EATON | Cutler-Hammer

Low Voltage Power Factor Correction Capacitor Banks and Harmonic Filters

Technical Data TD02607001E

Low Voltage Power Factor Correction Capacitor Banks and Harmonic Filters

Contents

Note:

Images contained in this document may be shown with optional components and features not included as part of the base offering.

Power Factor Correction Capacitors

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.

TABLE 1. CAPACITOR CELL CHART

VOLTAGE	KVAR	CATALOG NUMBER	DIMENSIONS IN INCHES (MM) D	H	WEIGHT IN LBS (KG)
240	1.5	**643PCRMA**	3.1 (79.5)	7.9 (200.0)	1.1 (0.5)
240	2	**8B43PCRMA**	3.1 (79.5)	9.4 (238.0	1.3 (0.6)
240	2.5	**1043PCRMA**	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)
240	3	**12X43PCRMA**	3.5 (89.5)	9.4 (238.0)	1.8 (0.8)
240	4	**423PCRMA**	3.1 (79.5)	7.9 (200.0)	1.1 (0.5)
240	5	**2043PCRMA**	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)
240	6.3	**6B23PCRMA**	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)
240	7.5	**7X23PCRMA**	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)
240	8.3	**8B23PCRMA**	3.5 (89.5)	9.4 (238.0)	1.8 (0.8)
240	10	**1023PCRMA**	3.5 (89.5)	9.4 (238.0)	1.3 (0.6)
240	12.5	**12X23PCRMA**	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)
240	15	**1523PCRMA**	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)
240	16.7	**16S23PCRMA**	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)
240	17.5	**17X23PCRMA**	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)
480	1.5	**1X43PCRMA**	2.1 (53.0)	5.0 (125.8)	0.7 (0.3)
480	2	**243PCRMA**	2.5 (63.5)	5.5 (140.8)	0.9 (0.4)
480	2.5	**2X43PCRMA**	2.5 (63.5)	5.5 (140.8)	0.9 (0.4)
480	3	**343PCRMA**	2.5 (63.5)	5.5 (140.8)	0.9 (0.4)
480	4	**443PCRMA**	2.5 (63.5)	6.5 (165.8)	0.9 (0.4)
480	5	**543PCRMA**	2.5 (63.5)	6.5 (165.8)	0.9 (0.4)
480	6	**643PCRMA**	3.1 (79.5)	7.9 (200.0)	1.1 (0.5)
480	7.5	**7X43PCRMA**	3.1 (79.5)	7.9 (200.0)	1.1 (0.5)
480	8.3	**8B43PCRMA**	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)
480	9	**943PCRMA**	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)
480	10	**1043PCRMA**	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)
480	12.5	**12X43PCRMA**	3.5 (89.5)	9.4 (238.0)	1.8 (0.8)
480	15	**1543PCRMA**	3.5 (89.5)	9.4 (238.0)	1.8 (0.8)
480	18	**1843PCRMA**	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)
480	20	**2043PCRMA**	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)
480	25	**2543PCRMA**	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)
480	30	**3043PCRMA**	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)
600	5	**563PCRMA**	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)
600	7.5	**7X63PCRMA**	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)
600	10	**1063PCRMA**	3.1 (79.5)	9.4 (238.0)	1.3 (0.6)
600	12.5	**12X63PCRMA**	3.5 (89.5)	9.4 (238.0)	1.8 (0.8)
600	15	**1563PCRMA**	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)
600	17.5	**17X63PCRMA**	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)
600	20	**2063PCRMA**	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)
600	25	**2563PCRMA**	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)

Notes:

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.

Capacitor Cell With M12 Threaded Mounting Bolt, Washer, Nut

TABLE 2. HARMONIC RATED CAPACITOR CELL CHART

VOLTAGE	KVAR	CATALOG NUMBER	DIMENSIONS IN INCHES (MM) D	H	WEIGHT IN LBS (KG)
240	12.5	**12X23PHRMA**	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)
480	15.0	**1543PHRMA**	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)
480	25.0	**2543PHRMA**	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)
600	12.3	**12A63PHRMA**	3.5 (89.5)	12.3 (313.0)	2.6 (1.2)
600	14.7	**14S63PHRMA**	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)
600	16.7	**16S63PHRMA**	3.5 (89.5)	15.3 (388.0)	3.3 (1.5)

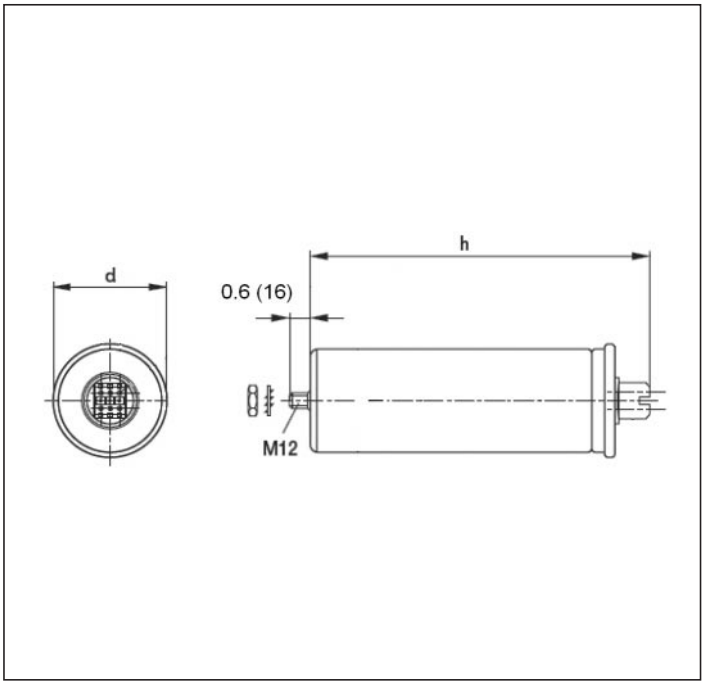


FIGURE 1. CAPACITOR CELL DIMENSIONS

UNIPUMP

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.

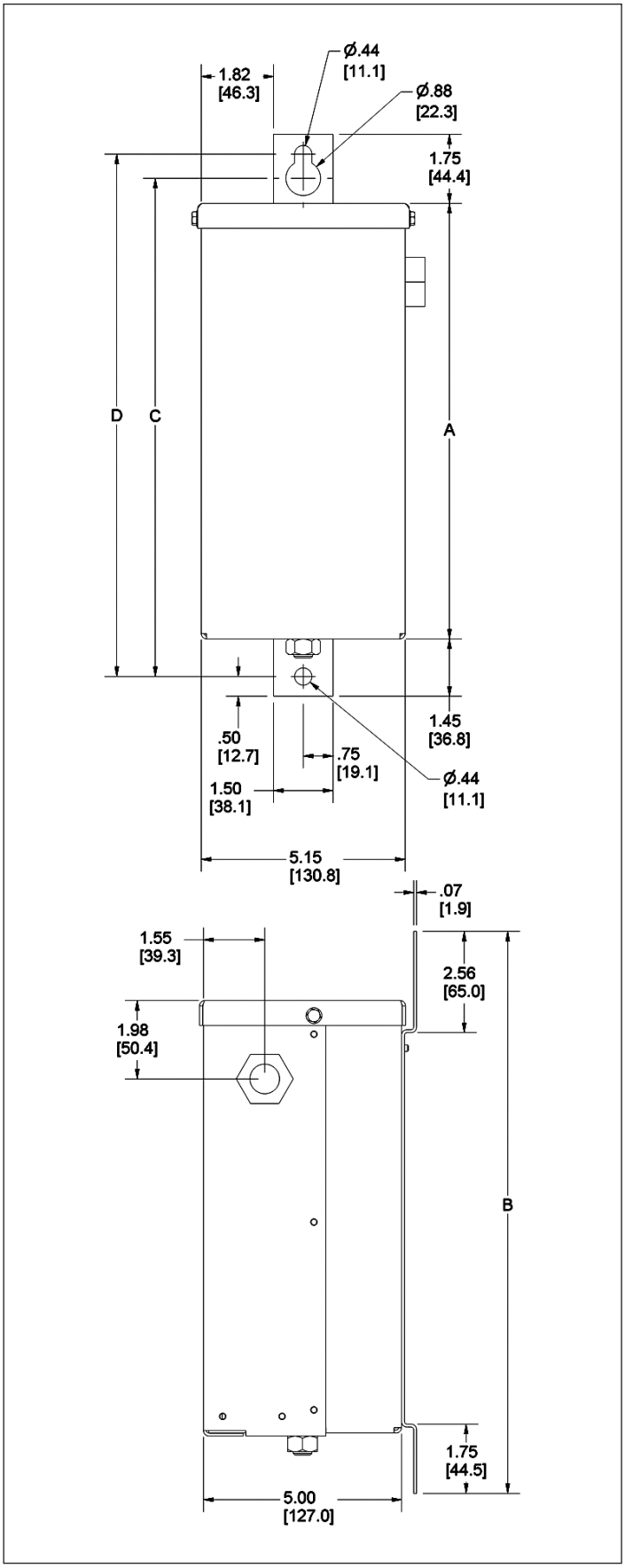


FIGURE 2. UNIPUMP DIMENSIONS

Capacitor Cells

- **Terminals**: Insulated finger-safe terminals rated for 3 kVAC withstand.
- **Dielectric fill**: 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 UL recognized three-phase pressure-sensitive interrupter and thermally or mechanically activated disconnecting link removes capacitor from the supply before dangerous pressure buildup or excessive fault current. 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.

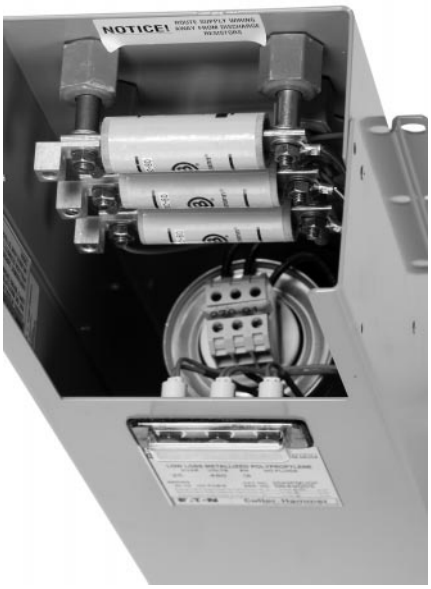
TABLE 3. UNIPUMP DIMENSION CHART

	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)

TABLE 4. UNIPUMP SELECTION CHART

KVAR	CATALOG NUMBER	RATED CURRENT	CASE SIZE	CABLE SIZE	SHIPPING WT. IN LBS (KG)
240 Vac					
2	**223JMR**	4.8	AA	14.0	10.0 (4.7)
2.5	**2X23JMR**	6.0	AA	14.0	10.0 (4.7)
3	**323JMR**	7.2	AA	14.0	10.0 (4.7)
4	**423JMR**	9.6	AA	14.0	11.0 (4.8)
5	**523JMR**	12.0	AA	14.0	11.0 (4.8)
6	**623JMR**	14.4	BB	12.0	15.0 (6.6)
7.5	**7X23JMR**	18.0	BB	12.0	15.0 (6.6)
480 Vac					
2	**243JMR**	2.4	AA	14.0	10.4 (4.7)
2.5	**2X43JMR**	3.0	AA	14.0	10.4 (4.7)
3	**343JMR**	3.6	AA	14.0	10.4 (4.7)
4	**443JMR**	4.8	AA	14.0	10.4 (4.7)
5	**543JMR**	6.0	AA	14.0	10.4 (4.7)
6	**643JMR**	7.2	AA	14.0	10.6 (4.8)
7.5	**7X43JMR**	9.0	AA	14.0	10.6 (4.8)
10	**1043JMR**	12.0	AA	14.0	10.8 (4.9)
12.5	**12X43JMR**	15.0	BB	12.0	15.0 (6.8)
15	**1543JMR**	18.0	BB	12.0	15.0 (6.8)
17.5	**17X43JMR**	21.0	BB	8.0	15.8 (7.2)
20	**2043JMR**	24.0	BB	8.0	16.8 (7.7)
25	**2543JMR**	30.0	BB	8.0	16.8 (7.7)
600 Vac					
5	**563JMR**	4.9	AA	14.0	10.8 (4.9)
6	**663JMR**	5.9	AA	14.0	10.8 (4.9)
7.5	**7X63JMR**	7.4	AA	14.0	10.8 (4.9)
10	**1063JMR**	9.8	AA	14.0	10.8 (4.9)
12.5	**12X63JMR**	12.3	BB	12.0	15.0 (6.8)
15	**1563JMR**	14.7	BB	12.0	15.8 (7.2)
17.5	**17X63JMR**	17.2	BB	8.0	16.8 (7.7)
20	**2063JMR**	19.6	BB	8.0	16.8 (7.7)

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.
- Internally fused through the use of an overpressure disconnector.
- Quick lead-times.
- Harmonic filters available.
- Slim profile allows reduced footprint, conserving valuable floor space.
- New capacitor configuration leads to cooler operating conditions and extended 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 from enclosure sizes A1 through C1.

- **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.
- **Options**:
  - Replaceable fuses and indicator lights
  - Air filters for enclosure sizes C2 and larger
- **Optional Fusing**:
  - **Size Code A1**: Three midget-type fuses with 100,000 ampere interrupting capacity
  - **Size Code A2 and larger**: Slotted-blade type fuses with 200,000 ampere interrupting capacity; Fuses mounted on stand-off bushings; Solderless connectors for easy hookup of incoming line conductors
  - **Fuse indicating lights**: Red, neon blown-fuse indicating lights are protected by transparent weatherproof guard

UNIPAK with Optional Air Filter

Capacitor Cells

- **Terminals**: Insulated finger-safe terminals rated for 3 kVAC withstand.
- **Dielectric fill**: 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 UL recognized three-phase pressure-sensitive interrupter and thermally or mechanically activated disconnecting link removes capacitor from the supply before dangerous pressure buildup or excessive fault current. 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.

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 80ºC. Open frame construction with 220ºC 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 180ºC.
- **Warranty**: One-year replacement of reactors.

TABLE 5. 240 VAC UNIPAK SELECTION CHART

KVAR	CATALOG NUMBER	RATED CURRENT	ENCLOSURE	SHIPPING WEIGHT IN LBS (KG)
1	**123PMURN**	2.4	A1	18 (8)
1.5	**1X23PMURN**	3.6	A1	18 (8)
2	**223PMURN**	4.8	A1	19 (9)
2.5	**2X23PMURN**	6	A1	19 (9)
3	**323PMURN**	7.2	A1	19 (9)
4	**423PMURN**	9.6	A1	20 (9)
5	**523PMURN**	12	A2	29 (13)
6	**623PMURN**	14.4	A2	29 (13)
7.5	**7X23PMURN**	18	A2	30 (14)
8	**823PMURN**	19.2	A2	31 (14)
10	**1023PMURN**	24	A2	31 (14)
12.5	**12X23PMURN**	30	A2	32 (14)
15	**1523PMURN**	36	A2	33 (15)
17.5	**17X23PMURN**	42	B1	44 (20)
20	**2023PMURN**	48	B1	45 (20)
22.5	**22X23PMURN**	54	B1	46 (21)
25	**2523PMURN**	60	B1	46 (21)
30	**3023PMURN**	72	B1	47 (21)
32.5	**32X23PMURN**	78	B1	47 (22)
35	**3523PMURN**	84	B1	48 (22)
37.5	**37X23PMURN**	90	C1	60 (27)
40	**4023PMURN**	96	C1	64 (29)
42.5	**42X23PMURN**	102	C1	65 (30)
45	**4523PMURN**	108	C1	66 (30)
50	**5023PMURN**	120	C1	68 (31)
60	**6023PMURN**	144	C1	69 (31)
70	**7023PMURN**	168	C2	99 (45)
75	**7523PMURN**	180	C2	100 (46)
80	**8023PMURN**	192	C2	101 (46)
90	**9023PMURN**	216	C2	103 (47)
100	**10023PMURN**	240	C2	104 (47)
120	**12023PMURN**	288	D1	133 (60)
140	**14023PMURN**	336	D1	137 (62)
150	**15023PMURN**	360	D1	140 (64)
160	**16023PMURN**	384	E1	175 (80)
180	**18023PMURN**	432	E1	182 (83)
200	**20023PMURN**	480	E1	189 (86)

Notes:

- Multiply the 240 Vac kvar rating by 0.75 to calculate the kvar value at 208 Vac.
- Internally fused available standard. Replaceable fuses and indicator lights also available — please consult the factory.
- For dimensional information, refer to **Page 10**.

Part Numbers for Tables 5 and 6:

- PMURN — Internally fused
- PMURF — Replaceable fuses and indicator lights

TABLE 6. 480 VAC UNIPAK SELECTION CHART

KVAR	CATALOG NUMBER	RATED CURRENT	ENCLOSURE	SHIPPING WEIGHT IN LBS (KG)
1.5	**1X43PMURN**	1.8	A1	17 (8)
2	**243PMURN**	2.4	A1	18 (8)
2.5	**2X43PMURN**	3	A1	18 (8)
3	**343PMURN**	3.6	A1	19 (9)
4	**443PMURN**	4.8	A1	19 (9)
5	**543PMURN**	6	A1	19 (9)
6	**643PMURN**	7.2	A1	19 (9)
7.5	**7X43PMURN**	9	A1	20 (9)
8	**843PMURN**	9.6	A1	20 (9)
9	**943PMURN**	10.8	A1	20 (9)
10	**1043PMURN**	12	A1	20 (9)
12.5	**12X43PMURN**	15	A2	29 (13)
15	**1543PMURN**	18	A2	29 (13)
17.5	**17X43PMURN**	21	A2	30 (14)
20	**2043PMURN**	24	A2	31 (14)
22.5	**22X43PMURN**	27	B1	44 (20)
25	**2543PMURN**	30	A2	32 (15)
27.5	**27X43PMURN**	33	B1	44 (20)
30	**3043PMURN**	36	B1	44 (20)
32.5	**32X43PMURN**	39	B1	45 (20)
35	**3543PMURN**	42	B1	45 (20)
37.5	**37X43PMURN**	45	B1	46 (21)
40	**4043PMURN**	48	B1	46 (21)
42.5	**42X43PMURN**	51	B1	47 (21)
45	**4543PMURN**	54	B1	47 (22)
50	**5043PMURN**	60	B1	48 (22)
55	**5543PMURN**	66	B1	48 (22)
60	**6043PMURN**	72	B1	48 (22)
65	**6543PMURN**	78	C1	64 (29)
70	**7043PMURN**	84	C1	65 (30)
75	**7543PMURN**	90	C1	65 (30)
80	**8043PMURN**	96	C1	66 (30)
85	**8543PMURN**	102	C1	68 (31)
90	**9043PMURN**	108	C1	68 (31)
100	**10043PMURN**	120	C1	69 (31)
120	**12043PMURN**	144	C1	69 (31)
125	**12543PMURN**	150	C2	99 (45)
140	**14043PMURN**	168	C2	100 (46)
150	**15043PMURN**	180	C2	101 (46)
160	**16043PMURN**	192	C2	103 (47)
180	**18043PMURN**	216	C2	104 (47)
200	**20043PMURN**	240	D1	137 (62)
225	**22543PMURN**	270	D1	140 (64)
250	**25043PMURN**	300	E1	170 (77)
300	**30043PMURN**	360	E1	175 (80)
350	**35043PMURN**	420	E1	182 (83)
400	**40043PMURN**	480	E1	189 (86)

Notes:

- Internally fused available standard. Replaceable fuses and indicator lights also available — please consult the factory.
- For dimensional information, refer to **Page 10**.

UNIPAK Low Voltage Fixed Capacitor Banks (Continued)

TABLE 7. 600 VAC UNIPAK SELECTION CHART

KVAR	CATALOG NUMBER	RATED CURRENT	ENCLOSURE	SHIPPING WEIGHT IN LBS (KG)
5	**563PMURN**	4.9	A1	19 (9)
7.5	**7X63PMURN**	7.4	A1	19 (9)
10	**1063PMURN**	9.8	A1	20 (9)
12.5	**12X63PMURN**	12.3	A1	20 (9)
15	**1563PMURN**	14.7	A2	29 (13)
17.5	**17X63PMURN**	17.2	A2	29 (13)
20	**2063PMURN**	19.6	A2	30 (14)
22.5	**22X63PMURN**	22.1	B1	44 (20)
25	**2563PMURN**	24.5	B1	31 (14)
27.5	**27X63PMURN**	27.0	B1	44 (20)
30	**3063PMURN**	29.4	B1	45 (20)
32.5	**32X63PMURN**	31.9	B1	45 (20)
35	**3563PMURN**	34.3	B1	46 (21)
37.5	**37X63PMURN**	36.8	B1	46 (21)
40	**4063PMURN**	39.2	B1	47 (21)
42.5	**42X63PMURN**	41.7	B1	47 (22)
45	**4563PMURN**	44.1	B1	48 (22)
50	**5063PMURN**	49.0	B1	48 (22)
55	**5563PMURN**	53.9	C1	64 (29)
60	**6063PMURN**	58.8	C1	64 (29)
65	**6563PMURN**	63.7	C1	65 (30)
70	**7063PMURN**	68.6	C1	65 (30)
75	**7563PMURN**	73.5	C1	66 (30)
80	**8063PMURN**	78.4	C1	68 (31)
85	**8563PMURN**	83.3	C1	68 (31)
90	**9063PMURN**	88.2	C1	69 (31)
100	**10063PMURN**	98.0	C1	69 (31)
120	**12063PMURN**	117.6	C2	99 (45)
125	**12563PMURN**	122.5	C2	100 (46)
140	**14063PMURN**	137.2	C2	101 (46)
150	**15063PMURN**	147.0	C2	103 (47)
160	**16063PMURN**	156.8	D1	135 (61)
180	**18063PMURN**	176.4	D1	137 (62)
200	**20063PMURN**	196.0	D1	140 (64)
225	**22563PMURN**	220.5	D1	143 (65)
250	**25063PMURN**	245.0	E1	170 (77)
300	**30063PMURN**	294.0	E1	175 (80)
350	**35063PMURN**	343.0	E1	182 (83)
400	**40063PMURN**	392.0	E1	189 (86)

Notes:

- Internally fused available standard. Replaceable fuses and indicator lights also available — please consult the factory.
- For dimensional information, refer to **Page 10**.

Part Numbers:

- PMURN — Internally fused
- PMURF — Replaceable fuses and indicator lights

UNIPAK — with Harmonic Cells

TABLE 8. LOW VOLTAGE FIXED CAPACITOR SYSTEMS WITH HARMONIC CELLS

KVAR	CATALOG NUMBER	RATED CURRENT	CASE SIZE	SHIPPING WEIGHT IN LBS (KG)
240 V				
15	**1523HURN**	36	B1	38.4 (17)
25	**2523HURN**	60	B1	38.4 (17)
30	**3023HURN**	72	C1	55.2 (25)
50	**5023HURN**	120	C1	57.6 (26)
60	**6023HURN**	144	C2	100.8 (46)
75	**7523HURN**	180	C2	104.4 (47)
100	**10023HURN**	240	D1	136.8 (62)
125	**12523HURN**	300	E1	189.6 (86)
480 V				
15	**1543HURN**	18	A2	25.2 (11)
25	**2543HURN**	30	B1	37.2 (17)
30	**3043HURN**	36	B1	38.4 (17)
50	**5043HURN**	60	B1	39.6 (18)
60	**6043HURN**	72	C1	52.8 (24)
75	**7543HURN**	90	C1	55.2 (25)
100	**10043HURN**	120	C1	57.6 (26)
125	**12543HURN**	150	C2	100.8 (46)
150	**15043HURN**	180	C2	104.4 (47)
200	**20043HURN**	240	D1	136.8 (62)
250	**25043HURN**	300	E1	186.0 (84)
300	**30043HURN**	360	E1	189.6 (86)
600 V				
15	**1563HURN**	14.7	B1	37.2 (17)
25	**2563HURN**	24.5	B1	38.4 (17)
30	**3063HURN**	29.4	B1	39.6 (18)
50	**5063HURN**	49	C1	55.2 (25)
60	**6063HURN**	58.8	C1	57.6 (26)
75	**7563HURN**	73.5	C2	100.8 (46)
100	**10063HURN**	98	C2	104.4 (47)
125	**12563HURN**	122.5	D1	136.8 (62)
150	**15063HURN**	147	D1	136.8 (62)
200	**20063HURN**	196	E1	186.0 (84)
250	**25063HURN**	245	E1	189.6 (86)

TABLE 9. FIXED UNIPAK HARMONIC FILTERS

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

Note:

Other ratings available, please consult factory.

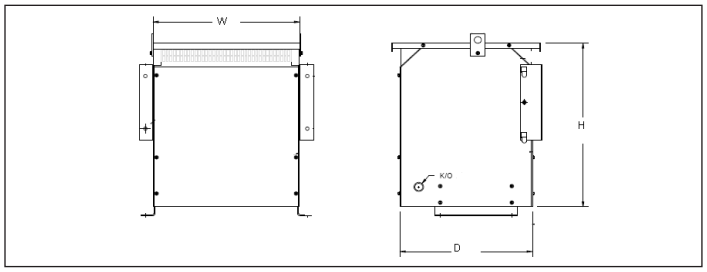


FIGURE 3. REACTOR CABINET

TABLE 10. REACTOR CABINET DIMENSIONS

	HEIGHT	WIDTH	DEPTH	MM
R	20.50	20.50	20.75	520.7 x 520.7 x 527.1
S	24.50	24.50	22.00	622.3 x 622.3 x 558.8
T	32.00	30.75	27.75	812.8 x 781.1 x 704.9

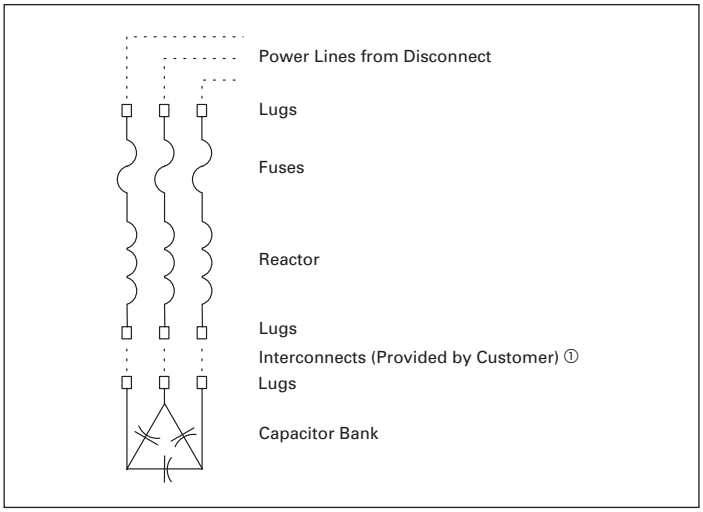


FIGURE 4. FILTER SCHEMATIC WITH WIRING INTERCONNECTS

① Refer to NEC.

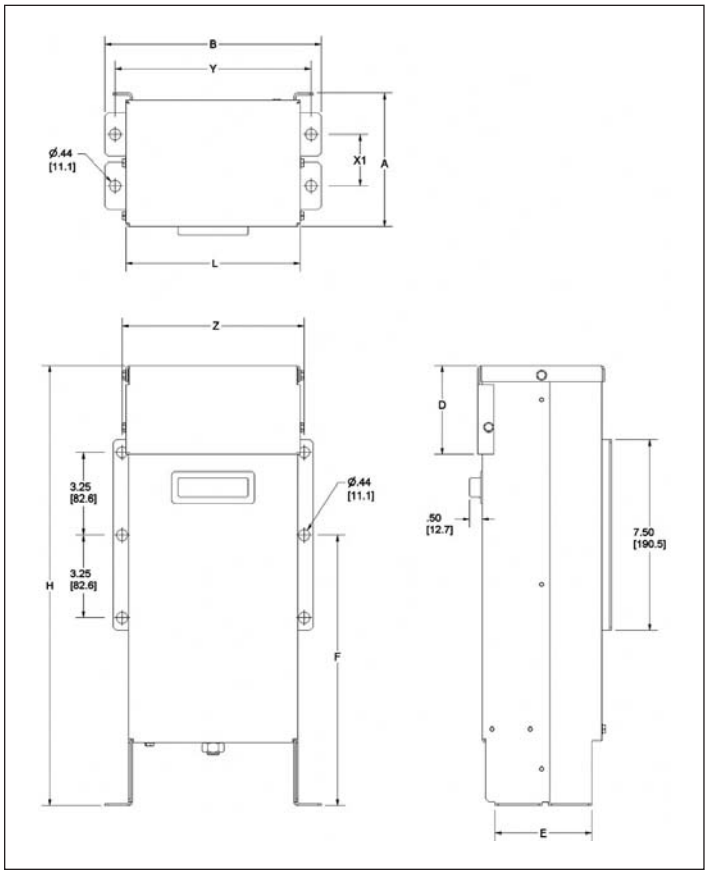


FIGURE 5. CASE A1, A2

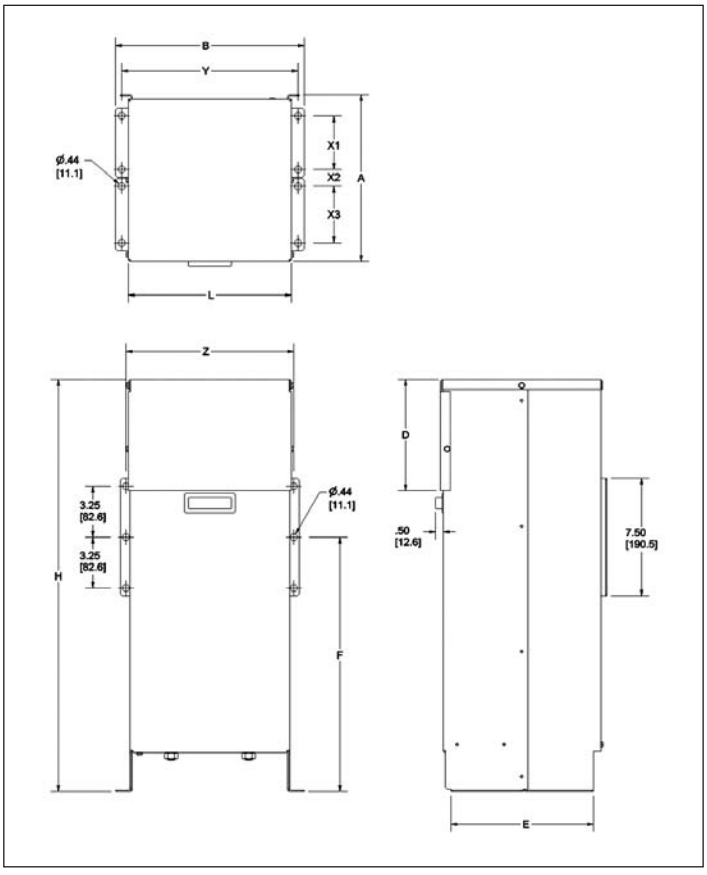


FIGURE 7. CASE C1, C2

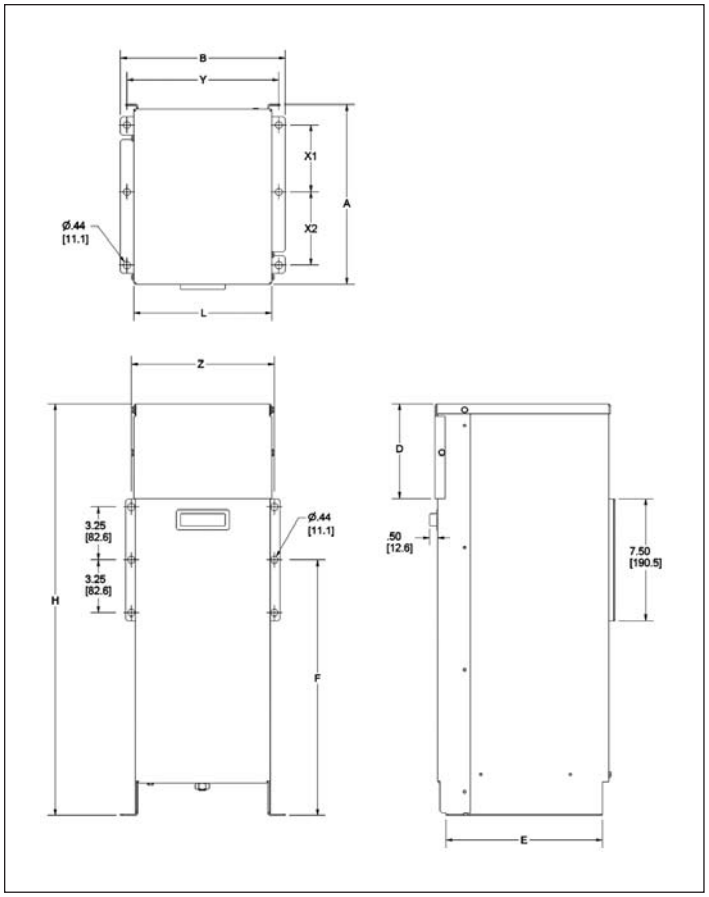


FIGURE 6. CASE B1

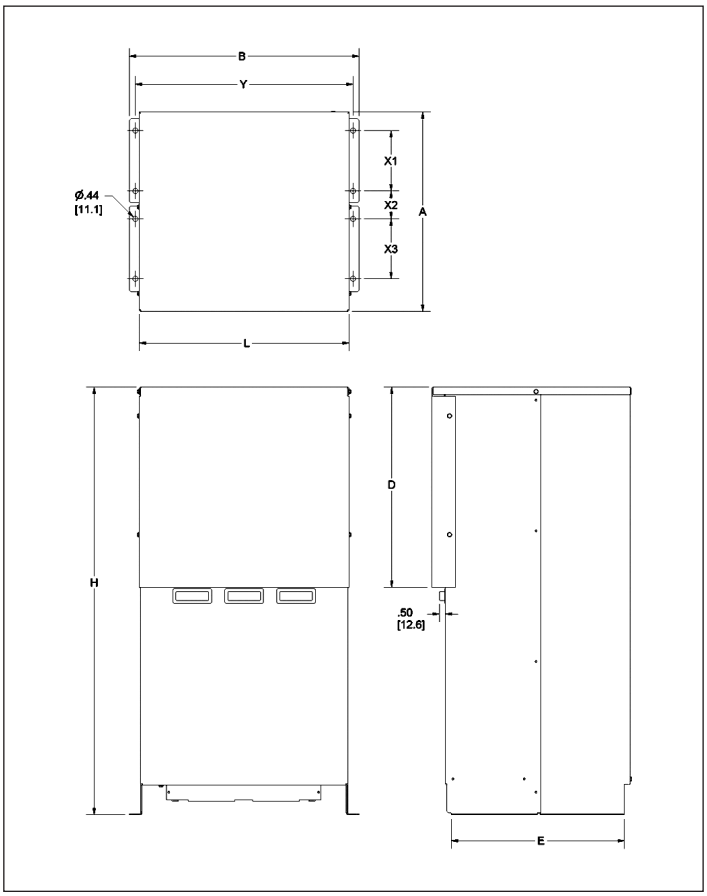


FIGURE 8. CASE D1, E1

TABLE 11. UNIPAK ENCLOSURES

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

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 fan**: Provides ventilation; dust filtering included.
- **Safety**: Personnel ground fault interruption provides protection in case of accidental contact with control power and ground.

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 capable (RS-485/Modbus®) 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.

Options

- Optional molded case circuit breaker rated 65 kAIC at 480 V and 600 V.
- NEMA 3R weatherproofing.

TABLE 12. WALL-MOUNTED SWITCHED CAPACITOR BANKS — LOW VOLTAGE APPLICATIONS

KVAR	STEP X KVAR	RATED CURRENT AMPERES	CASE SIZE	SHIPPING WEIGHT LBS. (KG)	FUSED CATALOG NUMBER
240 Volt					
25	5 x 5	60	J	217 (98.5)	**25MCSR2313**
50	5 x 10	120	J	255 (115.8)	**50MCSR2313**
75	5 x 15	180	J	260 (118.0)	**75MCSR2313**
100	5 x 20	240	J	270 (122.6)	**100MCSR231**
125	5 x 25	300	J	292 (132.6)	**125MCSR231**
150	5 x 30	361	J	314 (142.6)	**150MCSR231**
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 ①	5 x 60	288	J	310 (140.7)	**300MCSD631**

① Available only in rectangular style cell option. Consult factory for more information.

Note:

Other ratings available, please consult factory.

TABLE 13. OPTIONS

DESCRIPTION	OPTION CODE
Current transformer — Multi-tap, split core current transformer (3000:5 A) ②	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
Molded case circuit breaker (65 kAIC at 480 V)	M
Weatherproofing (NEMA 3R)	W
Communicating Controller (RS-485/Modbus)	C
Metering and Thermostatic Temp Control	L

② 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 factory.

Enclosure J — Dimensions in Inches (mm)

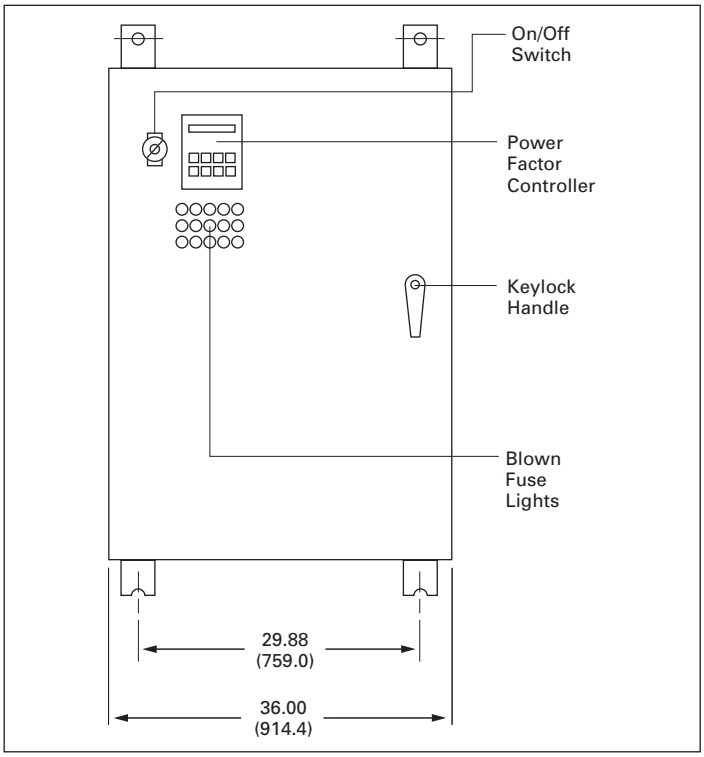


FIGURE 9. FRONT VIEW OF ENCLOSURE J

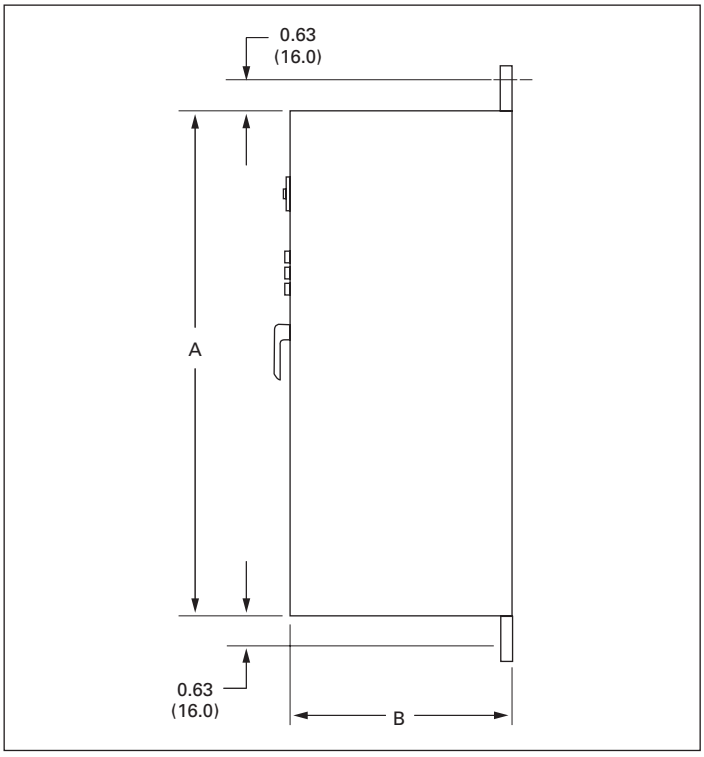


FIGURE 10. SIDE VIEW OF ENCLOSURE J

TABLE 14. ENCLOSURE J — DIMENSIONS IN INCHES (MM)

DESCRIPTION	HEIGHT A	DEPTH B
Without MCCB	36.00 (914.4)	13.67 (347.2)
With MCCB	60.00 (1524.0)	13.67 (347.2)

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 capable (RS-485/Modbus) 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 molded 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.
- Optional digital metering — IQ 250.
- Bottom cable entry spacing.

AUTOVAR 600 — Interior View

Modular Step Nest Assembly

Bottom Entry Location

Factory Pre-wired for Future Expansion

TABLE 15. FLOOR-MOUNTED SWITCHED CAPACITOR BANKS — LOW VOLTAGE APPLICATIONS

KVAR	STEP X KVAR	RATED CURRENT AMPERES	ENCLOSURE SIZE	SHIPPING WEIGHT LBS. (KG)	FUSED CATALOG 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	L	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	L	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 factory.

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
Molded case circuit breaker (65 kAIC at 480 V)	M
Weatherproofing (NEMA 3R)	W
Communicating Controller (RS-485/Modbus)	C
Metering and Thermostatic Temp Control	L
IQ 250 Solid-State Meter ②	Q

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 factory.

② Not available with weatherproofing option.

Dimensions in Inches (mm)

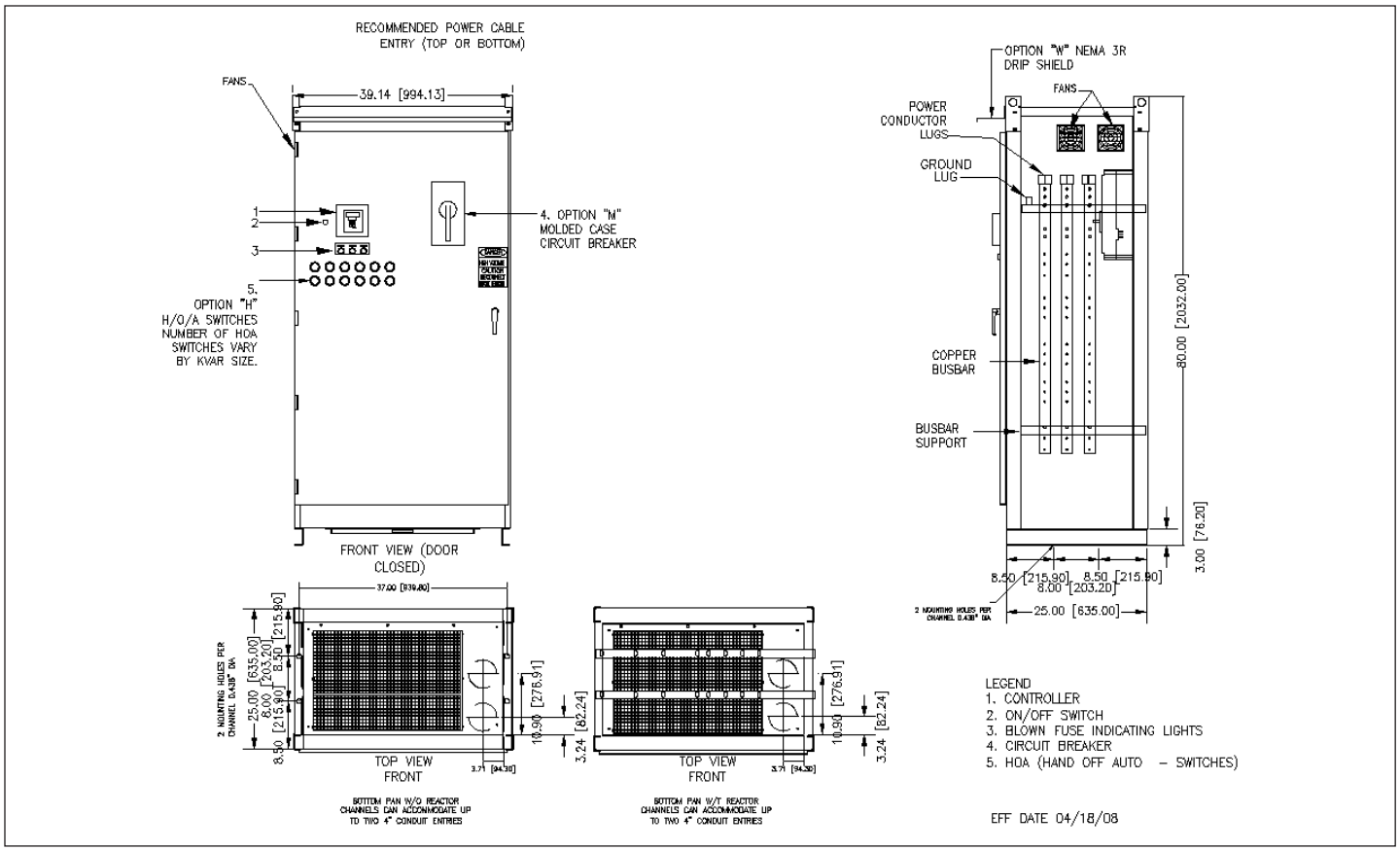


FIGURE 11. AUTOVAR "L" (SINGLE DOOR) ENCLOSURE

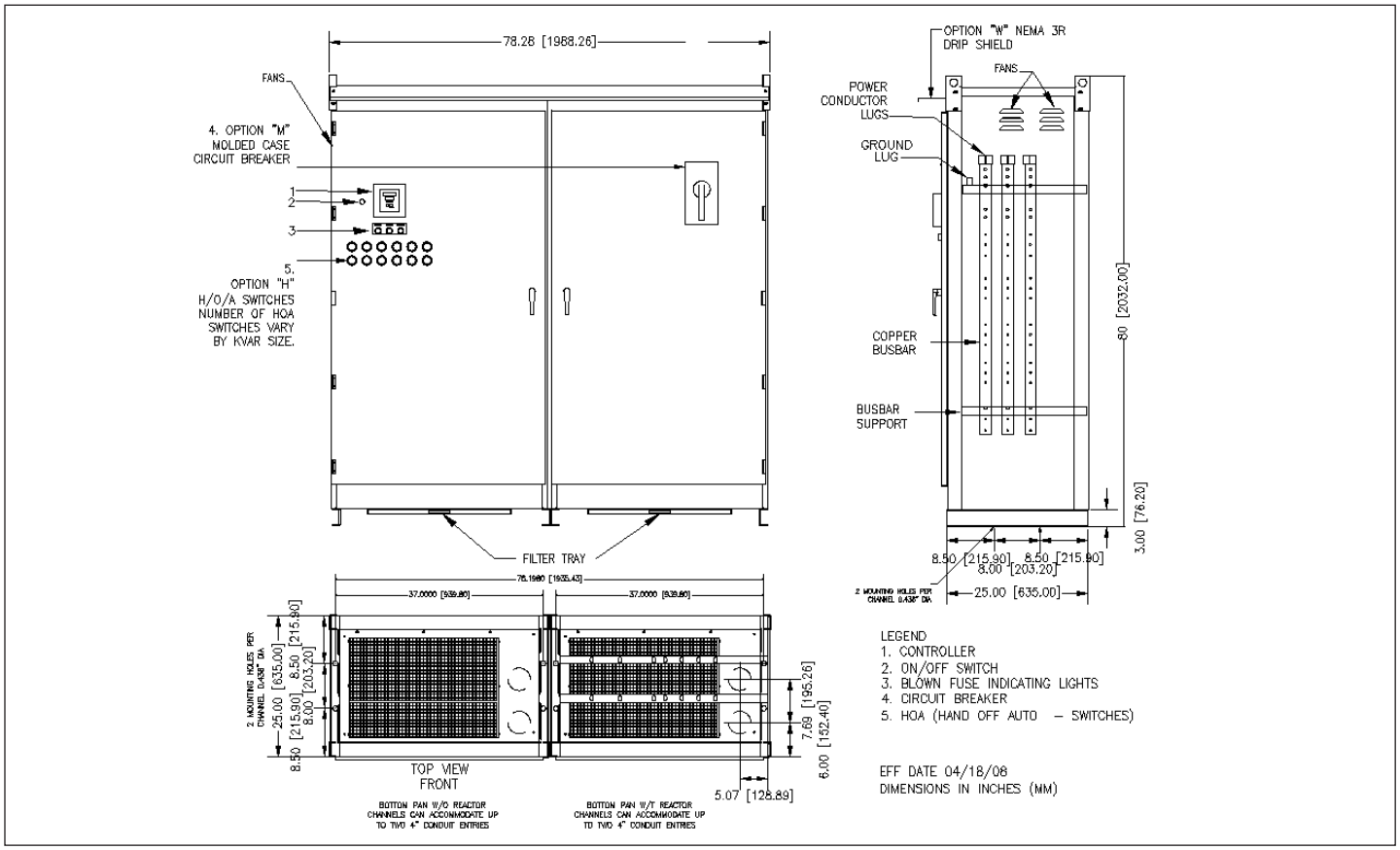


FIGURE 12. AUTOVAR "KK" (1 DOUBLE DOOR) ENCLOSURE

AUTOVAR Filter

AUTOVAR Filter — Interior View

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 capable (RS-485/Modbus) 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.

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 molded 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

TABLE 17. FLOOR-MOUNTED SWITCHED HARMONIC FILTERS — LOW VOLTAGE

KVAR	STEP X KVAR	RATED CURRENT AMPERES	ENCLOSURE SIZE	SHIPPING WEIGHT LBS. (KG)	FUSED CATALOG NUMBER
480 Vac					
150	3 x 50	180	L	1242 (564.6)	**150THFSR431**
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					
150	3 x 50	144	KK or L + L	1242 (564.6)	**150THFSR632**
200	4 x 50	192	KK or L + L	1438 (652.9)	**200THFSR632**
250	5 x 50	241	KK or L + L	1634 (741.8)	**250THFSR632**
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 catalog number to 1. For example, 500THFSR431.
- Other ratings available, please consult factory.
- 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.)
- 240 volt filters available, please consult factory.

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
Molded case circuit breaker (65 kAIC at 480 V)	M
Weatherproofing (NEMA 3R)	W
Communicating Controller (RS-485/Modbus)	C
Metering and Thermostatic Temp Control	L
IQ 250 Solid-State Meter ②	Q

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 factory.

② Not available with weatherproofing option.

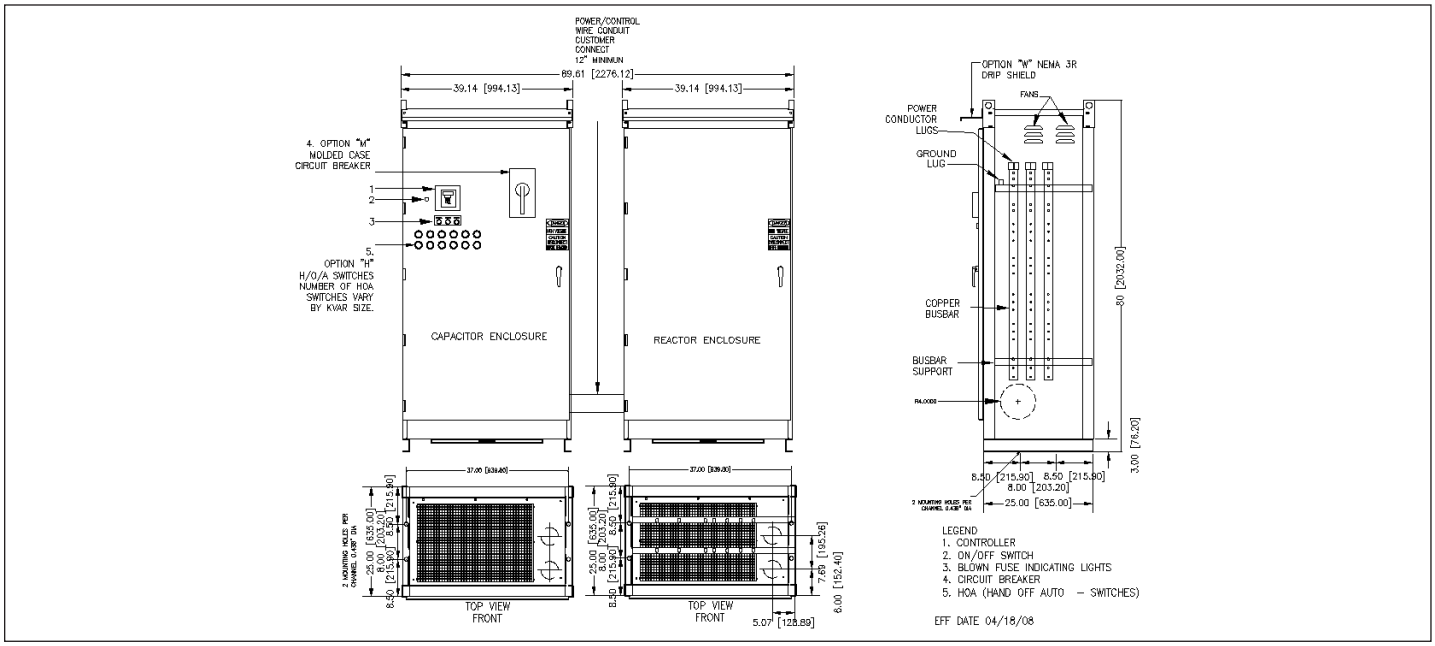


FIGURE 13. AUTOVAR "L + L" (2 SINGLE DOOR) ENCLOSURES

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.
- Base product is three-phase balanced delta connected. For unbalanced single-phase system, please consult factory.

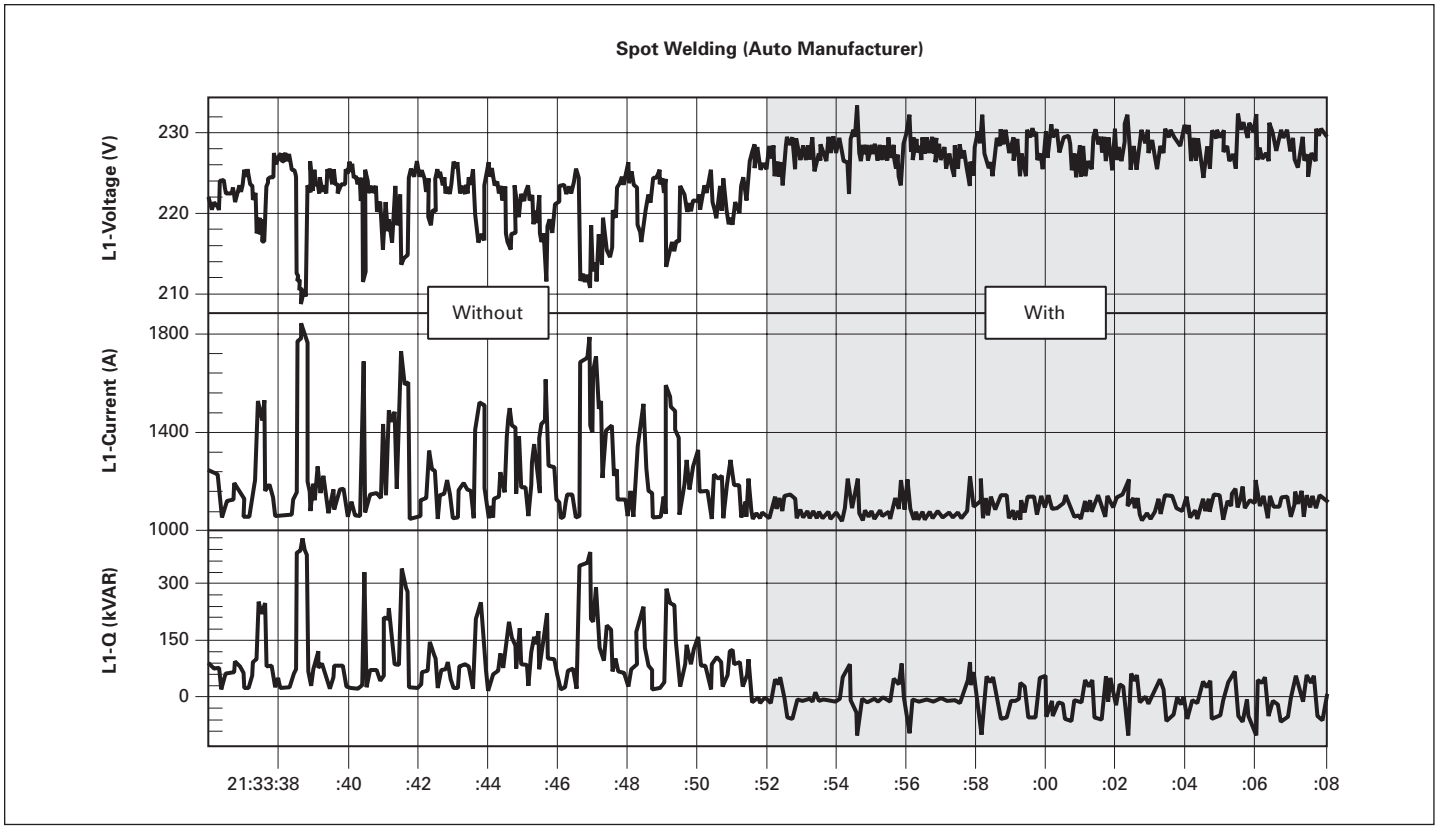


FIGURE 14. APPLICATION EXAMPLE — SPOT WELDING

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.

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

TABLE 19. REAL-TIME TRANSIENT-FREE SYSTEMS — 480 VAC

OUTPUT KVAR	OUTPUT PER STEP (KVAR)	DIMENSIONS W X D X H	CATALOG NUMBER	RECOMMENDED INTEGRAL BREAKER OPTION AVAILABLE (AMPERES)
Compensate Rapid Loads Within One Cycle (Typically 5 – 20 ms) — Standard 7% Inductors — Detuned to 227 Hz (3.78th Harmonic)				
156	31	31.5 x 23.6 x 82.7	**FTE15652480**	400
187	37.5	31.5 x 23.6 x 82.7	**FTE18752480**	400
219	31	31.5 x 23.6 x 82.7	**FTE21974480**	400
250	50	31.5 x 23.6 x 82.7	**FTE25052480**	600
262	37.5	31.5 x 23.6 x 82.7	**FTE26274480**	600
312	62.5	31.5 x 23.6 x 82.7	**FTE31252480**	600
375	75	31.5 x 23.6 x 82.7	**FTE37552480**	800
437	62.5	31.5 x 23.6 x 82.7	**FTE43774480**	800
450	150	31.5 x 23.6 x 82.7	**FTE45031480**	800
600	100	63.0 x 23.6 x 82.7	**FTE60661480**	1200
687	62.5	63.0 x 23.6 x 82.7	**FTE687112480**	1200
750	125	63.0 x 23.6 x 82.7	**FTE75061480**	1600
825	75	63.0 x 23.6 x 82.7	**FTE825112480**	1600
900	150	63.0 x 23.6 x 82.7	**FTE90061480**	1600
1125	125	94.5 x 23.6 x 82.7	**FTE112591480**	2000
1350	150	94.5 x 23.6 x 82.7	**FTE135091480**	2500
1500	125	126.0 x 23.6 x 82.7	**FTE1500121480**	2500
1800	150	126.0 x 23.6 x 82.7	**FTE1800121480**	3200
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	**FTE15652480T**	400
187	37.5	31.5 x 23.6 x 82.7	**FTE18752480T**	400
219	31	31.5 x 23.6 x 82.7	**FTE21974480T**	400
250	50	31.5 x 23.6 x 82.7	**FTE25052480T**	600
262	37.5	31.5 x 23.6 x 82.7	**FTE26274480T**	600
312	62.5	31.5 x 23.6 x 82.7	**FTE31252480T**	600
375	75	31.5 x 23.6 x 82.7	**FTE37552480T**	800
437	62.5	31.5 x 23.6 x 82.7	**FTE43774480T**	800
450	150	31.5 x 23.6 x 82.7	**FTE45031480T**	800
600	100	63.0 x 23.6 x 82.7	**FTE60661480T**	1200
687	62.5	63.0 x 23.6 x 82.7	**FTE687112480T**	1200
750	125	63.0 x 23.6 x 82.7	**FTE75061480T**	1600
825	75	63.0 x 23.6 x 82.7	**FTE825112480T**	1600
900	150	63.0 x 23.6 x 82.7	**FTE90061480T**	1600
1125	125	94.5 x 23.6 x 82.7	**FTE112591480T**	2000
1350	150	94.5 x 23.6 x 82.7	**FTE135091480T**	2500
1500	125	126.0 x 23.6 x 82.7	**FTE1500121480T**	2500
1800	150	126.0 x 23.6 x 82.7	**FTE1800121480T**	3200

Notes:

- Standard systems have separate individual connections on each phase in individual cabinets.
- Systems with internal phase connections are available — contact Asheville PFC group for pricing.
- Systems with integral breakers/disconnects have internal phase connections between each cabinet.

TABLE 20. FAST TRANSIENT-FREE SWITCHING SYSTEMS — 480 VAC

OUTPUT KVAR	OUTPUT PER STEP (KVAR)	DIMENSIONS W X D X H	CATALOG NUMBER	RECOMMENDED INTEGRAL BREAKER OPTION AVAILABLE (AMPERES)
Compensate Any Load Within 3 – 4 Seconds — Standard 7% Inductors — Detuned to 227 Hz (3.78th Harmonic)				
156	31	31.5 x 23.6 x 82.7	**FTA15652480**	400
187	37.5	31.5 x 23.6 x 82.7	**FTA18752480**	400
219	31	31.5 x 23.6 x 82.7	**FTA21974480**	400
250	50	31.5 x 23.6 x 82.7	**FTA25052480**	600
262	37.5	31.5 x 23.6 x 82.7	**FTA26274480**	600
312	62.5	31.5 x 23.6 x 82.7	**FTA31252480**	600
375	75	31.5 x 23.6 x 82.7	**FTA37552480**	800
437	62.5	31.5 x 23.6 x 82.7	**FTA43774480**	800
450	150	31.5 x 23.6 x 82.7	**FTA45031480**	800
600	100	63.0 x 23.6 x 82.7	**FTA60661480**	1200
687	62.5	63.0 x 23.6 x 82.7	**FTA687112480**	1200
750	125	63.0 x 23.6 x 82.7	**FTA75061480**	1600
825	75	63.0 x 23.6 x 82.7	**FTA825112480**	1600
900	150	63.0 x 23.6 x 82.7	**FTA90061480**	1600
1125	125	94.5 x 23.6 x 82.7	**FTA112591480**	2000
1350	150	94.5 x 23.6 x 82.7	**FTA135091480**	2500
1500	125	126.0 x 23.6 x 82.7	**FTA1500121480**	2500
1800	150	126.0 x 23.6 x 82.7	**FTA1800121480**	3200
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	**FTA15652480T**	400
187	37.5	31.5 x 23.6 x 82.7	**FTA18752480T**	400
219	31	31.5 x 23.6 x 82.7	**FTA21974480T**	400
250	50	31.5 x 23.6 x 82.7	**FTA25052480T**	600
262	37.5	31.5 x 23.6 x 82.7	**FTA26274480T**	600
312	62.5	31.5 x 23.6 x 82.7	**FTA31252480T**	600
375	75	31.5 x 23.6 x 82.7	**FTA37552480T**	800
437	62.5	31.5 x 23.6 x 82.7	**FTA43774480T**	800
450	150	31.5 x 23.6 x 82.7	**FTA45031480T**	800
600	100	63.0 x 23.6 x 82.7	**FTA60661480T**	1200
687	62.5	63.0 x 23.6 x 82.7	**FTA687112480T**	1200
750	125	63.0 x 23.6 x 82.7	**FTA75061480T**	1600
825	75	63.0 x 23.6 x 82.7	**FTA825112480T**	1600
900	150	63.0 x 23.6 x 82.7	**FTA90061480T**	1600
1125	125	94.5 x 23.6 x 82.7	**FTA112591480T**	2000
1350	150	94.5 x 23.6 x 82.7	**FTA135091480T**	2500
1500	125	126.0 x 23.6 x 82.7	**FTA1500121480T**	2500
1800	150	126.0 x 23.6 x 82.7	**FTA1800121480T**	3200

Notes:

- Standard systems have separate individual connections on each phase in individual cabinets.
- Systems with internal phase connections are available — contact Asheville PFC group for pricing.
- 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, HCUs can provide effective harmonic correction for varying load conditions and harmonic spectrums up to their rated capacity. HCUs 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, 8 ms full response time.
- 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 ahead of each non-linear load.
- 2-line, 20 character per line alphanumeric display.

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

Notes:

- Add suffix "S" for HCUs to be applied at 600 V.
- Add suffix "S1" for 600 V applied HCUs to be used for power factor correction only.
- Double the quantity of same ratio CTs are required for 600 V HCUs.
- NEMA 12 enclosure option available upon request. Change part number to HCUXXXXXN12. All NEMA 12 HCUs are housed in an air-conditioned floor standing enclosure and include a mains disconnect.
- Consult factory for additional information.

TABLE 22. CURRENT TRANSFORMER RATINGS — DIMENSIONS IN INCHES (MM)

MODEL	RATIO	TYPE	INTERNAL DIAMETER IN INCHES (MM)
CT1000SC	1000/5	Split	4.65 (118.1)
CT3000SC	3000/5	Split	6.50 (165.1)
CT5000SC	5000/5	Split	7.50 (190.5)

Notes:

- 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 factory.
- Startup and Commissioning by factory trained personnel is required for proper operation and warranty of this system.
- Additional CTs required for parallel operation of HCUs.
- Consult factory for additional information.

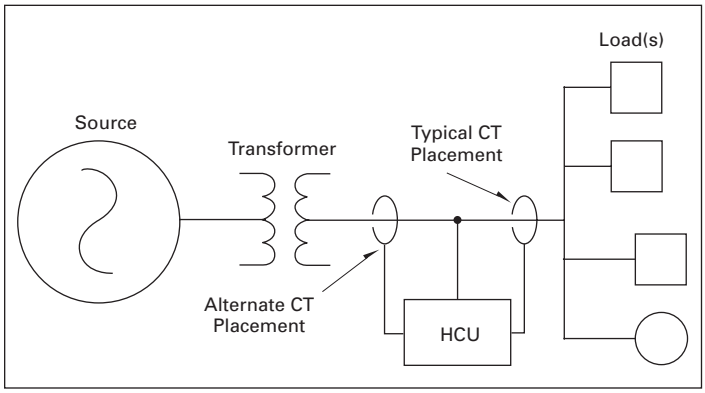


FIGURE 15. INSTALLATION DIAGRAM

TABLE 23. TRANSFORMER 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)

Note:

Double the quantity of same ratio CTs are required for 600 V HCUs.

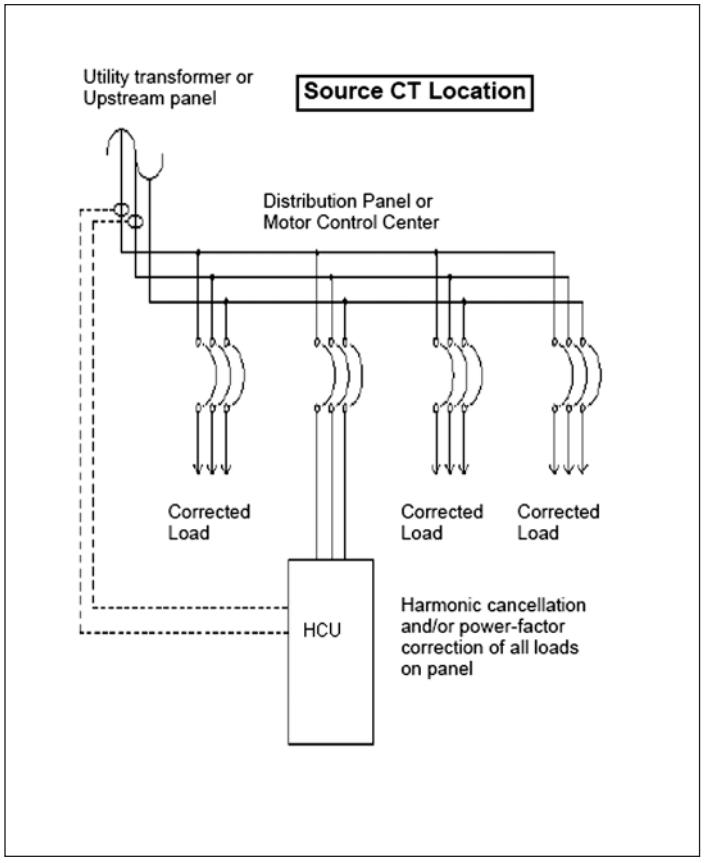


FIGURE 16. SOURCE CT LOCATION

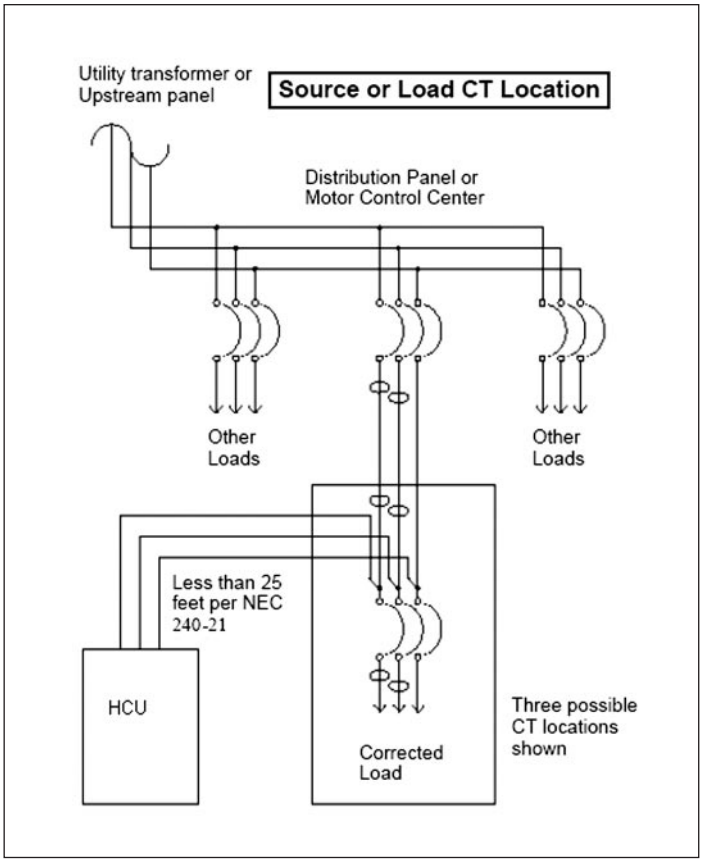


FIGURE 18. SOURCE OR LOAD CT LOCATION

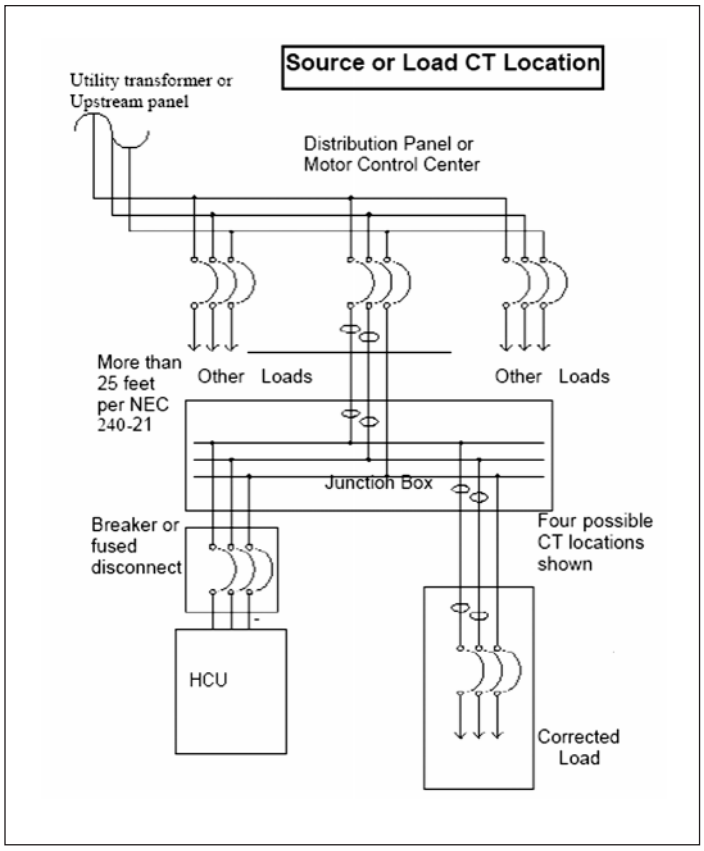


FIGURE 17. SOURCE OR LOAD CT LOCATION

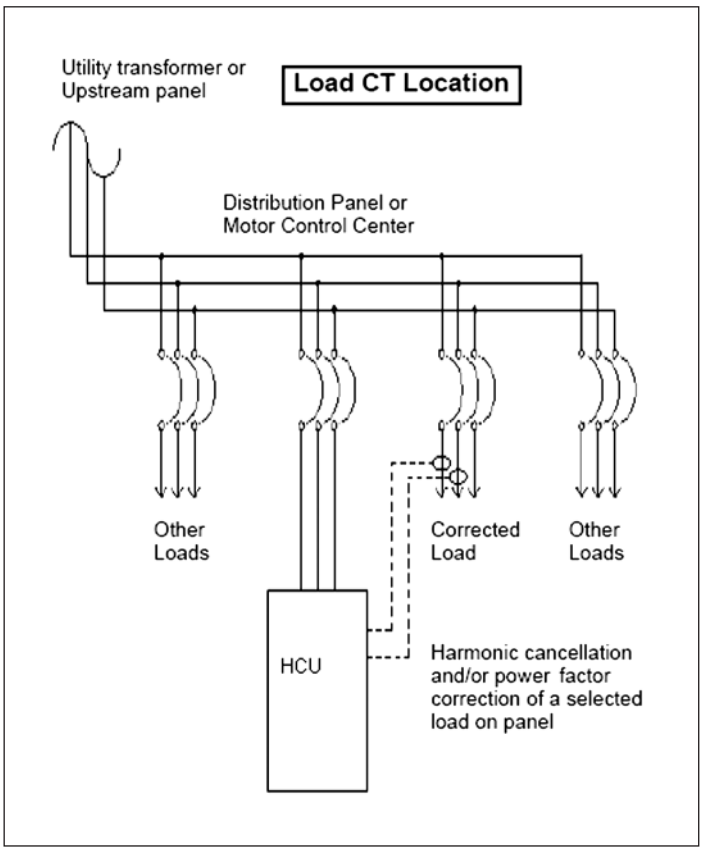


FIGURE 19. LOAD CT LOCATION

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.

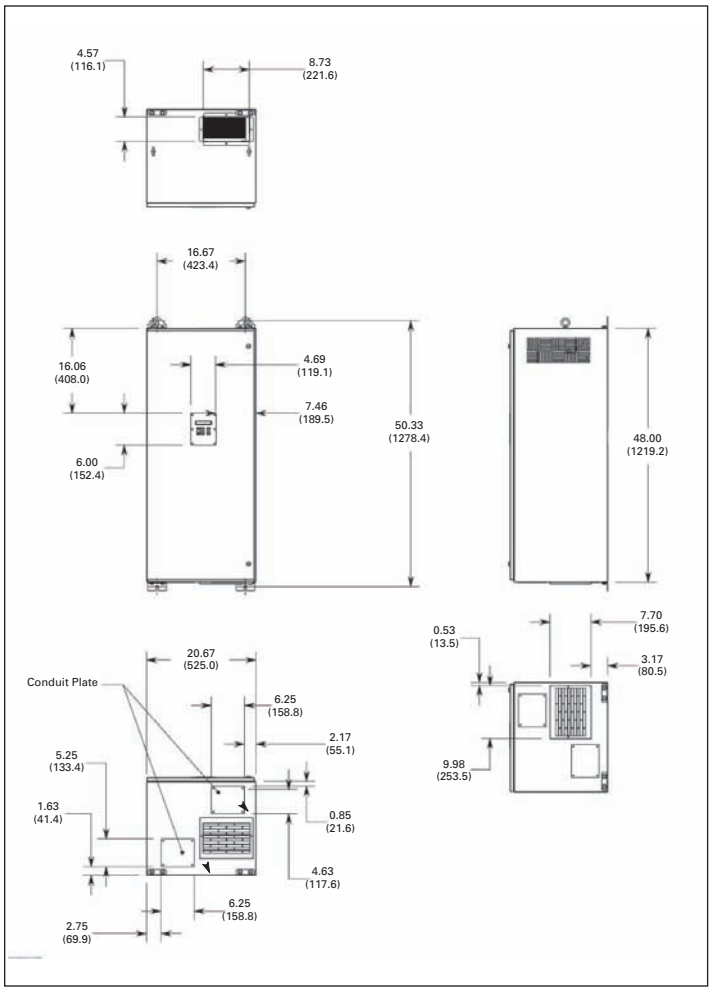


FIGURE 20. HCU050 — 50 AMPERES — DIMENSIONS IN INCHES (MM)

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 conduit entry.

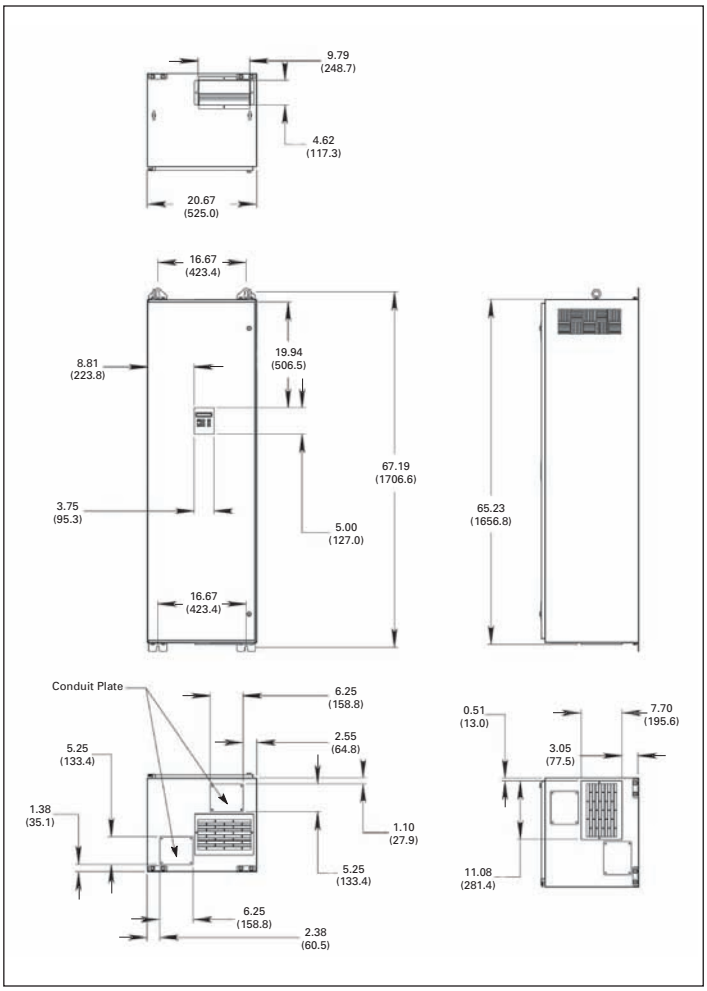


FIGURE 21. HCU100 — 100 AMPERES — DIMENSIONS IN INCHES (MM)

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.

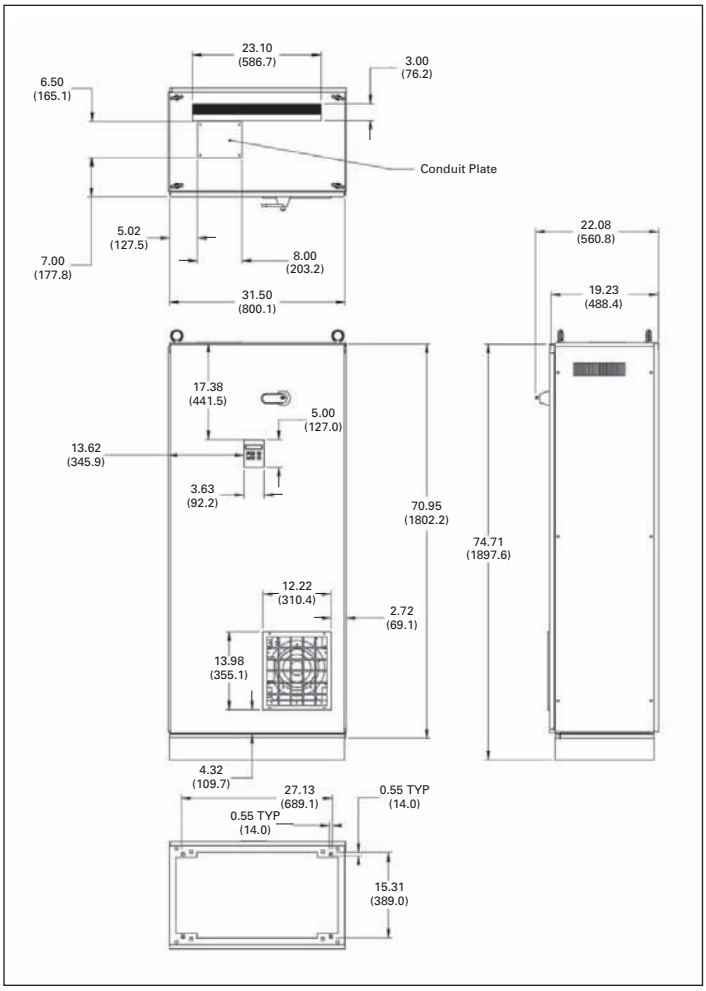


FIGURE 22. HCU300 — 300 AMPERES — DIMENSIONS IN INCHES (MM)

Notes

Notes

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