

K-Factor Transformers

SolaHD 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. Our 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.

Features

- Energy Efficient Compliant to DOE 2016¹
- 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
- Meets transit test requirements for ISTA (International Safe Transit Association) – Test Procedure 1E for packaged-product
- Quiet operation with sound levels 3-6 dB below the NEMA ST-20 requirements



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

Certifications and Compliances


-  Listed: E25872
- UL 1561

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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* 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).

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:

1. Weather shields (set of two) must be ordered separately.
2. 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.*

480 Δ Volt Primary
380Y/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

Electrical Connections (Three Phase) cont.

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