTAGE" decals shall be provided on the outside of each transformer. A similar decal shall also be provided on the inside of each door(s).
- F. The transformer kVA shall be indicated in permanent 3" high yellow on black letters on the outside of each transformer.
- G. District five-digit transformer number shall be indicated in permanent 3" high yellow on black numbers on the upper right corner of each transformer. Starting number sequence will be indicated on Purchase Order.

#### 2.2.6 IDENTIFICATION NAMEPLATE

1. The Tank shall be complete with a stainless steel or anodized aluminum laser engraved nameplate.
2. The nameplate shall contain the manufacturers name, address, kVA, primary voltage, secondary voltage(s), % impedance, rated temperature rise, a wiring diagram indicating connections and voltages with polarity (additive or subtractive), losses (no load and full load), insulating fluid identification, and PCB content, weight when full, manufacturers part (catalog) number, and serial number unique to the transformer.
3. The nameplate shall conform to IEEE C57 12.00 and C57 12.34 latest revision.

The nameplate shall be mounted on a permanently attached backing plate with welds or rivets. Removable nameplates or nameplates attached to removable parts will not be accepted

#### 2.2.7 SHIPPING AND IDENTIFICATION

##### A. SHIPPING

1. Transformers shall be shipped on pallets.
2. A shipping tag indicating kVA size, manufacturer, voltage ratings, serial number and purchase order number shall be attached to all transformers

#### 2.2.8 TESTING

- A. All transformers shall be tested in accordance with the requirements of IEEE C57.12.90 latest revision. All transformers shall be capable of withstanding short circuit tests.

- B. All units shall be tested for the following:
  - (a) No-Load (85°C or 20°C) losses at rated current
  - (b) Total (85°C) losses at rated current
  - (c) Percent Impedance (85°C) at rated current
  - (d) Excitation current (100% voltage) test
  - (e) Winding resistance measurement tests
  - (f) Ratio tests using all tap settings
  - (g) Polarity and phase relation tests
  - (h) Induced potential tests
  - (i) Full wave and reduced wave impulse test
- C. All transformers shall meet or exceed DOE-2016 efficiency and loss standards.

#### 2.2.9 LOSS CRITERIA

- A. All transformers shall meet or exceed DOE-2016 efficiency and loss standards.
- B. Transformers that do not meet the loss requirements shall not be accepted.
- C. All actual tested loss data and statement of compliance with DOE 2016 will be transmitted to the District within five days after shipment of the transformers.

#### 2.2.10 VENDOR EVALUATION

- A. Vendor evaluations as well as loss evaluations will be used to determine the low bidder. Delivery dates will be of prime concern during the bid evaluation.

#### 2.2.11 EXCEPTIONS

- A. Any exceptions taken shall be clearly delineated in the bidders proposal on a clearly indicated "Exception Sheet".

#### 2.2.12 WARRANTY

- A. Manufacturer shall warrant to District that the apparatus or services to be furnished hereunder shall be of the highest quality and free from defects in material, workmanship, and title and will be of the kind designated in the pertinent purchase order. The Manufacturer's warranty shall be effective for a minimum period of eighteen (18) months after the date of shipment to the District or twelve (12) months after energization, whichever occurs first. Terms of Manufacturer's warranty shall be included in the bid proposal and will be a criterion for evaluation.
- B. The manufacturer shall guarantee that all transformers furnished under this specification are of first class material and workmanship throughout, that they have been tested in accordance with this specification, and that the results of the tests comply with the requirements of this specification, and, in lieu of other claims against it, agrees to replace or repair:
  - 1. Any transformer found to be defective in material or workmanship or found not to be in compliance with the requirements of this specification before or during installation of the transformer.
  - 2. Any transformer failing during normal and proper use within the manufacturer's guarantee period which shows defects of material or workmanship.

#### 2.2.13 QUALITY ASSURANCE

- 1. The manufacturer shall have specialized in the design, manufacture and assembly of liquid filled padmounted tamper-resistant transformers for a minimum of 10 years.

2. The manufacturer shall have a well-documented quality assurance program, which includes procedures for all activities in order entry, design, material procurement, manufacturing processes, testing, shipping and post shipment product follow.
3. The manufacturer's test floor shall have a documented calibration program. All equipment shall receive regular calibrations. Calibration standards shall be traceable to National Bureau of Standards.

The transformers shall be manufactured by a company which is certified to ISO 9001:2000. A copy of the Certificate of Compliance to this requirement is available upon request.

#### 2.2.14 APPROVED MANUFACTURERS

1. The following are approved manufacturers for transformers to be supplied for the project:
  - (a) All RUS Approved Manufacturers

END DIVISION 2

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## SECTION 2 - DIVISION 3 – POLE MOUNTED SINGLE-PHASE DISTRIBUTION TRANSFORMER

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### 2.3.1 GENERAL SCOPE

- A. This specification covers the electrical and mechanical characteristics of Single-Phase Pole Mount Type Distribution Transformers.
- B. Quantity and ratings of Single-Phase Pole Mount Transformers, as listed in Table 3 and this specification Division, shall be supplied quarterly, as listed

**Table 3**

<b>POLE MOUNT SINGLE PHASE DISTRIBUTION TRANSFORMER</b>				
<b>Bid Item</b>	<b>KVA</b>	<b>Primary Voltage</b>	<b>Secondary Voltage</b>	<b>Quantity Purchase</b>
4	15	7200	120/240	20
5	25	7200	120/240	20
6	50	7200	120/240	10
7	75	7200	120/240	3
8	100	7200	120/240	2

### 2.3.2 INDUSTRY STANDARDS

- A. All characteristics, definitions, and terminology, except as specifically covered in this specification, shall be in accordance with the latest revision of the following ANSI/IEEE, Department of Energy, and NEMA standards. Transformers provided shall conform to Rural Utility Services (RUS) requirements and be listed in the “Informational Publication 202-1 – List of Materials.

C57.12.00 – IEEE Standard for Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

C57.12.20 – IEEE Standard for Overhead-Type Distribution Transformers, 500kVA and Smaller: High Voltage, 34500V and Below; Low Voltage, 7970/13800Y V and below

C57.12.31 – IEEE Standard for Pole Mounted Equipment – Enclosure Integrity

C57.12.35 – IEEE Standard for Bar Coding for Distribution Transformers

C57.12.90 – IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers

C57.12.91 – IEEE Guide for Loading Mineral-Oil-Immersed Transformers  
NEMA TR 1-1993 (R2000) – Transformers, Regulators and Reactors, Table 0-2 Audible Sound Levels

10 CFR Part 431 – Department of Energy – Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule



2.3.3 RATINGS

- A. The transformer shall be designed in accordance with this specification and shall have one of the following kVA ratings:  
 15kVA and 50 kVA as listed in Table 3
- B. The voltage provided and the basic insulation level (BIL) shall be in accordance with Table 4.

Table 4  
 Ratings for Single-Phase Transformers  
 (Single Ratio)

Transformer High-voltage		Minimum kVA Rating For Low-voltage Rating of:	
Rating (V)	BIL (kV)	120/240 (V)	277 or 240/480 <sup>1</sup> (V)
7200/12470Y (dual bushing)	95	Transformer Rating	Transformer Rating

- (a) Low-voltage rating of 120/240 volts or 240/480 volts is suitable for series, multiple, or three-wire service.
- C. The secondary voltage shall be as indicated in Table 3 and the basic insulation level (BIL) of the secondary voltage shall be 30 kV.  
 120/240 (5-100kVA - 3 Bushings)  
 240/480 (5-100kVA - 3 Bushings)  
 120 (5-100kVA - 2 Bushings)  
 277 (5-100kVA - 2 Bushings)
- D. TAPS – No tap required.

2.3.4 CONSTRUCTION

- A. The core and coil shall be vacuum processed to ensure maximum penetration of insulating fluid into the coil insulation system. While under vacuum, the transformer will be filled with preheated filtered degassed insulating fluid. The core shall be manufactured from burr-free, grain-oriented silicon steel and shall be precisely stacked to eliminate gaps in the corner joints. The coil shall be insulated with B-stage, epoxy coated, diamond pattern insulating paper, which shall be thermally cured under pressure to ensure proper bonding of conductor and paper.
- B. Insulating/cooling fluid within the tank shall be electrical grade mineral oil.
- C. All fluids shall be certified and indicated on the nameplate to be less than 1 part/million PCB content.
- D. The tank shall include a pressure relief device as a means to relieve pressure in excess of pressure resulting from normal operation. The venting and sealing characteristics shall be as follows:  
 Cracking pressure: 10psig ± 2 psig  
 Resealing pressure: 6 psig minimum  
 Zero leakage from reseal pressure to -8 psig  
 Flow at 15 psig: 35 SCFM minimum

- E. The tank provided shall have a recessed tank bottom which offers protection when sliding over rough surfaces.
- F. The tank shall have an internal mark, which indicates the proper oil level per Section 7.2.3 of ANSI C57.12.20.
- G. The tank shall be provided with a mild steel cover ring with stainless steel cover ring loops and a stainless-steel bolt. A bronze nut shall also be provided to eliminate corrosion problems and avoid galling.
- H. The tanks shall be complete with an anodized aluminum laser engraved nameplate. Nameplate shall conform to ANSI C57.12.00, nameplate A.
- I. The tank shall include, grounding provisions, ANSI support lugs (hanger brackets) and lift lugs.
- J. High Voltage Bushings and Terminals
  - 1. The high-voltage bushings provided shall be in accordance with Table 5.

Table 5  
Electrical Characteristics of Bushings

BIL Withstand (kV)	<u>Creepage Distance</u> <sup>1</sup>		60-Hz Dry 1-Minute Withstand (kV)	60-Hz Wet 10-Second Withstand (kV)
	Inches	Millimeters		
95	10½ ± ½	267 ± 13	35	30

- (a) Creepage distances are minimum values where no tolerance is specified.
- 2. The transformer shall be supplied with two (2) high voltage bushing.
- 3. The bushing terminals provided shall be tin plated to accommodate both aluminum and copper conductors. The size of these terminals shall be in accordance with Table 6.

Table 6  
High-Voltage Terminal Sizes for Single-Phase Transformers

Size of <u>Terminal Opening</u> Inches Millimeters	AWG Size of Conductor Terminal will Accommodate	kVA Range for High- <u>Voltage Rating of:</u> 7.2 kV to 34.5kV
5/16 7.9	No 8 Solid to No 2 Stranded	10-500

- 4. The color of the bushings shall match Light Gray Number 70, Munsell Notation 5B7.0/0.4.

K. Low Voltage Bushings and Terminals

1. The low-voltage bushings provided shall have a BIL of 30kV.
2. The bushing terminals provided shall be tin plated to accommodate both aluminum and copper conductors. The size of the terminals shall be in accordance with Table 7.

Table 7  
Low-Voltage Terminal Sizes for Single-Phase Transformers

Size of Terminal Opening Inches    Millimeters		AWG Size of Conductor Terminal will Accommodate	Transformer Low Voltage Rating (volts)		
			120/240	240/480	277
5/16	7.9	No 8 Solid to No 2 Stranded	-	-	-
5/8	15.9	No 6 Solid to No 4/0-19 Stranded	10-15	10-25	10-25
13/16	20.6	No 2 Solid to 350 kcmil-19 Stranded	25-50	37 ½ - 100	37 ½ - 100
15/16	23.8	No 1/0 Solid to 500 kcmil-37 Stranded	75	-	-
1-1/4	31.8	No 2/0 Solid to 1000 kcmil-61 Stranded	100	-	-
Spade H		---	167-250	167-500	167-250

3. The internal secondary leads shall be permanently embossed with the letters A, B, C, and D per ANSI C57.12.00 and C57.12.20. This marking can be used as a means to locate such leads with respect to one another for internal reconnection.

L. Overcurrent Protection

1. No overcurrent protection is required with the transformer.

M. Overvoltage Protection

1. No over voltage protection is required with the transformer.

2.3.5 FINISH PERFORMANCE REQUIREMENTS

- A. Transformer shall be painted Munsell Notation 5BG7.0/0.4, ANSI 70 Gray. The coating system shall meet or exceed ANSI C57.12.31 coating system requirements for pole -mount equipment, including the following performance tests:

- (a) Salt spray test per ASTM B117 / D1654
- (b) Cross hatch adhesion test ASTM D3359
- (c) Humidity test per ASTM D4585 / D3363
- (d) Impact test per ASTM D2794 / B1117
- (e) Ultraviolet accelerated weathering (QUV) test per ASTM G154 / D523
- (f) Abrasion resistance Taber abraser test per ASTM D4060 / B1117

- B. Certified test data shall be furnished upon request.

#### 2.2.15 PRODUCTION TESTING

- A. All units shall be tested for the following:
  - (a) No-Load (85°C or 20°C) losses at rated current
  - (b) Total (85°C) losses at rated current
  - (c) Percent Impedance (85°C) at rated current
  - (d) Excitation current (100% voltage) test
  - (e) Winding resistance measurement tests
  - (f) Ratio tests using all tap settings
  - (g) Polarity and phase relation tests
  - (h) Induced potential tests
  - (i) Full wave and reduced wave impulse test
- B. All transformers shall meet or exceed DOE-2016 efficiency and loss standards.
- C. Transformers that do not meet the loss requirements shall not be accepted.
- D. All actual tested loss data and statement of compliance with DOE 2016 will be transmitted to the District within 5 days after shipment of the transformers.

#### 2.2.16 ACCESSORIES

- A. The following accessories shall be provided:
  - (a) Non-PCB Decal
  - (b) Primary Voltage Decal
  - (c) Secondary Voltage Decal
  - (d) kVA Rating Decal
  - (e) Tank ground connector
  - (f) Ground strap
  - (g) District five-digit transformer number shall be indicated in permanent 1 1/2" high yellow on black numbers on the bottom of each transformer. Starting number sequence will be indicated on Purchase Order.

#### 2.2.17 SHIPPING

- A. The unit shall be sufficiently banded or blocked to a suitable wood pallet.

#### 2.2.18 APPROVED MANUFACTURERS

- 1. The following are approved manufacturers for transformers to be supplied for the project:
  - (a) All RUS Approved Manufacturers

END DIVISION 3

Total Evaluated Transformer Price (1 + VAF).....\$ \_\_\_\_\_  
 Transformer(s) Delivery Timeframe (from placement of order) ..... \_\_\_\_\_ weeks

Drawings included with proposal (yes/no):..... \_\_\_\_\_

Substitutions:

The following substitutions of materials and/or equipment are proposed:

Manufacturer and Description	Add/Deduct
_____	\$ _____
_____	\$ _____
_____	\$ _____
_____	\$ _____
_____	\$ _____
_____	\$ _____

Exceptions

All exceptions taken to items in this specification are to be listed below. The paragraph number and title should be stated, followed by an explanation of the exception to be taken. (Attach additional sheets if necessary.)

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Dated at:

\_\_\_\_\_ this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_ .

Bidder \_\_\_\_\_ (SEAL)

By \_\_\_\_\_

(Signature)

(Printed or Typed)

Title \_\_\_\_\_

Attest:

\_\_\_\_\_

Complete Business Address of Bidder:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

State of Incorporation:

\_\_\_\_\_

Complete Address of Principal Offices:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Name, Address and Telephone Number of  
Person to Contact Regarding this Proposal.  
Include both Mail and Street Addresses:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone:

\_\_\_\_\_

Facsimile:

\_\_\_\_\_

I/We acknowledge receipt of the following addenda:

<u>Addenda No.</u>	<u>Date Received</u>
_____	_____
_____	_____
_____	_____

3.1.1 TECHNICAL DATA TO BE FURNISHED WITH BID

DISTRIBUTION TRANSFORMER

The following technical information and data shall be submitted for each transformer classification with the bid:

The transformers shall be designed and manufactured for installation outdoors in a non-hazardous area over an ambient temperature range of 08F to 1008F at an altitude of 400 feet above sea level.

- (1) Classification( 1-Phase Pole Mount:, 1-Phase Pad Mount; 3-Phase Pad Mount)..... \_\_\_\_\_
- (2) Number of phases..... \_\_\_\_\_
- (3) kVA Rating ..... \_\_\_\_\_
- (4) Primary Voltage ..... \_\_\_\_\_
- (5) Secondary Voltage ..... \_\_\_\_\_
- (6) Frequency..... \_\_\_\_\_
- (7) Class ..... \_\_\_\_\_
- (8) Coolant..... \_\_\_\_\_
- (9) Temperature Rise ..... \_\_\_\_\_
- (10) Rated BIL High Voltage ..... \_\_\_\_\_
- (11) Rated BIL Low Voltage ..... \_\_\_\_\_
- (12) High Voltage Bushing Type..... \_\_\_\_\_
- (13) Low Voltage Bushing Type ..... \_\_\_\_\_
- (14) Tank Design Type..... \_\_\_\_\_
- (15) Oil Type ..... \_\_\_\_\_
- (16) No-load Losses (watts) ..... \_\_\_\_\_
- (17) Load Losses (watts) ..... \_\_\_\_\_
- (18) Impedance (%)..... \_\_\_\_\_

Provide In Oil Switch Data for three (3) Phase Pad Mount 300KVA or Larger.

Provide Method of Price Escalation Factor.