

K-Factor Transformers

K-Factor transformers are designed to reduce the heating effects of harmonic currents created by loads like those shown in Chart A. The K-Factor rating is an index of the transformer's ability to withstand harmonic content while operating within the temperature limits of its insulating system. SolaHD K-Factor transformers have UL ratings of K-4, K-13, and K-20.

The SolaHD K-Factor design is a specialized transformer that offers these benefits:

- Conductors capable of carrying the harmonic currents of non-linear loads without exceeding the temperature rating of the insulation system.
- A transformer design that takes into account the increase in naturally occurring "stray" losses caused by non-linear loads. These losses cause standard transformers to dramatically overheat and substantially shorten design life.
- A core and coil design that manages the DC flux caused by triplen harmonics. As these harmonics increase, they cause additional current to circulate in the delta winding. This produces a DC flux in the core which leads to core saturation, voltage instability and overheating.



Certifications and Compliances

-  Listed: E25872
- UL 1561

Features

- Energy Efficient Compliant to DOE 2016 ¹
- Conductors to carry harmonics of a K-rated load without exceeding insulation temperature ratings
- UL 1561 Listed up to K-20 rated protection
- Rated temperature rise of 150°C, 220°C insulation
- Shielded for quality power
- Basic design takes "stray losses" into account and functions within safe operating temperatures
- Core and coil design engineered to manage the zero sequence flux caused by triplen harmonics
- Provides 100% rated current without overheating the windings or saturating the core

Accessories and Optional Design Styles

- Wall mounting brackets (500 lbs maximum) (Item WB1C)
- Weather Shields (UL Listed/NEMA Type 3R)
- Totally enclosed non-ventilated designs (TENV) (Non UL) *
- Low temperature rise units available
- Open core and coil designs (UL Recognized)
- Copper Wound designs
- Alternate voltages

* Not all optional designs are UL Listed. Contact Technical Services.

1. DOE 2016 refers to Department of Energy CFR (Code of Federal Regulations) title 10, part 431.196).

Chart A: Typical Load K-Factors

Load	K-Factor
Electric discharge lighting	K-4
UPS with optional input filter	K-4
Welders	K-4
Induction heating equipment	K-4
PLCs and solid state controls	K-4
Telecommunications equipment (e.g., PBX)	K-13
UPS without input filtering.....	K-13
Multiwire receptacle circuits in general care areas of health care facilities and classrooms of schools, etc.	K-13
Multi-wire receptacle circuits supplying inspection or testing equipment on an assembly or production line.....	K-13
Mainframe computer loads	K-20
Solid state motor drives (variable speed drives).....	K-20

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Selection Tables: Three Phase

Group A: K-4 Rated 480 Δ Primary, 208Y/120 Secondary, 60 Hz

kVA	Catalog Number	Type 3R Weather Shield ¹	Height in (mm)	Width in (mm)	Depth in (mm)	Approx. Ship Weight lbs (kg)	Design Style ²	Elec Conn ²	Primary Amps	Secondary Amps
15	K4E2H15S	WS-02	23 (584)	18 (457)	14 (356)	221 (100)	1	5	18.1	41.7
30	K4E2H30S	WS-14	28 (711)	23 (584)	16 (406)	310 (141)	1	5	36.1	83.4
45	K4E2H45S	WS-14	28 (711)	23 (584)	16 (406)	387 (176)	1	5	54.2	125
75	K4E2H75S	WS-30	34 (864)	28 (711)	22 (559)	678 (308)	1	5	90.3	208
112.5	K4E2H112S	WS-30	34 (864)	28 (711)	22 (559)	794 (360)	1	5	135	313
150	K4E2H150S	WS-10	44 (1118)	33 (838)	21 (533)	1005 (456)	1	5	181	417
225	K4E2H225S	WS-11	46 (1168)	36 (914)	24 (610)	1368 (621)	1	5	271	625
300	K4E2H300S	WS-11	46 (1168)	36 (914)	24 (610)	1479 (671)	1	5	361	834
500	K4E2H500S	WS-12	65 (1651)	45 (1143)	35 (889)	2457 (1114)	1	5	602	1390

Group B: K-13 Rated 480 Δ Primary, 208Y/120 Secondary, 60 Hz

kVA	Catalog Number	Type 3R Weather Shield ¹	Height in (mm)	Width in (mm)	Depth in (mm)	Approx. Ship Weight lbs (kg)	Design Style ²	Elec Conn ²	Primary Amps	Secondary Amps
15	K13E2H15S	WS-14	28 (711)	23 (584)	16 (406)	310 (141)	1	5	18.1	41.7
30	K13E2H30S	WS-14	28 (711)	23 (584)	16 (406)	387 (176)	1	5	36.1	83.4
45	K13E2H45S	WS-30	34 (864)	28 (711)	22 (559)	678 (308)	1	5	54.2	125
75	K13E2H75S	WS-30	34 (864)	28 (711)	22 (559)	794 (360)	1	5	90.3	208
112.5	K13E2H112S	WS-10	44 (1118)	33 (838)	21 (533)	1005 (456)	1	5	135	313
150	K13E2H150S	WS-11	46 (1168)	36 (914)	24 (610)	1368 (621)	1	5	181	417
225	K13E2H225S	WS-11	46 (1168)	36 (914)	24 (610)	1479 (671)	1	5	271	625
300	K13E2H300S	WS-12	65 (1651)	45 (1143)	35 (889)	2457 (1114)	1	5	361	834

Group C: K-20 Rated 480 Δ Primary, 208Y/120 Secondary, 60 Hz

kVA	Catalog Number	Type 3R Weather Shield ¹	Height in (mm)	Width in (mm)	Depth in (mm)	Approx. Ship Weight lbs (kg)	Design Style ²	Elec Conn ²	Primary Amps	Secondary Amps
15	K20E2H15S	WS-14	28 (711)	23 (584)	16 (406)	310 (141)	1	5	18.1	41.7
30	K20E2H30S	WS-14	28 (711)	23 (584)	16 (406)	387 (176)	1	5	36.1	83.4
45	K20E2H45S	WS-30	34 (864)	28 (711)	22 (559)	678 (308)	1	5	54.2	125
75	K20E2H75S	WS-30	34 (864)	28 (711)	22 (559)	794 (360)	1	5	90.3	208
112.5	K20E2H112S	WS-10	44 (1118)	33 (838)	21 (533)	1005 (456)	1	5	135	313
150	K20E2H150S	WS-11	46 (1168)	36 (914)	24 (610)	1368 (621)	1	5	181	417
225	K20E2H225S	WS-11	46 (1168)	36 (914)	24 (610)	1479 (671)	1	5	271	625
300	K20E2H300S	WS-12	65 (1651)	45 (1143)	35 (889)	2457 (1114)	1	5	361	834

Notes:

- Weather shields (set of two) must be ordered separately.
- Design Styles and Electrical Connections can be found at the end of the Ventilated Distribution Transformers section.

Electrical Connections (Single Phase)

1

240 x 480 Volt Primary,
120/240 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN

Primary Voltage	Interconnect	Connect Lines To
504	1 to 2	H1 & H2
492	2 to 3	H1 & H2
480	3 to 4	H1 & H2
468	4 to 5	H1 & H2
456	5 to 6	H1 & H2
444	6 to 7	H1 & H2
432	7 to 8	H1 & H2
252	H1 to 2 H2 to 1	H1 & H2
240	H1 to 4 H2 to 3	H1 & H2
228	H1 to 6 H2 to 5	H1 & H2
216	H1 to 8 H2 to 7	H1 & H2
Secondary Voltage	Interconnect	Connect Lines To
240	X2 to X3	X1 & X4
120-0-120	X2 to X3 X2 to \perp	X1-X2-X4
120	X1 to X3 X2 to X4	X1 & X4

ES5 Series

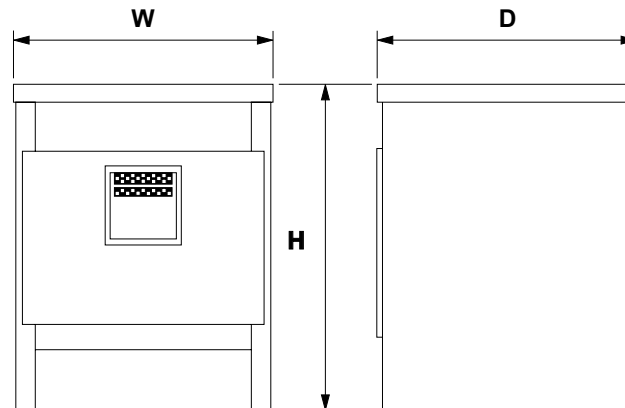
2

120/208/240/277 Volt Primary,
120/240 Volt Secondary
Taps: None

Primary Voltage	Interconnect	Connect Lines To
277	1 to 2	H1 & H2
240	3 to 4	H1 & H2
208	5 to 6	H1 & H2
120	H1 to 4 H2 to 3	H1 & H2
Secondary Voltage	Interconnect	Connect Lines To
240	X2 to X3	X1 & X4
120-0-120	X2 to X3 X2 to \perp	X1-X2-X4
120	X1 to X3 X2 to X4	X1 & X4

ES12 Series

Design Style



Style 1 - Ventilated

Electrical Connections (Three Phase)

480 Δ Volt Primary,
208Y/120 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN

5

Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	X1, X2, X3	X0- X1, X2, X3
1	504	208	120
2	492		
3	480		
4	468		
5	456		
6	444		
7	432		

E2 and 3H Series

** Shield available in electrostatically shielded units only.*

480 Δ Volt Primary,
240 Δ W/120 CT Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN

6

Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	X1, X2, X3	X6-X1, X6-X3
1	504	240	120
2	492		
3	480		
4	468		
5	456		
6	444		
7	432		

E5 Series

** Shield available in electrostatically shielded units only.*

Electrical Connections (Three Phase) cont.

480 Δ Volt Primary
380/220 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN **7**

Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	X1, X2, X3	X0- X1, X2, X3
1	504	380	220
2	492		
3	480		
4	468		
5	456		
6	444		
7	432		

E79 Series

480 Δ Volt Primary
480Y/277 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN **8**

Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	X1, X2, X3	X0- X1, X2, X3
1	504	480	277
2	492		
3	480		
4	468		
5	456		
6	444		
7	432		

E81 Series

208 Δ Volt Primary
208Y/120 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN **9**

Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	X1, X2, X3	X0- X1, X2, X3
1	218	208	120
2	213		
3	208		
4	203		
5	198		
6	192		
7	187		

E3 Series

208 Δ Volt Primary
480Y/277 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN **10**

Primary X1-X2-X3		Secondary Voltage	
@ Tap	Voltage	H1-H2-H3	H0- H1, H2, H3
1	218	480	277
2	213		
3	208		
4	203		
5	198		
6	192		
7	187		

E84 Series

240 Δ Volt Primary
208Y/120 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN **11**

Primary H1-H2-H3		Secondary Voltage	
@ Tap	Voltage	X1, X2, X3	X0- X1, X2, X3
1	252	208	120
2	246		
3	240		
4	234		
5	228		
6	222		
7	216		

E6 Series

240 Δ Volt Primary
480Y/277 Volt Secondary
Taps: 2, 2½% FCAN; 4, 2½% FCBN **12**

Primary X1-X2-X3		Secondary Voltage	
@ Tap	Voltage	H1, H2, H3	H0- H1, H2, H3
1	252	480	277
2	246		
3	240		
4	234		
5	228		
6	222		
7	216		

E85 Series