Acme Electric®

Non-Linear Load Transformers

Product Overview

HUBBELL

About

Today's modern facilities contain electrical distribution systems with high levels of non-linear loads generated by computers, programmable controllers, variable speed drives and power converters. These non-linear loads generate harmonic current which may result in the premature failure of transformers and other electrical devices due to overheating. Harmonics adversely affect every component of the power system creating additional dielectric, thermal, and mechanical stresses.

Non-linear load or K factor transformers are designed with thermal capabilities beyond a standard distribution transformer to account for the additional losses caused by non-linear loads. These transformers are designed to minimize the thermal damage from harmonics with neutral and terminal connections sized at 200% of normal load and increased coil capacity. K-factor transformers operate up to nameplate capacity without derating.

Applications

- Educational facilities
- Financial Institutions
- Office buildings
- Electric Vehicle Chargers
- Data centers
- Hospitals and Healthcare Facilities

- Special winding techniques minimize eddy current losses.
- A double sized neutral handles excessive neutral currents.
- UL Listed for “K” Factor Loads 4, 9, & 13.

General Description and Features

The amount of harmonics produced by a given load is represented by the term “K” factor. The larger the “K” factor, the more harmonics are present. Linear loads have a “K” factor of 1; switch mode power supplies typically have a “K” factor as high as 13.

Features & Benefits

- Available in K-factors of 4, 9, & 13 the most common ratings required
- NEMA 3R Enclosure for outdoor applications
- Primary and secondary terminals come standard with lugs (up to 112.5kVA) for ease of installation
- 150°C temperature rise units are standard. 80°C and 115 degrees temperature rise available to suite the exact requirements of your application
- 10-year limited warranty to provide you piece of mind
- UL/cUL Listed to ensure compliance with local and national electrical codes
- 15 through 1,000 kVA for use in the most common low voltage applications
- An electrostatic shield to attenuate noise on the electrical system

The following guide will help you select the proper transformer when the K-factor is unknown.*

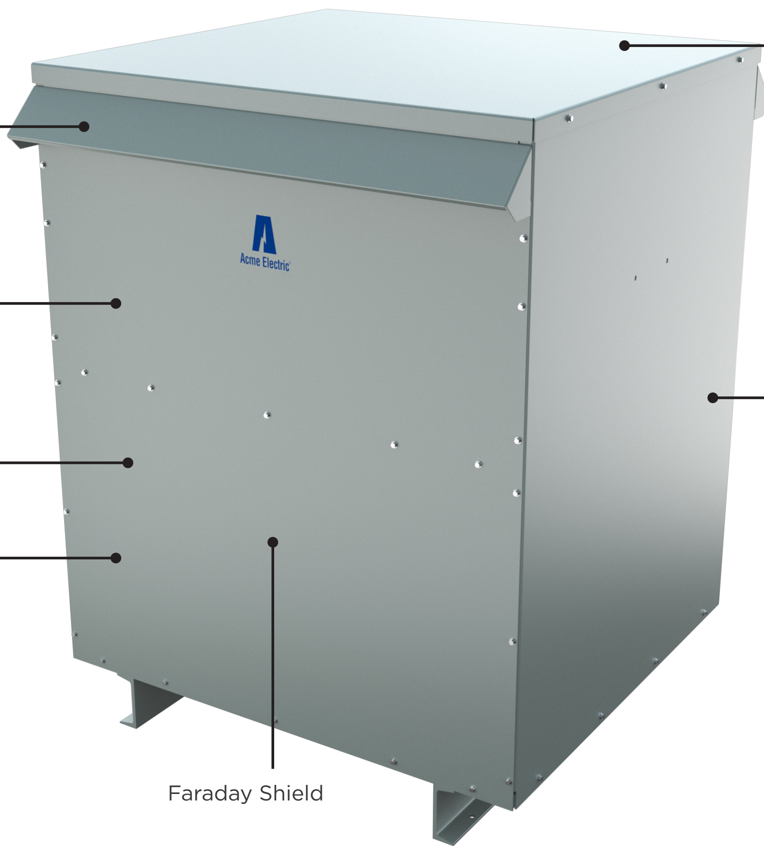
K-Factor/Type of Load

K1	Resistance heating, incandescent lighting, motors, transformers, control/distribution
K9	Welders, induction heaters, hid lighting, fluorescent lighting, solid state controls
K-13	Telecommunications equipment, branch circuits in classrooms, data centers and health care facilities

**These ratings are to be used as a guide only. They may vary from one load equipment manufacturer to another. A Spectrum Analysis is the best source.*

Note: Non-sinusoidal and non-linear are synonymous terms relating to the same transformer type.

General Description and Features



Double-sized neutral conductor handles excessive neutral currents

Selection Charts

K FACTOR 4, 150°C RISE
480 DELTA PRIMARY VOLTS — 208Y/120 SECONDARY VOLTS — 3Ø, 60 Hz — DOE/NRCan 2019 Compliant

kVA	Catalog Number	Height (Inches)(Cm.)	Width (Inches)(Cm.)	Depth (Inches)(Cm.)	Weight (Lbs.)(Kg.)	Mounting Type (Wall)(Floor)	Wiring Diagrams	Design Figures
15.0	T3015K0013BK4S	25.50 (64.8)	24.40 (62.0)	19.40 (49.3)	325 (147.0)	F(1)	22	E
30.0	T3030K0013BK4S	25.50 (64.8)	24.40 (62.0)	19.40 (49.3)	366 (166.0)	F(1)	22	E
45.0	T3045K0013BK4S	25.50 (64.8)	24.40 (62.0)	19.40 (49.3)	500 (226.8)	F(1)	22	E
75.0	T3075K0013BK4S	29.40 (74.7)	28.15 (71.5)	22.37 (56.8)	600 (272.0)	F	22	E
112.5	T3112K0013BK4S	35.40 (89.9)	31.90 (81.0)	26.87 (68.3)	938 (425.5)	F	22	E
150.0	T3150K0013BK4S	41.52 (105.5)	32.90 (83.6)	29.88 (75.9)	1213 (550.2)	F	22	E
225.0	T3225K0013BK4S	41.52 (105.5)	32.90 (83.6)	29.88 (75.9)	1600 (725.8)	F	22	E

K FACTOR 9, 150°C RISE
480 DELTA PRIMARY VOLTS — 208Y/120 SECONDARY VOLTS — 3Ø, 60 Hz — DOE/NRCan 2019 Compliant

kVA	Catalog Number	Height (Inches)(Cm.)	Width (Inches)(Cm.)	Depth (Inches)(Cm.)	Weight (Lbs.)(Kg.)	Mounting Type (Wall)(Floor)	Wiring Diagrams	Design Figures
15.0	T3015K0013BK9S	25.50 (64.8)	24.40 (62.0)	19.40 (49.3)	366 (166.0)	F(1)	22	E
30.0	T3030K0013BK9S	25.50 (64.8)	24.40 (62.0)	19.40 (49.3)	500 (226.8)	F(1)	22	E
45.0	T3045K0013BK9S	29.90 (75.9)	28.15 (71.5)	22.37 (56.8)	600 (272.0)	F(1)	22	E
75.0	T3075K0013BK9S	35.90 (91.2)	31.90 (81.0)	26.88 (68.3)	938 (425.5)	F	22	E
112.5	T3112K0013BK9S	41.52 (105.5)	32.90 (83.6)	29.88 (75.9)	1213 (550.2)	F	22	E
150.0	T3150K0013BK9S	41.52 (105.5)	32.90 (83.6)	29.88 (75.9)	1600 (725.8)	F	22	E
225.0	T3225K0013BK9S	45.60 (115.8)	39.50 (100.3)	35.50 (90.2)	1938 (879.0)	F	22	E

K FACTOR 13, 150°C RISE
480 DELTA PRIMARY VOLTS — 208Y/120 SECONDARY VOLTS — 3Ø, 60 Hz — DOE/NRCan 2019 Compliant

kVA	Catalog Number	Height (Inches)(Cm.)	Width (Inches)(Cm.)	Depth (Inches)(Cm.)	Weight (Lbs.)(Kg.)	Mounting Type (Wall)(Floor)	Wiring Diagrams	Design Figures
15.0	T3015K0013BK13S	25.50 (64.8)	24.40 (62.0)	19.40 (49.3)	366 (166.0)	F(1)	22	E
30.0	T3030K0013BK13S	25.50 (64.8)	24.40 (62.0)	19.40 (49.3)	500 (226.8)	F(1)	22	E
45.0	T3045K0013BK13S	29.90 (75.9)	28.15 (71.5)	22.37 (56.8)	600 (272.0)	F(1)	22	E
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225.0	T3225K0013BK13S	45.60 (115.8)	39.50 (100.3)	35.50 (90.2)	1938 (879.0)	F	22	E

(1) Wall mounting brackets are available for these sizes, refer to page 8.

For Additional Low Temperature Rise 115° and 80° Degree Units and Copper Wound Units, Consult Factory Non-Linear Load Isolation® Wiring Diagrams and Design Figures refer to page 7

Definition of Terms

1. Linear loads

Loads where the current waveform conforms to the waveform of the applied voltage or loads where a change in current is directly proportional to a change in applied voltage. For example:

- Resistance heating
- Water heater

2. Non-linear loads

Loads where the current waveform does not conform to the waveform of the applied voltage or loads where a change in current is not proportional to a change in applied voltage. Examples are:

- Computer power supplies
- Motor drives
- Data centers

Non-linear loads produce non-sinusoidal current or voltage waveforms.

3. Sinusoidal current or voltage

This term refers to a periodic waveform that can be expressed as the sine of a linear function of time.

4. Non-linear currents or voltages

A waveform of current or voltage which cannot be expressed as the sine of a linear function of time. A non-linear load would result in a non-sinusoidal current or voltage.

5. Harmonic

A sinusoidal waveform with a frequency that is an integral multiple of the fundamental 60 Hz frequency.

- 60 Hz Fundamental
- 120 Hz 2nd Harmonic
- 180 Hz 3rd Harmonic
- 240 Hz 4th Harmonic
- etc.

Current waveforms from non-linear loads appear distorted because the non-linear waveform is the result of adding harmonic components to the fundamental current.

6. Triplen harmonics

Odd multiples of the 3rd harmonic (3rd, 9th, 15th, 21st, etc.).

7. Harmonic distortion

Non-linear distortion of a system characterized by the appearance in the output of harmonic currents (voltages) when the input is sinusoidal.

8. Voltage harmonic distortion (VHD)

Voltage harmonic distortion is distortion caused by harmonic currents flowing through the system impedance. The utility power system has relatively low system impedance, and the VHD is very low. But, VHD on the distribution power system can be significant due to its relatively high system impedance.

9. Total harmonic distortion (THD)

The square root of the sum of the squares of all harmonic currents present in the load excluding the 60 Hz fundamental.
It is usually expressed as a percent of the fundamental.

10. Root mean squared current (or voltage) RMS

1: The vector sum of the fundamental current and the total harmonic distortion.

2: Square root of the sum of the squared value of the fundamental current and the squared value of the total harmonic distortion.

11. Eddy currents

Currents flowing in a conducting material in the presence of a time varying magnetic field. These currents are in addition to the current drawn by the load.

12. Eddy current losses

Power dissipated due to eddy currents. Includes eddy current losses in the core, windings, case and associated hardware of a transformer.

13. Stray losses

A term used to express the difference between the measured alternating current losses on a transformer and the direct current (DC) losses (I2R). Stray losses include eddy losses. Stray losses are usually expressed as a percent of the direct current (DC) losses.

14. Per unit value

1: Percent value divided by 100.

2: The ratio of two components of a system.

15. Harmonic spectrum “K” factor

The sum of the product of each harmonic current squared and that harmonic number squared for all harmonics from the fundamental (60 Hz) to the highest harmonic of any measurable consequence. When the “K” factor is multiplied by the stray losses of the transformer, the answer represents the losses in the transformer caused by harmonic currents. When these losses are added to the I2R losses of the transformer, the total load losses are known. The “K” factor for a linear load without harmonics is one (1).

Wiring Diagrams, Design Figure, Accessories

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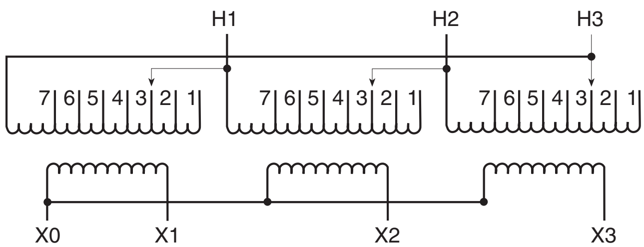
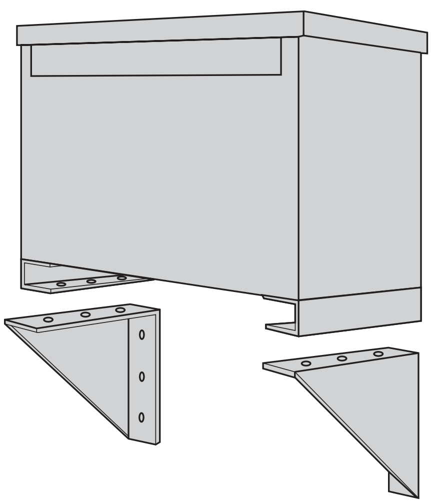
- **PRIMARY:** 480 Volts Delta
- **SECONDARY:** 208Y/120 Volts
- **TAPS:** 2, 21/2% ANFC, 4, 21/2% BNFC



Primary Volts	Connect Primary Lines To	Inter-Connect	Connect Secondary Lines To
504	H1, H2, H3	1	
492	H1, H2, H3	2	
480	H1, H2, H3	3	
468	H1, H2, H3	4	
456	H1, H2, H3	5	
444	H1, H2, H3	6	
432	H1, H2, H3	7	
Secondary Volts			
208			X1, X2, X3
120 1 phase			X1 to X0 X2 to X0 X3 to X0

WALL MOUNTING BRACKET

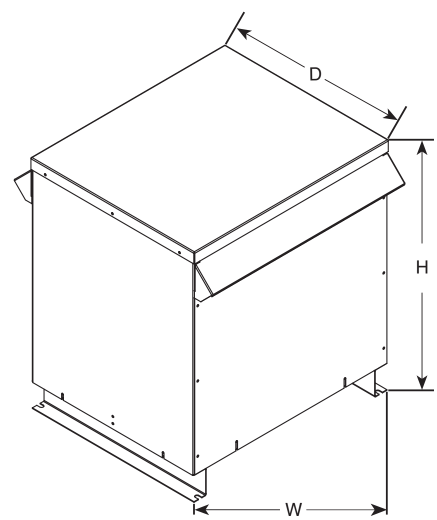


Required on:
Ventilated Units:
1Ø, 37.5 and 50 kVA
3Ø, 30, 45 and 75 kVA
Catalog Number: **PL-79912**

Encapsulated Units:
3Ø dit., 11 kVA — 20 kVA
3Ø std. distribution 15 kVA
Catalog Number: PL-79911

Wall mounting brackets are not required on:
1Ø units — 25 kVA and below
3Ø units — 9 kVA and below

Drawing is for reference only.
Contact factory for certified drawings.



Design E

Acme Electric

Our history is strong, engaging and dedicated... just like our people.

The Acme Electric Legacy

Acme Electric provides transformers, filters and specialty magnetics to OEM, industrial and commercial markets. Founded in 1917 in Cleveland, Ohio as the Acme Electric and Machine Company, Acme has a legacy of providing innovative electrical products. Acme is now part of Hubbell Incorporated, one of the largest electrical manufacturers in North America. Hubbell's history of innovation extends back to 1888 and the invention of the pull chain light switch and the electric plug.

Acme's original product line of motor-driven battery chargers, electrical appliances and electrical generators has transformed to a diversified mix of high-quality low voltage, medium voltage and transformers and inductors and fittings.

Learn more about us at www.hubbell.com/acmeelectric

Acme Electric®

For more than 100 years, Acme Electric has used our design and manufacturing expertise to craft dependable power distribution systems.

GET IN TOUCH:

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