CITY OF AUSTIN ELECTRIC UTILITY DEPARTMENT

PURCHASE SPECIFICATION

FOR

TRANSFORMER, DISTRIBUTION, VAULT, THREE-PHASE,

500-2500 KVA

DATE	PREPARED BY	ISSUANCE/REVISION	APPROVAL PROCESS SUPV. / MATERIALS SUPV.
04/03/2012	Arthur Gonzalez Jr.	Issuance	
11/06/2015	Dennis Patrick	Revision	Michael Pittman
12/02/2015	Dennis Patrick	Revision	Michael Pittman

REASON FOR REVISION	AFFECTED PARAGRAPHS
11/6/15: Added Signage for Secondary Voltage	Section 7.0
12/2/15: Added IFD Requirement	Section 3.6.4

This specification, until rescinded, shall apply to each future purchase and contract for the commodity described herein.
Retain for future reference.

CITY OF AUSTIN ELECTRIC UTILITY DEPARTMENT

PURCHASE SPECIFICATION

FOR

THREE-PHASE DISTRIBUTION VAULT TRANSFORMERS

500 & 750kVA like in Network, or sizes up to 2500kVA?

500-2500 KVA

1.0 SCOPE AND CLASSIFICATION

1.1 Scope

This specification describes the minimum acceptable requirements for 3-phase, pad-mounted, 60-Hertz, Δ-YGrd. connected, Envirotemp FR-3 fluid immersed, self-cooled, distribution vault type transformers, rated 500 kVA through 2500 kVA.

The transformers supplied under this specification are intended for use on in at grade and subsurface distribution vaults and shall be designed for use in submersible applications while serving distribution electrical facilities.

The City of Austin Electric Utility Department is hereinafter referred to as Austin Energy (AE).

1.2 Classification

1.2.1 Voltage shall be 12,470 Volts delta on the primary side and 480Y/277 or 208Y/120 Volts on the secondary side, as specified on bid request.

1.2.2 Transformer rating shall be 500 and 750 KVA for 208Y/120 and 500, 750, 1000, 1500, 2000, and 2500 kVA for 480Y/277 as specified on bid request.

1.2.3 Any item supplied under these specifications, but not in complete compliance with these specifications, shall be subject to rejection.

1.2.4 All manufacturers furnishing transformers under these specifications shall have at least five years experience in the manufacture and sale of 3-phase distribution power transformers.

2.0 APPLICABLE SPECIFICATIONS

Transformers supplied in accordance with this specification shall comply with applicable provisions of the latest NEMA, IEEE, ANSI, ASTM, NESC, and NEC standards relating to distribution transformers. In case of conflict between any of the standards mentioned in this specification and the contents of this document, the AE specification shall govern. All characteristics, definitions and terminology, except that specifically covered in this specification shall be in accordance with the latest revisions of the following standards:

2.1 C57.12.00

General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers

2.2 C57.12.26

Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers with Separable Insulated High-Voltage Connectors; High Voltage, (34,500 GrdY/19,920 Volts and below and 2500 kVA and Smaller Requirements).

2.3 C57.12.28

Switchgear and Transformers - Pad-Mounted Equipment - Enclosure Integrity

2.4 C57.12.34

IEEE Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers (2500 kVA and Smaller) - High Voltage: 34500GrdY/19920 Volts and below; Low-Voltage: 480 Volt 2500 kVA and Smaller.

2.5 C57.12.40

Subway and Vault Types (Liquid Immersed) Requirements.

2.6 C57.12.70

Terminal Markings and Connections for Distribution Power Transformers

2.7 C57.12.80

Standard Terminology for Power and Distribution Transformers

2.8 C57.12.90

Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers.

2.9 C57.91

Guide For Loading Mineral-Oil-Immersed Overhead and Pad-Mounted Distribution Transformers Rated 500 kVA and Less with 65°C or 55°C Average Winding Rise

2.10 NEMA TR-1

Transformers, Regulators and Reactors

2.10 C.57.147

Acceptance and Maintenance of Natural Ester Fluids in Transformers

3.0 FUNCTIONAL REQUIREMENTS

3.1 Fusing

500 kVA transformers shall be equipped with Cooper Power System flapper sidewall-mount bayonet draw-out fuse holder assembly #4000361C99FV or buyer approved equivalent with solid link in series with a partial-range, ester fluid immersed, and current-limiting fuse as listed below.

750 kVA through 2500 kVA transformers shall be equipped with Cooper Power Systems silver-plated bayonet draw-out fuse holder assembly #4038804B03M or buyer approved equivalent with solid link in series with a partial-range, ester fluid immersed, current- limiting fuse as listed below.

KVA	Cooper ELSP #	Cooper Solid Link #
500	3544150M71M	403861C10CB
750	3544125M71M	403861C10CB
1000	3544125M71M*	403861C10CB
1500	3544125M71M*	403861C10CB
2000	3544125M71M*	403861C10CB
2500	3544125M71M*	403861C10CB

* Indicates parallel fuse application – use two (2) fuses

Bay-o-net type fuses shall be designed so that the fuses can be removed by using a hot stick. A metal oil-drip shield shall be furnished directly beneath the bay-o-net fuse. Lead connections to the partial-range current-limiting fuse shall be made using bolts, to assure solid electrical and mechanical connections.

Mounting the bayonet fuse holders to 0.188" thick stainless steel or 0.179" mild steel inserts which are welded to the 0.3125" thick copper bearing steel tank side is acceptable.

3.2 Bushings and Terminals

The primary bushing wells and parking stands for distribution vault type dead-front power transformers shall be arranged as per IEEE C57.12.26, Figures 5A. The transformer shall be provided with three high voltage bushing wells (in compliance with IEEE 386) externally clamped and ~~three~~ parking stands. The high voltage primary bushing wells shall be rated 200 ampere ~~minimum~~ and located on segment 1, the front of the transformer, as shown in Attachment 1. The high-voltage leads shall be of such length as to permit field replacement of bushings wells. All bushing wells shall have a removable stud for field replacement.

Six bushing wells for feed-through?

Low-voltage line and neutral terminals shall be in accordance with IEEE C57.12.26 Figure 8(a), and shall be top-mounted as shown in Attachment 1.

Are we sure we want top-mounted with overhead secondary racks, or same as pad-mounts with side-mount where customer will need to go urd to a disconnect, then into the building?

All secondary terminals shall be tin-plated copper and shall be in compliance with IEEE C57.12.26, Figures 9(a), 9(b), or 9(c), except that all distribution vault type power transformers shall have 4 hole secondary terminals rated to carry 150% the full load rating of the transformer that the secondary spade is installed on. In addition, the secondary spade terminals of the transformer shall be equipped with a tin plated CMC/ESP spade adapter or buyer approved equivalent as listed below:

Transformer	# of Holes on CMC/ESP Spade Adapter	CMC/ESP Spade Adapter #
500-1000 kVA	8- hole	APMB8B78TP
1500 kVA and above	10-hole	APMB10B34TP

The spade adapters shall be orientated as shown in Attachment 3.

The secondary terminals equipped with spade adapter shall have a pliable, insulated, and removable PVC molded boot installed on it. The PVC molded boot shall have a dielectric strength of at least 600V and shall be designed to fit over the secondary terminals and spade adapter. The PVC molded boot shall be installed utilizing fasteners.

3.3 Internal Bushing Leads

High-voltage bushing leads shall be trained and appropriately insulated to avoid dielectric breakdown between adjacent cables. Spacers, permanently held in place, should be used to prevent cables from failing phase-to-phase or phase-to-ground.

Low-voltage bushing leads shall create good electrical and strong mechanical connections.

3.4 High Voltage Taps

Distribution vault type power transformers shall be provided with two high-voltage taps 2 ½ % above & below rated voltage.

The tap-changer handle shall be mounted for external operation and located on segment 1, the front of the distribution vault type power transformer as shown in Attachment 1. The tap changer shall be designed for de-energized operation. An indicator shall clearly show the position of the tap changer.

Mounting the tap changer to 0.188" thick stainless steel or 0.179" mild steel inserts which are welded to the 0.3125" thick copper bearing steel tank side is acceptable.

3.5 Switching

A 3-phase, hookstick-operable, gang-operated, two-position, under-oil loadbreak switch shall be supplied on all distribution vault type power transformers. The switch shall have a minimum load break rating of 200 amps and a make-and-latch rating of 10,000 amps rms, symmetrical, 15-cycle. The switch shall have an open/close indication plate. This switch shall be located in segment 1, the front of the transformer, as shown in Attachment 1. The switch shall be Cooper Part # LS2B515H3S2B or buyer approved equivalent. Mounting the switch to 0.188" thick stainless steel or 0.179" mild steel inserts which are welded to the 0.3125" thick copper bearing steel tank side is acceptable.

3.6 Accessory Equipment

The following equipment and devices shall be provided on all distribution vault type power transformers and be located on segment 1, the front of the unit, as shown in Attachment 1:

3.6.1. An oil-drain valve, with sampling device. The valve shall be a gate valve, not less than ½".

3.6.2. A liquid-level gauge

3.6.3. A temperature indicator

3.6.4 All transformers shall be equipped with a resettable device (which can be reset by trained personnel only) which detects and provides external indication of internal transformer faults, and also incorporates pressure relief functionality. The approved device is manufactured by IFD Corporation part number IFD-ORCA-10PSI-aA, or approved equal.

3.7 Terminal Marking and Angular Displacement

Terminal designations shall be as per IEEE C57.12.70. Terminals shall be clearly marked with oil-resistant yellow paint.

The identification of terminal connections shall be shown on the nameplate.

The angular displacement between the high- and low-voltage terminals shall be as per Figure 10, IEEE C57.12.26.

3.8 Nameplate

As described in IEEE C57.12.00, the contractor shall affix a durable metal nameplate to each transformer. The nameplate shall be located in segment 1, the front of the transformer, and shall be readable with the cables in place.

The nameplate shall be made from anodized aluminum or non-rust stainless steel. The information contained on the nameplates shall be inscribed and painted black.

The nameplate shall conform to IEEE C57.12.00 Nameplate C for all distribution vault type power transformers. All information shall be in English and ft-pound-seconds (fps) non-metric units of measure.

The nameplate shall indicate the current-limiting fuse on a circuit diagram.

4.0 PERFORMANCE

4.1 Insulation Level

4.1.1. The high-voltage insulation shall be as follows:

Rated High Voltage (Volts)	BIL (kV)	Insulation Class (kV)
12470 Δ	95	15

4.1.2. The low-voltage insulation level shall be as follows:

Low Voltage Rating (Volts)	BIL (kV)	Insulation Class (kV)
208Y/120	30	1.2
480Y/277	30	1.2

4.2 Temperature Rise Limits

The Temperature rise and loading conditions shall be in accordance with IEEE C57.12.00 section 5.11.

4.3 Impedance

The impedance voltage is the voltage required to circulate rated current through one of two specified windings of a transformer when the other winding is short-circuited, with the windings connected as for rated-voltage operation (IEEE C57.12.80).

In accordance with IEEE C57.12.00, section 9.2, the allowable impedance-voltage tolerance for any individual transformer shall be as follows:

KVA Rating	Impedance Voltage

500	2.0% ± 10.0%	(1.8% to 2.2%)
750 - 2500	5.75% ± 7.5%	(5.3% to 6.2%)

Any unit that is outside of the tolerance shown will be rejected. There is no additional tolerance allowed on these values.

5.0 MATERIAL

5.1 Core and Coil Construction

The transformer coils shall be designed to maintain the nameplate kVA rating throughout the temperature range. All materials used shall be of the 65ºC (85ºC Hot Spot) Class and shall be thoroughly tested for compatibility with all transformer components before use in the design. Only thermally upgraded, one hundred percent conduction, particle tested kraft paper shall be used for secondary layer insulation. Provisions shall be made for securing the sheet windings and the primary windings in position during construction and for short-circuit conditions. Insulating paper shall be thermally cured under pressure, epoxy coated, diamond pattern type.

The core shall be manufactured with burr-free, grain-oriented silicon steel.

5.2 Core-Coil Assembly

The core and coil, after assembly, shall be mounted in a rigid steel frame, constructed in such a way as to hold the coil in a rigid position within the core window without placing undue stress on the core or short circuiting the laminations at any point.

5.3 Tank

The transformer tank shall be of sufficient construction to conform to corrosion resistance requirements for vault type transformers outlined in IEEE C57.12.40 section 5.2.

The tank shall be of sufficient strength to withstand an internal pressure of 7 psig without permanent distortion and 12 psig without permanent rupturing or displacing other components of the transformer.

A one-inch pipe plug shall be provided, for filling, taking oil samples, and pressure testing. This plug shall be located on segment 1, the front of the transformer, as shown in Attachment 1.

The tank cover shall be welded-on type, as per IEEE C57.12.26.

Tank grounding provisions shall be stainless steel grounds pads as outlined in IEEE C57.12.40 section 5.7.7, except the HV ground pad provided needs to be a four hole NEMA pad.

All exterior nuts and bolts shall be of a corrosion-resistant material.

The transformer shall be of sealed-tank construction, which seals the interior of the tank from the atmosphere and which ensures constant gas volume and oil volume. The transformer shall remain effectively sealed for a top-oil temperature range of -5°C to 105°C.

All required gaskets shall be made of high temperature Viton.

The transformer base shall be arranged for rolling in two directions, parallel to and at right angles to the centerline of the high-voltage bushings.

The lifting provision shall be in accordance with IEEE C57.12.26.

The transformers shall be provided with a suitable base to allow for forklift forks to slide underneath the transformer and allow the transformer to be transported via forklift. The base shall also be permanently affixed to the transformer and be suitable of supporting the weight of the transformer for the life of the transformer while also providing enough height for the forklift forks to slide underneath the transformer. The base shall be suitable for the forklift forks to slide underneath the front of the transformer. See Attachment 1 for a detailed view of transformer base orientation.

Jack pads or bars shall be provided so that there is three inches (3”) of clearance up from the bottom of the transformer for lifting jacks.

5.4 Dielectric Fluid

The dielectric fluid shall be bio-based biodegradable electrical insulating and cooling liquid. The Coolant shall be a listed less-flammable fluid meeting the requirements of National Electrical Code Section 450-23 and National Electric Safety Code, section 15. The fluid shall be Factory Mutual Approved, UL Classified Dielectric Medium (UL-EOUV) and UL Classified Transformer Fluid (UL-EOUK), Envirotemp FR-3 fluid.

The Dielectric Fluid supplied with all transformers shall be in accordance with IEEE C57.147. The manufacturer shall provide batch test reports of the dielectric fluid characteristics to AE Distribution Standards.

The PCB content in the dielectric fluid shall be less than 1 ppm. The vendor shall provide written certification to the City that all dielectric fluid contains less than 1 ppm. The PCB content shall be shown on the nameplate of the transformer. The decal shall be colored blue with white lettering. The decal shall be 6" tall by 6" wide and shall have the precise wording, in capital letters, "NO PCBS".

5.5 Primer and Paint

All primer and paint shall be lead-free. The coating system shall be as per IEEE C57.12.28, as a minimum requirement. In addition to this IEEE standard, the unit shall be painted ANSI No. 70 Light Gray, with a minimum thickness of 5 mils.

5.6 Dimensions

All distribution vault type power transformers shall not exceed the following maximum dimensions:

Height	Length	Depth
8 ‘6”	7’	5’6”

6.0 ROUTINE AND DESIGN TESTS

6.1 Routine Tests

The contractor shall perform the routine tests, on all transformers, that are specified in Section 8 of IEEE C57.12.00, including routine type Lightning Impulse (BIL) testing. All testing shall be performed as per IEEE C57.12.90.

6.2 Design and Other Tests

The contractor is to perform the following design and other tests on all transformers, as per Section 8, Table 21 of IEEE C57.12.00: No-Load Loss and Excitation Current, Impedance Voltage and Load Loss. All testing shall be performed as per IEEE C57.12.90.

All transformers supplied to AE shall meet or exceed the efficiency values in accordance with Department of Energy 10 CFR 431 part III - Energy Conservation program for Commercial Equipment: Distribution Transformers Energy Conservation Standards table I.1. Any transformers not complying with Department of Energy efficiency ratings shall be rejected. Certified test data by serial number shall be provided with each transformer.

Contractor shall provide at time of bid certification that all transformer components are compatible with Dielectric Fluid provided.

AE may require the contractor to perform additional design and other tests on an as-needed basis. If so, AE will list the tests as a separate line item in the bid. All such testing shall be performed as per IEEE C57.12.90.

6.3 Required Information

For each item, the Bidder shall supply the following information on the bid sheet:

6.3.1. *Guaranteed No-Load Losses*, in watts, corrected to 20°C: Those losses which are incident to the excitation of the transformer. They are the losses of the transformer excited at rated voltage and frequency, but not supplying load. No-load losses are to be measured as per IEEE C57.12.90.

6.3.2. *Guaranteed Load Losses*, in watts, corrected to 85°C: Those losses which are incident to the carrying of a specified load. They are the losses of the transformer excited at rated voltage, frequency, and current. Load losses are to be measured as per IEEE C57.12.90.

6.3.3. *Guaranteed Total Losses*, in watts: The sum of the No-Load and Load Losses.

6.3.4. *Bid Amount*, per individual transformer.

6.3.5. *Adder for No-Load Losses*, per individual transformer: This amount is equal to (Guaranteed No-Load Losses, in watts) x ($5.239 per watt).

6.3.6. *Adder for Load Losses*, per individual transformer: This amount is equal to (Guaranteed Load Losses, in watts) x ($3.123 per watt).

6.3.7. *Total Owning Cost per Individual Transformer*: This amount is equal to the sum of the Bid Amount, the Adder for No-Load Losses, and the Adder for Load Losses.

6.3.8. *Total Owning Cost for the Estimated Annual Usage*: This amount is equal to (Total Owning Cost per Individual Transformer) x (Estimated Annual Usage).

6.4 Acceptance of Transformer Delivery and Losses Evaluation

6.4.1. Manufacturer's Test Report

Prior to the delivery of a transformer, the vendor shall provide a manufacturer's test report to the AE Distribution Standards Engineer. The test report shall contain the information as shown in Attachment II. The test report shall be emailed to the AE Distribution Standards.

The vendor shall also ship a paper copy of the test report with each transformer delivery.

AE will review each manufacturer's test report and will either reject any transformer that does not meet the requirements of this specification or pay a reduced price for the transformer, as calculated by the method in section 6.4.3 of this specification.

6.4.2. Incoming Inspection by AE

AE may test transformers at the point of delivery to verify and adjust, if necessary, the manufacturer's test-report data. AE will use the verified or adjusted data to assure compliance with this specification and to perform the transformer loss evaluation.

6.4.3. Transformer Loss Evaluation

In accordance with IEEE C57.12.00, section 9.3, actual losses on each individual transformer shall not exceed the vendor's guaranteed losses by more than the following percentages:

a) No-Load Losses.....10%
b) Total Losses.....6%

Any individual transformer having actual losses that exceed these limits will be subject to the following:

a) An immediate fee of $350.00
b) Possible return of the transformer to the vendor, at the discretion of AE

Should AE elect to keep the transformer, a losses fee will be assessed on the individual transformer to offset the increased total owning cost of the high-loss transformer. The fee will be calculated according to the following formula:

Losses Fee = ($5.239/W) (Measured No-Load Losses - Guaranteed No Load Losses)
+ ($3.123/W) (Measured Load Losses - Guaranteed Load Losses)

6.4.4. Impedance Voltage Evaluation

Any individual transformer having voltage impedance that does not fall within the acceptable range given in section 4.3 of this specification will not be accepted by AE and will be returned to the vendor at the vendor's expense.

6.4.5 Any transformers not complying with Department of Energy efficiency ratings shall be rejected in accordance with section 6.2 of this specification.

7.0 SIGNAGE

TYPICAL EXTERNAL SIGNAGE MATERIAL REQUIREMENTS POLE-MOUNTED TRANSFORMERS

"NO PCBS" decal: 6 inch X 6 inch, blue. Base Film: 0.0035-inch cast polyvinyl chloride, with UV inhibitors as per MIL-M-22106A, Cyasorb UV-9 light absorber C14H1203. Gloss 80 UL 94 rated. Over lamination: 002PVF (polyvinylflouride) Tedlar UV screening film from E.I. DuPont. Cold-seal bonded. Adhesive: 0.002-inch permanent acrylic hi-tack, with high-temperature-resistant Elasticisors for adhesion at 40 deg. F. PSTC test method: #1 modified for a 15 minute dwell time, with 2 mils of adhesive, 56 oz/inch width rating. Ink: Silkscreen type 4, with automotive grade pigments and binders, 0.0004-inch thick + 0.0001, inch high pigment volume concentration total PVC 40-50 (copper phthalocyanines). Liner: 0.0007-inch + 0.001-inch Kraft coated one side chemical resistant. For Salt spray testing, 240 hours 5%, at 100 degrees, with no blistering, color change, or other material degradation. No effect when immersed in diesel fuel, motor oil, anti-freeze, detergent 2 %, ammonium hydroxide (12% and 39%), kerosene, acetic acid, acetone and water. Service temperature range: -40 to +170 deg. F. The minimum lifetime exterior durability shall be 15 years from installation date with proper surface preparation.
Approved Manufacture or equal: Mitrographers, catalog number COA-001

"SIZE kVA" decal: width as required, 2 7/8 inches tall, Engineer Grade, adhesive reflective vinyl. Yellow numbers, black back ground.

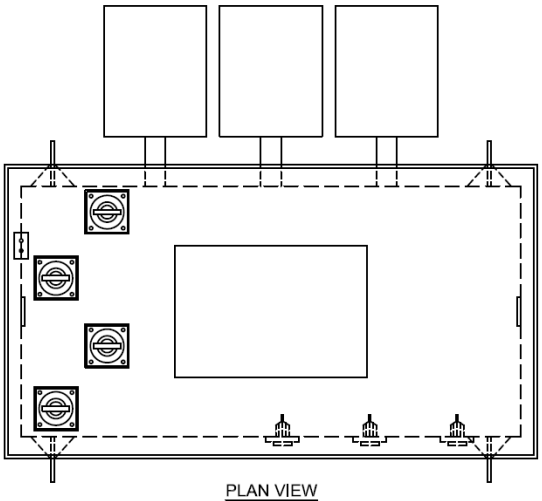
"City ID Number" decal: width as required, 2 7/8 inches tall, Engineer Grade, adhesive reflective vinyl, black numbers, Yellow back ground.

"SECONDARY VOLTAGE" decal: width as required, 2 7/8 inches tall, Engineer Grade, adhesive reflective vinyl. Yellow numbers, black back ground. Sticker shall read "L-L Voltage Y/ L-G Voltage".

ATTACHMENT 1

SEGMENT 3 (REAR)

SEGMENT 2

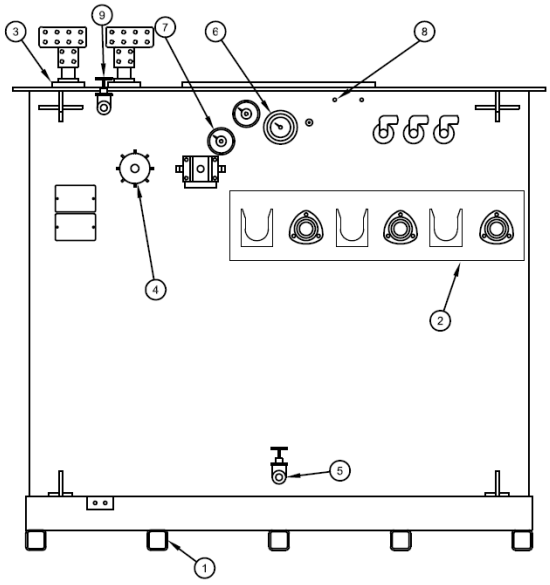


SEGMENT 4

PLAN VIEW

SEGMENT 1 (FRONT)

TRANSFORMER TOP



FRONT VIEW

TRANSFORMER BOTTOM

1. BASE
2. PRIMARY BUSHINGS
3. SECONDARY LINE TERMINALS
4. TAP CHANGER
5. OIL DRAIN VALVE
6. LIQUID LEVEL GAUGE
7. TEMP. INDICATOR
8. PRESSURE RELIEF DEVICE
9. 1" DRAIN VALVE AND SAMPLER

ATTACHMENT 2

AUSTIN ENERGY TRANSFORMER TEST REPORT FORM

(insert name of manufacturer)
CERTIFIED TRANSFORMER TEST REPORT

VENDOR NAME: _____
VENDOR PURCHASE ORDER NUMBER: _____
AUSTIN ENERGY PURCHASE ORDER NUMBER: _____
AUSTIN ENERGY STOCK NUMBER: _____

MANUFACTURER ORDER NUMBER: _____
MFG CATALOGUE NUMBER: _____
MANUFACTURER INVOICE NUMBER: _____
MFG DRAWING NUMBER: _____
TEST DATE: _____
SHIP DATE: _____

TYPE	PHASE	FREQUENCY	KVA	LOW VOLTAGE	HIGH VOLTAGE
ANSI 1	3PH	60 Hz			

SERIAL NUMBER	PERCENT IMPEDANCE	EXCITING CURRENT	LOSSES MEASURED NO-LOAD LOSS	LOSSES MEASURED LOAD LOSS	LOSSES MEASURED TOTAL LOSS	%REGULATION AT 80% PF	%REGULATION AT 100% PF	BIL (KV)	DOE EFF %
GUARANTEED LOSSES:									

NOTES:

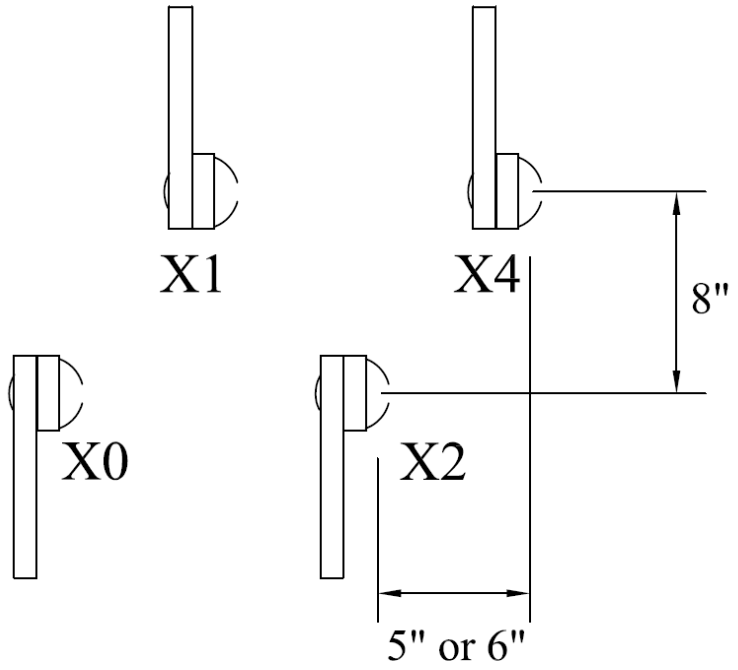
1) Losses are measured at 100% of rated voltage. No-load loss data corrected to 20° C. Load Loadd data corrected to 85°C.
2) All transformers were manufactured using insulating fluid containing less than 1 PPM PCB. ASTM D4059 Test Certification available.
3) The winding temperature rise above ambient temperature does not exceed 65°C.
4) Exciting current is measured at 100% rated load.
5) All transformers listed have received and passed the following test, in accordance with ANSI/IEEE C57.12.00, latest edition: Continuity, Ratio, Leak, Polarity and Phase Relationship, Routine Impulse, Induced Voltage, Applied Voltage.

THE MANUFACTURER CERTIFIES THAT THIS TEST REPORT IS A TRUE AND ACCURATE RECORD OF FINAL PRODUCTION-LINE TEST THAT WERE CONDUCTED IN ACCORDANCE WITH CURRENT ANSI TRANSFORMER TEST STANDARDS, AND THAT THE ABOVE TRANSFORMERS WITHSTOOD THESE TESTS.

NAME OF CERTIFYING INDIVIDUAL: _____

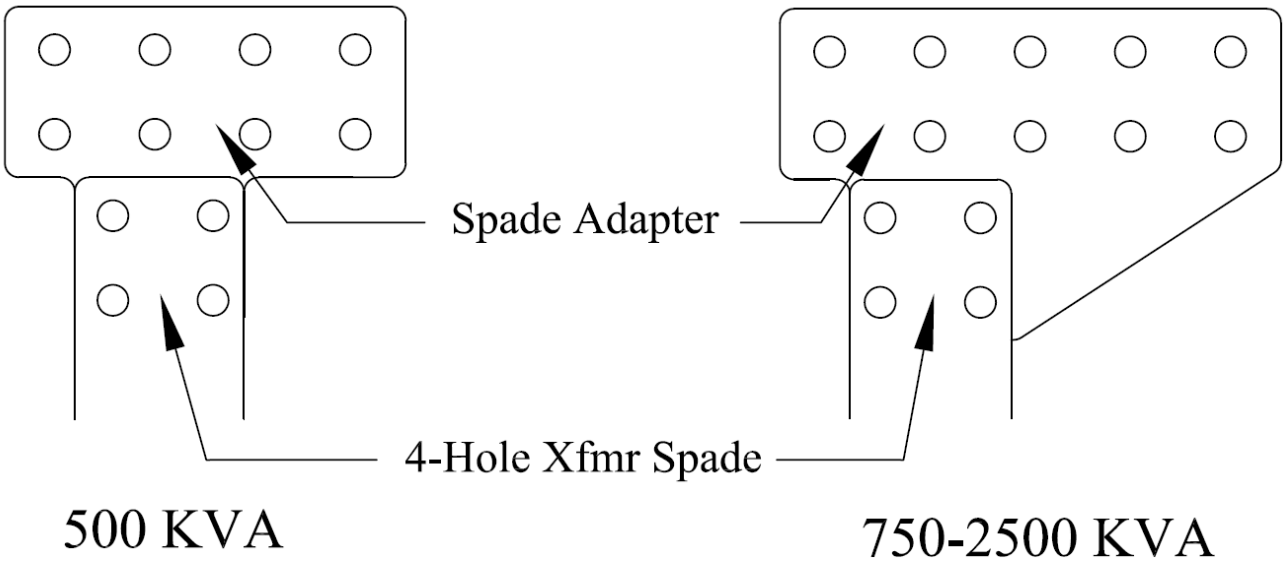
ATTACHMENT 3

Orientation of Spade Adapter



(Depending on Xfmr kVA Size)

Profile View



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