



**POWEROHM
RESISTORS INC.**

**Braking Resistors
Brake Modules
VBR Load Analyzer**

**Manufactured for
GE AF-650GP &
Legacy Drives**



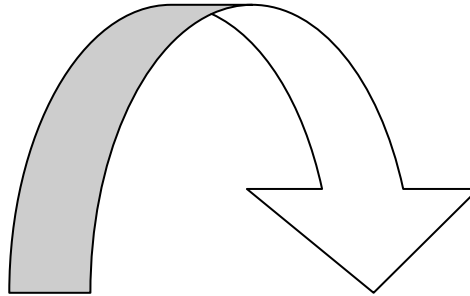
**(800) 838-4694
www.powerohm.com**

POWEROHM HAS CLOSED THE LOOP



C
H
O
P
P
E
R
S

DRIVES



BRAKE RESISTORS

S
I
Z
I
N
G



On Braking Resistors

Powerohm Resistors is pleased to offer the first printing of the Powerohm Braking Resistor catalog for GE AF-650 Drives. In addition to the comprehensive Dynamic Braking Resistor selection list, we have sections for the Powerohm Resistors new line of stand alone **DB Modules/Choppers** and the exciting new **VBR**, a diagnostic tool, which facilitates the proper selection and takes the mystery out of sizing Dynamic Braking Resistors.

This comprehensive guide also offers complete information on all the resistor selections including the panel mounted type CR case style resistors, to rugged style type screened or louvered enclosed units. All units are covered, and conveniently listed under the appropriate section by Voltage, HP, Duty Cycle.

Once your part number is selected, additional technical information such as ohms, watts, dimensions, weight and the list price of the unit may be found on pages 24 thru 27.

Powerohm's new DB Module/Chopper is listed on page 15. Models are available in continuous amp ratings of 80, 115, 300, and 600.

Powerohm's VBR takes the mystery out of sizing DB resistors. The light compact, portable unit will assist in sizing the proper DB Resistor for any of the AF-650 Drives series. The unit may be purchased or rented from Powerohm Resistors Inc. A complete description of the unit's operation is available on pages 16 thru 17, purchasing and rental information is available on page 28.

Finally, additional product information such as Installation and Mounting instructions is included as well as other product information pages and useful Application and Engineering Notes.

Feel free to call Powerohm Resistors Inc. toll free at 1-800-838-4694 if you have any questions.

Table of Contents

AF-650 GP General Purpose Drives (All duty cycles)

230V Standard Enclosed Resistors	4
230V Case Resistors	5
460V Standard Enclosed Resistors	6
460V Case Resistors	7

Legacy Drives (All duty cycles)

230V Standard Enclosed Resistors	8
460V Standard Enclosed Resistors	9

Resistor Tables

230V AF-650 Part Number Index	24
460V AF-650 Part Number Index	25-26
230V Legacy Part Number Index	27
460V Legacy Part Number Index	27

DB White Paper

10 - 14

Brake Module

Information	15
Pricing	28

VBR Information

Information	16 -17
Pricing	28

Enclosure Details

CR Case Resistors	18
GCE Enclosures	19
ED Enclosures	20

Installation Instructions

21 -22

Engineering Notes

23

230V AF-650 GP General Purpose Drive

Standard Enclosed Resistors						
Volts	HP	Braking Torque	Ohms	(KW)	10% Duty Cycle	40% Duty Cycle
230	0.33	160	425	0.095	PRDB2101TBNC	PRDB2401TBNC
230	0.5	160	310	0.25	PRDB2102TBNC	PRDB2402TBNC
230	1	160	145	0.065	PRDB2103TBNC	PRDB2403TBNC
230	2	160	65	0.25	PRDB2104TBNC	PRDB2404TBNC
230	3	160	50	0.285	PRDB2105TBNC	PRDB2405TBNC
230	7	160	25	0.8	PRDB2106TBNC	PRDB2406TBNC
230	7.5	158	20	1	PRDB2107TBNC	
230	10	153	15	2	PRDB2108TBNC	
230	15	154	10	2.8	PRDB2109TBNC	
230	20	150	7	4	PRDB2110TBNC	
230	25	150	6	4.8	PRDB2111TBNC	
230	30	150	4.7	6	PRDB2112TBNC	
230	40	150	3.3	8	PRDB2113TBNC	
230	50	150	2.7	10	PRDB2114TBNC	



CONSTRUCTION NOTES:

Enclosures have a mill galvanized finish.
 Resistance values have a +/- 10% tolerance.
 All enclosures include a terminal block for customer connections and a normally closed thermal switch.

230V AF-650 GP General Purpose Drive

Case Resistors					
Volts	HP	Braking Torque	Ohms	(KW)	Case Style
230	0.33	160	430	0.1	PRDB2601FP
230	0.5	160	310	0.2	PRDB2602FP
230	1	160	150	0.2	PRDB2603FP
230	2	160	72	0.2	PRDB2604FP
230	3	160	50	0.2	PRDB2605FP
230	7	160	60	0.2	PRDB2606FP



CONSTRUCTION NOTES:

Case style

Resistance values have a +/- 10% tolerance.

All resistors include standard 18" leads.

Normally Closed thermal switches are available as an option.

460V AF-650 GP General Purpose Drive

Standard Enclosed Resistors						
Volts	HP	Braking Torque	Ohms	(KW)	10% Duty Cycle	40% Duty Cycle
460	0.5	160	620	0.065	PRDB4101TBNC	PRDB4401TBNC
460	1	160	620	0.065	PRDB4102TBNC	PRDB4402TBNC
460	2	160	310	0.25	PRDB4103TBNC	PRDB4403TBNC
460	3	160	210	0.29	PRDB4104TBNC	PRDB4404TBNC
460	5	160	110	0.6	PRDB4105TBNC	PRDB4405TBNC
460	8	160	80	0.85	PRDB4106TBNC	PRDB4406TBNC
460	10	160	65	1	PRDB4107TBNC	PRDB4407TBNC
460	15	160	40	2	PRDB4108TBNC	PRDB4408TBNC
460	20	160	30	3	PRDB4109TBNC	PRDB4409TBNC
460	25	160	25	4	PRDB4110TBNC	PRDB4410TBNC
460	30	160	20	4	PRDB4111TBNC	PRDB4411TBNC
460	40	160	15	5	PRDB4112TBNC	PRDB4412TBNC
460	50	160	12	6	PRDB4113TBNC	PRDB4413TBNC
460	60	160	9.8	15	PRDB4114TBNC	PRDB4414TBNC
460	75	150	7.3	13	PRDB4115TBNC	PRDB4415TBNC
460	100	150	4.7	15	PRDB4116TBNC	PRDB4416TBNC
460	125	150	3.8	22	PRDB4117TBNC	PRDB4417TBNC
460	150	150	3.2	27	PRDB4118TBNC	PRDB4418TBNC
460	200	150	2.6	32	PRDB4119TBNC	PRDB4419TBNC
460	250	150	2.1	39	PRDB4120TBNC	PRDB4420TBNC
460	300	150	3.3	56	PRDB4121TBNC	
460	350	150	2.6	72	PRDB4122TBNC	
460	450	150	2.1	100	PRDB4123TBNC	
460	550	150	1.3	144	PRDB4124TBNC	
460	600	150	1.3	144	PRDB4125TBNC	
460	650	150	1.3	144	PRDB4126TBNC	
460	750	150	1.3	144	PRDB4127TBNC	
460	900	150	1.3	144	PRDB4128TBNC	
460	1000	150	1.3	144	PRDB4129TBNC	
460	1200	150	1.3	144	PRDB4130TBNC	



CONSTRUCTION NOTES:

Enclosures have a mill galvanized finish.
 Resistance values have a +/- 10% tolerance.
 All enclosures include a terminal block for customer connections and a normally closed thermal switch.

460V AF-650 GP General Purpose Drive

Case Resistors					
Volts	HP	Braking Torque	Ohms	(KW)	Case Style
460	0.5	160	830	0.1	PRDB4601FP
460	1	160	620	0.2	PRDB4602FP
460	2	160	310	0.2	PRDB4603FP
460	3	160	210	0.2	PRDB4604FP
460	5	160	240	0.2	PRDB4605FP
460	7.5	160	160	0.2	PRDB4606FP
460	10	160	130	0.2	PRDB4607FP
460	15	160	80	0.24	PRDB4608FP
460	20	160	72	0.24	PRDB4609FP



CONSTRUCTION NOTES:

Case style

Resistance values have a +/- 10% tolerance.

All resistors include standard 18" leads.

Normally Closed thermal switches are available as an option.

230V Legacy Drive

Standard Enclosed Resistors						
Volts	HP	Ohms	(KW)	New Model No.	Legacy Model No.	Powerohm Part No.
230	0.5	100	0.2	DB2501TBNC	6KE\$32DBR001	PRDB2501TBNC
230	1	100	0.2	DB2502TBNC	6KE\$32DBR001	PRDB2502TBNC
230	2	40	0.4	DB2503TBNC	6KE\$32DBR003	PRDB2503TBNC
230	3	40	0.4	DB2504TBNC	6KE\$32DBR003	PRDB2504TBNC
230	5	33	0.4	DB2505TBNC	6KE\$32DBR005	PRDB2505TBNC
230	7.5	20	0.8	DB2506TBNC	6KE\$32DBR007	PRDB2506TBNC
230	10	15	0.9	DB2507TBNC	6KE\$32DBR010	PRDB2507TBNC
230	15	10	1.4	DB2508TBNC	6KE\$32DBR015	PRDB2508TBNC
230	20	9	1.4	DB2509TBNC	6KE\$32DBR020	PRDB2509TBNC
230	25	7	1.8	DB25010TBNC	6KE\$32DBR025	PRDB25010TBNC
230	30	6	1.8	DB25011TBNC	6KE\$32DBR030	PRDB25011TBNC
230	40	4	3	DB25012TBNC	6KE\$32DBR040	PRDB25012TBNC
230	50	3	3.7	DB25013TBNC	6KE\$32DBR050	PRDB25013TBNC
230	60	3	4.5	DB25014TBNC	6KE\$32DBR060	PRDB25014TBNC
230	75	2	5.5	DB25015TBNC	6KE\$32DBR075	PRDB25015TBNC
230	100	2	8.3	DB25016TBNC	6KE\$32DBR100	PRDB25016TBNC
230	125	1	11.3	DB25017TBNC	6KE\$32DBR150	PRDB25017TBNC
230	150	1	11.3	DB25018TBNC	6KE\$32DBR150	PRDB25018TBNC



CONSTRUCTION NOTES:

Enclosures have a mill galvanized finish.
 Resistance values have a +/- 10% tolerance.
 All enclosures include a terminal block for customer connections and a normally closed thermal switch.

460V Legacy Drive

Standard Enclosed Resistors						
Volts	HP	Ohms	(KW)	New Model No.	Legacy Model No.	Powerohm Part No.
460	1	200	0.2	DB4501TBNC	6KE\$34DBR001	PRDB4501TBNC
460	2	160	0.4	DB4502TBNC	6KE\$34DBR003	PRDB4502TBNC
460	3	160	0.4	DB4503TBNC	6KE\$34DBR003	PRDB4503TBNC
460	5	130	0.4	DB4504TBNC	6KE\$34DBR005	PRDB4504TBNC
460	7.5	80	0.8	DB4505TBNC	6KE\$34DBR007	PRDB4505TBNC
460	10	60	0.9	DB4506TBNC	6KE\$34DBR010	PRDB4506TBNC
460	15	40	1.4	DB4507TBNC	6KE\$34DBR015	PRDB4507TBNC
460	20	34.4	1.4	DB4508TBNC	6KE\$34DBR020	PRDB4508TBNC
460	25	27	1.8	DB4509TBNC	6KE\$34DBR025	PRDB4509TBNC
460	30	22	1.8	DB45010TBNC	6KE\$34DBR030	PRDB45010TBNC
460	40	15	3.6	DB45012TBNC	6KE\$34DBR040	PRDB45012TBNC
460	50	12	4.8	DB45013TBNC	6KE\$34DBR050	PRDB45013TBNC
460	60	10	6	DB45014TBNC	6KE\$34DBR060	PRDB45014TBNC
460	75	7.5	7.2	DB45015TBNC	6KE\$34DBR075	PRDB45015TBNC
460	100	6	9.6	DB45016TBNC	-	PRDB45016TBNC
460	125	5	12	DB45017TBNC	-	PRDB45017TBNC
460	150	3.75	14.4	DB45018TBNC	-	PRDB45018TBNC
460	200	3	19.2	DB45019TBNC	-	PRDB45019TBNC
460	250	2.5	24	DB45020TBNC	-	PRDB45020TBNC
460	300	2.2	28.8	DB45021TBNC	-	PRDB45021TBNC
460	350	1.95	33.6	DB45022TBNC	-	PRDB45022TBNC
460	400	1.6	38.4	DB45023TBNC	-	PRDB45023TBNC
460	450	1.37	43.2	DB45024TBNC	-	PRDB45024TBNC
460	500	1.3	48	DB45025TBNC	-	PRDB45025TBNC
460	600	1.1	57.6	DB45026TBNC	-	PRDB45026TBNC
460	700	0.84	67.2	DB45027TBNC	-	PRDB45027TBNC
460	800	0.75	76.8	DB45028TBNC	-	PRDB45028TBNC



CONSTRUCTION NOTES:

Enclosures have a mill galvanized finish.
 Resistance values have a +/- 10% tolerance.
 All enclosures include a terminal block for customer connections and a normally closed thermal switch.

SIZING AND DESIGN CONSIDERATIONS FOR POWER RESISTORS USED IN DYNAMIC BRAKING APPLICATIONS ON VARIABLE FREQUENCY DRIVES

Abstract

VFD's operated in Constant Torque applications often employ the use of dynamic braking resistors to allow faster process and product cycle times that otherwise would be unattainable. For safety code reasons, including personnel and equipment, particular processes may need to have a quick stop feature so the process is terminated quickly.

This paper will examine the design considerations for braking resistors when used in both of the above applications. The paper also examines and suggests the proper element type that might be used as well as other options. Increasing the throughput rates of processes (increased efficiency) and safety considerations (quick process stops) for equipment and personnel, will also be examined.

The Problem Described

Efficiency and flow through rates may sometimes seem to be at a fixed upper end speed range. Increasing these maximum speeds without giving consideration to the inertia may cause nuisance tripping of the VFD and thus the process. Simply by decreasing the deceleration time to increase the overall process time, may not be possible without a resistive load due to the inertia present in the system.

Secondly, quickly terminating and shutting down a process for equipment and personnel safety and code considerations may also be desired.

The choice of the proper dynamic braking resistor would provide the solution for both of these situations.

Constant Torque Processes

Some constant torque processes may be operated in speed/torque quadrants that oppose one another. Figure 1 shows a typical four quadrant graph of a drive. In Quadrants I and II, regeneration of energy from the load (a counter emf) is generated back through the motor. The motor, in essence, becomes a generator. This regenerated energy looks to the connected Drive for the opportunity to dissipate itself. The Drive is able to absorb some of this energy in the bus capacitors but is unable to sustain this condition for large loads or long periods without the need to rid itself of this over-voltage situation.

Concurrently, when processes need to be quickly terminated for the safety of personnel and equipment, the inertia in the system may cause an over-voltage fault in the drive if decelerated too quickly. Many applications, by safety code, must be terminated in a predetermined period. Also, when retrofitting or installing a VFD in place of an existing mechanical or DC system, it is very important to obtain the total inertia that would affect the desired braking time.

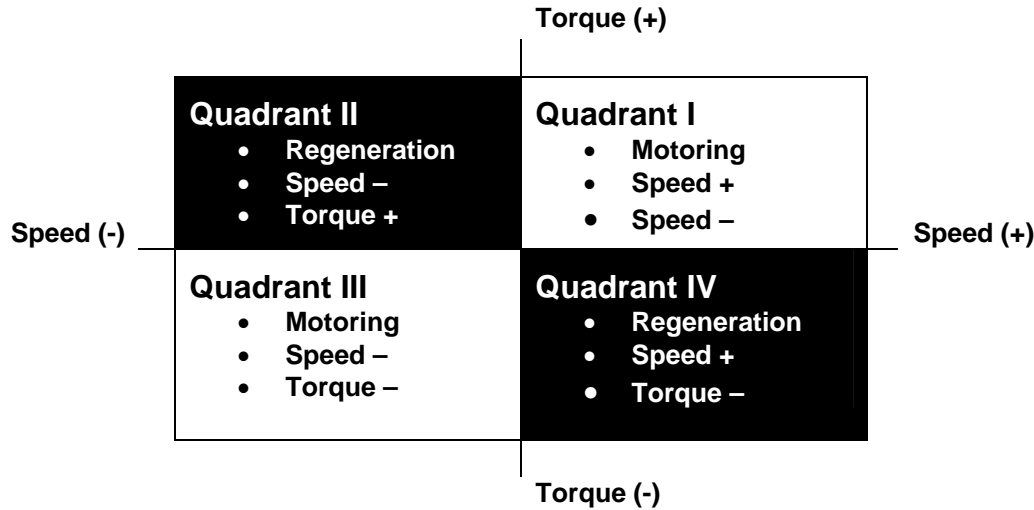


Figure 1

Resistor Element Type Options

The type of resistor element to be used in a braking resistor application is a function of braking current and the duty cycle. The continuous current rating of the braking resistor is derived from calculations based on the duty cycle along with considerations of the Brake IGBT built in the drive or the IGBT in the external brake chopper.

The proper ohm value is chosen based on the torque requirements of the application along with considerations of the current rating of the IGBT. The selected resistance value must be greater than the minimum resistance specified for the drive. Installing a braking resistor with too low of a resistance value may violate the maximum current rating of the IGBT and cause permanent damage to the drive.

There are many types of element options available for selection. The proper selection is important to insure performance and reliability as well as to provide the most compact and economical package. Note that the ohm value and continuous amp rating of the resistor is inversely proportional to one another. In other words, in a typical family of element types while maintaining the same approximate overall size, the higher the ohm rating of given resistor element, the lower the current rating.

The following element selection chart provides an approximate guide to use for the proper selection of natural convection cooled resistors. This example is for a 460 volt VFD.

HP	Duty Cycle Range	Element type
1-25	up to 10%	Case style, Smoothwound or Wirewound
1-25	above 10%	Wirewound or Edgewound
30-75	up to 10%	Wirewound or Edgewound
30-75	above 10%	Wirewound, Edgewound or Grid
100 and up	up to 10%	Edgewound, Grid or Ribbon
100 and up	above 10%	Edgewound, Grid or Ribbon

Series Connections Versus Parallel Connections

According to Ohm's Law, the same total ohm value of a braking resistor circuit can be obtained using either a series or a parallel connection of elements. However, the thermal mass (active element weight) of the series connection is much greater than the equivalent parallel connection because the series connected resistors feature a larger cross-sectional element to manage its higher current rating.

Figure 2 shows a pair of 50 ohm resistors connected in series for an equivalent resistance of 100 ohms. Figure 3 shows a pair of 200 ohm resistors connected in parallel for an equivalent resistance of 100 ohms. Both configurations have the same equivalent resistance, however, are the configurations equal when applied in a VFD cyclic braking application? The answer is absolutely not!

To demonstrate more clearly, we shall examine the test results for both the series connected resistor configuration with the parallel connected resistor configuration while subjected to a repeat cycle as well as a single shot or quick stop.

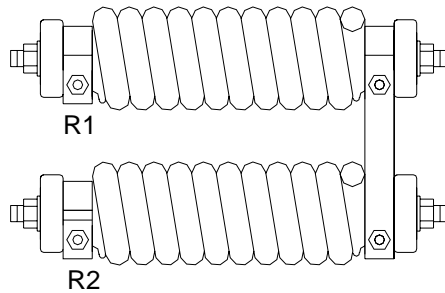


Figure 2

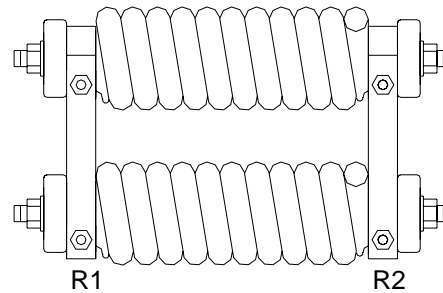


Figure 3

Repeat Cycle Applications involve a duty cycle. Typically, the resistor is overloaded for a few seconds and then allowed to cool for several more seconds. This cycle of on time and off time repeats indefinitely. After multiple cycles, the resistor stabilizes between two temperatures. The highest temperature occurs at the end of the on (or heating) cycle and the lowest temperature occurs at the end of the off (or cooling) cycle. The off time is typically longer than the on time for most repeat cycle applications such as motor control.

Single Shot or Quick Stop Applications involve absorbing large amounts of energy in a short period of time and then allowing the resistor to completely cool down to ambient temperature. A good example is an emergency stop application.

Repeat Cycle Test Comparison

Figure 4 illustrates the corresponding element temperatures for a 50% duty cycle application, (5 seconds on/ 5 seconds off), for both the series and parallel connection while subjected to the same voltage and overall current flow. As noted, both circuits equal 100 ohms total, but the active element weight of the series connection is 3 times greater than the parallel connection giving it an advantage. Why is this important? The answer is the watt second capability of the resistor unit. Notice the element temperature rise of the series circuit is operating much lower than the equivalent parallel circuit. The total element mass of the series connected unit has a watt second rating equivalent to approximately 3 times the parallel unit in this given example. The higher the watt second rating of a resistor assembly, the lower temperature rise, the longer the life expectancy.

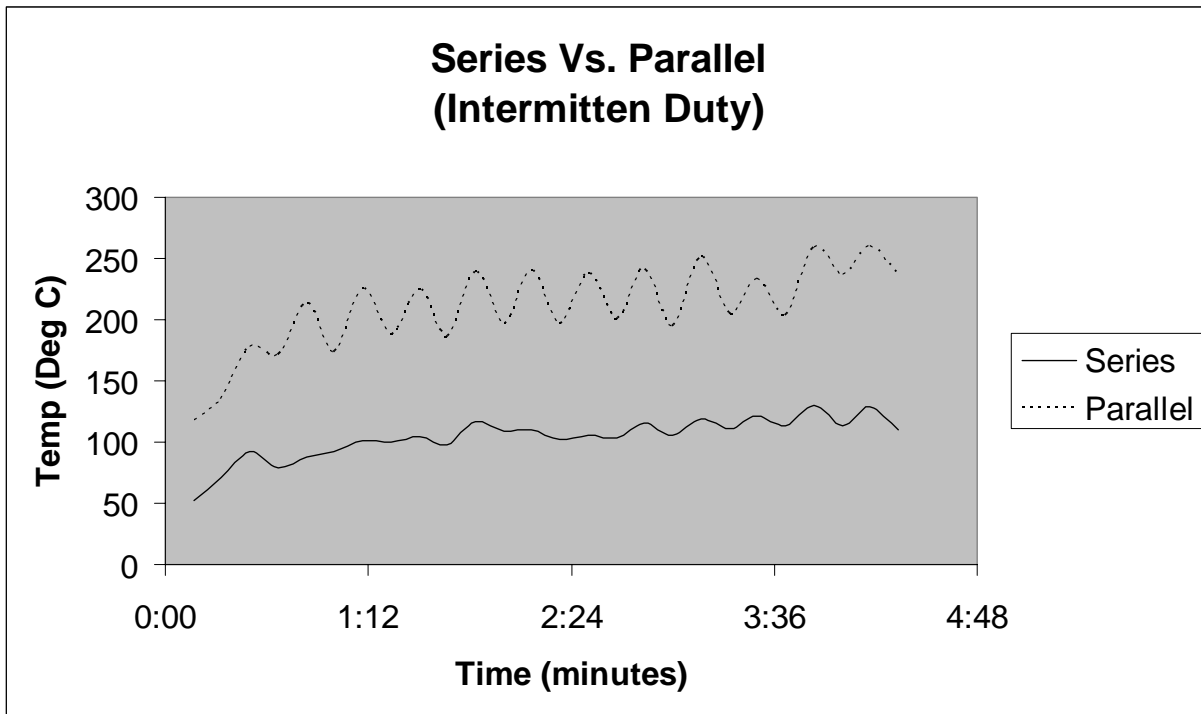


Figure 4

One Shot Cycle Test Comparison

Figure 5 illustrates the corresponding element temperatures for a single shot application. The graph shows the temperature comparisons for both the series and parallel configurations while subjected to the same overall current flow and the same ON time. The test was stopped once the parallel configuration reached its full temperature rise of 375 degrees Celsius. As noted, both circuits equal 100 ohms total, but the active element weight of the series connection is 3 times greater than the parallel connection giving it an advantage. As you can see from the graph the series configuration's temperature rise was much lower than the equivalent parallel circuit. The total element mass of the series connected unit has a watt second rating equivalent to approximately 3 times the parallel unit in this given example. Once again, the higher the watt second rating of a resistor assembly, the lower temperature rise, the better the reliability.

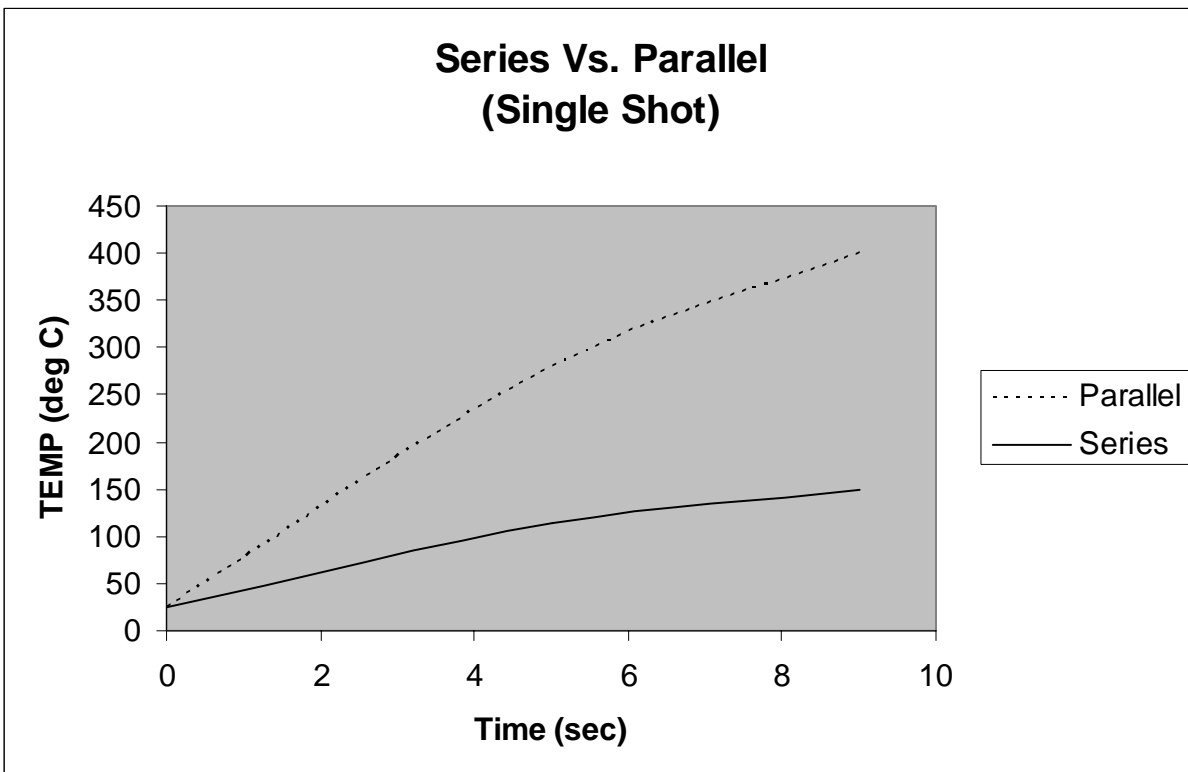


Figure 5

Powerohm Type BM Braking Modules

PRODUCT OVERVIEW

Powerohm Type BM Braking Modules can be used in conjunction with any AC drive to monitor the DC bus of the drive and activate external braking resistor as needed not only to avoid over-voltage trips, but to greatly improve the performance of the drive system. The use of Braking Modules and resistors increase the braking torque capability of a variable frequency drive, allowing faster and more controlled deceleration times.

To accommodate system horsepower requirements beyond the capability of a single Module, the Modules are all Master/Slave programmable. This allows an arrangement of multiple Modules to effectively function as a single higher rated module.

Pricing for the Brake Modules appears on page 28, while the pricing for the resistors may be found in the resistor index pages 24 – 27.

GENERAL SPECIFICATIONS

The Powerohm Type BM Braking Module is available in three different voltage classes including 240, 480 and 600 volts.

Powerohm Part No.	Nominal AC Line Voltage	RMS Continuous Load Current	Turn ON Voltage	Max Peak Current
BM2-30S	240	50	390	200
BM2-80S-F	240	115	390	200
BM2-300	240	300	390	300
BM2-600	240	600	390	600
BM4-30S	480	50	775	200
BM4-80S-F	480	115	775	200
BM4-300	480	300	775	300
BM4-600	480	600	775	600
BM6-30S	600	50	970	200
BM6-80S-F	600	115	970	200
BM6-300	600	300	970	300
BM6-600	600	600	970	600



VBR

Variable Braking Resistor Analyzer

Available for Rent or Purchase



With the VBR you can:

- Correctly size the OHMS and WATTS for any application
- Quickly provide a DB Resistor Sizing Service for your customers
- Provide a temporary DB solution while the permanent is on its way
- Validate the existing resistor size being employed as the optimum choice
- Provide OEM's and Integrator's with a portable / adjustable diagnostic tool for sizing braking resistors.

VBR Operation



CAUTION: Reference the Drive Manual and the Powerohm Braking Resistor Manual when selecting the proper resistance value. Do not select resistance values below the minimum values listed for the drive. Selecting a resistance value below the minimum will result in failure of the brake IGBT and/or drive.

Step 1. Secure the VBR unit in place and plug in supplied power cord to a 120VAC source before connecting load leads to drive or braking module. Attach the supplied load lead cables to the drive by connecting the red lead to DC+ and the black lead to DC-. **Warning:** Drive power and DC bus must be OFF before connecting the loads leads.

Step 2. Turn power selector switch to the ON position to activate the VBR unit. (Fig 1.) The selector switch should illuminate green and blowers should function when ON. Insure that there is a minimum clearance of 24 inches beyond the exhaust to any non-flammable surfaces.

Step 3. If the drive has an existing braking resistor installed, it is important to not press the "Braking Enable" pushbutton. Enabling a selected resistor value may push the equivalent resistance below the minimum allowed. Note that the VBR can be used to analyze an existing braking resistor to determine if a more effective resistor could be used for the installation (skip to Step 5 if this is the case).

Step 4. Select a desired resistance value and press "Braking Enable" to activate the resistive load. (Fig 2.) It is critical that the resistance value selected is greater than the minimum resistance value specified by the drive or braking module manufacturer. Selecting a resistance value lower than the minimum may cause permanent damage to the drive or braking module. The VBR is now ready to monitor your braking cycle.

Step 5. Start and run the Drive at full load, through its entire motoring and braking cycles for a minimum of 30 minutes. To prevent under sizing the resistor, be sure to operate at maximum load in combination with the most sever duty cycle. During the cycling of the Drive you will notice that "VBR Reading" will begin to register a readout from 1 to 135. (Fig 3.)

Step 6. It is important to run the Drive a minimum of 30 minutes so that the proper watt selection of the resistor is realized. At this time the "VBR Reading" should have reached its maximum value and you are you are ready to record the peak "VBR Reading." Lift off the small cover below the digital readout to access the programming keys. Press the up arrow key, which is the second key from the left. This blinking number displayed is the peak readout that will be used in sizing your braking resistor.

Step 7. With the resistance value you selected in Step 4 (or the value of an existing braking resistor) and the peak "VBR Reading" you recorded from Step 6, you can now properly select a fixed resistor for your application. Go to the VBR resistor selection chart to obtain the correct braking resistor part number.

Step 8. The VBR unit must remain ON a minimum of 5 minutes after the drive is powered down to allow the unit to cool. Do not remove load leads until the Drive and DC bus have been powered down. Use caution when handling the VBR unit as the exhaust area surface may be HOT!



Figure 1.



Figure 2.



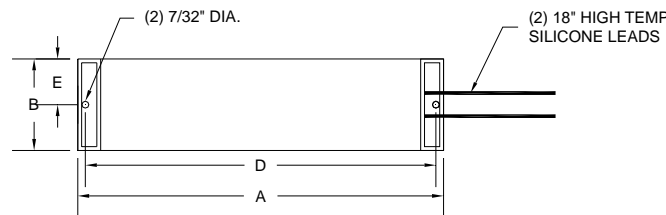
Figure 3.

Type CR Case Resistors

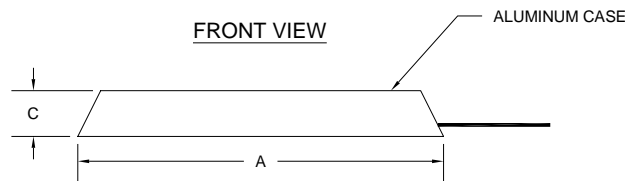
Powerohm's Type CR resistors are manufactured with quality components for superior performance and increased life expectancy. Our case resistors feature a nickel-chromium wire helically wound, then placed inside a ceramic fixture and inserted into a corrosion resistant aluminum case. Each coil end is terminated to high temperature wire leads and encapsulated with a ceramic potting material. The result is a resistor element electrically isolated, but thermally bound to the outer case to allow the element heat to transfer to the metallic case and efficiently cool. The units are supplied with 18" wire leads, and the case is machined to include two mounting holes for easy installation.

ELECTRICAL RATINGS & DIMENSIONS OF STANDARD SIZE CASE RESISTORS					
WATTAGE	DIMENSIONS IN INCHES				
	A	B	C	D	E
100	6	1-1/2	3/4	5-1/2	3/4
150	9	1-1/2	3/4	8-1/2	3/4
200	6	3	1-1/2	5-1/2	1/1/2
300	9	3	1-1-2	8-1/2	1/1/2
400	12	33	1-1/2	11-1/2	1/1/2

TOP VIEW



FRONT VIEW



Type GCE Enclosures

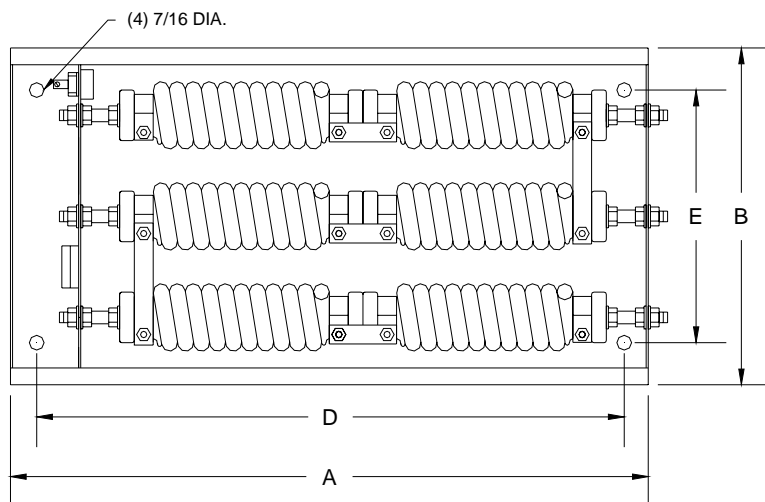
These heavy gage screened enclosures feature a solid bottom and a built-in compartment separated from the resistor assembly. The resistors are factory wired to a terminal block mounted in this compartment using high temperature Teflon or silicone wire. The terminal compartment also houses a normally closed thermal switch used for detecting resistor temperature overloads. During installation, standard 90°C rated wire is routed into the compartment through the removable 1/2 inch conduit knockouts and connected to the factory wired terminal block.

Our standard unit includes a screened cover which is CNC punched to obtain maximum cooling and professional aesthetics. Mounting holes are located inside the enclosure and can be easily accessed by removing the cover. Resistor coils are interconnected using stainless steel bus bars, producing a corrosion resistant current path to withstand nearly any harsh industrial environment. The standard finish is galvanized, but an optional ANSI 61 powder coated finish is available upon request. As shown in the table below, the size of the enclosure will vary depending on the number of resistor coils required for your application. Please do not hesitate to call the factory if you need assistance. Units are available with louvered covers; add "-W" to the part number and note that the 'A' and 'B' dimensions will increase by 2 inches and the 'C' dimension will increase by 1 inch.

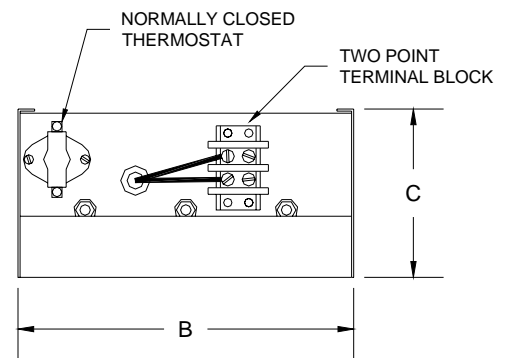
GCE ENCLOSURE DIMENSIONS AND COIL OPTIONS

PART NUMBER	MAX. NO. WR COLS	MAX NO. SXR, VR or ER	DIMENSIONS IN INCHES				
			A	B	C	D	E
GCE1	1	(1) Size 2	12	5	5	10-1/2	---
GCE2	2	(2) Size 2	12	7	5	10-1/2	4-1/2
GCE3	3	(3) Size 2	12	10	5	10-1/2	7-1/2
GCE4	4	(4) Size 2	12	13	5	10-1/2	10-1/2
GCE5	5	(5) Size 2	12	16	5	10-1/2	13-1/2
GCE6	6	(3) Size 5	19	10	5	17-1/2	7-1/2
GCE8	8	(4) Size 5	19	13	5	17-1/2	10-1/2
GCE9	9	(3) Size 7	26-1/2	10	5	25	7-1/2
GCE10	10	(5) Size 5	19	16	5	17-1/2	13-1/2
GCE12	12	(4) Size 7	26-1/2	13	5	25	10-1/2
GCE15	15	(5) Size 7	26-1/2	16	5	25	13-1/2
GCE18	18	(6) Size 7	28	10	10	26-1/2	7-1/2
GCE24	24	(8) Size 7	28	13	10	26-1/2	10-1/2
GCE30	30	(10) Size 7	28	16	10	26-1/2	13-1/2

TOP VIEW



LEFT SIDE VIEW



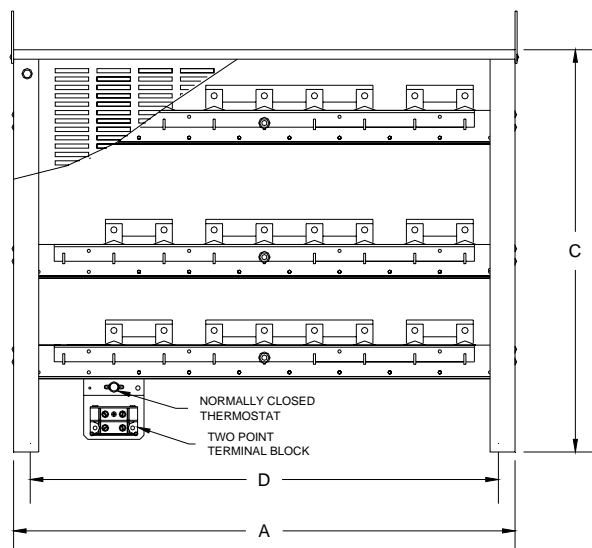
Type ED Enclosures

The Type ED enclosure is designed for applications requiring a large number of Type SXR, WR, VR and/or ER resistor coils. In addition to the large capacity, these units are supplied with terminal connections up to 400 amps continuous located on a terminal plate in the bottom of the enclosure. These factory wired connections allow standard 90°C rated wire to be used if routed along the enclosure bottom. If installing without the optional terminal connections, always use 200°C rated silicone or Teflon wire when attaching directly to resistors. A normally closed thermal switch is also provided, which is used to detect resistor temperature overloads.

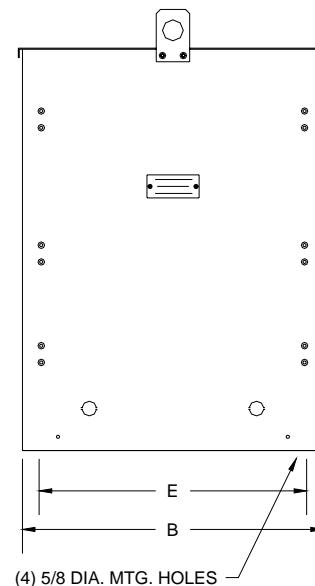
These rigid enclosures include a screened top and removable front and back screened covers. The enclosure sides are solid and the bottom is open and furnished with two lifting eyes. Mounting holes are located inside the enclosure and can be easily accessed by removing the front or rear cover. Resistor coils are interconnected using all stainless steel bus bars, producing a corrosion resistant current path to withstand nearly any harsh industrial environment. The standard finish is galvanized, but an optional ANSI 61 powder coated finish is available upon request. As shown in the table below, the size of the enclosure will vary depending on the number of resistor coils required for your application. Units are available with louvered covers; add "-W" to the part number and note that the 'A' and 'B' dimensions will increase by 4 inches and the 'C' dimensions will increase by 1-1/2 inches.

ED ENCLOSURE DIMENSIONS AND COIL OPTIONS							
PART NUMBER	MAX. NO. WR COLS	MAX NO. SXR, VR or ER	DIMENSIONS IN INCHES				
			A	B	C	D	E
ED1	18	(9) Size 5	30	18	10	26	16
ED2	36	(18) Size 5	30	18	16	26	16
ED3	54	(27) Size 5	30	18	24	26	16
ED4	72	(36) Size 5	30	18	32	26	16
ED5	90	(45) Size 5	30	18	40	26	16
ED6	108	(54) Size 5	30	18	48	26	16
ED7	126	(63) Size 5	30	18	56	26	16
ED8	144	(72) Size 5	30	18	64	26	16
ED9	162	(81) Size 5	30	18	72	26	16
ED10	180	(90) Size 5	30	18	80	26	16

FRONT VIEW



SIDE VIEW



Installation Instructions

Construction: Powerohm braking resistors consists of smoothwound, wirewound or edgewound type resistor coils mounted in ventilated enclosures. All current carrying components used to manufacture our resistor coils including the elements and terminals are stainless steel for maximum corrosion resistance. Standard enclosures will be mill galvanized with terminals factory wired to a terminal block and normally closed thermal switch. Braking resistors are available with a variety of options such as special enclosure finishes and outdoor ratings.

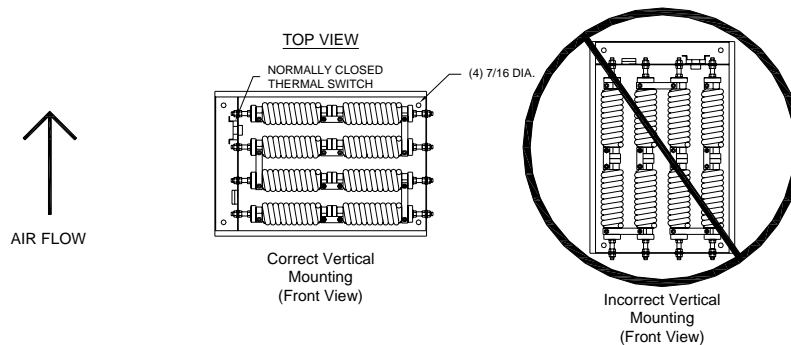
INSPECTION: Upon receipt of your Powerohm Braking Resistor, be sure to inspect the unit carefully for any shipping damage. After unpacking, check the unit for loose, broken, bent or otherwise damaged parts due to shipping. Report any shipping damage immediately to the freight carrier. Be sure to verify that the part number and ratings listed on the nameplate conform to the order specification. The ohm rating listed on the nameplate is critical (too low of an ohm value may cause damage to the drive).

INSTALLATION:

IMPORTANT: The National Electric Code (NEC) and local regulations govern the installation and wiring of electrical equipment such as braking resistors. DC power wiring, AC power wiring, control wiring and conduit must be installed in accordance with these codes.

Powerohm braking assemblies cool by natural convection causing hot air to rise vertically from the enclosure. Braking resistors should be mounted in a well ventilated location free of any combustible materials or equipment affected by heat. Units should be installed with at least 24 inches of free space above the enclosure top and 6 inches of free space surrounding the enclosure sides. If necessary, units can be mounted on spacers or channels to limit heat from conducting from the resistor enclosure to its mounting surface.

Braking resistor enclosures 28 inches or less in width, can be mounted vertically or horizontally. If the unit is mounted vertically, it is important that the resistor coils remain in a horizontal position. Also, if a thermal switch is included with the unit, position the equipment so the switch remains near the top of the enclosure. See below for vertical mounting details.



To install the unit, first remove the ventilated cover. Units 28 inches or less in width require a 5/16 inch wrench, while larger units require a 7/16 inch wrench to remove the cover hardware. Mounting holes can be found on the inside of the braking resistor enclosure. Mounting dimensions are listed on pages 25-36. Units that are 28 inches or smaller have 7/16 inch diameter mounting holes designed for 3/8 inch hardware. 30 inch wide units have 5/8 inch diameter mounting holes designed for 1/2 inch hardware. Be sure to fasten the unit securely in place.

Smaller 28 inch wide enclosures have convenient conduit knockouts for easy connection. Remove the proper knockout after determining a suitable entry point. Larger units may require field punching for conduit entry. It is preferable to route conduit near the bottom of the resistor enclosure. After attaching conduit, pull wiring into the enclosure for connection to resistor. If connecting directly to the terminals on the resistor elements, it is necessary to use high temperature silicon or Teflon wire rated 200°C. Try to route wiring along the bottom of the enclosure and avoid running the wiring across the top or near the resistor elements. Units are supplied with either #10, 3/8 or 1/2 inch terminal hardware. If you choose to use the factory installed terminal block, then you may connect to it using standard 90°C rated wire. Be sure to properly ground the resistor enclosure to prevent electrical shock.

A normally closed thermal switch is included with the unit, featuring ¼ inch quick connect terminals.

After installing and wiring to your Powerohm Braking Resistor, return the ventilated cover to its proper position. Securely tighten cover hardware (do not exceed 20 inch-pounds of torque).

MAINTENANCE: Periodically check the unit for loose connections and an accumulation of dust or dirt on the inside and outside of the resistor enclosure. Be sure to allow the unit to cool before servicing (contact may result in burn injury). Remove all power before servicing unit to avoid electrical shock. Allow at least one minute after input power has been removed for the bus voltage to discharge. Electric shock can cause injury or death.

Resistor elements should not glow red under normal operating conditions. If the resistor elements glow red you may need a higher rated braking resistor.

TECHNICAL SUPPORT: If you have any questions about your braking resistor, contact Powerohm for assistance at (800) 838-4694.

Application / Engineering Notes

- 1) ND HP = Normal duty HP rating of the drive
- 2) Torque (% of Motor) = Maximum torque (power) a motor can discharge back through the drive
- 3) Rated Ohms = the nominal resistance value designed to exceed the minimum resistance rating of the drive. Any listed torque rating less than 100% is due to the limitations of the drive. Applications requiring torque values that exceed the limitations of the drive, may require an external chopper module and a corresponding resistor.
- 5) Duty cycle %. The duty cycle and braking scheme determine the power rating (watts) and therefore the physical size of the braking resistor. Duty cycle is calculated by dividing the braking stop time by the total cycle time. Maximum cycle time is 2 minutes.

All standard enclosed resistors assemblies come mounted in a screened guarded enclosure and include a prewired terminal block and a normally closed thermal switch.

For outdoor enclosures add 10% to the price and -W to the part number. The standard enclosure finish is mill galvanized, however other finishes are available. Consult factory.

230V AF-650 GP Standard Enclosed Part Number Index

Powerohm P/N	Ohms	Watts	Encl Qty	Encl P/N	Dimensions	Weight (lbs)	List Price
PRDB2101TBNC	425	95	1	GCE1	12W x 5D x 5H	7	\$135
PRDB2102TBNC	310	250	1	GCE1	12W x 5D x 5H	7	\$146
PRDB2103TBNC	145	65	1	GCE1	12W x 5D x 5H	6.5	\$129
PRDB2104TBNC	65	250	1	GCE1	12W x 5D x 5H	7.2	\$137
PRDB2105TBNC	50	285	1	GCE1	12W x 5D x 5H	7.2	\$137
PRDB2106TBNC	25	800	1	GCE2	12W x 7D x 5H	9.4	\$207
PRDB2107TBNC	20	1000	1	GCE3	12W x 10D x 5H	12.6	\$266
PRDB2108TBNC	15	2000	1	GCE5	12W x 16D x 5H	18	\$383
PRDB2109TBNC	10	2800	1	GCE9	26.5W x 10D x 5H	23	\$490
PRDB2110TBNC	7	4000	1	GCE9	26.5W x 10D x 5H	23	\$490
PRDB2111TBNC	6	4800	1	GCE12	26.5W x 13D x 5H	30.04	\$701
PRDB2112TBNC	4.7	6000	1	GCE12	26.5W x 13D x 5H	31.8	\$817
PRDB2113TBNC	3.3	8000	1	GCE24	28W x 13D x 10H	52.2	\$974
PRDB2114TBNC	2.7	10000	1	GCE24	28W x 13D x 10H	57.5	\$1,044
PRDB2401TBNC	425	430	1	GCE1	12W x 5D x 5H	9.25	\$171
PRDB2402TBNC	310	800	1	GCE2	12W x 7D x 5H	9.4	\$207
PRDB2403TBNC	145	260	1	GCE1	12W x 5D x 5H	7.2	\$137
PRDB2404TBNC	65	800	1	GCE2	12W x 7D x 5H	9.4	\$207
PRDB2405TBNC	50	1000	1	GCE3	12W x 10D x 5H	12.6	\$266
PRDB2406TBNC	25	3000	1	GCE8	19W x 13D x 5H	25.6	\$537

230V AF-650 GP Case Style Part Number Index

Powerohm P/N	Ohms	Watts	Encl Qty	Encl P/N	Dimensions	Weight (lbs)	List Price
PRDB2601FP	430	100	1	CR100	6W x 1.5D x 0.75H	1	\$54
PRDB2602FP	310	200	1	CR200	6W x 3D x 1.5H	2	\$75
PRDB2603FP	150	200	1	CR200	6W x 3D x 1.5H	2	\$75
PRDB2604FP	72	200	1	CR200	6W x 3D x 1.5H	2	\$75
PRDB2605FP	50	200	1	CR200	6W x 3D x 1.5H	2	\$75
PRDB2606FP	60	200	1	CR200	6W x 3D x 1.5H	2	\$75

All resistors assemblies come mounted in a screened guarded enclosure and include a prewired terminal block and a normally closed thermal switch.

For outdoor enclosures add 10% to the price and -W to the part number. The standard enclosure finish is mill galvanized, however other finishes are available. Consult factory.

460V AF-650 GP Standard Enclosed Part Number Index

Powerohm P/N	Ohms	Watts	Encl Qty	Encl P/N	Dimensions	Weight (lbs)	List Price
PRDB4101TBNC	620	65	1	GCE1	12W x 5D x 5H	7	\$129
PRDB4102TBNC	620	65	1	GCE1	12W x 5D x 5H	7	\$129
PRDB4103TBNC	310	250	1	GCE1	12W x 5D x 5H	7	\$146
PRDB4104TBNC	210	290	1	GCE1	12W x 5D x 5H	7.2	\$137
PRDB4105TBNC	110	600	1	GCE2	12W x 7D x 5H	9.4	\$207
PRDB4106TBNC	80	850	1	GCE3	12W x 10D x 5H	12.6	\$266
PRDB4107TBNC	65	1000	1	GCE3	12W x 10D x 5H	12.6	\$266
PRDB4108TBNC	40	2000	1	GCE5	12W x 16D x 5H	18	\$383
PRDB4109TBNC	30	3000	1	GCE8	19W x 13D x 5H	25.6	\$537
PRDB4110TBNC	25	4000	1	GCE10	19W x 16D x 5H	30	\$654
PRDB4111TBNC	20	4000	1	GCE10	19W x 16D x 5H	30	\$654
PRDB4112TBNC	15	5000	1	GCE9	26.5W x 10D x 5H	26	\$599
PRDB4113TBNC	12	6000	1	GCE12	26.5W x 13D x 5H	28.6	\$701
PRDB4114TBNC	9.8	15000	1	GCE30	28W x 16D x 10H	71	\$1,703
PRDB4115TBNC	7.3	13000	1	GCE24	28W x 13D x 10H	61.2	\$1,419
PRDB4116TBNC	4.7	15000	1	GCE24	28W x 13D x 10H	74	\$1,419
PRDB4117TBNC	3.8	22000	1	ED3	30W x 18D x 24H	158	\$3,066
PRDB4118TBNC	3.2	27000	1	ED3	30W x 18D x 24H	170	\$3,066
PRDB4119TBNC	2.6	32000	1	ED4	30W x 18D x 32H	183.8	\$3,335
PRDB4120TBNC	2.1	39000	1	ED3	30W x 18D x 24H	178.4	\$3,538
PRDB4121TBNC	3.3	56000	1	ED5	30W x 18D x 40H	232	\$5,250
PRDB4122TBNC	2.6	72000	1	ED7	30W x 18D x 56H	395.4	\$7,496
PRDB4123TBNC	2.1	100000	1	ED7	30W x 18D x 56H	410.7	\$7,850
PRDB4124TBNC	1.3	144000	1	ED10T	30W x 36D x 80H	819	\$14,924
PRDB4125TBNC	1.3	144000	1	ED10T	30W x 36D x 80H	819	\$14,924
PRDB4126TBNC	1.3	144000	1	ED10T	30W x 36D x 80H	819	\$14,924
PRDB4127TBNC	1.3	144000	1	ED10T	30W x 36D x 80H	819	\$14,924
PRDB4128TBNC	1.3	144000	1	ED10T	30W x 36D x 80H	819	\$14,924
PRDB4129TBNC	1.3	144000	1	ED10T	30W x 36D x 80H	819	\$14,924
PRDB4130TBNC	1.3	144000	1	ED10T	30W x 36D x 80H	819	\$14,924
PRDB4401TBNC	620	260	1	GCE1	12W x 5D x 5H	7.75	\$160
PRDB4402TBNC	620	260	1	GCE1	12W x 5D x 5H	7.75	\$160
PRDB4403TBNC	310	800	1	GCE2	12W x 7D x 5H	9.4	\$207
PRDB4404TBNC	210	1350	1	GCE4	12W x 13D x 5H	15.8	\$325
PRDB4405TBNC	110	2000	1	GCE5	12W x 16D x 5H	18	\$383
PRDB4406TBNC	80	3000	1	GCE8	19W x 13D x 5H	25.6	\$537
PRDB4407TBNC	65	5000	1	GCE15	26.5W x 16D x 5H	37.6	\$808
PRDB4408TBNC	40	5000	1	GCE15	26.5W x 16D x 5H	37.6	\$808
PRDB4409TBNC	30	9000	1	GCE18	28W x 10D x 10H	44	\$1,039
PRDB4410TBNC	25	13000	1	GCE24	28W x 13D x 10H	54	\$1,291
PRDB4411TBNC	20	13000	1	GCE24	28W x 13D x 10H	48.4	\$1,291
PRDB4412TBNC	15	16000	1	GCE30	28W x 16D x 10H	63.8	\$1,434

All standard enclosed resistors assemblies come mounted in a screened guarded enclosure and include a prewired terminal block and a normally closed thermal switch.

For outdoor enclosures add 10% to the price and -W to the part number. The standard enclosure finish is mill galvanized, however other finishes are available. Consult factory.

460V AF-650 GP Standard Enclosed Part Number Index

Powerohm P/N	Ohms	Watts	Encl Qty	Encl P/N	Dimensions	Weight (lbs)	List Price
PRDB4413TBNC	12	19000	1	ED2	30W x 18D x 16H	91	\$2,154
PRDB4414TBNC	9.8	38000	1	ED3	30W x 18D x 24H	163.5	\$3,106
PRDB4415TBNC	7.3	38000	1	ED3	30W x 18D x 24H	168.2	\$3,302
PRDB4416TBNC	4.7	45000	1	ED4	30W x 18D x 32H	237.3	\$4,261
PRDB4417TBNC	3.8	75000	1	ED6	30W x 18D x 48H	338.6	\$6,450
PRDB4418TBNC	3.2	90000	1	ED8	30W x 18D x 64H	462.4	\$8,779
PRDB4419TBNC	2.6	112000	1	ED8	30W x 18D x 64H	500.8	\$8,779
PRDB4420TBNC	2.1	135000	1	ED8T	30W x 38D x 64H	740	\$13,562

460V AF-650 GP Case Style Part Number Index

Powerohm P/N	Ohms	Watts	Encl Qty	Encl P/N	Dimensions	Weight (lbs)	List Price
PRDB4601FP	830	100	1	CR100	6W x 1.5D x 0.75H	1	\$54
PRDB4602FP	620	200	1	CR200	6W x 3D x 1.5H	2	\$75
PRDB4603FP	310	200	1	CR200	6W x 3D x 1.5H	2	\$75
PRDB4604FP	210	200	1	CR200	6W x 3D x 1.5H	2	\$75
PRDB4605FP	240	200	1	CR200	6W x 3D x 1.5H	2	\$75
PRDB4606FP	160	200	1	CR200	6W x 3D x 1.5H	2	\$75
PRDB4607FP	130	200	1	CR200	6W x 3D x 1.5H	2	\$75
PRDB4608FP	80	240	1	CR200	6W x 3D x 1.5H	2	\$75
PRDB4609FP	72	240	1	CR200	6W x 3D x 1.5H	2	\$75

All resistors assemblies come mounted in a screened guarded enclosure and include a prewired terminal block and a normally closed thermal switch.

For outdoor enclosures add 10% to the price and -W to the part number. The standard enclosure finish is mill galvanized, however other finishes are available. Consult factory.

230V Legacy Standard Enclosed Part Number Index

Powerohm P/N	Ohms	Watts	Encl Qty	Encl P/N	Dimensions	Weight (lbs)	List Price
PRDB2501TBNC	100	200	1	GCE1	12W x 5D x 5H	7.2	\$137
PRDB2502TBNC	100	200	1	GCE1	12W x 5D x 5H	7.2	\$137
PRDB2503TBNC	40	400	1	GCE1	12W x 5D x 5H	7.2	\$137
PRDB2504TBNC	40	400	1	GCE1	12W x 5D x 5H	7.2	\$137
PRDB2505TBNC	33	400	1	GCE1	12W x 5D x 5H	7.2	\$137
PRDB2506TBNC	20	800	1	GCE2	12W x 7D x 5H	9.4	\$207
PRDB2507TBNC	15	900	1	GCE3	12W x 10D x 5H	12.6	\$266
PRDB2508TBNC	10	1400	1	GCE4	12W x 13D x 5H	15.8	\$325
PRDB2509TBNC	8.6	1400	1	GCE4	12W x 13D x 5H	15.8	\$325
PRDB25010TBNC	6.6	1800	1	GCE9	26.5W x 10D x 5H	20	\$381
PRDB25011TBNC	5.8	1800	1	GCE6	19W x 10D x 5H	16.2	\$384
PRDB25012TBNC	4	3000	1	GCE6	19W x 10D x 5H	19.9	\$484
PRDB25013TBNC	3	3700	1	GCE9	26.5W x 10D x 5H	26.72	\$605
PRDB25014TBNC	2.5	4500	1	GCE9	26.5W x 10D x 5H	28.7	\$647
PRDB25015TBNC	2	5500	1	GCE9	26.5W x 10D x 5H	30.8	\$647
PRDB25016TBNC	1.6	8300	1	GCE12	26.5W x 13D x 5H	43.48	\$761
PRDB25017TBNC	1.2	11300	1	GCE15	26.5W x 16D x 5H	59	\$1,135
PRDB25018TBNC	1.2	11300	1	GCE15	26.5W x 16D x 5H	59	\$1,135

460V Legacy Standard Enclosed Part Number Index

Powerohm P/N	Ohms	Watts	Encl Qty	Encl P/N	Dimensions	Weight (lbs)	List Price
PRDB4501TBNC	200	200	1	GCE1	12W x 5D x 5H	7.2	\$137
PRDB4502TBNC	160	400	1	GCE1	12W x 5D x 5H	7.2	\$137
PRDB4503TBNC	160	400	1	GCE1	12W x 5D x 5H	7.2	\$137
PRDB4504TBNC	130	400	1	GCE1	12W x 5D x 5H	7.2	\$137
PRDB4505TBNC	80	800	1	GCE2	12W x 7D x 5H	9.4	\$207
PRDB4506TBNC	60	900	1	GCE3	12W x 10D x 5H	12.6	\$266
PRDB4507TBNC	40	1400	1	GCE4	12W x 13D x 5H	15.8	\$325
PRDB4508TBNC	34.4	1400	1	GCE4	12W x 13D x 5H	15.8	\$325
PRDB4509TBNC	27	1800	1	GCE5	12W x 16D x 5H	18	\$383
PRDB45010TBNC	22	1800	1	GCE5	12W x 16D x 5H	18	\$383
PRDB45012TBNC	15	3600	1	GCE6	19W x 10D x 5H	20.2	\$514
PRDB45013TBNC	12	4800	1	GCE6	19W x 10D x 5H	22	\$553
PRDB45014TBNC	10	6000	1	GCE9	26.5W x 10D x 5H	26.2	\$708
PRDB45015TBNC	7.5	7200	1	GCE9	26.5W x 10D x 5H	33	\$817
PRDB45016TBNC	6	9600	1	GCE9	26.5W x 10D x 5H	38.6	\$1,022
PRDB45017TBNC	5	12000	1	GCE12	26.5W x 13D x 5H	51.2	\$1,192
PRDB45018TBNC	3.75	14400	1	GCE15	26.5W x 16D x 5H	60.5	\$1,215
PRDB45019TBNC	3	19200	1	GCE15	26.5W x 16D x 5H	103.6	\$2,228
PRDB45020TBNC	2.5	24000	1	GCE15	26.5W x 16D x 5H	113.2	\$2,228
PRDB45021TBNC	2.2	28800	1	ED3	30W x 18D x 24H	150.6	\$2,818
PRDB45022TBNC	1.95	33600	1	ED3	30W x 18D x 24H	178.4	\$3,538
PRDB45023TBNC	1.6	38400	1	ED3	30W x 18D x 24H	155.9	\$3,298
PRDB45024TBNC	1.37	43200	1	ED4	30W x 18D x 32H	214.8	\$4,143
PRDB45025TBNC	1.3	48000	1	ED4	30W x 18D x 32H	254.4	\$4,615
PRDB45026TBNC	1.1	57600	1	ED6	30W x 18D x 48H	293.2	\$5,246
PRDB45027TBNC	0.84	67200	1	ED6	30W x 18D x 48H	377.6	\$6,686
PRDB45028TBNC	0.75	76800	1	ED8	30W x 18D x 64H	462.4	\$8,779

All standard enclosed resistors assemblies come mounted in a screened guarded enclosure and include a prewired terminal block and a normally closed thermal switch.

For outdoor enclosures add 10% to the price and -W to the part number. The standard enclosure finish is mill galvanized, however other finishes are available. Consult factory.

TYPE BM BRAKE MODULES

Brake Module P/N	Drive Input Voltage	Minimum Ohms	Continuous Amps	Peak Amps	Dimensions	Weight (lbs)	List Price
BM2-30S	200 – 240	1.9	50	200	7" x 11" x 5"	8	\$1,280
BM2-80S-F	200 – 240	1.9	115	200	7" x 13" x 5"	10	\$1,420
BM2-300	200 – 240	1.3	300	300	7" x 22" x 10"	38	\$5,284
BM2-600	200 – 240	0.63	600	600	7" x 22" x 10"	38	\$5,882
BM4-30S	395 – 480	3.8	50	200	7" x 11" x 5"	8	\$1,280
BM4-80S-F	395 – 480	3.8	115	200	7" x 13" x 5"	10	\$1,420
BM4-300	395 – 480	2.5	300	300	7" x 22" x 10"	38	\$5,284
BM4-600	395 – 480	1.3	600	600	7" x 22" x 10"	38	\$5,882
BM6-30S	500 – 600	4.7	50	200	7" x 11" x 5"	8	\$1,280
BM6-80S-F	500 – 600	4.7	115	200	7" x 13" x 5"	10	\$1,420
BM6-300	500 – 600	3.1	300	300	7" x 22" x 10"	38	\$5,284
BM6-600	500 – 600	1.6	600	600	7" x 22" x 10"	38	\$5,882

VBR LOAD ANALYZER

VBR		Part Number	Dimensions	Weight (lbs)	List Price
		VBR4-30PF	20" x 20" x 10	50	\$4,800
		Carrying Case	30" x 28" x 20	40	\$1,500
Rental Charge	1 week minimum	Security Deposit \$1,750			\$900/wk

All resistors assemblies come mounted in a screened guarded enclosure and include a prewired terminal block and a normally closed thermal switch.

For outdoor enclosures add 10% to the price and -W to the part number. The standard enclosure finish is mill galvanized, however other finishes are available. Consult factory.

Sales Office:

Toll Free: 800-838-4694

Phone: (859) 384-8088

Fax (859) 384-8099

Remit to:

**5713 13th Street
Katy, Texas 77493**

