CITY OF AUSTIN - AUSTIN ENERGY (AE)

PURCHASE SPECIFICATION

FOR

TRANSFORMER, NTWK, VLT, 3PH, 500-2000 KVA, 12.47KV, 277/480Y

DATE	PREPARED BY	ISSUANCE/REVISION	APPROVAL PROCESS MANAGER/M&ESS MANAGER
05/29/97	Steve Booher	Revision	George Martinez / Peter Soosay
03/10/99	George Martinez	Revision	George Martinez / David Sloan
03/22/99	George Martinez	Revision	George Martinez / David Sloan
07/16/99	George Martinez	Revision	Carl Nance / George Martinez
03/04/05	Steven Booher	Revision	
06/27/11	Steven Booher	Revision	
10/16/15	Brantley Gosey	Revision	Michael Pittman
11/06/15	Dennis Patrick	Revision	Michael Pittman
03/10/16	Brantley Gosey	Revision	Michael Pittman
07/13/16	Brantley Gosey	Revision	Michael Pittman
12/17/18	Brantley Gosey	Revision	Julius Heslop

REASON FOR REVISION	***AFFECTED PARAGRAPHS***
03/10/99 - Change to 12.47 KV	Title change, remove 1.1.3, change ratings 1.2.2, Change BIL 1.2.4, remove contacts 3.3, add contacts 3.4, bushing 4.1, changed 4.3, added 4.9, changed losses and evaluation 7.1.
3/22/99 - Change LV throat requirements. Move General Requirements to Supplemental Terms and Conditions	Section 4.2, 6.0, 8.0, 9.0
07/16/99 - Network Transformer to include 2500 KVA, 480/277V Revised transformer ratings, Added sudden pressure Relay, Revised Evaluation	1.2.2, 4.2, 4.8 1.2.2, 3.7, 6.1
6/27/11 Add DOE requirement and revised loss requirements	3.8 and 6.1
10/16/15: Revise DOE requirement	3.8
11/06/15: Added Secondary Voltage Sticker	Section 7.0
03/10/16: Add primary network disconnect/grounding switch; changes for digital gauges and DGA indicator	Section 3.2-3.12
07/13/16: Changes back to analog gauges. Add “or buyer approved equal” for switch. Removal of DGA indicator. MFG PN correction.	Sections 3.3, 3.4, 3.7, 3.8, 3.12, 4.1
12/17/18: Add Barcoding Requirement	Section 1.2.2, 4.2, 8.0 – 8.6

This specification, until rescinded, shall apply to each future purchase and contract for the commodity described herein.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

CITY OF AUSTIN- AUSTIN ENERGY (AE)
PURCHASE SPECIFICATION
FOR
TRANSFORMER, NTWK, VLT, 3PH, 500-2000 KVA, 12.47KV, 277/480Y

1.0 SCOPE AND CLASSIFICATION

1.1 Scope

1.1.1 This specification covers three-phase oil filled network type transformers.

1.1.2 No deviations from this specification will be permitted.

1.2 Classification

1.2.1 Voltage shall be 12,470 Volts Delta, 480Y/277, or 216Y/125 Volts.

1.2.2 Transformer rating shall be 500 and 750 for 216Y/125 and 500, 1000, 1500, and 2000 kVA for 480Y/277 as specified on bid request.

1.2.3 No-load high voltage taps shall be 5% below, 2 1/2% below, rated 2 1/2% above, and 5% above.

1.2.4 Basic Insulation Level (BIL) shall be 125 kV for windings, 95 kV for bushings.

2.0 APPLICABLE STANDARDS

Network transformers furnished under these specifications shall meet all applicable, ASTM, EEI-NEMA, ANSI, AND IEEE Standards, latest revision.

2.1 ANSI C57.12.40 - Subway and Vault Types (Liquid Immersed) Requirements.

2.2 ANSI/ASTM D3487 - Mineral Insulating Oil Used in Electrical Apparatus.

2.3. ASTM D2300 - Standard Test Method for Gassing of Insulating Oils under Electrical Stress and Ionizing. Modified Pirelli Method R (1991)

2.4 ASTM D1816 - Standard Test Method for Dielectric Breakdown Voltage of Insulating Oils of Petroleum Origin Using VED Electrodes.

2.5 ASTM D877 - Standard Practices for Sampling Water-Formed Deposits. R (1994)

2.6 ASTM D971 - Standard Test Method for Interfacial Tension of Oil against Water by the Ring Method.

2.7 ASTM/D1500 - Standard Test Method for ASTM Color of Petroleum Products. (ASTM Color Scale) (IP Designation: 196/91)

2.8 ASTM D1524 - Standard Test Method for Visual Examination of Used Electrical Insulating Oils of Petroleum Origin in the field.

2.9 ASTM D1533 - Standard Test Method for Water in Insulating Liquids. (Karl Fisher Method)

2.10 ASTM D924 - Standard Test Method for Dissipation Factor and Relative Permittivity of Electric Insulating Liquids.

3.0 FUNCTIONAL REQUIREMENTS

3.1 Transformers shall be self-cooled, 65 degrees (^{o}) Centigrade (C) temperature rise above ambient, vault type construction, suitable for occasional submerged operation.

3.2 Marking of terminals, winding connections, and vector relationships of windings shall be as shown on the attached drawing (Attachment I). On the faceplate of the transformer the phase configuration shall be denoted such that the phase corresponding to H1 shall be denoted as C-phase, H2 shall be denoted as A-phase, and H3 shall be denoted as B-phase.

3.3 The transformer shall be equipped with a glass or magnetic type liquid level indicator on all oil filled compartments. The liquid level shall have a dark dial face with light markings and a light indicating hand. The dial markings shall show the 25 degrees (^{o}) centigrade (C) level and the minimum and maximum levels. The words "Liquid Level" shall be on the dial or on a suitable nameplate mounted adjacent to the indicator.

3.4 The transformer shall be equipped with a dial type thermometer on the main tank for indicating liquid temperature. The thermometer shall have a black indicating hand and a red maximum indicating hand. The main tank thermometer shall be provided with electric alarm contacts.

3.5 A primary disconnect and grounding switch shall be provided on the transformer. The primary disconnect and grounding switch shall conform to the requirements identified in IEEE standard C57.12.40-2011.

When the transformer is viewed from the side of the primary switch, with the switch handle on the right-hand side of the chamber, C-phase (H1) shall be closest to the handle, B-phase (H3) furthest from the handle, and A-phase (H2) between Phase B (H3) and C-phase (H1).

Sequential grounding sequence of operation shall be C-phase, then Phases C and A, and then Phases C, A, and B. This sequence of operation shall be identified on the switch index plate and also by stainless steel tags on the switch chamber. Those tags shall identify which phases are grounded and coordinate to the switch operation such that the operator can clearly determine which phases are grounded.

3.6 Transformers shall either utilize a primary dead break switch with sequential grounding or a primary mag break switch with sequential grounding.

3.7 Transformers using a primary dead break switch with sequential grounding, which requires de-energized operation only w/special Austin Energy sequential grounding & phase notation (C, CA, CAB). The primary dead break switch with sequential grounding shall be a Quality Switch Type QS-GBN Model 4L0201503ST3-NT1 for 208Y/120 secondary voltage or Model 4L0201503ST3-NT2 for 480Y/277 secondary voltage or buyer approved equal.

3.8 Transformers using a primary mag break switch with sequential grounding, which only interrupts exciting current w/special Austin Energy sequential grounding & phase notation (C, CA, CAB). The primary mag break switch with sequential grounding shall be a Quality Switch Type QS-GBN switch Model 4L0201503ST3-NA1 for 208Y/120 secondary voltage or Model 4L0201503ST3-NA2for 480Y/277 secondary voltage or buyer approved equal.

3.9 Alarm contacts shall be suitable for interrupting:

A. 0.02 ampere direct-current inductive load

B. 0.02 ampere direct-current noninductive load

C. 2.5 ampere alternating-current noninductive or inductive load

D. 250 volts maximum in all cases

3.10 The sudden pressure relay shall be mounted on the main tank to respond to changes in internal gas pressure. The Seal-in relay's contacts shall be for alarm and tripping and a reset switch, shall be externally mounted. The normal operating voltage of the seal-in relay shall be 125VAC. Adequate surge suppression to prevent false operations due to transient voltages on control leads shall be provided. The sudden pressure relay shall be designed such that external vibration or mechanical shocks shall not cause false operations. All mechanical provisions and equipment for testing shall be provided. In addition, the seal –in relay and wiring shall be rated for in-circuit testing with remote lockout relay.

3.11 All transformers supplied to AE shall meet or exceed the efficiency values in accordance with the latest revision of Department of Energy CFR Title 10, Volume 3, Chapter II, Subchapter D, Part 431, Subpart K – "Energy Efficiency Program for Certain Commercial and Industrial Equipment" as applicable. Certified test data by serial number shall be provided with each transformer.

4.0 PHYSICAL REQUIREMENTS

4.1 The transformer shall have 600-ampere minimum side-mounted apparatus bushings on the high side. The bushings shall be bolted to the tank for ease in replacement. Welded bushings are not acceptable. Bushings provided shall be Elastimold K675-S1 (copper) or AE approved equivalent.

4.2 The low voltage throat and bushings shall be in accordance with ANSI C57.12.40.

4.3 The neutral bushing shall be insulated from the transformer tank. The ground to tank shall be made by a flexible copper braid bolted between the transformer tank and the neutral bushing of the transformer. Copper braid size shall be equal to 500 MCM bare copper. The neutral bushing shall have a four-hole NEMA pad for 1000 kVA and smaller and a six-hole NEMA pad for 1500 and 2000 kVA transformers.

4.4 The high voltage compartment shall be completely sealed and filled with insulating oil prior to shipping.

4.5 The tap changer shall be designed for de-energized operation. An indicator shall clearly show the position of the tap changer.

4.6 The transformer tank shall be of a sealed construction, consisting of a welded main cover equipped with lifting lugs and hand-hole cover(s) with gasket.

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

4.8 Transformer sizes listed below are maximums and shall not be exceeded.

KVA	HEIGHT	LENGTH	DEPTH
500	6'0"	7'0"	3'6"
750	6'2"	7'0"	4'0"
1000	6'2"	7'6"	4'0"
1500	6'6"	8'0"	4'6"
2000	6'8"	8'6"	5'0"

4.9 All high voltage windings shall be made of copper.

5.0 INSULATING OIL REQUIREMENTS

5.1 The insulating oil shall be non-polychlorinated biphenyl (PCB), defined as containing less than one part per million (ppm) PCB. Certification of the non-PCB oil shall be furnished and shall include the method of testing used.

5.2 The transformer nameplate shall be marked “non-PCB." In addition, a blue “non-PCB” label of a minimum 1”X 2” size shall be installed directly below the nameplate.

5.3 The oil shall conform to the latest revision of ANSI/ASTM D3487, Type II. The gassing coefficient shall be negative when tested in accordance with ASTM D2300, Section 2.0.

5.4 The Contractor shall supply test reports, which verify compliance with the oil performance requirements given below:

Test and Method	
Dielectric Strength, ASTM D-1816, kV Minimum,	
0.04 inch gap:	20 kV
0.08 inch gap:	40 kV
Dielectric Strength, ASTM D-877, kV Minimum	30 kV
Power Factor, ASTM D-924,	
% maximum; 25° C	0.15
% maximum; 100 ^{o} C	1.50
Interfacial Tension, ASTM D-971, mN/m Minimum:	35
Color, ASTM D-1500, ASTM Units:	1.0
Visual Examination, ASTM D-1524	Bright and Clear
Water Content, ATSM D-1533, ppm, maximum:	25

5.5 The Contractor shall be subject upon request, to furnish laboratory test data for the insulating oil. Oil furnished under these specifications shall be subject to tests and any insulating oil failing these tests will be returned to the Contractor at the Contractor’s expense.

6.0 COST EVALUATION

6.1 All network transformer bids will be evaluated and awarded based on purchase price, guaranteed no-load losses, and guaranteed winding losses. The formula and cost of losses are as follows:

Total Evaluated Bid (owning cost) = Bid Price + (cost of no-load losses) x (quoted guaranteed no-load losses) + (Cost of winding losses) x (quoted guaranteed winding losses)

Cost of no-load losses = $5,239.00/kW

Cost of winding losses = $3,123.00/kW

6.2 Each Bidder shall quote the guaranteed no-load losses and guaranteed winding losses at the time of bid opening.

6.3 Before or upon delivery, the Contractor's certified factory test reports shall be provided to AE for final review.

6.4 Losses shall be the actual tested losses corrected to 20°C no load and 85°C for load, reported by serial number and City of Austin purchase order number for each transformer delivered.

6.5 The actual losses of any one transformer on an order shall not exceed the quoted guaranteed losses by more than the following percentages:

	No load losses	Total losses
Network Transformer	10%	6%

6.6 Penalty

For each transformer where the actual losses exceed the quoted guaranteed losses, a penalty will be assessed through a price reduction for each transformer.

Penalty = 2[($5,239.00/kW) (actual no load losses - quoted guaranteed no load losses) + ($3,123.00/kW) (actual winding losses - quoted guaranteed winding losses)]

7.0 SIGNAGE

TYPICAL EXTERNAL SIGNAGE MATERIAL REQUIREMENTS OF 3-PHASE PAD-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 (polyvinyl fluoride) 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. Salt spray: 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 decal shall last a minimum lifetime exterior durability of 15 years from installation date with proper surface preparation.

"SIZE KVA" decal: width as required, 2 7/8 inches tall, Engineer Grade, adhesive reflective vinyl, with yellow numbers, black background.

"SIZE SECONDARY" decal: width as required, 2-7/8 inches tall, Engineer Grade, adhesive reflective vinyl, with yellow numbers on Black Background. Sticker shall read "L-L VoltageY / L-G Voltage".

8.0 BARCODING

8.1 The following referenced documents are indispensable for the application of Specification E-708 (i.e., they must be understood and used, so each referenced document is cited in the text and its relationship to this document is explained). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

ANSI/AIM BC1-1995, Uniform Symbology Specification—Code 39.1
ANSI INCITS X3.182, Bar Code Print Quality Guideline.
ASTM B117, Standard Practice for Operating Salt Spray (Fog) Apparatus. 2
ASTM G154, Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.

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

IEEE Std C57.35.00TM, IEEE Standard for Barcoding for Distribution Transformers and Step-Voltage Regulators

8.2 Network Transformers shall be labeled with permanent and/or temporary bar-code labels, as specified by the user.

8.3 Permanent bar-code label

8.3.1 Purpose of the permanent bar-code label-
The information contained on the permanent bar-code label is to be used as the access key to a database after initial receipt of the equipment.

8.3.2 The permanent bar-code label shall contain ALL the information found on the nameplate including but not limited to the following data elements:

Transformers:-
a) Manufacturer Name.
b) Equipment serial number.
c) Year of Manufacturing.
d) Size of Equipment.(lbs.)
e) Type (Delta or Wye)
f) Voltage Levels (Primary Voltage L-L & Secondary Voltage "L-N/L-L")
g) Phase type (Single phase or Three Phase)
h) Capacity rating (kVA)
i) Impedance (%Z)

These data elements shall consist of combinations of one or more of the following 43 characters: 0 to 9, A To Z, -, ., /, +, $, %, and space

8.3.3 Data Format

The information encoded on the permanent bar-code label will appear as shown in Figure 1.

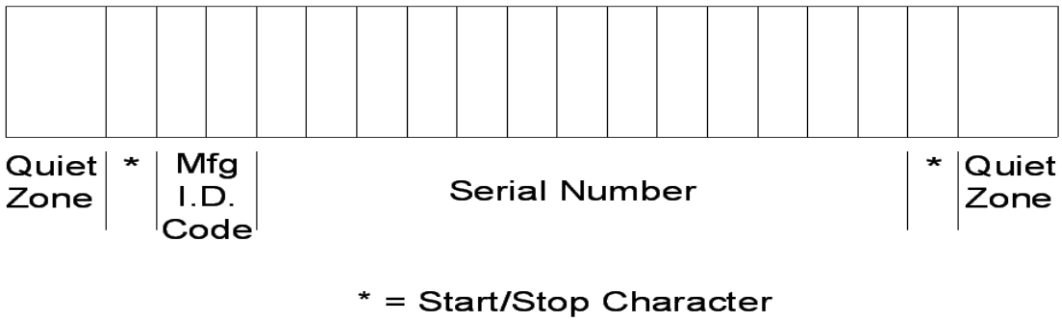


Figure 1

8.3.4 Bar-code symbology for the permanent label-The barcode symbology utilized on the permanent label shall be Code 39, also referred to as Code 3-of-9, in accordance with ANSI/AIM BC1-1995

8.4 Physical Requirements

8.4.1 Permanent label printing requirements

A) Barcode symbol print density-

The bar code symbol shall be of medium density [four to seven characters per inch (cpi)] with a narrow bar Width of 0.025 cm (0.010 in) to 0.038 cm (0.015 in), and a wide-to-narrow ratio of 3:1. The inter-character gap shall be equal in width to the width of a narrow element.

8.4.2 Quiet Zones

Quiet zones no less than 0.64 cm (0.25 in) in length shall immediately precede and follow the bar code symbol.

8.4.3 Dimensions

The height of the bar code symbol shall be no less than 0.61 cm (0.24 in).

8.4.4 Interpretation line

A human-readable interpretation of the data included in the bar code shall be printed immediately beneath the bar code symbol. The height of the interpretation line shall be no less than 0.25 cm (0.10 in).

8.4.5 Permanent bar-code label placement on equipment

The preferred location for the permanent bar-code label, including both the bar-code symbol and its accompanying interpretation line, is on the outside of the equipment (as shown in 8.6).

8.5 General Requirements

8.5.1 Permanent label quality/durability requirements and tests

A) Requirements

Permanent bar-code label symbols are intended to be readable with commonly available scanning equipment for the required lifetime of the equipment nameplate as defined by IEEE Std C57.12.00.

The readability of the nameplate bar-code label may, however, be affected by the specific scanner equipment being used and by environmental conditions in which the scanning operation is being performed. Users may wish to address these considerations in their specifications. The following durability tests described in 8.5.2 through 8.5.3 shall be performed.

NOTE—Barcodes on a 300-series stainless-steel substrate are recognized as being difficult to decode. Camera-based bar-code readers may provide the ability to read barcodes on some substrates that cannot be read with laser-type scanners.

8.5.2 Salt-spray test

A bar-code permanent nameplate shall be tested for 1500 h in a 5% salt spray in accordance with ASTM B117. Following the test, the bar-code label shall retain print quality as described in 8.5.4.

8.5.3 Ultraviolet accelerated weathering test

A bar-code permanent nameplate label shall be exposed for 500 h in accordance with ASTM G154, utilizing the FS-40 bulb with a cycle of 4-h ultraviolet at 60 °C followed by 4-h condensation at 50 °C. Following the test, the bar-code label shall retain print quality as described in 8.5.4.

8.5.4 Print quality retention

After completion of the tests described in 8.5.2 and 8.5.3, the bar-code label will have met the requirements of this standard if it can be successfully scanned. Successful scanning is achieved when a bar code is read (correctly interpreted) on four of five attempts using a wand-type or laser-type scanner. The scanner shall be used in accordance with the operating procedures specified by the scanner manufacturer.

8.6 Bar-code Label Location on Three-Phase Vault and Network-Type Transformers

The bar-code label shall be located on the high-voltage end of the transformer. See Figure 2.

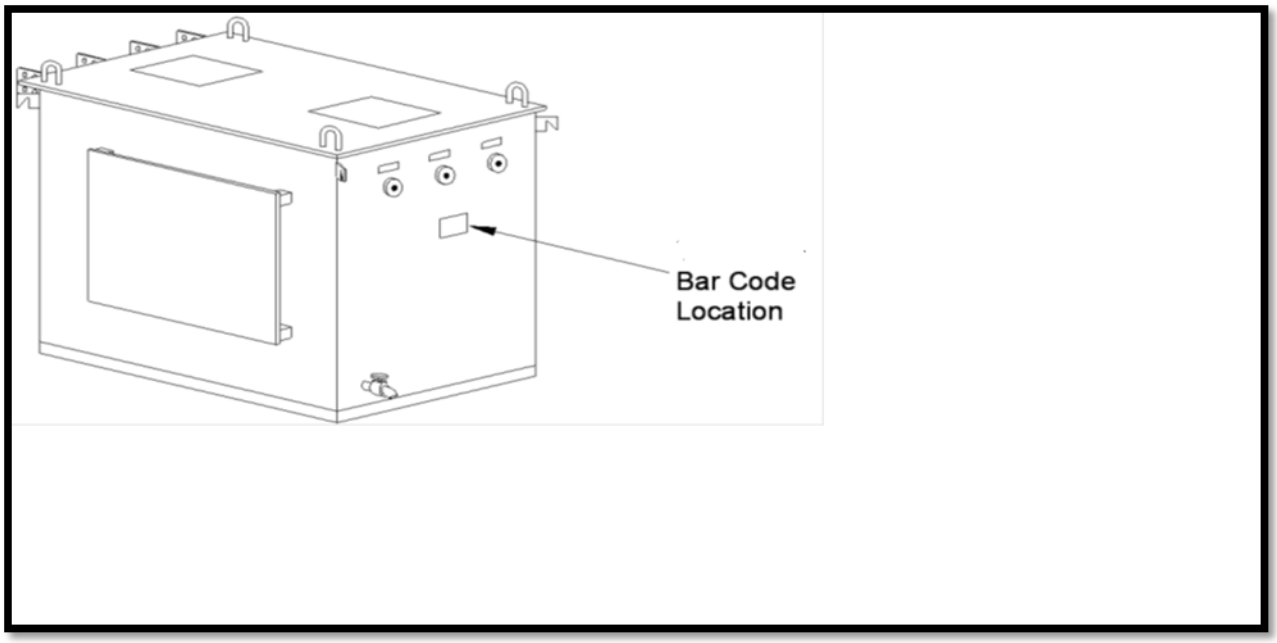
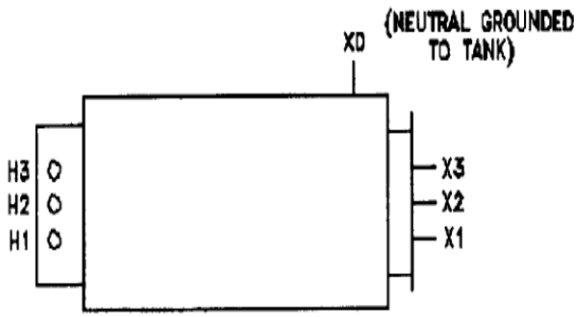
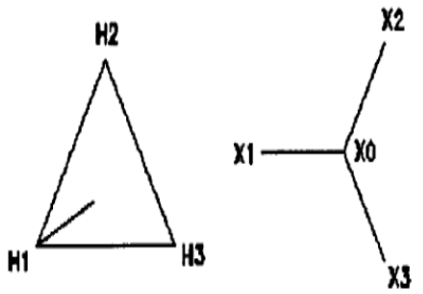


Figure 2 — Bar-code Label Location on Three-Phase Vault and Network-Type Transformers

ATTACHMENT 1



TERMINAL DESIGNATIONS



DELTA – WYE
VECTOR RELATIONSHIPS

TERMINAL DESIGNATIONS AND VECTOR RELATIONSHIPS
FOR NETWORK TRANSFORMERS

ATTACHMENT 1