

hammond  
POWER SOLUTIONS



# CENTURION D

dV/dT Filters



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### HPS dV/dT Filters

The HPS dV/dT filters are designed for use between variable frequency drives (VFD's) and motors when long cable lengths are used.

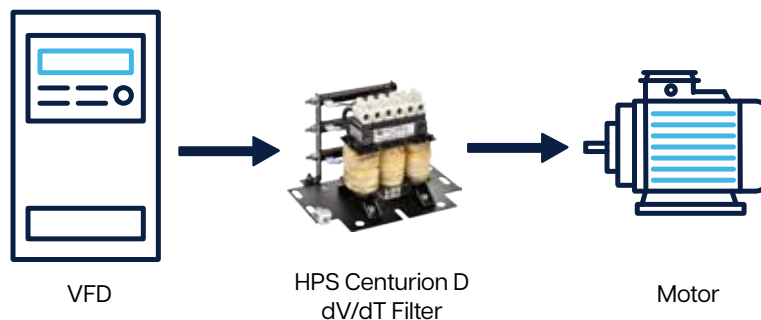
The HPS Centurion D dV/dT filter (D1) combines an inductor and parallel resistor network to mitigate both high frequency ringing and voltage spikes between the VFD and motor and within the motor's windings.

The HPS Centurion D can mitigate the effects of reflected wave voltages greater than what a reactor alone can accomplish. This filter provides protection to the motor by slowing down the rate of voltage increase (dV/dT) and minimizes the damaging peak voltages that occur within the motor's windings and along the length of cables feeding the motor.



### HPS dV/dT Operation Principle

The term “dV/dT” refers to the change in voltage over change in time. With regards to VFD's, dV/dT is explained as the rapid change in voltage at the beginning or end of the square wave pulses that make up the pulse width modulated (PWM) output of a VFD that powers the motor. As the square wave pulses travel the electrical cable to the motor, the differences in impedance between the cable and motor windings cause some energy in the pulse to be “reflected”. In applications where the distance between the motor and VFD is long, the voltage of two pulses can combine in the cable or motor windings. This creates voltage spikes that can be more than twice the VFD's DC bus voltage. Applications with long cables between the VFD and the motor can experience peak voltages up to 1600V in a 480V system and up to 2100V in a 600V system. These high peak voltages will cause premature motor insulation failures resulting in down time and lost revenue.



### Applications

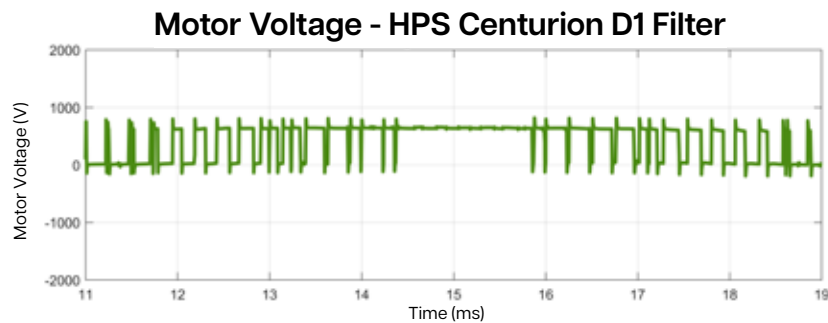
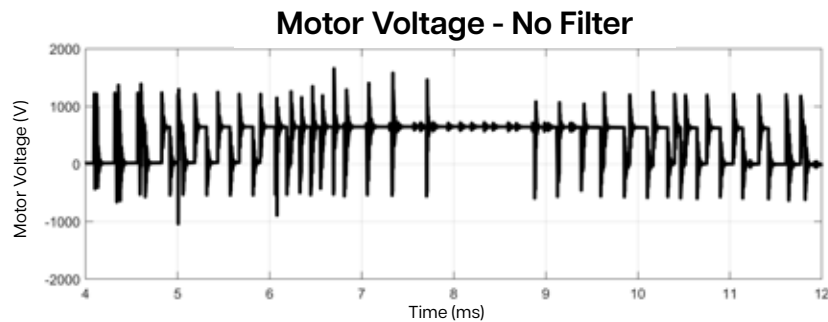
The HPS Centurion D series dV/dT filters are designed for applications with long cables between the VFD and the motor. VFD manufacturers often have recommendations on when to use dV/dT filters within their manuals. They should always be installed close to the VFD. Typical applications include:

- Oil & Gas Pumps
- Wastewater Treatment Plants
- HVAC Systems
- Pulp & Paper
- Irrigation Fields



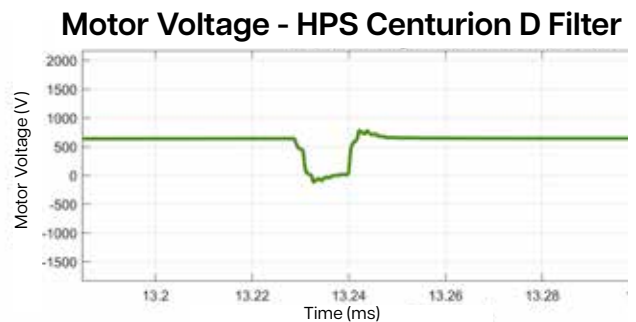
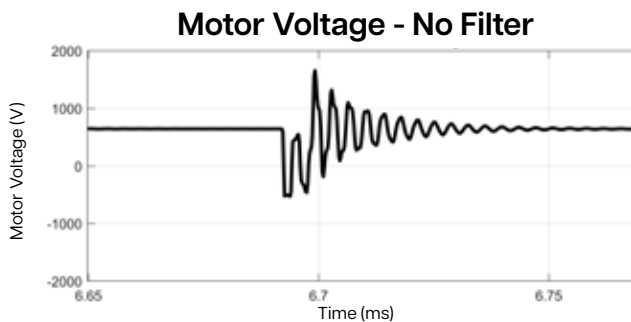
## The Reflected Wave Phenomenon

The reflected wave phenomenon in motor drives systems refers to the overvoltage at the motor or along the cables feeding it. The reflected wave phenomena occurs due to a mismatch between the cable's characteristic impedance and the motor's surge impedance. In addition, the high switching frequency and the fast rise time of the switching devices (IGBT) of the variable frequency drive (VFD) increase the magnitude of the reflected wave's voltage. The high rate of change in voltage with respect to time ( $dV/dT$ ) of the IGBTs causes a high voltage to be developed in the windings of motors, resulting in motor insulation stress.



HPS Centurion D Series  $dV/dT$  filter is engineered to mitigate reflected wave by reducing:

- Peak voltage seen by the motor
- Rise time of the pulses
- Pulses ringing



## Typical Performance

### Electrical Product Characteristics

|                               |   |
|-------------------------------|---|
| <b>System Voltage Rating:</b> | Up to 600V (480V-600V applications)         |
| <b>Current Rating:</b>        | 2A to 750A (consult HPS for higher ratings) |

### Technical Product Characteristics

|                                      |  |
|--------------------------------------|--|
| <b>Inverter Switching Frequency:</b> | 2kHz to 4kHz (consult HPS for higher switching frequency)      |
| <b>Inverter Operating Frequency:</b> | Up to 60Hz   |
| <b>Insulation System:</b>            | 130°C (2A - 54A), 180°C (>55A)                                 |
| <b>Voltage Drop:</b>                 | <3%  |
| <b>Motor Lead Length:</b>            | Up to 1000ft (600ft & 1000ft models available <sup>1,2</sup> ) |
| <b>Peak Voltage At Motor:</b>        | 150% of DC bus voltage   |
| <b>Approvals:</b>                    | cUL Listed   |



### Environmental Conditions

|                                       |  |
|---------------------------------------|--|
| <b>Ambient Operating Temperature:</b> | Open Style: Up to 50°C<br>Enclosed Style: Up to 40°C       |
| <b>Altitude:</b>                      | <1000M   |
| <b>Cooling Method:</b>                | Natural convection   |
| <b>Enclosure Type:</b>                | Open, Type 1 (Type 3R <sup>3</sup> available upon request) |

**Notes:**

<sup>1</sup>VFD rated cable recommended

<sup>2</sup>Maximum motor cable size to achieve 5% voltage drop (including 2% from the filter)

Maximum lead length and carrier frequency can vary depending on motor cable type

<sup>3</sup>Standard Type 3R enclosure coming soon.



## Selection Guide

System Voltage, the input voltage to the VFD, has a major effect on the reflected wave phenomenon. Typically, the reflected wave is twice of the DC bus voltage.

$$\sqrt{2} * \text{System Voltage} = \text{DC Bus Voltage}$$

$$\sqrt{2} \rightarrow 1.414 * 480 \text{ VAC} = 679 \text{ VDC Bus}$$

$$\text{Reflected Wave} = 2 * 679 \text{ Volts} \sim 1360 \text{ volts}$$

Modern motor insulation systems can typically handle reflected wave issues from 208 VAC and 240 VAC systems due to the lower DC bus voltage. North American 480 VAC and 600 VAC systems can experience motor damage from reflected waves. Please consult with HPS for any application that may require the use of dV/dT filters at voltages below 480V or output carrier frequencies above 4kHz. In addition to mitigating reflective wave issues, dV/dT filters can also lower the VFD's output voltage rise time and reduce the peak voltage seen by the motor and cabling. This can have the added benefit of reducing the motors temperature rise and audible noise.

Select the filter based on Full Load Amps (FLA) of the motor.

## Part Number Guide

|                  | Product Line  | Type | Model        | Voltage                                      | Current Rating               |   |   |   | Enclosure  | Cable Length |
|------------------|---------------|------|--------------|--|------------------------------|---|---|---|--|--------------|
|                  | C             | D    | 1            | X  | 0                            | 0 | 2 | 5 | F  | 1            |
| Example          | <b>Family</b> |      | <b>Model</b> | <b>Voltage</b>                               | <b>Current Rating (Amps)</b> |   |   |   | <b>Enclosure</b>   | <b>1</b>     |
|                  | C - Centurion |      | 1 - D1 Model | X - up to 600V<br>(480V & 600V applications) | 3A to 750A                   |   |   |   | F - Open Frame<br>E - Type 1<br>C - Type 3R <sup>1</sup> | 600 ft*      |
|                  | <b>Type</b>   |      |              |  | 3A 0003                      |   |   |   |  |              |
| D - dV/dT Filter |               |      | 17A 0017     |  |                              |   |   |   |  | 1 - 1000 ft  |

\*Default options - ignore if all following characters are default values.  
<sup>1</sup>Standard Type 3R enclosure coming soon.

### 600 ft Cable Length

| NEC 480<br>HP - Ref.<br>ONLY | NEC 600<br>HP - Ref.<br>ONLY | Part Number | Current<br>Rating<br>(A) | Enclosure<br>Style | Dimension Figure |                |                | Overall<br>Dimensions<br>Inches [mm] | "Weight<br>Lbs.<br>[kg]" | Watts<br>Loss |
|------------------------------|------------------------------|-------------|--------------------------|--------------------|------------------|----------------|----------------|--------------------------------------|--------------------------|---------------|
|                              |                              |             |                          |                    | Width            | Depth          | Height         |                                      |                          |               |
| 0.5-1.5                      | 0.5-2                        | CD1X0003F   | 3                        | Open               | 1                | 8.00 [203.20]  | 6.00 [152.40]  | 5.50 [139.70]                        | 4.00 [1.80]              | 38            |
|                              |                              | CD1X0003E   |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 9.00 [4.10]              |               |
| 2                            | 3                            | CD1X0003C   | 4                        | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             | 40            |
|                              |                              | CD1X0004F   |                          | Open               | 1                | 8.00 [203.20]  | 6.00 [152.40]  | 5.50 [139.70]                        | 4.00 [1.80]              |               |
| 3                            | 5                            | CD1X0004E   | 7                        | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 9.00 [4.10]              | 46            |
|                              |                              | CD1X0004C   |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 5                            | 7.5                          | CD1X0007F   | 9                        | Open               | 1                | 8.00 [203.20]  | 6.00 [152.40]  | 5.50 [139.70]                        | 6.00 [2.70]              | 42            |
|                              |                              | CD1X0007E   |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 9.00 [4.10]              |               |
| 7.5                          | 10                           | CD1X0007C   | 12                       | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             | 45            |
|                              |                              | CD1X0009F   |                          | Open               | 1                | 8.00 [203.20]  | 6.00 [152.40]  | 5.50 [139.70]                        | 6.00 [2.70]              |               |
| 10                           | 15                           | CD1X0009E   | 17                       | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 9.00 [4.10]              | 53            |
|                              |                              | CD1X0009C   |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 15                           | 20                           | CD1X0012F   | 22                       | Open               | 1                | 8.00 [203.20]  | 6.00 [152.40]  | 5.50 [139.70]                        | 6.00 [2.70]              | 66            |
|                              |                              | CD1X0012E   |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 9.00 [4.10]              |               |
| 20                           | 25                           | CD1X0012C   | 27                       | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             | 32            |
|                              |                              | CD1X0017F   |                          | Open               | 1                | 8.00 [203.20]  | 6.00 [152.40]  | 5.50 [139.70]                        | 6.00 [2.70]              |               |
| 25                           | 30                           | CD1X0017E   | 35                       | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 9.00 [4.10]              | 42            |
|                              |                              | CD1X0017C   |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 30                           | 40                           | CD1X0022F   | 45                       | Open               | 1                | 8.00 [203.20]  | 6.00 [152.40]  | 5.50 [139.70]                        | 6.00 [2.70]              | 52            |
|                              |                              | CD1X0022E   |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 9.00 [4.10]              |               |
| 40                           | 50                           | CD1X0022C   | 54                       | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             | 65            |
|                              |                              | CD1X0027F   |                          | Open               | 2                | 8.00 [203.20]  | 6.00 [152.40]  | 7.25 [184.15]                        | 14.0 [6.20]              |               |
| 50                           | 60                           | CD1X0027E   | 65                       | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 9.00 [4.10]              | 78            |
|                              |                              | CD1X0027C   |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 60                           | 75                           | CD1X0035F   | 80                       | Open               | 2                | 8.00 [203.20]  | 6.00 [152.40]  | 7.25 [184.15]                        | 14.0 [6.20]              | 97            |
|                              |                              | CD1X0035E   |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 9.00 [4.10]              |               |
| 75                           | 100                          | CD1X0035C   | 108                      | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             | 147           |
|                              |                              | CD1X0045F   |                          | Open               | 2                | 8.00 [203.20]  | 6.00 [152.40]  | 7.25 [184.15]                        | 14.0 [6.20]              |               |
|                              |                              | CD1X0045E   |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 9.00 [4.10]              |               |
|                              |                              | CD1X0045C   |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
|                              |                              | CD1X0054F   |                          | Open               | 2                | 8.00 [203.20]  | 6.00 [152.40]  | 7.25 [184.15]                        | 14.0 [6.20]              |               |
|                              |                              | CD1X0054E   |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 9.00 [4.10]              |               |
|                              |                              | CD1X0054C   |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
|                              |                              | CD1X0065F   |                          | Open               | 3                | 9.00 [228.60]  | 7.50 [190.50]  | 7.00 [177.80]                        | 28.0 [12.4]              |               |
|                              |                              | CD1X0065E   |                          | Type 1             | N2               | 14.00 [355.60] | 14.00 [355.60] | 12.13 [308.11]                       | 38.0 [17.2]              |               |
|                              |                              | CD1X0065C   |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
|                              |                              | CD1X0080F   |                          | Open               | 3                | 9.00 [228.60]  | 7.50 [190.50]  | 7.00 [177.80]                        | 28.0 [12.4]              |               |
|                              |                              | CD1X0080E   |                          | Type 1             | N2               | 14.00 [355.60] | 14.00 [355.60] | 12.13 [308.11]                       | 38.0 [17.2]              |               |
|                              |                              | CD1X0080C   |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
|                              |                              | CD1X0108F   |                          | Open               | 3                | 9.00 [228.60]  | 7.50 [190.50]  | 7.00 [177.80]                        | 28.0 [12.4]              |               |
|                              |                              | CD1X0108E   |                          | Type 1             | N2               | 14.00 [355.60] | 14.00 [355.60] | 12.13 [308.11]                       | 38.0 [17.2]              |               |
|                              |                              | CD1X0108C   |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |

**Selection Guide Continued**

**1000 ft Cable Length**

| NEC 480<br>HP - Ref.<br>ONLY | NEC 600<br>HP - Ref.<br>ONLY | Part Number | Current<br>Rating<br>(A) | Enclosure<br>Style | Dimension Figure |                |                | Overall<br>Dimensions<br>Inches [mm] | "Weight<br>Lbs.<br>[kg]" | Watts<br>Loss |
|------------------------------|------------------------------|-------------|--------------------------|--------------------|------------------|----------------|----------------|--------------------------------------|--------------------------|---------------|
|                              |                              |             |                          |                    | Width            | Depth          | Height         |                                      |                          |               |
| 0.5-1.5                      | 0.5-2                        | CD1X0003F1  | 3                        | Open               | 1                | 8.00 [203.20]  | 6.00 [152.40]  | 5.50 [139.70]                        | 4.00 [1.80]              | 50            |
|                              |                              | CD1X0003E1  |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 9.00 [4.10]              |               |
|                              |                              | CD1X0003C1  |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 2                            | 3                            | CD1X0004F1  | 4                        | Open               | 1                | 8.00 [203.20]  | 6.00 [152.40]  | 5.50 [139.70]                        | 4.00 [1.80]              | 52            |
|                              |                              | CD1X0004E1  |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 9.00 [4.10]              |               |
|                              |                              | CD1X0004C1  |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 3                            | 5                            | CD1X0007F1  | 7                        | Open               | 1                | 8.00 [203.20]  | 6.00 [152.40]  | 5.50 [139.70]                        | 4.00 [1.80]              | 58            |
|                              |                              | CD1X0007E1  |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 9.00 [4.10]              |               |
|                              |                              | CD1X0007C1  |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 5                            | 7.5                          | CD1X0009F1  | 9                        | Open               | 1                | 8.00 [203.20]  | 6.00 [152.40]  | 5.50 [139.70]                        | 6.00 [2.70]              | 54            |
|                              |                              | CD1X0009E1  |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 11.0 [5.00]              |               |
|                              |                              | CD1X0009C1  |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 7.5                          | 10                           | CD1X0012F1  | 12                       | Open               | 1                | 8.00 [203.20]  | 6.00 [152.40]  | 5.50 [139.70]                        | 6.00 [2.70]              | 57            |
|                              |                              | CD1X0012E1  |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 11.0 [5.00]              |               |
|                              |                              | CD1X0012C1  |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 10                           | 15                           | CD1X0017F1  | 17                       | Open               | 1                | 8.00 [203.20]  | 6.00 [152.40]  | 5.50 [139.70]                        | 6.00 [2.70]              | 64            |
|                              |                              | CD1X0017E1  |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 11.0 [5.00]              |               |
|                              |                              | CD1X0017C1  |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 15                           | 20                           | CD1X0022F1  | 22                       | Open               | 1                | 8.00 [203.20]  | 6.00 [152.40]  | 5.50 [139.70]                        | 6.00 [2.70]              | 76            |
|                              |                              | CD1X0022E1  |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 11.0 [5.00]              |               |
|                              |                              | CD1X0022C1  |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 20                           | 25                           | CD1X0027F1  | 27                       | Open               | 2                | 8.00 [203.20]  | 6.00 [152.40]  | 7.25 [184.15]                        | 14.0 [6.20]              | 37            |
|                              |                              | CD1X0027E1  |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 19.0 [8.60]              |               |
|                              |                              | CD1X0027C1  |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 25                           | 30                           | CD1X0035F1  | 35                       | Open               | 2                | 8.00 [203.20]  | 6.00 [152.40]  | 7.25 [184.15]                        | 14.0 [6.20]              | 47            |
|                              |                              | CD1X0035E1  |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 19.0 [8.60]              |               |
|                              |                              | CD1X0035C1  |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 30                           | 40                           | CD1X0045F1  | 45                       | Open               | 2                | 8.00 [203.20]  | 6.00 [152.40]  | 7.25 [184.15]                        | 14.0 [6.20]              | 57            |
|                              |                              | CD1X0045E1  |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 19.0 [8.60]              |               |
|                              |                              | CD1X0045C1  |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 40                           | 50                           | CD1X0054F1  | 54                       | Open               | 2                | 8.00 [203.20]  | 6.00 [152.40]  | 7.25 [184.15]                        | 14.0 [6.20]              | 70            |
|                              |                              | CD1X0054E1  |                          | Type 1             | N1               | 10.00 [254.00] | 8.00 [203.20]  | 8.13 [206.51]                        | 19.0 [8.60]              |               |
|                              |                              | CD1X0054C1  |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 29.0 [13.15]             |               |
| 50                           | 60                           | CD1X0065F1  | 65                       | Open               | 3                | 9.00 [228.60]  | 7.50 [190.50]  | 7.00 [177.80]                        | 28.0 [12.4]              | 89            |
|                              |                              | CD1X0065E1  |                          | Type 1             | N2               | 14.00 [355.60] | 14.00 [355.60] | 12.13 [308.11]                       | 38.0 [17.2]              |               |
|                              |                              | CD1X0065C1  |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 49.0 [22.2]              |               |
| 60                           | 75                           | CD1X0080F1  | 80                       | Open               | 3                | 9.00 [228.60]  | 7.50 [190.50]  | 7.00 [177.80]                        | 28.0 [12.4]              | 108           |
|                              |                              | CD1X0080E1  |                          | Type 1             | N2               | 14.00 [355.60] | 14.00 [355.60] | 12.13 [308.11]                       | 38.0 [17.2]              |               |
|                              |                              | CD1X0080C1  |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 49.0 [22.2]              |               |
| 75                           | 100                          | CD1X0108F1  | 108                      | Open               | 3                | 9.00 [228.60]  | 7.50 [190.50]  | 7.00 [177.80]                        | 28.0 [12.4]              | 158           |
|                              |                              | CD1X0108E1  |                          | Type 1             | N2               | 14.00 [355.60] | 14.00 [355.60] | 12.13 [308.11]                       | 38.0 [17.2]              |               |
|                              |                              | CD1X0108C1  |                          | Type 3R            | CN1-1            | 16.88 [428.75] | 13.99 [355.35] | 17.62 [447.55]                       | 49.0 [22.2]              |               |
| 100                          | 125                          | CD1X0130F1  | 130                      | Open               | 4                | 11.25 [285.75] | 9.00 [228.60]  | 7.50 [190.50]                        | 45.0 [40.4]              | 248           |
|                              |                              | CD1X0130E1  |                          | Type 1             | CH2              | 23.50 [596.90] | 16.5 [419.10]  | 17.90 [454.66]                       | 76.0 [34.5]              |               |
|                              |                              | CD1X0130C1  |                          | Type 3R            | DH1              | 21.50 [546.00] | 20.10 [510.00] | 22.00 [559.00]                       | 83.0 [37.6]              |               |
| 125                          | 150                          | CD1X0160F1  | 160                      | Open               | 4                | 12.63 [320.80] | 9.00 [228.60]  | 7.50 [190.50]                        | 55.0 [25.0]              | 263           |
|                              |                              | CD1X0160E1  |                          | Type 1             | CH2              | 23.50 [596.90] | 16.5 [419.10]  | 17.9 [454.66]                        | 86.0 [39.0]              |               |
|                              |                              | CD1X0160C1  |                          | Type 3R            | DH1              | 21.50 [546.00] | 20.10 [510.00] | 22.00 [559.00]                       | 93.0 [42.2]              |               |
| 150                          | 200                          | CD1X0200F1  | 200                      | Open               | 5                | 14.50 [368.30] | 9.00 [228.60]  | 10.25 [260.35]                       | 65.0 [29.5]              | 328           |
|                              |                              | CD1X0200E1  |                          | Type 1             | CH2              | 23.50 [596.90] | 16.5 [419.10]  | 17.9 [454.66]                        | 96.0 [43.5]              |               |
|                              |                              | CD1X0200C1  |                          | Type 3R            | DH1              | 21.50 [546.00] | 20.10 [510.00] | 22.00 [559.00]                       | 103 [46.7]               |               |

## 1000 ft Cable Length (Continued)

| NEC 480<br>HP - Ref.<br>ONLY | NEC 600<br>HP - Ref.<br>ONLY | Part Number | Current<br>Rating<br>(A) | Enclosure<br>Style | Dimension Figure |                |                | Overall<br>Dimensions<br>Inches [mm] | "Weight<br>Lbs.<br>[kg]" | Watts<br>Loss |
|------------------------------|------------------------------|-------------|--------------------------|--------------------|------------------|----------------|----------------|--------------------------------------|--------------------------|---------------|
|                              |                              |             |                          |                    | Width            | Depth          | Height         |                                      |                          |               |
| 200                          | 250                          | CD1X0250F1  | 250                      | Open               | 5                | 14.50 [368.30] | 9.00 [228.60]  | 10.25 [260.35]                       | 70.0 [31.8]              | 378           |
|                              |                              | CD1X0250E1  |                          | Type 1             | CH4              | 26.10 [662.94] | 20.50 [520.70] | 25.90 [657.86]                       | 110 [49.9]               |               |
|                              |                              | CD1X0250C1  |                          | Type 3R            | DH2              | 25.80 [655.00] | 23.80 [604.00] | 28.80 [731.00]                       | 120 [54.4]               |               |
| 250                          | 300                          | CD1X0305F1  | 305                      | Open               | 5                | 16.50 [419.10] | 13.50 [342.90] | 12.75 [323.85]                       | 85.0 [38.5]              | 434           |
|                              |                              | CD1X0305E1  |                          | Type 1             | CH4              | 26.10 [662.94] | 20.50 [520.70] | 25.90 [657.86]                       | 125 [56.7]               |               |
|                              |                              | CD1X0305C1  |                          | Type 3R            | DH2              | 25.80 [655.00] | 23.80 [604.00] | 28.80 [731.00]                       | 135 [61.2]               |               |
| 300                          | 350                          | CD1X0365F1  | 365                      | Open               | 5                | 16.50 [419.10] | 12.50 [317.50] | 12.75 [323.85]                       | 105 [47.6]               | 484           |
|                              |                              | CD1X0365E1  |                          | Type 1             | CH5              | 28.10 [713.74] | 21.30 [541.02] | 28.90 [734.06]                       | 161 [73.0]               |               |
|                              |                              | CD1X0365C1  |                          | Type 3R            | DH3              | 28.30 [719.00] | 27.00 [687.00] | 36.00 [914.00]                       | 203 [92.1]               |               |
| 350                          | 450                          | CD1X0415F1  | 415                      | Open               | 5                | 16.50 [419.10] | 12.50 [317.50] | 12.75 [323.85]                       | 115 [52.2]               | 514           |
|                              |                              | CD1X0415E1  |                          | Type 1             | CH5              | 28.10 [713.74] | 21.30 [541.02] | 28.90 [734.06]                       | 171 [77.6]               |               |
|                              |                              | CD1X0415C1  |                          | Type 3R            | DH3              | 28.30 [719.00] | 27.00 [687.00] | 36.00 [914.00]                       | 213 [96.6]               |               |
| 400-450                      | 500                          | CD1X0515F1  | 515                      | Open               | 5                | 16.50 [419.10] | 12.50 [317.50] | 12.75 [323.85]                       | 135 [61.2]               | 574           |
|                              |                              | CD1X0515E1  |                          | Type 1             | CH5              | 28.10 [713.74] | 21.30 [541.02] | 28.90 [734.06]                       | 191 [86.6]               |               |
|                              |                              | CD1X0515C1  |                          | Type 3R            | DH3              | 28.30 [719.00] | 27.00 [687.00] | 36.00 [914.00]                       | 233 [106]                |               |
| 500                          | 600                          | CD1X0600F1  | 300                      | Open               | 6                | 16.50 [419.10] | 13.50 [342.90] | 14.75 [374.65]                       | 170 [77.1]               | 684           |
|                              |                              | CD1X0600E1  |                          | Type 1             | CH6              | 33.50 [850.90] | 23.00 [584.20] | 31.20 [792.48]                       | 256 [116]                |               |
|                              |                              | CD1X0600C1  |                          | Type 3R            | DH4              | 31.50 [800.00] | 29.50 [749.00] | 44.50 [1130.0]                       | 297 [135]                |               |
| 600                          | 700                          | CD1X0750F1  | 750                      | Open               | 6                | 16.50 [419.10] | 13.50 [342.90] | 14.75 [374.65]                       | 200 [90.7]               | 1124          |
|                              |                              | CD1X0750E1  |                          | Type 1             | CH6              | 33.50 [850.90] | 23.00 [584.20] | 31.20 [792.48]                       | 286 [130]                |               |
|                              |                              | CD1X0750C1  |                          | Type 3R            | DH4              | 31.50 [800.00] | 29.50 [749.00] | 44.50 [1130.0]                       | 327 [148]                |               |

\*Typical watt losses at 480V system, 2kHz switching frequency, 60Hz  
 NOTE: The motor HP ratings above are for reference only.

# CORE & COIL DRAWINGS

Fig. # 1

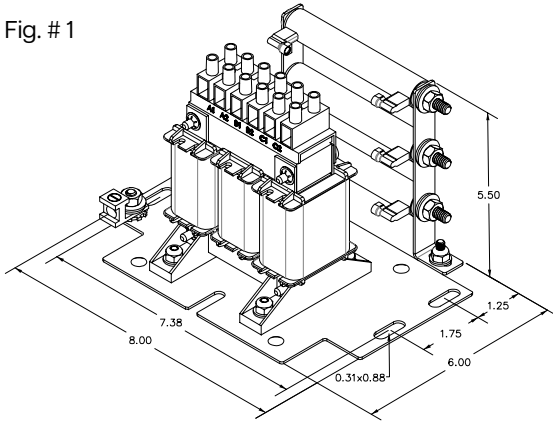


Fig. # 2

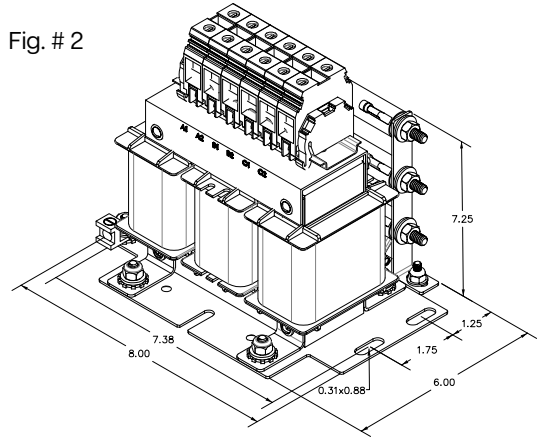


Fig. # 3

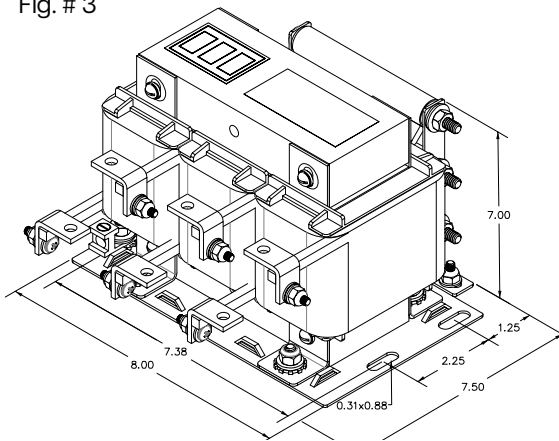


Fig. # 4

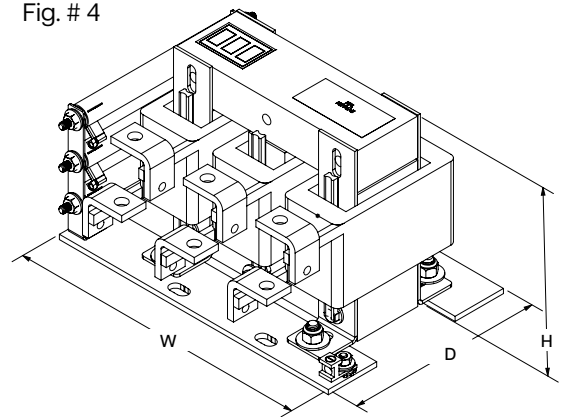


Fig. # 5

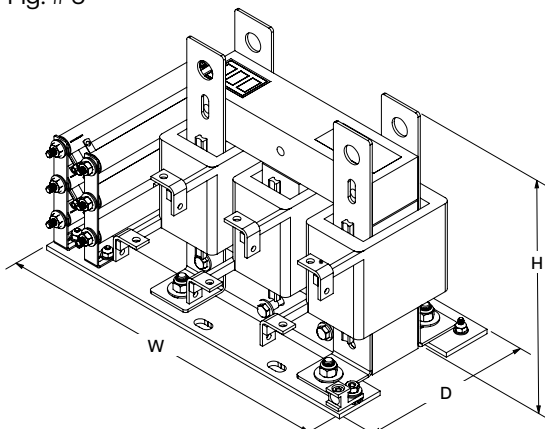
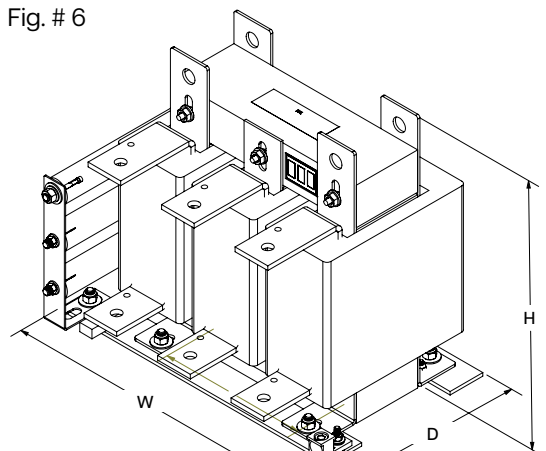
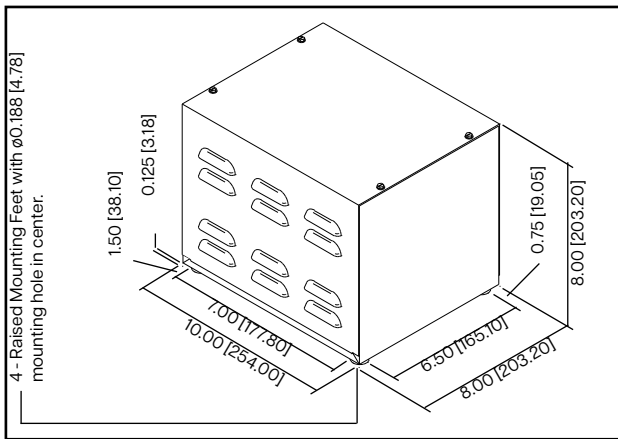


Fig. # 6



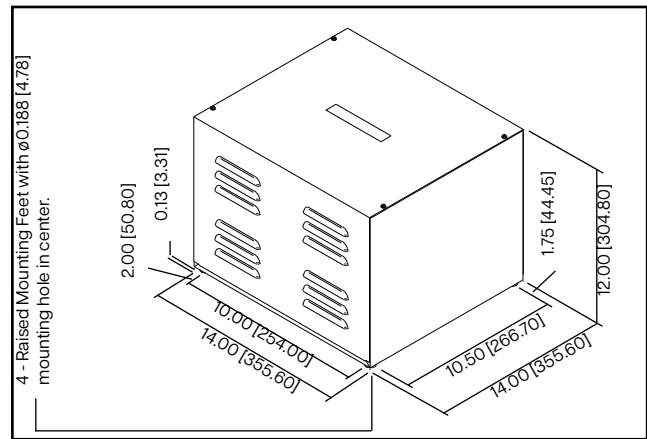
# TYPE 1 ENCLOSED DRAWINGS

## 'N1' SERIES ENCLOSURE



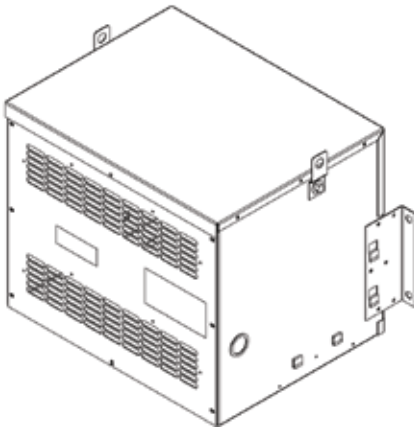
All dimension in inches [mm]

## 'N2' SERIES ENCLOSURE

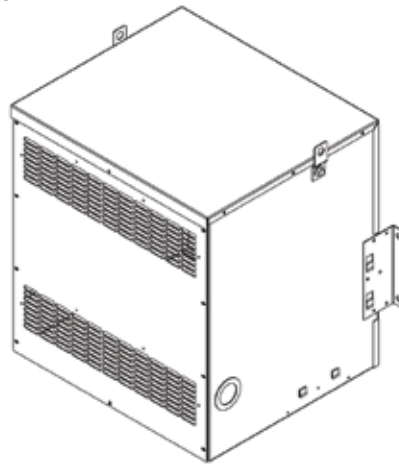


All dimension in inches [mm]

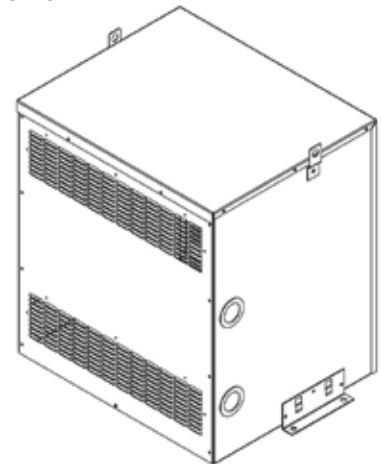
## CH2



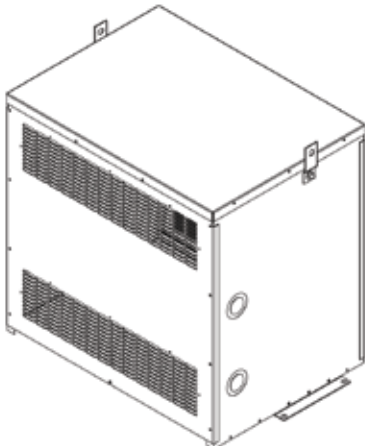
## CH4



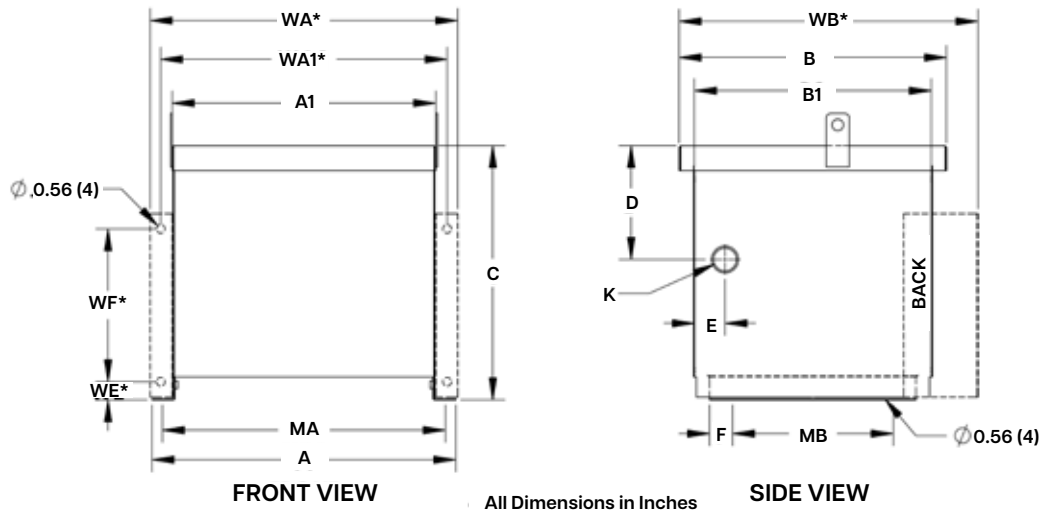
## CH5



## CH6

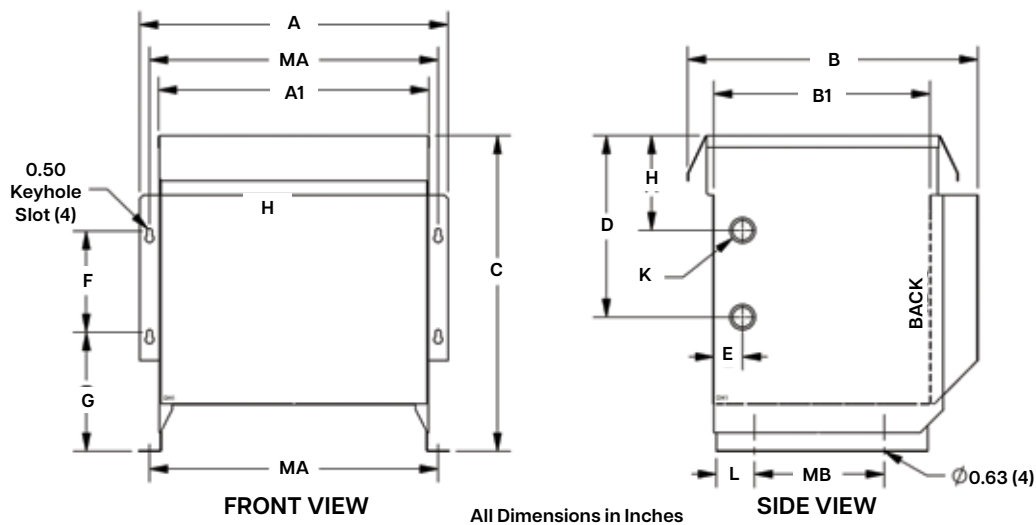


## TYPE 3R ENCLOSED DRAWINGS (STANDARD COMING SOON)



| Case Style | Dimensions in Inches [mm] |             |             |             |               |              |           |              |                     |               |            |
|------------|---------------------------|-------------|-------------|-------------|---------------|--------------|-----------|--------------|---------------------|---------------|------------|
|            | A                         | A1          | B           | B1          | C             | D            | E         | F            | K                   | MA            | MB         |
| CN1-1      | 16.9<br>[480]             | 14<br>[356] | 14<br>[356] | 12<br>[305] | 17.6<br>[448] | 7.4<br>[188] | 2<br>[51] | 1.88<br>[48] | 1.5/1.75<br>[39/45] | 15.5<br>[394] | 7<br>[178] |

\*Dimensions of enclosure when wall mounting bracket installed (optional accessory component)



| Case Style | Dimensions in Inches [mm] |               |               |             |               |               |           |            |               |              |                                    |             |               |            |  |
|------------|---------------------------|---------------|---------------|-------------|---------------|---------------|-----------|------------|---------------|--------------|------------------------------------|-------------|---------------|------------|--|
|            | A                         | A1            | B             | B1          | C             | D             | E         | F          | G             | H            | K                                  | L           | MA            | MB         |  |
| DH1        | 21.5<br>[546]             | 18.8<br>[477] | 20.1<br>[510] | 15<br>[381] | 22<br>[559]   | 12.6<br>[320] | 2<br>[51] | 7<br>[178] | 8.3<br>[211]  | 6.6<br>[168] | 1.38 X 1.75 K.O.<br>[35 x 44 K.O.] | 2.6<br>[66] | 20<br>[508]   | 9<br>[229] |  |
| DH2        | 25.8<br>[655]             | 23.3<br>[592] | 23.8<br>[604] | 18<br>[457] | 28.8<br>[731] | 17<br>[432]   | 2<br>[51] | 8<br>[203] | 10.3<br>[262] | 8.6<br>[218] | 1.75 X 2.50 K.O.<br>[44 X 63 K.O.] | 3.8<br>[96] | 24.6<br>[625] | 9<br>[229] |  |

<sup>1</sup>Knockout (K) sizes are actual diameters of knockout, not conduit sizes.

## Conduit Size vs. Actual Knockout Size Reference Table

| Standard Conduit Size | Actual Knockout Diameter |
|-----------------------|--------------------------|
| 0.50 [12.70]          | 0.88 [22.23]             |
| 0.75 [19.05]          | 1.13 [28.58]             |
| 1.00 [25.40]          | 1.38 [34.93]             |
| 1.25 [31.75]          | 1.75 [44.45]             |
| 1.50 [38.10]          | 2.00 [50.80]             |
| 2.00 [50.80]          | 2.50 [63.50]             |
| 2.50 [63.50]          | 3.00 [76.20]             |
| 3.00 [76.20]          | 3.63 [92.08]             |
| 3.50 [88.90]          | 4.13 [104.78]            |

Please note the above table is not applicable for Stainless Steel enclosures.  
All dimension in inches [mm]

## Termination Details

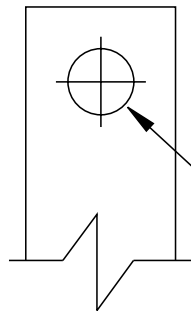


Diagram 1

DIAG 1A = 0.28" Dia.  
1B = 0.44" Dia.  
1C = 0.56" Dia.

| AMP Rating | Terminal Detail |
|------------|-----------------|
| 3          | 13-10 AWG       |
| 4          | 13-10 AWG       |
| 7          | 13-10 AWG       |
| 9          | 12 - 8 AWG      |
| 12         | 12 - 8 AWG      |
| 17         | 12 - 8 AWG      |
| 22         | 12 - 8 AWG      |
| 27         | 10 - 2 AWG      |
| 35         | 10 - 2 AWG      |
| 45         | 10 - 2 AWG      |
| 54         | 10 - 2 AWG      |
| 65         | Dia. 1A         |
| 80         | Dia. 1A         |
| 108        | Dia. 1A         |
| 130        | Dia. 1B         |
| 160        | Dia. 1B         |
| 200        | Dia. 1B         |
| 250        | Dia. 1B         |
| 305        | Dia. 1B         |
| 365        | Dia. 1B         |
| 415        | Dia. 1B         |
| 515        | Dia. 1C         |
| 600        | Dia. 1C         |
| 750        | Dia. 1C         |



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