BALDOR®
MOTORS AND DRIVES

Dynamic Braking Options For Series H Controls

Installation & Operating Manual

2/02 **MN701**

Table of Contents

Section 1
General Information

Overview

Whenever a motor is abruptly stopped or forced to slow down faster than if allowed to coast to a stop, the motor becomes a generator. When connected to a Baldor Series H control, the motor has the ability to produce braking torque. The braking torque is non–continuous and is limited by the available peak current, the peak current time rating and the dynamic braking (DB) capacity built into or connected to the control. Should these ratings and DB capacity be exceeded during braking, the control may trip off due on an overvoltage or REGEN power fault. Table 1-1 defines the voltage trip points for Series H controls.

Table 1-1 Voltage Operating Levels

Parameter Description	Control Input Voltage Rating		
Nominal Voltage	230VAC	460VAC	575VAC
Under Voltage Fault	200VDC	400VDC	550VDC
Soft Start (Minimum)	224VDC	440VDC	580VDC
Overvoltage Fault (Voltage exceeded)	400VDC	800VDC	992VDC
DB ON Voltage	388VDC	776VDC	970VDC
DB OFF Voltage	375VDC	750VDC	938VDC

Limited Warranty

For a period of two (2) years from the date of original purchase, BALDOR will repair or replace without charge controls and accessories which our examination proves to be defective in material or workmanship. This warranty is valid if the unit has not been tampered with by unauthorized persons, misused, abused, or improperly installed and has been used in accordance with the instructions and/or ratings supplied. This warranty is in lieu of any other warranty or guarantee expressed or implied. BALDOR shall not be held responsible for any expense (including installation and removal), inconvenience, or consequential damage, including injury to any person or property caused by items of our manufacture or sale. (Some states do not allow exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply.) In any event, BALDOR'S total liability, under all circumstances, shall not exceed the full purchase price of the control. Claims for purchase price refunds, repairs, or replacements must be referred to BALDOR with all pertinent data as to the defect, the date purchased, the task performed by the control, and the problem encountered. No liability is assumed for expendable items such as fuses.

Goods may be returned only with written notification including a BALDOR Return Authorization Number and any return shipments must be prepaid.

Safety Notice

This equipment contains voltages that may be as high as 1000 volts! Electrical shock can cause serious or fatal injury. Only qualified personnel should attempt the start–up procedure or troubleshoot this equipment.

This equipment may be connected to other machines that have rotating parts or parts that are driven by this equipment. Improper use can cause serious or fatal injury. Only qualified personnel should attempt the start–up procedure or troubleshoot this equipment.

PRECAUTIONS

⚠ **WARNING: Be sure to read all precautions statements in the Series H control manual before you install the dynamic brake hardware. Failure to observe all precautions may result in injury.**

⚠ **WARNING: The brake may generate enough heat to ignite combustible materials. Keep all combustible materials and flammable vapors away from the brake.**

⚠ **WARNING: The temperature of the air above the brake can be extremely high. These temperatures can cause sever burns so keep hands away from the area of the top of the enclosure during or after operation.**

⚠ **WARNING: Be sure the system is properly grounded before applying power. Do not apply AC power before you ensure that all grounding instructions have been followed. Electrical shock can cause serious or fatal injury.**

⚠ **Caution: The minimum resistance of the optional braking resistors is determined by the maximum amount of current the braking transistor can safety conduct. Using a DB resistor that has less resistance than is specified in Table 3-1 may damage the control and/or the DB transistor.**

⚠ **Caution: Use an RGA assembly that has a resistance equal to or greater than the Minimum Ohms specified in Table 3-3. Using less resistance than specified may damage the control and/or the DB transistor.**

⚠ **Caution: If the DB hardware mounting is in any position other than vertical, the DB hardware must be derated by 35% of its rated capacity.**

⚠ **Caution: Controls with an "E" or "W" suffix have an internal dynamic braking transistor and resistor installed. If you are installing a larger DB resistor , be sure to disconnect the internal resistor wires from terminals B+/R1and R2. These factory installed wires must be removed and the ends insulated with electrical tape to prevent contact with other components. Failure to disconnect the internal resistor will place the internal and the new resistors in parallel which may result in equipment damage.**

Section 2
Dynamic Brake Sizing

Sizing Procedure

This sizing procedure (with different formulas) is used to determine the required DB Hardware capacity for general industrial machinery or hoisting applications.

General Machinery

To determine regenerated watts (W_r), use the following formulas:

Determine T_{DEC}:

$$T_{DEC} = \frac{\Delta \text{ RPM} \times WK^2}{308 \times t} \quad (1)$$

Where:

T_{DEC} = Deceleration torque in lb-ft.

Δ RPM = Change in speed.

WK^2 = Inertia in lb-ft^2.

t= Time in seconds.

Determine D_r:

$$D_r = \text{Duty Cycle} = \frac{\text{Brake Time Required for Deceleration}}{\text{Total Cycle Time}} \quad (2)$$

Determine W_r:

$$W_r = T_{DEC} \times (S_r - S_m) \times D_r \times (0.0712) \quad (3)$$

Where:

W_r = Regenerated watts.

T_{DEC} = Deceleration torque in lb-ft.

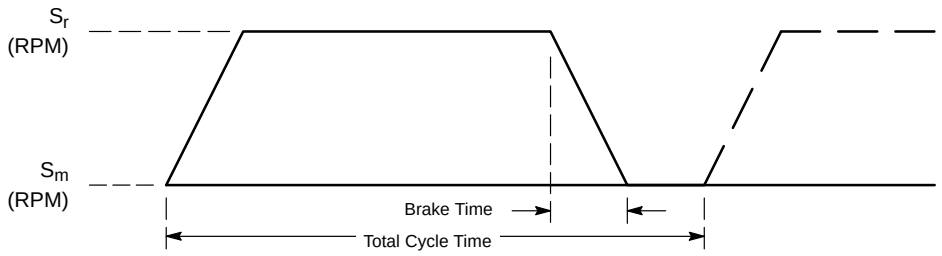
S_r = Maximum speed regenerating (in RPM).

S_m= Minimum speed regenerating (in RPM).

D_r = Duty cycle.

Determine part number of external resistor assembly to order:

Refer to Tables in Section 3 of this manual to select the part number. (4)



Hoisting Applications

To determine regenerated watts (W_r), use the following formulas:

Determine D_r:

$$D_r = \text{Duty Cycle} = \frac{\text{Lowering Time}}{\text{Total Cycle Time}} \quad (1)$$

Determine W_r:

$$W_r = \left(\frac{D_r \text{ X lbs X FPM X EFF}}{44}\right) \text{X } 1.25 \quad (2)$$

Where:

W_r = Regenerated watts.

D_r = Duty cycle.

FPM= Speed in feet per minute (to lower the load).

EFF= Mechanical efficiency (a decimal number).

1.25= Safety factor.

Note: To provide maximum life and allow for unusual loads, allow a 1.25 safety factor in the watts value.

Determine part number of external resistor assembly to order:

Refer to Tables in Section 3 of this manual to select the part number. (3)

Section 3
DB Hardware Selection

DB Hardware Selection

Baldor dynamic brake (DB) hardware includes optional RGA, RBA and RTA assemblies.

RGA – Resistor assembly.
RBA – Transistor/Resistor assembly.
RTA – Transistor assembly.

These optional assemblies are mounted in proximity to the control and are wired to the control. Table 3-1 is a matrix that describes these assemblies by the DB capacity and control enclosure size.

Table 3-1 Dynamic Brake Capacity Matrix

Control Catalog No. Suffix	Control Enclosure Size	Dynamic Brake Capacity		
		RGA	RBA	RTA
E	A	For more than 400 watts		
E	B	For more than 800 watts		
EO	C, D, E, F, G	For more than 4KW	For up to 4KW	For more than 4KW
ER	C, D, E, F, G	For any braking		
MO	D	For more than 4KW	For up to 4KW	For more than 4KW
MR	D	For any braking		

Assembly is not available for this enclosure size and DB capacity.

RGA Assemblies

RGA Assemblies include braking resistors completely assembled and mounted in a NEMA 1 enclosure. A listing of available RGA assemblies is provided in Table 3-1.

⚠ **Caution: The minimum resistance of the optional braking resistors is determined by the maximum amount of current the braking transistor can safety conduct. Using a DB resistor that has less resistance than is specified in Table 3-1 may damage the control and/or the DB transistor.**

Table 3-1 Dynamic Braking Resistor Assemblies (RGA)

Input Volts	Max CT HP *	Minimum Ohms	Continuous Rated Watts						
			600	1200	2400	4800	6400	9600	14200
230	1 - 2	30	RGA630	RGA1230	RGA2430				
	3 - 5	20	RGA620	RGA1220	RGA2420	RGA4820			
	7.5 - 10	10		RGA1210	RGA2410	RGA4810			
	15 - 20	6		RGA1206	RGA2406	RGA4806			
	25 - 40	4		RGA1204	RGA2404	RGA4804			
	50	2			RGA2402	RGA4802	RGA6402	RGA9602	RGA14202
460	1 - 3	120	RGA6120	RGA12120	RGA24120				
	5 - 7.5	60	RGA660	RGA1260	RGA2460	RGA4860			
	10	30	RGA630	RGA1230	RGA2430	RGA4830			
	15 - 25	20	RGA620	RGA1220	RGA2420	RGA4820			
	30 - 60	10		RGA1210	RGA2410	RGA4810			
	75 - 250	4		RGA1204	RGA2404	RGA4804	RGA6404	RGA9604	RGA14204
	300 - 450	2			RGA2402	RGA4802	RGA6402	RGA9602	RGA14202
575	1 - 2	200	RGA6200	RGA12200	RGA24200				
	3 - 5	120	RGA6120	RGA12120	RGA24120				
	7.5 - 10	60	RGA660	RGA1260	RGA2460	RGA4860			
	15	30	RGA630	RGA1230	RGA2430	RGA4830			
	20 - 30	24		RGA1224	RGA2424	RGA4824			
	40 - 150	14			RGA2414	RGA4814	RGA6414	RGA9614	RGA14214

***** Maximum standard 2.5KHz constant torque HP rating.

RBA Assemblies

An RBA Assembly includes a dynamic brake transistor and resistors completely assembled and mounted in a NEMA 1 enclosure. The are designed for EO and MO controls. Select the RBA (Table 3-2) based on the voltage rating of the control and the dynamic brake watt capacity required. If more than 4,000 watts of brake capacity is required, use a combination of RTA (DB transistor) and RGA (DB resistor) assemblies.

In this case, the minimum resistance of the RGA assembly must be equal to the minimum resistance value specified for the RTA assembly (refer to Table 3-3).

Table 3-2 Dynamic Braking Assemblies (RBA)

	MAXIMUM BRAKING TORQUE IN % OF MOTOR RATING													Cont. Watts	Catalog No.
	HP	20	25	30	40	50	60	75	100	150V	150	200	250		
INPUT VOLTAGE	200 to 240	90%	75%	60%	45%	36%								600	RBA2-610
		150%	125 %	100%	75%	62%								1800	RBA2-1806
		150%	150 %	150%	115 %	92%								4000	RBA2-4004
	380 to 480	150%	150 %	120%	90%	72%	60%	48%	36%	28%				600	RBA4-620
		150%	150 %	120%	90%	72%	60%	48%	36%	28%				1800	RBA4-1820
		150%	150 %	150%	150 %	150 %	120 %	96%	72%	56%	48%	36%	29%	4000	RBA4-4010
	550 to 600	150%	150 %	120%	90%	72%	60%	48%	36%	28%	28%			600	RBA5-624
		150%	150 %	120%	90%	72%	60%	48%	36%	28%	28%			1800	RBA5-1824
		150%	150 %	150%	150 %	150 %	120 %	96%	72%	56%	54%	40%	31%	4000	RBA5-4014

RTA Assemblies

RTA assemblies include a dynamic brake transistor and gate driver circuit board completely assembled and mounted in a NEMA 1 enclosure. Brake resistors are not included in the RTA assembly. Each RTA assembly is designed to be used with an RGA dynamic brake resistor assembly. The minimum resistance of the RGA assembly must be equal to or greater than the minimum resistance specified for the RTA assembly. Select the RTA (Table 3-3) based on the voltage and maximum 2.5KHz standard constant torque HP rating of the control which provides the dynamic brake watt capacity required.

⚠ **Caution: Use an RGA assembly that has a resistance equal to or greater than the Minimum Ohms specified in Table 3-3. Using less resistance than specified may damage the control and/or the DB transistor.**

Table 3-3 Dynamic Braking Transistor Assemblies (RTA)

HP	MAXIMUM BRAKING TORQUE IN % OF MOTOR RATING									
	208 - 230 VAC			380 - 480 VAC				550 - 600 VAC		
20	150%	150%	150%	150%	150%	150%	150%	150%	150%	150%
25	125%	150%	150%	150%	150%	150%	150%	150%	150%	150%
30	100%	150%	150%	120%	150%	150%	150%	150%	150%	150%
40	75%	115%	150%	90%	150%	150%	150%	127%	150%	150%
50	62%	92%	150%	72%	150%	150%	150%	100%	150%	150%
60				60%	150%	150%	150%	85%	145%	150%
75				48%	96%	150%	150%	68%	116%	150%
100				36%	72%	150%	150%	50%	87%	150%
150V				28%	56%	150%	150%	40%	70%	150%
150					48%	126%	150%	34%	58%	150%
200					36%	95%	150%	25%	44%	150%
250					29%	76%	150%		35%	122%
300						62%	125%		29%	100%
350						54%	108%			87%
400						47%	94%			76%
450						41%	84%			68%
CAT. NO.	**RTA2-6**	**RTA2-4**	**RTA2-2**	**RTA4-20**	**RTA4-10**	**RTA4-4**	**RTA4-2**	**RTA5-24**	**RTA5-14**	**RTA5-4**
Minimum Ohms	6	4	2	20	10	4	2	24	14	4

⚠ **WARNING: Resistors may generate enough heat to ignite combustible materials. To avoid fire hazard, keep all combustible materials and flammable vapors away from brake resistors.**

Physical Installation

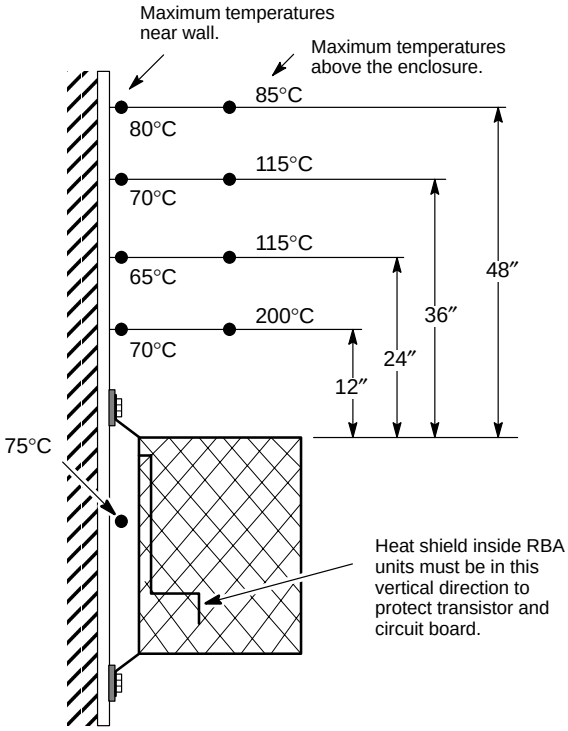
Dynamic Brake (DB) Hardware must be installed on a flat, non-flammable, vertical surface to obtain effective cooling and operation. The ambient temperature must not exceed 80°C.

1. Select a clean **VERTICAL** surface that is free from corrosive gasses, liquids, vibration, dust and metallic particles.

⚠ **Caution: If the DB hardware mounting is in any position other than vertical, the DB hardware must be derated by 35% of its rated capacity.**

2. Mount the DB hardware as shown in Figure 4-1.

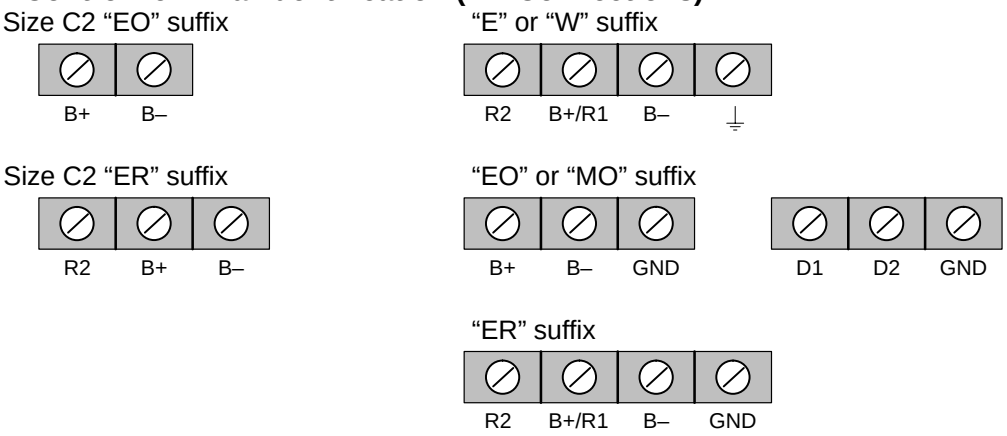
Figure 4-1 DB Hardware Installation



Electrical Installation

Terminal connections for DB hardware are determined by Control model number suffix (E, W, EO, MO or ER). See Figure 4-2 for terminal identification. Connect the DB assembly to the control terminal strip as shown in Figure 4-3, 4-4 or 4-5. Be sure to use wire size specified for your control (Tables 4-1 and 4-2).

Figure 4-2 Control Terminal Identification (DB Connections)

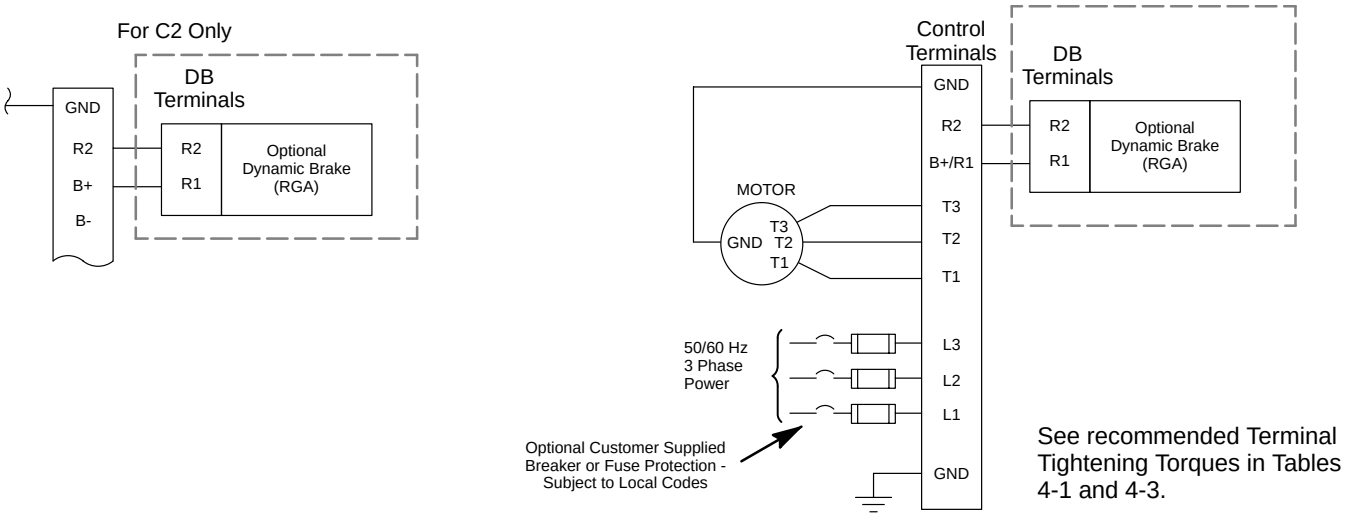


E or W Controls

Controls with an "E" or "W" suffix have an internal dynamic braking transistor and resistor installed. The internal resistor is sized for 20% braking cycle. If you are installing a larger DB resistor (RGA kit), be sure to disconnect the internal resistor wires from terminals B+/R1and R2. These factory installed wires must be removed and the wire ends insulated with electrical tape to prevent contact with other components. Be sure to select the proper size kit based on the dissipation rating of the resistor(s) to handle the average watts of the overhauling or cyclic load.

⚠ **Caution: Controls with an "E" or "W" suffix have an internal dynamic braking transistor and resistor installed. If you are installing a larger DB resistor , be sure to disconnect the internal resistor wires from terminals B+/R1and R2. These factory installed wires must be removed and the ends insulated with electrical tape to prevent contact with other components.**

Figure 4-3 Wiring for RGA Assembly



See recommended Terminal Tightening Torques in Tables 4-1 and 4-3.

Note: Although not shown, metal conduit should be used to shield all power wires and motor leads.

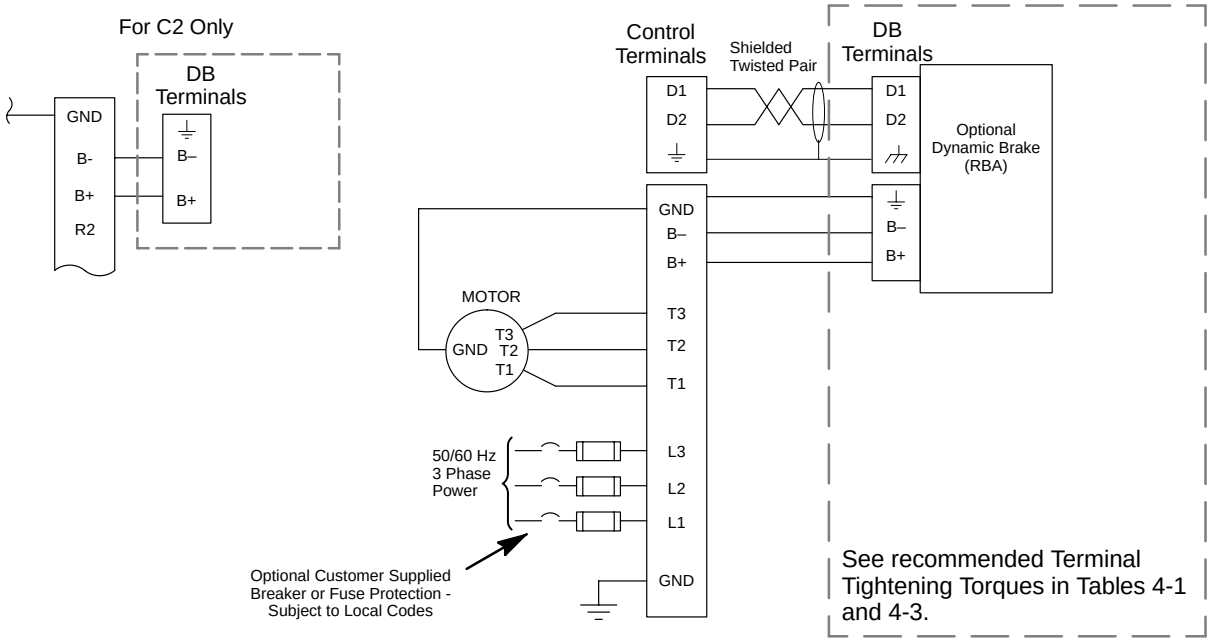
ER Controls

Controls with an “ER” suffix have an internal dynamic braking transistor factory installed. If dynamic braking is required, an optional RGA kit may be installed. Be sure to select the proper size kit based on the dissipation rating of the resistor(s) to handle the average watts of the overhauling or cyclic load.

EO or WO Controls

Controls with an “EO” or “MO” suffix do not have an internal dynamic braking transistor installed. If dynamic braking is required, an optional RBA kit may be installed. Be sure to select the proper size kit based on the dissipation rating of the resistor(s) to handle the average watts of the overhauling or cyclic load.

Figure 4-4 Wiring for RBA Assembly



See recommended Terminal Tightening Torques in Control manual.

Figure 4-5 Wiring for RTA Assembly (<22kW)

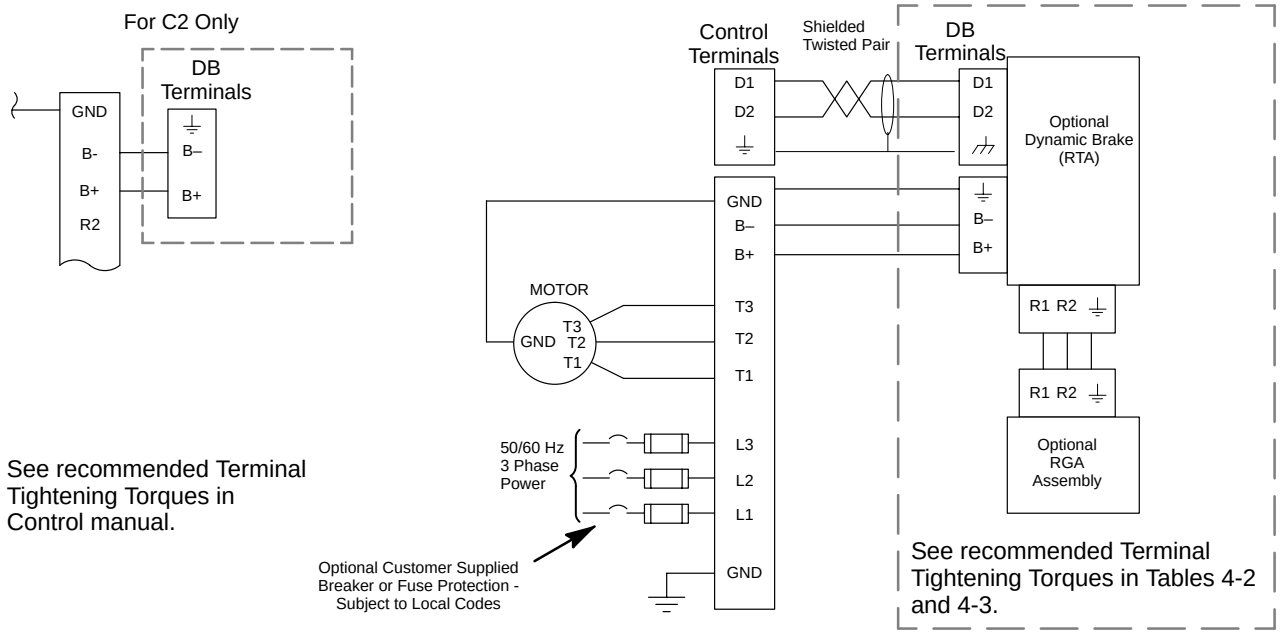
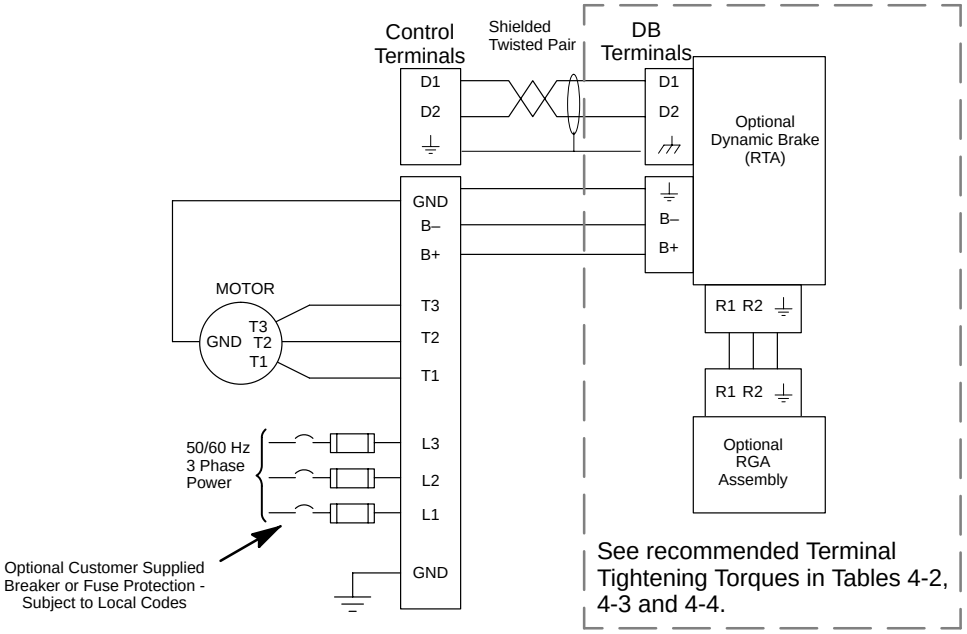


Figure 4-6 Wiring for RTA Assembly (90kW and 150kW)



See recommended Terminal Tightening Torques in Control manual.

Table 4-1 Control Terminal Torques & Wire Size for Model No. Suffix E or W

Control Voltage Rating VAC	B+ / B– / R1 / R2 / ⏚ Terminals			
	[1] Wire Size		Tightening Torque	
	AWG	mm^2	Nm	Lb–in
230, 460, 575	10	5.26	2.26	20

[1] All wire insulation must be rated for 600Volts or greater.

Table 4-2 Control Terminal Torques & Wire Size for Model No. Suffix EO, MO, or ER

Control Voltage Rating VAC	Braking Option Watts Rating	B+ / B– and R1 / R2 / ⏚ Terminals				[2] D1 / D2 / Terminals			
		[1] Wire Size		Tightening Torque		[1] Shielded Wire Size		Tightening Torque	
		AWG	mm^2	Nm	Lb–in	AWG	mm^2	Nm	Lb–in
230	<10,000	10	5.26	3.61	32	20-22	0.5	0.4	3.5
230	>10,000	8	8.37	3.61	32	20-22	0.5	0.4	3.5
460	<20,000	10	5.26	3.61	32	20-22	0.5	0.4	3.5
460	>20,000	8	8.37	3.61	32	20-22	0.5	0.4	3.5
575	<20,000	10	5.26	3.61	32	20-22	0.5	0.4	3.5
575	>20,000	8	8.37	3.61	32	20-22	0.5	0.4	3.5

[1] All wire insulation must be rated for 600 Volts or greater.

[2] D1 and D2 connections are to be made using shielded, twisted pair wire. Be sure to ground the wire shields at both ends (control and brake assembly).

Table 4-3 DB Terminal Torques (All)

Tightening Torque	
Nm	Lb–in
3.61	32

Table 4-4 L1 and L2 Torque (90kW and 150kW only)

Control Voltage Rating VAC	Braking Option Watts Rating	L1 and L2 Terminals			
		[1] Wire Size		Tightening Torque	
		AWG	mm^2	Nm	Lb–in
460	92,000	18	0.82	3.61	32
460	150,000	18	0.82	3.61	32

[1] All wire insulation must be rated for 600 Volts or greater.

Section 5
Programming

Adjusting Control Parameters

When installation is complete, the control parameters must be set so the control knows the resistance and wattage ratings of the dynamic brake hardware. The actual procedure may vary depending upon the type of control used.

Refer to the Programming section of the control manual. Access the Level 2 parameters and use the following information to assist in setting the DB parameter values.

Action	Description	Display	Comments
Press ▲ or ▼ key	Scroll to the Level 2 Block.	PRESS ENTER FOR LEVEL 2 BLOCKS	Press ENTER to access Level 2 Blocks.
Press ENTER key	First Level 2 block display.	PRESS ENTER FOR OUTPUT LIMITS	
Press ▲ or ▼ key	Scroll to Brake Adjust block.	PRESS ENTER FOR BRAKE ADJUST	
Press ENTER key	First Brake Adjust parameter.	RESISTOR OHMS P: XXX	
Press ENTER key	Select Resistor Ohms.	RESISTOR OHMS ▲▼ XXX XXX	
Use ▲ or ▼ and SHIFT keys	Set the Resistor Ohms value to the correct value for your DB hardware.	RESISTOR OHMS ▲▼ XXX XXX	Set the Resistor Ohms value to the value for your DB Hardware.
Press ENTER key	Save the Resistor Ohms value.	RESISTOR OHMS P: XXX	
Press ▲ key	Scroll to the Resistor Watts parameter.	RESISTOR WATTS P: XXX	
Press ENTER key	Select Resistor Watts.	RESISTOR WATTS ▲▼ XXX XXX	
Use ▲ or ▼ and SHIFT keys	Set the Resistor Watts value to the correct value for your DB hardware.	RESISTOR WATTS ▲▼ XXX XXX	Set the Resistor Watts value to the value for your DB Hardware.
Press ENTER key	Save the Resistor Watts value.	RESISTOR WATTS P: XXX	
Press ▲ key	Scroll to Menu Exit.	PRESS ENTER FOR MENU EXIT	
Press ENTER key	Exit to Brake Adjust parameter.	PRESS ENTER FOR BRAKE ADJUST	
Press DISP key	Return to Display mode.		

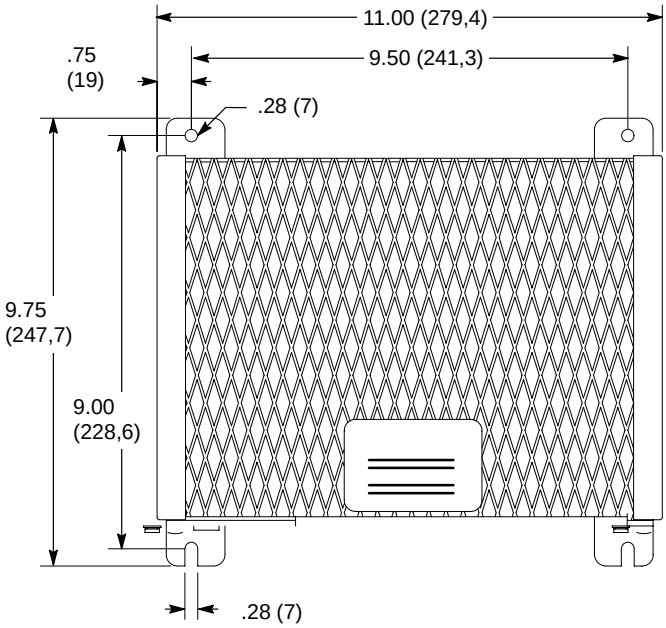
Section 6
Dimensions

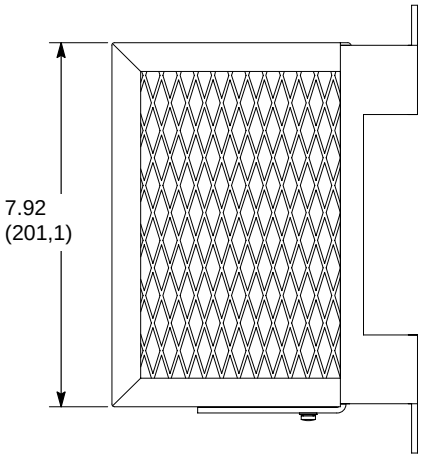
DB Hardware Dimensions

Table 6-1 DB Hardware Size Matrix

RGA Watts	DB Hardware Size				
	Size A	Size B	Size C	Size D	Size E
600	X				
1200	X				
2400		X			
4800		X			
6400			X		
9600				X	
14200					X
RBA Watts					
600	X				
1800		X			
4000		X			
RTA Assembly					
RTA2 (all)	X				
RTA4 (all)	X				
RTA5 (all)	X				

Size A


11.00 (279,4)
.75
(19)
9.50 (241,3)
.28 (7)
9.75
(247,7)
9.00
(228,6)
.28 (7)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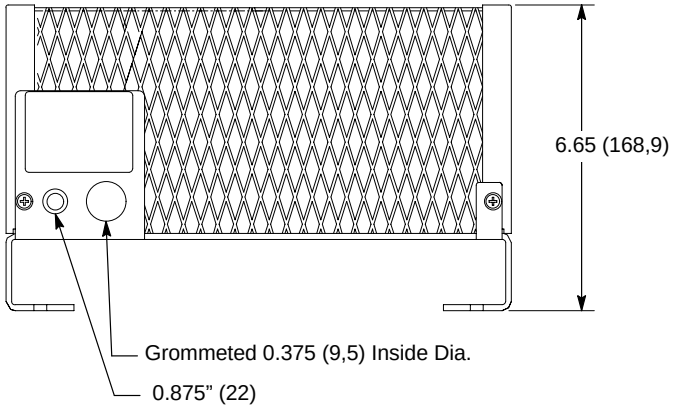
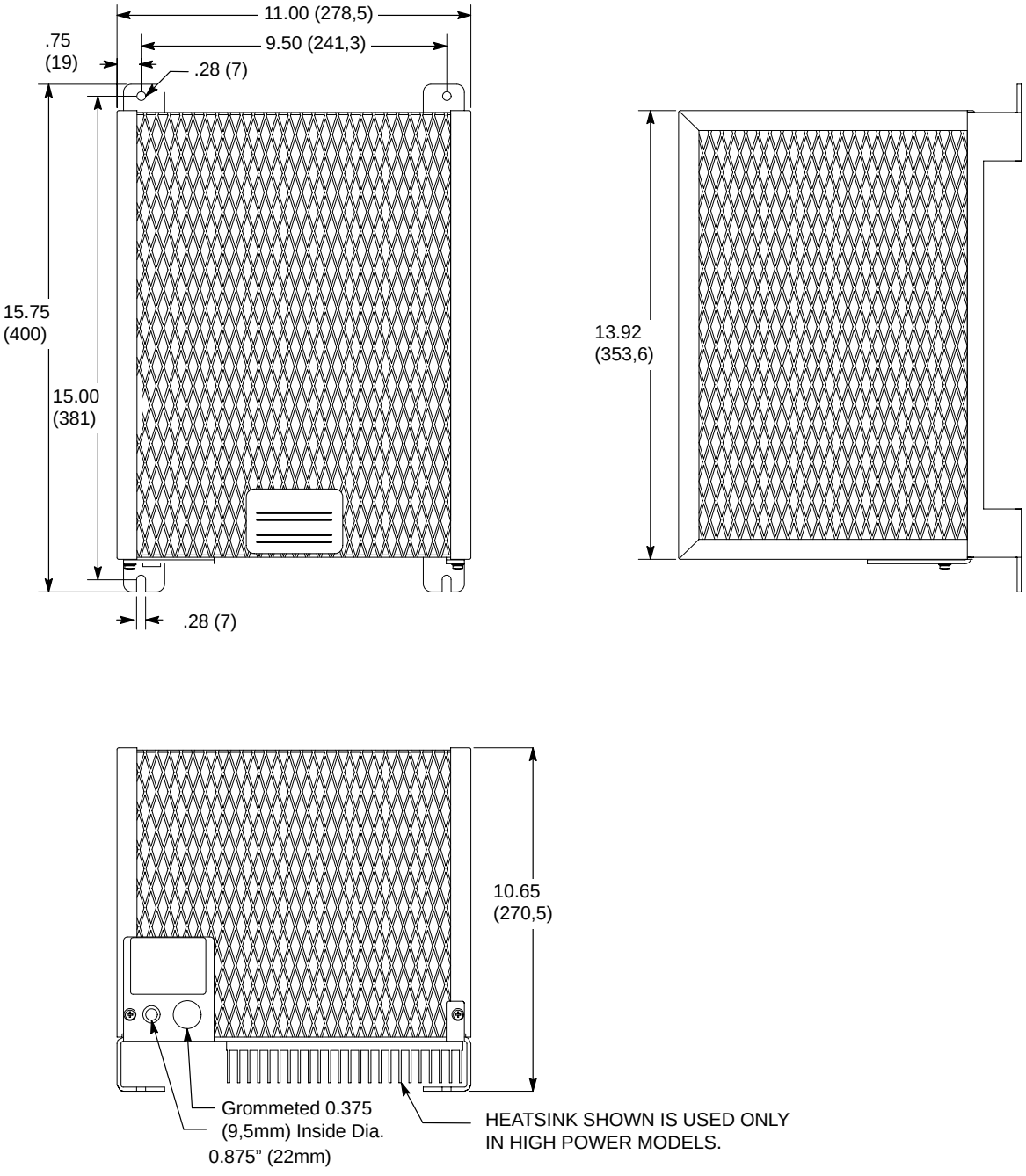
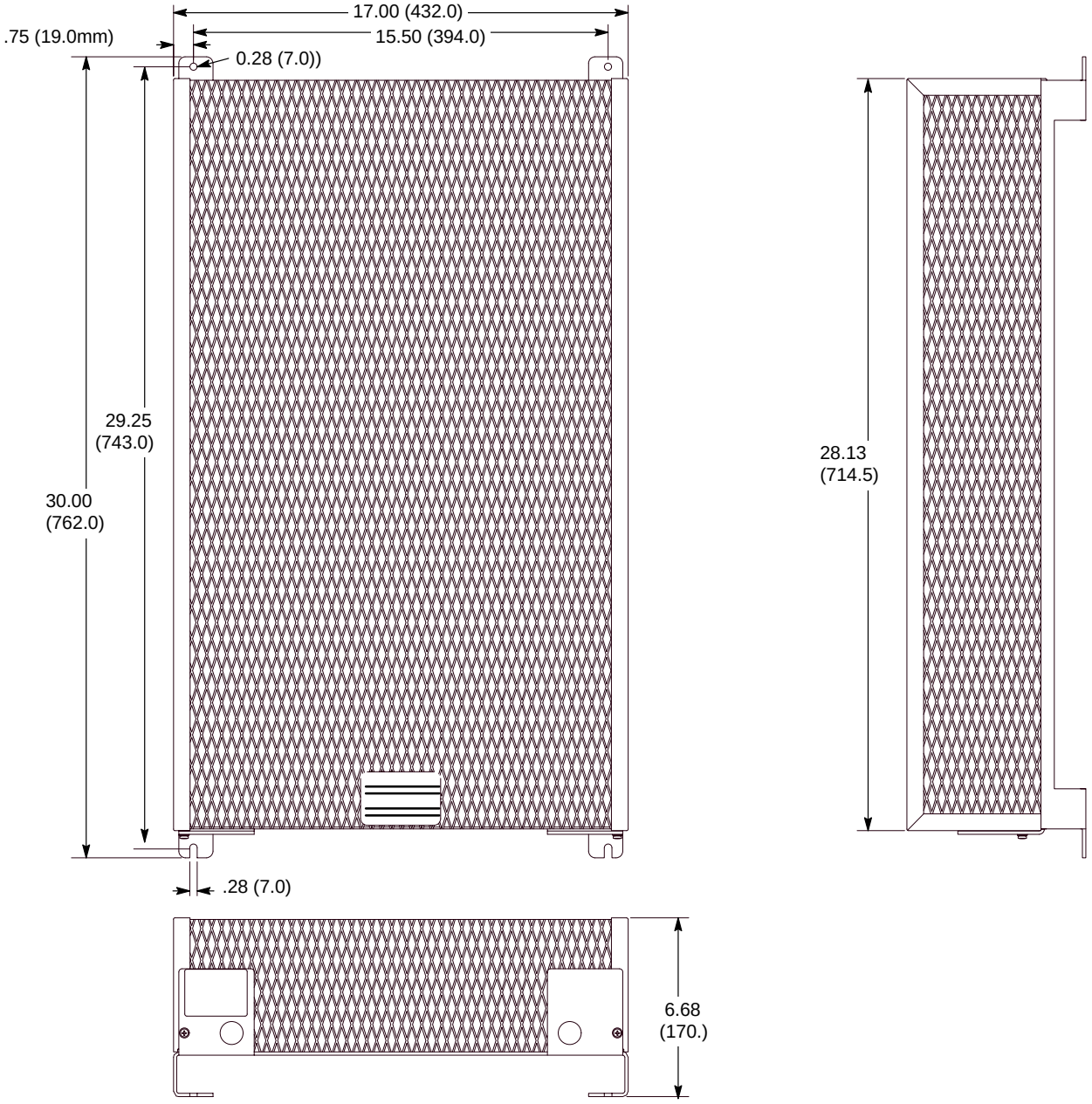
(201,1)


6.65 (168,9)
Grommeted 0.375 (9,5) Inside Dia.
0.875” (22)

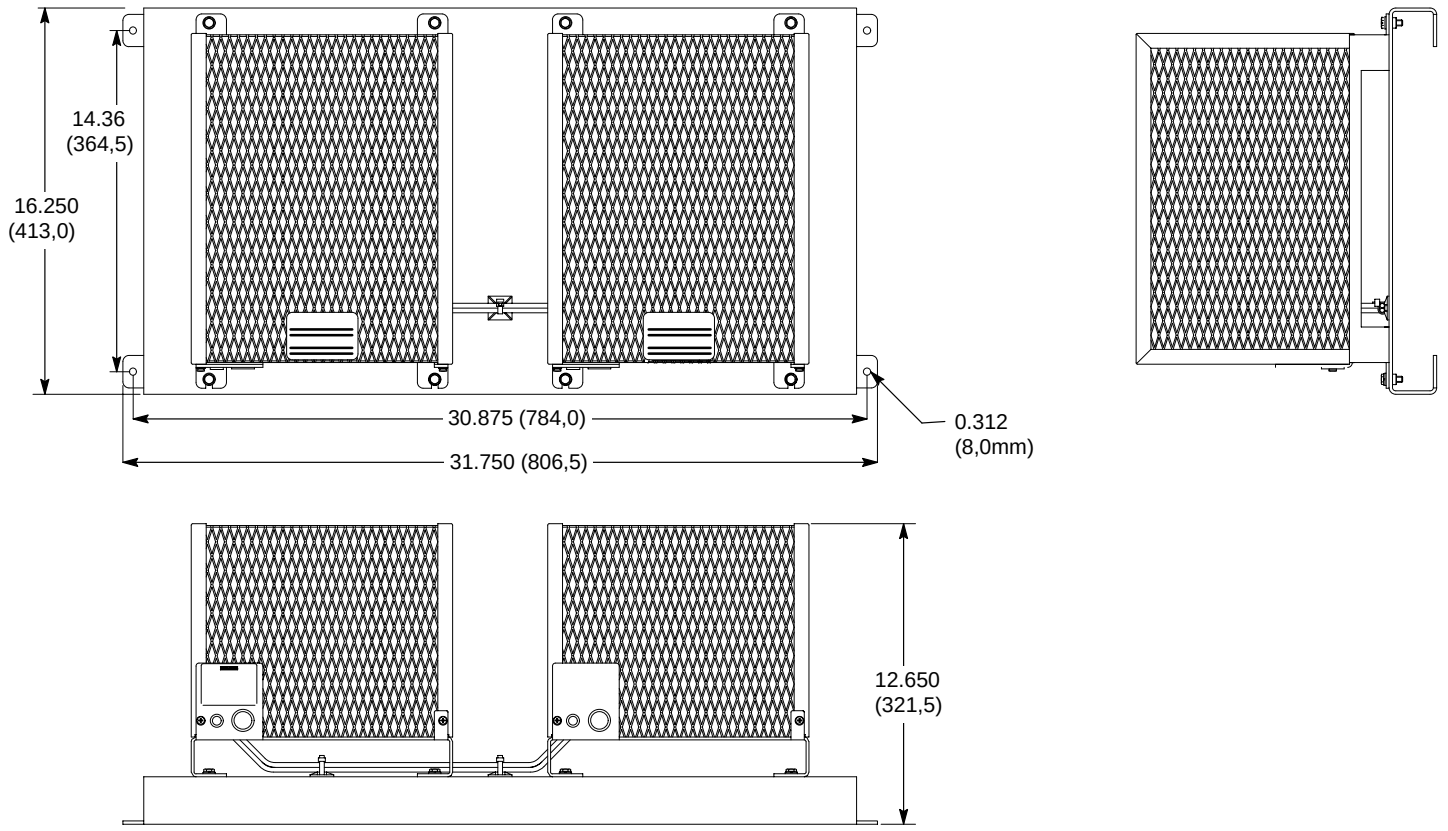
Size B


11.00 (278,5)
9.50 (241,3)
.75
(19)
.28 (7)
15.75
(400)
15.00
(381)
.28 (7)
13.92
(353,6)
10.65
(270,5)
Grommeted 0.375
(9,5mm) Inside Dia.
0.875” (22mm)
HEATSINK SHOWN IS USED ONLY
IN HIGH POWER MODELS.

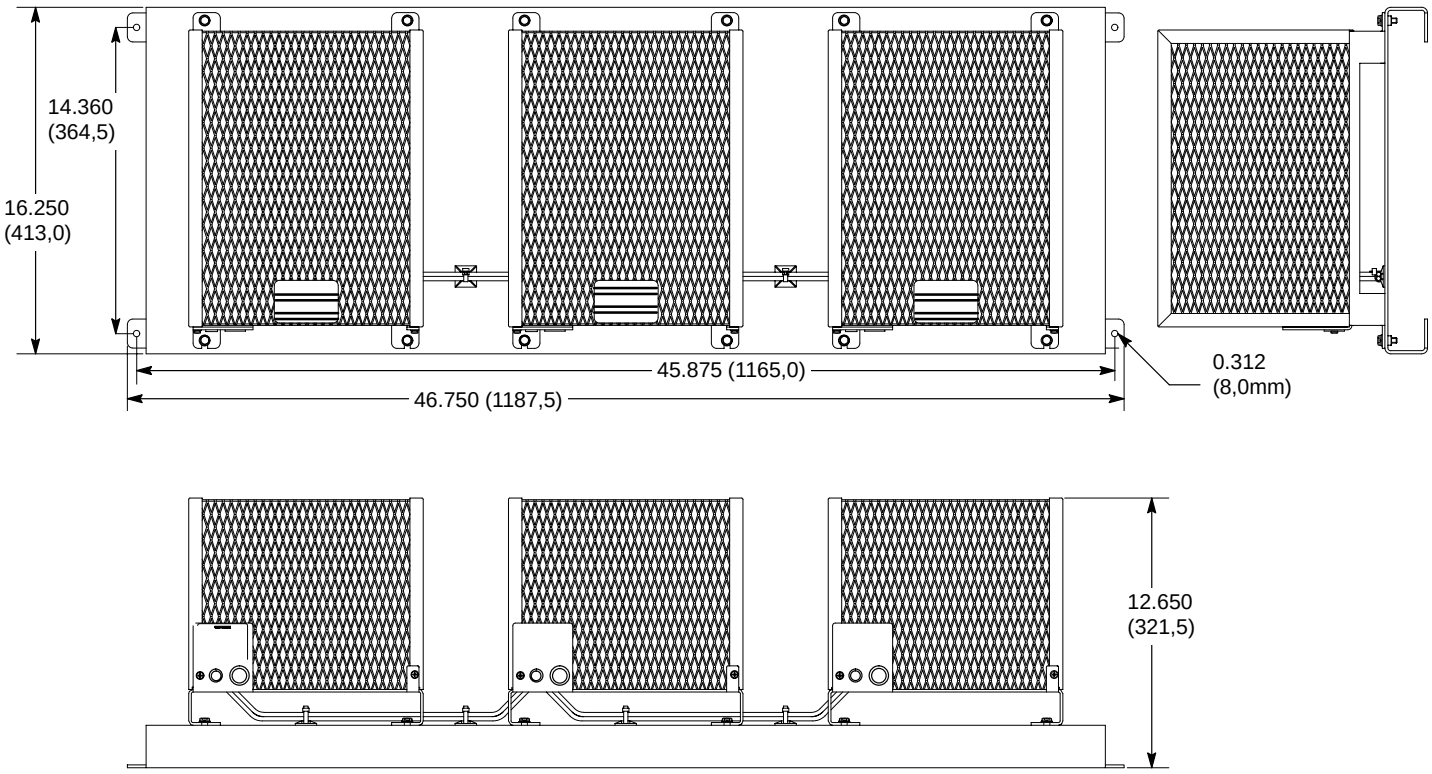
Size C


17.00 (432.0)
.75 (19.0mm)
15.50 (394.0)
0.28 (7.0))
29.25
(743.0)
30.00
(762.0)
28.13
(714.5)
.28 (7.0)
6.68
(170.)

Size D


14.36
(364,5)
16.250
(413,0)
30.875 (784,0)
31.750 (806,5)
0.312
(8,0mm)
12.650
(321,5)

Size E


14.360
(364,5)
16.250
(413,0)
45.875 (1165,0)
46.750 (1187,5)
0.312
(8,0mm)

12.650
(321,5)

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