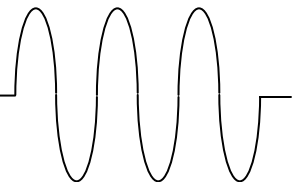


SINGLE PHASE MATRIX FILTER

SERIES A

240 - 480 Volts

USER MANUAL



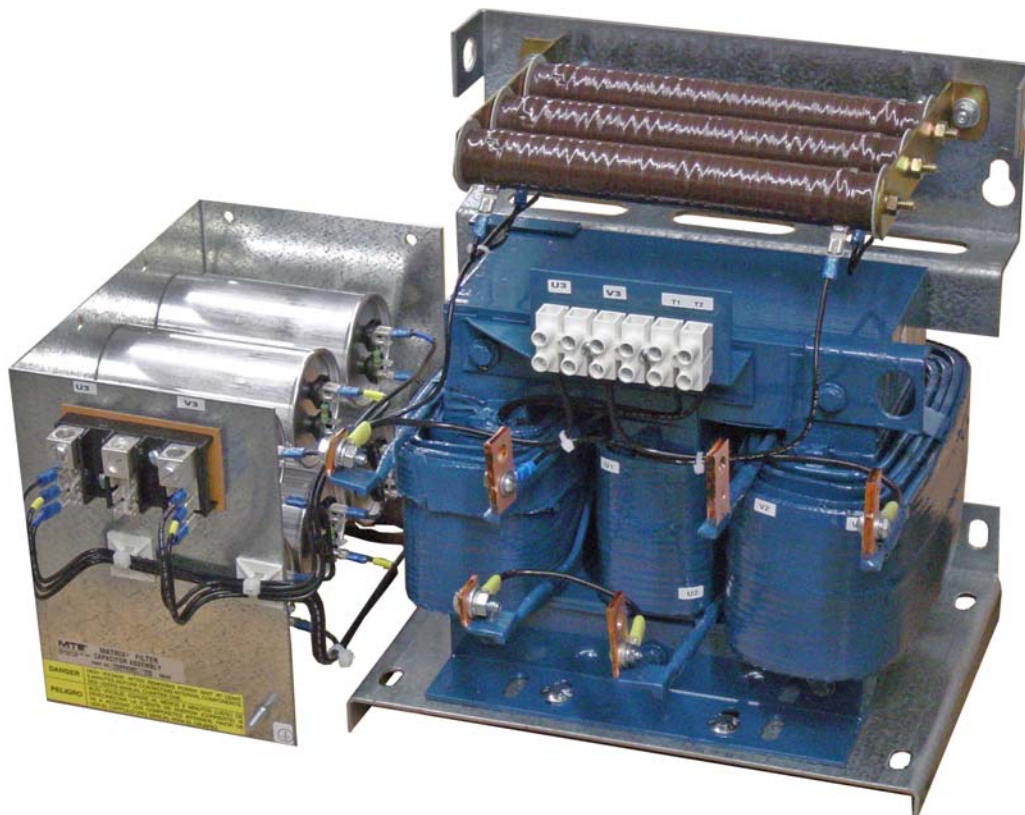
MTE Single Phase Matrix Filter

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IMPORTANT USER INFORMATION

NOTICE

The MTE Corporation Single Phase Matrix Filter is designed for harmonic mitigation of the 3rd, 5th, etc. produced by inverter drives supplying variable torque loads in a wide variety of applications. The suitability of this filter for a specific application must therefore be determined by the customer. In no event will MTE Corporation assume responsibility or liability for any direct or consequential damages resulting from the use or application of this filter. Nor will MTE Corporation assume patent liability with respect to the use of information, circuits or equipment described in this instruction manual.



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IMPORTANT SAFETY INFORMATION

WARNING

ONLY A QUALIFIED ELECTRICIAN CAN CARRY OUT THE ELECTRICAL INSTALLATION OF THIS FILTER

WARNING

High voltage is used in the operation of this filter. Use Extreme caution to avoid contact with high voltage when operating, installing or repairing this filter. **INJURY OR DEATH MAY RESULT IF SAFETY PRECAUTIONS ARE NOT OBSERVED.**

After removing power, allow at least five minutes to elapse and verify that the capacitors have discharged to a safe level before contacting internal components. Connect a DC voltmeter across the capacitor terminals. Start with the meter on the highest scale and progressively switch to a lower scale as the indicated voltage falls below the maximum value of the scale used.

WARNING

The opening of the branch circuit protective device may be an indication that a fault current has been interrupted. To reduce the risk of fire or electrical shock, current-carrying parts and other components of the filter should be examined and replaced if damaged.

WARNING

An upstream disconnect/protection device must be used as required by the National Electrical Code (NEC) or governing authority.

WARNING

Even if the upstream disconnect/protection device is open, the drive down stream of the filter may feed back high voltage to the filter. The drive safety instructions must be followed. **INJURY OR DEATH MAY RESULT IF THE DRIVE SAFETY PRECAUTIONS ARE NOT OBSERVED.**

WARNING

The filter must be grounded with a grounding conductor connected to all grounding terminals.

WARNING

Only spare parts obtained from MTE Corporation or an authorized MTE distributor can be used.

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INTRODUCTION

This manual was specifically developed to assist in the installation, interconnection and operation of the MTE Corporation single phase Matrix Filter.

This manual is intended for use by personnel experienced in the operation and maintenance of electronic drives. Because of the high voltages required by the filter and drive and the potential dangers presented by rotating machinery, it is essential that all personnel involved in the operation and maintenance of this filter know and practice the necessary safety precautions for this type of equipment. Personnel should read and understand the instructions contained in this manual before installing, operating or servicing the filter and the drive to which the filter is connected.

Upon Receipt of this Filter:

The MTE Single Phase Matrix Filter has been subjected to demanding factory tests before shipment. Carefully inspect the shipping container for damage that may have occurred in transit. Then unpack the filter and carefully inspect for any signs of damage. Save the shipping container for future transport of the filter.

In the event of damage, please contact and file a claim with the freight carrier involved immediately.

If the equipment is not going to be put into service upon receipt, cover and store the filter in a clean, dry location. After storage, ensure that the equipment is dry and that no condensation has accumulated on the internal components of the filter before applying power.

Repair/Exchange Procedure

MTE Corporation requires a Returned Material Authorization Number before it can accept any filters that qualify for return or repair. If problems or questions arise during installation, setup, or operation of the filter, please call the inside sales manager for assistance at:

Phone: 262-946-2800

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Product Specifications

Service Conditions

Load: 4 pulse variable torque rectifier and capacitor bus.

Input voltage: Nominal voltage VAC +/- 10%, 1 Phase

Maximum harmonic background voltage distortion: 1%

Frequency: Nominal Frequency + /- 0.75 Hz

Maximum source impedance: 6.00%

Minimum source impedance: 1.5%

Service Factor: 1.00

Ambient Temperature (Operating)

Enclosed Filters: -40 to +40 degrees C

Open Panel Filters: -40 to +50 degrees C

Storage Temperature: -40 to +90 degrees C

Altitude: 0 to 3300 Feet above sea level without de-rating

Relative Humidity: 0 to 95% non-condensing

Agency Approvals

UL and cUL listed to UL508 Type MX and CSA-C22.2 No 14-95
File E180243 (3 – 50) HP 480 VAC 60 Hz

Note: Short circuit ratings not required under exception No.1 of UL508A SB4.2.1 effective 4/25/06

Performance

Total Harmonic Current Distortion:

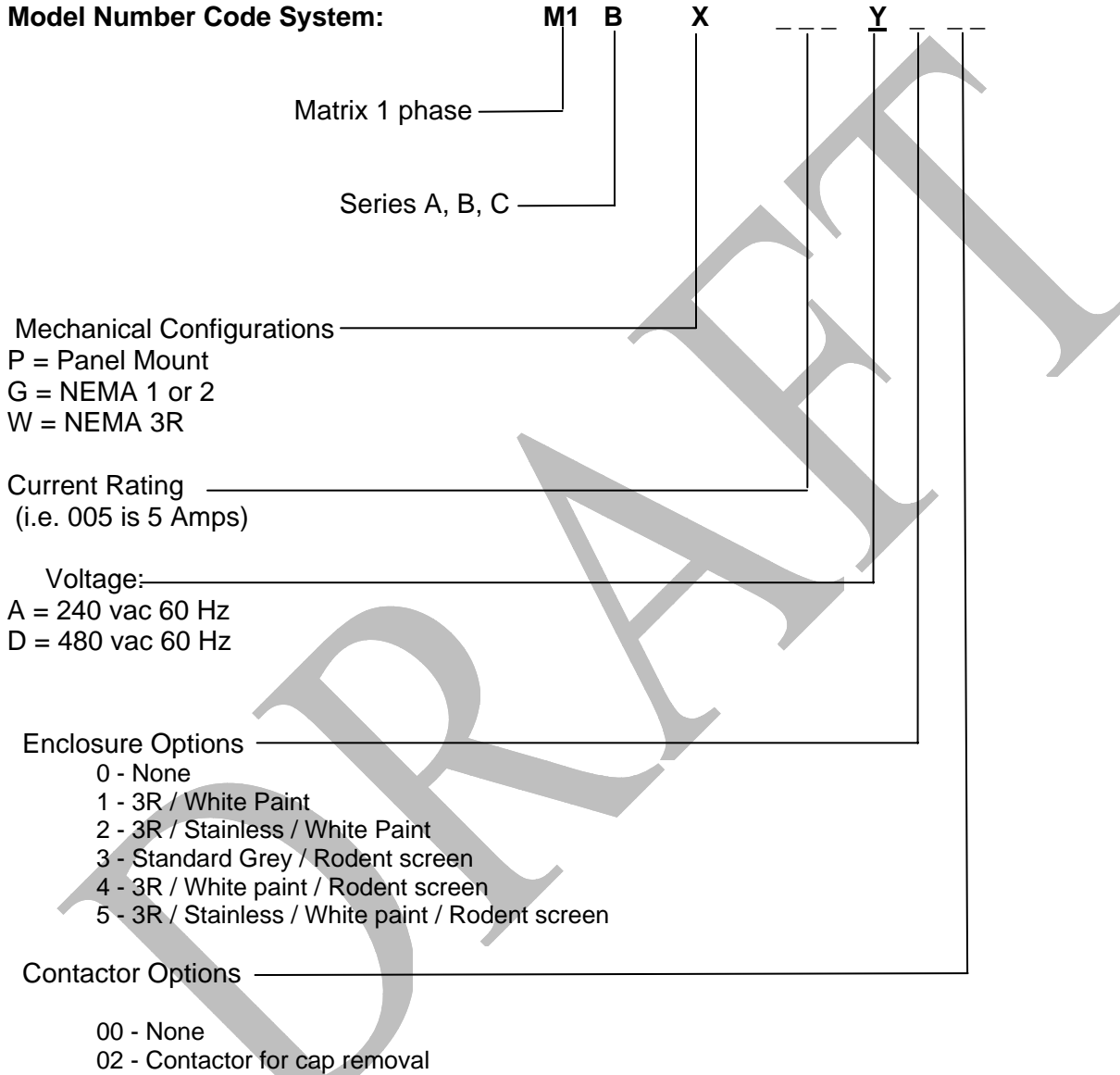
M1B to M1C product: 12% typical at full load guaranteed

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Model Code Part Number Configuration

Model Number Code System:



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PERFORMANCE

Chart 1

Harmonic Spectrum

12% Single Phase Matrix Filter
Harmonic Spectrum for 100% Load

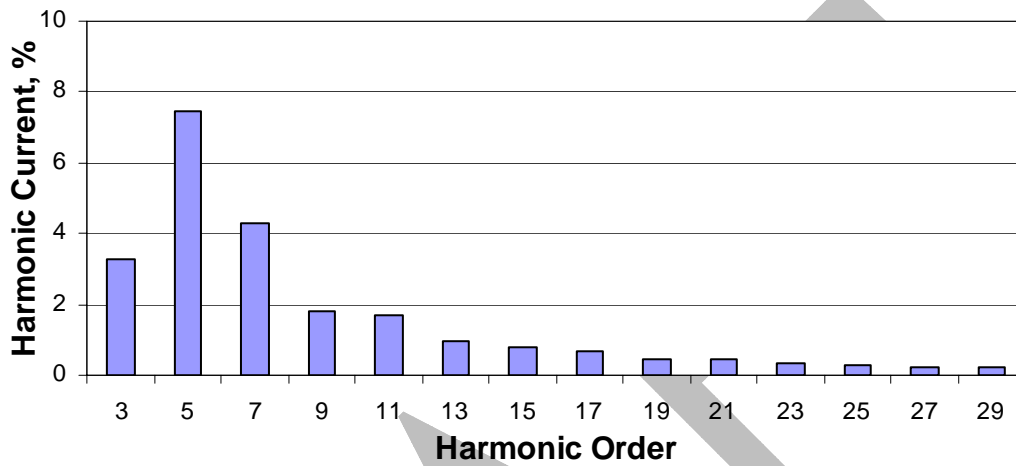
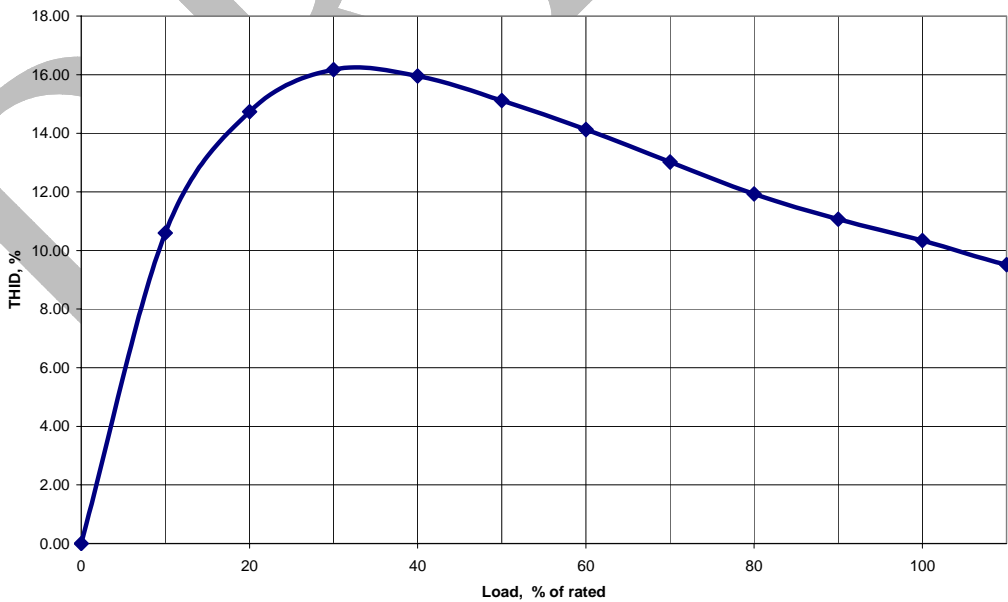


Chart 2

Load THID Performance

12% Single Phase Matrix Filter
Typical THID vs. Load



MTE Single Phase Matrix Filter

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Chart 3 Power Factor

12% Single Phase Matrix Filter
Power Factor vs. Load

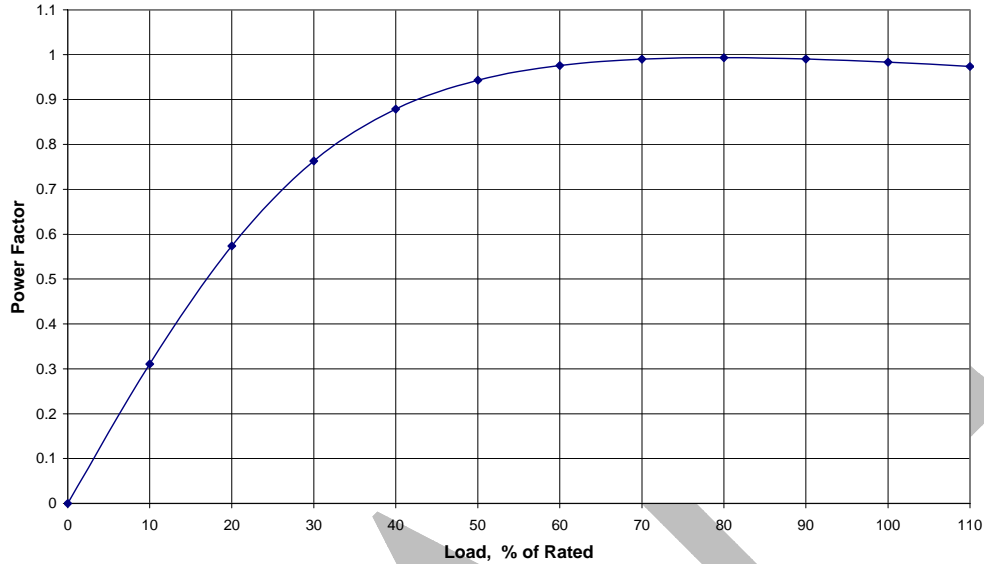
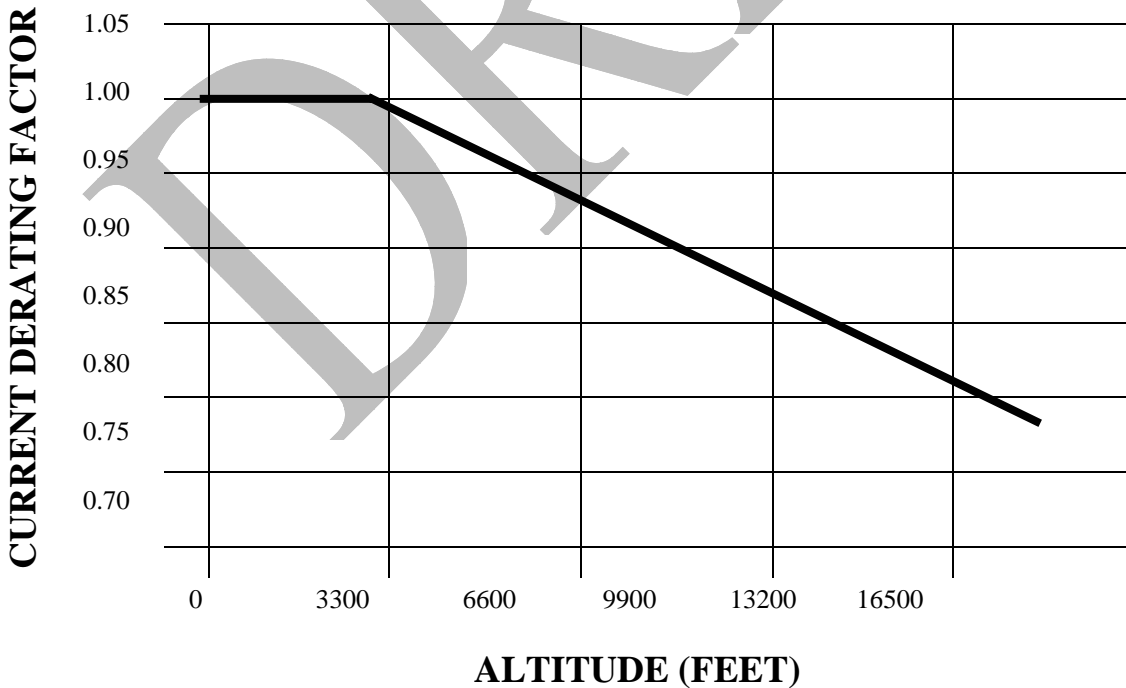


Chart 4 Altitude Derating Curve



MTE Single Phase Matrix Filter

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Technical Data, Electrical

240 Volt 60 Hertz

Table 1

Electrical Data						
Filter Current Rating	Open Cat. No.	NEMA-1 Cat. No.	NEMA-3R Cat. No.	Typical Dissipation Watts	Capacitor current AMPS	Cappanel interconnect Wire 75°AWG
4	M1BP004A	M1BG004A	M1BW004A	81	2.2	14
6	M1BP006A	M1BG006A	M1BW006A	91	3.3	14
8	M1BP008A	M1BG008A	M1BW008A	102	4.4	14
11	M1BP011A	M1BG011A	M1BW011A	117	6.1	14
13	M1BP013A	M1BG013A	M1BW013A	128	7.2	14
16	M1BP016A	M1BG016A	M1BW016A	143	8.9	14
25	M1BP025A	M1BG025A	M1BW025A	190	13.9	14
36	M1CP036A	M1CG036A	M1CW036A	265	20	14
45	M1CP045A	M1CG045A	M1CW045A	327	25	14
70	M1CP070A	M1CG070A	M1CW070A	537	38	10
90	M1CP090A	M1CG090A	M1CW090A	623	50	8
110	M1CP110A	M1CG110A	M1CW110A	654	61.1	8
130	M1CP130A	M1CG130A	M1CW130A	736	72.3	6
182	M1CP182A	M1CG182A	M1CW182A	1006	101.2	4
220	M1CP220A	M1CG220A	M1CW220A	1204	122.3	4

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Technical Data, Electrical 480 Volt 60 Hertz Table 4

Electrical Data						
Filter Current Rating	Open Cat. No.	NEMA-1 Cat. No.	NEMA-3R Cat. No.	Typical Dissipation Watts	Capacitor current AMPS	Cappanel interconnect Wire 75°AWG
2	M1BP002D	M1BG002D	M1BW002D	79	1.1	14
3	M1BP003D	M1BG003D	M1BW003D	89	1.7	14
4	M1BP003D	M1BG003D	M1BW003D	99	2.2	14
5	M1BP005D	M1BG005D	M1BW005D	109	2.8	14
6	M1BP005D	M1BG005D	M1BW005D	119	3.3	14
8	M1BP008D	M1BG008D	M1BW008D	139	4.4	14
13	M1BP013D	M1BG013D	M1BW013D	189	7.2	14
18	M1BP018D	M1BG018D	M1BW018D	240	10	14
23	M1BP023D	M1BG023D	M1BW023D	290	12.8	14
34	M1CP034D	M1CG034D	M1CW034D	392	18.9	14
44	M1CP044D	M1CG044D	M1CW044D	604	24.5	14
55	M1CP055D	M1CG055D	M1CW055D	663	30.6	10
66	M1CP066D	M1CG066D	M1CW066D	708	36.7	10
91	M1CP091D	M1CG091D	M1CW091D	991	50.6	8
110	M1CP110D	M1CG110D	M1CW110D	1078	61.2	8

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INSTALLATION INSTRUCTIONS

Filter Installation

Matrix Filters are supplied in the following mechanical configurations:

Panel mounted assemblies

Floor mounted general purpose NEMA 1, 2, & 3R cabinets

Panel mounted filters are designed for mounting in the vertical plane in the customer's enclosure. Include the power dissipation of the filter along with all the other components located in the panel to determine the internal temperature rise and cooling requirements of the enclosure. Allow a minimum side clearance of four (4) inches and a vertical clearance of six (6) inches for proper heat dissipation and access. Figure 5 through Figure 8 contain outline drawings for the various ratings and show proper mounting orientation.

Select a well ventilated, dust-free area away from direct sunlight, rain or moisture. Do not install in or near a corrosive environment. Avoid locations where the filter would be subjected to excessive vibrations.

General purpose NEMA 1, 2, and 3R enclosed filters are designed for floor mounting in the vertical plane in an environment suitable for the enclosure type.

Do not install in or near a corrosive environment. Avoid locations where the filter would be subjected to excessive vibrations. Allow a minimum side and back clearance of eight (8) inches and front clearance of thirty-six (36) inches for proper heat dissipation and access.

Industrial style NEMA 1 enclosed filters are designed for wall and floor mounting in the vertical plane. Do not install in or near a corrosive environment. Avoid locations where the filter would be subjected to excessive vibrations. For wall mounted enclosures allow a minimum side clearance of eight (8) inches and front clearance of forty-eight (48) inches for proper heat dissipation and access. For floor mounted enclosures allow a minimum side and back clearance of eight (8) inches and front clearance of forty-eight (48) inches for proper heat dissipation and access. will direct you to the appropriate outline drawings shown in Figure 5 & 6.

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Open Style Components Mechanical Data

240 Volts 60 Hertz

Table 5

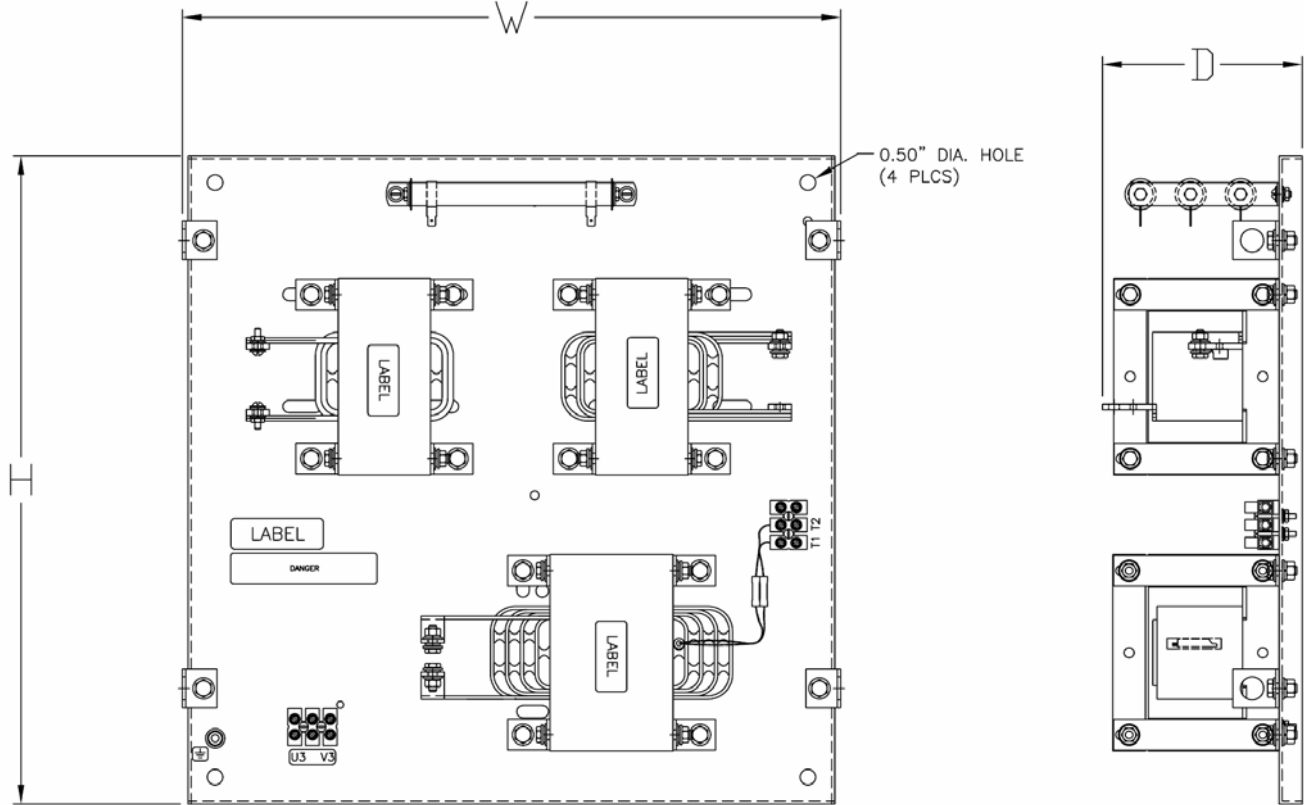
Rating	Cat. PN	Weight	Reactor Size	Fig.	Cap Panel	Cap panel Size	Cap panel Weight	Fig.
4	M1BP004A	13	9.2"H x6"W x 5.8"D	1	121	5.4"H x 5.6"W x 5.6"D	2.5	4
6	M1BP006A	14	9.2"H x6"W x 6.1"D	1	122	5.4"H x 5.6"W x 5.6"D	2.5	4
8	M1BP008A	15	9.2"H x6"W x 6.4"D	1	123	5.4"H x 5.6"W x 5.6"D	2.5	4
11	M1BP011A	19	10.1"H x 7.3"W x 5.8"D	2	124	5.4"H x 5.6"W x 5.6"D	2.5	4
13	M1BP013A	20	10.1"H x 7.3"W x 6.3"D	2	125	5.4"H x 5.6"W x 5.6"D	2.5	4
16	M1BP016A	21	10.1"H x 7.3"W x 6.3"D	2	126	5.4"H x 5.6"W x 5.6"D	2.5	4
25	M1BP025A	43	12.8"H x 7.5"W x 6.8"D	3	127	5.4"H x 5.6"W x 5.6"D	2.5	4
36	M1CP036A	70	17.8"H x 17"W x 5.3"D	A	128	5.4"H x 5.6"W x 5.6"D	2.5	4
45	M1CP045A	79	17.8"H x 17"W x 5.3"D	A	129	5.4"H x 5.6"W x 5.6"D	2.5	4
70	M1CP070A	95	17.8"H x 17"W x 5.3"D	A	130	5.4"H x 5.6"W x 5.6"D	5.0	4
90	M1CP090A	106	21"H x 22"W x 6.8"D	A	131	8"H x 7.3"W x 11"D	5.0	5
110	M1CP110A	125	21"H x 22"W x -6.8"D	A	132	8"H x 7.3"W x 11"D	7.5	5
130	M1CP130A	151	21"H x 22"W x -6.8"D	A	133	8"H x 7.3"W x 11"D	7.5	5
182	M1CP182A	212	3 reactor LR panel contact factory for sizes	NA	131	8"H x 7.3"W x 11"D	10.0	5
220	M1CP220A	250	3 reactor LR panel contact factory for sizes	NA	132	8"H x 7.3"W x 11"D	12.5	5

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Magnetic panel layout

Figure A



DK

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Open Style Components Mechanical Data

480 Volts 60 Hertz

Table 6

Rating	Cat. PN	Weight	Reactor Size	Fig.	Cap Panel	Cap panel Size	Cap panel Weight	Fig.
2	M1BP002D	13	12.9"H x 7.5"W x 7.6"D	1	111	5.6"H x 5.6"W x 7.3"D	2.5	4
3	M1BP003D	14	12.9"H x 7.5"W x 8"D	1	112	5.6"H x 5.6"W x 7.3"D	2.5	4
4	M1BP004D	15	12.9"H x 7.5"W x 8.3"D	1	108	5.6"H x 5.6"W x 7.3"D	2.5	4
5	M1BP005D	19	10.1"H x 7.3"W x 5.8"D	2	113	5.6"H x 5.6"W x 7.3"D	2.5	4
6	M1BP006D	20	10.1"H x 7.3"W x 6"D	2	114	5.6"H x 5.6"W x 7.3"D	2.5	4
8	M1BP008D	21	10.1"H x 7.3"W x 6.3"D	2	105	5.6"H x 5.6"W x 7.3"D	2.5	4
13	M1BP013D	43	12.8"H x 7.5"W x 6.8"D	3	110	5.6"H x 5.6"W x 8.2"D	2.5	4
18	M1BP018D	53	12.8"H x 7.5"W x 7.8"D	3	115	5.6"H x 5.6"W x 8.2"D	2.5	4
23	M1BP023D	56	12.8"H x 7.5"W x 8.3"D	3	106	5.6"H x 5.6"W x 8.2"D	2.5	4
34	M1CP034D	89	19.3"H x 21"W x 6.8"D	A	104	8"H x 7.3"W x 12"D	5.0	5
44	M1CP044D	120	19.3"H x 21"W x 6.8"D	A	116	8"H x 7.3"W x 12"D	5.0	5
55	M1CP055D	150	19.3"H x 21"W x 6.8"D	A	117	12"H x 7.3"W x 12"D	7.5	6
66	M1CP066D	179	21"H x 21"W x 6.8"D	A	103	12"H x 7.3"W x 12"D	7.5	6
91	M1CP091D	190	21"H x 21"W x 7.5"D	A	118	15"H x 7.3"W x 12"D	10.0	7
110	M1CP110D	210	3 reactor LR panel contact factory for sizes	NA	109	15"H x 7.3"W x 12"D	12.5	8

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Enclosed Unit Data

240 Volts 60 Hertz

Table 7

Filter Amps	NEMA 1	Enclosure	Weight	NEMA 3R	Enclosure	Weight	Figure
4	M1BG004A	CAB-12C2	59	M1BW004A	CAB-12C3	81	Figure 9
6	M1BG006A	CAB-12C2	59	M1BW006A	CAB-12C3	82	Figure 9
8	M1BG008A	CAB-12C2	59	M1BW008A	CAB-12C3	83	Figure 9
11	M1BG011A	CAB-12C2	60	M1BW011A	CAB-12C3	87	Figure 9
13	M1BG013A	CAB-12C2	60	M1BW013A	CAB-12C3	88	Figure 9
16	M1BG016A	CAB-12C2	60	M1BW016A	CAB-12C3	89	Figure 9
25	M1BG025A	CAB-17C2	84	M1BW025A	CAB-17C3	139	Figure 10
36	M1CG036A	CAB-17C2	84	M1CW036A	CAB-17C3	149	Figure 10
45	M1CG045A	CAB-17C2	84	M1CW045A	CAB-17C3	152	Figure 10
70	M1CG070A	CAB-20C2	96	M1CW070A	CAB-20C3	185	Figure 10
90	M1CG090A	CAB-20C2	96	M1CW090A	CAB-20C3	272	Figure 11
110	M1CG110A	CAB-20C2	96	M1CW110A	CAB-20C3	302	Figure 11
130	M1CG130A	CAB-20C2	96	M1CW130A	CAB-20C3	331	Figure 11
182	M1CG182A	CAB-26C2	160	M1CW182A	CAB-26C3	370	Figure 12
220	M1CG220A	CAB-26C2	160	M1CW220A	CAB-26D3	390	Figure 12

Note: Weight is shown in US pounds

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Enclosed Unit Data
480 Volts 60 Hertz
Table 8

Filter Amps	NEMA 1	Enclosure	Weight	NEMA 3R	Enclosure	Weight	Figure
2	M1BG002D	CAB-12C2	71	M1BW002D	CAB-12C3	81	Figure 9
3	M1BG003D	CAB-12C2	72	M1BW003D	CAB-12C3	82	Figure 9
4	M1BG004D	CAB-12C2	73	M1BW004D	CAB-12C3	83	Figure 9
5	M1BG005D	CAB-12C2	77	M1BW005D	CAB-12C3	87	Figure 9
6	M1BG006D	CAB-12C2	78	M1BW006D	CAB-12C3	88	Figure 9
8	M1BG008D	CAB-12C2	79	M1BW008D	CAB-12C3	89	Figure 9
13	M1BG013D	CAB-17C2	127	M1BW013D	CAB-17C3	139	Figure 10
18	M1BG018D	CAB-17C2	137	M1BW018D	CAB-17C3	149	Figure 10
23	M1CG023D	CAB-17C2	140	M1CW023D	CAB-17C3	152	Figure 10
34	M1CG034D	CAB-17C2	173	M1CW034D	CAB-17C3	185	Figure 10
44	M1CG044D	CAB-20C2	260	M1CW044D	CAB-20C3	272	Figure 11
55	M1CG055D	CAB-20C2	290	M1CW055D	CAB-20C3	302	Figure 11
66	M1CG066D	CAB-20C2	319	M1CW066D	CAB-20C3	331	Figure 11
91	M1CG091D	CAB-26C2	350	M1CW091D	CAB-26C3	370	Figure 12
110	M1CG110D	CAB-26C2	370	M1CW110D	CAB-26C3	390	Figure 12
155	M1CG155D	CAB-26D2	459	M1CW155D	CAB-26D3	486	Figure 13

Note: Weight is shown in US pounds

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HMR ASSEMBLIES

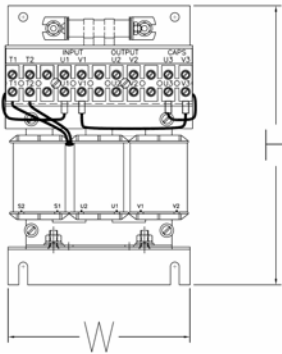


Figure 1 2 to 4 Amp

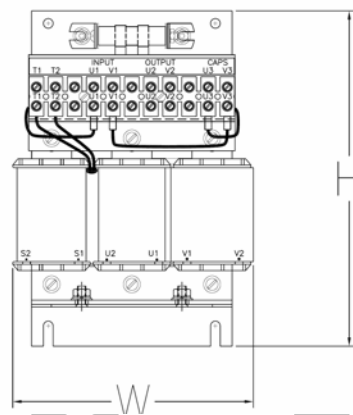
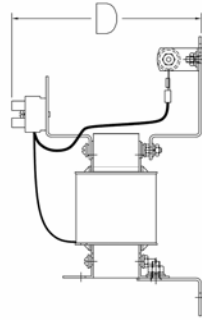


Figure 2 5 to 8 Amp

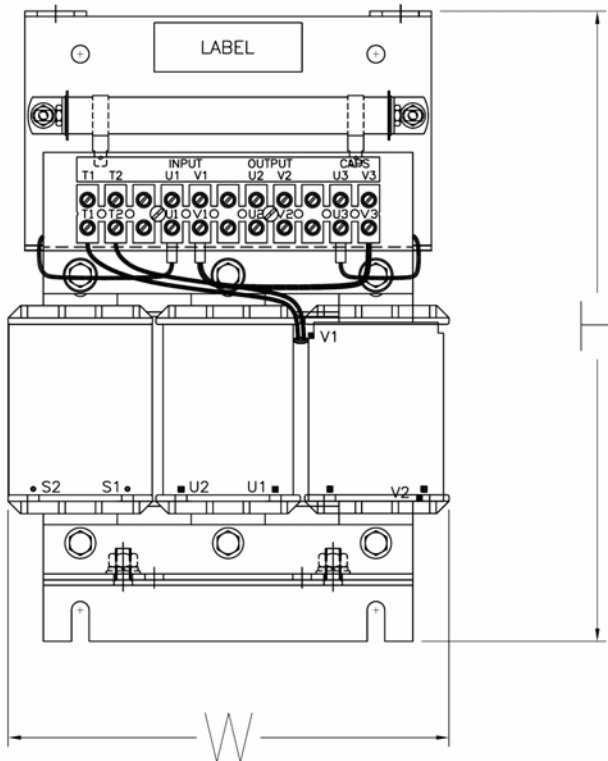
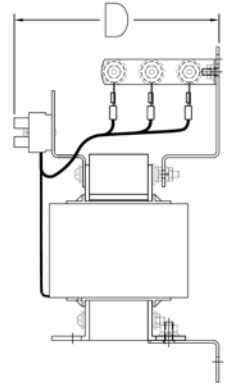
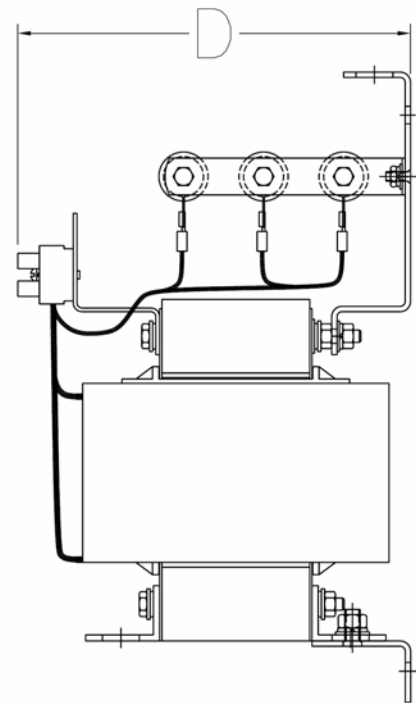


Figure 3 13 to 23 Amp



MTE Single Phase Matrix Filter

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CAPACITOR ASSEMBLIES

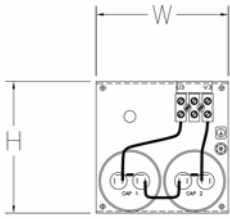


Figure 4 2 Cap panel

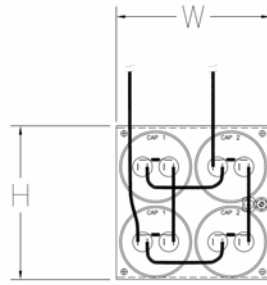
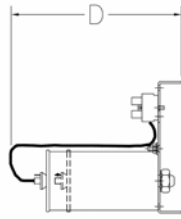


Figure 5 4 Cap panel

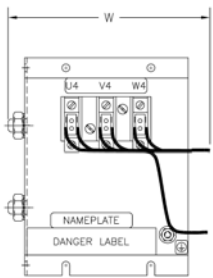
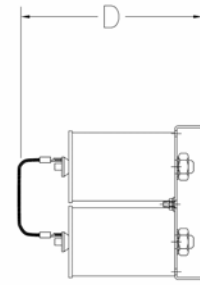


Figure 6 6 Cap panel

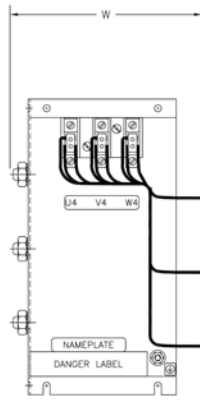
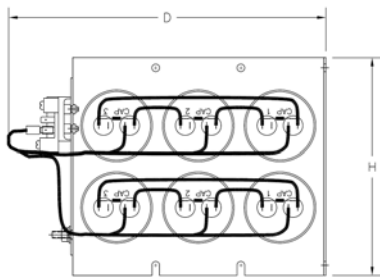


Figure 7 8-9 Cap panel
(Shown with 9)

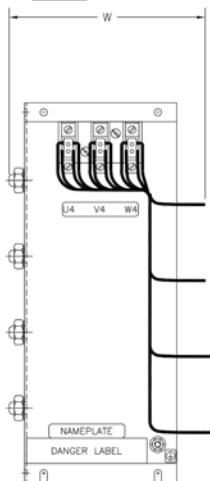
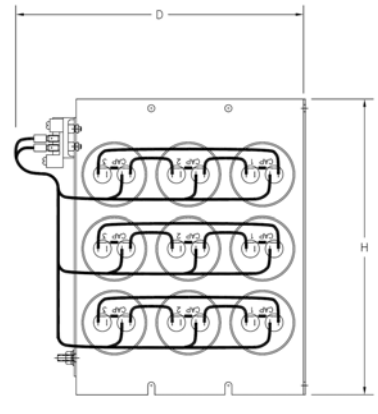
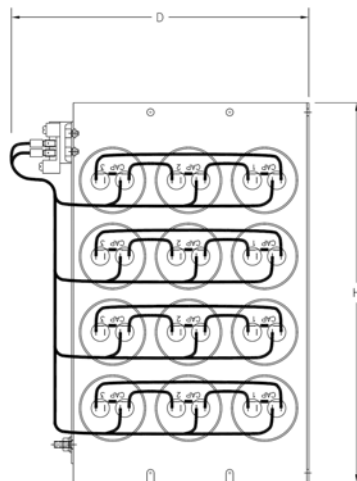


Figure 8 10-12 Cap panel
(Shown with 12)



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Enclosure Drawings NEMA 1

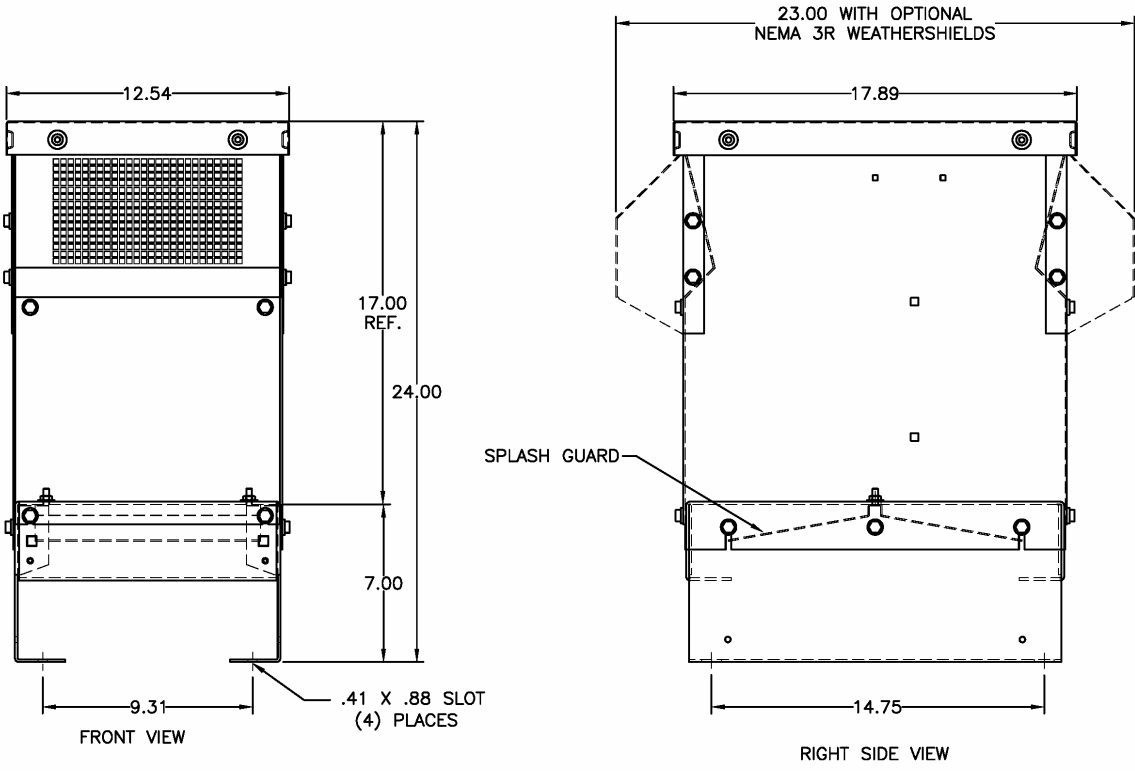


Figure 9 Cab 12C

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Enclosure Drawing continued

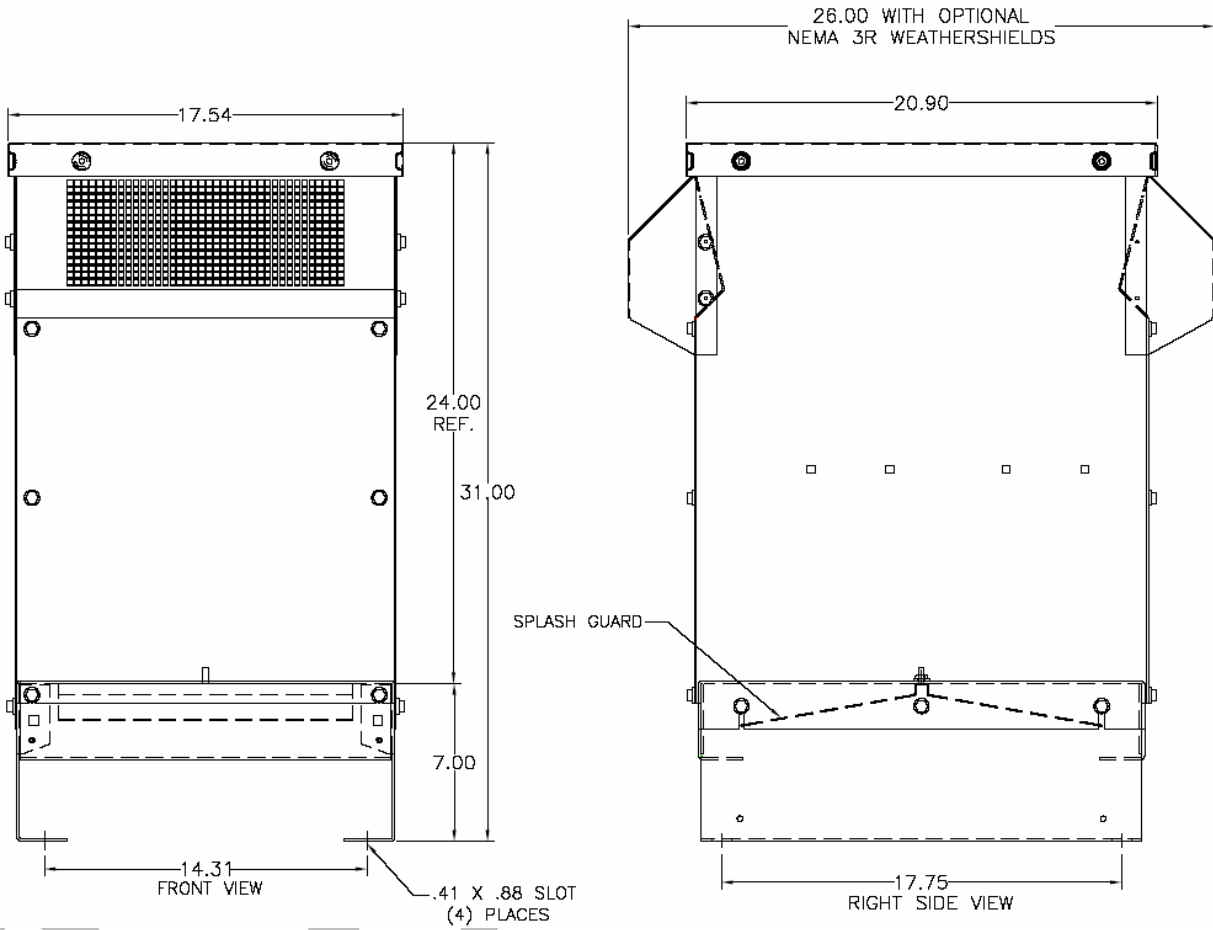


Figure 10 Cab -17C

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Enclosure Drawing continued

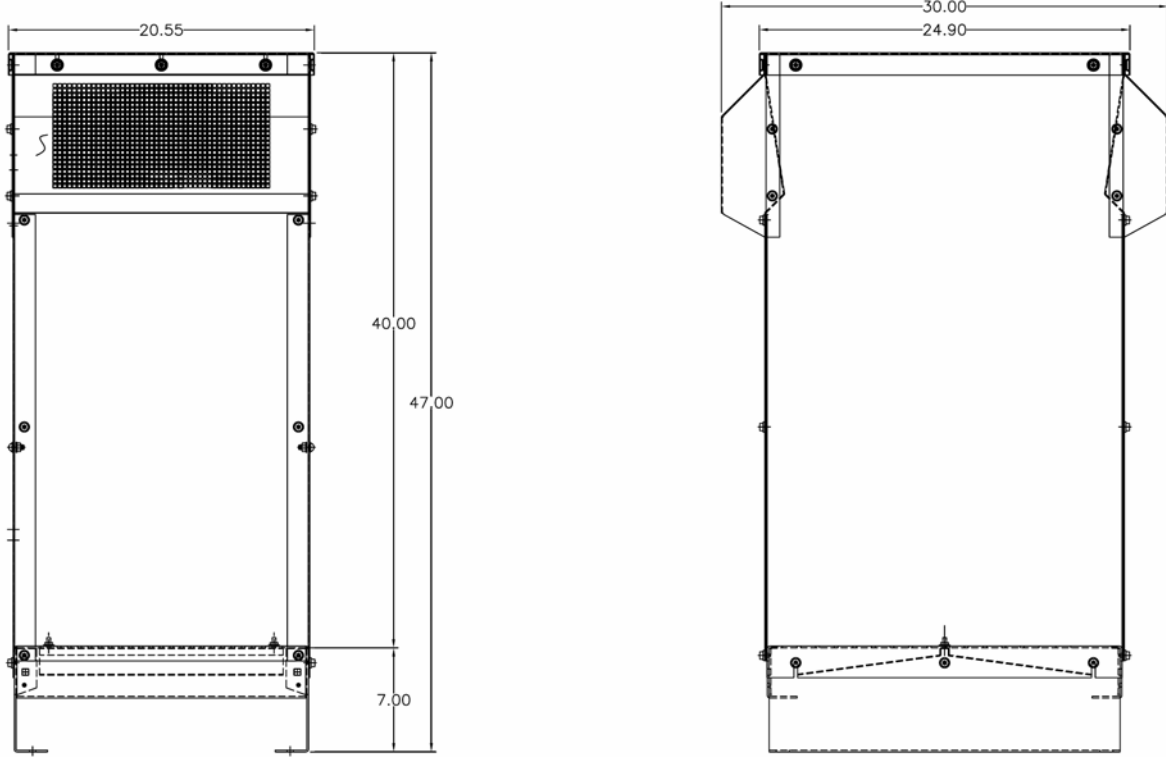


Figure 11 Cab - 20C

DATA

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Enclosure Drawing continued

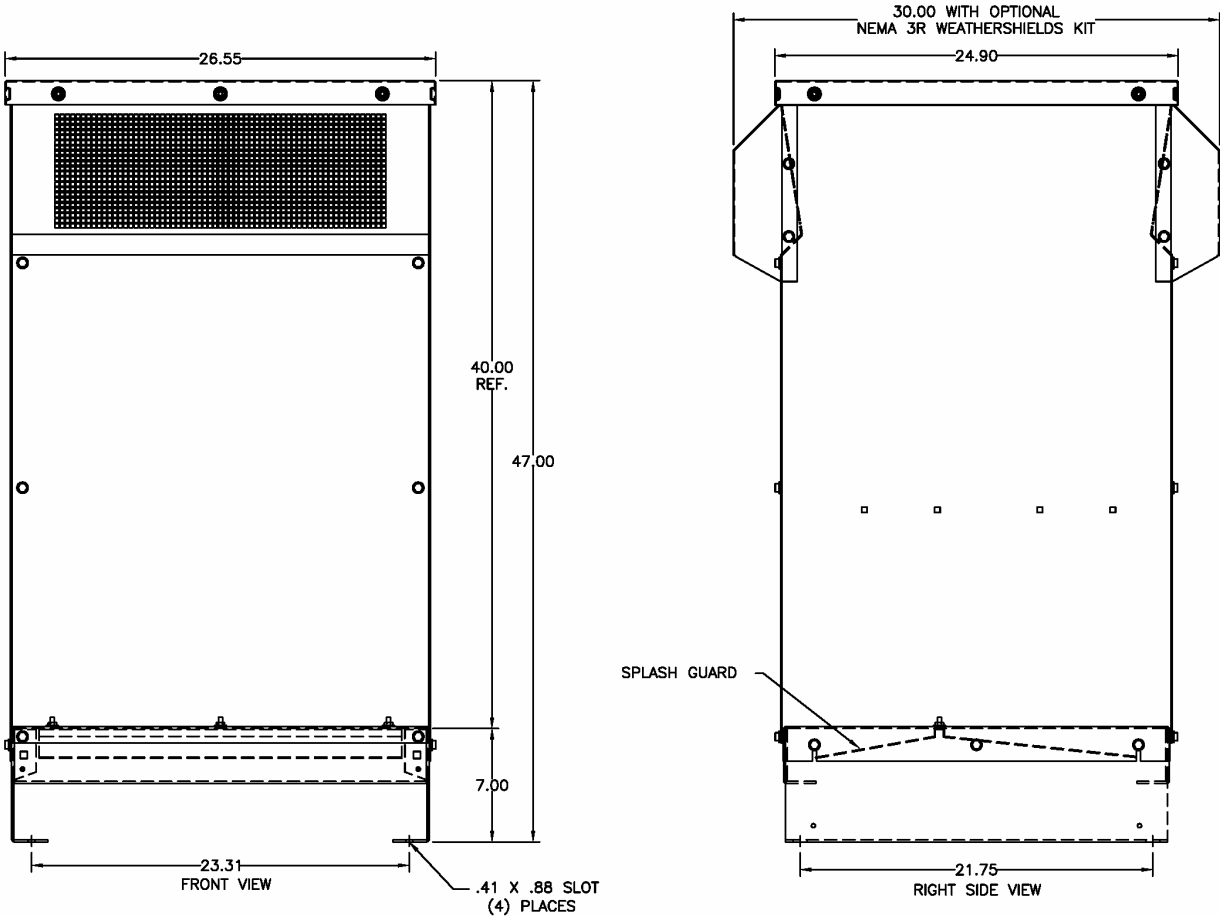


Figure 12 Cab - 26C

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Enclosure Drawing continued

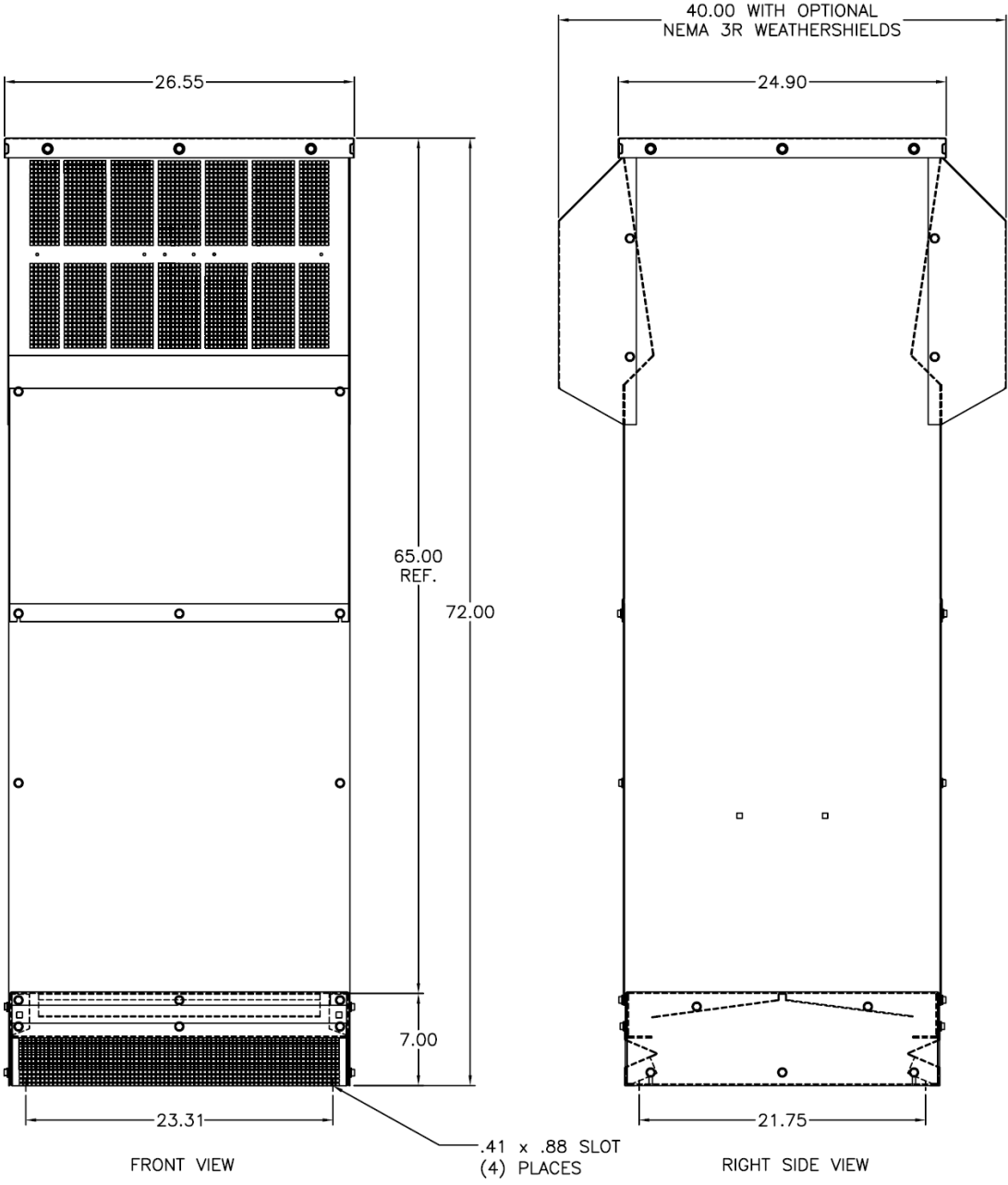


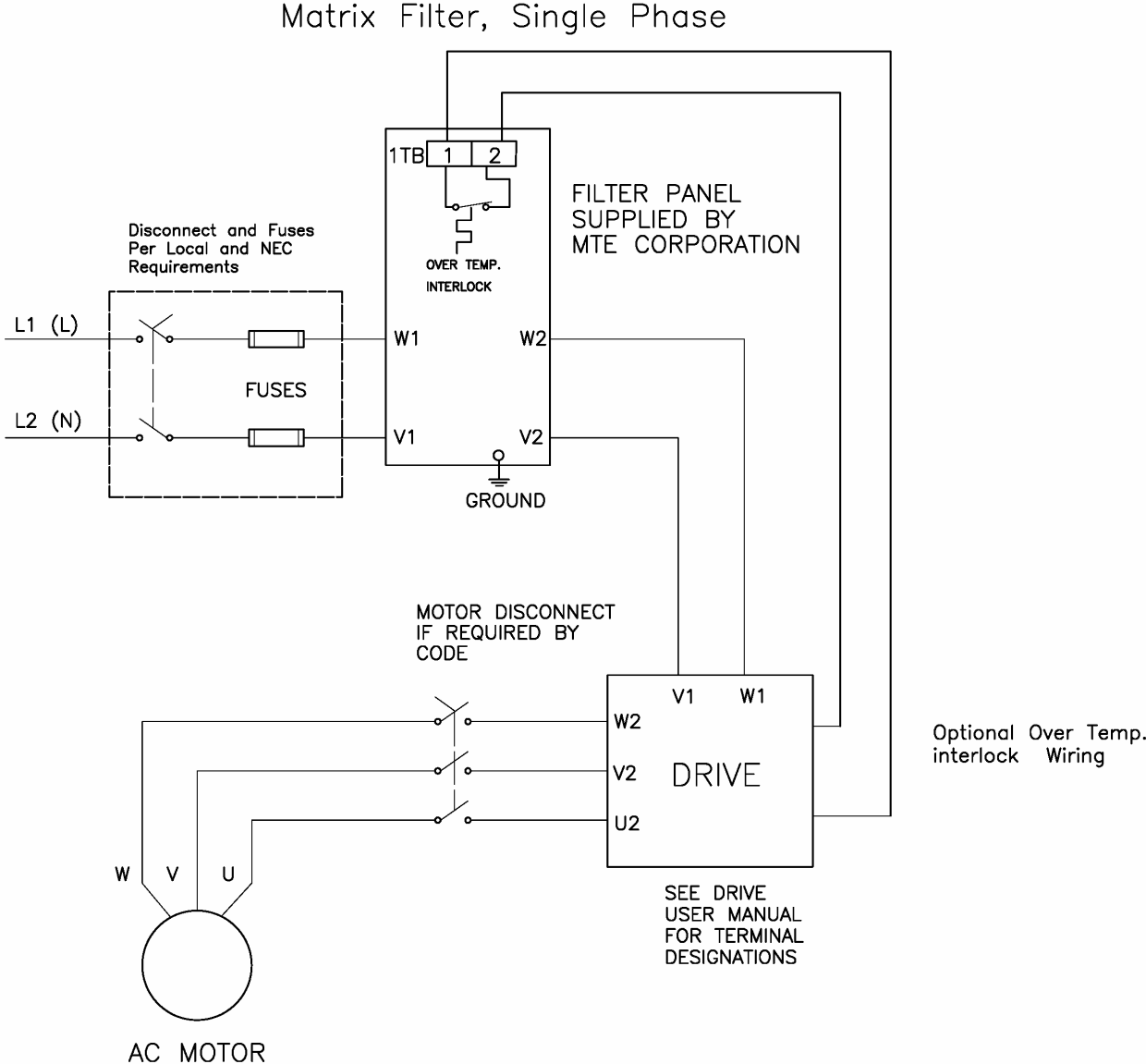
Figure 13 Cab – 26D

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Interconnection Diagram

Figure 14

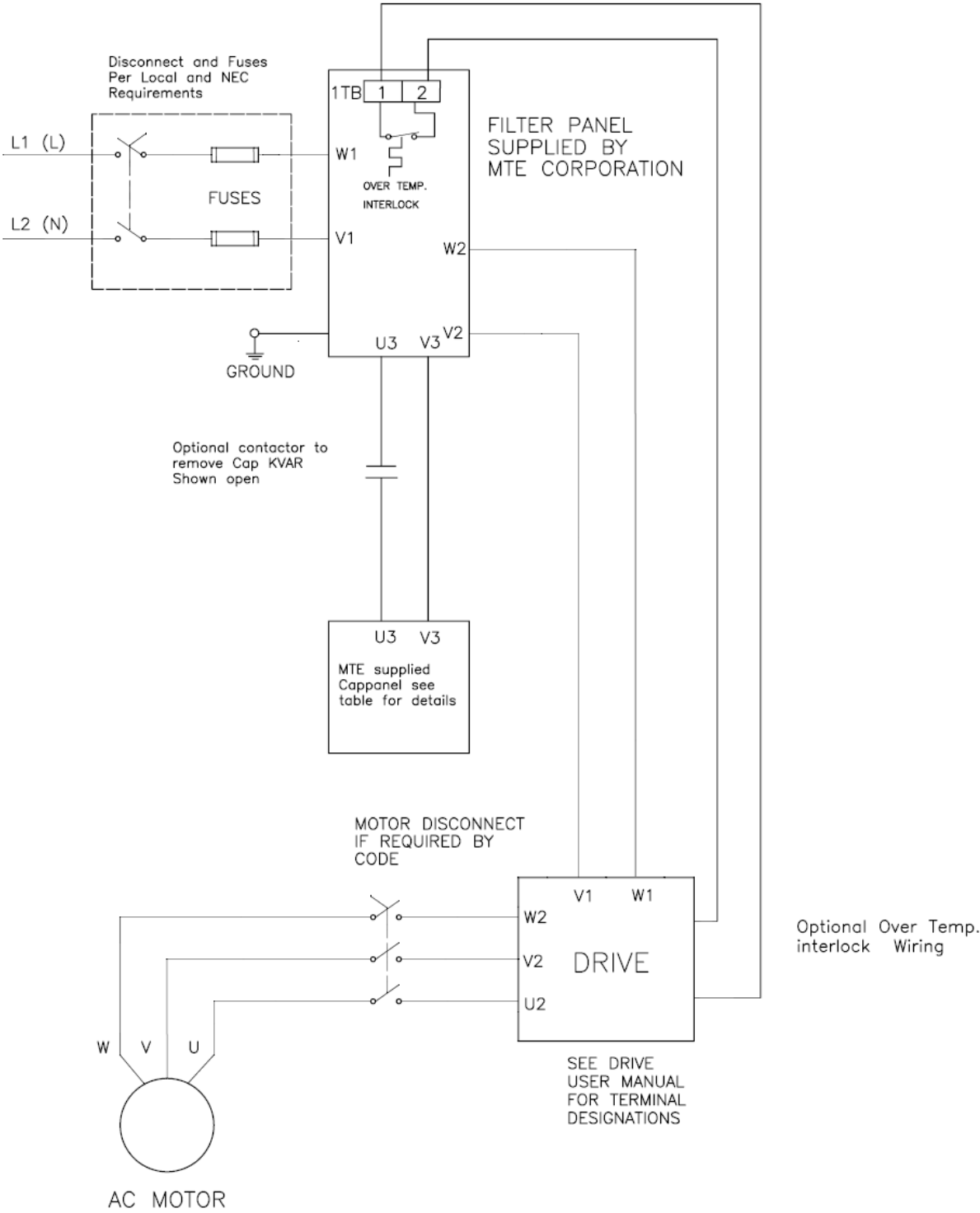


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Figure 15

Matrix Filter, Single Phase Panel with optional contactor



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FILTER DESCRIPTION

The MTE single phase Matrix Filter is a low pass filter containing proprietary technology, which makes it particularly useful for harmonic mitigation of adjustable speed drives using single phase power # shows a block diagram of the filter. AC power is connected to the input section which contains an AC reactor and circuitry which inhibits oscillation of the filter with the AC power system. The filter is a high order design comprised of magnetic and RC components. Capacitors in the filter operate with leading power factor at all loads, but unlike trap filters the MTE single phase Matrix Filter does not produce significant voltage rise at the point of common coupling within the power system.

Matrix filters are suitable for use with AC and DC drives and they can be used in both regenerative and non-regenerative applications when properly selected.

Filters for variable torque AC drives should be selected for a filter output current rating greater than or equal to the actual drive input current. If the input current rating is not available, use the selection table to properly size the filter to the single phase application.

Refer to the drive manufacturer user manual for proper size and wiring information.

Where a single filter is used to feed multiple drives, the output current rating of the filter should be selected to equal the total current rating of the individual drives when determined according to the instructions above.

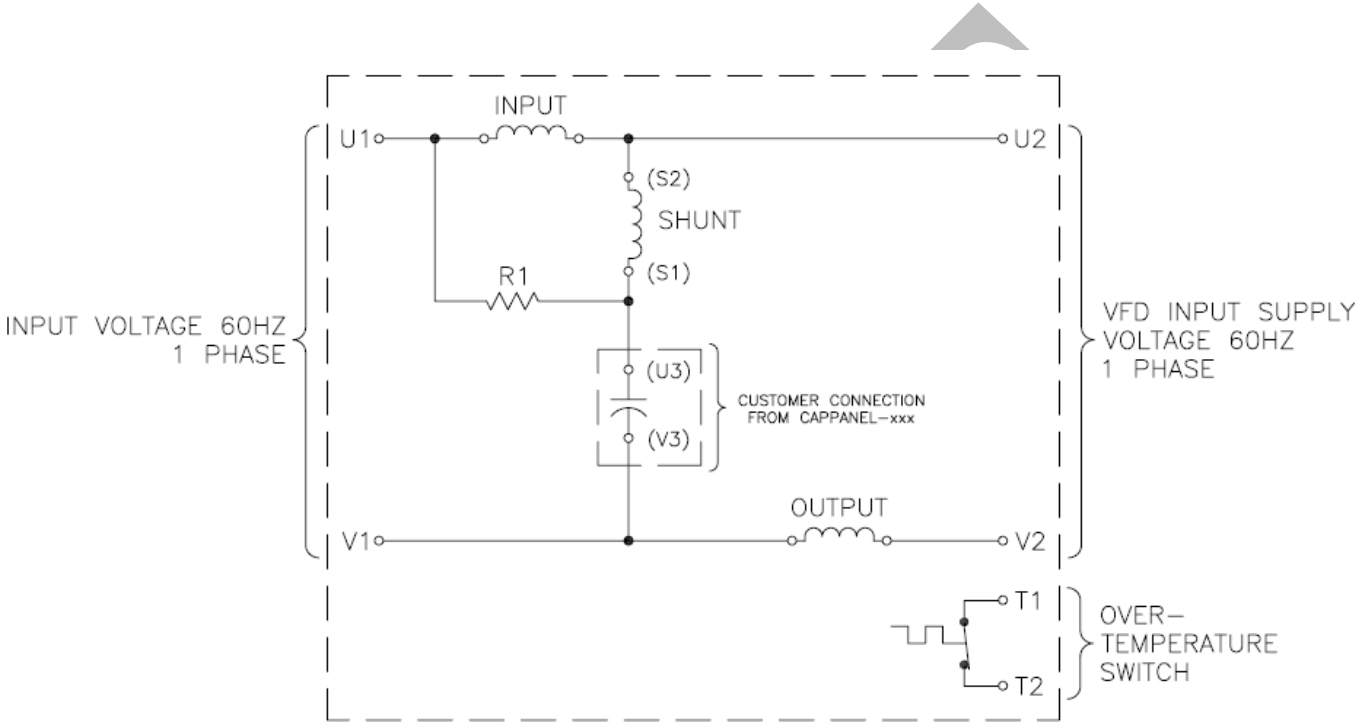
Because the filter supplies harmonic currents required by the drive, linear loads (such as space heaters, incandescent lighting and AC motors operated across the line) should not be connected to the output of the filter.

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FUNCTIONAL BLOCK DIAGRAM

Figure 16



DK

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Power Wiring Connection

WARNING

Input and output power wiring to the filter should be performed by authorized personnel in accordance with the NEC and all local electrical codes and regulations.

Verify that the power source to which the filter is to be connected is in agreement with the nameplate data on the filter. A fused disconnect switch or circuit breaker should be installed between the filter and its source of power in accordance with the requirements of the NEC and all local electrical codes and regulations. Refer to the drive user manual for selection of the correct fuse rating and class.

The filter is suitable for use on a circuit capable of delivering not more than 100,000 rms symmetrical amperes at 480 volts when protected by Bussmann type JJS, KTK, KTK-R, SPP or T class fuses.

Refer to the drive user manual for instructions on interconnecting the drive and motor and the correct start-up procedures for the inverter drive.

The filter is designed for use with copper conductors with a minimum temperature rating of 75 degrees C. Table 8 lists the wire range and terminal torque requirements for the power input and output connections by horsepower rating.

The capacitors should be located in the lowest temperature regions of the enclosure – generally toward the bottom – and the reactor may be located in any region where the ambient temperature does not exceed 50

degrees C. Size the conductors interconnecting the reactor and capacitor assemblies to carry the current shown in Table 3. For terminal specifications refer to Table 8.

For filters supplied in general purpose NEMA 1, 2 & 3R cabinets, interconnection between the filter, its power source, and the drive is shown in Figure 14 & 15. Refer to Figures 1-3 for the location of input, output, ground and over temperature switch terminals. Refer to the drive user manual for instructions on interconnecting the drive and motor and the correct start-up procedures for the drive.

Figure 15 shows a contactor interrupting the cappanel connection. The VFD run relay would be typically used to switch in the matrix filter capacitors at a 30 to 50 % load point Normal filter operation occurs when the contactor is closed. An open contactor provides only inductive impedance to mitigate the drive harmonics. It does protect the drive from any utility power transients.

Grounding and Ground Fault Protection

The filter must always be grounded with a grounding conductor connected to all ground terminals.

Due to high leakage currents associated with variable frequency drives, ground fault protective devices do not necessarily operate correctly when placed ahead of a matrix filter feeding a drive. When using this type of device, its function should be tested in the actual installation.

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Single Phase Matrix Filter		INSTR-021
Revision	Date	Revision History
---	11-11-09	New document by Wayne Walcott

DRAFT