

ULTRA-K

Series 600K

K-Rated High Efficiency Power Conditioning Transformer

15KVA – 500KVA

3 Phase General Specification

PART 1 - GENERAL

1.1 DESCRIPTION

This specification describes the design of a copper wound, multi-shielded, three phase, K-factor rated, high efficiency, power conditioning isolation transformer. The power conditioning transformer is a continuous duty rated, 600 volt class, convection cooled, dry type, isolation transformer to support harmonic rich non-linear loads while maintaining safe operating temperatures and includes superior transverse and common mode noise attenuation. The power conditioning transformer meets NEMA TP 1-2002 dry type transformer efficiency standards. In addition, the transformer is designed to achieve NEMA TP 1-2002 Table 4-2 efficiencies under a K-4, K-7 or K-13 non-linear load at or between 35% to 50% of its rating as outlined in section 2.3 K of this specification.

1.2 STANDARDS

The power conditioning system is designed in accordance with applicable portions of the following standards:

- A. NEMA TP 1-2002 Dry Type Distribution Transformer Efficiency Standards
- B. American National Standards Institute (ANSI C57.110 & C62.41-1991)
- C. Institute of Electrical and Electronic Engineers (IEEE 519-1992)
- D. National Fire Protection Association (NFPA) 70, National Electrical Code (NEC)
- E. Federal Information Processing Standards Publication 94 (FIPS Pub 94)
- F. UL Listed to Standard 1561
- G. C-UL listed to CSA Standard C22.2, No. 47-M90

PART 2 - PRODUCTS

2.1 Input Specifications

- A. Nominal AC input voltage ratings: 600 VAC, 480 VAC, 240 VAC or 208 VAC, 3 phase for transformers below 225kVA, and 600 VAC or 480 VAC, 3 phase for transformers 225kVA and above. All are designed with sufficient margin to sustain a constant input of +10% without saturation.
- B. The nominal operating frequency: 60 hertz \pm 3 hertz.
- C. The power conditioning system's primary is configured in a three phase delta. Transformers below 500kVA include full capacity taps at 2½ % increments, two (2) above and four (4) below the nominal voltage tap. 500kVA transformers include full capacity taps at 2½ % increments, one (1) above and two (2) below the nominal voltage tap.
- D. Energizing inrush current will not exceed 20 times the full load input current for ½ cycle.

2.2 Output Specifications

- A. Nominal AC output voltage ratings: 480 VAC or 208 VAC, wye derived, 60 hertz.
- B. Output impedance: 3-4 % typical.
- C. Harmonic k-rating: K-4, K-7, K-13, or K-20 rated in accordance with: $K = \sum I_h(\text{pu})^2 h^2$

2.3 Performance Specifications

- A. Load regulation: Maintained within $\pm 2.5\%$ or less of nominal, from no load to full load.
- B. Overload: 500% for 10 seconds, and 1,000% for one cycle.
- C. THD: $\leq 1\%$ added to the output voltage waveform under a linear load.
- D. Harmonic attenuation: Load generated triplen harmonics are attenuated at the primary.
- E. Output voltage: Sinusoidal with no flat topping when high crest factor (3.0 : 1), non-linear loads are present at the output.
- F. Audible noise measured at 1 meter from the unit:
 - 1. $\leq 50\text{dBA}$ for 15 KVA to 112 KVA
 - 2. $\leq 55\text{dBA}$ for 150 KVA to 225 KVA
 - 3. $\leq 60\text{dBA}$ for 300 KVA to 500 KVA
- G. Electrostatic shielding: Incorporates two, or an optional three, solid copper foil electrostatic shields which minimize inner winding capacitance, transients, and noise coupling between primary and secondary windings.
- H. Common mode noise attenuation: 126 dB with two shields, or 146dB with optional three shields.
- I. Transverse mode noise attenuation: 3 dB down at 10kHz, decaying 20 dB per decade.
- J. Efficiency: 98% typical and meets NEMA TP 1-2002 dry type transformer efficiency standards on models 15kVA and above.
- K. The power conditioning transformer is designed to achieve NEMA TP 1-2002 Table 4-2 efficiencies listed below under a K-4, K-7, or K-13 non-linear load at or between 35% to 50% load and at an operating temperature of 75 degrees C.

<u>kVA</u>	<u>Efficiency</u>
15*	97.00%
30	97.50%
50	97.70%
75	98.00%
112	98.20%
150	98.30%
225	98.50%
300	98.60%
500	98.70%

*15kVA model efficiency applicable to K4 and K7 loading only.

- L. Optional TVSS: Incorporates a fused (with front panel mounted, blown fuse lamp indicator) 3 phase, secondary connected, 6 mode spike suppression network. The TVSS is comprised of high energy metal oxide varistors with less than a 5 nanosecond response time and a maximum peak current handling capability of 40,000 amps (8x20μsec) per mode. The suppression network system will remain functional when subjected to ANSI/IEEE C62.41 Category B-3 waveforms. The spike suppression network increases the transverse mode noise attenuation to 3 dB down at 10kHz, decaying 40 dB per decade.

2.4 Output Power Ratings, Dimensions and Weights

Continuous kVA	Cabinet Dimensions (in)	Weight (lbs)
15	23"W x 20"D x 28.5"H	468
30	23"W x 20"D x 28.5"H	625
50	35"W x 25"D x 39.5"H	954
75	35"W x 25"D x 39.5"H	1196
100	41.5"W x 27.5"D x 39"H	1326
112	41.5"W x 27.5"D x 39"H	1350
150	41.5"W x 27.5"D x 39"H	1880
225	56"W x 41.5"D x 48"H	2794
300	56"W x 41.5"D x 48"H	3077
500	45"W x 48"D x 62.75"H	4860

2.5 Main Transformer

- A. Transformer windings: All copper conductor construction, with separate primary and secondary, isolated windings. The transformer conforms to NEC article 250, that specifies a separately derived power source. The neutral conductor is sized for 200% of the ampacity of the phase conductor.
- B. Terminals are provided for isolated three phase output conductors, neutral conductor and ground.
- C. All leads, wires and terminals are labeled to correspond with the circuit wiring diagram.
- D. Basic Impulse level: No less than 10,000 Volts.
- E. MTBF: $\geq 200,000$ hours.
- F. Transformer steel: Grain oriented, M6 grade, silicon steel.
- G. Flux density: $\leq 15k$ gauss.
- H. Core losses: $\leq 0.6\%$ of the KVA rating.
- I. Insulation: Class N, 200°C with a maximum temperature rise of 115°C above ambient, not exceeding 130°C under non-linear loading per UL 1561.
- J. Cooling: Natural convection.

2.6 Cabinet

- A. Enclosure: NEMA type 2 general purpose, floor mounted, and indoor enclosure.
- B. Construction: Cabinets are manufactured from 14 gauge steel with base sub-structure suitable for fork lifting.

- C. Paint: Baked on, powder coat paint finish with proper pre-treatment.
- D. Provisions exist to hardwire input and output connections to copper stand off bus located behind the front panel of the transformer cabinet. Input and output landing locations are available on either side of the transformer cabinet.

2.7 Environment

- A. Operating temperature range: -20°C to +40°C.
- B. Humidity: 0 to 95% non-condensing.
- C. Altitude: Up to 5000 feet above sea level without de-rating.

2.8 Warranty

Manufacturer guarantees equipment to be free from defects in material and workmanship for a period of 2 years following shipment from the factory.