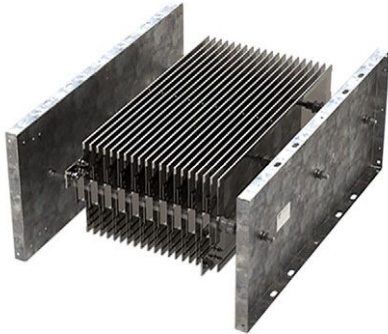


## High Power, High Current Grid Resistors, 6 kW and Larger



### OVERVIEW

Vishay Milwaukee resistor GRE3 grid offering expands on the GRE1 and GRE2 resistors allowing for an alternate form factor and increased power/resistance capabilities. With a robust all welded construction, Milwaukee resistor grid resistors are designed using stainless steel resistance elements to absorb high energy pulses and high power applications.

### CONTACT THE FACTORY FOR CUSTOM DESIGN AND OPTIONS FOR STANDARD DESIGN

Options include: custom mounting configurations, custom IP rated enclosures, element size / shape, power, multiple resistors in a single enclosure, etc.

For custom designs please include: duty cycle, total power and resistance and mounting requirements.

### FEATURES

- GRE3 high power capability to 36 kW at 40 °C
- Standard indoor and outdoor enclosure options
- All welded construction with double insulation
- Modular or custom designs available
- Multiple terminal taps available
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT

### APPLICATIONS OF GRID RESISTORS

#### Dynamic Braking

When an electric motor driven load is being decelerated, the motor acts as a generator, converting kinetic energy of the load to electrical energy. The dynamic braking circuit converts this electrical energy into heat to slow the load, through the use of dynamic braking resistors. Braking resistors ensure proper motor operation, allow heavy loads to stop quickly and protect the drive from damage. Furthermore, dynamic braking resistors that are improperly cooled, incorrectly sized, physically damaged or electrically failed can cause costly unwanted down time

#### Harmonic Filters

Within a harmonic filter installation the filter resistors are used to dissipate unwanted harmonic frequencies as heat.

#### Load Banks

Custom designed resistive load banks allow for load simulation of many electrical applications for testing purposes.

### CONTACT INFORMATION

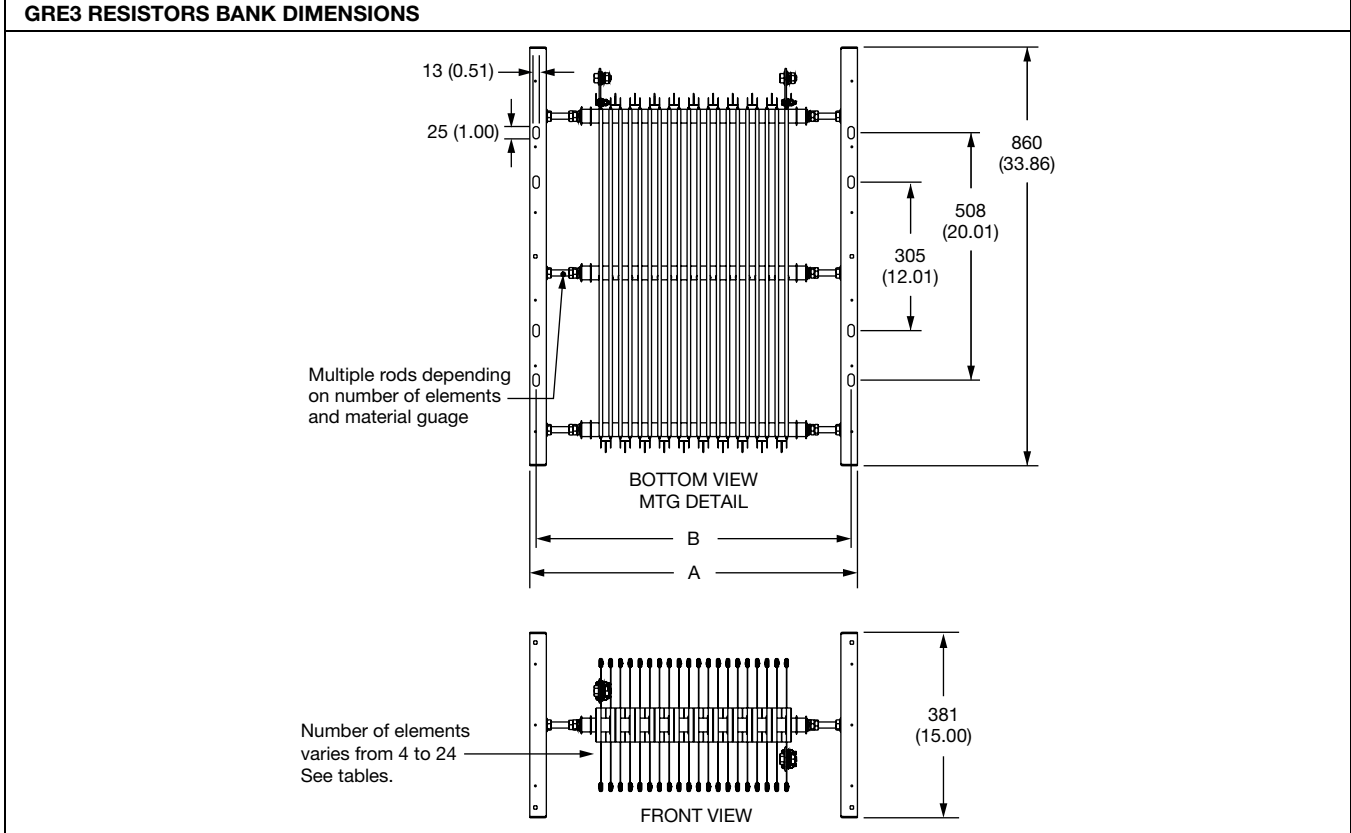
For design assistance, contact: [vishaymilwaukeeresistor@vishay.com](mailto:vishaymilwaukeeresistor@vishay.com) or +1-888-616-6666

### STANDARD ELECTRICAL SPECIFICATIONS

GLOBAL MODEL	POWER RATING OF RESISTOR BANK W	RESISTANCE RANGE Ω	TOLERANCE ± %	TEMPERATURE COEFFICIENT <sup>(1)</sup> ± ppm/°C	GLOBAL PART NUMBER <sup>(2)</sup>
GRE3	6000	0.08 to 40	10	± 365	GRE3AxxxxxK00N0000
GRE3	9000	0.12 to 60	10	± 365	GRE3BxxxxxK00N0000
GRE3	12 000	0.16 to 80	10	± 365	GRE3CxxxxxK00N0000
GRE3	15 000	0.2 to 100	10	± 365	GRE3DxxxxxK00N0000
GRE3	18 000	0.24 to 120	10	± 365	GRE3ExxxxxK00N0000
GRE3	21 000	0.28 to 140	10	± 365	GRE3FxxxxxK00N0000
GRE3	24 000	0.32 to 160	10	± 365	GRE3GxxxxxK00N0000
GRE3	27 000	0.36 to 180	10	± 365	GRE3HxxxxxK00N0000
GRE3	30 000	0.4 to 200	10	± 365	GRE3JxxxxxK00N0000
GRE3	33 000	0.44 to 220	10	± 365	GRE3KxxxxxK00N0000
GRE3	36 000	0.48 to 240	10	± 365	GRE3LxxxxxK00N0000

#### Notes

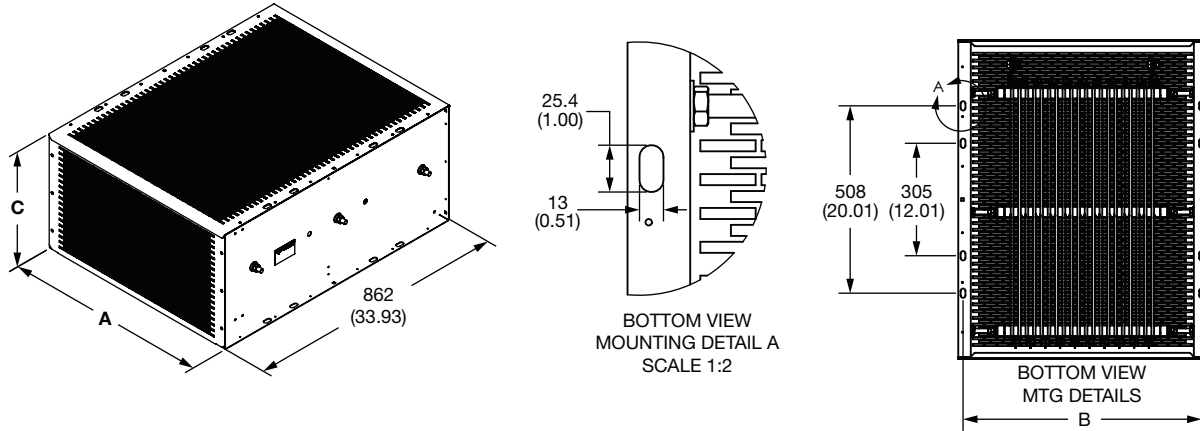
- Listed ratings are for individual resistor banks only. Multiple resistor banks can be combined to achieve resultant power ratings of up to 100 kW+
  - Standard resistor banks are highlighted in bold
- <sup>(1)</sup> Temperature coefficient of ± 930 is available upon request and used for some designs where TCR is not a critical factor  
<sup>(2)</sup> xxxxx in global part number represents the resistance, e.g. 1R500 = 1.5 Ω

**DIMENSIONS** in millimeters (inches)


MODEL	POWER RATING OF RESISTOR BANK W	TOTAL NUMBER OF ELEMENTS IN EACH BANK	A OVERALL LENGTH	B HOLE CENTER	MAX. WEIGHT kg	GLOBAL PART NUMBER
GRE3	6000	4	304.8 (12.0)	279.4 (11)	22	GRE3AxxxxxK00N0000
GRE3	9000	6	304.8 (12.0)	279.4 (11)	30	GRE3BxxxxxK00N0000
GRE3	12 000	8	304.8 (12.0)	279.4 (11)	36	GRE3CxxxxxK00N0000
GRE3	15 000	10	406.4 (16.0)	381 (15)	40	GRE3DxxxxxK00N0000
GRE3	18 000	12	406.4 (16.0)	381 (15)	48	GRE3ExxxxxK00N0000
GRE3	21 000	14	508 (20.0)	482 (19)	54	GRE3FxxxxxK00N0000
GRE3	24 000	16	508 (20.0)	482 (19)	60	GRE3GxxxxxK00N0000
GRE3	27 000	18	672 (26.50)	647 (25.5)	68	GRE3HxxxxxK00N0000
GRE3	30 000	20	672 (26.50)	647 (25.5)	75	GRE3JxxxxxK00N0000
GRE3	33 000	22	672 (26.50)	647 (25.5)	82	GRE3KxxxxxK00N0000
GRE3	36 000	24	672 (26.50)	647 (25.5)	90	GRE3LxxxxxK00N0000

**Notes**

- The power rating of each bank is directly related to the number of elements in the resistor, this means the length and weight of the resistor will vary by power rating. Please consult the table above for the relevant length and weight of the grid resistor to be quoted
- Standard resistor banks are highlighted in bold

**GRE3 STANDARD ENCLOSURE OPTIONS AND DIMENSIONS** in millimeters (inches)


Indoor (IP20) version shown. Outdoor (IP23) version will have a solid elevated roof instead of the screen top shown for the indoor version.

MODEL	ENCLOSURE HEIGHT (NUMBER OF RESISTOR BANKS)	TOTAL NUMBER OF ELEMENTS IN EACH BANK	IP RATING	A	B	C	STANDARD MATERIAL <sup>(1)</sup>
GRE3	1	12	20	406 (16)	381 (15)	382 (15)	Mill galvanized
GRE3	1	12	23	406 (16)	381 (15)	406 (16)	Mill galvanized
GRE3	1	16	20	508 (20)	482 (19)	382 (15)	Mill galvanized
GRE3	1	16	23	508 (20)	482 (19)	406 (16)	Mill galvanized
GRE3	1	22	20	673 (26.5)	647 (25.5)	382 (15)	Mill galvanized
GRE3	1	22	23	673 (26.5)	647 (25.5)	406 (16)	Mill galvanized
GRE3	2	12	20	406 (16)	381 (15)	764 (30)	Mill galvanized
GRE3	2	12	23	406 (16)	381 (15)	800 (31.5)	Mill galvanized
GRE3	2	16	20	508 (20)	482 (19)	764 (30)	Mill galvanized
GRE3	2	16	23	508 (20)	482 (19)	800 (31.5)	Mill galvanized
GRE3	2	22	20	673 (26.5)	647 (25.5)	764 (30)	Mill galvanized
GRE3	2	22	23	673 (26.5)	647 (25.5)	800 (31.5)	Mill galvanized
GRE3	3	12	20	406 (16)	381 (15)	1143 (45)	Mill galvanized
GRE3	3	16	20	508 (20)	482 (19)	1143 (45)	Mill galvanized
GRE3	3	22	20	673 (26.5)	647 (25.5)	1143 (45)	Mill galvanized

**Notes**

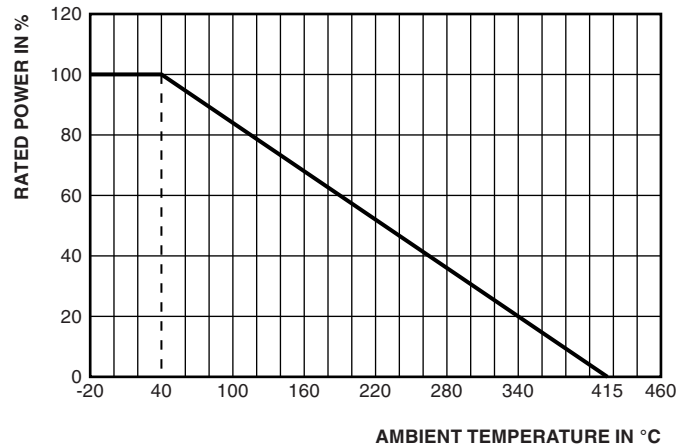
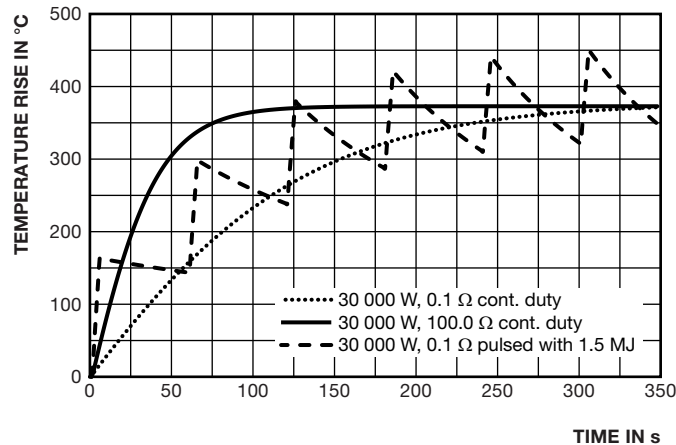
- Contact factory for any special requests or enclosure requirements: [vishaymilwaukeeresistor@vishay.com](mailto:vishaymilwaukeeresistor@vishay.com)
- (1) Stainless steel material option upon request



TECHNICAL SPECIFICATIONS		
PARAMETER	UNIT	RESISTOR CHARACTERISTICS
Power rating	W	6K to 36K per resistor load bank (up to 100K+ for assemblies)
Resistance range	$\Omega$	GRE3 with $\pm 365$ TCR: 0.08 to 240 GRE3 with $\pm 930$ TCR: 0.06 to 160
Resistance tolerance	%	10
TCR	ppm/ $^{\circ}$ C	$\pm 365$ , $\pm 930$
Operating temperature	$^{\circ}$ C	-55 to +415
Temperature rise	$^{\circ}$ C	375 above an ambient of 40 $^{\circ}$ C
Maximum altitude	f.a.s.l. (m.a.s.l.)	Derate above 4921 f.a.s.l. (1500 m.a.s.l.)
Short-term overload (surge)		25 x, 15 x, or 10 x rated power for 5 s (varies by wattage)
Maximum working voltage	V	$(P \times R)^{1/2}$
Insulation resistance	$\Omega$	1M
Dielectric voltage	$V_{RMS}$	2500 for 60 s
Creepage	inch (mm)	1.18 (30) typical
Inductance	$\mu$ H	GRE3: 45 to 225 (varies by wattage and resistance)
Electrical or mechanical customization		Consult factory: <a href="mailto:vishaymilwaukeeeresistor@vishay.com">vishaymilwaukeeeresistor@vishay.com</a>

APPLICATION FORMS AND TECHNICAL INFORMATION	
APPLICATION FORMS	WEB LINK
Harmonic Filter Resistors	<a href="http://www.vishay.com/doc?49889">www.vishay.com/doc?49889</a>
Load Bank Resistors	<a href="http://www.vishay.com/doc?49893">www.vishay.com/doc?49893</a>
Dynamic Braking Resistors	<a href="http://www.vishay.com/doc?49887">www.vishay.com/doc?49887</a>
Neutral Grounding Resistors	<a href="http://www.vishay.com/doc?49904">www.vishay.com/doc?49904</a>
APPLICATION NOTES	WEB LINK
Determining Nominal Resistance	<a href="http://www.vishay.com/doc?21044">www.vishay.com/doc?21044</a>
Understanding Load Steps and Resolution	<a href="http://www.vishay.com/doc?21045">www.vishay.com/doc?21045</a>
Understanding Tied Live Designs	<a href="http://www.vishay.com/doc?21043">www.vishay.com/doc?21043</a>
OTHER RESISTORS	WEB LINK
Wirewound Resistors Guide	<a href="http://www.vishay.com/doc?49654">www.vishay.com/doc?49654</a>

GLOBAL PART NUMBER INFORMATION																	
<b>Resistor only: GRE3J2R128K00N0000 (GRE3 30 000 W 2.128 <math>\Omega</math> 10 % IP00)</b>																	
<b>Resistor with two high IP20 enclosure: GRE3J2R128K2020000 (GRE3 60 000 W 2.128 <math>\Omega</math> 10 % 2-IP20)</b>																	
<b>Custom resistor with enclosure: GRE3J2R128K2021111 (GRE3-1111 60 000 W 2.128 <math>\Omega</math> 10 % 2-IP20)</b>																	
G	R	E	3	A	2	R	1	2	8	K	0	0	N	0	0	0	0
GLOBAL MODEL (5 digits)		RESISTANCE VALUE (5 digits)		TOLERANCE (1 digit)		ENCLOSURE TYPE (2 digits)		ENCLOSURE HEIGHT (1 digit)		SPECIAL (4 digits)							
GRE3A to GRE3L per Electrical Table on page 2		2R128 = 2.128 $\Omega$  R = decimal resistance value is for each individual resistor bank.		K = $\pm 10$ %  Tolerance value is for each individual resistor bank.		IPxx = IP rating  00 = IP00 / NEMA 0 (Open) 20 = IP20 / NEMA 1 (Screen) 23 = IP23 / NEMA 3 (Outdoor)		N = no enclosure (standard)  See GRE1 and GRE2 Enclosure Dimensions table for number.  Assumes all resistor banks to be identical per first 11 digits of part number and all resistors will be customer wired as required.			0000 = standard  Engineering controlled internal document number						

**DERATING CURVE**

**TEMPERATURE RISE OVER AMBIENT**


Standard GRE3Jxxxxx 30 000 W grid banks are rated with max. design temperature rise of 375 °C over an ambient.

**Continuous Duty Application with Constant Voltage Applied to Resistor**

Solid line - GRE3J100R0K00N0000 standard 30 000 W, 100 Ω resistor bank

Dotted line - GRE3JR1000K00N0000 standard 30 000 W, 0.1 Ω resistor bank

Graph shows the peak element temperature is reached between 100 s and 400 s depending on active mass of material used to achieve the desired resistance. Different rates of heating occur depending on the active mass used in the design.

**Pulse Application with Non-Constant Voltage Applied to Resistor**

Dashed line - GRE3JR1000K00N0000 standard 30 000 W, 0.1 Ω resistor bank

Graph shows the peak element temperature of about 450 °C over ambient is reached with an average continuous duty temperature of 375 °C over ambient when a continuous voltage 0.5 MJ energy pulse is applied to the resistor for 5 s once every minute, cycled continuously. Average temperature at continuous cycling is 375 °C (peaks above and below).

**MATERIAL SPECIFICATIONS**

Plate element	Stainless steel
Insulators	Ceramica/ alumina / mica
Mounting frame	Mill galvanized steel (stainless steel available upon request)



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