TECHNICAL SPECIFICATIONS

THREE PHASE LOAD CENTER TRANSFORMERS WITH HIGH SIDE SWITCH

ITEMS: TRALC001 and TRALC002

I. GENERAL

This specification covers three phase load center spot network transformers designed for vault installation. These units shall represent the highest quality in design, materials and workmanship and shall be manufactured and tested in accordance with the latest revisions of NEMA Pub. No. TR27 and the latest ANSI and IEEE standards for dry-type transformers of this class.

II. INFORMATION RELATIVE TO SYSTEM

The transformers described by this specification are intended for use on low-voltage network systems, and must be designed to operate in parallel with 5.75% impedance. The primary supply is provided by an underground 13,200/7620 volt, 60 hertz, distribution system. The secondary voltage shall be 480Y/277.

III. GENERAL REQUIREMENTS

III.1. INDUSTRY STANDARDS

Transformers supplied under this specification shall meet the requirements of the latest revision of the following list of standards and guides established for distribution transformers except where they conflict with JEA specifications, in which case JEA specifications shall apply.

AMERICAN STANDARD TESTING OF MATERIALS (ASTM)
AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
CODE OF FEDERAL REGULATIONS (EPA)
EDISON ELECTRIC INSTITUTE (EEI)
FEDERAL LAWS "RCRA" AND "CERCLA" FOR HAZARDOUS WASTE
INSTITUTE OF ELECTRICAL & ELECTRONICS ENGINEERING (IEEE)
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
NATIONAL ELECTRIC MANUFACTURERS ASSOCIATION (NEMA)
SOUTHEASTERN ELECTRIC EXCHANGE (SEE)

III.2. ENVIRONMENTAL ACCEPTABILITY

III.2.1. Transformers will be environmentally acceptable and, as of the date of manufacture, shall comply with all laws in effect, pertaining to hazardous chemicals.

III.3. TECHNICAL INQUIRIES

Any inquiry relating to the Technical Specifications of this IFB shall be directed to the technical evaluator:

JEA
Electric Distribution Standards
21 W. Church Street, 5th Floor Tower
Jacksonville, Florida 32202-3139
Phone No: (904) 665-6065
Fax No: (904) 665-4276

Bidder's questions may be communicated by telephone or fax. All such questions must be confirmed in writing. If further explanation is deemed necessary, the buyer will notify each bidder by addendum to these IFB documents.

IV. LIST OF APPROVED MANUFACTURERS

A listing of APPROVED MANUFACTURERS for each specific Distribution Transformer ITEM ID is shown in the JEA "Master Material Catalog – Electric" on jea.com at the following URL.
http://externalapps.jea.com/IABReporting/reports/jeaecatl.pdf
Bidders may sub-contract work to any of these Manufacturers for said ITEM ID's.

V. MATERIAL

Incoming material shall be inspected by qualified Quality Control Personnel. Material such as primary and secondary conductor, insulation materials, gasket material and core steel shall be checked and tested at regular intervals to insure that quality is uniform throughout and has not deteriorated during storage. New material or design changes, or transformer components, such as bushings, bayonets, latching devices, paint systems, or brackets shall be submitted to JEA for approval prior to inclusion in manufacturing.

V.1. REPAIR PARTS

A parts list will be furnished, upon request, for repair equipment. Lists will cover items such as gaskets, bushings, tap changers, etc.

V.2. ELIGIBILITY OF MATERIAL

V.2.1. Manufacturers and catalog numbers listed in the latest revision of the JEA "Master Material Catalog – Electric" or described in the technical portion of this specification may be bid.

V.2.2. All reasonable efforts will be made by the JEA to eliminate errors in the aforementioned master material catalog which might result in a bidder bidding an item eventually ruled unacceptable by JEA, but such possible occurrence shall not become the basis for any claim for damage or loss.

V.2.3. All Bidders are hereby advised to bid the item in accordance with the supplied technical data within this IFB. The "Brief Description" entered on the Bid Form is used as a reference tool to locate that particular item within the technical specifications and should in no way be used as the basis of pricing.

V.2.4. Bids submitted by vendors for unapproved manufacturers, or unapproved catalog numbers of approved manufacturers will not be evaluated.

V.2.5. Bidding and/or supplying products in the past not listed on the JEA master material catalog does not constitute approval.

VI. WARRANTY

As a reference for this technical specification; the following warranty requirements are dictated and shown in section 12.8 of the Solicitation and Contract Documents: "JEA will pay no freight charges on warranty transformers. Warranty will be two (2) years from date of installation or three (3) years from date of delivery, whichever comes first".

VII. COMPLIANCE WITH SPECIFICATIONS

If a discrepancy exists between the bid description and the approved technical data, the approved technical data will be the deciding and binding factor as to the exact item required. It will be the Contractor's responsibility to accept all additional expenses incurred for correcting material not bid in accordance with Section VI, Technical Specifications.

VIII. APPROVED MANUFACTURES

Prior to the JEA Purchasing Department posting an Invitation for Bid (IFB) or a Request for Proposal (RFP), only those manufacturers listed in the JEA Master Material Catalogs posted on JEA.com for each specific item shall be approved to bid or provide a proposal.

IX. SUBMITTAL REQUIREMENTS

The following information must be provided and approved following the BID opening within 5 days of request.

IX.1. The Technical Specifications The Technical Specifications Part A through Part I list approved manufacturer catalog numbers for various components, consisting of but not limited to, primary and secondary bushings, primary bushing inserts, secondary connectors or kits, ground lugs, lightning arresters, tap changers, weak links, clip fuses and bayonets.

IX.2. Manufacturer must supply total winding loss as defined by ANSI which includes stray losses for bid evaluation, and must list impedance and efficiency in the columns provided. Data shall be guaranteed for all transformers subject to tolerance stated in ANSI Standard C57.12.00, Table 16.

IX.2.1.1. No Load Loss in kW at 50% loading & 85º C.

IX.2.1.2. Load Loss in kW at 50% loading & 85º C.

IX.3. Manufacturer must submit one copy of shop drawings, catalog details and/or other submittals as required by the Technical Specifications for individual bid items within 5 days of request for approval to:

JEA
Underground Distribution Standards
21 West Church Street, 5th Floor
Jacksonville, Florida 32202

IX.4. Submitted shop drawings and all other submittals will be reviewed and one copy will be returned marked either approved or resubmit. If shop drawings are marked resubmit, make corrections as shown and resubmit for approval. Cover letter must reference each ITEM ID No Purchase Order shall be issued until Shop Drawings have been approved by JEA. No material shall be shipped until approved shop drawings have been received by the manufacturer.

IX.5. Shop Drawings from the Successful Bidder shall include Dimensions for Each Item ID as well as Manufacturers' Catalog Numbers for each item.

IX.6. Shop Drawings from the Successful Bidder shall include the information as seen on an Excel Spreadsheet shown on page 11 of 11 (blank to be provided by JEA).

X. COMPONENTS

All components shall be installed in accordance with component manufacturers' instructions.

XI. INSULATION

XI.1. The epoxy resin used for casting the coils shall have high electrical, mechanical and thermal strength. All epoxy shall be of dense fiberglass reinforced epoxide or hydroxyl cross-linking group epoxy resins forming a solid dielectric and have built-in self cleaning smooth unobstructed cooling ducts. The insulation shall be non moisture absorbent at 100% humidity having no cracks, gaps or voids. The primary windings shall be cast under vacuum.

XI.2. Nomex H insulating material may be used between layers for dielectric strength, but should not lessen the structural strength of the cast.

XI.3. The difference in the coefficient of expansion between the resin used and copper windings will not exceed 30x10-6. Aluminum windings will not exceed 24x10E-6.

XI.4. The insulation class of the windings with a minimum hot spot rating shall be not less than 150^{O}C at 15 kV. The temperature rise shall not exceed 70^{O}C above an ambient of 50^{O}C.

XI.5. Molded epoxy shall encase the primary and secondary taps of each coil to sufficiently secure them from movement for any reason during the life of the transformer.

XII. COIL CONSTRUCTION

XII.1. Copper or aluminum conductor may be used for both primary and secondary coils. The primary windings shall be cast under vacuum, and the secondary shall be either wire windings under vacuum casting or sheet windings encapsulated in epoxy. Both the primary and secondary windings of one phase shall be separately cast and heat bonded as one rigid tubular coil with no rigid mechanical connection between their coaxial arrangement. The coils shall be non-flammable, and self extinguishing after electric arc and during fault conditions as specified by NEMA or ANSI. The coils shall be suitable for operation in an ambient temperature range of -50^{O}C to +50^{O}C without degradation or cracking of the epoxy insulation system. Insulation system shall be nonexplosive, non toxic, fire resistant, air insulated, cooled by natural convection and forced air. The primary windings shall be corona free up to 25,000 volts RMS.

XII.2. The impregnation and casting procedure shall utilize a machined metal mold under vacuum to assure mechanical and electrical tolerances as well as to assure a void free homogeneous casting.

XII.3. The cast coils shall not absorb any humidity and shall be suitable for tropical climates with ambient temperatures of 50^{O}C and 100% humidity, and after a prolonged period of storage be able to be switched on with full rated voltage and load without any drying process.

XII.4. All transformer coils shall be designed to maintain their full nameplate KVA rating throughout the temperature range. All materials used shall be of the 65ºC (80ºC hot spot) class and be thoroughly tested for compatibility with all transformer components before inserted into design.

XII.5. All primary and secondary windings shall be free of burrs or defects.

XII.6. All connections to sheet windings shall be metallurgical bonded with conduction in area significantly greater than the area of the coil lead cross section.

XII.7. When aluminum risers are used, special attention must be called to the connections at the secondary bus. If EC grade aluminum is used, a T6061 hard aluminum pad shall be welded at this junction to insure a good aluminum to copper electrical path, and at the same time "trap" the metal so that no cold flow can occur. All welds shall have a conduction area significantly greater than the cross section of the riser. Only brass nuts, bolts and washers used as current carrying components shall be used at or above the oil level. All bolted connections shall be cleaned with proper solvents and or abrasives prior to assembly.

XII.8. Special attention shall also be given to primary lead connections. If aluminum wire is used, the connector should be of the type that traps the aluminum and cuts through the insulation and oxide. The riser within the coil shall be securely anchored to prevent the lead from being pulled out during assembly, shipment or repair.

XII.9. The completed coil shall have a neat, clean appearance free from rips, debris or ragged insulation.

XII.10. The coil shall be manufactured domestically (i.e. US or Canada).

XIII. CORE CONSTRUCTION

XIII.1. Transformer cores shall be constructed of high grade, grain oriented, non-aging silicon steel stacked in step or cruciform configuration to accommodate a round coil. The core shall be manufactured domestically (i.e. US or Canada). Joints shall utilize a miter cut with close tolerances to secure a gap free flux path. All shearing and slitting of core steel shall yield burrless edges. Assembled core shall be coated for corrosion prevention and noise reduction.

XIV. CORE AND COIL ASSEMBLY

XIV.1. The individual coils shall be assembled on the core so that an even compression on the coils is maintained through the warming/cooling cycles. Compression shall remain constant in the event of

unequal movement of the high and low voltage coils. Coil assembly shall provide excellent short circuit strength and allow for uniform circulation of cooling air flow through the windings.

XIV.2. The entire assembly shall be isolated by sound dampening pads to minimize the transmission of core vibration. Sound levels with and without cooling fans will not exceed the following:

KVA SIZE	MAX db
1000/1500	64/68
1500/2250	65/71

XIV.3. The high voltage taps shall be provided within epoxy bushings located on each coil. Tap changers will have two positions above and below nominal voltage of two steps of 2.5% each for a total range of 10%. Proper voltage shall be selected by repositioning a copper bus link over the desired position number on each leg. The low voltage neutral shall be brought out to a six (6) hole NEMA terminal which is solidly grounded to the case. A stainless steel or otherwise approved ground pad shall be provided on the case.

XV. TRANSFORMER CASE

XV.1. The transformer case shall be of free standing dead front steel construction with four removable lifting lugs provided at or near the top. Also, four removable lifting eyes shall be provided on the base to lift the unit with a crane using a spreader bar. The lifting lugs shall be accessible from the top without having to remove the top panels, and will lift the frame and panels from the base when required. All metal parts shall be free of rust, welding slag or spatter and other contamination before entering the painting process. The transformer case shall consist of internal bracing to secure the element from movement and damage. Dimensions of the fully assembled transformer with switches and arrestors are not to exceed 54"Wx126"Lx94"H for the 1000/1500 Kva Units and 54"Wx126"Lx96"H for the 1500/2250 Kva Units. Any variance from these dimensions will be discussed with and approved by the Underground Distribution Standards Committee prior to manufacture. The case shall be designed for jacking, rolling or sliding the complete unit from the bottom in either direction.

XV.2. A metal barrier shall be provided between the arrestors and other components to provide protection of the other equipment in the event of violent arrestor failure.

XV.3. The case finish color shall be light gray for indoor (ANSI NO. 61). It shall be shot blasted or treated with a phosphatizing agent to provide a good bond with the primer and prevent corrosion. All parts shall be complete before painted, galvanized or laminated. The tank finish shall consist of sufficient coat(s) of high grade quality paint which will not fade, blister or chalk and will be scuff resistant, to insure a system which is exceptionally for a minimum 1 year warranty period.

XV.4. Sheet metal shall be minimum 12 gauge. The panels shall have louvers for air convection on all side panels. Removable panels on the front, rear and switch end shall be side-hinged and latch able, have two lifting handles per door so that the panels may be opened and lifted off if required for access to the core, coils, arrestor and switch compartment. The panel where the low voltage neutral is brought out to a six (6) hole NEMA terminal shall be two parts (upper panel & lower panel). The upper panel is located at the NEMA terminal and the lower panel begins immediately below the NEMA terminal and is completely independent of the upper. This shall allow removal of the lower panel without having to disconnect any grounding cables.

XV.5. A 1/2" knockout shall be supplied for flex conduit attachment for the circuit to the protector interlock. It shall be 7.5" from the side and 23.5" from the bottom left corner of the protector end of the case.

XVI. ACCESSORY EQUIPMENT

In addition to the standard accessory equipment described in NEMA and ANSI standards, the following items shall be included:

XVI.1. HIGH VOLTAGE SWITCH/TERMINAL ASSEMBLY

XVI.1.1. A three position (closed, open, ground) air, load break or non-load-break, high voltage, three phase rotary switch shall be shipped assembled in a switch/terminal compartment with the transformer. The switches will be capable of carrying 200 amperes continuously and 15 kA for two seconds. When they are moved from open to ground or ground to open, a pause is enforced in the closed position to allow time for the electrical interlock to engage if the transformer is energized. The interlock shall be normally closed when the transformer is energized. The interlock contacts and terminal board shall have a cover and warning label for protection during cleaning. The operating sequence shall be closed (line voltage connected to the transformer) open (line voltage disconnected from the transformer) ground (line voltage solidly grounded). An inspection window shall be furnished in the switch/terminal compartment door such that the operator can clearly determine the status of all three switches without opening the door. (All switches will have visible air gap). A single electric interlock will be provided in accordance with ANSI C57.12.40 to prevent movement of the switch from any position when the transformer is energized. External switching shall be provided with provisions for padlocking. The enclosure shall be marked to indicate the position of the switch. The high voltage switch/terminal compartment shall be fitted with three high voltage epoxy or nylon bushing wells with removable studs (Components 702-322-73) suitable for receiving loadbreak inserts. 26kV bushing inserts with drain lug shall be supplied and installed (Chardon 9U02BA001, Cooper 2637612C01M or Elastimold 2701-A4). Dust covers shall also be installed. High voltage leads (from the load side switch to the transformer coils) shall be 15 kV cable.

XVI.1.2. The approved switch manufacturers are GE, ABB, Cleveland Price, Gilbert and Siemens. The switch shall be manufactured domestically (i.e. US or Canada).

XVI.1.3. Drawings of the total assembly shall be submitted and approved prior to manufacture.

XVI.2. LOW VOLTAGE COMPARTMENT

Secondary spacing shall be based on full phase to phase or phase to ground ratings. The low voltage transition compartment shall be designed to interface the transformer and a network protector. The low voltage throat shall be built per ANSI C57.12.40 and centered on the opposite end of the primary switches. The center line of the throat shall be 60 inches above the floor. Flex buss and terminations will be shipped in boxes with each transformer. The protector gasket shall be provided with each transformer. Neutral terminations and angular displacement between the primary and secondary will be in accordance with ANSI C57.12.40.

XVI.3. ARRESTORS

Distribution class poly-arrestors shall be provided and installed on the transformer side of the switch with provisions to fully ground to the system at a common point with 15kV rated leads.

XVI.4. THERMAL PROTECTION

Each phase shall be supplied with a thermal sensor connected to a device which can be connected to an alarm, or in series with the holding coil of a contactor. The alarm contacts shall be wired to a relay which will operate a light located on the control panel to indicate that the alarm has tripped. The alarm relay shall have a reset button.

XVI.5. COOLING FANS

At least 1/3 HP cooling fans will be provided with the transformer having thermostatically and manually controlled forced air operation. They will be flush mounted either on the side or bottom and pre-wired. If duct work is supplied, at least two fans will be supplied for redundancy. 120 volt power for the fans shall be supplied from the transformer secondary. Oilers are required on all fans for lubrication

XVI.6. IDENTIFICATION

Terminal markings and the name plate will be accordance with C57.12.40.

XVI.7. REMOTE CONTROL PANEL

The following equipment shall be mounted on an external control panel in conjunction and inclusive with Qualitrol digital controls series 108-004. The panel shall be hinged and latched.

XVI.7.1. Temperature indicator in degree graduation to 200^{O}C Thermo-couples with encapsulated leads to provide thermal and electrical protection in each phase.

XVI.7.2. Thermostat controls for the fans (energize at 110^{O}C and de-energize at 90^{O}C).

XVI.7.3. Digital temperature indicator to 260^{O}C.

XVI.7.4. An amber light indicating 150^{O}C.

XVI.7.5. A red light and a bell indicating 160^{O}C.

XVI.7.6. Contacts to trip a 30 Amp chemical fuse breaker at 170^{O}C.

XVI.7.7. A "G" shock indicator.

XVI.7.8. Fan switch to set either manual or automatic (thermostatically controlled) operation and exercise cycle.

XVI.7.9. Circuit breakers and fuses shall be sized and installed for all of the above equipment, and step-down transformer if used.

XVI.7.10. 1/4 Amp panel fuse.

XVI.7.11. Parts list of above equipment, including fans, for replacement.

XVI.8. HARDWARE

All hardware shall be either stainless steel or galvanized. Electrical connections shall be brass, copper or stainless.

XVI.9. GROUNDING SPADES

A two hole grounding spade shall be supplied on the outside of the case for grounding the transformer. It shall be a permanent part of the frame providing grounding protection when the panels are removed.

XVII. INSTRUCTION BOOK

An instruction book shall be supplied for each unit by serial number which contains information on the assembly, operation, maintenance and storage of the transformer and all accessory equipment. A bulletin which describes the high voltage switch shall also be supplied with each unit.

XVIII. POLARITY AND MARKING OF TERMINALS

The polarity and terminal marking of this transformer shall be according to NEMA standards TR27.

XIX. FINAL TESTING AND INSPECTION

XIX.1. The method of testing shall be per NEMA standards TR27 for dry-type transformers, and as stated below:

XIX.1.1. Transformers leaving the production line shall be tested for the following:

Polarity
Ratio-On all taps
Load Losses (or Winding Losses)
No Load Losses (or Core Losses)
Impedance
Dielectric (Induced - Potential)
Impulse
Partial discharge @ 2 times normal voltage
(>10 picocoulombs @ 25 kV RMS)

XIX.1.2. Prototype transformers of each design shall have been tested for:

Audible Sound Level
Short Circuit
Heat Loss in KW
Radio Interference (partial discharge)
Life Test

XIX.2. Three certified copies of all final test results including load and no load tests shall be supplied with each transformer within 30 days after delivery. The report is to be E-mailed to JEA UG Distribution Standards. JEA to supply address upon award of contract and changes as necessary.

XIX.2.1. JEA to supply E-Mail address upon award of contract.

A. Customer: JEA
B. JEA Purchase Order Number
C. Quantity Ordered
D. JEA IFB number
E. Bid item number
F. Core Loss of each transformer
G. Average core loss of all transformers on report
H. Winding Loss of each transformer
I. Average winding loss of all transformers on report
J. Impulse Test Statement.
K. KVA size
L. Primary voltage
M. Secondary voltage
N. Impedance

XIX.3. Transformer manufacturers shall supply a final testing schedule to JEA so arrangements can be made to witness the testing by JEA personnel.

XX. DELIVERY

XX.1. Terminations, jumpers, flex buss, spare parts and any other material not attached will be packaged in separate crates or boxes, but will be shipped with each transformer inside the low voltage compartment (on same pallet).

XX.2. A thick, plastic, heat shrink wrap ultraviolet cover shall be provided over the transformer, switch and protector throat for protection during normal handling and shipping.

XX.3. An additional cover for the terminal bushing compartment shall also be provided to protect them from exposure.

XX.4. There shall be a minimum of four inches of clearance between the base of the transformer and the bed of the truck to allow the unit to be off loaded using a fork lift/tow motor. The center of gravity shall be marked on both sides of the plastic cover.

XXI. RATINGS

The primary voltage, secondary voltage, KVA and minimum BIL ratings shall be as follows:

TRANSFORMER RATINGS

ITEM ID	KVA SIZES	INCREASED KVA CAPACITY *	PRIMARY VOLTAGE	SECONDARY VOLTAGE	BIL (KV)
TRALC001	1000	1500	13200 Delta	480Y/277	95/10
TRALC002	1500	2250	13200 Delta	480Y/277	95/10

* Each transformer shall have the ability to sustain a 50% total increased KVA capacity:

17% thermal overload
+ 33% forced air overload
50% total increased capacity

XXII. ANNUAL TRAINING

Each manufacturer that receives an award under this Contract shall be required to provide annually a one day seminar on transformers to JEA personnel at JEA's facility. The seminar shall be at no additional cost to JEA.

XXIII. LOSS SUMMARY REPORT

XXIII.1. A LOSS SUMMARY REPORT (following) must be used and certified by the Manufacturer covering all transformers shipped annually during the term of the Contract. This form must be submitted within 30 days after the last transformer shipment each year to:

JEA
Distribution Electric Standards
21 West Church Street, 5th Floor
Jacksonville, Florida 32202

NOTES: 1. No other test reports are required at this address.
2. P.O. numbers are not required on the final summary report.

XXIII.2. It is JEA's expectation that the manufacturer shall meet the quoted losses throughout the term of the contract. JEA will accept for delivery transformers which meet the losses quoted in the bid form plus/minus the material tolerances allowed by ANSI. Each manufacturer is required to submit annually a Final Summary Report. The average load and no load losses for all transformers shipped shall meet the quantities quoted plus one percent. JEA reserves the right to charge the manufacturer for excess losses.

XXIV. TRANSFORMER EFFICIENCY REQUIREMENTS

The transformers supplied under this specification shall meet the minimum transformer efficiencies, as described by the Federal Register, Part III, Department of Energy, 10 CFR Part 431, Energy conservation Program for Commercial Equipment: Distribution Transformers Energy conservation Standards; Final Rule, Friday , October 12, 2007 "Final Rule".

XXIV.1. A PORTION OF TABLE I.2. – STANDARD LEVELS FOR MEDIUM-VOLTAGE, DRY-TYPE DISTRIBUTION TRANSFORMERS IS SHOWN BELOW FOR INFORMATION PURPOSES.

Three Phase	
KVA	Efficiency
500	99.25
750	99.32
1000	99.36
1500	99.42
2000	99.46
2500	99.49

Note: All efficiency values are at 50 percent of nameplate-rated load, determined according to the DOE test procedure. 10 CFR Part 431, Sub-part K, Appendix A

Field Name	Description	Typical Data (Examples shown below)

MANUFACTURER
TRANSFORMER TEST REPORT SHEET

"LOSS SUMMARY REPORT"
FOR

JEA IFB NO._____

BID ITEM NO.	JEA ITEM ID	TOTAL QTY.* ORDERED	AVERAGE * CORE LOSS	AVERAGE * WINDING LOSS

* FOR THE 12 MONTH PERIOD

MANUFACTURER NAME:_____

ITEM ID	JEA ITEM ID	TRACG001
INDEX	file index number (not user assigned)	
TYPE	Transformer Type POLE=Poletype RPAD=1PH Padmount CPAD=3PH Padmount VAULT=3PH Vault type	POLE
PRI	Primary Voltage Description	14760/25565Y
SEC	Secondary Voltage Description	120/240
KVA	kVA Rating	10
MFG	Manufacturer Code	XYZ
CATID	Catalog/Part Number	
FEATURES	Construction Features	1HV CONV
TAPS	Taps Y=Yes N=No	N
FUSE	Fuse - Series Winding	NA
FUSE2	Fuse - Parallel Winding (if DV)	NA
COST	Delivered Price	$ 477.00
NL	No Load Losses - watts @ 20deg C	74
LL	Load Losses - watts @ 85deg C	379
AUX	Auxiliery watts (fans/pumps/etc…)	0.00
IZ	%Impedance	1.82
IEX	%Exciting Current	1.00
TStray	Total Stray Losses	0.00
Eddy	Eddy Losses	0.00
AWR	Average Winding Rise - Deg C	56.50
TOR	Top Oil Rise - Deg C	45.00
HSG	Hottest Spot Gradient - Deg C	18.30
TOTC	Top Oil Time Constant (hours)	2.40
HSTC	Hottest Spot Time Constant (minutes)	10.00
N	Top Oil Exponent - p.u.	0.80
M	Hot Spot Exponent - p.u.	0.80
TOTWT	Total Weight (lbs)	353.00
INTW	Interior (Core&Coil) Weight (lbs)	171.20
TKWT	Tank and Fittings Weight (lbs)	59.30
FLUID	Fluid Gallons	12.90
HVCM	Primary Winding Conductor Material (CU/AL)	CU
HVCW	Primary Winding Conductor Weight (lbs)	22.50
LVCM	Seconday Winding Conductor Material (CU/AL)	AL
LVCW	Secondary Winding Conductor Weight (lbs)	12.90
COREWT	Core Weight (lbs)	128.72
ADIM	Total (overall) Height (inches)	37.90
BDIM	Total (overall) Width (inches)	20.70
CDIM	Total (overall) Depth (inches)	22.80
COMMENT	Manufacture comments	

CERTIFIED BY:_____ DATE:_____