POWER QUALITY. SOLVED.
A STEEL PARTNERS COMPANY

# Matrix® AP

## 208V – 690V
## TECHNICAL REFERENCE MANUAL

| | |
|---|---|
| **WARNING** | **High Voltage! Only a qualified electrician can carry out the electrical installation of this filter.** |

## Quick Reference

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# 1. SAFETY

## Warnings and Cautions

The following symbols are used in this manual:

| | |
|---|---|
|  **WARNING** | High Voltage Warning: warns of situations that dangerously high voltage is involved. Failure to use proper precautions may lead to serious injury or death. |
|  **WARNING** | General Warning: warns of situations that can result in serious injury or death if proper precautions are not used. |
|  **Caution** | General Caution: identifies situations that could lead to malfunction or possible equipment damage. |

# General Safety Instructions

| | |
|---|---|
|  **WARNING** | **High Voltage! Only a qualified electrician can carry out the electrical installation of this filter.** |
| | 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.** |
|  **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. |
| | An upstream disconnect/protection device must be used as required by the National Electrical Code (NEC) or governing authority. |
| | Even if the upstream disconnect/protection device is open, the drive down stream of the filter may feedback high voltage to the filter. The drive safety instructions must be followed. **Injury or death may result if safety precautions are not observed.** |
| | The filter must be grounded with a grounding conductor connected to all grounding terminals. Open panel filters must have reactor grounded through a 2”x2” area cleaned of paint and varnish on lower mounting bracket. |
| | Only spare parts obtained from MTE Corporation or an authorized MTE distributor can be used. |
| | 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 and ensure that the voltage is at a safe level. |
|  **Caution** | Loose or improperly secured connections may damage or degrade filter performance. Visually inspect and secure all electrical connections before power is applied to the filter. |
| | The user of this filter must assure that the input voltage and frequency is correct for the filter rating and that the voltage applied falls within the rated operating tolerance envelop specified for the filter. For sever power line applications where the power feed is likely to experience surges and transients that exceed the input voltage rating, it is recommended that a TVSS (Transient Voltage Surge Suppression) or SPD (Surge Protection Device) be deployed ahead of the filter to reduce the possibility of exceeding the filter rated voltage. Consult with TVSS or SPD manufacturer to determine the correct protection requirements for your power line conditions. |

# 2. GENERAL INFORMATION

The purpose of the manual is to properly specify, size, and install the Matrix AP.

For the most current Matrix AP information, please refer to our website:

www.mtecorp.com/products/matrix-ap-harmonic-filters/

This manual is intended for use by personnel experienced in the operation and maintenance of drives. Because of the high voltages required by the filter, 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 drive to which it is connected.

## Receipt & Repair Statement

**Upon Receipt of this Filter:**

The Matrix AP harmonic 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 or dirt has accumulated on the internal components of the filter before applying power.

**Repair/Exchange Procedure**

MTE Corporation requires a Return Material Authorization Number and form before we can accept any filters that qualify for return or repair. If problems or questions arise during installation, setup, or operation of the filter, please contact MTE for assistance at:

Toll Free: 1-800-455-4MTE (1-800-455-4683)

International Tel: (+1)-262-253-8200

Fax: (+1)-262-253-8222

## Enclosures

MTE enclosures are designed to provide a degree of protection for electrical components and prevent incidental personnel contact with the enclosed equipment. Depending on the enclosure selected, these enclosures meet the requirements of NEMA 1, 2 or 3R.

An approximate cross reference guide between NEMA, UL, CSA and IEC enclosure follows.

Type 1 NEMA / IEC IP20 Enclosure**:**
Are designed for indoor use and will provide protection against contact with the enclosed equipment.

Type 2 NEMA / IEC IP20 Enclosure:
Are designed for indoor use and will provide protection against contact with the enclosed equipment and provide a degree of protection against limited amounts of falling water and dirt.

Type 3R NEMA / IEC IP23 Enclosure:
Are designed for outdoor use primarily to provide protection against contact with the enclosed equipment and provide a degree of protection against falling rain sleet and external ice formation.

## Agency Approvals

UL and cUL listed to UL508 Type Mx and CSA-C22.2 No 14-95
File E180243

## Warranty

Three years from the date of shipment. See https://www.mtecorp.com/industry-leading-warranty/ for details.

# 3. MATRIX AP PERFORMANCE DATA

## Performance Specifications

**Table 3-1: Performance Specifications**

| | |
|---|---|
| **Service Conditions** | Load: 6-pulse variable torque rectifier only |
| Input Voltage(s) | 208V Version (PN#'s MAPxxxxxA) - 208-240 VAC +/- 10%. 60 + 0.75 Hz. 3 phase<br>400V Version (PN#'s MAPxxxxxC) - 380-415 VAC +/- 10%. 50 + 0.75 Hz. 3 phase<br>480V Version (PN#'s MAPxxxxxD) - 480 VAC +/- 10%, 60 + 0.75 Hz. 3 phase<br>600V Version (PN#'s MAPxxxxxE) - 600 VAC +/- 10%. 60 + 0.75 Hz. 3 phase<br>690V Version (PN#'s MAPxxxxxF) - 690 VAC +/- 10%. 50 + 0.75 Hz. 3 phase |
| Input voltage line unbalance | 1% maximum to ensure performance guaranty |
| Maximum source impedance | **6.00% to ensure performance guaranty.**<br>**Please contact MTE for sizing with Gensets.** |
| Minimum source impedance | 1.5% |
| Service Factor | 1.00 |
| Overload | 150% for 1-minute duration with 10% output voltage reduction of nominal of voltage |
| Ambient Temperature (Operating) | Refer to Figure 3-5: Temperature Derating for derating guidelines |
| Insulation System | Class N (200 degrees C) |
| Enclosed Filters | 320A and above: -40 to +45 degrees C with no derating<br>Below 320A: -40 to +40 degrees C with no derating |
| Open Panel Filters | -40 to +50 degrees C with no derating |
| Storage Temperature | -40 to +90 degrees C |
| Altitude | 0 to 3300 Feet above sea level. Refer to Figure 3-4: Altitude Derating Curve for altitude de-rating |
| Relative Humidity | 0 to 95% non-condensing |
| Over Voltage | Category II |
| Insertion Loss | +5% no load<br>-5% full load |

**Generator sizing note**: Generator sizing is best completed by sizing programs or help from a generator manufacturing representative. Identify every load type and size that will be powered from the generator. If non-linear loads are present the generator may need to be oversized.
Generator rated KVA minimum load >= Matrix rated current x √ 3 generator voltage

FLA load current <= Matrix filter rated current

***Notes (SCCR):***

***MTE products are manufactured and certified to the UL 508 standard.***

***Regarding the UL 508A standard (for industrial control panels, third edition, dated April 24, 2018, and current), the default short circuit current rating (SCCR) for the harmonic filter used within the industrial control panel is defined in Table SB4.1.***

***The default short circuit rating can be increased by appropriately fusing the shunt section within the harmonic filter, or, appropriately fusing each capacitor branch within the shunt section of the harmonic filter, per UL508A Table SB4.2. By adding this protective fusing, the harmonic filter SCCR rating can be increased to 100kA. Contact MTE for the applicable application note.***

## Filter Efficiency + Watt loss
## Matrix AP 208V-240V, 60Hz

**Table 3-2: Watt Loss - Matrix AP 208V-240V, 60Hz**

| Maximum Output (Amps RMS) | Efficiency (%) | Typical Power Dissipation @ Rated Current (Watts) | Typical Capacitor Current (Amps RMS) |
|---|---|---|---|
| 6 | 97.3% | 95 | 2.0 |
| 8 | 97.4% | 102 | 2.6 |
| 11 | 97.6% | 122 | 3.6 |
| 14 | 98.4% | 180 | 4.6 |
| 21 | 98.6% | 187 | 6.9 |
| 27 | 98.5% | 191 | 8.9 |
| 34 | 98.4% | 217 | 11.2 |
| 44 | 97.9% | 269 | 14.5 |
| 52 | 97.7% | 287 | 17.2 |
| 66 | 98.1% | 334 | 21.8 |
| 83 | 98.2% | 373 | 27.4 |
| 103 | 99.2% | 475 | 34.0 |
| 128 | 98.6% | 558 | 42.2 |
| 165 | 98.9% | 601 | 54.5 |
| 208 | 99.1% | 681 | 68.6 |
| 240 | 99.0% | 1093 | 79.2 |
| 320 | 98.9% | 1305 | 105.6 |
| 403 | 98.7% | 1636 | 133 |

**NOTE: Use the IEC AC-3 rating for the corresponding filter capacitor current when selecting a contactor.**

# Filter Efficiency + Watt loss
# Matrix AP 380V-415V, 50Hz

**Table 3-3: Watt Loss - Matrix AP 380V-415V, 50Hz**

| Maximum Output (Amps RMS) | Efficiency (%) | Typical Power Dissipation @ Rated Current (Watts) | Typical Capacitor Current (Amps RMS) |
|---|---|---|---|
| 6 | 97.5% | 114 | 2.2 |
| 8 | 97.6% | 149 | 3.5 |
| 11 | 97.9% | 180 | 4.8 |
| 14 | 98.1% | 206 | 5.4 |
| 21 | 98.6% | 235 | 7.5 |
| 27 | 98.7% | 266 | 10.2 |
| 34 | 98.8% | 298 | 13.2 |
| 44 | 98.9% | 356 | 15.9 |
| 52 | 99.0% | 388 | 19.3 |
| 66 | 99.1% | 459 | 24.9 |
| 83 | 99.1% | 565 | 31.2 |
| 103 | 99.2% | 660 | 38.1 |
| 128 | 99.0% | 973 | 43.9 |
| 165 | 99.2% | 1,030 | 55.0 |
| 208 | 99.2% | 1,263 | 72.7 |
| 240 | 99.2% | 1,423 | 80.6 |
| 320 | 99.4% | 1,450 | 104.7 |
| 403 | 99.4% | 1,816 | 138.8 |
| 482 | 99.5% | 2,008 | 157.6 |
| 636 | 99.5% | 2,359 | 218.6 |
| 786 | 99.6% | 2,604 | 271.9 |
| 850 | 99.6% | 2,974 | 299.3 |
| 1000 | 99.5% | 3,954 | 341.1 |
| 1200 | 99.6% | 4,136 | 420.0 |

**NOTE: Use the IEC AC-3 rating for the corresponding filter capacitor current when selecting a contactor.**

# Filter Efficiency + Watt loss
# Matrix AP 480V, 60Hz

**Table 3-4: Watt Loss - Matrix AP 480V, 60Hz**

| Maximum Output (Amps RMS) | Efficiency (%) | Typical Power Dissipation @ Rated Current (Watts) | Typical Capacitor Current (Amps RMS) |
|---|---|---|---|
| 6 | 97.5% | 122 | 1.9 |
| 8 | 97.6% | 158 | 2.6 |
| 11 | 97.9% | 192 | 3.7 |
| 14 | 98.1% | 220 | 4.6 |
| 21 | 98.6% | 251 | 6.9 |
| 27 | 98.7% | 283 | 9.2 |
| 34 | 98.8% | 318 | 11.8 |
| 44 | 98.9% | 379 | 14.5 |
| 52 | 99.0% | 413 | 17.2 |
| 66 | 99.1% | 488 | 22.2 |
| 83 | 99.1% | 600 | 29.2 |
| 103 | 99.2% | 702 | 34.7 |
| 128 | 99.0% | 1,035 | 39.8 |
| 165 | 99.2% | 1,096 | 53.2 |
| 208 | 99.2% | 1,343 | 64.8 |
| 240 | 99.2% | 1,514 | 72.7 |
| 320 | 99.4% | 1,543 | 94.5 |
| 403 | 99.4% | 1,932 | 132.3 |
| 482 | 99.5% | 2,137 | 141.8 |
| 636 | 99.5% | 2,509 | 195.6 |
| 786 | 99.6% | 2,771 | 245.0 |
| 850 | 99.6% | 3,163 | 265.9 |
| 1000 | 99.5% | 4,206 | 308.6 |
| 1200 | 99.6% | 4,400 | 355.2 |
| 1600 | 99.4% | 4,500 | 496.5 |
| 2000 | 99.4% | 5,050 | 696.5 |
| 2300 | 99.4% | 6,100 | 716.0 |

**NOTE: Use the IEC AC-3 rating for the corresponding filter capacitor current when selecting a contactor.**

# Filter Efficiency + Watt loss
# Matrix AP 600V, 60Hz

**Table 3-5: Watt Loss - Matrix AP 600V, 60Hz**

| Maximum Output (Amps RMS) | Efficiency (%) | Typical Power Dissipation @ Rated Current (Watts) | Typical Capacitor Current (Amps RMS) |
|---|---|---|---|
| 6 | 97.6% | 150 | 1.9 |
| 8 | 97.8% | 183 | 2.6 |
| 11 | 98.2% | 205 | 3.7 |
| 14 | 98.3% | 250 | 4.6 |
| 21 | 98.7% | 285 | 6.9 |
| 27 | 98.9% | 304 | 9.2 |
| 34 | 99.0% | 366 | 11.8 |
| 44 | 99.1% | 395 | 14.5 |
| 52 | 99.1% | 494 | 17.2 |
| 66 | 99.0% | 655 | 22.2 |
| 83 | 99.1% | 718 | 29.2 |
| 103 | 99.0% | 1085 | 34.7 |
| 128 | 99.2% | 1090 | 39.8 |
| 165 | 99.3% | 1285 | 53.2 |
| 208 | 99.3% | 1431 | 64.8 |
| 240 | 99.3% | 1624 | 72.7 |
| 320 | 99.4% | 2021 | 94.5 |
| 403 | 99.5% | 2208 | 132.3 |
| 482 | 99.5% | 2481 | 141.8 |
| 636 | 99.6% | 2884 | 195.6 |
| 786 | 99.6% | 3368 | 245.0 |

**NOTE: Use the IEC AC-3 rating for the corresponding filter capacitor current when selecting a contactor.**

# Filter Efficiency + Watt loss
# Matrix AP 690V, 50Hz

**Table 3-6: Watt Loss - Matrix AP 690V, 50Hz**

| Maximum Output (Amps RMS) | Efficiency (%) | Typical Power Dissipation @ Rated Current (Watts) | Typical Capacitor Current (Amps RMS) |
|---|---|---|---|
| 52 | 98.9% | 681 | 17.2 |
| 66 | 98.9% | 844 | 21.8 |
| 83 | 99.1% | 850 | 27.4 |
| 103 | 99.1% | 1051 | 33.9 |
| 128 | 99.3% | 1106 | 42.2 |
| 165 | 99.4% | 1257 | 54.5 |
| 208 | 99.4% | 1400 | 68.6 |
| 240 | 99.4% | 1721 | 79.2 |
| 320 | 99.5% | 2031 | 105.6 |
| 403 | 99.4% | 2780 | 132.9 |
| 482 | 99.5% | 2883 | 159.1 |
| 636 | 99.6% | 3140 | 209.9 |

**NOTE: Use the IEC AC-3 rating for the corresponding filter capacitor current when selecting a contactor.**

## Load Effect on THID

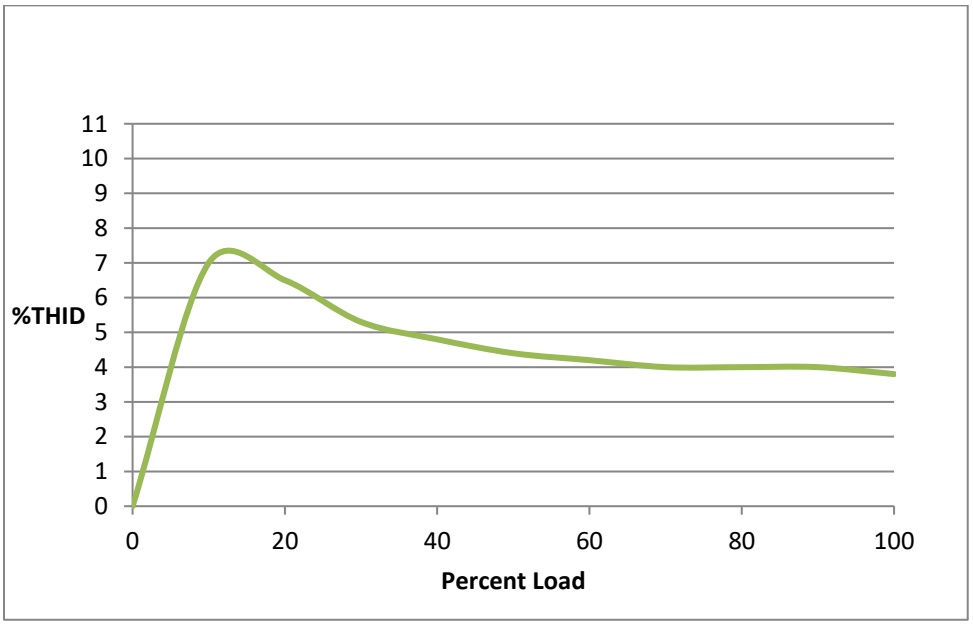


**Figure 3-1: Load Effect on THID**

## Typical Harmonic Spectrum

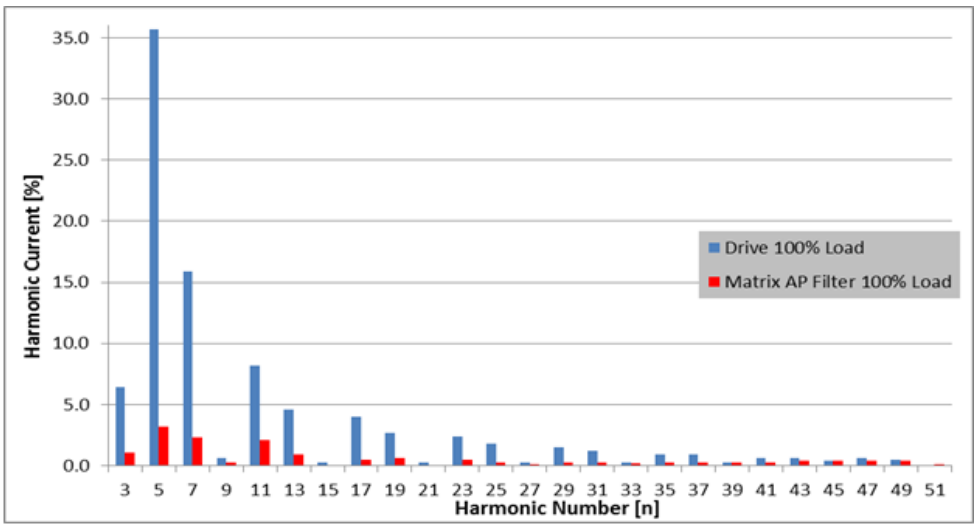


**Figure 3-2: Typical Harmonic Spectrum with and without Matrix AP**

## Power Factor

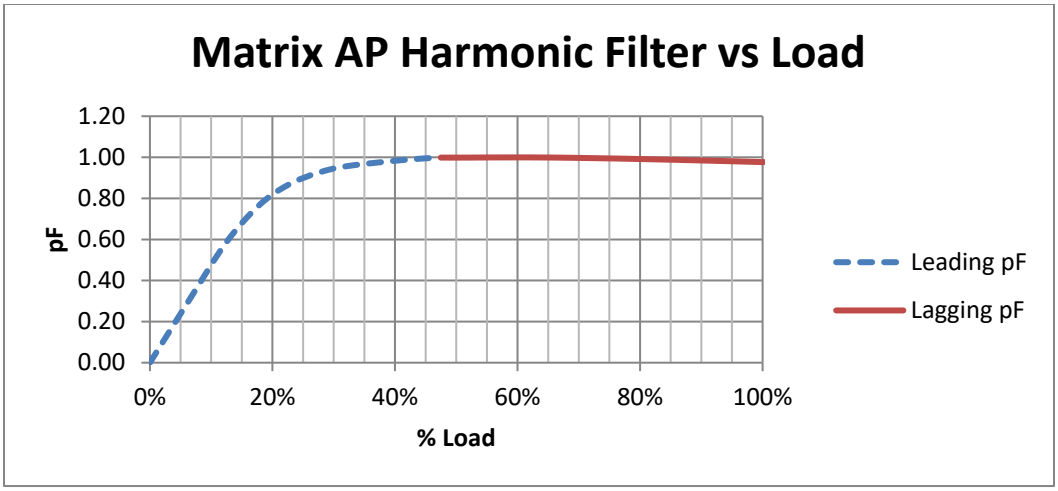


**Figure 3-3: Power Factor**

## Typical Performance with Unbalanced Line Voltage

**Table 3-7: Typical Performance with Unbalanced Line Voltage**

| All Components at Nominal Values and Worse Case Service Conditions | |
|---|---|
| **100% Load** | |
| **Nominal THID** | 4.2% |
| **1% Unbalance** | 4.4% |
| **2% Unbalance** | 4.8% |
| **3% Unbalance** | 5.4% |
| | |
| **30% Load** | |
| **Nominal THID** | 7.0% |
| **1% Unbalance** | 7.3% |
| **2% Unbalance** | 7.9% |
| **3% Unbalance** | 8.8% |

## Altitude Derating

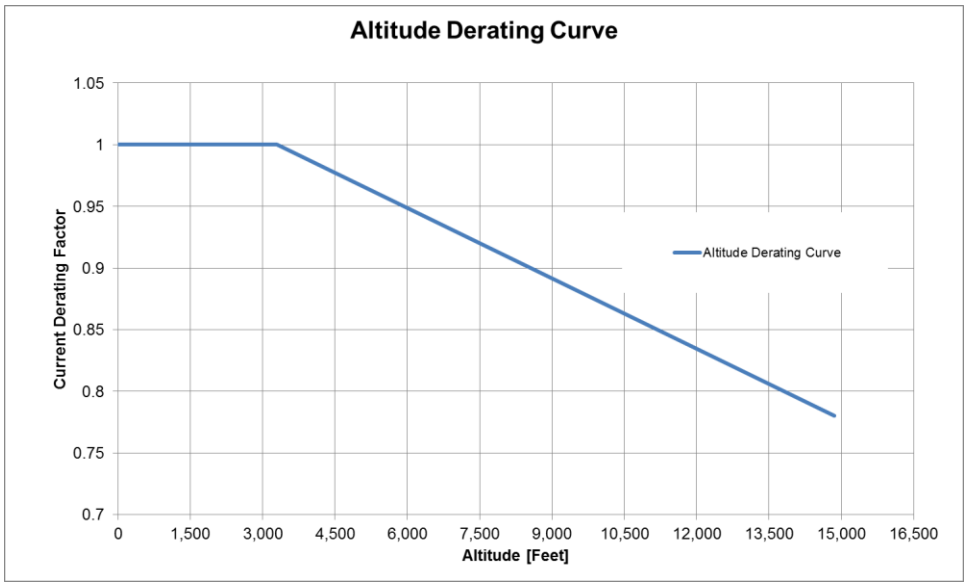


**Figure 3-4: Altitude Derating Curve**

## Temperature Derating

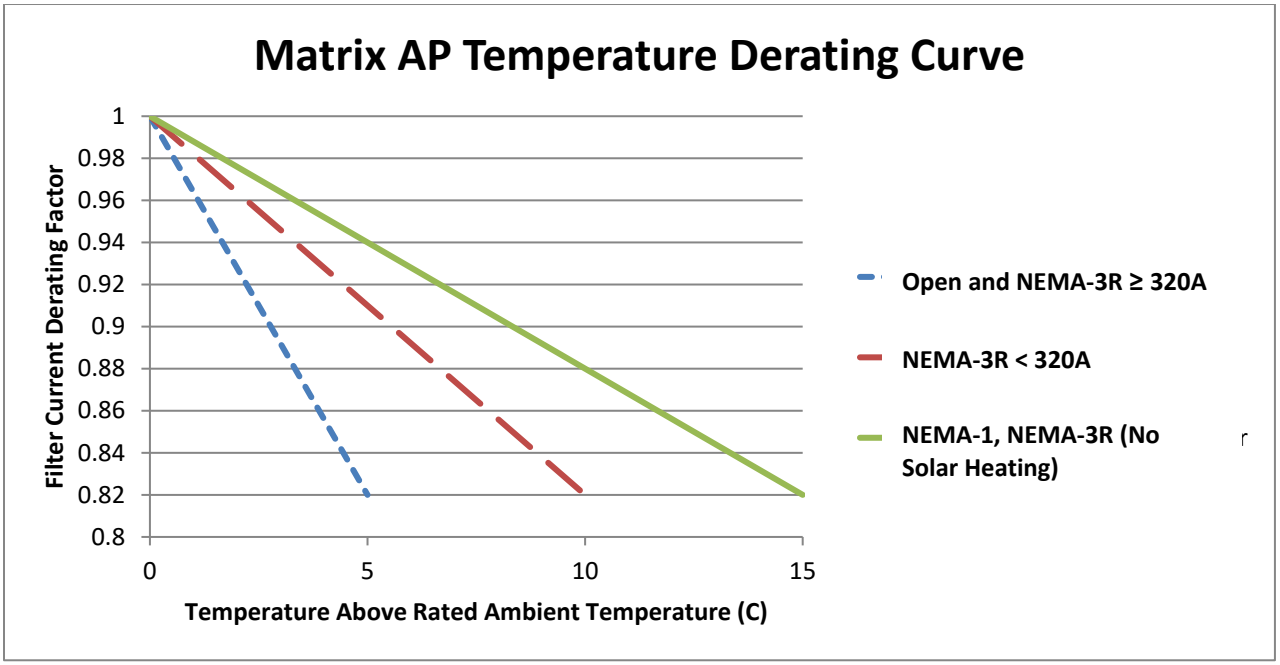


**Figure 3-5: Temperature Derating**

***NOTE: Do not extend derating beyond published data.***
***See or click Table 3-1: Performance Specifications (p5) for temperature ratings***

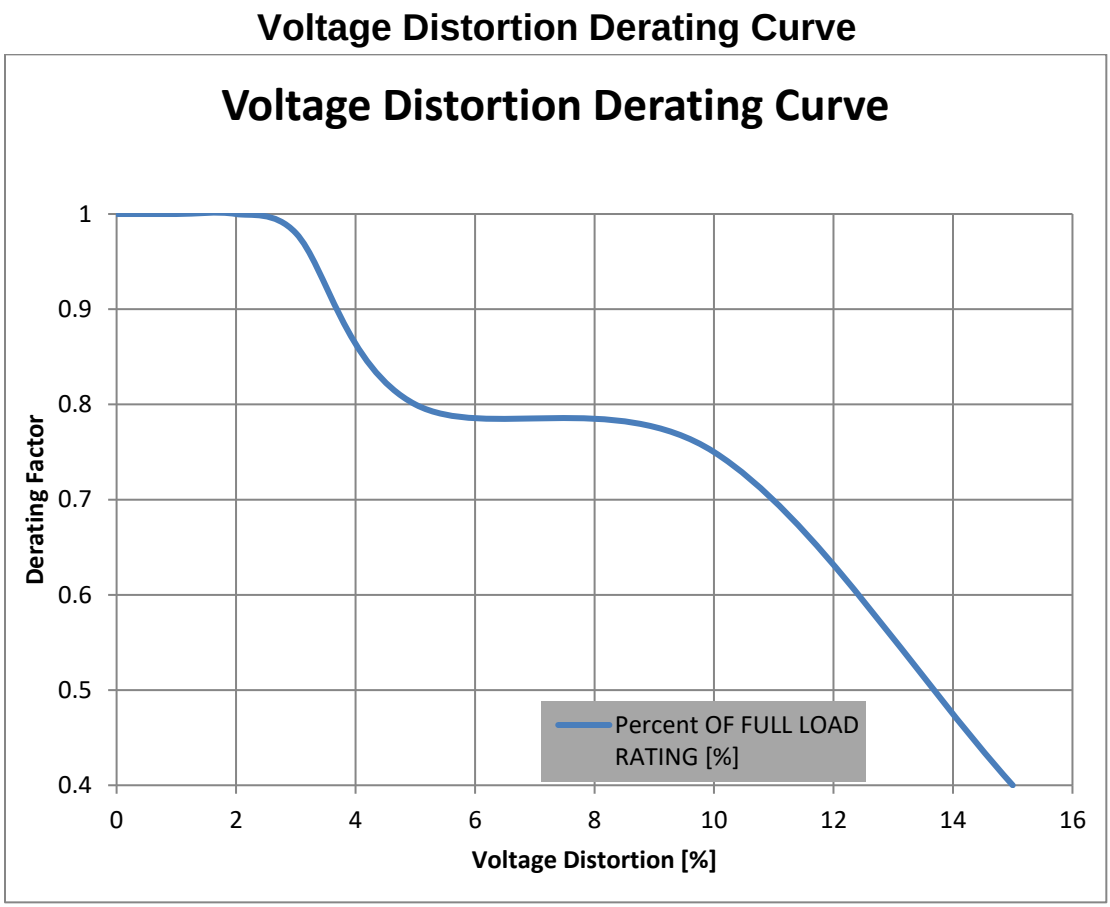


**Figure 3-6: Voltage Distortion Derating Curve**

**NOTE: This plot assists in proper derating of a Matrix AP harmonic filter in environments with a given voltage distortion. Example: In a system with 10% voltage distortion, a Matrix filter will need to be oversized by 25% to obtain the same performance as an appropriate filter in a 0% distortion environment.**

# 4. HOW TO SELECT

## Selection Guide

The MTE Corporation Matrix AP harmonic filter is designed for harmonic mitigation of 6-pulse 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. The Matrix AP harmonic filter uses a patented Adaptive Passive Harmonic Mitigating Reactor (AP HMR) technology to limit full load current distortion to less than 5% THID and 8% THID at 30% load.

Matrix AP harmonic filters are available in Open Panel, NEMA 1/2, and NEMA 3R mechanical configurations.

**NOTE: For inverters feeding isolation transformers select a filter with a current rating equal to or greater than that of the transformer primary current.**

**Please verify information below for proper selection:**

- ☐ **Line Voltage and Frequency**: Input voltage from 240V – 690V at standard frequency. See Table 3-1: Performance Specifications **(p5)** for specification.
- ☐ **Current Rating**: 208V-240V 6-403 Amp, 380V-415V 6-1200 Amp, 480V 6-2300 Amp, 600V 6-786 Amp, 690V 52-636 Amp.
- ☐ **Voltage Distortion**: See Figure 3-6: Voltage Distortion Derating Curve **(p14)** for voltage distortion derating curve.
- ☐ **Contactor Option**: See Figure 5-4: Contactor Option – 002 **(p33)** for contactor option 002, Figure 5-5: Contactor Option – 009 **(p34)** for contactor option 009, Figure 5-6: Contactor Option – 012 **(p35)** for contactor option 012, and Figure 5-7: Contactor Option – 013 **(p36)** for contactor option 013.
- ☐ **Performance**: See Table 3-1: Performance Specifications **(p5)** for specification.
- ☐ **Temperature:** See Table 3-1: Performance Specifications **(p5)** for specification, and Figure 3-5: Temperature Derating **(p13)** for temperature derating.
- ☐ **Altitude**: 3,300 feet above sea level without derating. See Figure 3-4: Altitude Derating Curve **(p13)** for derating curve.
- ☐ **Enclosure Type**: Open Panel, NEMA 1/2 & NEMA 3R, see **(p4)** for enclosure descriptions.
- ☐ Refer to Article 430 Table 430.91 of the National Electrical code for the selection of the appropriate enclosure Type Number for your application.

# Understanding the MATRIX AP Part Number:

**MAP x _ _ _ _ x _ _ _**

Matrix AP

Enclosure Type

P = Panel Mount (No Enclosure)
G = General Purpose (NEMA 1/2)*
W = Weather (NEMA 3R)*

Current Rating

0006 is 6 Amps
0083 is 83 Amps
2300 is 2300 Amps

Voltage Frequency Code

A 208 – 240 Volts 60 Hz
C 380 – 415 Volts 50 Hz
D 480 Volts 60 Hz
E 600 Volts 60 Hz
F 690 Volts 50 Hz

Contactor Options

002 - Contactor for capacitor disconnect
009 - Contactor with adjustable pick up and drop out**
012 - Contactor with control transformer
013 - Filter bypass and capacitor contactor with control transformer

**Additional Options**

Option - 400
Standard NEMA 3R enclosure with optional rodent/serpent screen
Option 400 provides intake exhaust air screens with (¼ x ¼) mesh

*Not available on units 1600A (480V) and above

**Contact MTE for support if an adjustment is needed

# Matrix AP 208-240 Volts, 60Hz Selection Tables
# Open Panel

**Table 4-1: Matrix AP 208V-240V Open Panel**

| Motor HP | Filter Amps Rating | Part Number | App. Wt. (lbs.) | Open Magnetics (in.) (H x W x D) | Capacitor (in.) (H x W) Capacitor Panel (in.) (H x W x D) |
|---|---|---|---|---|---|
| 1.5 | 6 | MAPP0006A | 19 | 8.5 x 8.0 x 5.4 | 7.5 x 3.0 |
| 2 | 8 | MAPP0008A | 19 | 8.5 x 8.0 x 5.4 | 7.5 x 3.0 |
| 3 | 11 | MAPP0011A | 22 | 8.6 x 8.0 x 5.4 | 7.5 x 4.6 |
| 5 | 14 | MAPP0014A | 21 | 8.6 x 8.0 x 5.4 | 7.5 x 3.9 |
| 5 | 21 | MAPP0021A | 30 | 9.8 X 8.0 X 4.8 | 9.1 x 4.6 |
| 7.5 | 27 | MAPP0027A | 36 | 9.7 x 9.0 x 5.3 | 9.1 x 4.6 |
| 10 | 34 | MAPP0034A | 51 | 11.7 x 10.5 x 6.7 | 10.6 x 4.6 |
| 15 | 44 | MAPP0044A | 52 | 11.6 x 10.5 x 7.2 | 9.0 x 4.6 |
| 20 | 52 | MAPP0052A | 56 | 11.7 x 10.5 x 7.2 | 9.0 x 3.5 |
| 25 | 66 | MAPP0066A | 64 | 11.6 x 10.5 x 7.7 | 9.0 x 3.9 |
| 30 | 83 | MAPP0083A | 77 | 11.6 x 10.5 x 9.1 | 9.0 x 3.9 |
| 40 | 103 | MAPP0103A | 111 | 14.0 x 12.0 x 9.6 | 10.6 x 4.6<br>10.6 x 4.6 |
| 50 | 128 | MAPP0128A | 134 | 14.0 x 12.0 x 10.8 | 10.6 x 4.6<br>10.6 x 4.6 |
| 60 | 165 | MAPP0165A | 157 | 13.9 x 13.4 x 12.0 | 10.6 x 4.6<br>9.0 x 4.6 |
| 75 | 208 | MAPP0208A | 174 | 14.0 x 13.4 x 12.0 | 9.0 x 4.6<br>9.0 x 4.6 |
| 100 | 240 | MAPP0240A | 225 | 19.9 x 15.3 x 11.9 | 6.7 x 7.6 x 16.4 |
| 125 | 320 | MAPP0320A | 263 | 19.9 x 15.3 x 12.8 | 6.7 x 7.6 x 16.4 |
| 150 | 403 | MAPP0403A | 280 | 20.0 x 15.3 x 12.8 | 8.3 x 7.6 x 16.4 |

**NOTE: Approximate weight of filter above includes weight of reactor and accompanying capacitor and/or cap-panel assembly.**

**NOTE: Reference drawings can be accessed by clicking on part number.**

# Matrix AP 208-240 Volts, 60Hz Selection Tables
# Enclosed

**Table 4-2: Matrix AP 208V-240V Enclosed**

| Motor KW | Filter Amps Rating | Part Number | NEMA 1/2 Enclosure (in.) (H x W x D) | App. Weight (lbs.) | Part Number | NEMA 3R Enclosure (in.) (H x W x D) | App. Weight (lbs.) |
|---|---|---|---|---|---|---|---|
| 1.5 | 6 | MAPG0006A | 24.0 x 12.5 x 17.9 | 65 | MAPW0006A | 24.0 x 12.5 x 23.0 | 73 |
| 2 | 8 | MAPG0008A | 24.0 x 12.5 x 17.9 | 65 | MAPW0008A | 24.0 x 12.5 x 23.0 | 73 |
| 3 | 11 | MAPG0011A | 24.0 x 12.5 x 17.9 | 69 | MAPW0011A | 24.0 x 12.5 x 23.0 | 77 |
| 5 | 14 | MAPG0014A | 24.0 x 12.5 x 17.9 | 68 | MAPW0014A | 24.0 x 12.5 x 23.0 | 76 |
| 5 | 21 | MAPG0021A | 24.0 x 12.5 x 17.9 | 77 | MAPW0021A | 24.0 x 12.5 x 23.0 | 85 |
| 7.5 | 27 | MAPG0027A | 24.0 x 12.5 x 17.9 | 84 | MAPW0027A | 24.0 x 12.5 x 23.0 | 92 |
| 10 | 34 | MAPG0034A | 24.0 x 12.5 x 17.9 | 98 | MAPW0034A | 24.0 x 12.5 x 23.0 | 105 |
| 15 | 44 | MAPG0044A | 24.0 x 12.5 x 17.9 | 100 | MAPW0044A | 24.0 x 12.5 x 23.0 | 108 |
| 20 | 52 | MAPG0052A | 24.0 x 12.5 x 17.9 | 105 | MAPW0052A | 24.0 x 12.5 x 23.0 | 109 |
| 25 | 66 | MAPG0066A | 24.0 x 12.5 x 17.9 | 112 | MAPW0066A | 24.0 x 12.5 x 23.0 | 120 |
| 30 | 83 | MAPG0083A | 24.0 x 12.5 x 17.9 | 124 | MAPW0083A | 24.0 x 12.5 x 23.0 | 132 |
| 40 | 103 | MAPG0103A | 33.9 x 18.3 x 20.9 | 185 | MAPW0103A | 33.9 x 18.3 x 26.0 | 195 |
| 50 | 128 | MAPG0128A | 33.9 x 18.3 x 20.9 | 207 | MAPW0128A | 33.9 x 18.3 x 26.0 | 218 |
| 60 | 165 | MAPG0165A | 33.9 x 18.3 x 20.9 | 232 | MAPW0165A | 33.9 x 18.3 x 26.0 | 243 |
| 75 | 208 | MAPG0208A | 33.9 x 18.3 x 20.9 | 249 | MAPW0208A | 33.9 x 18.3 x 26.0 | 259 |
| 100 | 240 | MAPG0240A | 51.3 x 27.7 x 24.9 | 394 | MAPW0240A | 51.3 x 27.7 x 30.0 | 407 |
| 125 | 320 | MAPG0320A | 51.3 x 27.7 x 24.9 | 432 | MAPW0320A | 51.3 x 27.7 x 30.0 | 445 |
| 150 | 403 | MAPG0403A | 51.3 x 27.7 x 24.9 | 448 | MAPW0403A | 51.3 x 27.7 x 30.0 | 461 |

**NOTE: Reference drawings can be accessed by clicking on part number.**

# Matrix AP 380-415 Volts, 50Hz Selection Tables
# Open Panel

**Table 4-3: Matrix AP 380V-415V Open Panel**

| Motor KW | Filter Amps Rating | Part Number | App. Wt. (lbs.) | Open Magnetics (in.) (H x W x D) | Capacitor (in.) (H x W) Capacitor Panel (in.) (H x W x D) |
|---|---|---|---|---|---|
| 1.1-2.2 | 6 | MAPP0006C | 20 | 8.6 x 8.0 x 5.4 | 7.5 x 3.0 |
| - | 8 | MAPP0008C | 21 | 8.7 x 8.0 x 5.4 | 7.5 x 3.0 |
| 3.7 | 11 | MAPP0011C | 28 | 9.9 x 9.0 x 4.8 | 7.5 x 3.0 |
| 5.5 | 14 | MAPP0014C | 34 | 9.8 x 9.0 x 5.3 | 8.0 x 3.9 |
| 7.5 | 21 | MAPP0021C | 51 | 11.7 x 10.5 x 6.7 | 8.0 x 3.9 |
| 11 | 27 | MAPP0027C | 58 | 11.8 x 10.5 x 7.2 | 8.3 x 4.6 |
| 15 | 34 | MAPP0034C | 69 | 11.7 x 10.5 x 7.7 | 9.2 x 4.6 |
| 18.5-22 | 44 | MAPP0044C | 81 | 11.7 x 10.5 x 8.2 | 9.2 x 4.6 |
| - | 52 | MAPP0052C | 104 | 14.0 x 12.0 x 9.0 | 9.2 x 4.6 |
| 30 | 66 | MAPP0066C | 117 | 14.0 x 12.0 x 9.0 | 10.6 x 4.6 |
| 37-45 | 83 | MAPP0083C | 138 | 14.0 x 12.0 x 10.9 | 10.6 x 4.6 |
| 55 | 103 | MAPP0103C | 151 | 14.1 x 12.0 x 11.0 | 10.6 x 4.6 |
| - | 128 | MAPP0128C | 218 | 20.0 x 15.3 x 10.7 | 11.1 x 16.4 x 7.6 |
| 75-90 | 165 | MAPP0165C | 274 | 20.0 x 15.3 x 11.7 | 8.0 x 16.4 x 7.6 |
| 110 | 208 | MAPP0208C | 291 | 20.1 x 15.3 x 11.8 | 9.9 x 16.4 x7.6 |
| - | 240 | MAPP0240C | 324 | 19.9 x 15.3 x 12.8 | 11.1 x 16.4 x 7.6 |
| 150 | 320 | MAPP0320C | 421 | 20.0 x 15.3 x 17.8 | 9.9 x 16.4 x 7.6 |
| 185-220 | 403 | MAPP0403C | 433 | 23.2 x 15.3 x 13.7 | 11.1 x 16.4 x 7.6 |
| - | 482 | MAPP0482C | 541 | 23.3 x 15.3 x 14.8 | (2) 8.0 x 16.4 x 7.6 |
| 280 | 636 | MAPP0636C | 683 | 25.8 x 24.0 x 16.5 | (2) 9.9 x 16.4 x 7.6 |
| 375 | 786 | MAPP0786C | 781 | 25.7 x 24.0 x 17.9 | (2) 11.1 x 16.4 x 7.6 |
| 450 | 850 | MAPP0850C | 978 | 25.9 x 24.0 x 20.3 | (2) 9.9 x 16.4 x 7.6<br>8.0 x 16.4 x 7.6 |
| 525 | 1000 | MAPP1000C | 970 | 25.9 x 24.0 x 21.2 | (3) 9.9 x 16.4 x 7.6 |
| 600 | 1200 | MAPP1200C | 999 | 26.0 x 24.0 x 22.2 | (3) 11.1 x 16.4 x 7.6 |

**NOTE: Approximate weight of filter above includes weight of reactor and accompanying capacitor and/or cap-panel assembly.**

**NOTE: Reference drawings can be accessed by clicking on part number.**

# Matrix AP 380-415 Volts, 50Hz Selection Tables
# Enclosed

**Table 4-4: Matrix AP 380V-415V Enclosed**

| Motor KW | Filter Amps Rating | Part Number | NEMA 1/2 Enclosure (in.) (H x W x D) | App. Weight (lbs.) | Part Number | NEMA 3R Enclosure (in.) (H x W x D) | App. Weight (lbs.) |
|---|---|---|---|---|---|---|---|
| 1.1-2.2 | 6 | MAPG0006C | 24.0 x 12.5 x 17.9 | 67 | MAPW0006C | 24.0 x 12.5 x 23.0 | 74 |
| - | 8 | MAPG0008C | 24.0 x 12.5 x 17.9 | 68 | MAPW0008C | 24.0 x 12.5 x 23.0 | 76 |
| 3.7 | 11 | MAPG0011C | 24.0 x 12.5 x 17.9 | 75 | MAPW0011C | 24.0 x 12.5 x 23.0 | 83 |
| 5.5 | 14 | MAPG0014C | 24.0 x 12.5 x 17.9 | 82 | MAPW0014C | 24.0 x 12.5 x 23.0 | 89 |
| 7.5 | 21 | MAPG0021C | 24.0 x 12.5 x 17.9 | 99 | MAPW0021C | 24.0 x 12.5 x 23.0 | 106 |
| 11 | 27 | MAPG0027C | 24.0 x 12.5 x 17.9 | 105 | MAPW0027C | 24.0 x 12.5 x 23.0 | 113 |
| 15 | 34 | MAPG0034C | 24.0 x 12.5 x 17.9 | 117 | MAPW0034C | 24.0 x 12.5 x 23.0 | 124 |
| 18.5-22 | 44 | MAPG0044C | 24.0 x 12.5 x 17.9 | 128 | MAPW0044C | 24.0 x 12.5 x 23.0 | 136 |
| - | 52 | MAPG0052C | 33.9 x 18.3 x 20.9 | 179 | MAPW0052C | 33.9 x 18.3 x 26.0 | 189 |
| 30 | 66 | MAPG0066C | 33.9 x 18.3 x 20.9 | 192 | MAPW0066C | 33.9 x 18.3 x 26.0 | 202 |
| 37-45 | 83 | MAPG0083C | 33.9 x 18.3 x 20.9 | 225 | MAPW0083C | 33.9 x 18.3 x 26.0 | 224 |
| 55 | 103 | MAPG0103C | 33.9 x 18.3 x 20.9 | 226 | MAPW0103C | 33.9 x 18.3 x 26.0 | 237 |
| - | 128 | MAPG0128C | 51.3 x 27.7 x 24.9 | 386 | MAPW0128C | 51.3 x 27.7 x 30.0 | 399 |
| 75-90 | 165 | MAPG0165C | 51.3 x 27.7 x 24.9 | 443 | MAPW0165C | 51.3 x 27.7 x 30.0 | 456 |
| 110 | 208 | MAPG0208C | 51.3 x 27.7 x 24.9 | 460 | MAPW0208C | 51.3 x 27.7 x 30.0 | 473 |
| - | 240 | MAPG0240C | 51.3 x 27.7 x 24.9 | 493 | MAPW0240C | 51.3 x 27.7 x 30.0 | 506 |
| 150 | 320 | MAPG0320C | 76.0 x 27.7 x 24.9 | 658 | MAPW0320C | 76.0 x 27.7 x 34.0 | 683 |
| 185-220 | 403 | MAPG0403C | 76.0 x 27.7 x 24.9 | 660 | MAPW0403C | 76.0 x 27.7 x 34.0 | 687 |
| - | 482 | MAPG0482C | 87.6 x 43.7 x 31.1 | 952 | MAPW0482C | 87.6 x 43.7 x 40.1 | 997 |
| 280 | 636 | MAPG0636C | 87.6 x 43.7 x 31.1 | 1091 | MAPW0636C | 87.6 x 43.7 x 40.1 | 1138 |
| 375 | 786 | MAPG0786C | 87.6 x 43.7 x 31.1 | 1187 | MAPW0786C | 87.6 x 43.7 x 40.1 | 1232 |
| 450 | 850 | MAPG0850C | 84.0 x 52.0 x 36.5 | 1600 | MAPW0850C | 84.0 x 52.0 x 45.5 | 1641 |
| 525 | 1000 | MAPG1000C | 84.0 x 52.0 x 36.5 | 1576 | MAPW1000C | 84.0 x 52.0 x 45.5 | 1617 |
| 600 | 1200 | MAPG1200C | 84.0 x 52.0 x 36.5 | 1602 | MAPW1200C | 84.0 x 52.0 x 45.5 | 1643 |

**NOTE: Reference drawings can be accessed by clicking on part number.**

# Matrix AP 480 Volts, 60Hz Selection Tables
# Open Panel

**Table 4-5: Matrix AP 480V Open Panel**

| Motor HP | Filter Amps Rating | Part Number | App. Wt. (lbs.) | Open Magnetics (in.) (H x W x D) | Capacitor (in.) (H x W) Capacitor Panel (in.) (H x W x D) |
|---|---|---|---|---|---|
| 3 | 6 | MAPP0006D | 20 | 8.7 x 8.0 x 5.4 | 7.5 x 3.0 |
| 5 | 8 | MAPP0008D | 21 | 8.7 x 8.0 x 5.4 | 7.5 x 3.0 |
| 7.5 | 11 | MAPP0011D | 28 | 9.9 x 9.0 x 4.8 | 7.5 x 3.0 |
| 10 | 14 | MAPP0014D | 32 | 9.8 x 9.0 x 5.3 | 7.5 x 3.0 |
| 15 | 21 | MAPP0021D | 51 | 11.7 x 10.5 x 6.6 | 8.0 x 3.9 |
| 20 | 27 | MAPP0027D | 56 | 11.8 x 10.5 x 7.2 | 8.0 x 3.9 |
| 25 | 34 | MAPP0034D | 67 | 11.7 x 10.5 x 7.7 | 8.0 x 3.9 |
| 30 | 44 | MAPP0044D | 80 | 11.7 x 10.5 x 8.2 | 8.3 x 4.6 |
| 40 | 52 | MAPP0052D | 103 | 14.0 x 12.0 x 9.1 | 9.2 x 4.6 |
| 50 | 66 | MAPP0066D | 116 | 14.0 x 12.0 x 9.0 | 9.2 x 4.6 |
| 60 | 83 | MAPP0083D | 139 | 14.0 x 12.0 x 10.9 | 10.6 x 4.6 |
| 75 | 103 | MAPP0103D | 151 | 14.1 x 12.0 x 11.0 | 10.6 x 4.6 |
| 100 | 128 | MAPP0128D | 204 | 20.0 x 15.3 x 10.7 | 6.7 x 16.4 x 7.6 |
| 125 | 165 | MAPP0165D | 233 | 20.0 x15.3 x 11.8 | 6.7 x 16.4 x 7.6 |
| 150 | 208 | MAPP0208D | 286 | 20.1 x 15.3 x 11.8 | 6.7 x 16.4 x 7.6 |
| 200 | 240 | MAPP0240D | 323 | 20.0 x 15.3 x 12.7 | 6.7 x 16.4 x 7.6 |
| 250 | 320 | MAPP0320D | 418 | 20.0 x 15.3 x 14.8 | 8.0 x16.4 x 7.6 |
| 300 | 403 | MAPP0403D | 418 | 23.3 x 15.3 x 13.7 | 9.9 x 16.4 x 7.6 |
| 400 | 482 | MAPP0482D | 533 | 23.3 x 15.3 x 14.8 | (2) 6.7 x 16.4 x 7.6 |
| 500 | 636 | MAPP0636D | 667 | 25.8 x 24.0 x 16.5 | (2) 8.0 x 16.4 x 7.6 |
| 600 | 786 | MAPP0786D | 774 | 25.7 x 24.0 x 17.9 | (2) 9.9 x 16.4 x 7.6 |
| 700 | 850 | MAPP0850D | 967 | 25.9 x 24.0 x 20.3 | (2) 6.7 x 16.4 x 7.6<br>8.0 x 16.4 x 7.6 |
| 900 | 1000 | MAPP1000D | 945 | 25.9 x 24.0 x 21.2 | (2) 8.0 x 16.4 x 7.6<br>9.9 x 16.4 x 7.6 |
| 1000 | 1200 | MAPP1200D | 980 | 26.0 x 24.0 x 22.2 | (3) 9.9 x 16.4 x 7.6 |
| 1300 | 1600 | MAPP1600D | 2272 | 33.4 x 36.0 x 29.3 | (4) 9.9 x 16.4 x 7.6 |
| 1500 | 2000 | MAPP2000D | 2678 | 33.6 x 36.0 x 31.3 | (5) 9.9 x 16.4 x 7.6 |
| 1850 | 2300 | MAPP2300D | 2893 | 33.4 x 36.0 x 32.4 | (6) 9.9 x 16.4 x 7.6 |

**NOTE: Approximate weight of filter above includes weight of reactor and accompanying capacitor and/or cap-panel assembly.**

**NOTE: Reference drawings can be accessed by clicking on part number.**

# Matrix AP 480 Volts, 60Hz Selection Tables
# Enclosed

**Table 4-6: Matrix AP 480V Enclosed**

| Motor HP | Filter Amps Rating | Part Number | NEMA 1/2 Enclosure (in.) (H x W x D) | App. Weight (lbs.) | Part Number | NEMA 3R Enclosure (in.) (H x W x D) | App. Weight (lbs.) |
|---|---|---|---|---|---|---|---|
| 3 | 6 | MAPG0006D | 24.0 x 12.5 x 17.9 | 67 | MAPW0006D | 24.0 x 12.5 x 23.0 | 75 |
| 5 | 8 | MAPG0008D | 24.0 x 12.5 x 17.9 | 68 | MAPW0008D | 24.0 x 12.5 x 23.0 | 76 |
| 7.5 | 11 | MAPG0011D | 24.0 x 12.5 x 17.9 | 75 | MAPW0011D | 24.0 x 12.5 x 23.0 | 83 |
| 10 | 14 | MAPG0014D | 24.0 x 12.5 x 17.9 | 80 | MAPW0014D | 24.0 x 12.5 x 23.0 | 88 |
| 15 | 21 | MAPG0021D | 24.0 x 12.5 x 17.9 | 99 | MAPW0021D | 24.0 x 12.5 x 23.0 | 106 |
| 20 | 27 | MAPG0027D | 24.0 x 12.5 x 17.9 | 104 | MAPW0027D | 24.0 x 12.5 x 23.0 | 112 |
| 25 | 34 | MAPG0034D | 24.0 x 12.5 x 17.9 | 114 | MAPW0034D | 24.0 x 12.5 x 23.0 | 122 |
| 30 | 44 | MAPG0044D | 24.0 x 12.5 x 17.9 | 128 | MAPW0044D | 24.0 x 12.5 x 23.0 | 135 |
| 40 | 52 | MAPG0052D | 33.9 x 18.3 x 20.9 | 177 | MAPW0052D | 33.9 x 18.3 x 26.0 | 188 |
| 50 | 66 | MAPG0066D | 33.9 x 18.3 x 20.9 | 190 | MAPW0066D | 33.9 x 18.3 x 26.0 | 201 |
| 60 | 83 | MAPG0083D | 33.9 x 18.3 x 20.9 | 212 | MAPW0083D | 33.9 x 18.3 x 26.0 | 219 |
| 75 | 103 | MAPG0103D | 33.9 x 18.3 x 20.9 | 226 | MAPW0103D | 33.9 x 18.3 x 26.0 | 237 |
| 100 | 128 | MAPG0128D | 51.3 x 27.7 x 24.9 | 370 | MAPW0128D | 51.3 x 27.7 x 30.0 | 383 |
| 125 | 165 | MAPG0165D | 51.3 x 27.7 x 24.9 | 437 | MAPW0165D | 51.3 x 27.7 x 30.0 | 450 |
| 150 | 208 | MAPG0208D | 51.3 x 27.7 x 24.9 | 452 | MAPW0208D | 51.3 x 27.7 x 30.0 | 464 |
| 200 | 240 | MAPG0240D | 51.3 x 27.7 x 24.9 | 488 | MAPW0240D | 51.3 x 27.7 x 30.0 | 501 |
| 250 | 320 | MAPG0320D | 76.0 x 27.7 x 24.9 | 655 | MAPW0320D | 76.0 x 27.7 x 34.0 | 680 |
| 300 | 403 | MAPG0403D | 76.0 x 27.7 x 24.9 | 655 | MAPW0403D | 76.0 x 27.7 x 34.0 | 680 |
| 400 | 482 | MAPG0482D | 87.6 x 43.7 x 31.1 | 944 | MAPW0482D | 87.6 x 43.7 x 40.1 | 989 |
| 500 | 636 | MAPG0636D | 87.6 x 43.7 x 31.1 | 1084 | MAPW0636D | 87.6 x 43.7 x 40.1 | 1129 |
| 600 | 786 | MAPG0786D | 87.6 x 43.7 x 31.1 | 1180 | MAPW0786D | 87.6 x 43.7 x 40.1 | 1225 |
| 700 | 850 | MAPG0850D | 84.0 x 52.0 x 36.5 | 1589 | MAPW0850D | 84.0 x 52.0 x 45.5 | 1630 |
| 900 | 1000 | MAPG1000D | 84.0 x 52.0 x 36.5 | 1565 | MAPW1000D | 84.0 x 52.0 x 45.5 | 1606 |
| 1000 | 1200 | MAPG1200D | 84.0 x 52.0 x 36.5 | 1593 | MAPW1200D | 84.0 x 52.0 x 45.5 | 1635 |

**NOTE: Reference drawings can be accessed by clicking on part number.**

# Matrix AP 600 Volts, 60Hz Selection Tables
# Open Panel

**Table 4-7: Matrix AP 600V Open Panel**

| Motor HP | Filter Amps Rating | Part Number | App. Wt. (lbs.) | Open Magnetics (in.) (H x W x D) | Capacitor (in.) (H x D) Capacitor Panel (in.) (H x W x D) |
|---|---|---|---|---|---|
| 5 | 6 | MAPP0006E | 20 | 8.7 x 8.0 x 5.4 | 7.5 x 3.0 |
| 5 | 8 | MAPP0008E | 28 | 9.8 x 9.0 x 4.8 | 7.5 x 3.0 |
| 10 | 11 | MAPP0011E | 43 | 9.8 x 9.0 x 5.3 | 7.5 x 3.0 |
| 10 | 14 | MAPP0014E | 60 | 11.7 x 10.5 x 6.7 | 9.2 x 4.6 |
| 15 | 21 | MAPP0021E | 60 | 11.7 x 10.5 x 7.2 | 7.5 x 3.9 |
| 25 | 27 | MAPP0027E | 69 | 11.7 x 10.5 x 7.7 | 8.3 x 4.6 |
| 30 | 34 | MAPP0034E | 89 | 11.7 x 10.5 x 8.2 | 8.3 x 4.6 |
| 40 | 44 | MAPP0044E | 137 | 14.0 x 12.0 x 9.9 | 9.2 x 4.6 |
| 50 | 52 | MAPP0052E | 140 | 14.1 x 12.0 x 10.3 | 9.2 x 4.6 |
| 60 | 66 | MAPP0066E | 166 | 14.0 x 12.0 x 11.0 | 10.6 x 4.6 |
| 75 | 83 | MAPP0083E | 148 | 14.1 x 12.0 x 10.9 | 10.6 x 4.6 |
| 100 | 103 | MAPP0103E | 205 | 20.0 x 15.3 x 10.7 | 6.7 x 16.4 x 7.6 |
| 125 | 128 | MAPP0128E | 269 | 20.0 x 15.3 x 11.7 | 6.7 x 16.4 x 7.6 |
| 150 | 165 | MAPP0165E | 287 | 20.1 x15.3 x 11.9 | 6.7 x 16.4 x 7.6 |
| 200 | 208 | MAPP0208E | 328 | 20.1 x 15.3 x 12.8 | 7.7 x 16.4 x 7.6 |
| 250 | 240 | MAPP0240E | 427 | 19.9 x 15.3 x 15.8 | 7.7 x 16.4 x 7.6 |
| 300 | 320 | MAPP0320E | 500 | 23.3 x 15.3 x 15.8 | 9.2 x 16.4 x 7.6 |
| 400 | 403 | MAPP0403E | 510 | 23.3 x 15.3 x16.1 | 12.1 x 16.4 x 7.6 |
| 500 | 482 | MAPP0482E | 670 | 25.9 x 24.0 x16.6 | (2) 7.7 x 16.4 x 7.6 |
| 600 | 636 | MAPP0636E | 754 | 25.9 x 24.0 x 17.7 | (2) 9.2 x 16.4 x 7.6 |
| 800 | 786 | MAPP0786E | 931 | 26.0 x 24.0 x 19.5 | (2) 12.1 x 16.4 x 7.6 |

**NOTE: Approximate weight of filter above includes weight of reactor and accompanying capacitor and/or cap-panel assembly.**

**NOTE: Reference drawings can be accessed by clicking on part number.**

# Matrix AP 600 Volts, 60Hz Selection Tables
# Enclosed

**Table 4-8: Matrix AP 600V Enclosed**

| Motor HP | Filter Amps Rating | Part Number | NEMA 1/2 Enclosure (in.) (H x W x D) | App. Weight (lbs.) | Part Number | NEMA 3R Enclosure (in.) (H x W x D) | App. Weight (lbs.) |
|---|---|---|---|---|---|---|---|
| 5 | 6 | MAPG0006E | 24.0 x 12.5 x 17.9 | 68 | MAPW0006E | 24.0 x 12.5 x 23.0 | 75 |
| 5 | 8 | MAPG0008E | 24.0 x 12.5 x 17.9 | 75 | MAPW0008E | 24.0 x 12.5 x 23.0 | 83 |
| 10 | 11 | MAPG0011E | 24.0 x 12.5 x 17.9 | 79 | MAPW0011E | 24.0 x 12.5 x 23.0 | 88 |
| 10 | 14 | MAPG0014E | 24.0 x 12.5 x 17.9 | 95 | MAPW0014E | 24.0 x 12.5 x 23.0 | 102 |
| 15 | 21 | MAPG0021E | 24.0 x 12.5 x 17.9 | 107 | MAPW0021E | 24.0 x 12.5 x 23.0 | 115 |
| 25 | 27 | MAPG0027E | 24.0 x 12.5 x 17.9 | 117 | MAPW0027E | 24.0 x 12.5 x 23.0 | 125 |
| 30 | 34 | MAPG0034E | 24.0 x 12.5 x 17.9 | 126 | MAPW0034E | 24.0 x 12.5 x 23.0 | 133 |
| 40 | 44 | MAPG0044E | 33.9 x 18.3 x 20.9 | 198 | MAPW0044E | 33.9 x 18.3 x 26.0 | 209 |
| 50 | 52 | MAPG0052E | 33.9 x 18.3 x 20.9 | 202 | MAPW0052E | 33.9 x 18.3 x 26.0 | 213 |
| 60 | 66 | MAPG0066E | 33.9 x 18.3 x 20.9 | 241 | MAPW0066E | 33.9 x 18.3 x 26.0 | 252 |
| 75 | 83 | MAPG0083E | 33.9 x 18.3 x 20.9 | 224 | MAPW0083E | 33.9 x 18.3 x 26.0 | 235 |
| 100 | 103 | MAPG0103E | 51.3 x 27.7 x 24.9 | 371 | MAPW0103E | 51.3 x 27.7 x 30.0 | 384 |
| 125 | 128 | MAPG0128E | 51.3 x 27.7 x 24.9 | 436 | MAPW0128E | 51.3 x 27.7 x 30.0 | 449 |
| 150 | 165 | MAPG0165E | 51.3 x 27.7 x 24.9 | 455 | MAPW0165E | 51.3 x 27.7 x 30.0 | 468 |
| 200 | 208 | MAPG0208E | 51.3 x 27.7 x 24.9 | 488 | MAPW0208E | 51.3 x 27.7 x 30.0 | 494 |
| 250 | 240 | MAPG0240E | 76.0 x 27.7 x 24.9 | 661 | MAPW0240E | 76.0 x 27.7 x 34.0 | 687 |
| 300 | 320 | MAPG0320E | 76.0 x 27.7 x 24.9 | 738 | MAPW0320E | 76.0 x 27.7 x 34.0 | 764 |
| 400 | 403 | MAPG0403E | 87.6 x 43.7 x 31.1 | 914 | MAPW0403E | 87.6 x 43.7 x 40.1 | 959 |
| 500 | 482 | MAPG0482E | 87.6 x 43.7 x 31.1 | 1091 | MAPW0482E | 87.6 x 43.7 x 40.1 | 1136 |
| 600 | 636 | MAPG0636E | 87.6 x 43.7 x 31.1 | 1230 | MAPW0636E | 87.6 x 43.7 x 40.1 | 1275 |
| 800 | 786 | MAPG0786E | 84.0 x 52.0 x 36.5 | 1535 | MAPW0786E | 84.0 x 52.0 x 45.5 | 1576 |

**NOTE: Reference drawings can be accessed by clicking on part number.**

# Matrix AP 690 Volts, 50Hz Selection Tables
# Open Panel

**Table 4-9: Matrix AP 690V Open Panel**

| Motor KW | Filter Amps Rating | Part Number | App. Wt. (lbs.) | Open Magnetics (in.) (H x W x D) | Capacitor (in.) (H x D) Capacitor Panel (in.) (H x W x D) |
|---|---|---|---|---|---|
| 37 | 52 | MAPP0052F | 191 | 19.8 x 15.3 x 11.1 | 6.7 x 16.4 x 7.6 |
| 45 | 66 | MAPP0066F | 207 | 19.8 x 15.3 x 11.2 | 7.7 x 16.4 x 7.6 |
| 55 | 83 | MAPP0083F | 254 | 19.8 x 15.3 x 11.6 | 6.7 x 16.4 x 7.6 |
| 75 | 103 | MAPP0103F | 242 | 20.1 x 15.3 x 11.7 | 9.2 x 16.4 x 7.6 |
| 90 | 128 | MAPP0128F | 324 | 19.9 x 15.3 x 12.7 | 8.0 x 16.4 x 7.6 |
| 110 | 165 | MAPP0165F | 408 | 19.9 x 15.3 x 14.8 | 10.7 x 16.3 x 7.6 |
| 150 | 208 | MAPP0208F | 449 | 23.1 x 15.3 x 13.7 | 6.7 x 16.4 x 7.6<br>7.7 x 16.4 x 7.6 |
| 185 | 240 | MAPP0240F | 504 | 23.2 x 15.3 x 14.9 | 7.7 x 16.4 x 7.6<br>8.0 x 16.4 x 7.6 |
| 222 | 320 | MAPP0320F | 672 | 25.9 x 24.0 x 16.7 | (2) 9.9 x 16.4 x 7.6 |
| 280 | 403 | MAPP0403F | 982 | 25.8 x 24.0 x 17.8 | 6.7 x 16.4 x 7.6<br>(2) 9.9 x 16.4 x 7.6 |
| 375 | 482 | MAPP0482F | 1167 | 25.9 x 24.0 x 19.0 | (3) 9.9 x 16.4 x 7.6 |
| 450 | 636 | MAPP0636F | 1089 | 25.9 x 24.0 x 21.6 | 11.1 x 16.4 x 7.6<br>(2) 11.1 x 16.4 x 7.6 |

**NOTE: Approximate weight of filter above includes weight of reactor and accompanying capacitor and/or cap-panel assembly.**

**NOTE: Reference drawings can be accessed by clicking on part number.**

# 5. HOW TO INSTALL

## Installation Checklist

| | |
|---|---|
|  **WARNING** | Prior to installation, please refer to all general warnings on pages 1 & 2. Failure to practice this can result in body injury! |
| | Input and output wiring to the filter should be performed by authorized personnel in accordance with NEC and all local electrical codes and regulations. |
|  **WARNING** | The filter is designed for use with copper conductors with a minimum temperature rating of 75 degrees C. |
| | **Do not install capacitor assembly above/near the Harmonic Mitigating Reactor. Premature or catastrophic failure may occur.** |

Matrix AP filters are supplied in the following mechanical configurations:

- Open Panel Mount: Open panel units consist of a reactor and one or more capacitor panel modules referred to as cap-panels on drawings and diagrams. Additional wiring between the reactor and capacitor/capacitor panel is required by customer.
- Floor mounted general purpose NEMA 1/2, & NEMA 3R cabinets: Reactor and capacitor/capacitor assemblies are supplied in a cabinet with all items pre-wired together.

**Minimum Required Space:**

Open panel filters are designed for mounting 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. A general guideline is to allow a side clearance of four (4) inches and a vertical clearance of six (6) inches for proper heat dissipation and access within the enclosure. Clearances may be less if proper ventilation exists. Filter components must operate within temperatures specified in this manual or filter operating life will be compromised. Also, be aware of minimum electrical clearances as defined by the appropriate system safety standard(s). Open panel Matrix AP filters generate heat and should be positioned away from heat sensitive components. Ensure that proper panel orientation is maintained. Avoid locations where the filter would be subjected to excessive vibrations. Locate the filter as close to the drive as possible.

**NOTE: Locate the capacitor panel in the lowest temperature regions of the enclosure – generally toward the bottom and away from high temperature components.**

General purpose NEMA 1/2, and NEMA 3R enclosed filters are designed for floor mounting in an environment suitable for the enclosure type. Do not install in or near a corrosive environment. 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. For lower ambient temperatures and increased air flow clearance distances can be reduced.

# Grounding

| | |
|---|---|
| **WARNING** | The filter must always be grounded with a grounding conductor connected to ground terminals. |
| | For open panel units, ensure a 2” x 2” area is cleaned of paint and varnish on lower mounting bracket for ground connection. |

**NOTE: For cable shield grounding follow the drive manufacturer’s recommendations.**

## 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.

## Overtemperature Interlock

An overtemperature interlock circuit should be used in conjunction with thermal switch to turn off the drive to prevent filter damage due to abnormal operating conditions. The temperature switch is normally closed and will open when an internal reactor temperature of 180°C is reached. See Table 5-1: Overtemperature Switch below for contact rating information and the drive user manual for interconnection information.

**Table 5-1: Overtemperature Switch**

| ***NC Switch*** opens at 180 Deg. +/- 5 Deg. C | | |
|---|---|---|
| **Current Amps** | **Voltage** | **Contact Load** |
| 6 | 120 AC | Resistive Loads |
| 3 | 120 AC | Inductive Loads |
| 3 | 240 AC | Resistive Loads |
| 2.5 | 240 AC | Inductive Loads |
| 8 | 12 VDC | Resistive Loads |
| 4 | 24 VDC | Resistive Loads |

MTE highly recommends the use of the overtemperature switch to prevent damage to the filter in rare instances of overheating from abnormal operating conditions.

# 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.<br>Cable lugs and mounting hardware are provided by the customer. |
| | Any extremely low or high resistance readings indicate a mis-wire and may result in damage to filter components if not corrected. |
| | On NEMA 3R enclosures, CAB-26AP and larger, no live parts shall be mounted below 8 inches from the bottom of the enclosure. |

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.

- For panel mounted filter applications, interconnection between the filter, its power source, the cap-panels, and the drive is shown in Figure 5-2: Open Panel Interconnection **(p31)**.

- For filters supplied in general purpose NEMA 1/2 & NEMA 3R cabinets, interconnection between the filter, its power source, and the drive is shown in Figure 5-3: Enclosed Interconnection **(p32)**.

Wire gauge range and terminal torque requirements as well as selecting conductors that interconnect the HMR and capacitor assemblies are shown in:

- Table 5-3: Torque Ratings – 208V-240V **(p38)**
- Table 5-4: Torque Ratings – 380V-415V **(p39)**
- Table 5-5: Torque Ratings – 480V **(p40)**
- Table 5-6: Torque Ratings – 600V **(p41)**
- Table 5-7: Torque Ratings – 690V **(p42)**

Filters that use multiple cap-panels share total cap current are shown in:

- Table 3-2: Watt Loss - Matrix AP 208V-240V, 60Hz **(p6)**
- Table 3-3: Watt Loss - Matrix AP 380V-415V, 50Hz **(p7)**
- Table 3-4: Watt Loss - Matrix AP 480V, 60Hz **(p8)**
- Table 3-5: Watt Loss - Matrix AP 600V, 60Hz **(p9)**
- Table 3-6: Watt Loss - Matrix AP 690V, 50Hz **(p10)**

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

The filter is designed for use with copper conductors with a minimum temperature rating of 75 degrees C.

## Wiring Checks

Using Figure 5-1: Basic Schematic Diagram **(p30)** and Figure 5-3: Enclosed Interconnection **(p32)**, visually check the wired components to confirm, verify, and correct wiring. Then, with a multi meter, check phase to phase isolation using the 100 K ohm range. The multi meter will read the parallel equivalent of the bleeder resistors after the capacitors initially charge. All phase to phase resistance values should be the same.

## Check for the Following Faults:

- Capacitor shorted
- Capacitor bus not connected
- Capacitor bus to chassis short
- Paralleling wiring errors

## Basic Schematic Diagram

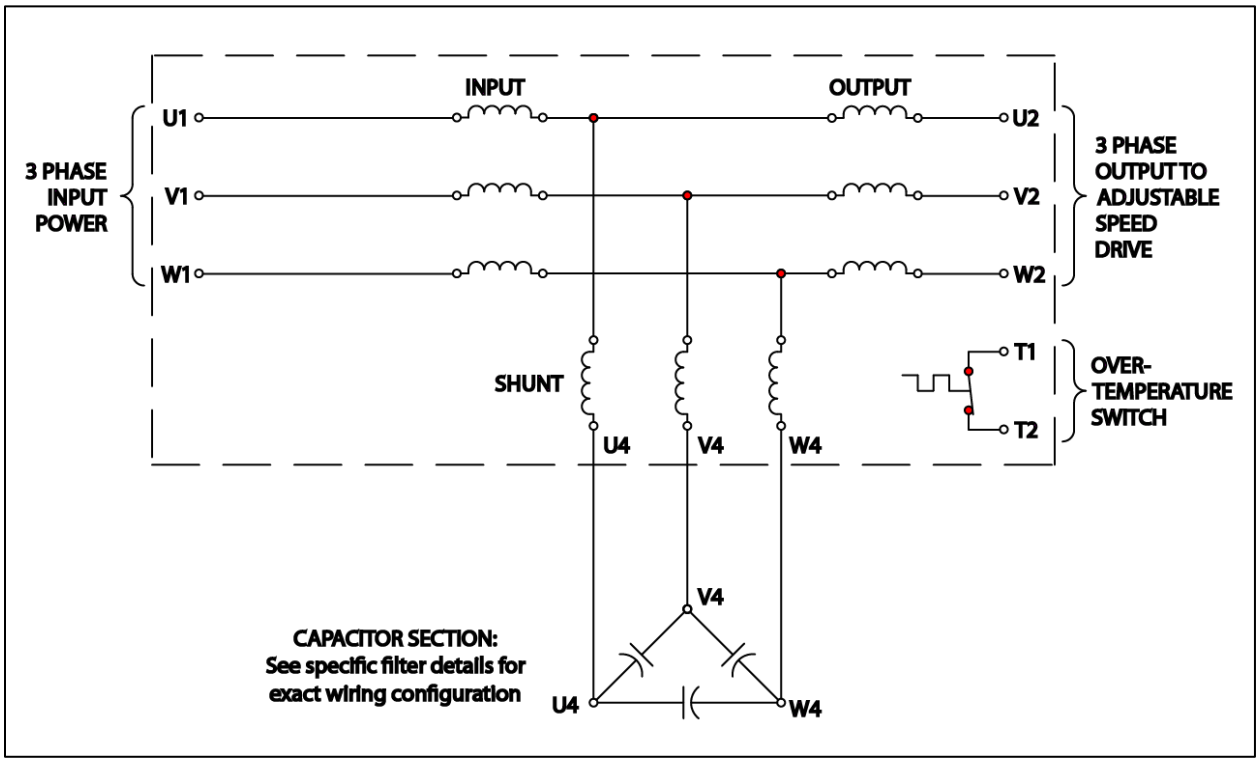


**Figure 5-1: Basic Schematic Diagram**

***NOTE: Drawing depicts delta configuration for capacitors, 690V filters are connected in a WYE configuration.***

# Open Panel Unit Interconnection Diagram

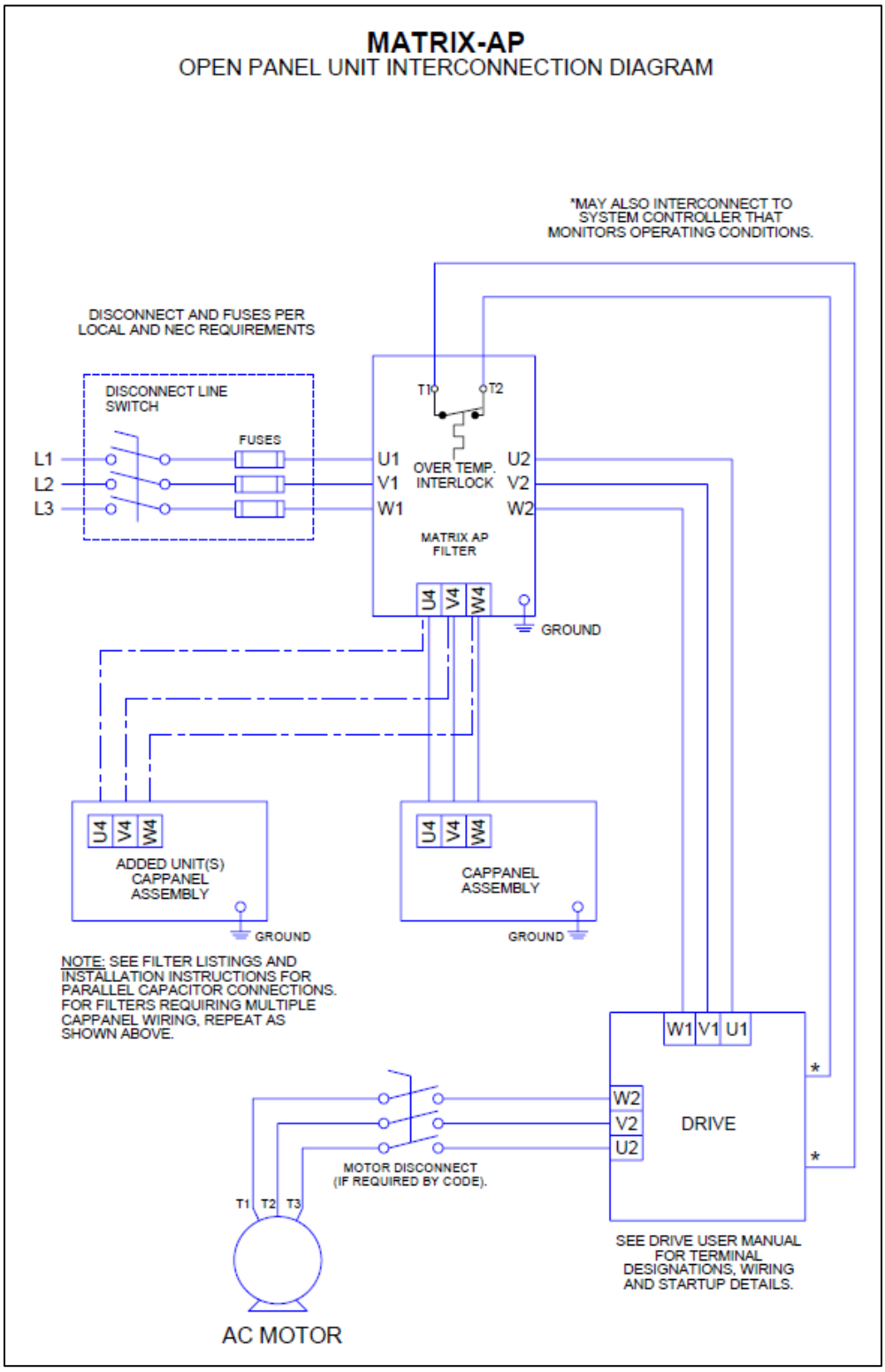


**Figure 5-2: Open Panel Interconnection**

# Enclosed Unit Interconnection Diagram

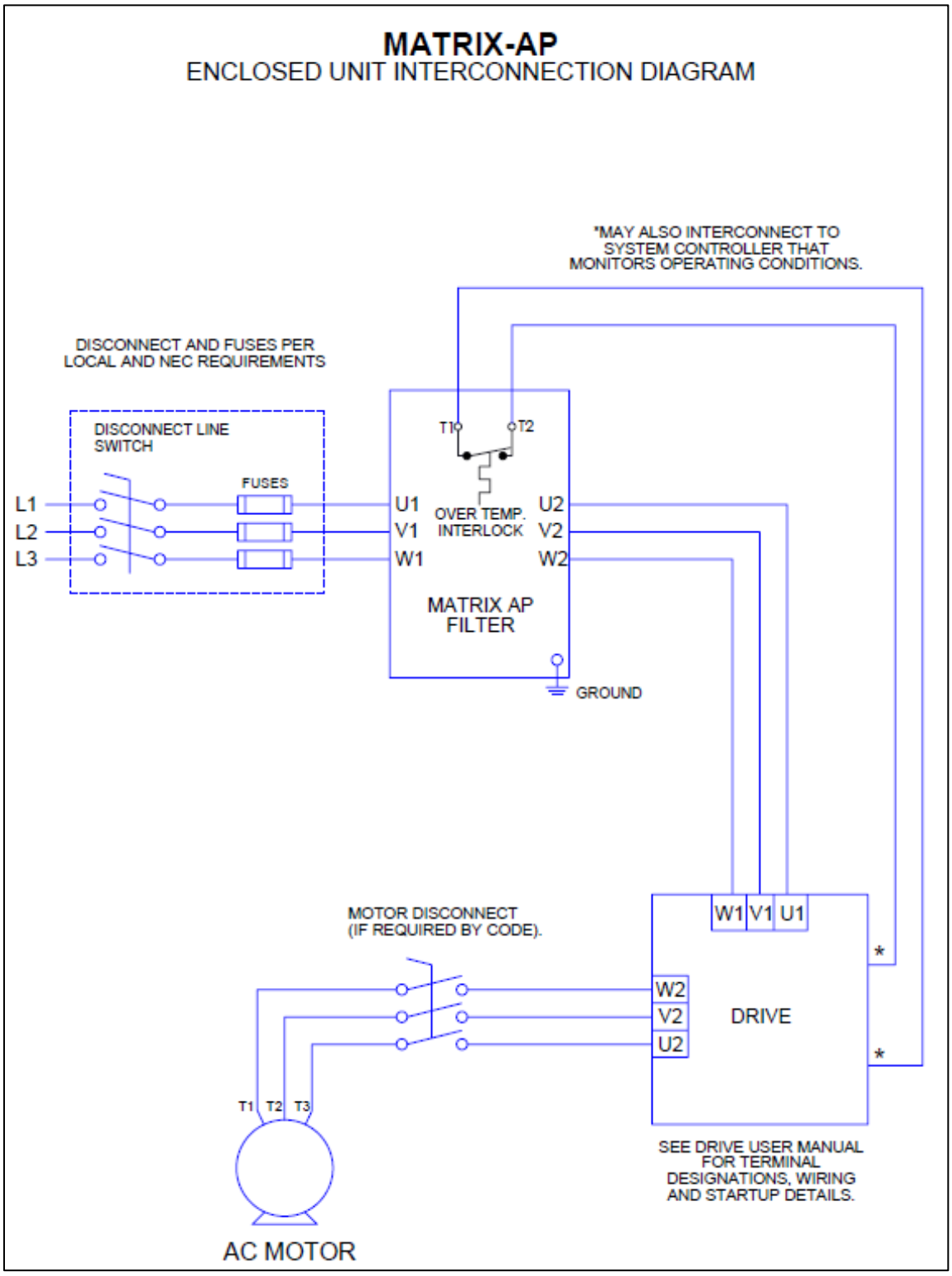


**Figure 5-3: Enclosed Interconnection**

# Contactor Option

## Option – 002

Capacitor contactor

This option provides a contactor to disconnect the filter capacitor bank when the drive is not running. The contactor is supplied with NO/NC auxiliary contacts. The contactor coil and auxiliary contacts are wired to a customer terminal block. This option is provided pre-wired complete for enclosed filters and as loose parts for open panel filters.

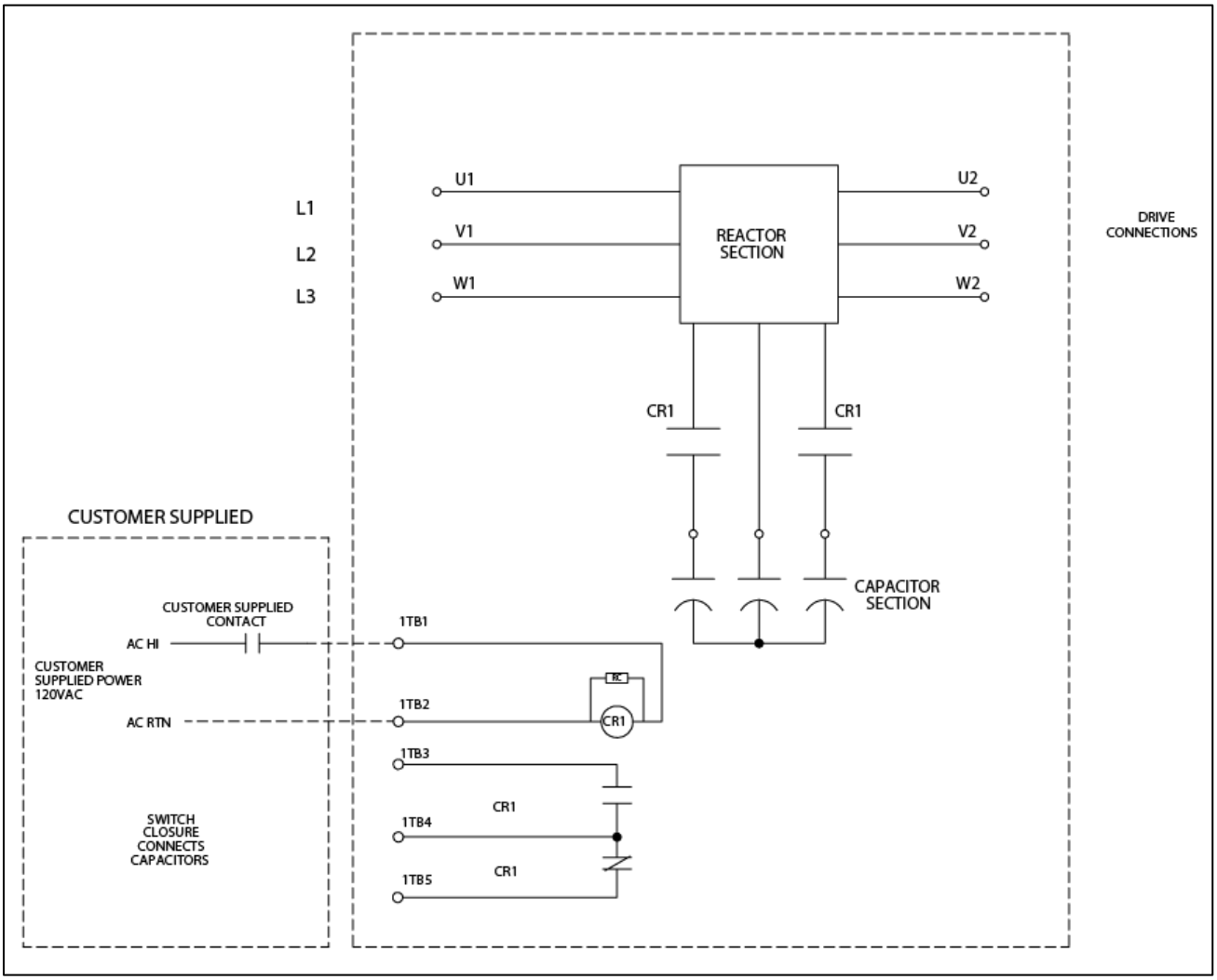


**Figure 5-4: Contactor Option – 002**

**NOTE: The above contactor option diagram is provided to help understand the circuit function and does not reflect actual circuit wiring.**

## Option – 009

Capacitor contactor with adjustable pick up and drop out

This option provides a contactor to disconnect the filter capacitor bank based on the motor load current. Two current operated switches provide independent adjustment of the pick-up and drop current levels. The switches are preset at the factory for pick up at 35% and drop out at 20% of the filter output current rating. This option is only available for enclosed filters.

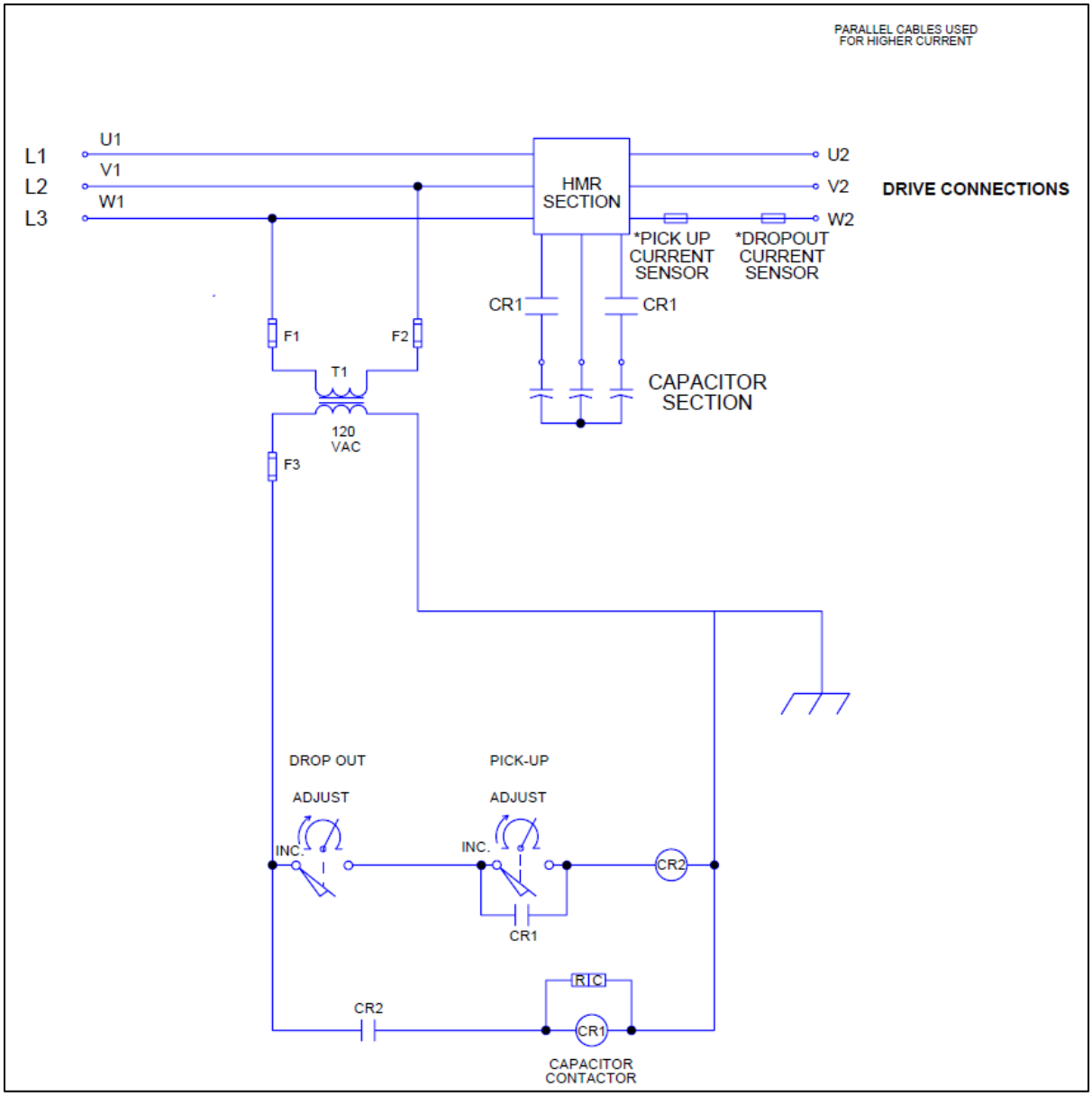


**Figure 5-5: Contactor Option – 009**

**NOTE: The above contactor option diagram is provided to help understand the circuit function and does not reflect actual circuit wiring.**

## Option – 012

Capacitor contactor with control transformer

This option provides a control transformer to power the capacitor contactor. The contactor is provided with NO/NC auxiliary contacts. For filter ratings 165 amps and above a pilot relay is also provided to limit inrush current below 0.60 amps. Connections are wired to a customer terminal block. This option is only available for enclosed filters.

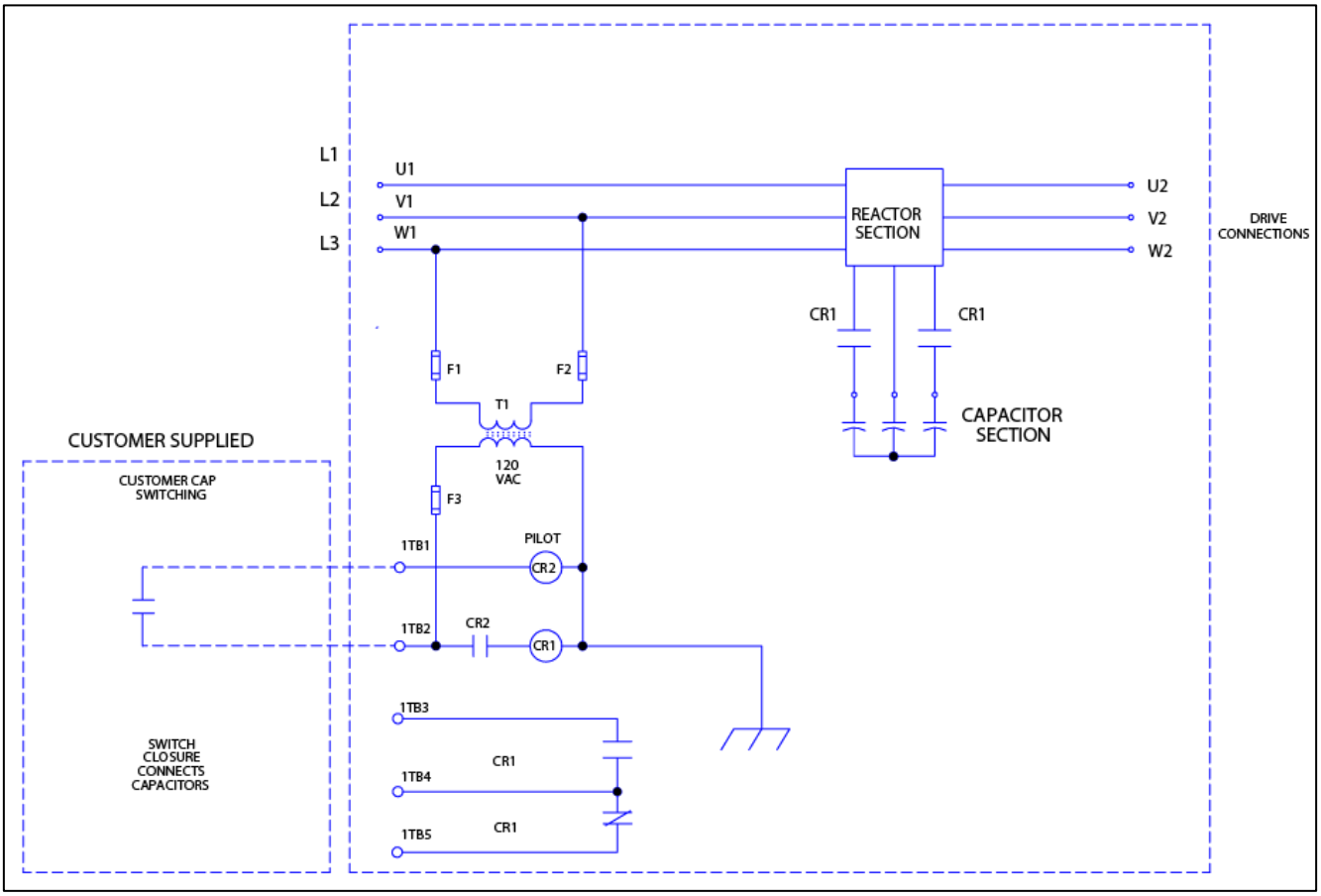


**Figure 5-6: Contactor Option – 012**

**NOTE: The above contactor option diagram is provided to help understand the circuit function and does not reflect actual circuit wiring.**

## Option – 013

Filter bypass and capacitor contactor with control transformer

This option provides a 120 VAC control transformer to power the capacitor and bypass contactors. Contactors are provided with NO/NC auxiliary contacts. For filter ratings 44 amps and above pilot relays are also provided to limit inrush currents below 0.60 amps. A jumper selection provides single contact switching for normal bypass control with capacitor removal. Connections are wired to a customer terminal block. To incorporate this option for a selected filter current rating use the part numbers shown below and select the option list price from the table below. This option is only available for enclosed filters.

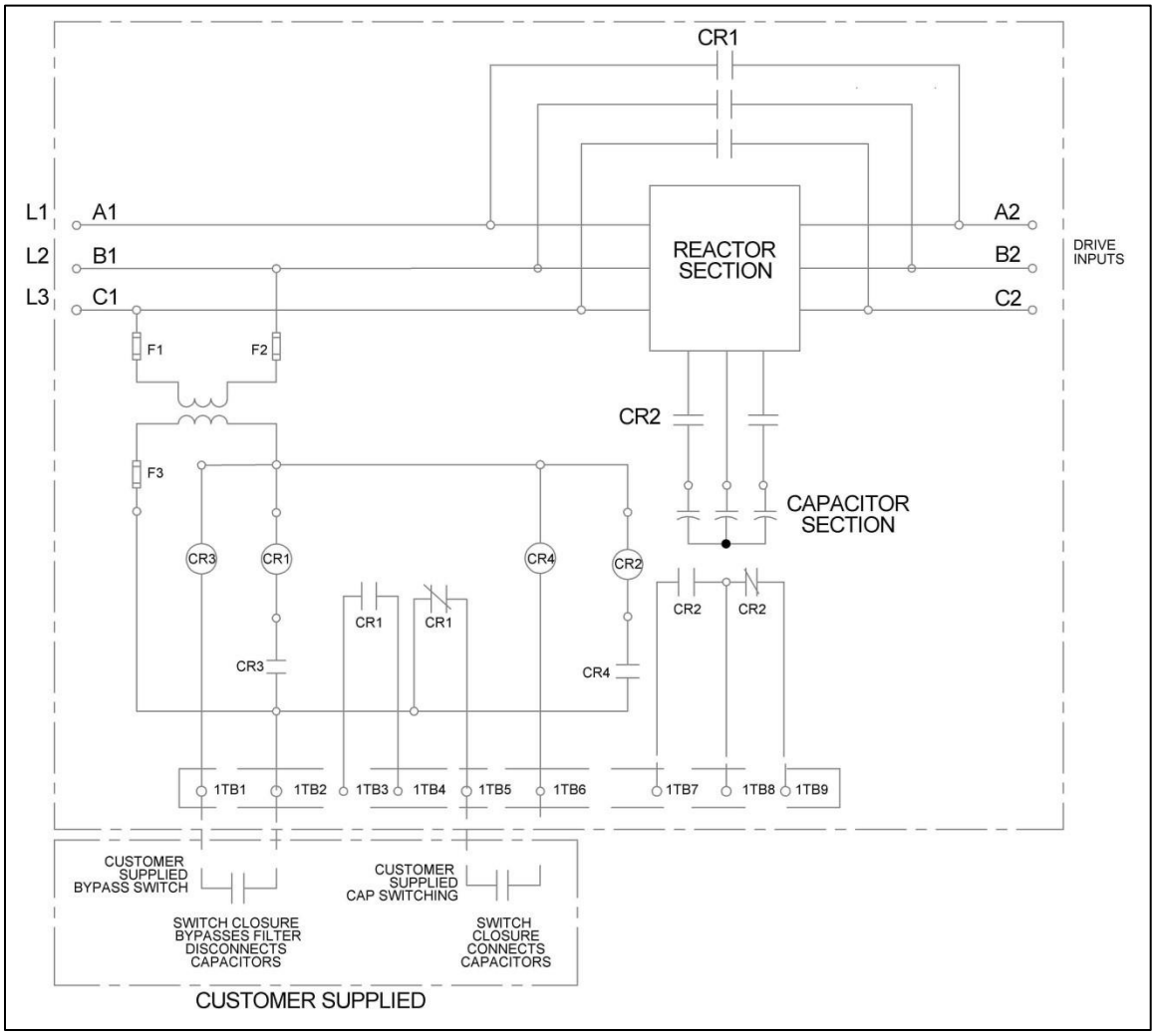


**Figure 5-7: Contactor Option – 013**

**NOTE: The above contactor option diagram is provided to help understand the circuit function and does not reflect actual circuit wiring.**

# Contactor Coil Switching Currents

## Option – 002

The following table indicates the 120 VAC 50/60 Hz current required to switch and hold the various size contactors used in Matrix Filter capacitor switching and bypass options. This data is provided to select the proper switch rating to remotely control the contactor and is consistent for the 208V-240V, 380V-415V, 480V, and 600V units.

Contactor Currents for 120 VAC 60 Hz coils.

**Table 5-2: Contactor Coil Switching Currents**

| Matrix filter current Rating AMPS | Capacitor Contactor Option 002 AMPS | |
|---|---|---|
| | ***INRUSH*** | ***SEALED*** |
| 6 | 0.341 | 0.054 |
| 8 | 0.341 | 0.054 |
| 11 | 0.341 | 0.054 |
| 14 | 0.341 | 0.054 |
| 21 | 0.341 | 0.054 |
| 27 | 0.341 | 0.054 |
| 34 | 0.341 | 0.054 |
| 44 | 0.341 | 0.054 |
| 52 | 0.341 | 0.054 |
| 66 | 0.341 | 0.054 |
| 83 | 0.341 | 0.054 |
| 103 | 0.341 | 0.054 |
| 128 | 0.922 | 0.064 |
| 165 | 1.70 | 0.304 |
| 208 | 1.70 | 0.304 |
| 240 | 2.00 | 0.42 |
| 320 | 1.41 | 0.025 |
| 403 | 1.41 | 0.025 |
| 482 | 2.08 | 0.036 |
| 636 | 2.08 | 0.036 |
| 786 | 3.75 | 0.036 |
| 850 | 3.75 | 0.036 |
| 1000 | 3.75 | 0.036 |
| 1200 | 3.75 | 0.036 |

# Torque Ratings Matrix AP 208V-240V

**Table 5-3: Torque Ratings – 208V-240V**

| Filter Rating (Amps) | Matrix AP HMR Terminals | | | Cap-panel Terminals U4-V4-W4 | | |
|---|---|---|---|---|---|---|
| | Input /Output Power U1-V1-W1 / U2-V2-W2 | | U4-V4-W4 interconnect Cap-panel | 208V-240V Capacitor/ Cap-panel Part Number | Minimum Interconnect Wire Gauge (AWG) | Terminal Torque (in-lbs.) |
| | Wire Range (AWG) | Terminal Torque (in-lbs.) | Terminal Torque (in-lbs.) | | | |
| 6 | 14-6 | 16 | 16 | CAP-352TP | 14 | 23 |
| 8 | 14-6 | 16 | 16 | CAP-352TP | 14 | 23 |
| 11 | 14-6 | 16 | 16 | CAP-366TP | 14 | 23 |
| 14 | 14-6 | 16 | 16 | CAP-342TP | 14 | 23 |
| 21 | 14-6 | 16 | 16 | CAP-369TP | 14 | 23 |
| 27 | 14-6 | 16 | 16 | CAP-356TP | 14 | 23 |
| 34 | 14-6 | 16 | 16 | CAP-357TP | 12 | 23 |
| 44 | 14-6 | 16 | 16 | CAP-373TP | 12 | 23 |
| 52 | 14-6 | 16 | 16 | CAP-374TP | 10 | 23 |
| 66 | 18-4 | 16 | 16 | CAP-375TP | 10 | 23 |
| 83 | Flat copper tab | 16 | 16 | CAP-377TP | 10 | 23 |
| 103 | Flat copper tab | 16 | 16 | CAP-358TP<br>CAP-359TP | 10 | 23 |
| 128 | Flat copper tab | 16 | 16 | CAP-348TP<br>CAP-358TP | 10 | 23 |
| 165 | Flat copper tab | 16 | 16 | CAP-358TP<br>CAP-376TP | 10 | 23 |
| 208 | Flat copper tab | 16 | 16 | (2) CAP-376TP | 8 | 23 |
| 240 | Flat copper tab | 16 | 16 | CAPPANEL-153 | 4 | 60 |
| 320 | Flat copper tab | 16 | 16 | CAPPANEL-154 | 2 | 60 |
| 403 | Flat copper tab | 16 | 16 | CAPPANEL-155 | 2 | 60 |

***NOTE: Cap-panel interconnect wiring specification according to UL508 75° C Table.***

***NOTE: To prevent flexing or bending of the coil windings attached to AP HMR Flat copper terminal tabs, use two wrenches to tighten customer provided cable mounting hardware.***

# Torque Ratings Matrix AP 380V-415V

**Table 5-4: Torque Ratings – 380V-415V**

| Filter Rating (Amps) | Matrix AP HMR Terminals | | | Cap-panel Terminals U4-V4-W4 | | |
|---|---|---|---|---|---|---|
| | Input /Output Power U1-V1-W1 / U2-V2-W2 | | U4-V4-W4 interconnect Cap-panel | 380V-415V Capacitor/ Cap-panel Part Number | Minimum Interconnect Wire Gauge (AWG) | Terminal Torque (in-lbs.) |
| | Wire Range (AWG) | Terminal Torque (in-lbs.) | Terminal Torque (in-lbs.) | | | |
| 6 | 14 – 6 | 16 | 16 | CAP-350TP | 14 | 23 |
| 8 | 14 – 6 | 16 | 16 | CAP-351TP | 14 | 23 |
| 11 | 14 – 6 | 16 | 16 | CAP-352TP | 14 | 23 |
| 14 | 14 – 6 | 16 | 16 | CAP-353TP | 14 | 23 |
| 21 | 14 – 6 | 16 | 16 | CAP-342TP | 14 | 23 |
| 27 | 14 – 6 | 16 | 16 | CAP-354TP | 14 | 23 |
| 34 | 14 – 6 | 16 | 16 | CAP-355TP | 12 | 23 |
| 44 | 18 – 4 | 16 | 16 | CAP-356TP | 12 | 23 |
| 52 | Flat copper tab | N/A | 16 | CAP-357TP | 10 | 23 |
| 66 | Flat copper tab | N/A | 16 | CAP-358TP | 10 | 23 |
| 83 | Flat copper tab | N/A | 16 | CAP-359TP | 10 | 23 |
| 103 | Flat copper tab | N/A | 16 | CAP-360TP | 8 | 23/60 |
| 128 | Flat copper tab | N/A | 16 | CAPPANEL-621C | 8 | 60 |
| 165 | Flat copper tab | N/A | 16 | CAPPANEL-544C | 6 | 60 |
| 208 | Flat copper tab | N/A | 16 | CAPPANEL-543C | 4 | 60 |
| 240 | Flat copper tab | N/A | 16 | CAPPANEL-595C | 4 | 60 |
| 320 | Flat copper tab | N/A | 16 | CAPPANEL-596C | 2 | 60 |
| 403 | Flat copper tab | N/A | 16 | CAPPANEL-597C | 1/0 | 60 |
| 482 | Flat copper tab | N/A | 16 | (2) CAPPANEL-595C | 4 | 60 |
| 636 | Flat copper tab | N/A | 16 | (2) CAPPANEL- 596C | 2 | 60 |
| 786 | Flat copper tab | N/A | 16 | (2) CAPPANEL- 597C | 1/0 | 60 |
| 850 | Flat copper tab | N/A | 16 | (2) CAPPANEL- 596C CAPPANEL-595C | 2 | 60 |
| 1000 | Flat copper tab | N/A | 16 | (3) CAPPANEL-596C | 2 | 60 |
| 1200 | Flat copper tab | N/A | 16 | (3) CAPPANEL-597C | 1/0 | 60 |

***NOTE: Cap-panel numbers designated with "C" as a suffix indicate cap-panels will be either -xxx or -xxxC.***

***NOTE: Cap-panel interconnect wiring specification according to UL508 75° C Table.***

***NOTE: To prevent flexing or bending of the coil windings attached to AP HMR Flat copper terminal tabs, use two wrenches to tighten customer provided cable mounting hardware.***

# Torque Ratings Matrix AP 480V

**Table 5-5: Torque Ratings – 480V**

| Filter Rating (Amps) | Matrix AP HMR Terminals | | | Cap-panel Terminals U4-V4-W4 | | |
|---|---|---|---|---|---|---|
| | Input /Output Power U1-V1-W1 / U2-V2-W2 | | U4-V4-W4 interconnect Cap-panel | 480V Capacitor/ Cap-panel Part Number | Minimum Interconnect Wire Gauge (AWG) | Terminal Torque (in-lbs.) |
| | Wire Range (AWG) | Terminal Torque (in-lbs.) | Terminal Torque (in-lbs.) | | | |
| 6 | 14 – 6 | 16 | 16 | CAP-338TP | 14 | 23 |
| 8 | 14 – 6 | 16 | 16 | CAP-339TP | 14 | 23 |
| 11 | 14 – 6 | 16 | 16 | CAP-349TP | 14 | 23 |
| 14 | 14 – 6 | 16 | 16 | CAP-340TP | 14 | 23 |
| 21 | 14 – 6 | 16 | 16 | CAP-341TP | 14 | 23 |
| 27 | 14 – 6 | 16 | 16 | CAP-342TP | 14 | 23 |
| 34 | 14 – 6 | 16 | 16 | CAP-343TP | 12 | 23 |
| 44 | 18 – 4 | 16 | 16 | CAP-344TP | 12 | 23 |
| 52 | Flat copper tab | N/A | 16 | CAP-345TP | 10 | 23 |
| 66 | Flat copper tab | N/A | 16 | CAP-346TP | 10 | 23 |
| 83 | Flat copper tab | N/A | 16 | CAP-347TP | 10 | 23 |
| 103 | Flat copper tab | N/A | 16 | CAP-348TP | 8 | 23/60 |
| 128 | Flat copper tab | N/A | 16 | CAPPANEL-555C | 8 | 60 |
| 165 | Flat copper tab | N/A | 16 | CAPPANEL-557C | 6 | 60 |
| 208 | Flat copper tab | N/A | 16 | CAPPANEL-545C | 4 | 60 |
| 240 | Flat copper tab | N/A | 16 | CAPPANEL-544C | 4 | 60 |
| 320 | Flat copper tab | N/A | 16 | CAPPANEL-543C | 2 | 60 |
| 403 | Flat copper tab | N/A | 16 | CAPPANEL-562C | 1/0 | 60 |
| 482 | Flat copper tab | N/A | 16 | (2) CAPPANEL-544C | 4 | 60 |
| 636 | Flat copper tab | N/A | 16 | (2) CAPPANEL-543C | 2 | 60 |
| 786 | Flat copper tab | N/A | 16 | (2) CAPPANEL-562C | 1/0 | 60 |
| 850 | Flat copper tab | N/A | 16 | (2) CAPPANEL-543C CAPPANEL-544C | 2 | 60 |
| 1000 | Flat copper tab | N/A | 16 | CAPPANEL-561C (2) CAPPANEL-543C | 2 | 60 |
| 1200 | Flat copper tab | N/A | 16 | (3) CAPPANEL-562C | 1/0 | 60 |
| 1600 | Flat copper tab | N/A | 16 | (4) CAPPANEL-563C | 1/0 | 60 |
| 2000 | Flat copper tab | N/A | 16 | (5) CAPPANEL-563C | 1/0 | 60 |
| 2300 | Flat copper tab | N/A | 16 | (6) CAPPANEL-562C | 1/0 | 60 |

# Torque Ratings Matrix AP 600V

**Table 5-6: Torque Ratings – 600V**

| Filter Rating (Amps) | Matrix AP HMR Terminals | | | Cap-panel Terminals U4-V4-W4 | | |
|---|---|---|---|---|---|---|
| | Input /Output Power U1-V1-W1 / U2-V2-W2 | | U4-V4-W4 interconnect Cap-panel | 600V Capacitor/ Cap-panel Part Number | Minimum Interconnect Wire Gauge (AWG) | Terminal Torque (in-lbs.) |
| | Wire Range (AWG) | Terminal Torque (in-lbs.) | Terminal Torque (in-lbs.) | | | |
| 6 | 14 – 6 | 16 | 16 | CAP-361TP | 14 | 23 |
| 8 | 14 – 6 | 16 | 16 | CAP-362TP | 14 | 23 |
| 11 | 14 – 6 | 16 | 16 | CAP-363TP | 14 | 23 |
| 14 | 14 – 6 | 16 | 16 | CAP-364TP | 14 | 23 |
| 21 | 14 – 6 | 16 | 16 | CAP-365TP | 14 | 23 |
| 27 | 14 – 6 | 16 | 16 | CAP-366TP | 14 | 23 |
| 34 | 14 – 6 | 16 | 16 | CAP-367TP | 12 | 23 |
| 44 | 18 – 4 | 16 | 16 | CAP-368TP | 12 | 23 |
| 52 | Flat copper tab | N/A | 16 | CAP-369TP | 10 | 23 |
| 66 | Flat copper tab | N/A | 16 | CAP-370TP | 10 | 23 |
| 83 | Flat copper tab | N/A | 16 | CAP-371TP | 10 | 23 |
| 103 | Flat copper tab | N/A | 16 | CAPPANEL-567C | 8 | 23/60 |
| 128 | Flat copper tab | N/A | 16 | CAPPANEL-568C | 8 | 60 |
| 165 | Flat copper tab | N/A | 16 | CAPPANEL-570C | 6 | 60 |
| 208 | Flat copper tab | N/A | 16 | CAPPANEL-572 | 4 | 60 |
| 240 | Flat copper tab | N/A | 16 | CAPPANEL-574C | 4 | 60 |
| 320 | Flat copper tab | N/A | 16 | CAPPANEL-576C | 2 | 60 |
| 403 | Flat copper tab | N/A | 16 | CAPPANEL-578C | 1/0 | 60 |
| 482 | Flat copper tab | N/A | 16 | (2) CAPPANEL-574C | 4 | 60 |
| 636 | Flat copper tab | N/A | 16 | (2) CAPPANEL-576C | 2 | 60 |
| 786 | Flat copper tab | N/A | 16 | (2) CAPPANEL-578C | 1/0 | 60 |

***NOTE: Cap-panel numbers designated with "C" as a suffix indicate cap-panels will be either -xxx or -xxxC.***

***NOTE: Cap-panel interconnect wiring specification according to UL508 75° C Table.***

***NOTE: To prevent flexing or bending of the coil windings attached to AP HMR Flat copper terminal tabs, use two wrenches to tighten customer provided cable mounting hardware.***

# Torque Ratings Matrix AP 690V

**Table 5-7: Torque Ratings – 690V**

| Filter Rating (Amps) | Matrix AP HMR Terminals | | | Cap-panel Terminals U4-V4-W4 | | |
|---|---|---|---|---|---|---|
| | Input /Output Power U1-V1-W1 / U2-V2-W2 | | U4-V4-W4 interconnect Cap-panel | 690V Capacitor/ Cap-panel Part Number | Minimum Interconnect Wire Gauge (AWG) | Terminal Torque (in-lbs.) |
| | Wire Range (AWG) | Terminal Torque (in-lbs.) | Terminal Torque (in-lbs.) | | | |
| 52 | 4 - 14 | N/A | 16 | CAPPANEL-622C | 12 | 60 |
| 66 | Flat copper tab | N/A | 16 | CAPPANEL-612 | 10 | 60 |
| 83 | Flat copper tab | N/A | 16 | CAPPANEL-613 | 10 | 60 |
| 103 | Flat copper tab | N/A | 16 | CAPPANEL-615C | 8 | 60 |
| 128 | Flat copper tab | N/A | 16 | CAPPANEL-617C | 8 | 60 |
| 165 | Flat copper tab | N/A | 16 | CAPPANEL-619C | 8 | 60 |
| 208 | Flat copper tab | N/A | 16 | CAPPANEL-614C CAPPANEL-616 | 8 | 60 |
| 240 | Flat copper tab | N/A | 16 | CAPPANEL-616 CAPPANEL-617C | 8 | 60 |
| 320 | Flat copper tab | N/A | 16 | (2) CAPPANEL-618C | 6 | 60 |
| 403 | Flat copper tab | N/A | 16 | (2) CAPPANEL-618C CAPPANEL-614C | 8 | 60 |
| 482 | Flat copper tab | N/A | 16 | (3) CAPPANEL-618 | 6 | 60 |
| 636 | Flat copper tab | N/A | 16 | CAPPANEL-620 (2) CAPPANEL-621C | 4 | 60 |

***NOTE: Cap-panel numbers designated with "C" as a suffix indicate cap-panels will be either -xxx or -xxxC.***

***NOTE: Cap-panel interconnect wiring specification according to UL508 75° C Table.***

***NOTE: To prevent flexing or bending of the coil windings attached to AP HMR Flat copper terminal tabs, use two wrenches to tighten customer provided cable mounting hardware.***

# 6. START-UP

## Safety Precautions

Before start-up, observe the following warnings and instructions:

| | |
|---|---|
| **WARNING** | Internal components of the filter are at line potential when the filter is connected to the drive. This voltage is extremely dangerous and may cause death or severe injury if you come in contact with it. |
| | Remove all power to the Matrix AP filter in compliance to standardized 26 CFR 1920.147 lockout/tagout policies. After disconnecting the utility power, wait at least 5 minutes before doing any work on the filter connections. 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 and ensure that the voltage is at a safe level. |
| | Use extreme caution to avoid contact with line voltage when checking for power. **INJURY OR DEATH MAY RESULT IF SAFETY PRECAUTIONS ARE NOT OBSERVED.** |
| | After disconnecting the utility power, wait at least 5 minutes before doing any work on the filter connections. 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. |

## Sequence of Operation

1. Read and follow safety precautions.
2. After installation, ensure that:
    - All filter ground terminals are connected to ground.
    - Power wiring to the utility, drive and motor is in accordance with the power wiring connection diagrams shown in installation instructions section.
    - Use the following guidelines for power and cap-panel wire gauges:
        - Table 5-3: Torque Ratings – 208V-240V **(p38)**
        - Table 5-4: Torque Ratings – 380V-415V **(p39)**
        - Table 5-5: Torque Ratings – 480V (**p40)**
        - Table 5-6: Torque Ratings – 600V **(p41)**
        - Table 5-7: Torque Ratings – 690V **(p42)**
3. Check that moisture has not condensed on the filter components. If moisture is present, do not proceed with start-up until the moisture has been removed.
4. Disconnect the filter output from the drive.
5. Connect the filter to the utility.
6. Confirm that line voltage is present at the input terminals (U, V1, W1) of the filter.
7. Confirm that line voltage is present at the output terminals (U2, V2, W2) of the filter and that it is less than or equal to 1.05 times the input voltage.
8. Using a clamp on Amp meter, check input phase currents to verify they are within a 5% match to each other and approximately 30% of filter current rating.
9. Remove power and verify that **NO VOLTAGE** is present on the filter terminals.
10. Connect the filter output to the drive.
11. Refer to the drive user manual for the drive start-up procedure. Observe all safety instructions in the drive user manual.

# 7. TROUBLESHOOTING

| | |
|---|---|
| **WARNIING** | When properly installed, this equipment has been designed to provide maximum safety for operating personnel.<br>However, hazardous voltages and elevated temperatures exist within the confines of the enclosure. Servicing should therefore be performed by qualified personnel only and in accordance with OSHA Regulations. |
| | 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.** |
| **CAUTION** | 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 or terminals U1, V1or V1, W1 and ensure that the voltage is at a safe level. |

To aid in troubleshooting, a basic schematic diagram, two interconnection diagrams, and a trouble shooting guide that lists potential problems and solutions are included:

**Figure 5-1: Basic Schematic Diagram (p30)**

**Figure 5-2: Open Panel Interconnection (p31)**

**Figure 5-3: Enclosed Interconnection (p32)**

**Table 7-1: Troubleshooting Guide (p47)**

# Matrix AP Harmonic Filter Field Checks

1. Disconnect all power and remove input power wiring from U1, V1, W1 terminals.
2. Remove VFD drive power connections from filter terminals U2, V2, W2 and any contactor or temperature switch wiring. (For filters using control transformers: remove power fuses on top of transformer.)
3. Visually inspect filter terminals and wiring lugs for signs of heat and corrosion. ***Contact factory if any wires appear to be missing or cut!***
4. Inspect the U4, V4, W4 capacitor interconnect terminals and wiring.
5. Visually inspect all capacitors for signs of case deformation, bowing of the top, leaking oil or terminal damage. Note the CAP- # and date code of any damaged capacitors.
6. Using a multi meter set to read 100K ohms check:
    a. Phase to phase U1-V1-W1-U1 (mechanically activate contactor if present) after reactor and caps charge reading should be about 40K (total equivalent breeder resistance value) and should be the same for each phase. Open circuit or very low readings indicate a problem.
    b. Phase to chassis U1- case, V1-case, W1- case; low readings indicate a ground fault problem.
7. Ensure the “disconnect” is safe, then wire the utility power to U1, V1, W1.
8. Apply power and verify that proper output voltage is present on U2, V2, and W2.
9. Using a clamp on amp meter read the filter input current:
    a. Readings will be 0.5 of the capacitor current listed in Table 3-2: Watt Loss - Matrix AP 208V-240V, 60Hz **(p6)** (208V-240V), Table 3-3: Watt Loss - Matrix AP 380V-415V, 50Hz **(p7)** (380V-415V), Table 3-4: Watt Loss - Matrix AP 480V, 60Hz **(p8)** (480V),Table 3-5: Watt Loss - Matrix AP 600V, 60Hz **(p9)** (600V) and Table 3-6: Watt Loss - Matrix AP 690V, 50Hz **(p10)** (690V) for the listed filter current in the user manual (mechanically activate the contactor if the filter is equipped with one). Readings should be the same (+/- 5%) for all phase currents; ***contact the factory if currents are out of tolerance!***
    b. Open contactor readings will show zero current for all phases.
10. Disconnect filter power and wire the VFD to U2, V2, and W2 as well as any control wiring to the filter contactor or temperature switch. Replace any control transformer fuses. Follow the drive power start-up guidelines in the drive manufacturer’s user manual.

**Table 7-1: Troubleshooting Guide**

| | |
|---|---|
| **PROBLEM:** | **Line voltage is not present at the filter output terminals.** |
| **Possible cause:** | Power to the filter is turned off. |
| **Solution:** | Turn power on. |
| **Possible cause:** | One or more external line fuses are blown. |
| **Solution:** | Verify the continuity of line fuses in all phases. Replace as necessary. |
| **PROBLEM:** | **Full Load Harmonic current distortion exceeds 5% on one or more phases at full load.** |
| **Possible cause:** | The capacitor assembly has not been connected. |
| **Solution:** | Check interconnection of capacitor assembly per the following:<br><br>**Figure 5-1: Basic Schematic Diagram (p30)**<br>**Figure 5-2: Open Panel Interconnection (p31)**<br>**Figure 5-3: Enclosed Interconnection (p32)** |
| **Possible cause:** | A capacitor has failed. |
| **Solution:** | Inspect the tops of all capacitors for bowing. Replace failed capacitors. |
| **Possible cause:** | Source impedance is less than 1.5%. |
| **Solution:** | Add a minimum 1.5% impedance line reactor to the filter input. |
| **Possible cause:** | Input source voltage harmonic distortion. |
| **Solution:** | Identify equipment causing harmonic voltage distortion and add filters as required or accept elevated THVD. |
| **Possible cause:** | Line voltage unbalance exceeds 1%. |
| **Solution:** | Balance input line voltage to 1% or less. |
| **PROBLEM:** | **Filter output voltage is not within specification** |
| **Possible cause:** | Filter input voltage is not within specification. |
| **Solution:** | Check the AC input line voltage and verify that it is within tolerance. Refer to the filter service conditions and performance specifications for tolerances. |
| **Possible cause:** | Source impedance is out of tolerance. |
| **Solution:** | Verify that the source impedance is within tolerance. Refer to the filter service conditions and performance specifications for tolerances. |
| **Possible cause:** | Source impedance is out of tolerance. |
| **Solution:** | Verify that the source impedance is within tolerance. Refer to the filter service conditions and performance specifications for tolerances. |
| **Possible cause:** | One or more Capacitors is damaged. |
| **Solution:** | Visually check capacitor top for distortion or doming. Check for shorts or open caps. Replace failed capacitors. |
| **Possible cause:** | Drive set up parameter does not allow for input filter |
| **Solution:** | Consult drive manufacturer to update set-up to accommodate input filter. |
| **Possible cause:** | Input voltage subject to extreme transients such as switching between two voltage sources. Drive faults on over or under voltage. |
| **Solution:** | Source switching is not recommended without proper phase synchronizing or allowing reasonable time delay before transfer to new source. |

| Matrix AP 208V – 690V Technical Reference Manual | | | MAP-TRM-E |
|---|---|---|---|
| Responsibility: Marketing Director<br>Approved By: Z Zakaria<br>ISO Section: 7.2.3 | | | |
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| --- | 1/1/12 | New document written by Chad Burks | |
| 001 | 1/20/12 | Revised by Chad Burks. Added all table and figure data. | |
| 002 | 3/9/12 | By CAB. Updates enclosed temp to 320A and above +45 C | |
| 003 | 3/16/12 | By CAB. Changed tables. Deleted 970, changed 1050 to 1000 | |
| 004 | 03/30/12 | By CAB Corrected table on page 6 | |
| 005 | 5/9/12 | By LB. Updated logo. Added 6A – 66A to tables, Contactor Option to part # Codes. Changes Storage Temp in Service Conditions Specifications from 70 degrees to 90 degrees. | |
| 006 | 05/21/12 | By JG. Added generator sizing note to specifications. | |
| 007 | 5/25/12 | By LB. Added page 35, Contactor Coil Switching Currents Table. | |
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| 009 | 08/15/12 | By JG. Added -009 and -012 contactor options. | |
| 010 | 01/04/12 | By CAB. Added 400V tables | |
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| 019 | 09/09/15 | By Marc Majewski – Updated Tables 4-1 and 6-2; corrected page numbers in selection tables; updated enclosure drawings to show dims for both NEMA ½ and NEMA 3R | |
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| 023 | 08/28/18 | By Marc Majewski – Updated the notes on the Interconnect Diagrams on pgs 31 & 32; updated the logo throughout | |
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