

EAT•N

Cutler-Hammer

**POWER FACTOR
CORRECTION CAPACITORS**

Product Guide 2008



Power Factor Correction Capacitor Banks and Harmonic Filters

Contents

<i>Description</i>	<i>Page</i>
Power Factor Correction Capacitor Banks and Harmonic Filters	
Power Factor Correction Capacitors	2
UNIPUMP™ Power Factor Correction Capacitors	4
UNIPAK™	6
UNIPAK Filter — Harmonic Filtering	6
AUTOVAR® 300 Automatic Power Factor Correction Capacitor Systems	13
AUTOVAR 600 Automatic Power Factor Correction Capacitor Systems	15
AUTOVAR Filter — LV Automatic Harmonic Filter	19
Transient-Free Static Switching Power Factor Correction Units	22
Active Harmonic Filter-Harmonic Correction Units	25

Power Factor Correction Capacitors

Power Factor Correction Capacitors



Capacitor Cell With M12 Threaded Mounting Bolt, Washer, Nut

Product Description

Eaton introduces Cutler-Hammer power factor correction capacitor banks and harmonic filters. Power factor correction capacitors and harmonic filters are an essential part of modern electric power systems. Power factor correction capacitors are the simplest and most economical means of increasing the capacity of any power system, minimizing energy losses and correcting load power factor. In addition, power factor penalties can be reduced and power quality can be greatly enhanced.

There are several reasons to correct poor power factor. The first is to reduce or eliminate a power factor penalty charged by the utility. Another reason is that your existing transformer is, or shortly will be, at full capacity and installing power factor correction capacitors can be a very cost-effective solution to installing a brand new service. Depending on the amount of power factor correction (kvar that needs to be injected into the electrical system to improve the power factor) and the dynamic nature of the load, a fixed or switched capacitor bank may be the best solution.

When capacity becomes a problem, the choice of a solution will be dependent upon the size of the increase needed. Like all power quality solutions, there are many factors that need to be considered when determining which solution will be best to solve your power factor problem.

Harmonic Filtering

As the world becomes more dependent on electric and electronic equipment, the likelihood that the negative impact

of harmonic distortion increases dramatically. The efficiency and productivity gains from these increasingly sophisticated pieces of equipment have a negative side effect...increased harmonic distortion in the power lines. The difficult thing about harmonic distortion is determining the cause. Once this has been determined, the solution can be easy. Passive and active harmonic filtering equipment will mitigate specific harmonic issues, and correct poor power factor as well.

Product Selection

Table 1. Capacitor Cell Chart

Voltage	kvar	Dimensions in Inches (mm)		Weight in Lbs. (kg)	Part Number
		D	H		
240	1.5	3.1 (79.5)	7.9 (200.0)	1.1 (0.5)	643PCRMA
240	2	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)	8B43PCRMA
240	2.5	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)	1043PCRMA
240	3	3.5 (89.5)	9.4 (238.0)	1.8 (0.8)	12X43PCRMA
240	4	3.1 (79.5)	7.9 (200.0)	1.1 (0.5)	423PCRMA
240	5	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)	2043PCRMA
240	6.3	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)	6B23PCRMA
240	7.5	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)	7X23PCRMA
240	8.3	3.5 (89.5)	9.4 (238.0)	1.8 (0.8)	8B23PCRMA
240	10	3.5 (89.5)	9.4 (238.0)	1.3 (0.6)	1023PCRMA
240	12.5	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)	12X23PCRMA
240	15	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)	1523PCRMA
240	16.7	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)	16S23PCRMA
240	17.5	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)	17X23PCRMA
480	1.5	2.1 (53.0)	5.0 (125.8)	0.7 (0.3)	1X43PCRMA
480	2	2.5 (63.5)	5.5 (140.8)	0.9 (0.4)	243PCRMA
480	2.5	2.5 (63.5)	5.5 (140.8)	0.9 (0.4)	2X43PCRMA
480	3	2.5 (63.5)	5.5 (140.8)	0.9 (0.4)	343PCRMA
480	4	2.5 (63.5)	6.5 (165.8)	0.9 (0.4)	443PCRMA
480	5	2.5 (63.5)	6.5 (165.8)	0.9 (0.4)	543PCRMA
480	6	3.1 (79.5)	7.9 (200.0)	1.1 (0.5)	643PCRMA
480	7.5	3.1 (79.5)	7.9 (200.0)	1.1 (0.5)	7X43PCRMA
480	8.3	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)	8B43PCRMA
480	9	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)	943PCRMA
480	10	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)	1043PCRMA
480	12.5	3.5 (89.5)	9.4 (238.0)	1.8 (0.8)	12X43PCRMA
480	15	3.5 (89.5)	9.4 (238.0)	1.8 (0.8)	1543PCRMA
480	18	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)	1843PCRMA
480	20	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)	2043PCRMA
480	25	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)	2543PCRMA
480	30	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)	3043PCRMA
600	5	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)	563PCRMA
600	7.5	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)	7X63PCRMA
600	10	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)	1063PCRMA
600	12.5	3.5 (89.5)	9.4 (238.0)	1.8 (0.8)	12X63PCRMA
600	15	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)	1563PCRMA
600	17.5	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)	2063PCRMA
600	20	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)	2563PCRMA

Note: Kvar rating standard. NEMA kvar tolerance is +15% to 0%. Part number shown is for 3-phase units. Up to 5 kvar at 480 V — fast-on terminals are standard. Above 5 kvar at 480 V (and on all other voltages) — sigut terminals are standard.

Table 2. Harmonic Rated Capacitor Cell Chart

Voltage	kvar	Dimensions in Inches (mm)		Weight in Lbs. (kg)	Part Number
		D	H		
240	12.5	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)	12X23PHRMA
480	15.0	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)	1543PHRMA
480	25.0	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)	2543PHRMA
600	12.3	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)	12A63PHRMA
600	14.7	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)	14S63PHRMA
600	16.7	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)	16S63PHRMA

Technical Data and Specifications

Dimensions

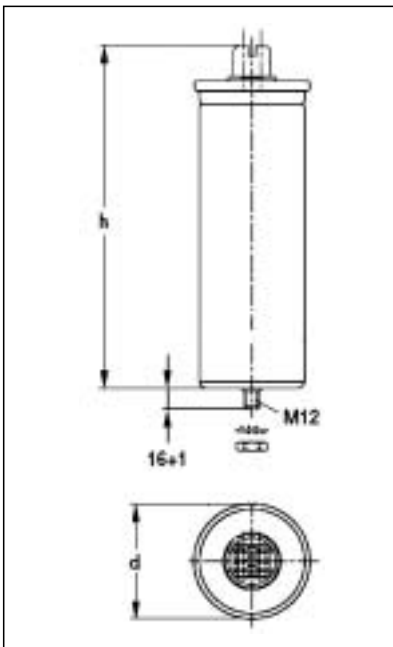


Figure 1. Capacitor Cell Dimensions

UNIPUMP

UNIPUMP Power Factor Correction Capacitors



UNIPUMP

Product Description

Non-fused capacitors for outdoor irrigation and oil field installations.

- Designed expressly for outdoor pumping applications.
- Pole or wall mounting.
- Small, light-weight enclosure for easy installation.
- SO-WA type flexible cable facilitates installation (4-conductor).
- Gland-type weatherproof bushings.
- Strong outer case.
- UL and CSA listed.

Applications

Outdoor irrigation and oil and gas field pumping.

Features and Specifications

Configuration

- **Outer case:** Heavy, No. 14 gauge steel finished with durable baked-on enamel. Integral strap mounting bracket with keyhole at top for pole or wall installation. No knockouts.

Capacitor Cells

- **Terminals:** Insulated finger-safe terminals rated for 3 kVAC withstand. Rated for 30 kV BIL.
- **Dielectric fill:** Dry-type cells utilize soft organic polymer resin — Resinol.
 - Eliminates potential for corona / partial discharge / electrochemical oxidation.
 - Excellent heat dissipation
 - Flash point: +444°F (+229°C)
 - Fire point: +840°F (+449°C)
- **Design:** Self-healing metallized high crystalline polypropylene with ramp metallization film. Total losses less than .45 watt per kvar. (Dielectric losses less than .2 watt per kvar.)
- **Ramp metallization:** Provides thicker film at higher current density areas, allowing for reduced internal losses, lower operating temperatures and longer life expectancy.

Also prevents chain reaction breakdown by limiting propagation of film vaporization.

- **Pressure sensitive interrupter:** Built-in, three-phase pop-up interrupter design. UL recognized. Removes capacitor from line before internal pressure can cause case rupture. Bulged capacitor cell top provides easy visual indication of interrupter operation.
- **Ceramic discharge resistors:** Reduce residual voltage to less than 50 volts within one minute of de-energization. Selected for 20-year nominal life. Exceeds NEC requirements.
- **Capacitor operating temperature:** -40°F (-40°C) to +115°F (+46°C).
- **Case:** Weatherproof aluminum housing.
- **Warranty:** The longest in the industry — five full years of warranty on capacitor cells.

Product Selection

Table 3. UNIPUMP Selection Chart

kvar	Rated Current	Case Size	Cable Size	Shipping Weight in Lbs. (kg)	Catalogue Number
240 Vac					
2	4.8	AA	14.0	10.0 (4.7)	223JMR
2.5	6.0	AA	14.0	10.0 (4.7)	2X23JMR
3	7.2	AA	14.0	10.0 (4.7)	323JMR
4	9.6	AA	14.0	11.0 (4.8)	423JMR
5	12.0	AA	14.0	11.0 (4.8)	523JMR
6	14.4	BB	12.0	15.0 (6.6)	623JMR
7.5	18.0	BB	12.0	15.0 (6.6)	7X23JMR
480 Vac					
2	2.4	AA	14.0	10.4 (4.7)	243JMR
2.5	3.0	AA	14.0	10.4 (4.7)	2X43JMR
3	3.6	AA	14.0	10.4 (4.7)	343JMR
4	4.8	AA	14.0	10.4 (4.7)	443JMR
5	6.0	AA	14.0	10.4 (4.7)	543JMR
6	7.2	AA	14.0	10.6 (4.8)	643JMR
7.5	9.0	AA	14.0	10.6 (4.8)	7X43JMR
10	12.0	AA	14.0	10.8 (4.9)	1043JMR
12.5	15.0	BB	12.0	15.0 (6.8)	12X43JMR
15	18.0	BB	12.0	15.0 (6.8)	1543JMR
17.5	21.0	BB	8.0	15.8 (7.2)	17X43JMR
20	24.0	BB	8.0	16.8 (7.7)	2043JMR
25	30.0	BB	8.0	16.8 (7.7)	2543JMR
600 Vac					
5	4.9	AA	14.0	10.8 (4.9)	563JMR
6	5.9	AA	14.0	10.8 (4.9)	663JMR
7.5	7.4	AA	14.0	10.8 (4.9)	7X63JMR
10	9.8	AA	14.0	10.8 (4.9)	1063JMR
12.5	12.3	AA	12.0	15.0 (6.8)	12X63JMR
15	14.7	BB	12.0	15.8 (7.2)	1563JMR
17.5	17.2	BB	8.0	16.8 (7.7)	17X63JMR
20	19.6	BB	8.0	16.8 (7.7)	2063JMR

Technical Data and Specifications

Dimensions

Table 4. UNIPUMP Dimension Chart

Size Code	Dimensions in Inches (mm)			
	A	B	C	D
AA	11.0 (279.7)	14.2 (360.9)	12.6 (320.0)	13.2 (335.5)
BB	14.0 (354.5)	17.1 (435.6)	15.5 (394.7)	16.1 (410.2)

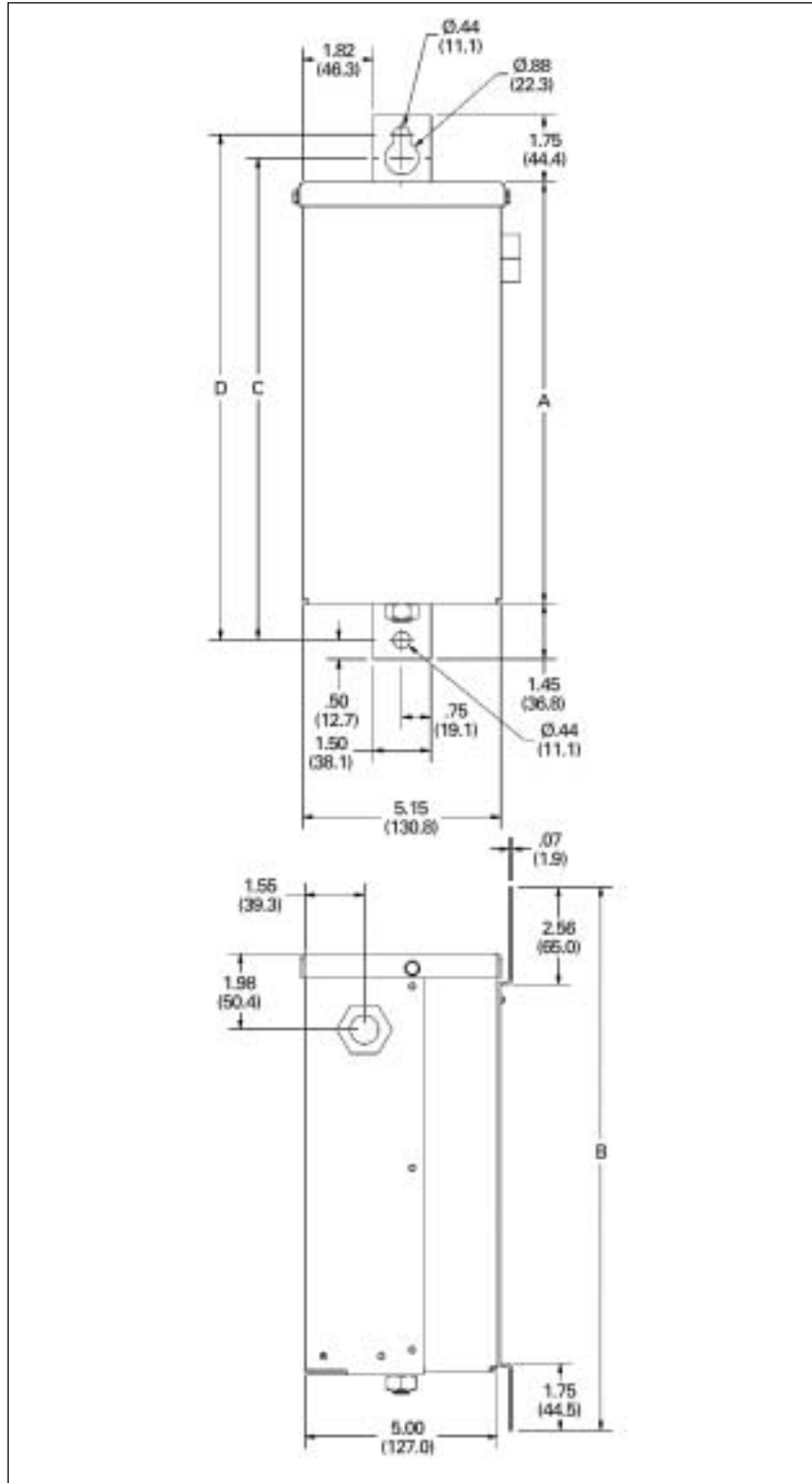


Figure 2. UNIPUMP Dimensions

UNIPAK

UNIPAK



UNIPAK



UNIPAK Interior

Features, Benefits and Functions

- Five-year warranty on capacitor cells.
- Designed for heavy-duty applications.
- Twenty-year life design.
- Indoor/outdoor service.

- Wall (up to 180 kvar) and floor-mounted units available.
- Fuse protection standard.
- Blown-fuse indicating lights standard.
- Quick lead-times.
- Harmonic filters available.
- Slim profile allows reduced footprint, conserving valuable floor space.
- New capacitor configuration leads to cooler operating conditions, extending capacitor life.

Standards and Certifications

- UL and CSA listed.

Features and Specifications

Configuration

- **Outer case:** Heavy, No. 14 gauge steel finished with durable baked-on enamel. Wall mounting flanges and floor mounting feet. Elimination of knockouts permits indoor/outdoor use. Manufactured to NEMA requirements 1, 3R and 12.
- Elevated floor mounting feet allow access for easy maintenance.

Note: NEMA 12 up to 180 kvar only.

- **Cover:** "L" shaped gasketed cover with multiple fasteners provides front opening for ease of installation and service.
- **Ground terminal:** Furnished inside case.
- **Power terminal lugs:** Large size provided for easy connection.
- **Fusing:**
 - **Size Code A1:** Three midget-type fuses with 100,000 ampere interrupting capacity
 - **Size Code A2 and larger:** Three slotted-blade type fuses with 200,000 ampere interrupting capacity; Fuses mounted on stand-off bushings or fuse blocks; Solderless connectors for easy hookup of incoming line conductors
 - **Fuse indicating lights:** Red, neon blown-fuse indicating lights are protected by transparent weather-proof guard

Options:

- No fuses
- Fused, no indicating lights
- Air filters for units 200 kvar and above



UNIPAK with Optional Air Filter

UNIPAK Filter — Harmonic Filtering

Capacitor Cells

- **Terminals:** Insulated finger-safe terminals rated for 3 kVAC withstand. Rated for 30 kV BIL.
- **Dielectric fill:** Dry-type cells utilize soft organic polymer resin — Resinol.
 - Eliminates potential for corona / partial discharge / electrochemical oxidation.
 - Excellent heat dissipation
 - Flash point: +444°F (+229°C)
 - Fire point: +840°F (+449°C)
- **Design:** Self-healing metallized high crystalline polypropylene with ramp metallization film. Total losses less than .45 watt per kvar. (Dielectric losses less than .2 watt per kvar.)
- **Ramp metallization:** Provides thicker film at higher current density areas, allowing for reduced internal losses, lower operating temperatures and longer life expectancy. Also prevents chain reaction breakdown by limiting propagation of film vaporization.
- **Pressure sensitive interrupter:** Built-in, three-phase pop-up interrupter design. UL recognized. Removes capacitor from line before internal pressure can cause case rupture. Bulged capacitor cell top provides easy visual indication of interrupter operation.

UNIPAK

- **Ceramic discharge resistors:** Reduce residual voltage to less than 50 volts within one minute of de-energization. Selected for 20-year nominal life. Exceeds NEC requirements.
- **Capacitor operating temperature:** -40°F (-40°C) to +115°F (+46°C).
- **Case:** Weatherproof aluminum housing.
- **Warranty:** The longest in the industry — five full years of warranty on capacitor cells.

Harmonic Rated Capacitor Cells

- Standard voltage rated capacitor cells designed for higher dielectric strength and with added ability to withstand stress caused by dv/dt voltage transients caused by harmonics.
- Better suited for harmonic applications than higher voltage rated cells.

UNIPAK with Harmonic Rated Capacitor Cells

- Standard capacitor systems utilizing harmonic rated capacitor cells.
- For use in moderate harmonic environments where engineering supervision allows in place of harmonic filter designs.
- Provides future conversion capability into a harmonic filter design due to facility growth or increased non-linear load levels.

UNIPAK Filter — Harmonic Filtering

Harmonic filter systems for low voltage, heavy-duty applications.

- Reduce harmonics and correct power factor.
- Tuned for maximum efficiency in reducing harmonic currents associated with non-linear load environments (such as VFDs).
- Two-enclosure design isolates capacitors from high-temperature operating reactors, and allows for flexible installation.
- Twenty-year life design.
- Five-year cell warranty / one-year reactor warranty.
- Three-phase cell capacitor construction. Three-phase interrupter system.
- UL and CSA listed.

Applications

Designed for power factor correction in plants experiencing harmonics problems due to high amounts of non-linear loads.

Reactors

- **Tuning:** Tuned to 4.7 harmonic order.
- **Detuning:** Reactor designs can be detuned upon request (4.2nd, 6.7th for example) to protect capacitors against alternate harmonics.

- **Construction:** 100% copper windings for cool operating temperatures; designed operating temperature rise less than 80°C. Open frame construction with 220°C insulation system.
- **Thermal sensors:** One per phase, self-resetting thermistors provide reactor over-temperature protection and indication.
- **Reactor indicating light:** Thermal overload indicating light activates when reactor temperature reaches 180°C.
- **Warranty:** One-year replacement of reactors.

UNIPAK

Product Selection

UNIPAK Low Voltage Fixed Capacitor Banks

Table 5. 240 Vac UNIPAK Selection Chart

kvar	Rated Current	Enclosure	Shipping Weight in Lbs. (kg)	Part Number
1	2.4	A1	18 (8)	123PMURF
1.5	3.6	A1	18 (8)	1X23PMURF
2	4.8	A1	19 (9)	223PMURF
2.5	6	A1	19 (9)	2X23PMURF
3	7.2	A1	19 (9)	323PMURF
4	9.6	A1	20 (9)	423PMURF
5	12	A2	29 (13)	523PMURF
6	14.4	A2	29 (13)	623PMURF
7.5	18	A2	30 (14)	7X23PMURF
8	19.2	A2	31 (14)	823PMURF
10	24	A2	31 (14)	1023PMURF
12.5	30	A2	32 (14)	12X23PMURF
15	36	A2	33 (15)	1523PMURF
17.5	42	B1	44 (20)	17X23PMURF
20	48	B1	45 (20)	2023PMURF
22.5	54	B1	46 (21)	22X23PMURF
25	60	B1	46 (21)	2523PMURF
30	72	B1	47 (21)	3023PMURF
32.5	78	B1	47 (22)	32X23PMURF
35	84	B1	48 (22)	3523PMURF
40	96	C1	64 (29)	4023PMURF
42.5	102	C1	65 (30)	42X23PMURF
45	108	C1	66 (30)	4523PMURF
50	120	C1	68 (31)	5023PMURF
60	144	C1	69 (31)	6023PMURF
70	168	C2	99 (45)	7023PMURF
75	180	C2	100 (46)	7523PMURF
80	192	C2	101 (46)	8023PMURF
90	216	C2	103 (47)	9023PMURF
100	240	C2	104 (47)	10023PMURF
120	288	D1	133 (60)	12023PMURF
140	336	D1	137 (62)	14023PMURF
150	360	D1	140 (64)	15023PMURF
160	384	E1	175 (80)	16023PMURF
180	432	E1	182 (83)	18023PMURF
200	480	E1	189 (86)	20023PMURF

Notes:

- Multiply the 240 Vac kvar rating by 0.75 to calculate the kvar value at 208 Vac.
- Fused with blown-fuse indication available standard. Non-fused and no lights also available — please consult Marketing.
- Other ratings available, consult Marketing.
- For dimensional information, refer to Page 11.

Part Numbers:

- PMURF – 3 Fuses + 3 Lights.
- PMUR3 – 3 Fuses + No Lights.
- PMURN – Non-Fused.

Table 6. 480 Vac UNIPAK Selection Chart

kvar	Enclosure	Rated Current	Shipping Weight in Lbs. (kg)	Part Number
1.5	A1	1.8	17 (8)	1X43PMURF
2	A1	2.4	18 (8)	243PMURF
2.5	A1	3	18 (8)	2X43PMURF
3	A1	3.6	19 (9)	343PMURF
4	A1	4.8	19 (9)	443PMURF
5	A1	6	19 (9)	543PMURF
6	A1	7.2	19 (9)	643PMURF
7.5	A1	9	20 (9)	7X43PMURF
8	A1	9.6	20 (9)	843PMURF
9	A1	10.8	20 (9)	943PMURF
10	A1	12	20 (9)	1043PMURF
12.5	A2	15	29 (13)	12X43PMURF
15	A2	18	29 (13)	1543PMURF
17.5	A2	21	30 (14)	17X43PMURF
20	A2	24	31 (14)	2043PMURF
22.5	B1	27	44 (20)	22X43PMURF
25	A2	30	32 (15)	2543PMURF
27.5	B1	33	44 (20)	27X43PMURF
30	B1	36	44 (20)	3043PMURF
32.5	B1	39	45 (20)	32X43PMURF
35	B1	42	45 (20)	3543PMURF
37.5	B1	45	46 (21)	37X43PMURF
40	B1	48	46 (21)	4043PMURF
42.5	B1	51	47 (21)	42X43PMURF
45	B1	54	47 (22)	4543PMURF
50	B1	60	48 (22)	5043PMURF
55	B1	66	48 (22)	5543PMURF
60	B1	72	48 (22)	6043PMURF
65	C1	78	64 (29)	6543PMURF
70	C1	84	65 (30)	7043PMURF
75	C1	90	65 (30)	7543PMURF
80	C1	96	66 (30)	8043PMURF
85	C1	102	68 (31)	8543PMURF
90	C1	108	68 (31)	9043PMURF
100	C1	120	69 (31)	10043PMURF
120	C1	144	69 (31)	12043PMURF
125	C2	150	99 (45)	12543PMURF
140	C2	168	100 (46)	14043PMURF
150	C2	180	101 (46)	15043PMURF
160	C2	192	103 (47)	16043PMURF
180	C2	216	104 (47)	18043PMURF
200	D1	240	137 (62)	20043PMURF
225	D1	270	140 (64)	22543PMURF
250	E1	300	170 (77)	25043PMURF
300	E1	360	175 (80)	30043PMURF
350	E1	420	182 (83)	35043PMURF
400	E1	480	189 (86)	40043PMURF

Notes:

- Fused with blown-fuse indication available standard.
- Non-fused and no lights also available — please consult the Marketing.
- Other ratings available, consult Marketing.
- For dimensional information, refer to Page 11.

UNIPAK

UNIPAK Low Voltage Fixed Capacitor Banks (Continued)

Table 7. 600 Vac UNIPAK Selection Chart

kvar	Enclosure	Rated Current	Shipping Weight in Lbs. (kg)	Part Number
5	A1	4.9	19 (9)	563PMURF
7.5	A1	7.4	19 (9)	7X63PMURF
10	A1	9.8	20 (9)	1063PMURF
12.5	A1	12.3	20 (9)	12X63PMURF
15	A2	14.7	29 (13)	1563PMURF
17.5	A2	17.2	29 (13)	17X63PMURF
20	A2	19.6	30 (14)	2063PMURF
22.5	B1	22.1	44 (20)	22X63PMURF
25	A2	24.5	31 (14)	2563PMURF
27.5	B1	27.0	44 (20)	27X63PMURF
30	B1	29.4	45 (20)	3063PMURF
32.5	B1	31.9	45 (20)	32X63PMURF
35	B1	34.3	46 (21)	3563PMURF
37.5	B1	36.8	46 (21)	37X63PMURF
40	B1	39.2	47 (21)	4063PMURF
42.5	B1	41.7	47 (22)	42X63PMURF
45	B1	44.1	48 (22)	4563PMURF
50	B1	49.0	48 (22)	5063PMURF
55	C1	53.9	64 (29)	5563PMURF
60	C1	58.8	64 (29)	6063PMURF
65	C1	63.7	65 (30)	6563PMURF
70	C1	68.6	65 (30)	7063PMURF
75	C1	73.5	66 (30)	7563PMURF
80	C1	78.4	68 (31)	8063PMURF
85	C1	83.3	68 (31)	8563PMURF
90	C1	88.2	69 (31)	9063PMURF
100	C1	98.0	69 (31)	10063PMURF
120	C2	117.6	99 (45)	12063PMURF
125	C2	122.5	100 (46)	12563PMURF
140	C2	137.2	101 (46)	14063PMURF
150	C2	147.0	103 (47)	15063PMURF
160	D1	156.8	135 (61)	16063PMURF
180	D1	176.4	137 (62)	18063PMURF
200	D1	196.0	140 (64)	20063PMURF
225	D1	220.5	143 (65)	22563PMURF
250	E1	245.0	170 (77)	25063PMURF
300	E1	294.0	175 (80)	30063PMURF
350	E1	343.0	182 (83)	35063PMURF
400	E1	392.0	189 (86)	40063PMURF

Notes:

- Fused with blown-fuse indication available standard. Non-fused and no lights also available — please consult Marketing.
- Other ratings available, consult Marketing.
- For dimensional information, refer to **Page 11**.

Part Numbers:

- PMURF – 3 Fuses + 3 Lights.
- PMUR3 – 3 Fuses + No Lights.
- PMURN – Non-Fused.

UNIPAK — with Harmonic Cells

Table 8. Low Voltage Fixed Capacitor Systems with Harmonic Cells

kvar	Rated Current	Case Size	Shipping Weight in Lbs. (kg)	Fused Catalogue Number
240 V				
15	36	B1	38.4 (17)	1523HURF
25	60	B1	38.4 (17)	2523HURF
30	72	C1	55.2 (25)	3023HURF
50	120	C1	57.6 (26)	5023HURF
60	144	C2	100.8 (46)	6023HURF
75	180	C2	104.4 (47)	7523HURF
100	240	D1	136.8 (62)	10023HURF
125	300	E1	189.6 (86)	12523HURF
480 V				
15	18	A2	25.2 (11)	1543HURF
25	30	B1	37.2 (17)	2543HURF
30	36	B1	38.4 (17)	3043HURF
50	60	B1	39.6 (18)	5043HURF
60	72	C1	52.8 (24)	6043HURF
75	90	C1	55.2 (25)	7543HURF
100	120	C1	57.6 (26)	10043HURF
125	150	C2	100.8 (46)	12543HURF
150	180	C2	104.4 (47)	15043HURF
200	240	D1	136.8 (62)	20043HURF
250	300	E1	186.0 (84)	25043HURF
300	360	E1	189.6 (86)	30043HURF
600 V				
15	14.7	B1	37.2 (17)	1563HURF
25	24.5	B1	38.4 (17)	2563HURF
30	29.4	B1	39.6 (18)	3063HURF
50	49	C1	55.2 (25)	5063HURF
60	58.8	C1	57.6 (26)	6063HURF
75	73.5	C2	100.8 (46)	7563HURF
100	98	C2	104.4 (47)	10063HURF
125	122.5	D1	136.8 (62)	12563HURF
150	147	D1	136.8 (62)	15063HURF
200	196	E1	186.0 (84)	20063HURF
250	245	E1	189.6 (86)	25063HURF

UNIPAK

UNIPAK Low Voltage Fixed Harmonic Filters

Table 9. Fixed UNIPAK Harmonic Filters

kvar	Rated Current	Case Size	Shipping Weight		Reactor Cabinet Case Size	Reactor Shipping Weight		Combined Shipping Weight		Fused Catalogue Number
			Lbs.	kg		Lbs.	kg	Lbs.	kg	
240 V										
15	36	B1	48.4	22.0	R	90.0	40.9	138.4	62.8	15232HMURF
25	60	B1	48.4	22.0	R	105.0	47.7	153.4	69.6	25232HMURF
30	72	C1	65.2	29.6	R	110.0	49.9	175.2	79.5	30232HMURF
50	120	C1	67.6	30.7	R	130.0	59.0	197.6	89.7	50232HMURF
60	144	C2	110.8	50.3	R	160.0	72.6	270.8	122.9	60232HMURF
75	180	C2	114.4	51.9	R	185.0	84.0	299.4	135.9	75232HMURF
100	240	D1	146.8	66.6	R	240.0	109.0	386.8	175.6	100232HMURF
125	300	E1	199.6	90.6	S	280.0	127.1	479.6	217.7	125232HMURF
150	360	E1	220.0	99.9	S	280.0	127.1	500.0	227.0	150232HMURF
480 V										
15	18	A2	35.2	16.0	R	90.0	40.9	125.2	56.8	15432HMURF
25	30	B1	47.2	21.4	R	105.0	47.7	152.2	69.1	25432HMURF
30	36	B1	48.4	22.0	R	110.0	49.9	158.4	71.9	30432HMURF
50	60	B1	49.6	22.5	R	130.0	59.0	179.6	81.5	50432HMURF
60	72	C1	62.8	28.5	R	160.0	72.6	222.8	101.2	60432HMURF
75	90	C1	65.2	29.6	R	185.0	84.0	250.2	113.6	75432HMURF
100	120	C1	67.6	30.7	R	240.0	109.0	307.6	139.7	100432HMURF
125	150	C2	110.8	50.3	R	280.0	127.1	390.8	177.4	125432HMURF
150	180	C2	114.4	51.9	S	280.0	127.1	394.4	179.1	150432HMURF
200	240	D1	146.8	66.6	S	330.0	149.8	476.8	216.5	200432HMURF
250	300	E1	196.0	89.0	T	570.0	258.8	766.0	347.8	250432HMURF
300	360	E1	199.6	90.6	T	575.0	261.1	774.6	351.7	300432HMURF
600 V										
15	14.7	B1	47.2	21.4	R	90.0	40.9	137.2	62.3	15632HMURF
25	24.5	B1	48.4	22.0	R	90.0	47.7	153.4	69.6	25632HMURF
30	29.4	B1	49.6	22.5	R	105.0	49.9	159.6	72.5	30632HMURF
50	49	C1	65.2	29.6	R	110.0	59.0	195.2	88.6	50632HMURF
60	58.8	C1	67.6	30.7	R	130.0	72.6	227.6	103.3	60632HMURF
75	73.5	C2	110.8	50.3	R	160.0	84.0	295.8	134.3	75632HMURF
100	98	C2	114.4	51.9	R	185.0	109.0	354.4	160.9	100632HMURF
125	122.5	D1	146.8	66.6	S	240.0	127.1	426.8	193.8	125632HMURF
150	147	D1	146.8	66.6	S	280.0	127.1	426.8	193.8	150632HMURF
200	196	E1	196.0	89.0	T	330.0	149.8	526.0	238.8	200632HMURF
250	245	E1	199.6	90.6	T	570.0	258.8	769.6	349.4	250632HMURF

Note: Other ratings available, please consult Marketing.

Technical Data and Specifications

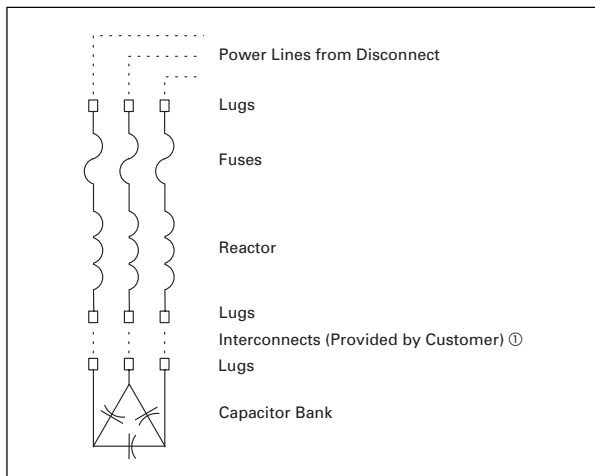


Figure 3. Filter Schematic with Wiring Interconnects

① Refer to NEC.

Dimensions

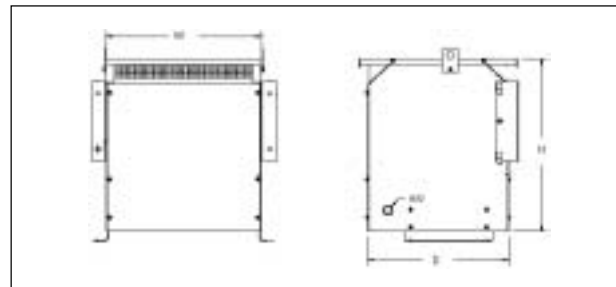


Figure 4. Reactor Cabinet

Table 10. Reactor Cabinet Dimensions

Case Size	Dimensions in Inches (mm)		
	Height	Width	Depth
R	24.75 (628.7)	20.00 (508.0)	18.13 (460.5)
S	25.00 (635.0)	24.25 (616.0)	20.25 (514.4)
T	31.00 (787.4)	25.00 (635.0)	32.75 (831.9)

Low Voltage Fixed Capacitor Banks and Fixed Harmonic Filters — Dimensions in Inches (mm)

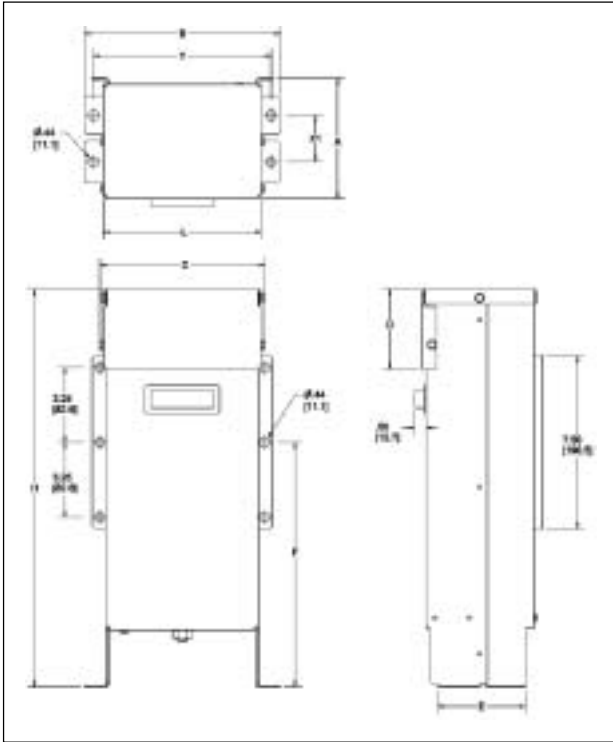


Figure 5. Case A1, A2

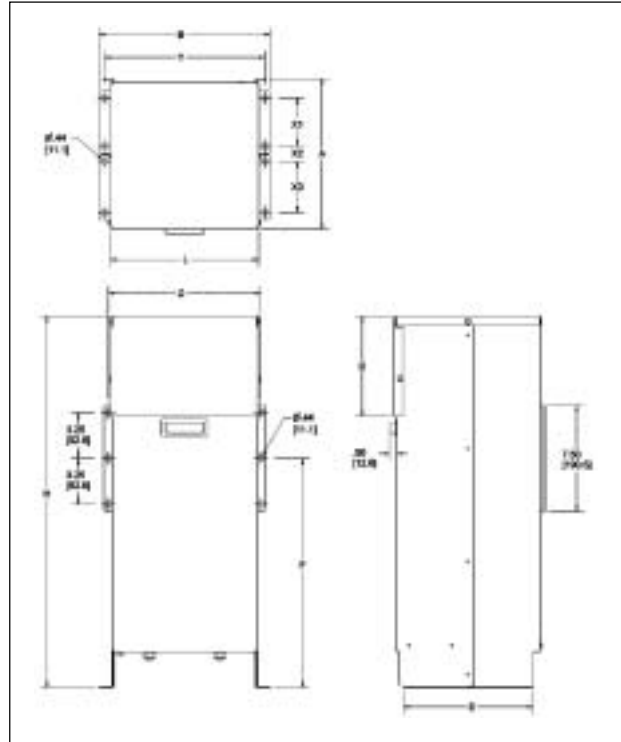


Figure 7. Case C1, C2

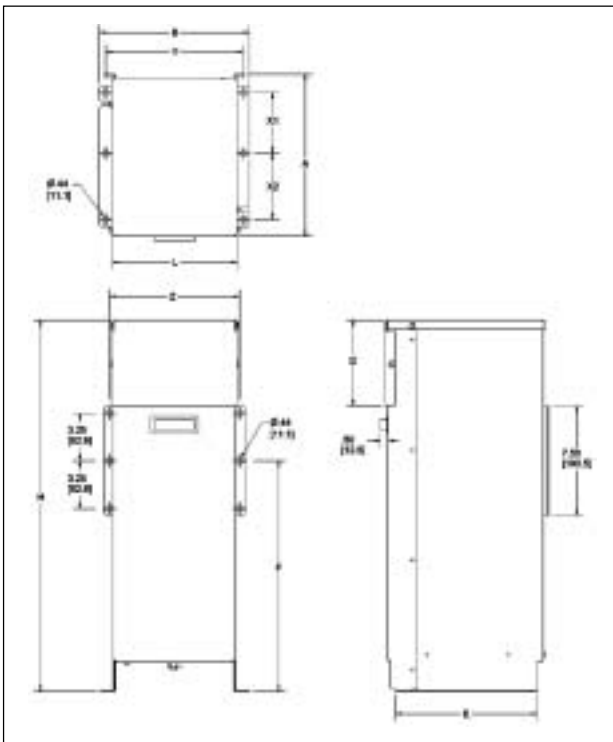


Figure 6. Case B1

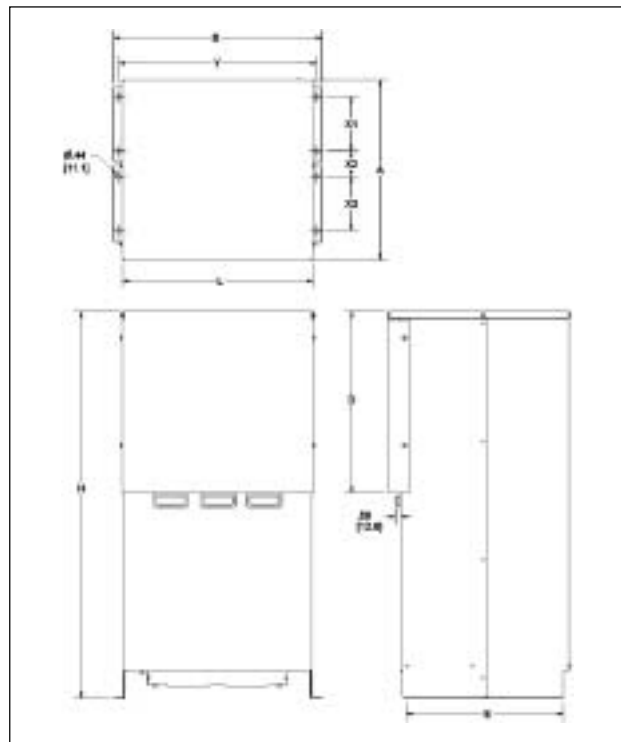


Figure 8. Case D1, E1

UNIPAK

Table 11. UNIPAK Enclosures

Case Size	Dimensions in Inches (mm)											
	A	B	D	E	F	H	L	X1	X2	X3	Y	Z
A1	5.3 (133.5)	8.5 (215.9)	3.5 (88.7)	3.8 (96.8)	10.6 (270.2)	17.3 (439.4)	6.8 (173.9)	2.0 (51.5)	N/A	N/A	7.7 (195.6)	7.2 (181.7)
A2	6.0 (151.2)	8.5 (215.9)	5.6 (141.9)	4.5 (114.6)	13.3 (336.7)	22.3 (567.6)	6.8 (173.9)	2.3 (58.3)	N/A	N/A	7.7 (195.6)	7.2 (181.7)
B1	11.1 (280.8)	10.1 (257.3)	5.8 (148.0)	9.6 (244.1)	15.7 (399.0)	25.3 (642.6)	8.5 (215.3)	4.1 (104.4)	4.5 (114.3)	N/A	9.3 (237.0)	8.8 (223.1)
C1	10.6 (270.4)	12.1 (306.8)	7.1 (180.0)	9.1 (231.5)	16.2 (412.5)	26.3 (668.0)	10.4 (264.8)	3.4 (86.9)	1.1 (27.3)	3.6 (92.0)	11.3 (286.5)	10.7 (272.6)
C2	12.0 (304.2)	19.3 (490.7)	16.9 (428.3)	9.5 (240.5)	16.3 (413.0)	36.0 (914.4)	17.7 (448.8)	3.0 (75.3)	1.5 (38.1)	3.8 (95.3)	18.3 (465.3)	18.0 (456.5)
D1	16.8 (426.6)	19.3 (490.7)	16.9 (428.3)	14.6 (370.1)	N/A	36.0 (914.4)	17.7 (448.8)	5.1 (129.1)	2.4 (59.7)	5.0 (127.9)	18.3 (465.3)	N/A
E1	22.3 (566.4)	24.4 (618.7)	16.8 (425.5)	19.5 (494.1)	N/A	36.0 (914.4)	22.7 (576.7)	6.5 (165.1)	4.4 (111.9)	5.0 (127.0)	22.4 (567.9)	N/A

Legend:

A = Total depth

B = Total width

D = Height of removable front cover

E = Depth of feet

F = Height of middle mounting hole in wall bracket

H = Total height

L = Width without feet and brackets

X = Depth between front and rear mounting holes in inches

Y = Width between floor mounting holes

Z = Width between wall bracket mounting holes

AUTOVAR 300

AUTOVAR 300 Automatic Power Factor Correction Capacitor Systems



AUTOVAR 300

Product Description

Automatically switched power factor correction systems for low voltage applications.

- Wall-mount design is ideal for minimum space requirements.
- Programmable to automatically add/subtract capacitor banks to maintain preset target power factor.
- Heavy-duty, three-phase capacitor construction.
- Five-year warranty of cells.
- UL and CSA listed.

Applications

Service entrance power factor correction installations requiring precise maintenance of target power factor in a very small footprint.

Features and Specifications

Configuration

- **Cabinet:** Wall mounting 12 gauge steel with ANSI 61 gray, NEMA 1 (gasketed).
- **Power line interconnect:** Rugged, power distribution block connection.
- **Fusing:** 200,000 ampere interrupting capacity provided on all three phases of each bank. Blade-type fuses mounted on insulator stand-offs with blown-fuse indicating lights.
- **Blown-fuse lights:** Blown-fuse indicating lights for each phase and stage located on the door.
- **Door interlock:** Door interlock automatically disengages capacitors. Power continues to be provided to the unit until the disconnect is open.
- **Exhaust fans:** Provide ventilation. Dust filtering included.

Controller

- Visual indication of incorrect CT polarity.
- Digital display of power factor and number of energized banks.
- Automatic setting of c/k value (sensitivity based on CT ratio and kvar available).
- Alarm on failed step.
- Visual indication of insufficient kvar to reach target power factor.
- Capacitors disabled in steps within 35 milliseconds of main power interruption.
- Automatic sensing of kvar values per step.
- Optional communications capability from controller.

- Optional metering capability:
 - Voltage
 - Current (sensed phase only)
 - Frequency
 - Active power (kW)
 - Reactive power (kvar)
 - Apparent power (kVA)
- Optional thermostatic control exhaust fans.

Contactor

- Fully rated for capacitor switching up to 60 kvar at 600 V.
- Integral pre-charge/pre-insertion module standard. The contactor reduces damaging switching transients. This provides safety and durability for the system:
 - Lessens the chance of disrupting sensitive electronic equipment
 - Reduced inrush current extends the life of the capacitor cells
- UL/CSA recognized.

Additional Features

- Optional moulded case circuit breaker rated 65 kAIC at 480 V and 600 V.
- Personnel ground fault interruption provides protection in case of accidental contact with control power and ground.
- NEMA 3R weatherproofing.

AUTOVAR 300

Product Selection

Table 12. Wall-Mounted Switched Capacitor Banks — Low Voltage Applications

kvar	Step x kvar	Rated Current Amperes	Case Size	Shipping Weight Lbs. (kg)	Fused Catalogue Number
240 Volt					
25	5 x 5	60	J	217 (98.5)	25MCSR231
50	5 x 10	120	J	255 (115.8)	50MCSR231
75	5 x 15	180	J	260 (118.0)	75MCSR231
100	4 x 25	240	J	270 (122.6)	100MCSR231
125	5 x 25	300	J	292 (132.6)	125MCSR231
480 Volt					
50	5 x 10	60	J	200 (90.8)	50MCSR4313
75	5 x 15	90	J	210 (95.3)	75MCSR4313
100	5 x 20	120	J	210 (95.3)	100MCSR4313
125	5 x 25	150	J	240 (109.0)	125MCSR4313
150	5 x 30	180	J	240 (109.0)	150MCSR4313
175	5 x 35	210	J	260 (118.0)	175MCSR431
200	5 x 40	241	J	270 (122.6)	200MCSR431
225	5 x 45	270	J	290 (131.7)	225MCSR431
250	5 x 50	300	J	292 (132.6)	250MCSR431
300	5 x 60	361	J	310 (140.7)	300MCSR431
600 Volt					
50	5 x 10	48	J	200 (90.8)	50MCSR6313
75	5 x 15	72	J	210 (95.3)	75MCSR6313
100	5 x 20	96	J	210 (95.3)	100MCSR6313
125	5 x 25	120	J	240 (109.0)	125MCSR6313
150	5 x 30	144	J	240 (109.0)	150MCSR6313
175	5 x 35	168	J	260 (118.0)	175MCSR631
200	5 x 40	192	J	270 (122.6)	200MCSR631
225	5 x 45	216	J	290 (131.7)	225MCSR631
250	5 x 50	240	J	292 (132.6)	250MCSR631
300	5 x 60	288	J	310 (140.7)	300MCSR631

Note: Other ratings available, please consult Marketing.

Table 13. Options

Description	Option Code
Current transformer — Multi-tap, split core current transformer (3000:5 A) ①	TX2
Hands-off Auto Switch — Provides manual control to connect or disconnect capacitor stages regardless of controller output	H
Remote Alarm Relay — Relay for a remote alarm to indicate inability to reach target power factor	A
Moulded case circuit breaker (65 kAIC at 480 V)	M
Weatherproofing (NEMA 3R)	W
Communicating Controller	C
Metering Option Controller	D
Thermostatic Temp Control	L

① A current transformer with a 5 ampere secondary is required to operate an automatic capacitor bank. Rating based on Service Entrance Ampacity. For other ratios, please consult Marketing.

Dimensions

Enclosure J — Dimensions in Inches (mm)

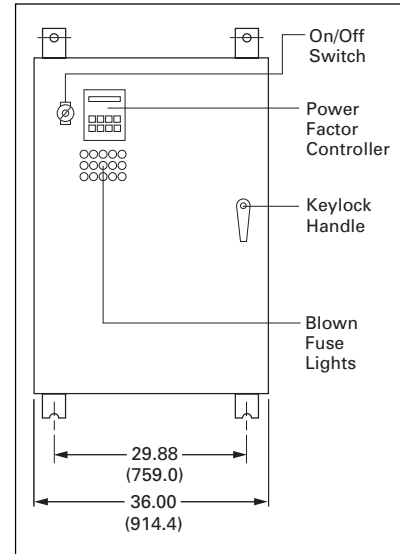


Figure 9. Front View of Enclosure J

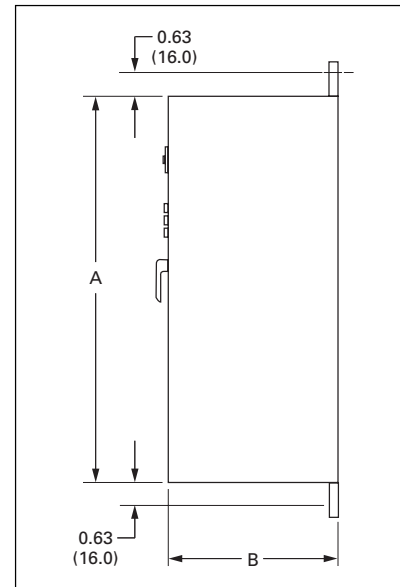


Figure 10. Side View of Enclosure J

Table 14. Enclosure J — Dimensions in Inches (mm)

Description	Dimensions in Inches (mm)	
	Height A	Depth B
Without MCCB	36.00 (914.4)	12.00 (304.8)
With MCCB	60.00 (1524.0)	12.00 (304.8)

AUTOVAR 600

AUTOVAR 600 Automatic Power Factor Correction Capacitor Systems



AUTOVAR 600

Applications

Service entrance power factor correction installations requiring precise maintenance of target power factor.

- Programmable to automatically add/subtract capacitor banks to maintain preset target power factor.
- Heavy-duty, three-phase capacitor construction.
- Five-year warranty of cells.
- UL and CSA listed.

Features and Specifications

Configuration

- **Cabinet:** 12 gauge steel with ANSI 61 gray, baked enamel finish. Lift bolts standard, NEMA 1.
- **Power line interconnect:** Rugged, copper bus bar connection with access provided for top or bottom entry. Bus bars are braced for 65 kAIC at 480 V. All internal power wiring connections from bus are laid out on a most direct basis with minimum bends for ease of troubleshooting. Clear barrier limiting access to live parts included standard.

- **Modular tray design:** Capacitor banks arranged in modular trays with capacitors, fuses, blown-fuse indicating lights, and contactors grouped in a logical, easily understood layout. This permits easy access, quick identification of operating problems and ease of expandability.
- **Fusing:** UL recognized, 200,000 ampere interrupting capacity provided on all three phases of each bank. Blade-type fuses mounted on insulator stand-offs.
- **Blown-fuse lights:** Blown-fuse indicating lights located on the door-mounted blown and at individual fuses to facilitate tracing of cleared fuses.
- **Push-to-test:** Allows testing of door-mounted blown fuse indicating lights.
- **AutoLocate:** When door is open and bus energized, fuse circuit automatically checks for cleared fuses. If a fuse has cleared, the light at the fuse comes on for easy troubleshooting.
- **Door interlock:** Door interlock automatically turns off control circuit when engaged. Power continues to be provided to the unit until disconnect is open.
- **Exhaust fans:** Two fans per cabinet provide thermal protection. Dust filtering provided.
- **Ease of expansion:** Capacitor stage nests are self-contained and can be added in the field. Two bolts mount the nest in the field. Control wire plugs connect to factory standard wire harness on the left side of the cabinet.
- **Ease of replacement:** Cells can be easily individually replaced by removing the mounting bolt and lifting out of the nest without removal of any other components.

Controller

- Visual indication of incorrect CT polarity.
- Digital display of power factor and number of energized banks.
- Automatic setting of c/k value (sensitivity based on CT ratio and kvar available).
- Alarm on failed step.
- Visual indication of insufficient kvar to reach target power factor.

- Capacitors disabled in steps within 35 milliseconds of main power interruption.
- Automatic sensing of kvar values per step.
- Optional communications capability from controller.
- Optional metering capability:
 - Voltage
 - Current (sensed phase only)
 - Frequency
 - Active power (kW)
 - Reactive power (kvar)
 - Apparent power (kVA)
- Optional thermostatic control exhaust fans.

Contactors

- Fully rated for capacitor switching up to 60 kvar at 600 V.
- Integral pre-charge/pre-insertion module standard. The contactor reduces damaging switching transients. This provides safety and durability for the system:
 - Lessens the chance of disrupting sensitive electronic equipment
 - Reduced inrush current extends the life of the capacitor cells
- UL/CSA recognized.

Additional Features

- Optional moulded case circuit breaker, rated 65 kAIC at 480 V and 600 V.
- Personnel ground fault interruption provides protection in case of accidental contact with control power and ground.
- Control wiring — standard NEC color-coded modular bundles with quick disconnect feature for ease of troubleshooting or ease of expandability.
- Optional digital metering — IQ 220.
- Bottom cable entry spacing.

AUTOVAR 600



AUTOVAR 600 — Interior View



Modular Step Nest Assembly



IQ 220 Electronic Meter



Bottom Entry Location



Factory Pre-wired for Future Expansion

Product Selection
Table 15. Floor-Mounted Switched Capacitor Banks — Low Voltage Applications

kvar	Step x kvar	Rated Current Amperes	Enclosure Size	Shipping Weight Lbs. (kg)	Fused Catalogue Number
240 Vac					
75	3 x 25	180	L	644 (292.4)	75TPCSR231
100	4 x 25	214	L	692 (314.2)	100TPCSR231
125	5 x 25	300	L	740 (336.0)	125TPCSR231
150	6 x 25	316	L	788 (357.8)	150TPCSR231
200	8 x 25	481	L	884 (401.3)	200TPCSR231
250	10 x 25	600	L	944 (428.6)	250TPCSR231
300	12 x 25	720	L	1022 (464.0)	300TPCSR231
350	7 x 50	844	KK	1616 (734.0)	350TPCSR231
400	8 x 50	965	KK	1704 (774.0)	400TPCSR231
480 Vac					
150	3 x 50	180	L	632 (287.0)	150TPCSR431
200	4 x 50	240	L	676 (306.9)	200TPCSR431
250	5 x 50	300	L	720 (326.9)	250TPCSR431
300	6 x 50	360	L	764 (346.9)	300TPCSR431
350	7 x 50	420	L	808 (366.8)	350TPCSR431
400	8 x 50	480	L	852 (386.8)	400TPCSR431
450	9 x 50	540	L	896 (406.8)	450TPCSR431
500	10 x 50	600	L	944 (428.6)	500TPCSR431
550	11 x 50	660	L	984 (446.7)	550TPCSR431
600	12 x 50	720	L	1022 (464.0)	600TPCSR431
660	11 x 60	792	L	1010 (458.5)	660TPCSR431
700	7 x 100	840	KK	1616 (734.0)	700TPCSR431
720	12 x 60	864	L	1050 (476.7)	720TPCSR431
800	8 x 100	960	KK	1704 (774.0)	800TPCSR431
840	14 x 60	1008	KK	1690 (767.7)	840TPCSR431
900	9 x 100	1080	KK	1792 (814.0)	900TPCSR431
1000	10 x 100	1200	KK	1888 (857.0)	1000TPCSR431
1100	11 x 100	1320	KK	1966 (893.0)	1100TPCSR431
1200	12 x 100	1440	KK	2044 (928.0)	1200TPCSR431
600 Vac					
150	3 x 50	144	L	632 (287.0)	150TPCSR631
200	4 x 50	192	L	676 (306.9)	200TPCSR631
250	5 x 50	240	L	720 (326.9)	250TPCSR631
300	6 x 50	288	L	764 (346.9)	300TPCSR631
350	7 x 50	336	L	808 (366.8)	350TPCSR631
400	8 x 50	384	L	852 (386.8)	400TPCSR631
450	9 x 50	432	L	896 (406.8)	450TPCSR631
500	10 x 50	480	L	944 (428.6)	500TPCSR631
550	11 x 60	528	L	984 (446.7)	550TPCSR631
600	12 x 50	576	L	1022 (464.0)	600TPCSR631
660	11 x 60	634	L	1010 (458.5)	660TPCSR631
700	7 x 100	672	KK	1616 (734.0)	700TPCSR631
720	12 x 60	692	L	1050 (476.7)	720TPCSR631
800	8 x 100	768	KK	1704 (774.0)	800TPCSR631
840	14 x 60	1008	KK	1690 (767.7)	840TPCSR631
900	9 x 100	864	KK	1792 (814.0)	900TPCSR631
1000	10 x 100	960	KK	1888 (857.0)	1000TPCSR631
1100	11 x 100	1056	KK	1966 (893.0)	1100TPCSR631
1200	12 x 100	1152	KK	2044 (928.0)	1200TPCSR631

Note: Other ratings available, please consult Marketing.

Table 16. Options

Description	Option Code
Current transformer — Multi-tap, split core current transformer (3000:5 A) ^①	TX2
Hands-off Auto Switch — Provides manual control to connect or disconnect capacitor stages regardless of controller output	H
Remote Alarm Relay — Relay for a remote alarm to indicate inability to reach target power factor	A
Moulded case circuit breaker (65 kAIC at 480 V)	M
Weatherproofing (NEMA 3R)	W
Communicating Controller	C
Metering Option Controller	D
Thermostatic Temp Control	L
IQ 220 Solid-State Meter ^②	IQ

^① A current transformer with a 5 ampere secondary is required to operate an automatic capacitor bank. Rating based on Service Entrance Ampacity. For other ratios, please consult Marketing.

^② Not available with weatherproofing option.

AUTOVAR 600

Technical Data and Specifications

Dimensions in Inches (mm)

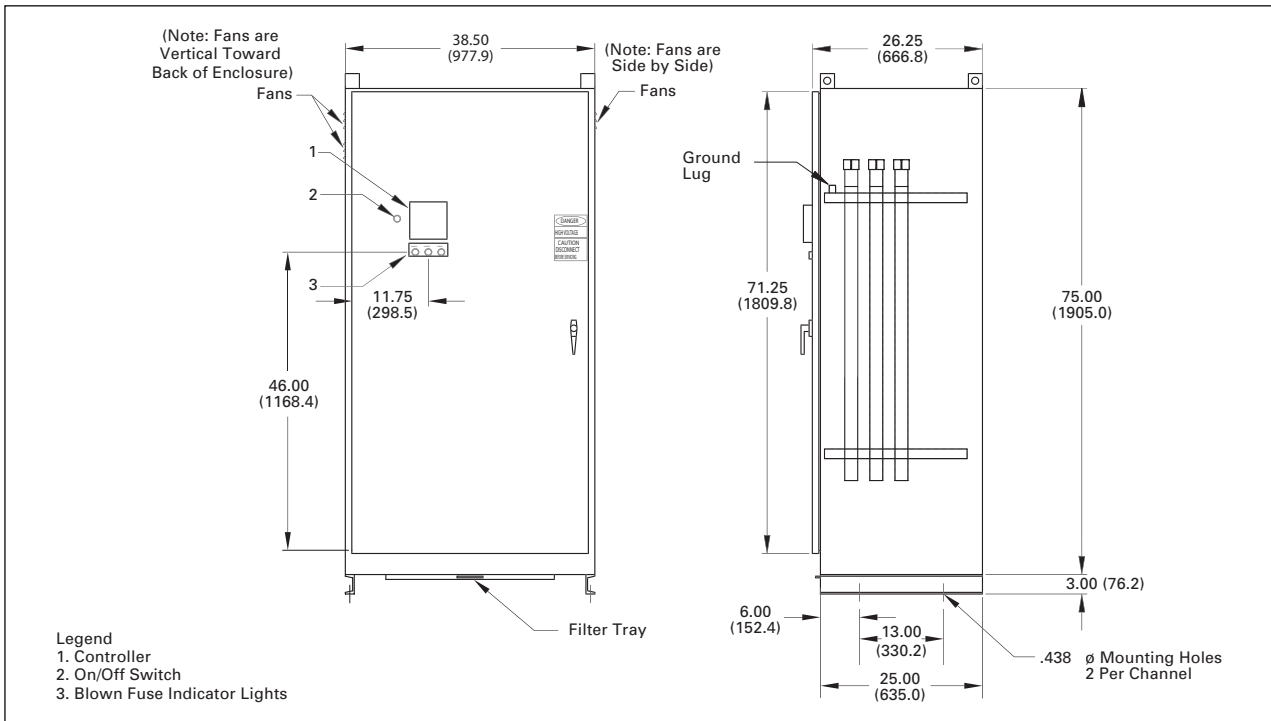


Figure 11. Front View of Enclosure L

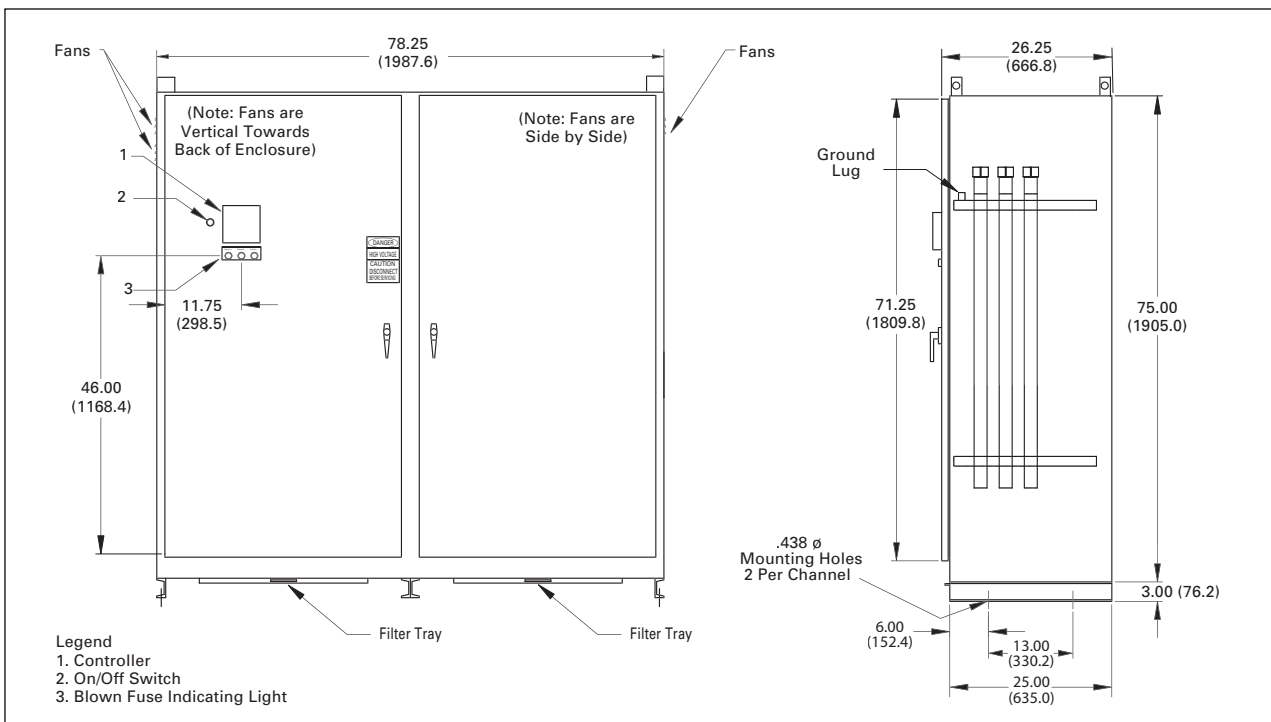


Figure 12. Front and Side View of Enclosure KK

AUTOVAR Filter

**AUTOVAR Filter — LV
Automatic Harmonic Filter**



AUTOVAR Filter



AUTOVAR Filter — Interior View

Product Description

Automatically switched harmonic filter/power factor corrections systems.

- Programmable to automatically add/subtract filter banks to maintain preset target power factor.
- Filter steps tuned for maximum efficiency in reducing harmonic currents in three-phase environments with heavy non-linear loads.
- Efficient modular design for short lead times, ease of maintenance and ease of future expansion.
- Heavy-duty, three-phase capacitor construction with reliable, threaded terminal connections.
- Cool operating, 100% copper wound, thermal protected reactors are sized up to 150% of rated capacitor current.
- UL and CSA listed.

Applications

Service entrance power factor correction installations requiring precise maintenance of target power factor in three-phase, non-linear, high harmonic environments.

Features and Specifications

Configuration

- **Operation:** AUTOVAR harmonic filters are designed to be sized the same as any power factor correction unit. In most low voltage applications where harmonics are generated by non-linear loads, no harmonic audit is necessary to design the AUTOVAR filter because it is already designed for typical harmonic spectrums at the kvar size specified.
- **Cabinet:** 12 gauge steel with ANSI 61 gray, baked enamel finish. Lift bolts standard, NEMA 1.
- **Power line interconnect:** Rugged, copper bus bar connection with access provided for top or bottom entry. Bus bars are braced for 65 kAIC at 480 V. All internal power wiring connections from bus are laid out on a most direct basis with minimum bends for ease of troubleshooting. Clear barrier limiting access to live parts included standard.
- **Modular tray design:** Capacitor banks arranged in modular trays with capacitors, fuses, blown-fuse indicating lights, and contactors grouped in a logical, easily understood layout. This permits easy access, quick identification of operating problems and ease of expandability.
- **Fusing:** UL recognized, 200,000 ampere interrupting capacity provided on all three phases of each bank. Blade-type fuses mounted on insulator stand-offs.
- **Blown-fuse lights:** Blown-fuse indicating lights located on the door-mounted blown and at individual fuses to facilitate tracing of cleared fuses.
- **Push-to-test:** Allows testing of door-mounted blown fuse indicating lights.
- **AutoLocate:** When door is open and bus energized, fuse circuit automatically checks for cleared fuses. If a fuse has cleared, the light at the fuse comes on for easy troubleshooting.

- **Door interlock:** Door interlock automatically turns off control circuit when engaged. Power continues to be provided to the unit until disconnect is open.
- **Exhaust fans:** Two fans per cabinet provide thermal protection. Dust filtering provided.
- **Ease of expansion:** Capacitor stage nests are self-contained and can be added in the field. Control wire plugs connect to factory standard wire harness on the left side of the cabinet.
- **Ease of replacement:** Cells can be easily individually replaced by removing the mounting bolt and lifting out of the nest without removal of any other components.

Controller

- Visual indication of incorrect CT polarity.
- Digital display of power factor and number of energized banks.
- Automatic setting of c/k value (sensitivity based on CT ratio and kvar available).
- Alarm on failed step.
- Visual indication of insufficient kvar to reach target power factor.
- Capacitors disabled in steps within 35 milliseconds of main power interruption.
- Automatic sensing of kvar values per step.
- Optional communications capability from controller.
- Optional metering capability:
 - Voltage
 - Current (sensed phase only)
 - Frequency
 - Active power (kW)
 - Reactive power (kvar)
 - Apparent power (kVA)
- Optional thermostatic control exhaust fans.

Contactors

- Fully rated for capacitor switching up to 60 kvar at 600 V.
- Integral pre-charge/pre-insertion module standard. The contactor reduces damaging switching transients. This provides safety and durability for the system:
 - Lessens the chance of disrupting sensitive electronic equipment
 - Reduced inrush current extends the life of the capacitor cells
- UL/CSA recognized.

AUTOVAR Filter

Reactors

- **Tuning:** Reactors tuned to the 4.7th harmonic order (nominal 5th). This provides maximum effectiveness in reducing harmonic currents in three-phase systems with harmonics caused by 6-pulse devices.
- **Detuning:** Reactor designs can be detuned upon request (4.2nd, 6.7th for example) to protect capacitors against alternate harmonics.
- **Windings:** 100% copper windings for minimal temperature rise under load.
- **Thermal overload protection:** Each reactor includes three normally closed, auto reset thermostats that open at 180°C. When thermostats engage, the contactor opens.
- **Insulation:** 220°C insulation system.
- **Warranty:** One-year replacement of reactors.

Additional Features

- Optional moulded case circuit breaker rated 65 kAIC at 480 V and 600 V.
- Personnel ground fault interruption provides protection in case of accidental contact with control power and ground.
- Control wiring — standard NEC color-coded modular bundles with quick disconnect feature for ease of troubleshooting or ease of expendability.



AUTOVAR Filter — Reactor Cabinet

Product Selection

Low Voltage Switched Harmonic Filters

Table 17. Floor-Mounted Switched Harmonic Filters — Low Voltage

kvar	Step x kvar	Rated Current Amperes	Enclosure Size	Shipping Weight Lbs. (kg)	Fused Catalogue Number
480 Vac					
200	4x 50	240	L	1438 (652.9)	200THFSR431
250	5 x 50	300	L	1634 (741.8)	250THFSR431
300	6 x 50	360	KK or L + L	1830 (830.8)	300THFSR432
350	7 x 50	420	KK or L + L	2026 (919.8)	350THFSR432
400	8 x 50	480	KK or L + L	2222 (1008.8)	400THFSR432
450	9 x 50	540	KK or L + L	2371 (1076.4)	450THFSR432
500	10 x 50	600	KK or L + L	2525 (1146.4)	500THFSR432
550	11 x 50	660	KK or L + L	2750 (1248.5)	550THFSR432
600	12 x 50	720	KK or L + L	2830 (1284.8)	600THFSR432
600 Vac					
300	6 x 50	288	KK or L + L	1830 (830.8)	300THFSR632
350	7 x 50	336	KK or L + L	2026 (919.8)	350THFSR632
400	8 x 50	384	KK or L + L	2222 (1008.8)	400THFSR632
450	9 x 50	432	KK or L + L	2371 (1076.4)	450THFSR632
500	10 x 50	480	KK or L + L	2525 (1146.4)	500THFSR632
550	11 x 50	528	KK or L + L	2750 (1248.5)	550THFSR632
600	12 x 50	576	KK or L + L	2830 (1284.8)	600THFSR632

Notes:

- L + L under Enclosure Size denotes two Size L enclosures — one for the capacitors, one for the reactor case.
- For KK enclosure design, change the last digit of the catalogue number to 1. For example, 500THFSR431.
- Other ratings available, please consult Marketing.
- Enclosures for 550 and 600 kvar at 480 and 600 V will be one double-door section wide if circuit breakers are required. (Enclosure Size KK.)

Table 18. Options

Description	Option Code
Current transformer — Multi-tap, split core current transformer ①	TX2
Hands-off Auto Switch — Provides manual control to connect or disconnect capacitor stages regardless of controller output	H
Remote Alarm Relay — Relay for a remote alarm to indicate inability to reach target power factor	A
Moulded case circuit breaker (65 kAIC at 480 V)	M
Weatherproofing (NEMA 3R)	W
Communicating Controller	C
Metering Option Controller	D
Thermostatic Temp Control	L
IQ 220 Solid-State Meter ②	IQ

① A current transformer with a 5 ampere secondary is required to operate an automatic capacitor bank. Rating based on Service Entrance Ampacity. For other ratios, please consult Marketing.

② Not available with weatherproofing option.

Technical Data and Specifications

Dimensions in Inches (mm)

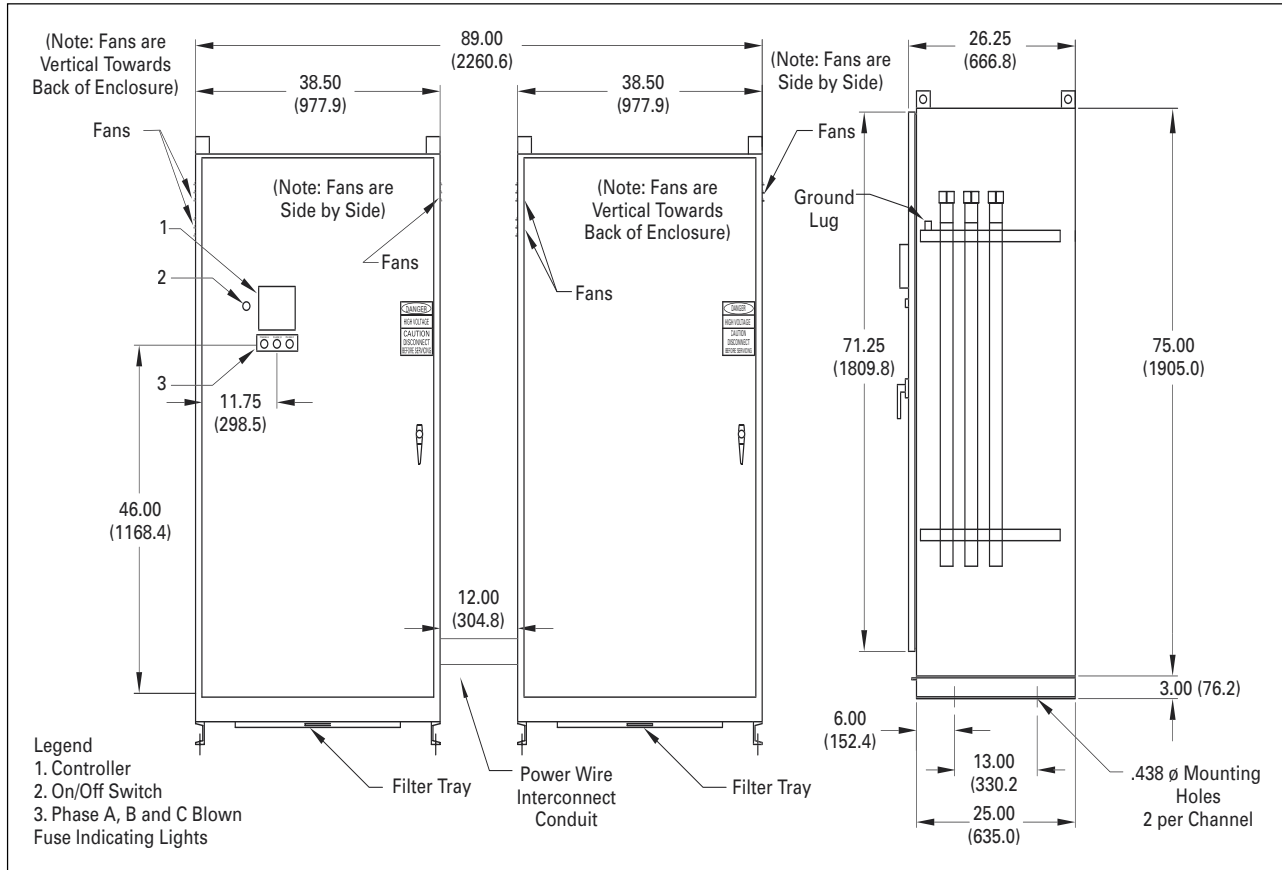


Figure 13. Front and Side View of Enclosures L + L

Transient-Free Static Switching Units

Transient-Free Static Switching Power Factor Correction Units



Transient-Free Power Factor Correction System

Product Description

Transient-free static switching units are available in two models.

The FTE model is a real-time transient-free system, used to compensate extremely rapid loads within one cycle of operation (typically 5 – 20 msec).

The FTA model is a fast transient-free system, used to compensate any loads within 3 – 4 seconds.

Units are available as tuned (designed to absorb the 5th and higher order harmonics), or detuned (designed to prevent resonance in a system and absorb up to 50% of the 5th harmonic).

Features

- Transient-free capacitor group switching, using electronic switching elements.
- Simultaneous connection/disconnection of all required steps.
- Consistent capacitor values and stable filter characteristics.
- Harmonic filtration.
- Three independent control modes:
 - Power factor control.
 - Voltage control.
 - Load sharing with another compensation system connected to the same transformer.

- Unique SCAN feature reduces capacitor duty cycles.
- Remote control of compensation systems available via LAN or Ethernet.
- Integrated three-phase network analyzer:
 - Measures all power parameters on each phase (V, I, kW, kvar, kVA)
 - Measures voltage and current harmonics to the 63rd harmonic

FTE unit includes all of the above, plus:

- Reduces voltage flicker and voltage sag.
- Provides network reactive power support.
- Offers voltage control options.

Product Configurations

Network Voltage

- 210 – 690 V.
- Engineered solutions up to 15 kV.

Frequency

- 45 – 55 Hz for 50 Hz network.
- 55 – 65 Hz for 60 Hz network.

Capacitor Group Configurations

- Up to 12 groups per one controller.
- Switching sequence:
 - 1:1:1:1 (all equal)
 - 1:2:2:2 (half group)
 - 1:2:4:4 (quarter, half groups)

Acquisition Time

- FTE — 5 – 20 ms for a 50 Hz network.
- FTE — 4 – 16 ms for a 60 Hz network.
- FTA — 1 – 4 second maximum.

Enclosure

Applicable Standards

- EMC — EN50081-2, EN50082-2, EN55011, EN61000-4-2/3/4/5, ENV50204, ENV50141.
- CE Mark — 73/23/EEC am. 93/68, 98/37/EC art. 4(2).
- Safety — EN61010-1, EN60439-1, EN60204.
- UL 508.
- CSA.

Applications

- Motor starting.
- On-site generation support.
- Spot welding.
- Wind turbines.
- Other dynamic loads.

Three current transformers with a 5 ampere secondary are required to operate this capacitor bank. Rating based on Service Entrance Ampacity. For other ratios, consult Marketing.

- Startup and Commissioning by factory trained personnel is required for proper operation and warranty of this system.

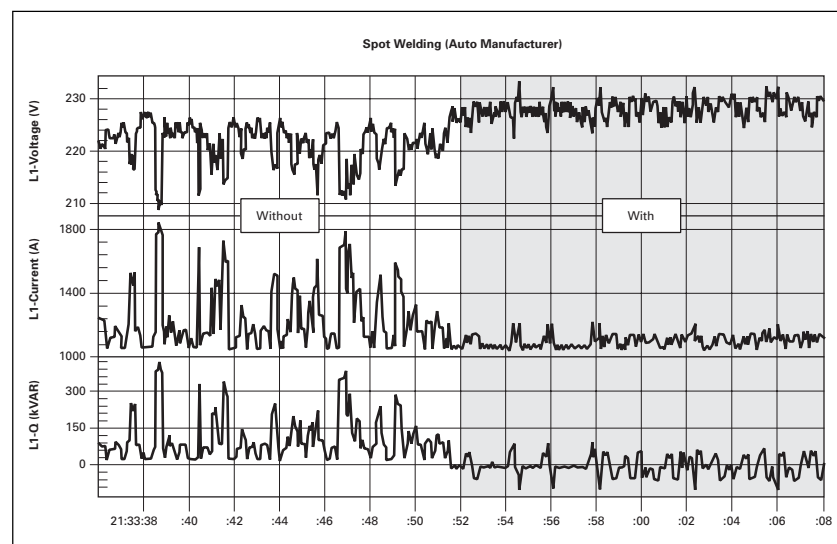


Figure 14. Application Example — Spot Welding

Product Selection

Transient-Free Reactive Power Compensation Systems

Table 19. Real-Time Transient-Free Systems — 480 Vac

Output kvar	Output per Step (kvar)	Dimensions W x D x H	Recommended Integral Breaker Option available (Amperes)	Catalogue Number
Compensate Rapid Loads Within One Cycle (Typically 5 – 20 ms) — Standard 6% Inductors — Detuned to 245 Hz (4.08th Harmonic)				
156	31	31.5 x 23.6 x 82.7	400	FTE15652480
187	37.5	31.5 x 23.6 x 82.7	400	FTE18752480
219	31	31.5 x 23.6 x 82.7	400	FTE21974480
250	50	31.5 x 23.6 x 82.7	600	FTE25052480
262	37.5	31.5 x 23.6 x 82.7	600	FTE26274480
312	62.5	31.5 x 23.6 x 82.7	600	FTE31252480
375	75	31.5 x 23.6 x 82.7	800	FTE37552480
437	62.5	31.5 x 23.6 x 82.7	800	FTE43774480
450	150	31.5 x 23.6 x 82.7	800	FTE45031480
600	100	63.0 x 23.6 x 82.7	1200	FTE60661480
687	62.5	63.0 x 23.6 x 82.7	1200	FTE687112480
750	125	63.0 x 23.6 x 82.7	1600	FTE75061480
825	75	63.0 x 23.6 x 82.7	1600	FTE825112480
900	150	63.0 x 23.6 x 82.7	1600	FTE90061480
1125	125	94.5 x 23.6 x 82.7	2000	FTE112591480
1350	150	94.5 x 23.6 x 82.7	2500	FTE135091480
1500	125	126.0 x 23.6 x 82.7	2500	FTE1500121480
1800	150	126.0 x 23.6 x 82.7	3200	FTE1800121480
Compensate Rapid Loads Within One Cycle (Typically 5 – 20 ms) — 4.5% Inductors — Tuned to 282 Hz (4.7th Harmonic)				
156	31	31.5 x 23.6 x 82.7	400	FTE15652480T
187	37.5	31.5 x 23.6 x 82.7	400	FTE18752480T
219	31	31.5 x 23.6 x 82.7	400	FTE21974480T
250	50	31.5 x 23.6 x 82.7	600	FTE25052480T
262	37.5	31.5 x 23.6 x 82.7	600	FTE26274480T
312	62.5	31.5 x 23.6 x 82.7	600	FTE31252480T
375	75	31.5 x 23.6 x 82.7	800	FTE37552480T
437	62.5	31.5 x 23.6 x 82.7	800	FTE43774480T
450	150	31.5 x 23.6 x 82.7	800	FTE45031480T
600	100	63.0 x 23.6 x 82.7	1200	FTE60661480T
687	62.5	63.0 x 23.6 x 82.7	1200	FTE687112480T
750	125	63.0 x 23.6 x 82.7	1600	FTE75061480T
825	75	63.0 x 23.6 x 82.7	1600	FTE825112480T
900	150	63.0 x 23.6 x 82.7	1600	FTE90061480T
1125	125	94.5 x 23.6 x 82.7	2000	FTE112591480T
1350	150	94.5 x 23.6 x 82.7	2500	FTE135091480T
1500	125	126.0 x 23.6 x 82.7	2500	FTE1500121480T
1800	150	126.0 x 23.6 x 82.7	3200	FTE1800121480T

Note: Standard systems have separate individual connections on each phase in individual cabinets.

Note: Systems with internal phase connections are available — contact Marketing.

Note: Systems with integral breakers/disconnects have internal phase connections between each cabinet.

Transient-Free Static Switching Units

Transient-Free Reactive Power Compensation Systems (Continued)

Table 20. Fast Transient-Free Switching Systems — 480 Vac

Output kvar	Output per Step (kvar)	Dimensions W x D x H	Recommended Integral Breaker Option available (Amperes)	Catalogue Number
Compensate Any Load Within 3 – 4 Seconds — Standard 6% Inductors — Detuned to 245 Hz (4.08th Harmonic)				
156	31	31.5 x 23.6 x 82.7	400	FTA15652480
187	37.5	31.5 x 23.6 x 82.7	400	FTA18752480
219	31	31.5 x 23.6 x 82.7	400	FTA21974480
250	50	31.5 x 23.6 x 82.7	600	FTA25052480
262	37.5	31.5 x 23.6 x 82.7	600	FTA26274480
312	62.5	31.5 x 23.6 x 82.7	600	FTA31252480
375	75	31.5 x 23.6 x 82.7	800	FTA37552480
437	62.5	31.5 x 23.6 x 82.7	800	FTA43774480
450	150	31.5 x 23.6 x 82.7	800	FTA45031480
600	100	63.0 x 23.6 x 82.7	1200	FTA60661480
687	62.5	63.0 x 23.6 x 82.7	1200	FTA687112480
750	125	63.0 x 23.6 x 82.7	1600	FTA75061480
825	75	63.0 x 23.6 x 82.7	1600	FTA825112480
900	150	63.0 x 23.6 x 82.7	1600	FTA90061480
1125	125	94.5 x 23.6 x 82.7	2000	FTA112591480
1350	150	94.5 x 23.6 x 82.7	2500	FTA135091480
1500	125	126.0 x 23.6 x 82.7	2500	FTA1500121480
1800	150	126.0 x 23.6 x 82.7	3200	FTA1800121480
Compensate Any Load Within 3 – 4 Seconds — 4.5% Inductors — Tuned to 282 Hz (4.7th Harmonic)				
156	31	31.5 x 23.6 x 82.7	400	FTA15652480T
187	37.5	31.5 x 23.6 x 82.7	400	FTA18752480T
219	31	31.5 x 23.6 x 82.7	400	FTA21974480T
250	50	31.5 x 23.6 x 82.7	600	FTA25052480T
262	37.5	31.5 x 23.6 x 82.7	600	FTA26274480T
312	62.5	31.5 x 23.6 x 82.7	600	FTA31252480T
375	75	31.5 x 23.6 x 82.7	800	FTA37552480T
437	62.5	31.5 x 23.6 x 82.7	800	FTA43774480T
450	150	31.5 x 23.6 x 82.7	800	FTA45031480T
600	100	63.0 x 23.6 x 82.7	1200	FTA60661480T
687	62.5	63.0 x 23.6 x 82.7	1200	FTA687112480T
750	125	63.0 x 23.6 x 82.7	1600	FTA75061480T
825	75	63.0 x 23.6 x 82.7	1600	FTA825112480T
900	150	63.0 x 23.6 x 82.7	1600	FTA90061480T
1125	125	94.5 x 23.6 x 82.7	2000	FTA112591480T
1350	150	94.5 x 23.6 x 82.7	2500	FTA135091480T
1500	125	126.0 x 23.6 x 82.7	2500	FTA1500121480T
1800	150	126.0 x 23.6 x 82.7	3200	FTA1800121480T

Note: Standard systems have separate individual connections on each phase in individual cabinets.

Note: Systems with internal phase connections are available — contact Marketing.

Note: Systems with integral breakers/disconnects have internal phase connections between each cabinet.

Active Harmonic Filter-Harmonic Correction Unit — NEMA 1 Enclosure Specifications



Harmonic Correction Units — NEMA 1 Enclosure

Product Description

Active Harmonic Filters (Harmonic Correction Units — HCU) provide dynamic harmonic correction by actively injecting equal and opposite currents into the customer’s electrical distribution system that cancel the entire spectrum of harmonic currents at the point of connection.

Typical applications include locations with large amounts of non-linear loads including 6- and 12-pulse PWM AC variable frequency drives, DC drives, as well as other switch-mode power supply equipment. This equipment can be found in water and wastewater treatment facilities, industrial manufacturing and warehousing plants, military bases, and commercial (HVAC) locations.

Unlike passive filters, by providing dynamic correction, HCU’s can provide effective harmonic correction for varying load conditions and harmonic spectrums up to their rated capacity. HCU’s also have the secondary benefit of providing power factor correction with any excess capacity after correcting all harmonic conditions.

Advantages

- Can be sized to guarantee specific levels of harmonic correction, such as meeting IEEE 519 recommended levels.
- Cannot be overloaded.
- Can be expanded without affecting performance.
- Broad spectrum of cancellation (2nd to 50th harmonic).
- Power factor improvement.
- Easier and less expensive installation.
- Comprehensive control.

Features, Benefits and Functions

- Fast action.
 - 20 kHz switching carrier frequency.
 - UL / CSA approved.
 - 208 – 480 V +/- 10%, 600 V with autotransformer.
 - 50/60 Hz +/- 3 Hz frequency.
 - Ambient temperature 0°C – +40°C enclosed.
 - Seismic Zone 4.
 - NEMA 1 and NEMA 12 enclosures available:
 - Wall-mount (50 and 100 ampere designs)
 - Floor-standing (300 ampere design)
 - Output capacity — self limited to 100% current rated.
 - Corrective capability — <5% TDD and near unity displacement power factor.
- Note:** Requires at least 3% series input line reactor or equivalent 6% DC bus choke in each AC drive for optimum performance.
- 2-line, 20 character per line alphanumeric display.

Active Harmonic Filters

Product Selection and Sizing

Table 21. Harmonic Control Unit Ratings — NEMA 1 Enclosed

Model	Voltage	Frequency	Total Current Amperes (rms)	Watt Losses (kw)	H x W x D Exterior Dimensions in Inches (mm)	Unit Weight Lbs. (kg)	Enclosure Type	Disconnect
HCU050D5N1	208 – 480	50/60 Hz	50	1.8	51.80 x 20.70 x 18.50 (1315.7 x 525.8 x 469.9)	250 (113.5)	Wall-Mount/ NEMA 1	—
HCU100D5N1	208 – 480	50/60 Hz	100	3.0	68.70 x 20.70 x 18.50 (1745.0 x 525.8 x 469.9)	350 (158.9)	Wall-Mount/ NEMA 1	—
HCU300D5N1	208 – 480	50/60 Hz	300	8.0	74.90 x 32.20 x 19.50 (1902.5 x 817.9 x 495.3)	775 (351.9)	Free-Standing/ NEMA 1	X

Table 22. Current transformer Ratings — Dimensions in Inches (mm)

Model	ac Line Current Rating	Type	Internal Diameter in Inches (mm)
CT500SC	500	Split	2.25 (57.2)
CT1000SC	1000	Split	4.65 (118.1)
CT3000SC	3000	Split	6.50 (165.1)
CT5000SC	5000	Split	7.50 (190.5)

Note: Current transformers are rated for 400 Hz. Two current transformers are required for 3-phase loads. Three current transformers are required when single-phase loads are present.

Rating based on Service Entrance Ampacity and optional parallel operation. For other ratios, please consult Marketing.

Startup and Commissioning by factory trained personnel is required for proper operation and warranty of this system.

Table 23. Autotransformer Required for 600 V operation

Model	Amperes		H x W x D Dimensions in Inches (mm)	Unit Weight Lbs. (kg)
	Total Current	HCU Size		
HCUNWL106740EN	39.2	50 A	30.00 x 24.00 x 21.00 (762.0 x 609.6 x 533.4)	290 (131.7)
HCUNWL106742EN	78.3	100 A	37.00 x 31.00 x 22.00 (939.8 x 787.4 x 558.8)	500 (227.0)
HCUNWL106744EN	235	300 A	44.00 x 39.00 x 30.00 (1117.6 x 990.6 x 762.0)	1100 (499.4)

Technical Data and Specifications

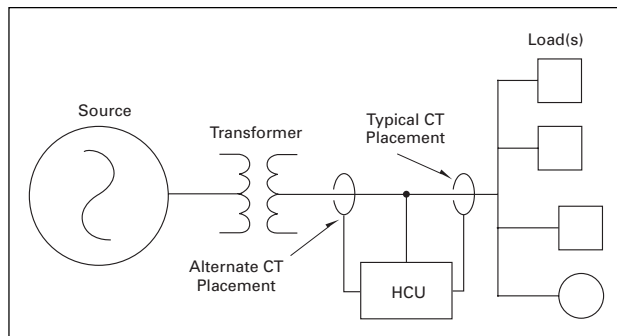


Figure 15. Installation Diagram

Source CT Schematics

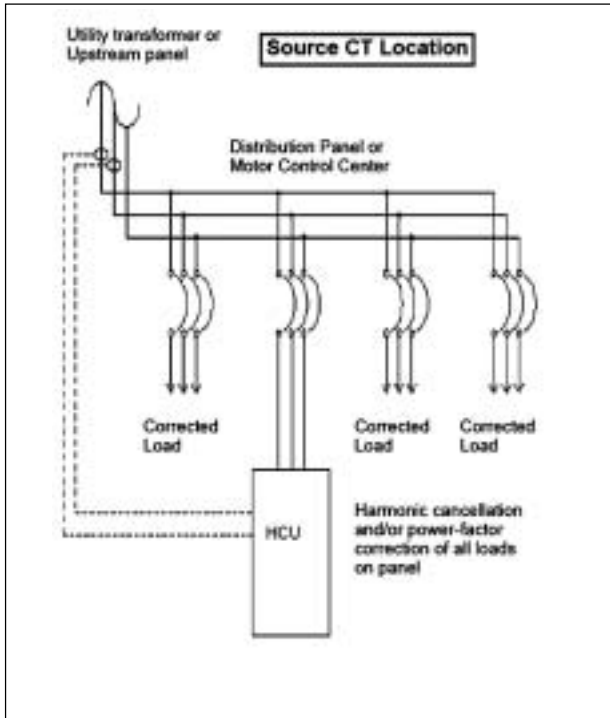


Figure 16. Source CT Location

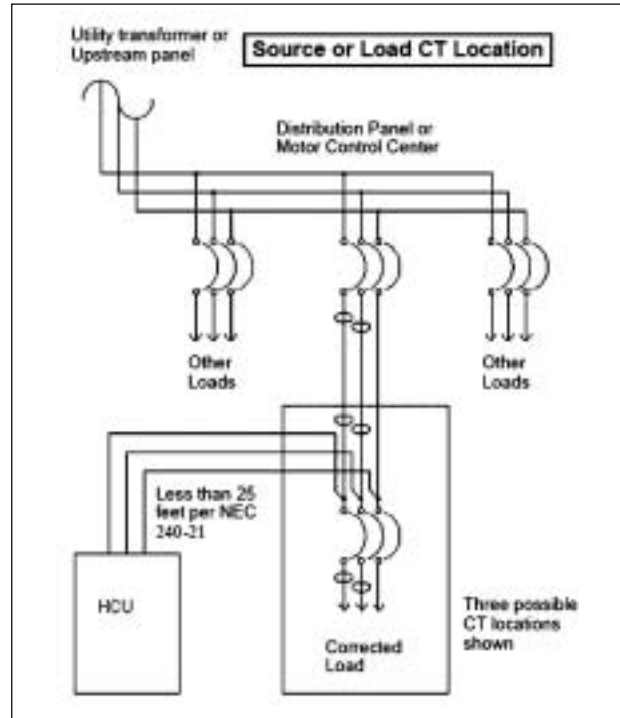


Figure 18. Source or Load CT Location

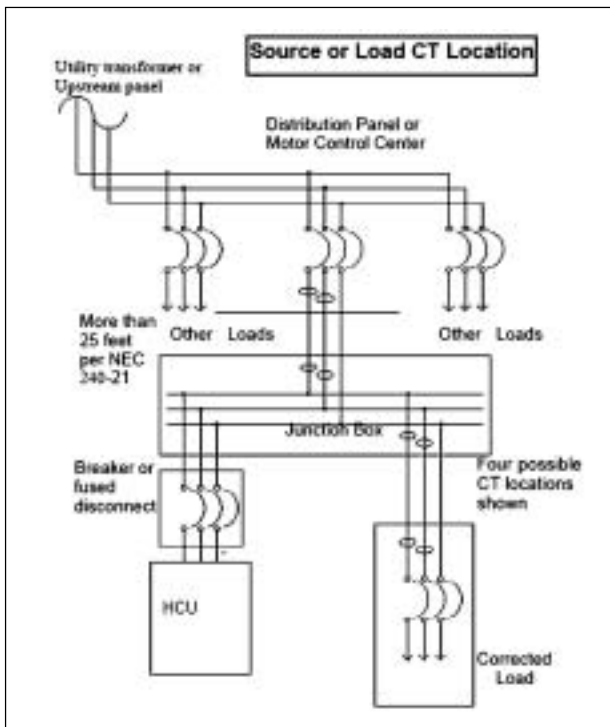


Figure 17. Source or Load CT Location

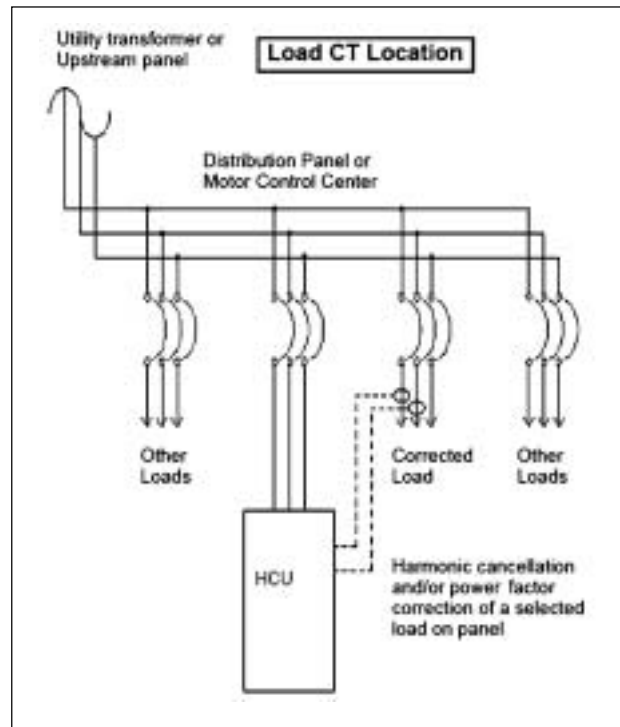


Figure 19. Load CT Location

Active Harmonic Filters

Dimensions

Drawings — NEMA 1 Enclosure

HCU050 Layout Dimensions

The HCU050 series offers 50 amperes of corrective current in a convenient package. The enclosed model comes standard with a digital interface panel for control diagnostics and programming. Input fuses are included. The enclosed unit includes a removable panel for bottom conduit entry.

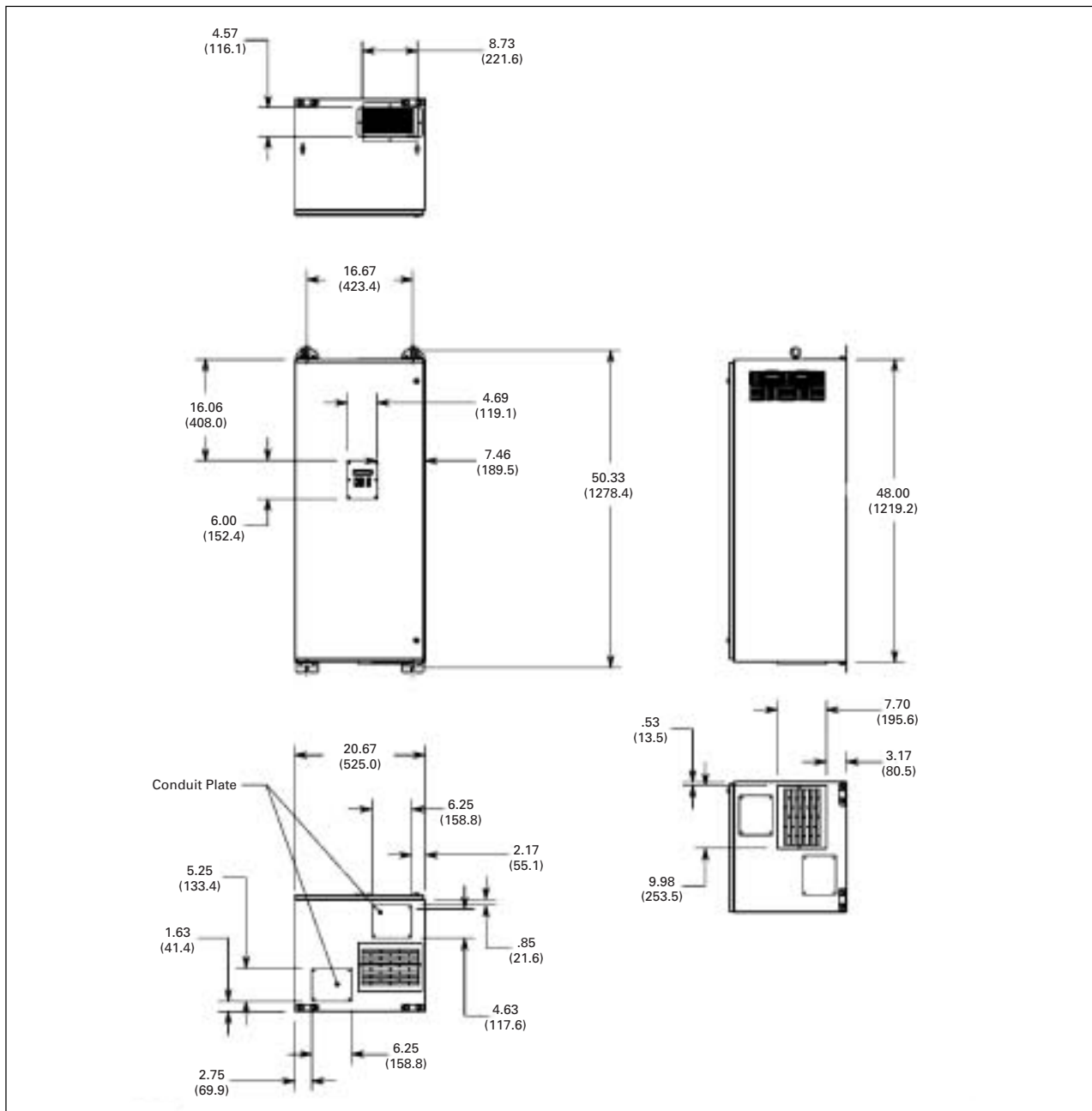


Figure 20. HCU050 — 50 Amperes — Dimensions in Inches (mm)

Drawings — NEMA 1 Enclosure

HCU100 Layout Dimensions

The HCU100 series offers 100 amperes of corrective current in a wall-mounted NEMA 1 enclosure. The enclosed model comes standard with a digital interface module for control, diagnostics and programming. Input fuses are included. The enclosed unit includes a removable panel for bottom unit conduit entry.

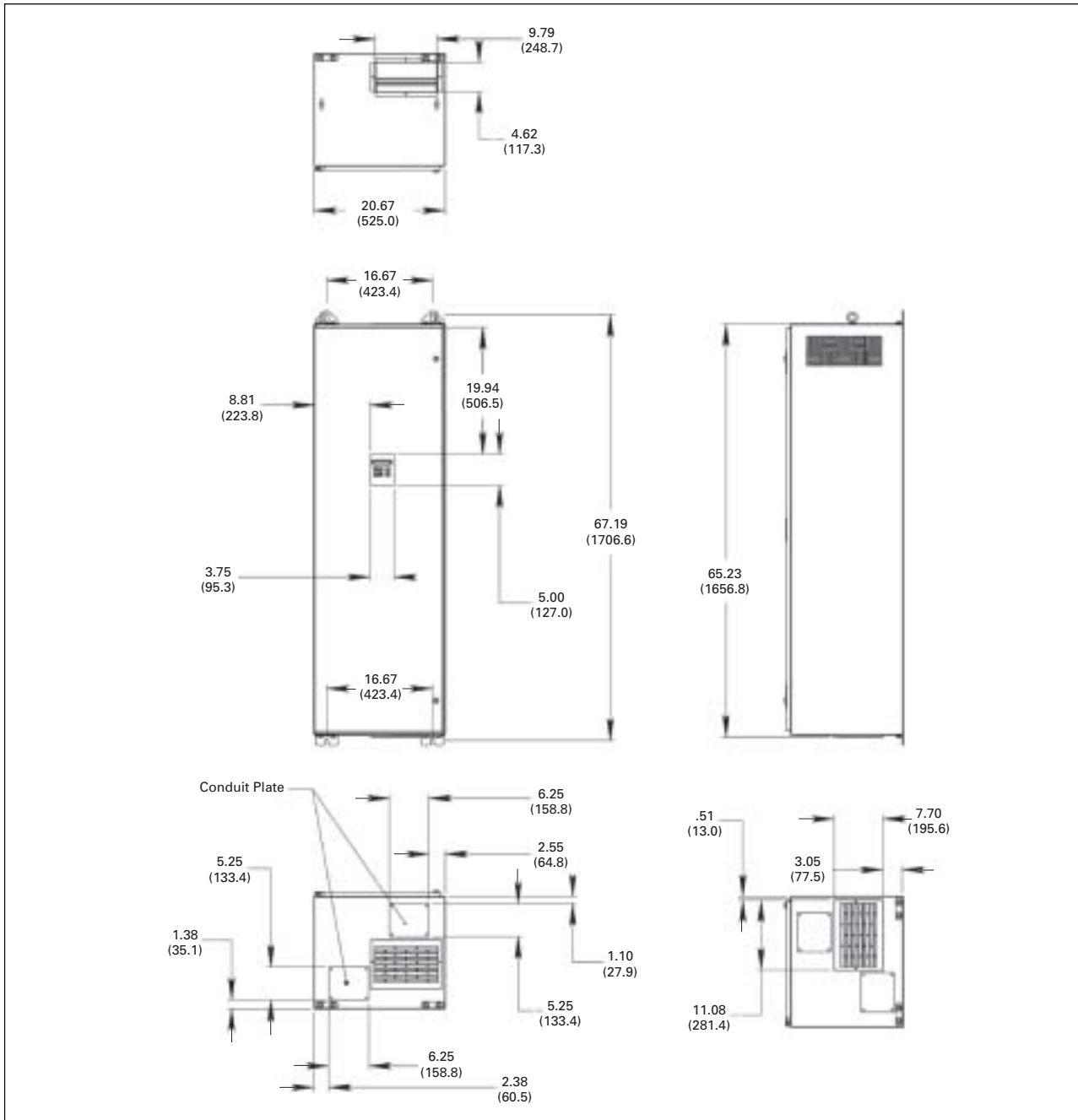


Figure 21. HCU100 — 100 Amperes — Dimensions in Inches (mm)

Active Harmonic Filters

Drawings — NEMA 1 Enclosure

HCU300 Layout Dimensions

The HCU300 series offers 300 amperes of corrective current for large capacity applications. It is available in a floor-standing NEMA 1 enclosure (including a door-interlocking disconnect). The enclosed model comes standard with digital interface module for control, diagnostics and programming. Input fuses are included. The enclosed unit includes a removable panel for top conduit entry.

NEMA is the registered trademark and service mark of the National Electrical Manufacturers Association. UL is a registered trademark of Underwriters Laboratories Inc. Cutler-Hammer is a federally registered trademark of Eaton Corporation. ISO is the registered trademark and sole property of the International Organization for Standardization.

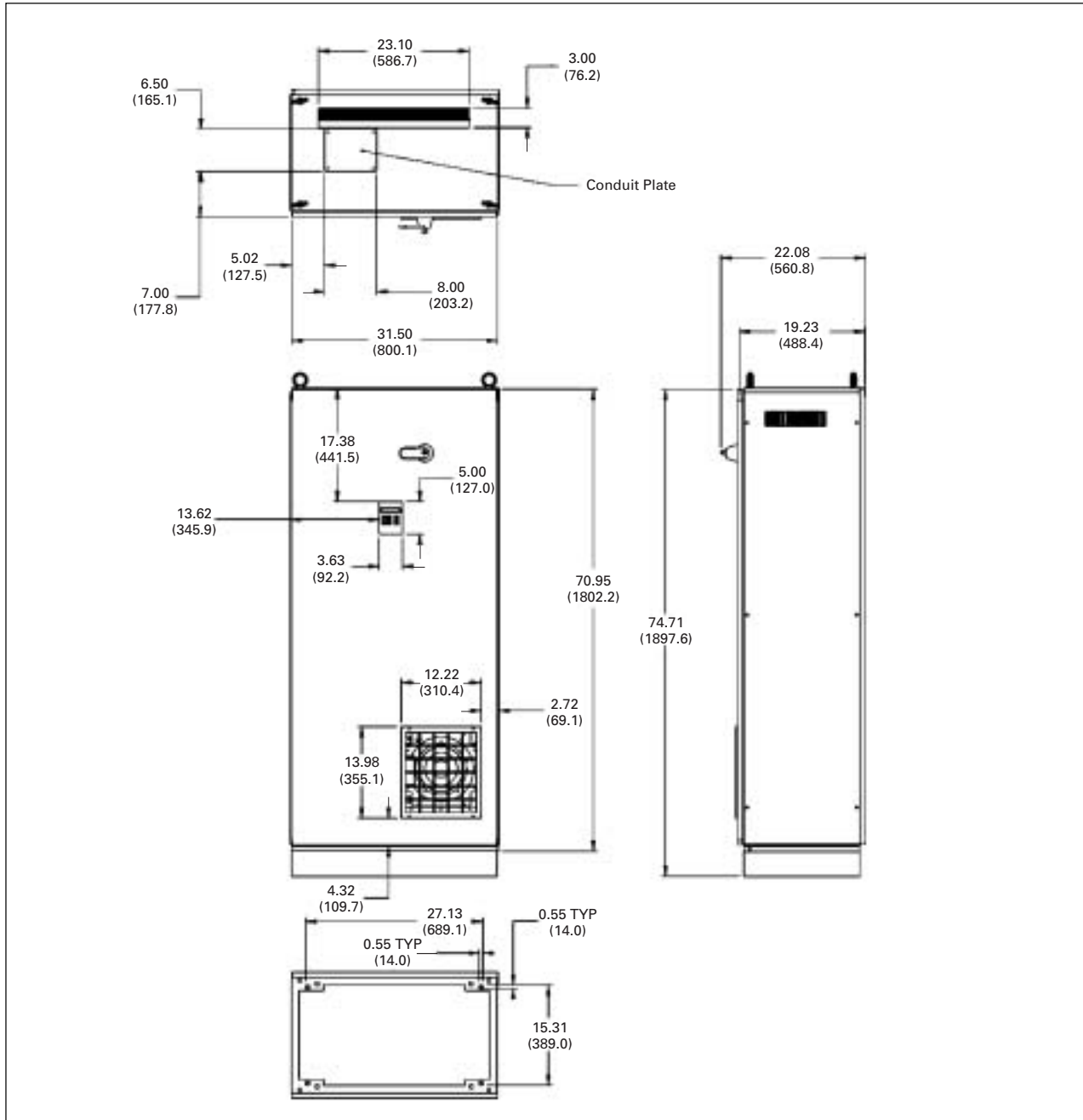


Figure 22. HCU300 — 300 Amperes — Dimensions in Inches (mm)

Eaton's electrical business is a global leader in electrical control, power distribution, and industrial automation products and services. Through advanced product development, world-class manufacturing methods, and global engineering services and support, Eaton's electrical business provides customer-driven solutions under brand names such as Cutler-Hammer®, Powerware®, Durant®, Heinemann®, Holec® and MEM®, which globally serve the changing needs of the industrial, utility, light commercial, residential, and OEM markets. For more information, visit www.eatoncanada.ca.

Eaton Corporation is a diversified industrial manufacturer with 2007 sales of \$13.0 billion. Eaton is a global leader in electrical systems and components for power quality, distribution and control; fluid power systems and services for industrial, mobile and aircraft equipment; intelligent truck drivetrain systems for safety and fuel economy; and automotive engine air management systems, powertrain solutions and specialty controls for performance, fuel economy and safety. Eaton has 70,000 employees and sells products to customers in more than 150 countries. For more information, visit www.eaton.com

Eaton Yale Company
5050 Mainway
Burlington, ON L7L 5Z1
Canada
Tel.: 1-800-268-3578
www.eatoncanada.ca



PowerChain
Management™
Solutions

EATON

Cutler-Hammer

©Eaton Yale Company, 2008
All rights reserved
Printed in Canada
PG.25A.02.T.K
March 2008