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## SECTION 3

# RM SERIES LINE REACTORS & RC SERIES DV/DT FILTER REACTORS

### Single and Three Phase

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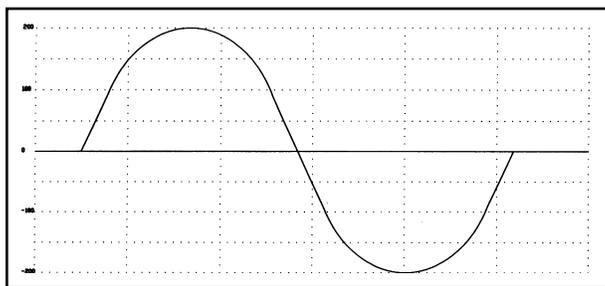
## Why Choose A Line Reactor

Utilizing Variable Speed Drives to control motor speed has impacted industry both in energy savings and increased efficiencies. The challenge for today's designers is dealing with non linear wave shapes generated by solid state devices.

By choosing a Hammond line reactor, many line problems can be eliminated. Additionally, performance, life expectancy and efficiency of both the motor and the drive itself are significantly enhanced.

### ELIMINATE NUISANCE TRIPPING

Transients due to switching on the utility line and harmonics from the drive system, can cause intermittent tripping of circuit breakers. Furthermore, modern switchgear, equipped with solid state trip sensing devices, is designed to react to peak current rather than RMS current. As switching transients can peak over 1000 volts, the resulting overvoltage will cause undesirable interruptions. A reactor added to your circuit restricts the surge current by utilizing its inductive characteristics, and therefore eliminates nuisance tripping.



*Normal sine wave from the Utility supply.*

### EXTEND THE LIFE OF SWITCHING COMPONENTS

Due to the attenuation of line disturbances, the life of your solid state devices are extended when protected by the use of a Hammond line reactor.

### SATURATION

Due to the care in the selection of the core material with its optimum flux density, Hammond line reactors will not saturate under the most adverse line conditions. Since the inductance is linear over a broader current range, equipment is protected even in extreme overcurrent circumstances.

### EXTEND THE LIFE OF YOUR MOTOR

Line reactors, when selected for the output of your drive, will enhance the waveform and virtually eliminate failures due to output circuit faults. Subsequently, motor operating temperatures are reduced by 10 to 20 degrees and motor noise is reduced due to the removal of some of the high frequency harmonic currents.

### LOW HEAT DISSIPATION

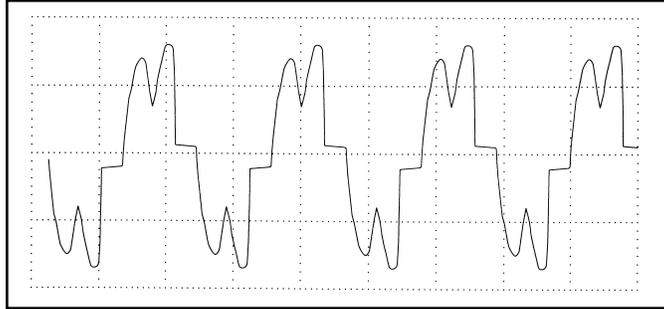
Particular attention has been focused on the design and field testing of this product line. The result are reactors with ideal operating features including low temperature rises and reduced losses. Hammond reactors will operate efficiently and heat dissipation in your equipment will be of minimal concern.



## MINIMIZE HARMONIC DISTORTION

Nonlinear current waveforms contain harmonic distortion. By using a Hammond line reactor you can limit the inrush current to the rectifier in your drive. The peak current is reduced, the wave form is rounded and harmonic distortion is minimized. Current distortion typically is reduced to 30%.

Severe Harmonic current distortion can also cause the system voltage to distort. Often, high peak harmonic current drawn by the drive, causes “flat-topping” of the voltage waveform. Adding a reactor controls the current component, and voltage harmonic distortion is therefore reduced.



***The total harmonic distortion of variable speed drives produces complex wave shapes such as the phase current shown above. The challenge for today's designers is to effectively minimize these line problems.***

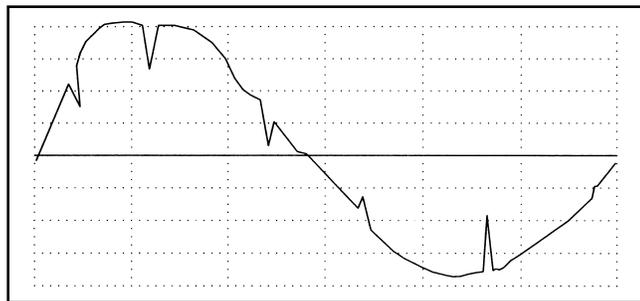
## SHORT CIRCUIT CAPABILITY

Hammond line reactors can withstand current under short circuit conditions, reducing the potential of severe damage to electronic equipment. In a short circuit, the inductance of the coil is necessary to limit overcurrent after the core has saturated. Hammond has extensive experience in designing and testing dry-type transformers to withstand short circuits for the most demanding applications, and this experience has been applied to line reactor design.

## REDUCE LINE NOTCHING

Whenever AC power is converted to DC by a rectifier using a nonlinear device, such as an SCR, the process of commutation occurs. The result is a notch in the voltage waveform. The number of notches is a function of both the number of pulses and the number of SCR's in the rectifier.

Line Reactors are used to provide the inductive reactance needed to reduce notching, which can adversely effect equipment operation.



***A voltage waveform illustrating line notching. Line reactors are used to provide the inductive reactance needed to reduce such notches.***



## Why Choose A Line Reactor con't...

### IMPEDANCE RATINGS

**Definition:**

$$\% Z = \frac{(VD \times 100) \times \sqrt{3}}{VS}$$

Z = IMPEDANCE (three phase)

VD = VOLTAGE DROP ACROSS REACTOR

VS = VOLTAGE SUPPLY FOR RATED CURRENT TO FLOW THROUGH REACTOR

### SELECTION - 3% OR 5% IMPEDANCE REACTOR

Choose 3% impedance reactors to satisfy most solid state applications in North America. Reactors rated for 3% impedance are ideal for absorbing normal line spikes and motor current surges, and will prevent most nuisance line tripping of circuit protection devices or equipment.

Where considerably higher line disturbances are present, a 5% impedance reactor may be required. Additionally, if the application is overseas, or when it is necessary to comply to IEEE 519, the higher impedance reactor is recommended. These units may also be selected to further reduce harmonic current and frequencies if desirable, or to both extend motor life or diminish motor noise.

### LINE REACTORS OR DRIVE ISOLATION TRANSFORMERS ?

When true line isolation is required, such as limiting short circuit current, or where it is necessary to step up or step down voltage, use a drive isolation transformer. Hammond carries an extensive line of drive isolation transformers in stock. Refer to Section 4 for information on Drive Isolation transformers.



## The RM Line Reactor . . .

### CORE

The quality and performance of a line reactor is fundamentally dependant on its ability to withstand harmonics and transients in what is clearly a difficult environment. The bonding and clamping techniques of the gapped core also significantly impacts its performance characteristics.

Hammond has paid particular attention to these basics to ensure both reliable and consistent performance.

Core materials, manufacturing and assembly processes have been carefully evaluated to produce optimum losses and sound levels necessary for this product.

### COILS

Copper conductors, precision wound for optimum short circuit withstandability and electrical balance, are used throughout the RM line. Choice of conductors, winding techniques and cooling ducts are precisely selected to assure the highest continuous, reliable performance.

### INSULATION SYSTEM

Hammond Line Reactors are designed to meet the most difficult temperature environments. On units up to 160 amps, RM line reactors are 115°C temperature rise, designed for 180°C Insulation Class. This results in a permissible 24 hour maximum ambient of 50°C, or an average of 40°C continuously.

On units larger than 160 amps, Insulation Class

220 is used throughout with a maximum permissible continuous ambient temperature of 60° C. These temperature tests are all measured at 150% rated 60 Hz current. For further information on temperature rises, please consult our Sales Offices.

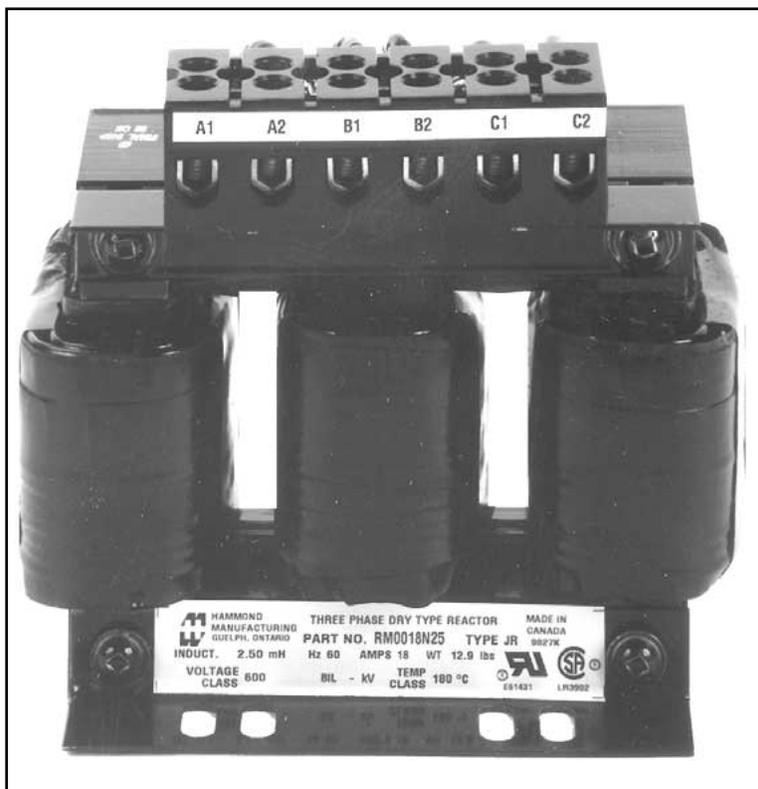
### VPI IMPREGNATION

Every reactor is fully VPI vacuum and pressure processed with VT (vinyl-toluene) Polyester Resin. This modern, vinyl-toluene based resin with its thicker build, offers significant benefits for electrical, mechanical and thermal properties.

This impregnation process and material results in a much improved dielectric constant, dissipation

factor, bonding strength and dielectric breakdown (volts per mil) than any other impregnation material including the more traditional oil modified epoxies and varnishes.

Vacuum impregnation is considered vital for the integrity of electrical equipment located in such sensitive locations. The core and coil assembly is finished in black to optimize heat dissipation.



### TERMINATIONS

Customer connections are provided for in several ways. Finger-proof-terminal blocks are provided on three model ranges, and terminal pads are supplied on higher current ratings. Refer to the dimensional summary for details. All connections are brazed to ensure electrical integrity.



## ... Features Of Construction

### ENCLOSURES

Enclosed reactors are standard as NEMA 2, suitable for floor or wall mounting. Other enclosures available are NEMA 1, UH2, UH3, UH4 and UH10. Wall mounting kits are available for UH2 enclosures. Please consult customer service for details.

Enclosures are finished with a 7 stage phosphate process with a baked enamel ANSI grey final finish.



### QUALITY CONTROL

Every reactor is production line tested in accordance with the requirements for UL, ANSI, NEMA and CSA. This confirms that every unit meets our highest expectations for Quality Assurance.

Additionally, line reactors have been short circuit tested at a certified laboratory to confirm the withstandability of our reactors to short circuits that may be present in a distribution system. Tests were done in accordance with ANSI C57.12.91 at 25 times rated current for 2 seconds. Those test results are available upon request. Successfully withstanding this test ensured that the RM line reactor will survive power stresses such as short circuits that may be present in a distribution circuit.

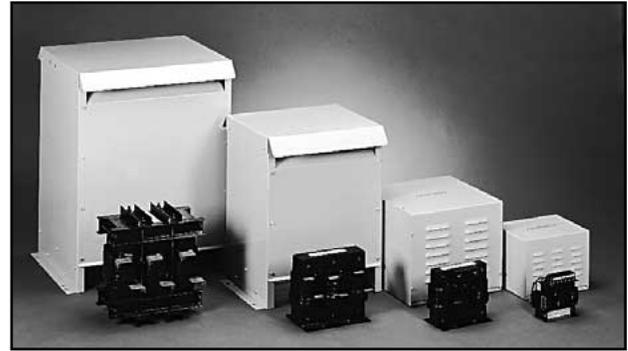
### UL and CSA CERTIFICATION

A vital assurance for our customers is the approval of this product line to national standards.

Our open and enclosed style reactors are recognized by UL and certified by CSA as follows:

UL File No.: E61431

CSA File No.: LR3902



This approval is inclusive to 2000 amps and 8.6 kV class, and may be of interest for any special applications.

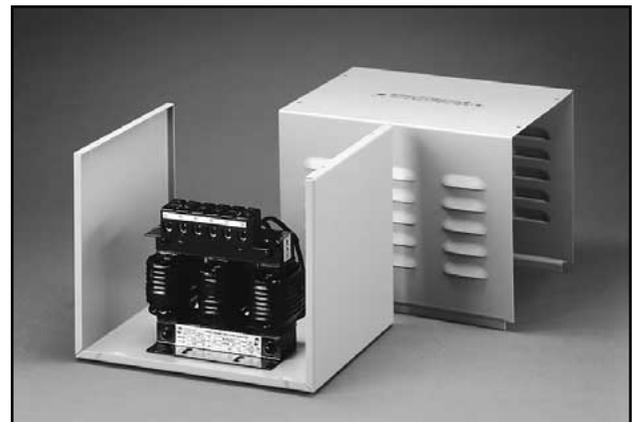
Our products are built in accordance with and meet UL 508 and UL 506 standards.

### INPUT AND OUTPUT SIDE REACTORS

Hammond 3 Phase Line Reactors are designed for both the input and output side of variable speed drives including Insulated Gate Bipolar Transistor (IGBT) type inverters.

### SPECIALS

For special applications or for any features that you may require beyond the standard line listed, please contact our Sales Offices.



## Standard 3 Phase Line Reactor Specifications

### RATINGS:

Nominal Inductance +/- 10% @ rated current.  
 95% of nominal inductance @ 150% rated current.  
 50% of nominal inductance @ 350% of rated current.

The above performance indicates that even at very substantial overload conditions (even beyond what other equipment in the circuit could tolerate), the RM Line Reactor will still provide current limiting performance against total harmonic distortion generated by the drive system.

### OVERLOAD:

150% rated 60 Hz current overload continuous.

### TEMPERATURE RISE:

115° C on units up to 160 amps; average ambient of 40°C.  
 115° C on units larger than 160 amps; average ambient of 60° C.

### INSULATION SYSTEM:

180° C Temperature Class up to 160 amps,  
 220° C Temperature Class over 160 amps.

### FREQUENCY:

60 Hz Fundamental Current Maximum.

### COOLING METHOD:

Natural convection

### SYSTEM VOLTAGE:

600 Volts Maximum

### APPROVALS:

UL File No.: E61431  
 CSA File No.: LR 3902

### SOUND LEVEL:

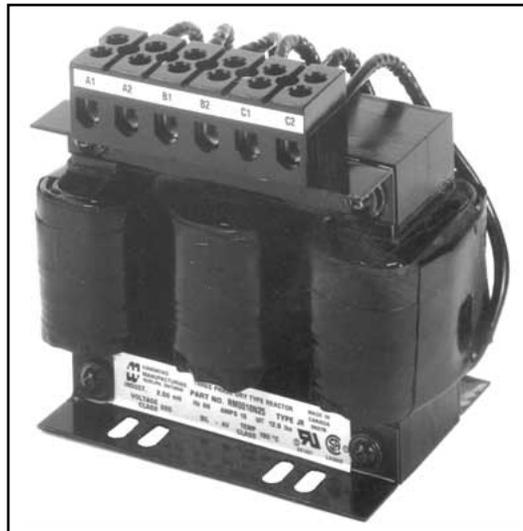
2 to 18 amps:	58 dBA
130 to 320 amps:	70 dBA
25 to 100 amps:	64 dBA
400 to 1200 amps:	75 dBA

### ENCLOSURE: (when specified)

NEMA 2

### HARMONIC WITHSTAND:

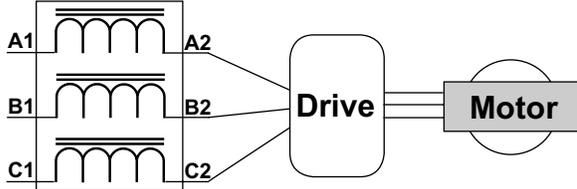
Hammond reactors are designed to withstand typical harmonics associated with both the input and output side of AC variable speed drives including IGBT type inverter drives. For additional information, contact our Sales Office.



# Application and Connection Diagrams For Line Reactors

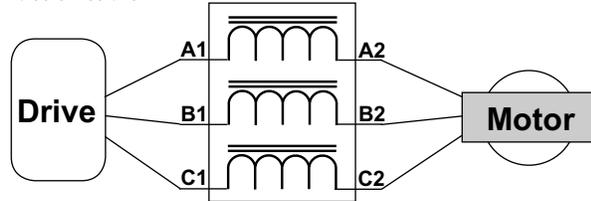
## INPUT SIDE OF DRIVE

Installed on the input side of drives, reactors will reduce line notching, limit current and voltage spikes and surges from the incoming line, and will reduce harmonic distortion from the drive onto the line. Units are installed in front of the drive or inverter as shown.



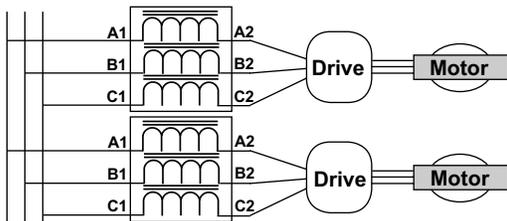
## OUTPUT SIDE OF DRIVE

On the output side between the motor and the controller, reactors protect the controller from short circuits at the load. Motor performance improves. Voltage and current waveforms from the supply are enhanced reducing motor overheating and noise emissions.



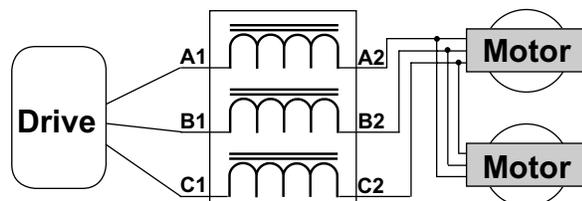
## MULTIPLE DRIVES

Individual line reactors are recommended when multiple drives are installed on the same power line. Individual reactors eliminates cross talk between multiple drives and provides isolated protection for each controller for its own specific load.



## MULTIPLE MOTORS

A single reactor can be installed when the application calls for multiple motors on the same drive. The reactor is sized based on the total horsepower of all the motors. Recommended for simultaneous operating motors only.



# RM Series Line Reactor Selection Tables

**Line Reactor Part Number Guide**

RM 0002 M 32 \* \_

Further suffix to follow.  
 Add suffix "E" for Enclosure.  
 Inductance Value  
 The inductance value is preceded with a letter to designate the position of the decimal point to determine the inductance. The letters are as follows:  
 'M' XX. mH  
 'N' X.X mH  
 'P' 0.XX mH  
 'U' .0XX mH or XX.0 uH  
 Example: M32 is 32.0 mH  
 4 digits for current rating  
 In-Line Reactor

**Note:** As all characters of the P/N represent performance values of the reactor, P/N's are not completely sequential. They are sorted by current rating.

\* Add the Suffix "E" to the standard part number for an Enclosed unit.

240 VOLT - 60 Hz				
HP RATING	3% IMPEDANCE		5% IMPEDANCE	
	P/N	AMPS	P/N	AMPS
0.5	RM0004N65	4	RM0004M12	4
1	RM0004N30	4	RM0004N65	4
1.5	RM0008N30	8	RM0008N50	8
2	RM0008N15	8	RM0008N30	8
3	RM0012N13	12	RM0012N25	12
5	RM0018P80	18	RM0018N15	18
7.5	RM0025P50	25	RM0025N12	25
10	RM0035P40	35	RM0035P80	35
15	RM0045P30	45	RM0055P50	55
20	RM0055P25	55	RM0055P50	55
25	RM0080P20	80	RM0080P40	80
30	RM0080P20	80	RM0080P23	80
40	RM0110P15	110	RM0110P18	110
50	RM0130P10	130	RM0130P20	160
60	RM0160U75	160	RM0160P15	160
75	RM0200U55	200	RM0200P11	200
100	RM0250U45	250	RM0250U90	250
125	RM0320U40	320	RM0320U75	320
150	RM0400U30	400	RM0400U61	400
200	RM0500U25	500	RM0500U50	500
250	RM0600U20	600	RM0600U40	600
300	RM0750U15	750	RM0750U25	750
350	RM0900U13	900	RM0900U26	900
400	RM1000U11	1000	RM1000U18	1000
500	RM1200U10	1200	RM1200U15	1200

480 VOLT - 60 Hz				
HP RATING	3% IMPEDANCE		5% IMPEDANCE	
	P/N	AMPS	P/N	AMPS
1	RM0002M12	2	RM0002M20	2
1.5	RM0004N91	2	RM0004M12	2
2	RM0004N65	4	RM0004M12	4
3	RM0008N50	8	RM0008N75	8
5	RM0008N30	8	RM0008N50	8
7.5	RM0012N25	12	RM0012N42	12
10	RM0018N15	18	RM0018N25	18
15	RM0025N12	25	RM0025N20	25
20	RM0035P80	35	RM0035N17	35
25	RM0035P80	35	RM0035N12	35
30	RM0045P70	45	RM0045N12	45
40	RM0055P50	55	RM0055P85	55
50	RM0080P40	80	RM0080P70	80
60	RM0080P40	80	RM0080P70	80
75	RM0110P30	110	RM0110P45	110
100	RM0130P20	130	RM0130P30	130
125	RM0160P15	160	RM0160P23	160
150	RM0200P11	200	RM0200P24	200
200	RM0250U90	250	RM0250P15	250
250	RM0320U75	320	RM0320P13	320
300	RM0400U61	400	RM0400P11	400
350	RM0500U50	500	RM0500U85	500
400	RM0500U50	500	RM0500U85	500
500	RM0600U40	600	RM0600U65	600
600	RM0750U36	750	RM0750U60	750
700	RM0900U26	900	RM0900U43	900
800	RM1000U29	1000	RM1000U38	1000
1000	RM1200U18	1200	RM1200U30	1200

600 VOLT - 60 Hz				
HP RATING	3% IMPEDANCE		5% IMPEDANCE	
	P/N	AMPS	P/N	AMPS
1	RM0002M20	2	RM0002M32	2
1.5	RM0002M12	2	RM0002M20	2
2	RM0004M12	4	RM0004M22	4
3	RM0004N91	4	RM0004M12	4
5	RM0008N50	8	RM0008N75	8
7.5	RM0012N31	12	RM0012N51	12
10	RM0012N25	12	RM0012N42	12
15	RM0018N15	18	RM0018N25	18
20	RM0025N12	25	RM0025N20	25
25	RM0035N12	35	RM0035N17	35
30	RM0035P80	35	RM0035N17	35
40	RM0045P70	45	RM0045N12	45
50	RM0055P50	55	RM0055P85	55
60	RM0080P40	80	RM0080P70	80
75	RM0080P40	80	RM0080P70	80
100	RM0110P30	110	RM0110P45	110
125	RM0130P20	130	RM0130P37	130
150	RM0160P23	160	RM0160P32	160
200	RM0200P19	200	RM0200P24	200
250	RM0250P15	250	RM0250P19	250
300	RM0320U96	320	RM0320P16	320
350	RM0400U82	400	RM0400P14	400
400	RM0400U82	400	RM0400P14	400
500	RM0500U57	500	RM0500U96	500
600	RM0600U65	600	RM0600U80	600
700	RM0700U41	700	RM0700U68	700
800	RM0750U36	750	RM0750U60	750
900	RM0900U32	900	RM0900U53	900
1000	RM1000U29	1000	RM1000U48	1000
1200	RM1200U24	1200	RM1200U40	1200



## Standard 3 Phase Line Reactor Specification Charts

Current (Amps)	Part Number	Inductance	Watts Loss	Dimensions					Mtg Slot/ Hole Size	Dim. Fig. #	Encl. Fig. #	Weight (Lbs.)	Enclosed Weight(Lbs.)
				H	W	D	Mtg. D	Mtg. W					
2	RM0002M12	12.0	7	3.40	4.40	2.83	1.77	1.44	.28 x .63	1	N1	2	9
2	RM0002M20	20.0	9	3.40	4.40	2.83	1.77	1.44	.28 x .63	1	N1	3	10
2	RM0002M32	32.0	13	3.40	4.40	2.83	1.77	1.44	.28 x .63	1	N1	3	10
4	RM0004M12	12.0	21	3.40	4.40	3.33	2.39	1.44	.28 x .63	1	N1	4	11
4	RM0004M22	22.0	25	4.80	6.00	3.30	2.09	2.00	.28 x .63	3	N1	8	15
4	RM0004N30	3.00	7	3.40	4.40	2.83	1.77	1.44	.28 x .63	1	N1	2	9
4	RM0004N65	6.50	13	3.40	4.40	2.83	1.77	1.44	.28 x .63	1	N1	3	10
4	RM0004N91	9.10	15	3.40	4.40	2.83	1.77	1.44	.28 x .63	1	N1	3	10
8	RM0008N15	1.50	11	3.40	4.40	2.83	1.77	2.00	.28 x .63	1	N1	3	10
8	RM0008N30	3.00	25	3.40	4.40	2.83	1.77	2.00	.28 x .63	1	N1	3	10
8	RM0008N50	5.00	31	3.40	4.40	3.39	2.39	2.00	.28 x .63	1	N1	4	11
8	RM0008N75	7.50	31	4.80	6.30	3.55	2.34	2.00	.28 x .63	3	N1	9	16
12	RM0012N13	1.30	23	3.40	4.40	2.83	1.77	2.00	.28 x .63	1	N1	3	10
12	RM0012N25	2.50	26	4.80	6.00	3.30	2.09	2.00	.28 x .63	3	N1	8	15
12	RM0012N31	3.10	30	4.80	6.00	3.55	2.34	2.00	.28 x .63	3	N1	9	16
12	RM0012N42	4.20	34	4.80	6.30	3.80	2.59	2.00	.28 x .63	3	N1	10	17
12	RM0012N51	5.10	39	4.80	6.00	3.80	2.59	2.00	.28 x .63	3	N1	13	20
18	RM0018N15	1.50	29	4.80	6.30	3.55	2.34	2.00	.28 x .63	3	N1	9	16
18	RM0018N25	2.50	40	5.70	6.00	3.84	2.84	3.00	.28 x .63	2	N1	13	20
18	RM0018P80	0.80	19	4.80	6.00	3.30	2.09	2.00	.28 x .63	3	N1	7	14
25	RM0025N12	1.20	44	5.70	6.00	3.34	2.34	3.00	.28 x .63	2	N1	10	18
25	RM0025N20	2.00	59	5.61	6.90	3.95	2.75	3.00	.38 x .63	3	N2	18	35
25	RM0025P50	0.50	23	5.70	6.00	3.09	2.09	3.00	.28 x .63	2	N1	7	14
35	RM0035N12	1.20	75	6.88	8.50	4.37	3.12	3.00	.44 X 1.00	3	N2	26	43
35	RM0035N17	1.70	90	6.88	8.50	4.37	3.62	3.00	.44 X 1.00	3	N2	35	52
35	RM0035P40	0.40	36	5.70	6.00	3.34	2.34	3.00	.28 x .63	2	N1	9	16
35	RM0035P80	0.80	51	5.61	6.90	3.95	2.75	3.00	.38 x .63	3	N2	17	24
45	RM0045N12	1.20	100	6.88	8.50	4.37	3.63	3.00	.44 X 1.00	3	N2	35	52
45	RM0045P30	0.30	33	5.70	6.00	3.84	2.84	3.00	.28 x .63	2	N1	13	20
45	RM0045P70	0.70	64	5.61	6.90	4.45	3.25	3.00	.38 x .63	3	N2	22	39
55	RM0055P25	0.25	39	5.70	6.00	3.84	2.84	3.00	.28 x .63	2	N1	12	19
55	RM0055P50	0.50	75	6.88	8.50	4.37	3.12	3.00	.44 X 1.00	3	N2	26	43
55	RM0055P85	0.85	110	6.88	8.50	4.37	3.62	3.00	.44 X 1.00	3	N2	35	52
80	RM0080P20	0.20	88	6.88	8.50	4.37	3.12	3.60	.44 X 1.00	4	N2	26	43
80	RM0080P23	0.23	70	6.88	8.50	4.87	3.62	3.60	.44 X 1.00	4	N2	33	50
80	RM0080P40	0.40	138	6.88	8.50	4.87	3.62	3.60	.44 X 1.00	4	N2	36	53
80	RM0080P70	0.70	140	8.29	10.50	5.85	4.23	3.60	.44 X 1.25	4	N2	63	30
110	RM0110P15	0.15	86	6.88	8.50	4.37	3.12	3.60	.44 X 1.00	4	N2	27	44
110	RM0110P18	0.18	95	6.88	8.50	4.87	3.62	3.60	.44 X 1.00	4	N2	35	52
110	RM0110P30	0.30	123	8.29	10.50	5.35	3.73	3.60	.44 X 1.25	4	N2	52	69
110	RM0110P45	0.45	130	8.30	10.50	5.85	4.23	3.60	.44 X 1.25	4	N2	63	80
130	RM0130P10	0.10	95	6.88	8.50	4.37	3.12	3.00	.44 X 1.00	4	N2	27	44
130	RM0130P20	0.20	115	8.29	10.50	5.35	3.73	3.60	.44 X 1.25	4	N2	41	58
130	RM0130P30	0.30	142	8.29	10.50	5.85	4.23	3.60	.44 X 1.25	4	N2	53	70
130	RM0130P37	0.37	143	8.29	10.50	6.85	5.23	3.60	.44 X 1.25	4	N2	75	92
160	RM0160P15	0.15	129	8.29	10.50	5.35	3.73	3.60	.44 X 1.25	4	N2	46	63
160	RM0160P23	0.23	142	8.29	10.50	6.35	4.73	3.60	.44 X 1.25	4	N2	66	83
160	RM0160P32	0.32	141	8.29	10.50	6.87	6.73	3.60	.44 X 1.25	4	UH2	104	164
160	RM0160U75	0.08	100	6.88	8.50	4.37	3.12	3.60	.44 X 1.00	4	N2	29	46

SECTION 3



## Standard 3 Phase Line Reactor Specification Charts

Current (Amps)	Part Number	Inductance	Watts Loss	Dimensions					Mtg Slot/ Hole Size	Dim. Fig. #	Encl. Fig. #	Weight (Lbs.)	Enclosed Weight(Lbs.)
				H	W	D	Mtg. D	Mtg. W					
200	RM0200P11	0.11	114	8.29	10.50	5.85	4.23	3.60	.44 X 1.25	4	UH2	52	112
200	RM0200P19	0.190	138	8.29	10.50	7.85	6.23	3.60	.44 X 1.25	4	UH2	93	153
200	RM0200P24	0.240	164	8.29	10.50	8.35	6.73	3.60	.44 X 1.25	4	UH2	105	165
200	RM0200U55	0.055	89	6.88	10.50	4.87	3.62	3.60	.44 X 1.00	4	N2	37	154
250	RM0250P15	0.150	188	11.43	13.75	6.75	5.44	4.80	.44 X 1.00	5	UH2	119	179
250	RM0250P19	0.190	203	11.43	13.75	7.25	5.94	4.80	.44 X 1.00	5	UH2	137	197
250	RM0250U45	0.045	90	8.29	10.50	5.35	3.73	3.60	.44 X 1.25	4	UH2	40	100
250	RM0250U90	0.090	131	8.29	10.50	6.35	4.73	4.80	.44 X 1.25	4	UH2	65	125
320	RM0320P13	0.13	245	11.43	13.75	7.75	6.44	4.80	.44 X 1.00	5	UH2	127	187
320	RM0320P16	0.160	270	11.43	13.75	7.25	5.94	4.80	.44 X 1.00	5	UH2	146	206
320	RM0320U40	0.040	94	8.29	10.50	6.85	5.23	4.80	.44 X 1.25	4	UH2	69	129
320	RM0320U75	0.075	184	11.43	13.75	7.25	5.94	4.80	.44 X 1.00	5	UH2	87	147
320	RM0320U96	0.096	214	11.43	13.75	6.25	5.44	4.80	.44 X 1.00	5	UH2	107	167
400	RM0400P11	0.11	278	11.43	13.75	7.75	6.44	4.80	.44 X 1.00	5	UH2	156	216
400	RM0400P14	0.14	305	14.00	18.00	9.75	8.25	6.00	0.563	6	UH2	253	313
400	RM0400U30	0.030	130	8.29	10.50	6.35	4.73	4.80	.44 X 1.25	4	UH2	61	121
400	RM0400U61	0.061	177	11.43	13.75	6.75	5.44	4.80	.44 X 1.00	5	UH2	115	175
400	RM0400U82	0.082	210	11.43	13.75	7.75	6.44	4.80	.44 X 1.00	5	UH2	148	208
500	RM0500U25	0.025	152	11.43	13.75	7.75	6.44	4.80	.44 X 1.00	5	UH2	100	160
500	RM0500U50	0.05	196	11.43	13.75	7.75	6.44	4.80	.44 X 1.00	5	UH2	151	211
500	RM0500U57	0.057	217	11.43	13.75	8.25	6.94	4.80	.44 X 1.00	5	UH3	168	245
500	RM0500U85	0.085	280	11.43	13.75	9.75	8.44	4.80	.44 X 1.00	5	UH3	225	302
500	RM0500U96	0.096	317	14.00	18.00	10.25	8.75	6.00	0.563	6	UH3	282	359
600	RM0600U20	0.020	147	11.43	13.75	8.30	6.94	4.80	.44 X 1.00	5	UH3	115	192
600	RM0600U40	0.040	223	11.43	13.75	8.25	6.94	4.80	.44 X 1.00	5	UH3	177	254
600	RM0600U65	0.065	290	11.43	13.75	9.75	8.44	4.80	.44 X 1.00	5	UH3	230	307
600	RM0600U80	0.080	340	14.00	18.00	10.75	9.25	6.00	0.563	6	UH4	310	417
700	RM0700U41	0.041	276	14.00	18.00	9.25	7.25	6.00	0.563	6	UH4	240	347
700	RM0700U68	0.068	400	20.50	22.50	10.75	8.75	7.50	0.75	6	UH4	403	510
750	RM0750U15	0.015	209	14.00	18.00	8.25	6.25	6.00	0.563	6	UH4	159	266
750	RM0750U25	0.025	250	14.00	18.00	8.75	6.75	6.00	0.563	6	UH4	184	291
750	RM0750U36	0.036	293	14.00	18.00	9.75	7.75	6.00	0.563	6	UH4	236	343
750	RM0750U60	0.060	415	20.50	22.50	10.75	8.75	7.50	0.75	6	UH4	403	510
900	RM0900U13	0.013	216	14.00	18.00	9.25	7.25	6.00	0.563	6	UH4	159	266
900	RM0900U26	0.026	286	14.00	18.00	10.25	8.25	6.00	0.563	6	UH4	259	366
900	RM0900U32	0.032	400	20.50	22.50	10.25	8.25	7.50	0.75	6	UH4	340	447
900	RM0900U43	0.043	441	20.50	22.50	11.75	9.75	7.50	0.75	6	UH4	434	541
900	RM0900U53	0.053	490	20.50	22.50	12.25	10.25	7.50	0.75	6	UH4	546	653
1000	RM1000U11	0.011	179	14.00	22.50	8.75	6.75	6.00	0.563	6	UH4	170	277
1000	RM1000U18	0.018	232	14.00	22.50	10.75	8.75	6.00	0.563	6	UH10	282	432
1000	RM1000U29	0.029	377	20.50	22.50	11.75	9.75	7.50	0.75	6	UH10	394	544
1000	RM1000U38	0.038	416	20.50	22.50	12.25	10.25	7.50	0.75	6	UH10	534	684
1000	RM1000U48	0.048	490	20.50	22.50	13.25	11.25	7.50	0.75	6	UH10	642	792
1200	RM1200U10	0.010	228	14.00	18.50	9.25	7.25	6.00	0.563	6	UH10	205	355
1200	RM1200U15	0.015	287	14.00	18.50	10.75	8.75	6.00	0.563	6	UH10	282	432
1200	RM1200U18	0.018	395	20.50	22.50	10.25	8.25	7.50	0.75	6	UH10	343	493
1200	RM1200U24	0.024	440	20.50	22.50	11.25	9.25	7.50	0.75	6	UH10	444	594
1200	RM1200U30	0.030	490	20.50	22.50	12.25	10.25	7.50	0.75	6	UH10	534	684
1200	RM1200U40	0.040	576	20.50	22.50	13.75	11.75	7.50	0.75	6	UH10	700	850



## Single Phase Line Reactors

Hammond Line Reactors may be used in Single Phase Applications . However, in order to do so, please use the following selection tables and follow the circuit diagrams listed below. **Note:** Please ensure you properly insulate terminals B1 and B2 before any connections are made.

### PART NUMBER GUIDE

RM 0002 M 32 \_ \_

Further suffix to follow. Add suffix "E" for Enclosure.

Inductance Value

The inductance value is preceded with a letter to designate the position of the decimal point to determine the inductance. The letters are as follows:

- 'M' XX. mH
- 'N' X.X mH
- 'P' 0.XX mH
- 'U' .0XX mH or XX.0 uH

Example: M32 is 32.0 mH

4 digits for current rating

In-Line Reactor

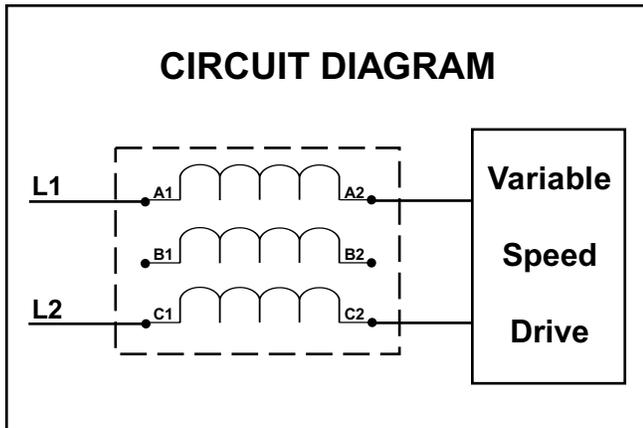
**Note:** As all characters of the P/N represent performance values of the reactor, P/N's are not completely sequential. They are sorted by current rating.

### SELECTION TABLES

240 VOLT				
HP Rating	3% IMPEDANCE		5% IMPEDANCE	
	P/N	Amps	P/N	Amps
0.5	RM0004N65	4	RM0004N65	4
1	RM0004N65	4	RM0004N65	4
1.5	RM0008N50	8	RM0008N50	8
2	RM0008N30	8	RM0008N30	8
3	RM0012N25	12	RM0012N25	12
5	RM0018N15	18	RM0018N15	18
7.5	RM0025P50	25	RM0025P50	25
10	RM0035P80	35	RM0035P80	35

480 VOLT				
HP Rating	3% IMPEDANCE		5% IMPEDANCE	
	P/N	Amps	P/N	Amps
1	RM0004M12	4	RM0004M22	4
1.5	RM0004M12	4	RM0004M12	4
2	RM0004N65	4	RM0004M12	4
3	RM0008N75	8	RM0008N75	8
5	RM0008N50	8	RM0008N50	8
7.5	RM0012N25	12	RM0012N31	12
10	RM0018N15	18	RM0018N25	18

600 VOLT				
HP Rating	3% IMPEDANCE		5% IMPEDANCE	
	P/N	Amps	P/N	Amps
1	RM0004M22	4	RM0002M32	2
1.5	RM0004M12	4	RM0004M22	4
2	RM0004M12	4	RM0004M22	4
3	RM0004N65	4	RM0004M12	4
5	RM0008N50	8	RM0008N75	8
7.5	RM0012N31	12	RM0012N51	12
10	RM0012N25	12	RM0012N51	12



# RM Line Reactor Cross-Reference Table

MTE Part Number	Current (amps)	Hammond Part Number	Induct. (mH)	TCI Part Number
RL-00201	2	RM0002M12	12.000	KLR2A
RL-00202	2	RM0002M20	20.000	KLR2C
RL-00203	2	RM0002M32	32.000	*
RL-00404	4	RM0004M12	12.000	*
RL-00401	4	RM0004N30	3.000	KLR4B
RL-00402	4	RM0004N65	6.500	KLR4A
RL-00403	4	RM0004N91	9.100	KLR4C
RL-00801	8	RM0008N15	1.500	KLR8B
RL-00802	8	RM0008N30	3.000	KLR8A
RL-00803	8	RM0008N50	5.000	KLR8C
RL-00804	8	RM0008N75	7.500	*
RL-01201	12	RM0012N13	1.300	KLR12B
RL-01202	12	RM0012N25	2.500	KLR12A
RL-01203	12	RM0012N42	4.200	KLR12C
RL-01802	18	RM0018N15	1.500	KLR16A
RL-01803	18	RM0018N25	2.500	KLR16C
RL-01801	18	RM0018P80	0.800	KLR16B
RL-02502	25	RM0025N12	1.200	KLR25A
RL-02503	25	RM0025N20	2.000	KLR25C
RL-02501	25	RM0025P50	0.500	KLR25B
RL-03503	35	RM0035N12	1.200	KLR35C
RL-03501	35	RM0035P40	0.400	KLR35B
RL-03502	35	RM0035P80	0.800	KLR35A
RL-04503	45	RM0045N12	1.200	KLR45C
RL-04501	45	RM0045P30	0.300	KLR45B
RL-04502	45	RM0045P70	0.700	KLR45A
RL-05501	55	RM0055P25	0.250	KLR55B
RL-05502	55	RM0055P50	0.500	KLR55A
RL-05503	55	RM0055P85	0.850	KLR55C

MTE Part Number	Current (amps)	Hammond Part Number	Induct. (mH)	TCI Part Number
RL-00201	2	RM0002M12	12.000	KLR2A
RL-08001	80	RM0080P20	0.200	KLR80B
RL-08002	80	RM0080P40	0.400	KLR80A
RL-08003	80	RM0080P70	0.700	KLR80C
RL-10001	100	RM0110P15	0.150	KLR110B
RL-10002	100	RM0110P30	0.300	KLR110A
RL-10003	100	RM0110P45	0.450	KLR110C
RL-13001	130	RM0130P10	0.100	KLR130B
RL-13002	130	RM0130P20	0.200	KLR130A
RL-13003	130	RM0130P30	0.300	KLR130C
RL-16002	160	RM0160P15	0.150	KLR160A
RL-16003	160	RM0160P23	0.230	KLR160C
RL-16001	160	RM0160U75	0.075	KLR160B
RL-20002	200	RM0200P11	0.110	KLR200A
RL-20003	200	RM0200P19	0.190	KLR200C
RL-20001	200	RM0200U55	0.055	KLR200B
RL-25003	250	RM0250P15	0.150	KLR250C
RL-25001	250	RM0250U45	0.045	KLR250B
RL-25002	250	RM0250U90	0.090	KLR250A
RL-32003	320	RM0320P13	0.130	KLR300C
RL-32001	320	RM0320U40	0.040	KLR300B
RL-32002	320	RM0320U75	0.075	KLR300A
RL-40003	400	RM0400P11	0.110	KLR360C
RL-40001	400	RM0400U30	0.030	KLR360B
RL-40002	400	RM0400U61	0.061	KLR360A
RL-50001	500	RM0500U25	0.025	KLR480B
RL-50002	500	RM0500U50	0.050	KLR480A
RL-50003	500	RM0500U85	0.085	KLR480C
RL-60001	600	RM0600U20	0.020	KLR600B
RL-60002	600	RM0600U40	0.040	KLR600A
RL-60003	600	RM0600U65	0.065	KLR600C



## DV/DT Filter Reactors

The advent of pulse width modulated (PWM) inverters with IGBT high speed transistors, has resulted in smaller more cost effective drives and increased switching speeds. A waveform with increased harmonics at higher frequencies is the result of these much faster switching devices, usually at frequencies of 10,000 to 20,000 Hertz.

Drives and motors often need to be separated by significant distances. For deep wells or mines, the motors are usually controlled on the surface. As a result, the distance between the drive and the motor creates long motor lead lengths. In some plant applications, the motors can withstand the harsh environment but the sensitive variable frequency drive cannot. This again results in long lead lengths to the motor.

Most manufactures of variable frequency drives will publish a recommended maximum distance between their equipment and the motor. Sometimes these recommendations create application difficulties, thus increased motor lead lengths are inevitable.

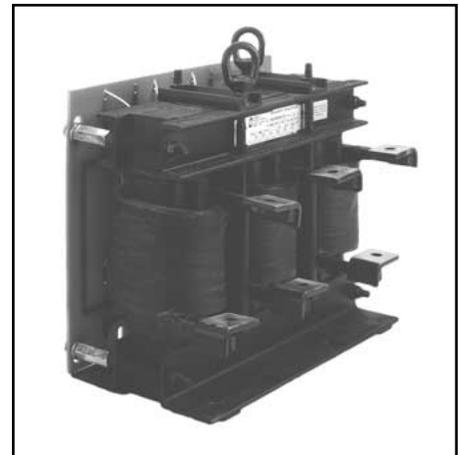
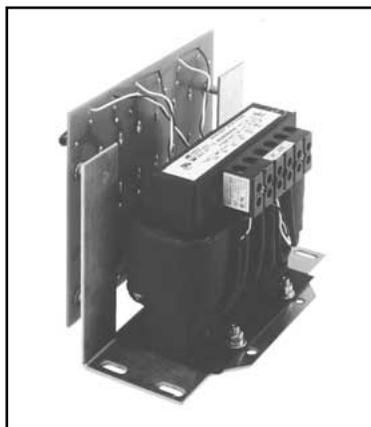
DV/DT is explained as the steep-front voltage pulses that travel down these long leads in the circuit to the motor and subsequently reverted back in a “reflective wave”. When the conductors are long enough, usually 20 feet or more, the time for reflection matches the time for transmission resulting in a high amplitude ‘standing wave’ on the circuit. Voltage spikes of up to 2100 volts are frequently experienced for 600-volt systems, and motor winding failures are the result.

A Filter Reactor, installed in front of the motor, combines the current limiting ability of an AC line reactor plus an resistive capacitance circuit that forms a damped, low pass filter. It provides protection for the motor by slowing the rate of voltage increase and minimizing the peak voltage that occurs at the motor terminals.

The cost of a DV/DT Filter Reactor is little more than the cost of the reactor and can be mounted next to the motor, or inside the PWM enclosure.

### APPLICATIONS

The Hammond RC series DV/DT filter reactors are specifically designed for drive/motor applications with long lead lengths (usually where the motor cable length is 20 feet and greater). They are always installed between the IGBT variable frequency drive and the motor. Typical installation applications include production process lines, conveyor systems and deep wells.



## TYPICAL “RC” DV/DT FILTER REACTOR PERFORMANCE

The RC series DV/DT filter reactors combine appropriate values of inductance, capacitance and resistance to form a filter which reduces dv/dt and peak voltages from the PWM voltage waveform. This combined with a 3% impedance reactor, that will reduce motor heating harmonics, will significantly increase the life of the motor.

Long lead length motor drive applications can experience motor terminal peak voltage spikes twice the DC bus voltage, and higher. Therefore motor terminal voltage peaks of 1200 volts for 480V drives and 1600 volts for 600V drives are not uncommon. The highest peak voltages will typically occur in lower HP applications.

## Standard “RC” DV/DT Filter Reactor Specifications

## RATINGS:

Nominal Inductance +/- 10% @ rated current.  
95% of nominal inductance @ 150% rated current.  
50% of nominal inductance @ 350% of rated current.

The above performance indicates that even at very substantial overload conditions (even beyond what other equipment in the circuit could tolerate), the RM Line Reactor will still provide current limiting performance against total harmonic distortion generated by the drive system.

## OVERLOAD:

150% rated 60 Hz current overload continuous.

## TEMPERATURE RISE:

115° C on units up to 160 amps; average ambient of 40°C.

115° C on units larger than 160 amps; average ambient of 60° C.

## INSULATION SYSTEM:

180° C Temperature Class up to 160 amps,  
220° C Temperature Class over 160 amps.

## FREQUENCY:

60 Hz Fundamental Current Maximum.

## COOLING METHOD:

Natural convection

## SYSTEM VOLTAGE:

600 Volts Maximum

## APPROVALS:

UL File No.: E61431  
CSA File No.: LR 3902

## SOUND LEVEL:

2 to 18 amps:	58 dBA
130 to 320 amps:	70 dBA
25 to 100 amps:	64 dBA
400 to 600 amps:	75 dBA

## ENCLOSURE: (when specified)

NEMA 2

## HARMONIC WITHSTAND:

Hammond dv/dt filter reactors are designed to withstand harmonics associated with the output side of variable speed drives including IGBT type inverters.

## SWITCHING FREQUENCY:

2.5 KHz up to 20 KHz.



## “RC” DV/DT Filter Reactor Selection

### SELECTION GUIDELINES

Hammond RC output filter reactors are current rated devices. Therefore, to properly size and select the correct unit for your application, it is necessary to know the total motor load on the inverter. All RC filter reactors are designed to be located next to and wired directly to the input terminals of the motor. Placement of these filter reactors anywhere else in the circuit will negatively impact the units performance.

Our RC DV/DT filter reactor is standard with 3% impedance RM line reactors. Utilizing a 3% reactor provides optimum performance and protection for the motor. Using smaller impedance reactors will not protect against the same current peaks, and motor performance will be diminished.

**DVDT Filter Reactor Part Number Guide**

RC 0002 M 32 \* \_

↑ ↑ ↑ ↑ ↑

Further suffix to follow.  
Add suffix “E” for Enclosure.

Inductance Value

The inductance value is preceded with a letter to designate the position of the decimal point to determine the inductance. The letters are as follows:

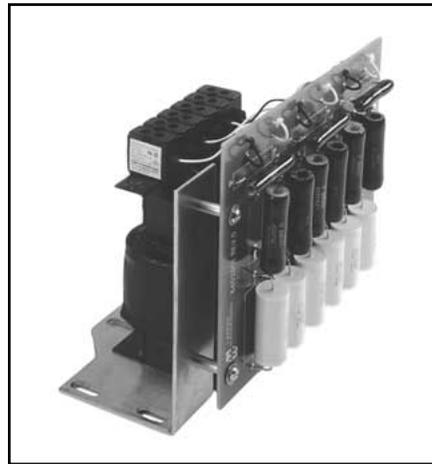
‘M’	XX. mH
‘N’	X.X mH
‘P’	0.XX mH
‘U’	.0XX mH or XX.0 uH

Example: M32 is 32.0 mH

4 digits for current rating  
DV/DT Filter Reactor

**Note:** As all characters of the P/N represent performance values of the reactor, P/N's are not completely sequential. They are sorted by current rating.

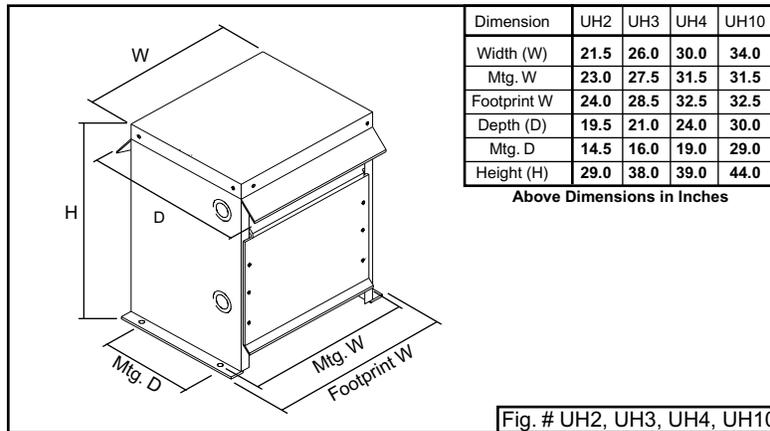
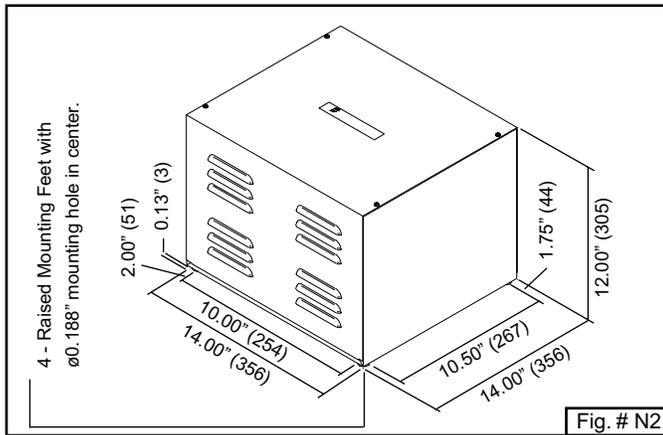
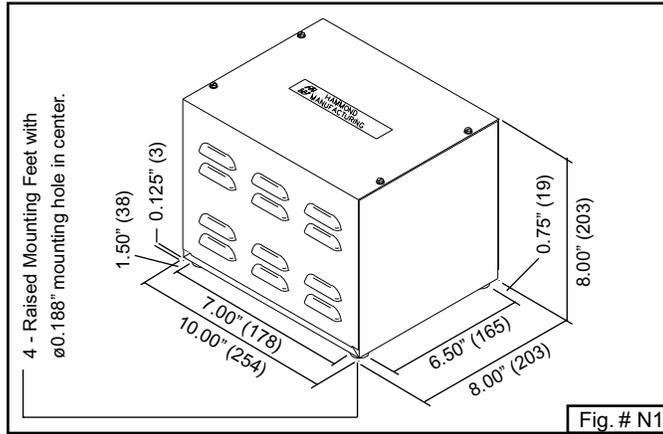
\* Add the Suffix “E” to the standard part number below for an Enclosed unit.



### “RC” DV/DT FILTER REACTOR SELECTION TABLE

Current (Amps)	Part Number	Inductance	Watts Loss	Dimensions					Mtg Slot/ Hole Size	Dim. Fig. #	Encl. Fig. #	Weight (Lbs.)	Enclosed Weight(Lbs.)
				H	W	D	Mtg. D	Mtg. W					
2	RC0002M12	12.0	62	7.40	9.00	6.18	2	8.25	.28 x .88	7	N1	4	11
4	RC0004N65	6.50	68	7.40	9.00	6.18	2	8.25	.28 x .88	7	N1	5	12
8	RC0008N30	3.00	80	7.40	9.00	6.18	2	8.25	.28 x .88	7	N1	5	12
12	RC0012N25	2.50	81	7.40	9.00	6.18	2	8.25	.28 x .88	8	N1	10	17
18	RC0018N15	1.50	84	7.40	9.00	6.18	2	8.25	.28 x .88	8	N1	11	18
25	RC0025N12	1.20	99	7.40	9.00	6.18	2	8.25	.28 x .88	8	N1	12	19
35	RC0035P80	0.80	106	7.40	9.00	6.18	2	8.25	.28 x .88	9	N2	19	36
45	RC0045P70	0.70	119	7.40	9.00	6.42	2	8.25	.28 x .88	9	N2	24	41
55	RC0055P50	0.50	130	7.40	9.00	6.27	2	8.25	.28 x .88	10	N2	28	45
80	RC0080P40	0.40	193	7.40	9.00	7.83	2	8.25	.28 x .88	10	N2	38	55
110	RC0110P30	0.30	423	11.62	14.00	8.70	4.20	3.60	.44 X 1.25	11	UH1	55	95
130	RC0130P20	0.20	415	11.62	14.00	8.20	3.73	3.60	.44 X 1.25	11	UH1	44	88
160	RC0160P15	0.15	429	11.62	14.00	8.70	4.23	3.60	.44 X 1.25	11	UH1	49	89
200	RC0200P11	0.11	414	11.62	14.00	9.23	4.23	3.60	.44 X 1.25	11	UH2	55	115
250	RC0250U90	0.090	431	11.62	14.00	9.73	4.70	3.60	.44 X 1.25	11	UH2	68	128
320	RC0320U75	0.075	484	11.43	14.40	9.50	5.94	4.80	.44 X 1.00	12	UH2	90	150
400	RC0400U61	0.061	477	11.43	14.40	11.50	6.44	4.80	.44 X 1.00	12	UH2	118	178
500	RC0500U50	0.05	496	11.43	14.40	11.50	6.44	4.80	.44 X 1.00	12	UH3	154	231
600	RC0600U40	0.040	523	11.43	14.40	12.00	6.94	4.80	.44 X 1.00	12	UH4	180	287

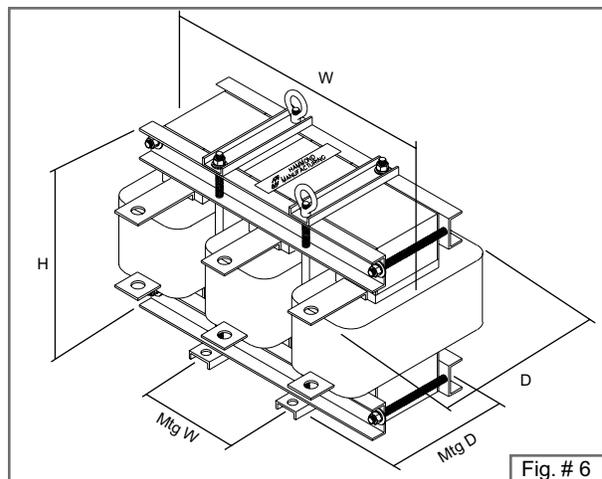
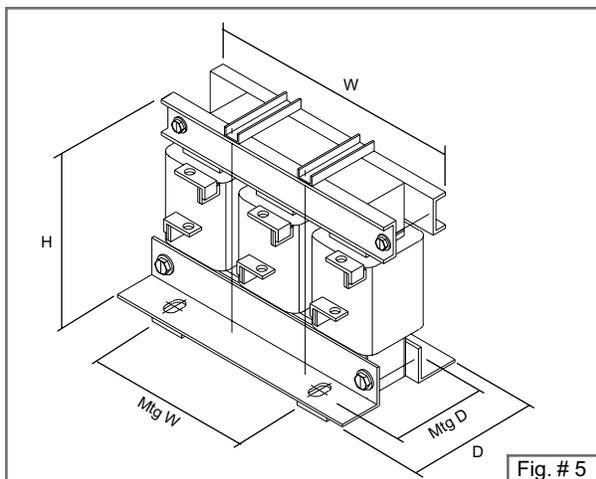
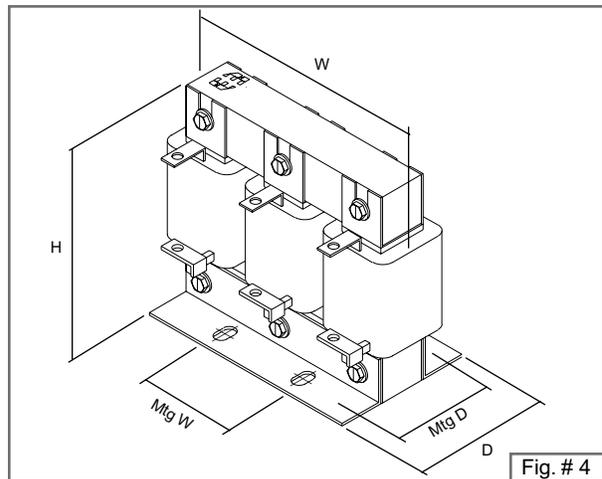
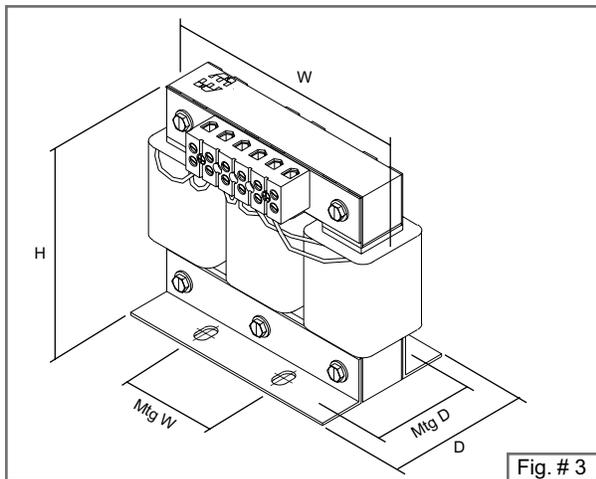
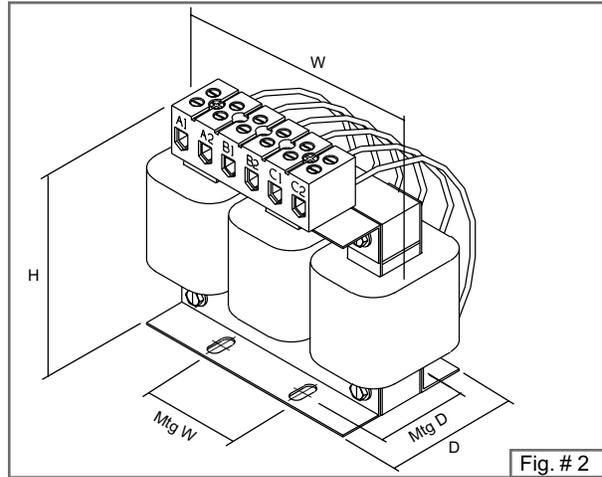
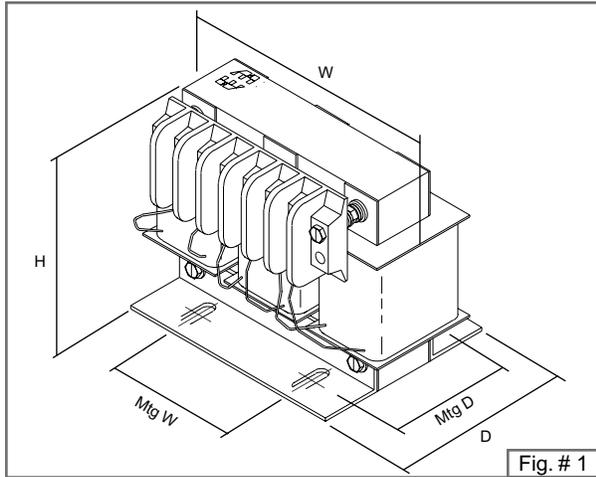
# Enclosure Reference Drawings



CONNECTOR DETAIL		
Open Style Ref.	Type	Range/Dia.
Figure #1	Terminal Block	#12 - #22
Figure #2	Terminal Block	#4 - #18
Figure #3	Terminal Block	#4 - #18
All Others:		
80 to 200 amps	Terminal Pad	.313" dia. hole
above 200 amps	Terminal Pad	.5" dia. hole



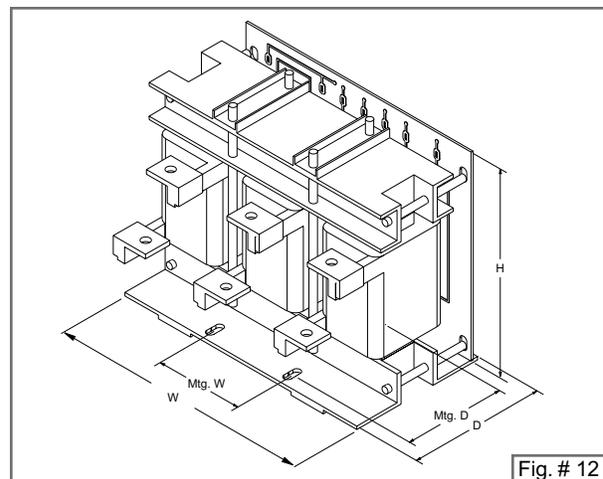
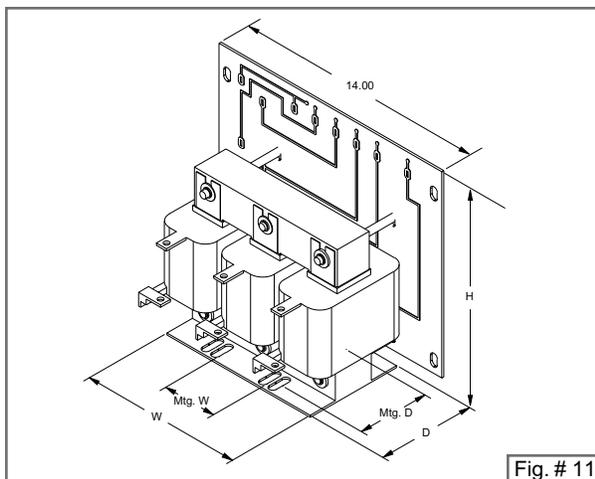
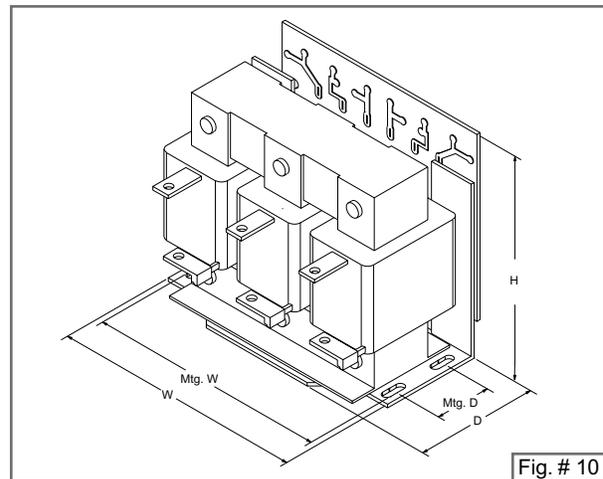
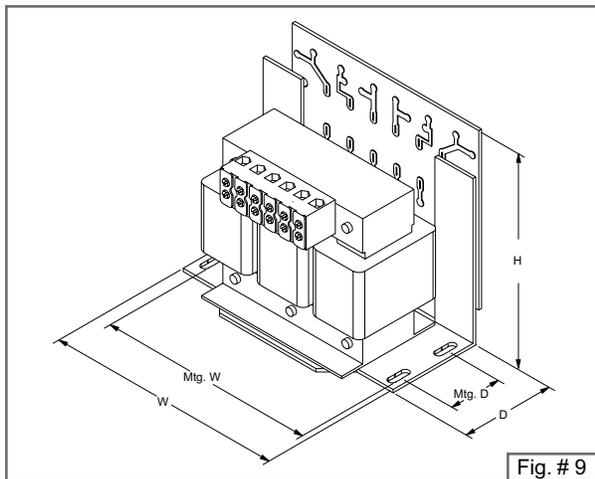
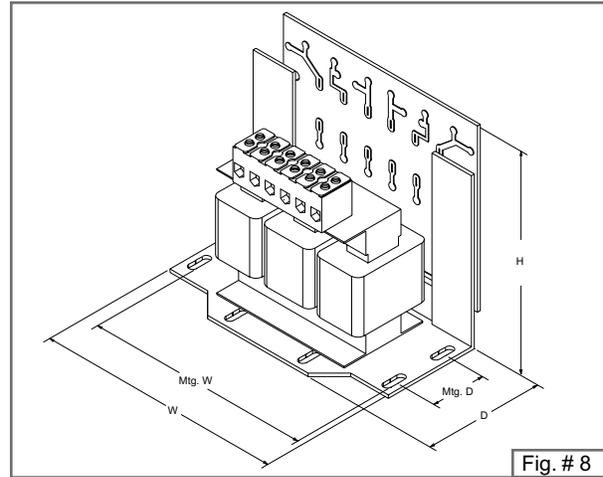
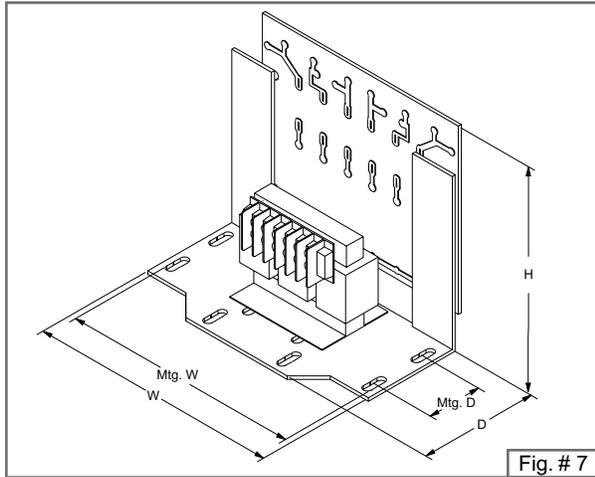
# Open Style "RM" Reference Drawings



SECTION 3



# Open Style "RC" Reference Drawings



SECTION 3

