

## 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 2016<sup>1</sup>
- 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 <sup>1</sup> | Height in (mm) | Width in (mm) | Depth in (mm) | Approx. Ship Weight lbs (kg) | Design Style <sup>2</sup> | Elec Conn <sup>2</sup> | 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 <sup>1</sup> | Height in (mm) | Width in (mm) | Depth in (mm) | Approx. Ship Weight lbs (kg) | Design Style <sup>2</sup> | Elec Conn <sup>2</sup> | 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 <sup>1</sup> | Height in (mm) | Width in (mm) | Depth in (mm) | Approx. Ship Weight lbs (kg) | Design Style <sup>2</sup> | Elec Conn <sup>2</sup> | 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<br>H2 to 3        | H1 & H2          |
| Secondary Voltage | Interconnect              | Connect Lines To |
| 240               | X2 to X3                  | X1 & X4          |
| 120-0-120         | X2 to X3<br>X2 to $\perp$ | X1-X2-X4         |
| 120               | X1 to X3<br>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**