PART 1 - GENERAL

1.01 WORK INCLUDED:

A. Copper-wound transformer optimized for light loading, meeting US Department of Energy proposed Candidate Standard Level (CSL) 3 efficiency, extremely low no load losses, with optional integrated efficiency & power quality meter.

B. Load Mix: Transformer shall be UL listed to feed a mix of equipment load profiles such as computers without derating or significant degradation of efficiency.

1.02 QUALITY ASSURANCE:

A. NEC Compliance: Comply with NEC as applicable to installation and construction of electrical power/distribution transformers.

B. NEMA Compliance: Comply with applicable portions of NEMA Std Pub Nos. TR 1 and TR 27 pertaining to power/distribution transformers.

C. ANSI Compliance: Comply with applicable ANSI standards pertaining to power/distribution transformers.

D. ANSI/IEEE Compliance: Comply with applicable ANSI/IEEE standards pertaining to power/distribution transformers.

E. ANSI/NEMA Compliance: Comply with NEMA Std ST 20; "Dry-Type Transformers for General Applications".

F. ANSI/UL Compliance: Comply with applicable portions of ANSI/UL 506; "Safety Standard for Specialty Transformers".

G. UL Labels: Provide distribution transformers which have been UL-listed and labelled.
1.03 SUBMITTALS:

A. Submit product data including the following:

1. Copy of ISO 14001 Certification of manufacturing operation.
2. Copy of ISO 9001 Certification of manufacturing operation.
3. Insulation system impregnant data sheet as published by supplier.
4. Construction Details including enclosure dimensions, kVA rating, primary & secondary nominal voltages, voltage taps, BIL, unit weight
5. Basic Performance characteristics including insulation class, temperature rise, core and coil materials, impedances & audible noise level, unit weight
6. Inrush Current (typical 3 cycle recovery)
7. Short Circuit Current data: Primary (Sym. O/P S/C) & Secondary (L-N/G S/C)
8. Efficiency Data
   a. No load and full load losses per NEMA ST20
   b. Linear load Efficiency data @ 1/6 load
   c. Linear load efficiency data @ 1/4, 1/2, 3/4 & full load
   d. Linear Load Efficiency @ 35% loading tested per NEMA TP-2.
   e. Efficiency under K7 load profile at 15%, 25%, 50%, 75%, 100% of nameplate rating.
9. Copy of Factory ISO 9001 documentation describing nonlinear load test program
   a. Meter and CT details including model, accuracy, serial numbers and calibration information.
SPECIFICATIONS FOR
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KNOXVILLE, TENNESSEE

10. Copy of Linear & Nonlinear load test report for a representative 75kVA transformer

11. 25 year Product Warranty Certificate

12. Packaging method for shipment (meeting specification requirements) including representative picture

13. UL and other applicable agency certifications

B. Description of manufacturer’s factory nonlinear load test program.

1. In light of the significant degradation of transformer performance when feeding nonlinear load compared to linear load, it is mandatory that the manufacturer test the transformers under nonlinear load representative of real world load mix. Transformers that have not been subject to testing under nonlinear load will not be considered for this project due to the uncertainty related to their real world performance.

2. Given the lack of a standard for testing transformers under nonlinear load, the manufacturer must have a nonlinear Load Test Program operating in the production environment that is audited and documented per quality standard ISO 9001.

3. The nonlinear load bank shall consist of a phase-neutral loading with a k7 profile, representative of a mix of typical commercial equipment.

4. Meters and CTs shall both be revenue class accurate. CTs shall be operated within their approved accuracy loading range. Dual meters shall gather simultaneous primary and secondary energy and harmonic data. Meter and CT details including model, accuracy, serial numbers and calibration information.

5. Efficiency: Measurements shall be taken at multiple load levels and plotted to show compliance with specification and correlation to the designed efficiency curve.

6. Efficiency shall be determined purely by measurements using method and instrumentation per NEMA TP-2 Standard. Other methods are not acceptable.
7. Harmonic data including current and Voltage THD at the different load levels shall be included with the test report.

C. Shop Drawings: Submit manufacturer's drawings indicating above data, dimensions, and weight loadings for transformer installations, showing layout, mountings and supports, spatial relationship to associated equipment, and transformer connections to electrical equipment.

1.04 WARRANTY

A. Transformer shall carry a 25-year pro-rated warranty, which shall be standard for the product line.

1.05 COMMERCIAL PRODUCT

A. Transformer shall be a standard item in the manufacturer’s catalog.

1.06 INTERNATIONAL STANDARDS ORGANIZATION REGISTRATION OF MANUFACTURING PLANT

A. Registration to current ISO standard is required.

B. Independent annual audits are conducted.

C. Product shall be manufactured in registered facility


E. ISO 14001:2004 Registered – Environmental Management System

1. Transformer manufacturing results in potentially significant emissions of volatile compounds and other waste. ISO 14001 registration means:

a. That a facility has had an independent environmental impact assessment of raw material sourcing and all manufacturing processes,

b. Has implemented an independent annually audited program that minimizes environmental impact during manufacturing process and includes a strictly monitored continuous improvement program.

PART 2 - PRODUCTS
2.01 ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

B. Powersmiths International Corp.

C. Substitutions are permitted, subject to meeting all the requirements of this specification AND having written approval by engineer 10 days prior to bid closing. Substitutions after bid closing are not acceptable.

2.02 TRANSFORMER SPECIFICATION

A. Compatibility: This product must facilitate the ability of the electrical system to supply a sinusoidal voltage in order to improve the long-term compatibility of the electrical system with all types of linear and nonlinear connected loads today and in the future. All national and international standards on harmonics and power quality set limits on levels of voltage distortion to maintain compatibility.

B. Copper-wound, 3-phase, common core, ventilated, dry-type, isolation transformer built to NEMA ST20 and relevant NEMA, UL and IEEE standards; 200% rated neutral; 60Hz rated; Transformers 750 kVA and less, 600 volt primary and less, shall be U.L. and CSA Listed and bear the label. All terminals, including those for changing taps, must be readily accessible by removing a front cover plate. Windings shall be continuous with terminations brazed or welded. 10kV BIL.

C. Insulation System:

1. Shall be NOMEX-based with an Epoxy Co-polymer impregnant for lowest environmental impact, long term reliability and long life expectancy

2. Class: 220 degrees C

3. Impregnant Properties for low emissions during manufacturing, highest reliability and life expectancy

4. Epoxy co-polymer

5. VOC: less than 1.65 lbs/gal (low emissions during manufacturing)
6. Water absorption (24hrs @25C): less than 0.05% (superior insulation, longer life)

7. Chemical Resistance: Must have documented excellent performance rating by supplier

8. Dielectric Strength: minimum of 3200 volts/mil dry (for superior stress, overvoltage tolerance)

9. Dissipation Factor: max. 0.02 @25C to reduce aging of insulation, extending useful life

D. Operating Temperature Rise: 130 degree C in a 40 degree C maximum ambient

E. Noise levels:
   1. Per NEMA ST-20
   2. Production Test every unit. Data to be available upon request.

F. UL Listed & Labeled K-Rating: K-7 or higher

G. Maximum No Load Losses
   1. Transformers are energized 24 hours a day for their entire life, potentially 40 years or more. These losses are incurred whether the transformer is loaded or not, and cost the user many times the purchase price of the transformer even at current energy rates.

H. Efficiency at 15% loading
   1. Data shows that transformers are typically very lightly loaded for extended periods of time, therefore to minimize operating cost under real world loading conditions, efficiency at 1/6 loading shall be maximized.
   2. Efficiency at 1/6 load shall meet or exceed: 15kVA: 97.3%, 30kVA: 97.6%, 45kVA: 97.9%, 75kVA: 98.2%, 112.5kVA: 98.4%, 150kVA: 98.5%, 225kVA: 98.6%, 300kVA: 98.7%, 500kVA: 98.8%, 750kVA: 98.9%
I. DOE 10 CFR Part 430 CSL 3 Efficiency requirement, tested per NEMA TP-2:
   1. Shall meet or exceed: 15kVA: 97.6%, 30kVA: 98.1%, 45kVA: 98.3%, 75kVA: 98.6%, 112.5kVA: 98.8%, 150kVA: 98.9%, 225kVA: 98.9%, 300kVA: 99.0%, 500kVA: 99.1%, 750kVA: 99.2%

J. Efficiency under k-7 nonlinear load at 50% of nameplate rating:
   1. 15kVA: 97.3%, 30kVA: 97.7%, 45kVA: 97.9%, 75kVA: 98.4%, 112.5kVA: 98.7%, 150kVA: 98.8%, 225kVA: 98.8%, 300kVA: 98.8%, 500kVA: 98.9%, 750kVA: 98.9%

K. Voltage Taps: For transformers 30kVA-300kVA, provide two 2-1/2% full capacity taps above and below nominal primary voltage. For transformers 15kVA and smaller as well as 500kVA and larger provide one 5% full capacity tap above and below nominal primary voltage.

L. Impedance: Between 3.5% and 5.8% unless otherwise noted.

M. Enclosure type: NEMA 2, drip-proof [optional NEMA 3R]

N. Maximum Footprint for 130 degree C rise model in a NEMA 1 enclosure:
   1. 17” Wide x 17” Deep x 27” High for 15kva.
   2. 26” Wide x 18” Deep x 30” High for 30kVA, 45kVA
   3. 33” Wide x 22” Deep x 40” High for 75kVA, 112.5kVA
   4. 38” Wide x 28” Deep x 52” High for 150kVA
   5. 38” Wide x 32” Deep x 52” High for 225kVA, 300kVA
   6. 52” Wide x 38” Deep x 61” High for 500kVA
   7. 63” Wide x 46” Deep x 67” High for 750kVA

O. OPTIONS
   1. Demonstrate compliance by providing factory production test report for every unit on this project upon shipment to customer or customer representative.
2. Lug Kit: Supply with standard screw-type lugs

PART 3 - EXECUTION

3.01 INSTALLATION OF TRANSFORMERS:

A. Install transformers as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, ANSI and IEEE standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate transformer installation work with electrical raceway and wire/cable work, as necessary for proper interface.

C. Install units on vibration mounts; comply with manufacturer's indicated installation method if any.

D. Connect transformer units to electrical wiring system; comply with requirements of other Electrical Work sections.

3.02 GROUNDING:

A. Provide equipment grounding connections, sufficiently tight to assure permanent and effective ground. Provide a separately derived grounding point for each transformer. Extend grounding conductor to an earth electrode and building steel. Where available, connect to a cold water main.

3.03 TESTING:

A. Upon completion of installation of transformers, energize primary circuit at rated voltage and frequency from normal power source and test transformers, including, but not limited to, audible sound levels, to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting. Test voltage and connect tap setting for an acceptable no load voltage level.

END OF SECTION 16461