

# CDE

## AeroPower™ Power Factor Correction Capacitors

SINGLE-PHASE AND THREE-PHASE  
PFC CAPACITORS FOR  
HIGH RELIABILITY APPLICATIONS

A row of several tall, grey, rectangular power factor correction capacitors. Each unit has a white label with technical specifications and the AeroPower logo. The background is a solid blue color.

## Intelligent Capacitor Solutions

AeroPower™ power factor correction capacitors are constructed using high quality materials and Lean Six Sigma manufacturing practices to provide reliable performance and long life during continuous use.

CDE capacitors undergo 100% electrical and visual testing to further ensure high level performance. If you have specialized needs, our flexible manufacturing processes allow us to quickly provide custom configurations.



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**CDE provides intelligent capacitor solutions.**



**CORNELL  
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ENERGIZING IDEAS

## AeroPower™ Power Factor Correction Capacitors

### SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS FOR HIGH RELIABILITY APPLICATIONS



#### Applications

- Power Factor Correction Systems
- Harmonic Filters
- Alternative Energy Power Systems
- Induction Heating Capacitor Alternatives

**Custom ratings and sizes are available. Please contact CDE.**

CDE manufactures both single-phase and three-phase power factor correction capacitors up to 4,800 VAC. Our AeroPower brand PFC capacitors are designed for high reliability applications, and have a life rating of over 200,000 hours. They are designed to withstand harmonic currents, with special high harmonic versions available.

Three types of standard reactive compensation capacitors are available:

- AMP0: Vacuum-impregnated metallized polypropylene, compact size. Available in both oil-filled and dry configurations. (Made in USA.)
- MMP0: Vacuum-impregnated metallized polypropylene, rugged welded case. (Made in USA.)
- EPFC: Euro-style vacuum-impregnated metallized polypropylene, round aluminum studded case. (Made in China and India.)

#### Highlights

- Both European and North American styles available
- Long life
- Over-current rating to 150% (200% for 50 Hz EPFC)
- Over-voltage rating to 120%
- Includes discharge resistors
- Large 325 KVAR capacitors available
- Single-phase and three-phase
- Loss of KVAR/fault detection
- Oil or epoxy filled versions available



#### Specifications

|                                     |                                                                       |
|-------------------------------------|-----------------------------------------------------------------------|
| <b>KVAR Range:</b>                  | 0.5 to 325 KVAR                                                       |
| <b>Capacitance Tolerance:</b>       | 0 to +15%                                                             |
| <b>AC Voltage Range:</b>            | 240 VAC to 4,800 VAC; single-phase or three-phase                     |
| <b>Rated Frequency:</b>             | 50 or 60 Hz                                                           |
| <b>Capacitor Connection:</b>        | 3-phase, internal delta connection standard; wye available on request |
| <b>Operating Life:</b>              | 100,000–200,000+ hours                                                |
| <b>Total Losses:</b>                | <0.5 Watts / KVAR at 60 Hertz, 25°C                                   |
| <b>Operating Temperature Range:</b> | -40°C to +46°C                                                        |
| <b>Approval Certification:</b>      | UL, cUL (≤600 VAC)                                                    |

## AeroPower™ Power Factor Correction Capacitors

### SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS FOR HIGH RELIABILITY APPLICATIONS

#### Standard Voltage and KVAR Ratings at 60 Hertz\*

| LOW VOLTAGE | AMPO   | EPFC   | MMP0   |
|-------------|--------|--------|--------|
| 240 VAC     | 0.5–10 | 0.5–10 | 20–30  |
| 480 VAC     | 0.5–25 | 2–40   | 25–100 |
| 600 VAC     | 1.0–25 | 10–40  | 25–100 |
| 750 VAC     | –      | –      | 25–150 |

| MEDIUM VOLTAGE | MMP0   |
|----------------|--------|
| 900 VAC        | 25–150 |
| 1040 VAC       | 25–240 |
| 1200 VAC       | 25–240 |
| 2400 VAC       | 25–300 |
| 2770 VAC       | 25–300 |
| 4160 VAC       | 25–300 |
| 4800 VAC       | 25–325 |

#### Standard Voltage and KVAR Ratings at 50 Hertz

| LOW VOLTAGE | EPFC |
|-------------|------|
| 400 VAC     | 2–50 |
| 415 VAC     | 2–50 |
| 440 VAC     | 2–50 |
| 480 VAC     | 5–25 |
| 525 VAC     | 5–25 |

\*Please consult the factory for other voltages, frequencies and KVAR ratings.

#### Construction

All AeroPower capacitors are impregnated with either a dielectric fluid or an epoxy resin to give added insulation, excellent corona protection and a moisture barrier. The dielectric fluid and the epoxy resin are considered a green (benign), environmentally friendly material. MMP0 and EPFC capacitors are 100% leak tested. CDE products do not contain PCBs.

#### Harmonic Distortion

Harmonic distortion is the resulting non-sinusoidal current waveform generated by a non-linear load. The most common non-linear load is a pulse rectifier, which is used in most switch mode power supplies, variable speed drives and uninterruptible power supplies. The distorted current waveform generates a distorted source voltage due to the system (electrical power system) impedance. A distorted waveform can be analyzed by decomposing it into a fundamental component (line frequency) and higher frequency components of varying amplitude.

The effects of harmonic distortion on metallized film capacitors are (1) higher operating temperature because of higher I<sup>2</sup>R losses and (2) higher voltage stress on the dielectric. Both of these factors will shorten the life of a capacitor dramatically.

All CDE power factor correction capacitors are designed to handle harmonic currents, however, CDE also offers capacitors that are custom designed for systems with high harmonic distortion. By using our high-harmonic capacitors in your harmonic rich application, you will have a more robust construction compared to using standard capacitors in the same application.

#### Cover Terminals

AMPO and low voltage MMP0 cells are available in a three-terminal configuration, specified by KVAR rating (see individual specifications). The internal schematics for these terminal configurations are shown in Figures 1A and 1B.

## AeroPower™ Power Factor Correction Capacitors

SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS  
FOR HIGH RELIABILITY APPLICATIONS

Figure 1A: AMPO & Low Voltage MMPO

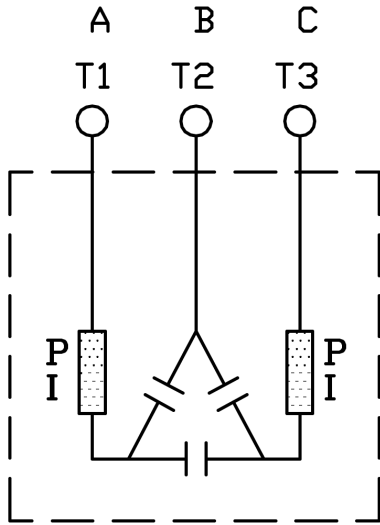
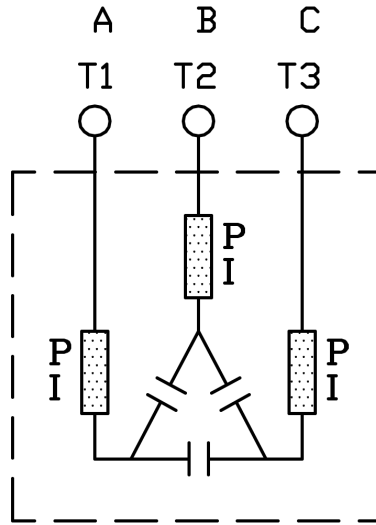


Figure 1B: EPFC

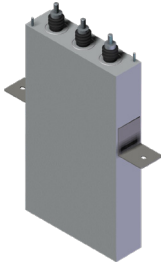
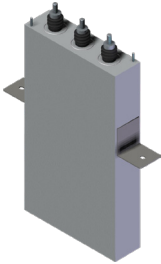


Internal Schematics for Low Voltage  
Three-Terminal Capacitors

## AeroPower™ Power Factor Correction Capacitors

### SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS FOR HIGH RELIABILITY APPLICATIONS

#### Reactive Power Compensation Capacitor Specifications

|  | AMP0 Low Voltage<br>(Three-phase and<br>single-phase)<br>(up to 600 VAC)          | MMP0 Low Voltage<br>(Three-phase and<br>single-phase)<br>(up to 600 VAC)          | MMP0 Low Voltage<br>(Three-phase and<br>single-phase)<br>(750 to 900 VAC)         | MMP0 Medium<br>Voltage<br>(Three-phase and<br>single-phase)<br>(1040 to 4800 VAC)  | EPFC Low Voltage<br>(Three-phase)<br>(up to 600 VAC)<br>(60 Hz)                     | EPFC Low Voltage<br>(Three-phase)<br>(up to 525 VAC)<br>(50 Hz)                     |
|--|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |

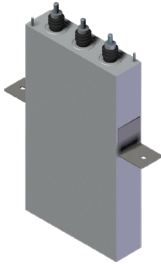
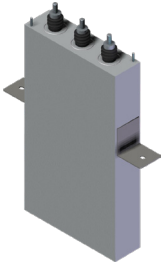
#### Electrical Characteristics

|                                      |                                                                     |                                                                     |                                                                      |                                                                      |                                                                     |                                                                     |
|--------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
| <b>Rated Voltages</b>                | 240, 480 and 600 VAC                                                | 240, 480 and 600 VAC                                                | 750 and 900 VAC                                                      | 1040 , 1200, 2400, 2770, 4160 and 4800 VAC                           | 240, 480 and 600 VAC                                                | 400, 415, 440, 480 and 525 VAC                                      |
| <b>Rated Frequency</b>               | 60 Hertz                                                            | 60 Hertz                                                            | 60 Hertz                                                             | 60 Hertz                                                             | 60 Hertz                                                            | 50 Hertz                                                            |
| <b>Capacitor Type</b>                | Fluid impregnated (Dry also available)                              | Fluid impregnated                                                   | Fluid impregnated                                                    | Fluid impregnated                                                    | Fluid impregnated                                                   | Fluid impregnated                                                   |
| <b>Dielectric System</b>             | Self-healing metallized polypropylene film                          | Self-healing metallized polypropylene film                          | Self-healing metallized polypropylene film                           | Self-healing metallized polypropylene film                           | Self-healing metallized polypropylene film                          | Self-healing metallized polypropylene film                          |
| <b>Impregnation Fluid</b>            | Non-PCB, non-toxic, biodegradable, Class III combustible fluid      | Non-PCB, non-toxic, biodegradable, Class III combustible fluid      | Non-PCB, non-toxic, biodegradable, Class III combustible fluid       | Non-PCB, non-toxic, biodegradable, Class III combustible fluid       | Non-PCB, non-toxic, biodegradable, Class III combustible fluid      | Non-PCB, biodegradable, natural oil                                 |
| <b>Capacitor Connection, 3-phase</b> | Internal delta connection                                           | Internal delta connection                                           | Internal wye connection                                              | Internal delta or wye connection                                     | Internal delta connection                                           | Internal delta connection                                           |
| <b>Capacitance Tolerance</b>         | -0% to +15%                                                         | -0% to +15%                                                         | -0% to +15%                                                          | -0% to +15%                                                          | -0% to +15%                                                         | -5% to +10%                                                         |
| <b>Discharge Device</b>              | External resistors reduce residual voltage to <50 V within 1 minute | Internal resistors reduce residual voltage to <50 V within 1 minute | Internal resistors reduce residual voltage to <50 V within 5 minutes | Internal resistors reduce residual voltage to <50 V within 5 minutes | Internal resistors reduce residual voltage to <50 V within 1 minute | Internal resistors reduce residual voltage to <50 V within 1 minute |
| <b>Total Losses</b>                  | <0.5 Watts / KVAR at 60 Hertz, 25°C                                 | <0.5 Watts / KVAR at 60 Hertz, 25°C                                 | <0.5 Watts / KVAR at 60 Hertz, 25°C                                  | <0.5 Watts / KVAR at 60 Hertz, 25°C                                  | <0.5 Watts / KVAR at 60 Hertz, 25°C (without resistors)             | <0.5 Watts / KVAR at 50 Hertz, 25°C (without resistors)             |
| <b>Design Service Life</b>           | 200,000 hours continuous duty                                       | 200,000 hours continuous duty                                       | 200,000 hours continuous duty                                        | 200,000 hours continuous duty                                        | 200,000 hours continuous duty                                       | 100,000 hours (150,000 high harmonic)                               |

## AeroPower™ Power Factor Correction Capacitors

### SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS FOR HIGH RELIABILITY APPLICATIONS

#### Reactive Power Compensation Capacitor Specifications (cont.)

|  | AMP0 Low Voltage<br>(Three-phase and<br>single-phase)<br>(up to 600 VAC)          | MMP0 Low Voltage<br>(Three-phase and<br>single-phase)<br>(up to 600 VAC)          | MMP0 Low Voltage<br>(Three-phase and<br>single-phase)<br>(750 to 900 VAC)         | MMP0 Medium<br>Voltage<br>(Three-phase and<br>single-phase)<br>(1040 to 4800 VAC)  | EPFC Low Voltage<br>(Three-phase)<br>(up to 600 VAC)<br>(60 Hz)                     | EPFC Low Voltage<br>(Three-phase)<br>(up to 525 VAC)<br>(50 Hz)                     |
|--|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |

#### Over Current

|                          |                                                                   |                                                                   |                                                                   |                                                                      |                                                                   |                                                                   |
|--------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|
| <b>Standard</b>          | 135% * rated current<br>continuous, includes<br>harmonic currents | 135% * rated current<br>continuous, includes<br>harmonic currents | 135% * rated current<br>continuous, includes<br>harmonic currents | 135% * rated<br>current continuous,<br>includes harmonic<br>currents | 135% * rated current<br>continuous, includes<br>harmonic currents | 150% * rated current<br>continuous, includes<br>harmonic currents |
| <b>High<br/>Harmonic</b> | 150% * rated current<br>continuous, includes<br>harmonic currents | 150% * rated current<br>continuous, includes<br>harmonic currents | 150% * rated current<br>continuous, includes<br>harmonic currents | 150% * rated<br>current continuous,<br>includes harmonic<br>currents | 150% * rated current<br>continuous, includes<br>harmonic currents | 200% * rated current<br>continuous, includes<br>harmonic currents |

#### Over Voltage

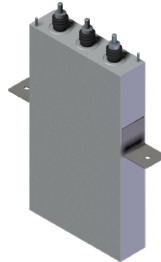
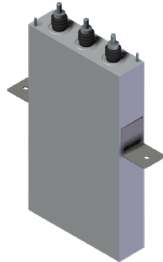
|                      |                                    |                                    |                                    |                                    |                                    |                                                  |
|----------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|--------------------------------------------------|
| <b>Standard</b>      | 110% * rated<br>voltage continuous | 110% * rated<br>voltage continuous | 110% * rated<br>voltage continuous | 110% * rated<br>voltage continuous | 110% * rated<br>voltage continuous | 110% * rated<br>(8 hrs. in every 24 hrs.)        |
| <b>High Harmonic</b> | 120% * rated<br>voltage continuous | 120% * rated<br>voltage continuous | 120% * rated<br>voltage continuous | 120% * rated<br>voltage continuous | 120% * rated<br>voltage continuous | 120% * rated<br>(5 minutes in<br>every 24 hours) |

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### SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS FOR HIGH RELIABILITY APPLICATIONS

#### Reactive Power Compensation Capacitor Specifications (cont.)

|  | AMP0 Low Voltage<br>(Three-phase and<br>single-phase)<br>(up to 600 VAC) | MMP0 Low Voltage<br>(Three-phase and<br>single-phase)<br>(up to 600 VAC) | MMP0 Low Voltage<br>(Three-phase and<br>single-phase)<br>(750 to 900 VAC) | MMP0 Medium<br>Voltage<br>(Three-phase and<br>single-phase)<br>(1040 to 4800 VAC) | EPFC Low Voltage<br>(Three-phase)<br>(up to 600 VAC)<br>(60 Hz) | EPFC Low Voltage<br>(Three-phase)<br>(up to 525 VAC)<br>(50 Hz) |
|--|--------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|
|--|--------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|



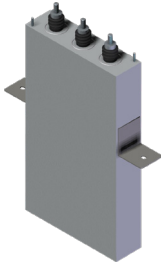
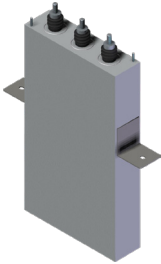
#### Mechanical Characteristics

| Enclosure Type       | Drawn tin plated steel rectangular can                                          | Heavygaugewelded steel construction                                 | Heavygaugewelded steel construction                                 | Heavygaugewelded steel construction                                          | Extruded aluminum cylindrical can with M12 mounting stud                 | Extruded aluminum cylindrical can with M12 mounting stud         |
|----------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------------|
| Finish               | None (standard)<br>Painted (optional)                                           | Light gray paint, ANSI #61, UL approved for outdoor usage           | Light gray paint, ANSI #61, UL approved for outdoor usage           | Light gray paint, ANSI #61, UL approved for outdoor usage                    | None                                                                     | None                                                             |
| Mounting             | Optional bracketing is available                                                | Heavy gauge brackets, mounting holes 2 x 1/2 x 5/8" slots           | Heavy gauge brackets, mounting holes 2 x 1/2 x 5/8" slots           | Heavy gauge brackets, mounting holes 2 x 1/2 x 5/8" slots                    | M12 mounting stud 10 NM max. torque                                      | M12 mounting stud 10 NM max. torque                              |
| Terminals            | 3- and 2-terminal cover: 1/4"-20 male threaded stud, 20 in-lbs fastening torque | 1/2"-13 brass studs, 160 in-lbs fastening torque, 30 kV BIL bushing | 1/2"-13 brass studs, 160 in-lbs fastening torque, 30 kV BIL bushing | 1/2"-13 brass studs, 160 in-lbs fastening torque, 60 kV BIL ceramic bushings | M6 terminal 2-1/2 NM fastening torque, M8 terminal 4 NM fastening torque | 3-phase terminal with electrical shock protection (finger proof) |
| Loss of KVAR feature | -                                                                               | Optional                                                            | Optional                                                            | -                                                                            | -                                                                        | -                                                                |

## AeroPower™ Power Factor Correction Capacitors

### SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS FOR HIGH RELIABILITY APPLICATIONS

#### Reactive Power Compensation Capacitor Specifications (cont.)

|  | AMP0 Low Voltage<br>(Three-phase and<br>single-phase)<br>(up to 600 VAC)          | MMP0 Low Voltage<br>(Three-phase and<br>single-phase)<br>(up to 600 VAC)          | MMP0 Low Voltage<br>(Three-phase and<br>single-phase)<br>(750 to 900 VAC)         | MMP0 Medium<br>Voltage<br>(Three-phase and<br>single-phase)<br>(1040 to 4800 VAC)  | EPFC Low Voltage<br>(Three-phase)<br>(up to 600 VAC)<br>(60 Hz)                     | EPFC Low Voltage<br>(Three-phase)<br>(up to 525 VAC)<br>(50 Hz)                     |
|--|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |

#### Environmental Characteristics

|                              |                                                                                               |                                                                                               |                                                                                               |                                                                          |                                                                                               |                                                                                               |
|------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| <b>Operating Temperature</b> | -40°C to +46°C,<br>-40°F to +115°F,<br>with natural<br>convection cooling                     | -40°C to +46°C,<br>-40°F to +115°F,<br>with natural<br>convection cooling                     | -40°C to +46°C,<br>-40°F to +115°F,<br>with natural<br>convection cooling                     | 40°C to +46°C,<br>-40°F to +115°F,<br>with natural<br>convection cooling | -40°C to +46°C,<br>-40°F to +115°F,<br>with natural<br>convection cooling                     | -40°C to +55°C,<br>-40°F to +131°F,<br>with natural<br>convection cooling                     |
| <b>Storage Temperature</b>   | -40°C to +85°C,<br>-40°F to +185°F                                                            | -40°C to +85°C,<br>-40°F to +185°F                                                            | -40°C to +85°C,<br>-40°F to +185°F                                                            | -40°C to +85°C,<br>-40°F to +185°F                                       | -40°C to +85°C,<br>-40°F to +185°F                                                            | -40°C to +85°C,<br>-40°F to +185°F                                                            |
| <b>Maximum Altitude</b>      | 2000 meters above<br>sea level                                                                | 2000 meters above<br>sea level                                                                | 2000 meters above<br>sea level                                                                | 2000 meters above<br>sea level                                           | 2000 meters above<br>sea level                                                                | 4000 meters above<br>sea level                                                                |
| <b>Humidity</b>              | 0 to 95%<br>non-condensing                                                                    | 0 to 95%<br>non-condensing                                                                    | 0 to 95%<br>non-condensing                                                                    | 0 to 95%<br>non-condensing                                               | 0 to 95%<br>non-condensing                                                                    | 0 to 95%<br>non-condensing                                                                    |
| <b>Standards</b>             | UL 810<br>UL C22.2<br>No. 190 Canadian<br>Standards                                           | UL 810<br>UL C22.2<br>No. 190 Canadian<br>Standards<br>ANSI/IEEE 18<br>NEMA CP-1              | ANSI/IEEE 18<br>NEMA CP-1                                                                     | ANSI/IEEE 18<br>NEMA<br>IEC 871-1                                        | UL 810<br>IEC 60831                                                                           | IS 5553<br>IEC 60289                                                                          |
| <b>Certifications</b>        | UL Recognized<br>CYTW2<br><br>cUL Recognized<br>CYTW8<br><br>RoHS Compliant                   | UL Recognized<br>CYTW2<br><br>cUL Recognized<br>CYTW8                                         | -                                                                                             | -                                                                        | UL Recognized<br>CYTW2<br><br>cUL Recognized<br>CYTW8                                         | CE                                                                                            |
| <b>Safety Features</b>       | Pressure interrupter<br><br>Self-healing<br>technology<br><br>External discharge<br>resistors | Pressure interrupter<br><br>Self-healing<br>technology<br><br>Internal discharge<br>resistors | Pressure interrupter<br><br>Self-healing<br>technology<br><br>Internal discharge<br>resistors | Self-healing<br>technology<br><br>Internal discharge<br>resistors        | Pressure interrupter<br><br>Self-healing<br>technology<br><br>Internal discharge<br>resistors | Pressure interrupter<br><br>Self-healing<br>technology<br><br>Internal discharge<br>resistors |

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### SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS FOR HIGH RELIABILITY APPLICATIONS

#### Safety Features

Discharge resistors are placed internally on MMP0 and EPFC and externally on AMP0 capacitor cells. The resistors are a safety feature that drains the voltage on the capacitor once the unit is taken offline to less than 50 volts in one minute or less for cells rated up to 600 VAC or in 5 minutes or less for cells rated over 600 VAC. The resistors are sized for long life continuous operation at maximum-rated temperature.

CDE low-voltage capacitor cells have UL and cUL recognized pressure-sensitive circuit interrupters. The circuit interrupter's purpose is to safely remove the capacitor from service at end-of-life or under heavy fault conditions and still maintain case integrity. CDE low-voltage capacitor cells are listed for use with or without fuses at 10,000 amps available fault current (AFC rating).

Self-healing technology: in case of an overload, the self-healing properties of the low-loss metallized polypropylene will prevent permanent dielectric breakdown.

#### Mounting Orientation

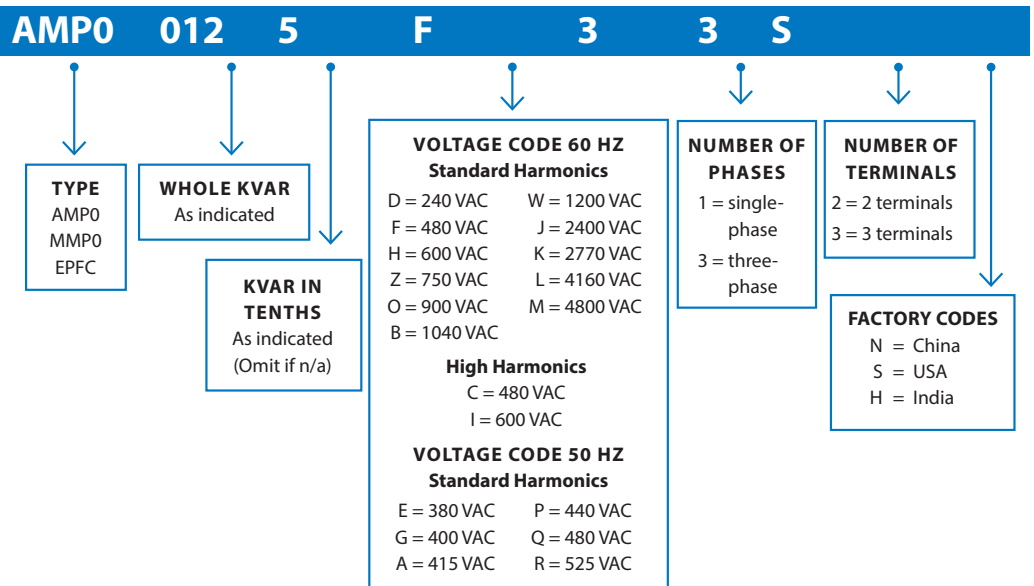
All CDE power factor correction capacitors can be mounted in a vertical position with the terminals facing up or horizontally. The units should not be mounted upside down. For proper operation of the pressure interrupter, capacitors mounted in banks must have enough space between them for expansion. In cases where brackets or mounting straps are used, there should only be enough pressure on the unit to hold it in place.

#### Suggested Mounting Clearances

|           | Side to Side<br>Clearance | Clearance above<br>Terminals |
|-----------|---------------------------|------------------------------|
| AMP0/EPFC | 0.5"                      | 1.0"                         |
| MMP0-LV   | 1.5"                      | 1.0"                         |
| MMP0-MV   | 1.5"                      | 3.0"                         |

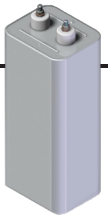
#### Part Numbering System

CDE's part numbering system is a descriptive part number made up of several different components such as KVAR, voltage rating, etc. The descriptors are explained below using AMP00125F33S as a representative part number.



## AeroPower™ Power Factor Correction Capacitors

SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS  
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### Type AMPO Capacitor Cells, 240 to 600 VAC, Three-Phase and Single-Phase Reactive Power Compensation Ratings

| KVAR RATING | CDE P/N | NOMINAL<br>CURRENT (A <sub>RMS</sub> ) | C, NOMINAL<br>CAPACITANCE (μF) | CAN SIZE<br>W x L x H (in) | APPROX WEIGHT<br>(lbs) |
|-------------|---------|----------------------------------------|--------------------------------|----------------------------|------------------------|
|-------------|---------|----------------------------------------|--------------------------------|----------------------------|------------------------|

#### 240 VAC, 60 Hz, 3-Phase, Delta Connection

|      |              |      |       |                    |     |
|------|--------------|------|-------|--------------------|-----|
| 2.5  | AMP00025D33S | 6    | 115.1 | 3.75 x 4.56 x 5    | 3.7 |
| 5    | AMP0005D33S  | 12   | 230.3 | 3.75 x 4.56 x 6    | 4.5 |
| 6    | AMP0006D33S  | 14.4 | 276.3 | 3.75 x 4.56 x 6.38 | 4.7 |
| 7.5  | AMP00075D33S | 18   | 345.4 | 3.75 x 4.56 x 7    | 5.2 |
| 10   | AMP0010D33S  | 24.1 | 460.4 | 3.75 x 4.56 x 7    | 5.2 |
| 12.5 | AMP00125D33S | 30.1 | 575.6 | 3.75 x 4.56 x 9    | 6.7 |

#### 480 VAC, 60 Hz, 3-Phase, Delta Connection

|      |              |      |       |                    |     |
|------|--------------|------|-------|--------------------|-----|
| 2.5  | AMP00025F33S | 3    | 28.8  | 3.75 x 4.56 x 5    | 3.7 |
| 5    | AMP0005F33S  | 6    | 57.6  | 3.75 x 4.56 x 5    | 3.7 |
| 7.5  | AMP00075F33S | 9    | 86.3  | 3.75 x 4.56 x 6    | 4.5 |
| 10   | AMP0010F33S  | 12   | 115.1 | 3.75 x 4.56 x 6.38 | 4.7 |
| 12.5 | AMP00125F33S | 15   | 143.9 | 3.75 x 4.56 x 6.38 | 4.7 |
| 15   | AMP0015F33S  | 18   | 172.7 | 3.75 x 4.56 x 7    | 5.2 |
| 16.7 | AMP00167F33S | 20.1 | 191.9 | 3.75 x 4.56 x 7    | 5.2 |
| 17.5 | AMP00175F33S | 21   | 201.5 | 3.75 x 4.56 x 7    | 5.2 |
| 20   | AMP0020F33S  | 24.1 | 230.3 | 3.75 x 4.56 x 7    | 5.2 |
| 22.5 | AMP00225F33S | 27.1 | 259   | 3.75 x 4.56 x 9    | 6.7 |
| 25   | AMP0025F33S  | 30.1 | 287.8 | 3.75 x 4.56 x 9    | 6.7 |

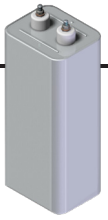
#### 480 VAC, High Harmonic Applications, 3-Phase, Delta Connection

|      |              |      |       |                    |     |
|------|--------------|------|-------|--------------------|-----|
| 7.5  | AMP00075C33S | 9    | 86.3  | 3.75 x 4.56 x 6.38 | 4.7 |
| 10   | AMP0010C33S  | 12   | 115.1 | 3.75 x 4.56 x 6    | 4.5 |
| 12.5 | AMP00125C33S | 15   | 143.9 | 3.75 x 4.56 x 7    | 5.2 |
| 15   | AMP0015C33S  | 18   | 172.7 | 3.75 x 4.56 x 10.5 | 7.8 |
| 16.7 | AMP00167C33S | 20.1 | 191.9 | 3.75 x 4.56 x 10.5 | 7.8 |
| 17.5 | AMP00175C33S | 21.1 | 201.5 | 3.75 x 4.56 x 10.5 | 7.8 |
| 20   | AMP0020C33S  | 24.1 | 230.3 | 3.75 x 4.56 x 10.5 | 7.8 |

Custom ratings and sizes available. Please contact CDE.

## AeroPower™ Power Factor Correction Capacitors

SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS  
FOR HIGH RELIABILITY APPLICATIONS



### Type AMPO Capacitor Cells, 240 to 600 VAC, Three-Phase and Single-Phase (cont.)

#### Reactive Power Compensation Ratings

| KVAR RATING | CDE P/N | NOMINAL<br>CURRENT (A <sub>RMS</sub> ) | C <sub>N</sub> NOMINAL<br>CAPACITANCE (μF) | CAN SIZE<br>W x L x H (in) | APPROX WEIGHT<br>(lbs) |
|-------------|---------|----------------------------------------|--------------------------------------------|----------------------------|------------------------|
|-------------|---------|----------------------------------------|--------------------------------------------|----------------------------|------------------------|

#### 600 VAC, 60 Hz, 3-Phase, Delta Connection

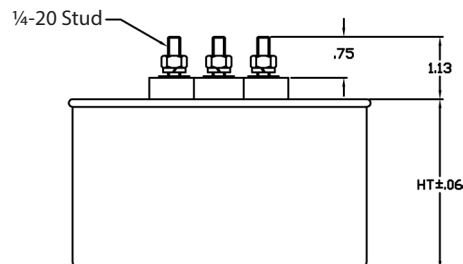
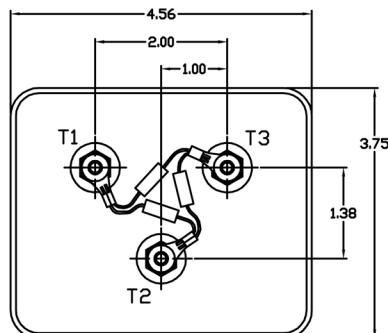
|      |              |      |       |                    |     |
|------|--------------|------|-------|--------------------|-----|
| 2.5  | AMP00025H33S | 2.4  | 18.4  | 3.75 x 4.56 x 5    | 3.7 |
| 5    | AMP0005H33S  | 4.8  | 36.8  | 3.75 x 4.56 x 5    | 3.7 |
| 7.5  | AMP00075H33S | 7.2  | 55.3  | 3.75 x 4.56 x 6    | 4.5 |
| 10   | AMP0010H33S  | 9.6  | 73.7  | 3.75 x 4.56 x 6    | 4.5 |
| 12.5 | AMP00125H33S | 12   | 92.1  | 3.75 x 4.56 x 6    | 4.5 |
| 15   | AMP0015H33S  | 14.4 | 110.5 | 3.75 x 4.56 x 6    | 4.5 |
| 16.7 | AMP00167H33S | 16.1 | 123.1 | 3.75 x 4.56 x 6    | 4.5 |
| 17.5 | AMP00175H33S | 16.8 | 128.9 | 3.75 x 4.56 x 6    | 4.5 |
| 20   | AMP0020H33S  | 19.2 | 147.4 | 3.75 x 4.56 x 7    | 5.2 |
| 22.5 | AMP00225H33S | 21.7 | 165.8 | 3.75 x 4.56 x 8.63 | 6.4 |
| 25   | AMP0025H33S  | 24.1 | 184.2 | 3.75 x 4.56 x 9    | 6.7 |

#### 600 VAC, High Harmonic Applications, 3-Phase, Delta Connection

|      |              |      |       |                    |     |
|------|--------------|------|-------|--------------------|-----|
| 10   | AMP0010I33S  | 9.6  | 73.7  | 3.75 x 4.56 x 6    | 4.5 |
| 12.5 | AMP00125I33S | 12   | 92.1  | 3.75 x 4.56 x 8.25 | 6.2 |
| 15   | AMP0015I33S  | 14.4 | 110.5 | 3.75 x 4.56 x 9    | 6.7 |
| 16.7 | AMP00167I33S | 16.1 | 123.1 | 3.75 x 4.56 x 9    | 6.7 |
| 17.5 | AMP00175I33S | 16.8 | 128.9 | 3.75 x 4.56 x 10.5 | 7.8 |
| 20   | AMP0020I33S  | 19.2 | 147.4 | 3.75 x 4.56 x 10.5 | 7.8 |

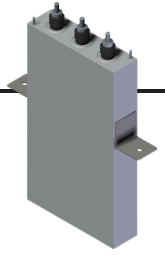
### Outline Drawings

AMPO: Suffix "33S"



## AeroPower™ Power Factor Correction Capacitors

SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS  
FOR HIGH RELIABILITY APPLICATIONS



### Type MMP0 Capacitor Cells, 240 to 600 VAC, Three-Phase and Single-Phase Reactive Power Compensation Ratings

| KVAR RATING | CDE P/N | NOMINAL<br>CURRENT (A <sub>RMS</sub> ) | C, NOMINAL<br>CAPACITANCE (μF) | CAN SIZE<br>W x L x H (in) | APPROX WEIGHT<br>(lbs) |
|-------------|---------|----------------------------------------|--------------------------------|----------------------------|------------------------|
|-------------|---------|----------------------------------------|--------------------------------|----------------------------|------------------------|

#### 240 VAC, 60 Hz, 3-Phase, Delta Connection

|    |            |      |        |                    |      |
|----|------------|------|--------|--------------------|------|
| 25 | MMP0025D33 | 60.1 | 1151.3 | 3.75 x 13.5 x 13.5 | 31.3 |
| 30 | MMP0030D33 | 72.2 | 1381.6 | 3.75 x 13.5 x 15.5 | 36.5 |

#### 480 VAC, 60 Hz, 3-Phase, Delta Connection

|     |            |       |        |                    |      |
|-----|------------|-------|--------|--------------------|------|
| 25  | MMP0025F33 | 30.1  | 287.8  | 3.75 x 13.5 x 8.5  | 21.4 |
| 30  | MMP0030F33 | 36.1  | 345.4  | 3.75 x 13.5 x 9.5  | 23.5 |
| 35  | MMP0035F33 | 42.1  | 403    | 3.75 x 13.5 x 11.5 | 28.1 |
| 40  | MMP0040F33 | 48.1  | 460.5  | 3.75 x 13.5 x 11.5 | 28.3 |
| 50  | MMP0050F33 | 60.1  | 575.6  | 3.75 x 13.5 x 13.5 | 32.3 |
| 60  | MMP0060F33 | 72.2  | 690.8  | 3.75 x 13.5 x 15.5 | 36.4 |
| 75  | MMP0075F33 | 90.2  | 863.5  | 3.75 x 13.5 x 18.5 | 43.1 |
| 80  | MMP0080F33 | 96.2  | 921    | 3.75 x 13.5 x 19.5 | 44.6 |
| 90  | MMP0090F33 | 108.3 | 1036.2 | 3.75 x 13.5 x 20.5 | 45.9 |
| 100 | MMP0100F33 | 120.3 | 1151.3 | 3.75 x 13.5 x 24   | 55.3 |

#### 480 VAC, High Harmonic Applications, 3-Phase, Delta Connection

|     |            |       |        |                    |      |
|-----|------------|-------|--------|--------------------|------|
| 25  | MMP0025C33 | 30.1  | 287.8  | 3.75 x 13.5 x 8.5  | 21.4 |
| 50  | MMP0050C33 | 60.1  | 575.6  | 3.75 x 13.5 x 13.5 | 32.3 |
| 75  | MMP0075C33 | 90.2  | 863.5  | 3.75 x 13.5 x 18.5 | 43.1 |
| 100 | MMP0100C33 | 120.3 | 1151.3 | 3.75 x 13.5 x 24   | 55.3 |

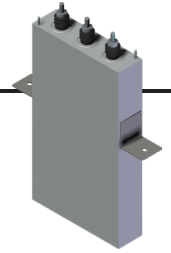
#### 600 VAC, High Harmonic Applications, 3-Phase, Delta Connection

|     |            |      |       |                    |      |
|-----|------------|------|-------|--------------------|------|
| 25  | MMP0025I33 | 24.1 | 184.2 | 3.75 x 13.5 x 8.5  | 21.4 |
| 30  | MMP0030I33 | 28.9 | 221   | 3.75 x 13.5 x 9.5  | 23.5 |
| 35  | MMP0035I33 | 33.7 | 275.9 | 3.75 x 13.5 x 11.5 | 28.1 |
| 40  | MMP0040I33 | 38.5 | 294.7 | 3.75 x 13.5 x 11.5 | 28.3 |
| 45  | MMP0045I33 | 43.3 | 331.6 | 3.75 x 13.5 x 13.5 | 32.2 |
| 50  | MMP0050I33 | 48.1 | 368.4 | 3.75 x 13.5 x 13.5 | 32.3 |
| 60  | MMP0060I33 | 57.7 | 442.1 | 3.75 x 13.5 x 15.5 | 36.4 |
| 75  | MMP0075I33 | 72.2 | 552.6 | 3.75 x 13.5 x 18.5 | 43.1 |
| 80  | MMP0080I33 | 77   | 589.5 | 3.75 x 13.5 x 19.5 | 44.6 |
| 90  | MMP0090I33 | 86.6 | 663.1 | 3.75 x 13.5 x 20.5 | 45.9 |
| 100 | MMP0100I33 | 96.2 | 736.8 | 3.75 x 13.5 x 24   | 55.3 |

Custom ratings and sizes available. Please contact CDE.

## AeroPower™ Power Factor Correction Capacitors

SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS  
FOR HIGH RELIABILITY APPLICATIONS



### Type MMP0 Capacitor Cells, 750 VAC and 900 VAC, Three-Phase and Single-Phase Reactive Power Compensation Ratings

| KVAR RATING | CDE P/N | NOMINAL<br>CURRENT (A <sub>RMS</sub> ) | C <sub>1</sub> NOMINAL<br>CAPACITANCE (μF) | CAN SIZE<br>W x L x H (in) | APPROX WEIGHT<br>(lbs) |
|-------------|---------|----------------------------------------|--------------------------------------------|----------------------------|------------------------|
|-------------|---------|----------------------------------------|--------------------------------------------|----------------------------|------------------------|

#### 750 VAC, 60 Hz, 3-Phase, "WYE" Connection

|     |            |    |        |                  |      |
|-----|------------|----|--------|------------------|------|
| 100 | MMP0100Z33 | 77 | 1414.7 | 3.75 x 13.5 x 24 | 55.3 |
|-----|------------|----|--------|------------------|------|

#### 900 VAC, 60 Hz, 3-Phase, "WYE" Connection

|     |            |      |       |                    |      |
|-----|------------|------|-------|--------------------|------|
| 100 | MMP0100O33 | 64.2 | 982.4 | 3.75 x 13.5 x 20.5 | 49.6 |
|-----|------------|------|-------|--------------------|------|

### Type MMP0 Capacitor Cells, 1040 VAC to 4800 VAC, Three-Phase and Single-Phase Reactive Power Compensation Ratings

| KVAR RATING | CDE P/N | NOMINAL<br>CURRENT (A <sub>RMS</sub> ) | C <sub>1</sub> NOMINAL<br>CAPACITANCE (μF) | CAN SIZE<br>W x L x H (in) | APPROX WEIGHT<br>(lbs) |
|-------------|---------|----------------------------------------|--------------------------------------------|----------------------------|------------------------|
|-------------|---------|----------------------------------------|--------------------------------------------|----------------------------|------------------------|

#### 1040 VAC, 60 Hz, 3-Phase, Delta Connection

|     |            |      |       |                    |      |
|-----|------------|------|-------|--------------------|------|
| 25  | MMP0025B33 | 13.9 | 61.3  | 5.63 x 13.5 x 6    | 20.5 |
| 75  | MMP0075B33 | 41.6 | 183.9 | 5.63 x 13.5 x 10   | 34.2 |
| 100 | MMP0100B33 | 55.6 | 245.2 | 5.63 x 13.5 x 11.5 | 39.3 |
| 125 | MMP0125B33 | 69.4 | 306.6 | 5.63 x 13.5 x 13   | 44.5 |
| 150 | MMP0150B33 | 83.3 | 367.9 | 5.63 x 13.5 x 15   | 51.3 |
| 175 | MMP0175B33 | 97.2 | 429.2 | 5.63 x 13.5 x 17.5 | 59.9 |
| 200 | MMP0200B33 | 111  | 490.5 | 5.63 x 13.5 x 20   | 68.4 |

#### 1200 VAC, 60 Hz, 3-Phase, Delta Connection

|     |            |      |       |                    |      |
|-----|------------|------|-------|--------------------|------|
| 25  | MMP0025W33 | 12   | 46.1  | 5.63 x 13.5 x 6    | 20.5 |
| 50  | MMP0050W33 | 24.1 | 92.1  | 5.63 x 13.5 x 9    | 30.8 |
| 100 | MMP0100W33 | 48.1 | 184.2 | 5.63 x 13.5 x 11.5 | 39.3 |
| 125 | MMP0125W33 | 60.1 | 230.3 | 5.63 x 13.5 x 14   | 47.9 |
| 150 | MMP0150W33 | 72.2 | 276.3 | 5.63 x 13.5 x 15   | 51.3 |
| 175 | MMP0175W33 | 84.2 | 322.4 | 5.63 x 13.5 x 17.5 | 59.9 |
| 200 | MMP0200W33 | 96.2 | 368.4 | 5.63 x 13.5 x 19   | 65   |

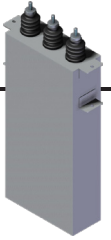
#### 2400 VAC, 60 Hz, 3-Phase, Delta Connection

|     |            |      |      |                    |      |
|-----|------------|------|------|--------------------|------|
| 25  | MMP0025J33 | 6    | 11.5 | 5.63 x 13.5 x 6    | 20.5 |
| 50  | MMP0050J33 | 12   | 23   | 5.63 x 13.5 x 7.5  | 25.7 |
| 75  | MMP0075J33 | 18   | 34.5 | 5.63 x 13.5 x 10   | 34.2 |
| 100 | MMP0100J33 | 24.1 | 46.1 | 5.63 x 13.5 x 11.5 | 39.3 |
| 125 | MMP0125J33 | 30.1 | 57.6 | 5.63 x 13.5 x 14   | 47.9 |
| 150 | MMP0150J33 | 36.1 | 69.1 | 5.63 x 13.5 x 16   | 54.7 |
| 175 | MMP0175J33 | 42.1 | 80.6 | 5.63 x 13.5 x 17.5 | 59.9 |
| 200 | MMP0200J33 | 48.1 | 92.1 | 5.63 x 13.5 x 19   | 65   |

Custom ratings and sizes available. Please contact CDE.

## AeroPower™ Power Factor Correction Capacitors

SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS  
FOR HIGH RELIABILITY APPLICATIONS



### Type MMP0 Capacitor Cells, 1040 VAC to 4800 VAC, Three-Phase and Single-Phase (cont.)

#### Reactive Power Compensation Ratings

| KVAR RATING | CDE P/N    | NOMINAL<br>CURRENT ( $A_{RMS}$ ) | C, NOMINAL<br>CAPACITANCE ( $\mu F$ ) | CAN SIZE<br>W x L x H (in) | APPROX WEIGHT<br>(lbs) |
|-------------|------------|----------------------------------|---------------------------------------|----------------------------|------------------------|
| 25          | MMP0025K33 | 5.2                              | 8.6                                   | 5.63 x 13.5 x 7.5          | 25.7                   |
| 50          | MMP0050K33 | 10.4                             | 17.3                                  | 5.63 x 13.5 x 9            | 30.8                   |
| 75          | MMP0075K33 | 15.6                             | 25.9                                  | 5.63 x 13.5 x 11.5         | 39.3                   |
| 100         | MMP0100K33 | 20.8                             | 34.6                                  | 5.63 x 13.5 x 15           | 47                     |
| 125         | MMP0125K33 | 26.1                             | 73.2                                  | 5.63 x 13.5 x 16           | 54.7                   |
| 150         | MMP0150K33 | 31.3                             | 51.9                                  | 5.63 x 13.5 x 17.5         | 59.9                   |
| 175         | MMP0175K33 | 36.5                             | 60.5                                  | 5.63 x 13.5 x 19           | 65                     |
| 200         | MMP0200K33 | 41.7                             | 69.1                                  | 5.63 x 13.5 x 20           | 68.4                   |

#### 4160 VAC, 60 Hz, 3-Phase, Delta Connection

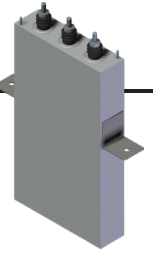
|     |            |      |      |                    |      |
|-----|------------|------|------|--------------------|------|
| 25  | MMP0025L33 | 3.5  | 3.8  | 5.63 x 13.5 x 7.5  | 25.7 |
| 50  | MMP0050L33 | 7    | 7.7  | 5.63 x 13.5 x 9    | 30.8 |
| 75  | MMP0075L33 | 10.4 | 11.5 | 5.63 x 13.5 x 11.5 | 39.3 |
| 100 | MMP0100L33 | 13.9 | 15.3 | 5.63 x 13.5 x 11.5 | 39.3 |
| 125 | MMP0125L33 | 17.4 | 19.2 | 5.63 x 13.5 x 16   | 54.7 |
| 150 | MMP0150L33 | 20.8 | 23   | 5.63 x 13.5 x 17.5 | 59.9 |
| 175 | MMP0175L33 | 24.3 | 26.8 | 5.63 x 13.5 x 19   | 65   |
| 200 | MMP0200L33 | 27.8 | 30.7 | 5.63 x 13.5 x 20   | 68.4 |

#### 4800 VAC, 60 Hz, 3-Phase, Delta Connection

|     |            |      |      |                    |      |
|-----|------------|------|------|--------------------|------|
| 25  | MMP0025M33 | 3    | 2.9  | 5.63 x 13.5 x 7.5  | 25.7 |
| 50  | MMP0050M33 | 6    | 4.8  | 5.63 x 13.5 x 9    | 30.8 |
| 75  | MMP0075M33 | 9    | 8.6  | 5.63 x 13.5 x 10   | 34.2 |
| 100 | MMP0100M33 | 12   | 11.5 | 5.63 x 13.5 x 11.5 | 39.3 |
| 125 | MMP0125M33 | 15   | 14.4 | 5.63 x 13.5 x 16   | 54.7 |
| 150 | MMP0150M33 | 18   | 17.3 | 5.63 x 13.5 x 17.5 | 59.9 |
| 175 | MMP0175M33 | 21.1 | 20.1 | 5.63 x 13.5 x 17.5 | 59.9 |
| 200 | MMP0200M33 | 24.1 | 23   | 5.63 x 13.5 x 20   | 68.4 |

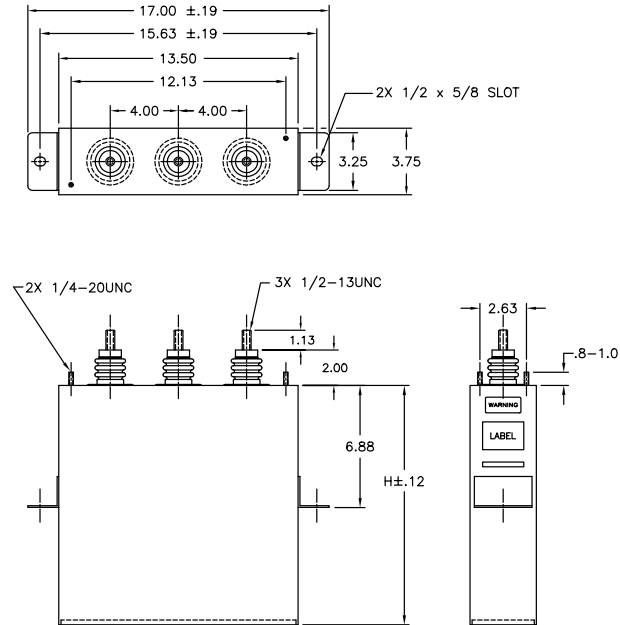
## AeroPower™ Power Factor Correction Capacitors

SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS  
FOR HIGH RELIABILITY APPLICATIONS

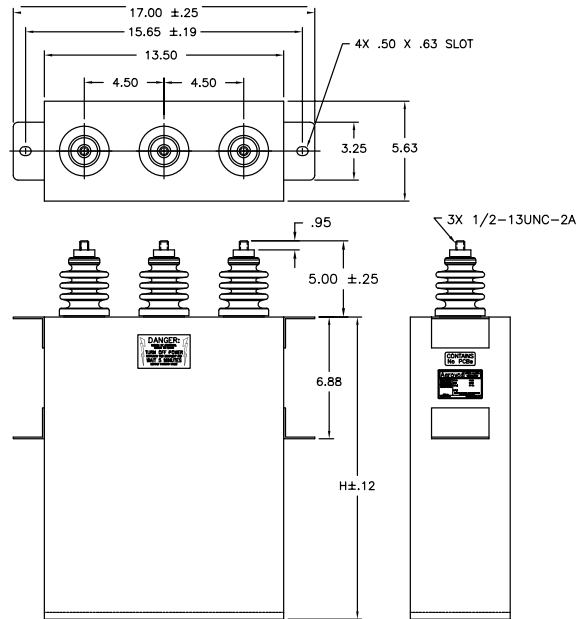


### Outline Drawings

MMP0: 240, 480, 600, 750 & 900 VAC



MMP0: 1040 to 4800 VAC



## AeroPower™ Power Factor Correction Capacitors

SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS  
FOR HIGH RELIABILITY APPLICATIONS



### Type EPFC Capacitor Cells\*

| KVAR RATING | CDE P/N | NOMINAL<br>CURRENT (A <sub>RMS</sub> ) | C, NOMINAL<br>CAPACITANCE (μF) | DIMENSIONS<br>D x H (mm) | APPROX WEIGHT<br>(kg) |
|-------------|---------|----------------------------------------|--------------------------------|--------------------------|-----------------------|
|-------------|---------|----------------------------------------|--------------------------------|--------------------------|-----------------------|

#### 240 VAC, 60 Hz, 3-Phase, Delta Connection

|     |              |      |       |          |      |
|-----|--------------|------|-------|----------|------|
| 0.5 | EPFC0005D33N | 1.2  | 23    | 76 x 70  | 0.48 |
| 1   | EPFC001D33N  | 2.4  | 46.1  | 76 x 76  | 0.5  |
| 2   | EPFC002D33N  | 4.8  | 92.1  | 76 x 140 | 0.78 |
| 2.5 | EPFC0025D33N | 6    | 115.1 | 76 x 140 | 0.78 |
| 3   | EPFC003D33N  | 7.2  | 138.2 | 76 x 140 | 0.78 |
| 4   | EPFC004D33N  | 9.6  | 184.2 | 86 x 115 | 0.9  |
| 5   | EPFC005D33N  | 12   | 230.3 | 86 x 170 | 1.2  |
| 6   | EPFC006D33N  | 14.4 | 276.3 | 86 x 170 | 1.2  |
| 7.5 | EPFC0075D33N | 18   | 345.4 | 86 x 170 | 1.2  |
| 10  | EPFC010D33N  | 24.1 | 460.4 | 86 x 200 | 1.35 |

#### 480 VAC, 60 Hz, 3-Phase, Delta Connection

|      |              |      |       |           |      |
|------|--------------|------|-------|-----------|------|
| 2    | EPFC002F33N  | 2.4  | 23    | 86 x 70   | 0.6  |
| 7.5  | EPFC0075F33N | 9    | 86.3  | 86 x 170  | 1.15 |
| 10   | EPFC010F33N  | 12   | 115.1 | 86 x 170  | 1.15 |
| 12.5 | EPFC0125F33N | 15   | 143.9 | 86 x 170  | 1.15 |
| 15   | EPFC015F33N  | 18   | 172.7 | 86 x 200  | 1.35 |
| 16.7 | EPFC0167F33N | 20   | 191.9 | 86 x 215  | 1.45 |
| 17.5 | EPFC0175F33N | 21   | 201.8 | 86 x 245  | 1.6  |
| 20   | EPFC020F33N  | 24   | 230.3 | 86 x 245  | 1.6  |
| 22.5 | EPFC0225F33N | 27   | 259   | 86 x 275  | 1.75 |
| 25   | EPFC025F33N  | 30   | 287.8 | 86 x 275  | 1.75 |
| 30   | EPFC030F33N  | 36   | 345.6 | 116 x 285 | 3.15 |
| 35   | EPFC035F33N  | 42.1 | 403.2 | 116 x 315 | 3.45 |
| 40   | EPFC040F33N  | 48.1 | 460.8 | 116 x 342 | 3.7  |

#### 480 VAC, 60 Hz, High Harmonic Applications, 3-Phase, Delta Connection

|      |              |    |       |          |      |
|------|--------------|----|-------|----------|------|
| 12.5 | EPFC0125C33N | 15 | 143.9 | 86 x 245 | 1.6  |
| 15   | EPFC015C33N  | 18 | 172.7 | 86 x 275 | 1.75 |
| 16.7 | EPFC0167C33N | 20 | 191.9 | 86 x 305 | 1.9  |
| 17.5 | EPFC0175C33N | 21 | 201.5 | 86 x 305 | 1.9  |
| 20   | EPFC020C33N  | 24 | 230.3 | 86 x 335 | 2.05 |

#### 600 VAC, 60 Hz, 3-Phase, Delta Connection

Custom ratings and sizes available. Please contact CDE.

## AeroPower™ Power Factor Correction Capacitors

SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS  
FOR HIGH RELIABILITY APPLICATIONS



### Type EPFC Capacitor Cells

| KVAR RATING | CDE P/N      | NOMINAL<br>CURRENT (A <sub>RMS</sub> ) | C, NOMINAL<br>CAPACITANCE (μF) | DIMENSIONS<br>D x H (mm) | APPROX WEIGHT<br>(kg) |
|-------------|--------------|----------------------------------------|--------------------------------|--------------------------|-----------------------|
| 10          | EPFC010H33N  | 9.6                                    | 73.7                           | 86 x 170                 | 1.15                  |
| 12.5        | EPFC0125H33N | 12                                     | 92.1                           | 86 x 170                 | 1.15                  |
| 15          | EPFC015H33N  | 14.4                                   | 110.5                          | 86 x 200                 | 1.35                  |
| 16.7        | EPFC0167H33N | 16                                     | 122.8                          | 86 x 215                 | 1.45                  |
| 17.5        | EPFC0175H33N | 16.8                                   | 128.9                          | 86 x 215                 | 1.45                  |
| 20          | EPFC020H33N  | 19.2                                   | 147.4                          | 86 x 245                 | 1.6                   |
| 22.5        | EPFC0225H33N | 21.6                                   | 165.8                          | 86 x 275                 | 1.75                  |
| 25          | EPFC025H33N  | 24                                     | 184.2                          | 86 x 275                 | 1.75                  |
| 30          | EPFC030H33N  | 28.8                                   | 219.9                          | 116 x 285                | 2.95                  |
| 35          | EPFC035H33N  | 33.6                                   | 258                            | 116 x 315                | 3.25                  |
| 40          | EPFC040H33N  | 38.4                                   | 294.9                          | 116 x 342                | 3.7                   |

### 600 VAC, 60 Hz, High Harmonic Applications, 3-Phase, Delta Connection

|      |              |      |       |           |      |
|------|--------------|------|-------|-----------|------|
| 10   | EPFC010I33N  | 9.6  | 73.7  | 86 x 200  | 1.35 |
| 12.5 | EPFC0125I33N | 12   | 92.1  | 86 x 245  | 1.6  |
| 15   | EPFC015I33N  | 14.4 | 110.5 | 86 x 245  | 1.6  |
| 16.7 | EPFC0167I33N | 16   | 122.8 | 86 x 275  | 1.75 |
| 17.5 | EPFC0175I33N | 16.8 | 128.9 | 86 x 275  | 1.75 |
| 20   | EPFC020I33N  | 19.2 | 147.4 | 86 x 305  | 1.9  |
| 25   | EPFC025I33N  | 24.1 | 184.4 | 116 x 315 | 3.5  |

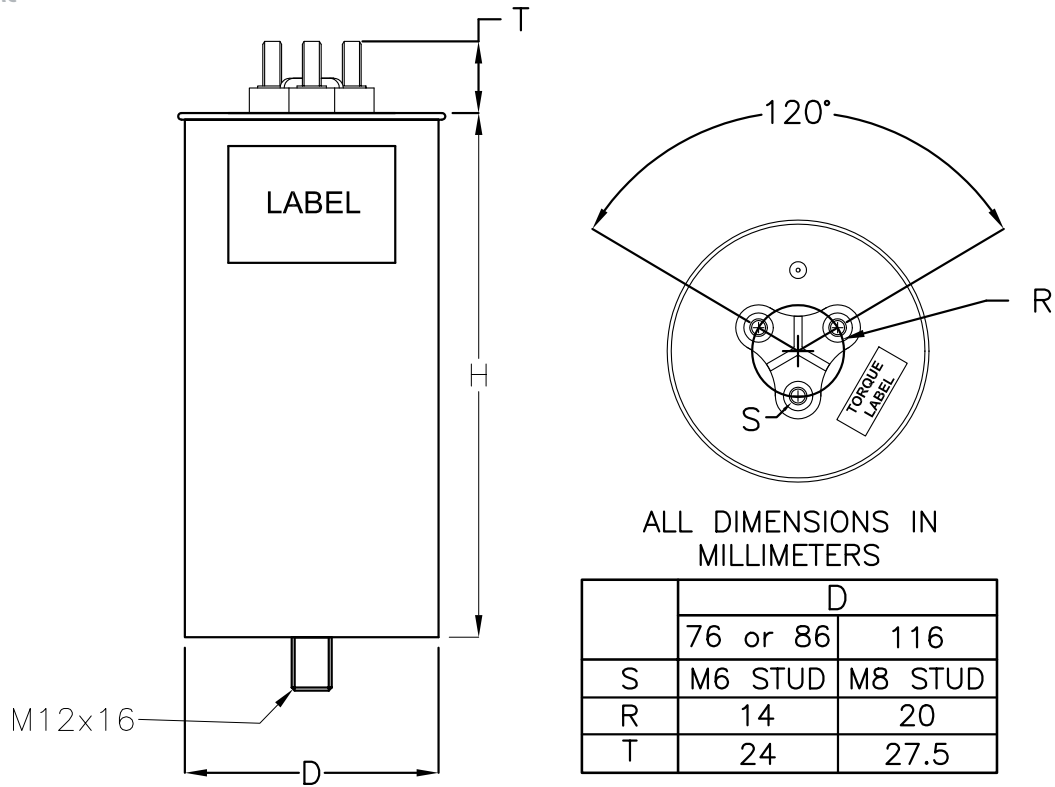
\*Made in China

## AeroPower™ Power Factor Correction Capacitors

SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS  
FOR HIGH RELIABILITY APPLICATIONS

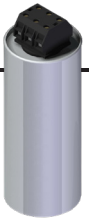
### Outline Drawings

EPFC: 240 to 600 VAC



## AeroPower™ Power Factor Correction Capacitors

SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS  
FOR HIGH RELIABILITY APPLICATIONS



### CDE 50 Hz EPFC\*

| KVAR RATING | CDE P/N | NOMINAL<br>CURRENT (A <sub>RMS</sub> ) | C <sub>t</sub> NOMINAL<br>CAPACITANCE (μF) | CAN SIZE<br>D x H (mm) | APPROX WEIGHT<br>(kg) |
|-------------|---------|----------------------------------------|--------------------------------------------|------------------------|-----------------------|
|-------------|---------|----------------------------------------|--------------------------------------------|------------------------|-----------------------|

#### 400 VAC, 50 Hz, 3-Phase Delta Connection

|      |              |      |       |           |      |
|------|--------------|------|-------|-----------|------|
| 2    | EPFC002G33H  | 2.88 | 39.8  | 75 x 175  | 0.91 |
| 2.5  | EPFC0025G33H | 3.6  | 49.7  | 75 x 175  | 0.91 |
| 5    | EPFC005G33H  | 7.2  | 99.5  | 75 x 175  | 0.91 |
| 7.5  | EPFC0075G33H | 10.8 | 149.2 | 75 x 210  | 1.08 |
| 10   | EPFC010G33H  | 14.4 | 198.9 | 85 x 210  | 1.45 |
| 12.5 | EPFC0125G33H | 18   | 248.7 | 95 x 210  | 1.36 |
| 15   | EPFC015G33H  | 21.6 | 298.4 | 95 x 210  | 1.36 |
| 20   | EPFC020G33H  | 28.9 | 397.9 | 95 x 247  | 1.93 |
| 25   | EPFC025G33H  | 36.1 | 497.4 | 116 x 247 | 2.81 |
| 30   | EPFC030G33H  | 43.3 | 596.8 | 116 x 247 | 2.81 |
| 50   | EPFC050G33H  | 72.2 | 994.7 | 116 x 353 | 3    |

#### 415 VAC, 50 Hz, 3-Phase Delta Connection

|      |              |      |       |           |      |
|------|--------------|------|-------|-----------|------|
| 2    | EPFC002A33H  | 2.8  | 37    | 75 x 175  | 0.91 |
| 5    | EPFC005A33H  | 7    | 92.4  | 75 x 175  | 0.91 |
| 7.5  | EPFC0075A33H | 10.4 | 138.6 | 75 x 210  | 1.08 |
| 10   | EPFC010A33H  | 13.9 | 184.8 | 75 x 210  | 1.08 |
| 12.5 | EPFC0125A33H | 17.4 | 231   | 85 x 210  | 1.45 |
| 15   | EPFC015A33H  | 20.9 | 277.2 | 95 x 210  | 1.36 |
| 20   | EPFC020A33H  | 27.8 | 369.6 | 95 x 247  | 1.93 |
| 25   | EPFC025A33H  | 34.8 | 462.1 | 116 x 247 | 2.81 |
| 30   | EPFC030A33H  | 41.7 | 554.5 | 116 x 247 | 2.81 |
| 50   | EPFC050A33H  | 69.6 | 924.1 | 116 x 353 | 3    |

#### 440 VAC, 50 Hz, 3-Phase Delta Connection

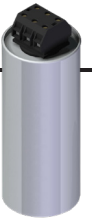
|      |              |      |       |           |      |
|------|--------------|------|-------|-----------|------|
| 2    | EPFC002P33H  | 2.6  | 32.9  | 75 x 175  | 0.91 |
| 2.5  | EPFC0025P33H | 3.3  | 41.1  | 75 x 175  | 0.91 |
| 5    | EPFC005P33H  | 6.6  | 82.2  | 75 x 175  | 0.91 |
| 7.5  | EPFC0075P33H | 9.8  | 123.3 | 75 x 175  | 0.91 |
| 10   | EPFC010P33H  | 13.1 | 164.4 | 75 x 210  | 1.1  |
| 12.5 | EPFC0125P33H | 16.4 | 205.5 | 85 x 210  | 1.16 |
| 15   | EPFC015P33H  | 19.7 | 246.6 | 95 x 210  | 1.36 |
| 20   | EPFC020P33H  | 26.2 | 328.8 | 95 x 247  | 1.93 |
| 25   | EPFC030P33H  | 32.8 | 411   | 116 x 210 | 2.4  |
| 30   | EPFC030P33H  | 39.4 | 493.2 | 116 x 247 | 2.81 |
| 50   | EPFC050P33H  | 65.6 | 822.1 | 116 x 353 | 3    |

#### 480 VAC, 50 Hz, 3-Phase Delta Connection

Custom ratings and sizes available. Please contact CDE.

## AeroPower™ Power Factor Correction Capacitors

SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS  
FOR HIGH RELIABILITY APPLICATIONS



| KVAR RATING | CDE P/N      | NOMINAL<br>CURRENT (A <sub>RMS</sub> ) | C <sub>i</sub> NOMINAL<br>CAPACITANCE (μF) | CAN SIZE<br>D x H (mm) | APPROX WEIGHT<br>(kg) |
|-------------|--------------|----------------------------------------|--------------------------------------------|------------------------|-----------------------|
| 5           | EPFC005Q33H  | 6                                      | 69.1                                       | 75 x 175               | 0.94                  |
| 7.5         | EPFC0075Q33H | 9                                      | 103.6                                      | 75 x 210               | 1.08                  |
| 10          | EPFC010Q33H  | 12                                     | 138.2                                      | 85 x 210               | 1.41                  |
| 12.5        | EPFC0125Q33H | 15                                     | 172.7                                      | 95 x 210               | 1.36                  |
| 15          | EPFC015Q33H  | 18                                     | 207.2                                      | 95 x 247               | 1.93                  |
| 20          | EPFC020Q33H  | 24.1                                   | 276.3                                      | 95 x 247               | 1.93                  |
| 25          | EPFC025Q33H  | 30.1                                   | 345.4                                      | 116 x 247              | 2.81                  |

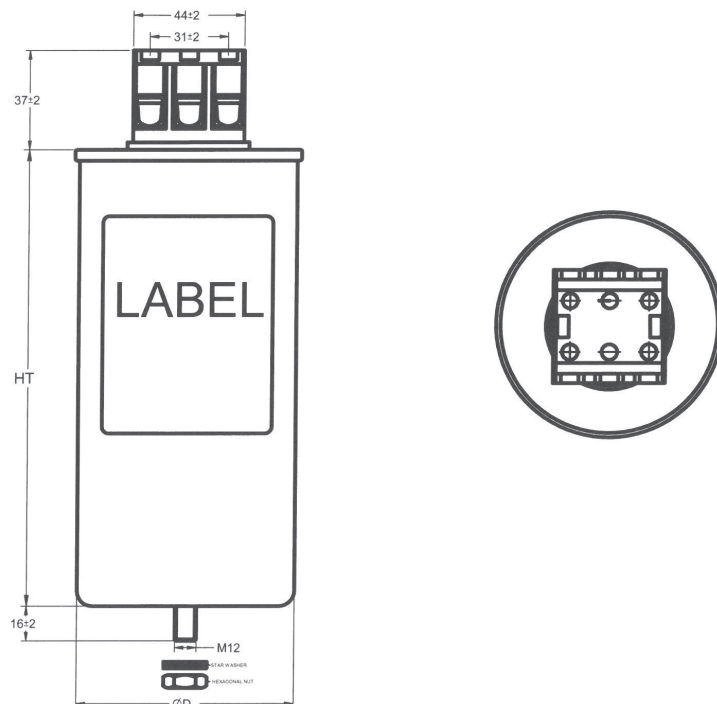
### 525 VAC, 50 Hz, 3-Phase Delta Connection

|      |              |      |       |           |      |
|------|--------------|------|-------|-----------|------|
| 5    | EPFC005R33H  | 5.5  | 57.7  | 75 x 175  | 0.96 |
| 7.5  | EPFC0075R33H | 8.2  | 86.6  | 75 x 210  | 1.11 |
| 10   | EPFC010R33H  | 11   | 115.5 | 95 x 210  | 1.36 |
| 12.5 | EPFC0125R33H | 13.8 | 144.4 | 95 x 247  | 1.93 |
| 15   | EPFC015R33H  | 16.5 | 173.2 | 95 x 247  | 1.93 |
| 20   | EPFC020R33H  | 22   | 231   | 116 x 247 | 2.81 |
| 25   | EPFC025R33H  | 27.5 | 288.7 | 136 x 247 | 2.99 |

\*Made in India

### Outline Drawings

EPFC: 400 to 525 VAC



Different terminal options available upon request.

## AeroPower™ Power Factor Correction Capacitors

SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS  
FOR HIGH RELIABILITY APPLICATIONS

### Equations for Power Factor Correction and Harmonic Distortion (Balanced Phase Loads)

#### Capacitors in Parallel

$$C_T = C_1 + C_2 + C_3 + \cdots C_n = \sum_{i=1}^n C_i$$

#### Capacitors in Series

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \cdots \frac{1}{C_n} = \sum_{i=1}^n \frac{1}{C_i}$$

$$DF = \tan(\delta) = \frac{ESR}{X_c} = (2\pi f)(C)(ESR)$$

$$\text{Power Loss} = (2\pi f)(C \times V^2)(DF)$$

$$X_c = \frac{1}{(2\pi f)C}$$

$$C_T = \frac{KVAR \times 10^{-3}}{(2\pi f)(KV)^2}$$

$$KW \text{ (Motor Input)} = \frac{hp \times 0.746}{\% \text{Eff}}$$

$$KVA = \frac{KW}{PF} = \sqrt{(KW)^2 + (KVAR)^2}$$

$$KVAR = \frac{2\pi \times f \times C \times (KV)^2}{10^{-3}}$$

$$KVAR_E = KVAR_R \times \left[ \frac{V_A}{V_R} \right]^2 \times \left[ \frac{f_A}{f_R} \right]$$

$$KVAR = \frac{hp \times 0.746}{\eta} \left[ \sqrt{\frac{1 - PF_0^2}{PF_0^2}} - \sqrt{\frac{1 - PF_T^2}{PF_T^2}} \right]$$

$$KVA = \frac{V_L \times I_L}{1000} \quad \text{Single-Phase}$$

$$KVA = \frac{\sqrt{3} \times V_L \times I_L}{1000} \quad \text{Three-Phase}$$

$$I_{RMS} = \sqrt{I_1^2 + \sum_{h=2}^{\infty} I_h^2}$$

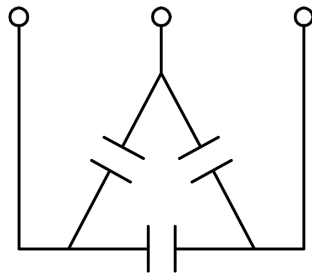
## AeroPower™ Power Factor Correction Capacitors

### SINGLE-PHASE AND THREE-PHASE PFC CAPACITORS FOR HIGH RELIABILITY APPLICATIONS

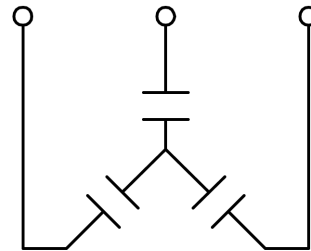
#### Legend

|          |                                             |                     |           |                                      |
|----------|---------------------------------------------|---------------------|-----------|--------------------------------------|
| K        | 1000                                        |                     | $V_A$     | Applied line Voltage                 |
| W        | Watts                                       |                     | $V_R$     | Rated line voltage                   |
| V        | Volts                                       |                     | $f_A$     | Applied frequency                    |
| A        | Amperes                                     |                     | $f_R$     | Rated frequency                      |
| hp       | Horsepower                                  |                     | $\eta$    | Motor efficiency                     |
| C        | Capacitance (Farads)                        |                     | $PF_0$    | Initial Power Factor                 |
| PF       | Power Factor                                |                     | $PF_T$    | Target Power Factor                  |
| KW       | Working Power (1000 Watts)                  |                     | $I_{RMS}$ | Root-mean-square value of current    |
| KVA      | Total Power (1000 Volt-Amperes)             |                     | $I_1$     | Current at fundamental frequency     |
| KVAR     | Reactive Power (1000 Volt-Amperes Reactive) |                     | $I_h$     | Harmonic current of order h          |
| $\delta$ | Loss Angle                                  |                     | $C_T$     | Total capacitance (Farads)           |
| $V_L$    | Line Voltage                                |                     | $X_c$     | Capacitor reactance                  |
| $I_L$    | Line current                                |                     | $I_{ph}$  | Phase current                        |
| $f$      | Frequency                                   |                     | DF        | Dissipation Factor                   |
| $KVAR_E$ | Effective KVAR                              | KVAR De-rating for  | ESR       | Equivalent Series Resistances (Ohms) |
| $KVAR_R$ | Rated KVAR                                  | Voltage & Frequency |           |                                      |

#### Connection Types



Delta Connection



Wye Connection



### Why Do You Need Power Factor Correction?

Power Factor Correction capacitors (PFCs) save power in an electric power system, and the savings can be substantial. PFCs do this by helping filter the harmonics load in the power system, which allows more efficient usage of utility power and reduces the amount of current lost. More useful power is transferred to the power system without requiring larger wiring or more robust equipment.

If a power system is receiving “dirty” power (fluctuations, harmonic dissonance, etc.) the PFC capacitor can filter these out and the capacitor will not fail. Use of PFC capacitors in industrial or manufacturing settings results in significant cost savings and longer equipment life. The efficient use of power also means the utility grid can avoid building additional power generators, saving capital cost, specifically in emerging markets.

### How Does Power Factor Correction Work?

Electric power has two components:

- 1) Active power which produces work.
- 2) Reactive power, which is needed to generate the magnetic fields required for the operation of inductive electrical equipment, but performs no useful work.

Active (or “real”) power is measured in KW (1000 Watts)

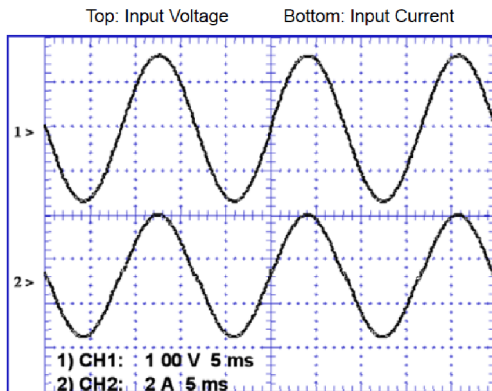
Reactive power is measured in KVAR (1000 Volt-Amperes Reactive)

Total (or “apparent”) power is measured in KVA (1000 Volt-Amperes)

The ratio of working power to total power is called power factor.

$$PF = \frac{\text{Real Power (expressed in Watts)}}{\text{Apparent Power (expressed in VA)}}$$

## CDE PFC Capacitor Care, Troubleshooting and Common Issues



Power factor correction capacitors increase the power factor by supplying reactive power when installed at or near inductive electrical equipment. Ideally, the electrical load (motor, lights, etc.) should emulate a resistor, in which case, the reactive power is zero. The goal is to have a perfect sinewave of the current match the voltage.

### Power Factor Correction Capacitors Save Money — So Keep Them Serviced!

Power factor correction capacitors lower electrical costs in two ways:

- 1) In many areas, the electrical rate includes a penalty charge when you have low power factor. Installing power factor capacitors on a facility's electrical distribution system makes it unnecessary for the utility to supply the reactive power which would otherwise be required by inductive electrical equipment. The savings the utility realizes in reduced generation, transmission, and distribution costs are passed onto the customer in the form of lower electrical bills.
- 2) The second source of savings realized by using power factor correction capacitors is in the form of increased KVA capacity in your electrical distribution system. Installing capacitors to furnish the non-productive current requirements of the facility makes it possible to increase the connected load as much as 20% without a corresponding increase in the size of the transformers, conductors, and protective devices in the distribution system which services the load.

### What Can Go Wrong?

Without regular monitoring and maintenance of your PFC system, the system may not perform optimally, or worse, it may be headed for a breakdown. Issues can range from a non-ideal power factor to catastrophic failure of the entire PFC system. The capacitors and reactors could be severely damaged or destroyed. This could result in a full power down of the facility which will put your business lines down (\$\$\$\$). By maintaining the PFC system this can be avoided, and keep expensive replacement costs in check.

### Safety Is Always First

Before working on any power factor system, make certain it is disconnected from the main power source, and that the output of the system is also disconnected. This ensures nothing is being fed backward through the system.

Also confirm the capacitors are discharged before disconnecting or adjusting any cabling or equipment. (PFC capacitors have discharge resistors to prevent shock, but manually checking that the capacitors did indeed discharge is always good practice.)

In the event testing needs to be completed while the PFC system is active, use extreme caution. Check that current transformers (CTs) are connected, as an open CT will create high voltage and could damage equipment as well as cause serious injury.

### Where Should We Start?

Begin by performing a complete visual inspection of the system. This is a quick check to ensure the switches are working and the

capacitor banks are also working properly.

- Look for discolored components, bulging and/or leaking capacitors and signs of heating and/or moisture. Bulging in a capacitor is a telltale sign that it is at the end of its life.
- Check reactors for discolored cabling or cases.
- Check that fans are free of debris and in proper working order.
- Check the PFC controller and manually step through connecting each capacitor bank.
- Check the PFC % and ensure the phases are balanced.

### Checking for Hot Spots

Thermal imaging is a great tool to evaluate an electrical system's performance. Imaging will need to be completed with the system running, so ensure you are following proper safety procedures first. Get your thermal imaging information where the wiring connections are to the capacitors and reactors - this includes the terminals of the capacitors.

- Check the capacitors for hot spots as well as the reactors. To do this, you will need to confirm the capacitors and reactors you are monitoring are live. There are usually manual settings from the PFC control to connect the components.
- Check specifically for temperature differences between phases of more than 7° C.
- Check that the spacing between capacitors is appropriate – 2 cm. minimum is usually standard. If there is forced air in your system, ensure the flow is appropriate and this is not causing heat transfer from one component to the next.
- If cabling or terminal heating is abnormal, ensure terminals are tightened to the appropriate torque, and that cables are not worn. Power down the system before adjusting.

### Check Capacitance

Depending on the system, you will want to power down and make certain any three phase transformers are disconnected to ensure the proper measurement of the capacitor. Also, check that the capacitors are discharged before measuring capacitance. A charged capacitor can cause shock and/or damage to the equipment otherwise.

- Check the voltage across the capacitor phase-to-phase as well as phase-to-neutral. The voltage across the capacitors should be zero.
- Check the capacitance per the configuration Y, delta, and neutral connected. All phases of the capacitor should read within a single digit % of each other. A larger capacitance difference between phases is cause for further investigation.
- It is also good practice to measure the capacitance at more than one frequency.

### Check Current

Checking current will need to be completed with a live system, so exercise caution.

- Using a current clamp CT, a best practice is to measure the current through the PFC system's current transformer and calculate the current on the line (this measurement can be used to validate the PFC panel).

- The CT ratio should be multiplied by the current measurement to calculate the current through the line/phase of the capacitor. The current measured will be the RMS (Root Mean Square) current through the capacitor (this current includes harmonics). Ensure the RMS current is acceptable for the capacitor rating and design.

Each current measurement on each phase should be within a single digit percentage of one another. Any phase imbalance will require deeper investigation.

- If the CT current is in question (measurement is high or low), measuring the line current for each phase into the capacitor would be the next step. As the current is much higher in the line than on the PFC system's current transformer, ensure the current clamp and meters are configured so as to measure the higher current.

### Check Voltage

A check of the voltage will also need to be completed with a live system (use caution).

- Check the RMS voltage for each phase measuring from phase-to-phase and also phase-to-neutral.
- Check that your voltage measurements comply with the capacitor design limits. Each phase should be within a single percent of one another. Any phase imbalance will require further investigation.

### Take a Deeper Dive — Harmonics and Transients

Checking voltage will also need to be completed with a live system (use caution). If the RMS measurements were within specifications, a study of the current and voltage harmonics would be a good idea. This will help you to understand power fluctuations due to transient loads from variable speed drives and any other nonlinear loads. Checking for systems tuned to harmonics is also a best practice when troubleshooting a faulty PFC system.

### In Conclusion, Continued, Regular Maintenance

Yearly visual inspection of the PFC system is a good practice to certify the system is in good working order. It can become quite costly if routine maintenance is not completed as the cabling, capacitors and reactors may become damaged and require replacement. By maintaining the PFC system this can be avoided the expensive cost of replacement can be kept in check.

## About CDE

CDE is a leading provider of film capacitors for industrial, medical and specialized applications serving original equipment manufacturers (OEM) and distributors. The company has world-class design, manufacturing and testing facilities in New Bedford, Massachusetts and global manufacturing facilities in China and India to enable quick turn-around for shipping and delivery worldwide.

CDE capacitors are among the world's most reliable components. Our extensive custom design and development capabilities coupled with broad, standardized product offerings allow us to provide intelligent capacitor solutions that meet or exceed our customers' application requirements.

Our aim is to be the best and most sought after provider of capacitor solutions for specialty markets.