

Type K and Type HHC — 38 to 695 Amperes

Engineered for endurance, the Euclid™ Type K and Type HHC resistors feature a continuous stainless steel resistive element supported in rugged mill-type frames. Every detail of their construction has been designed to assure reliable performance, even in the toughest applications, from both a mechanical and electrical point-of-view.

## Application

Euclid™ resistors can be used for any power resistor application calling for a convection cooled resistor. They can be easily stacked, parallel or series connected to meet the specific requirements of the application. Types K and HHC resistors are ruggedly constructed and specifically designed for heavy duty industrial environments where vibration and other severe treatment is encountered. Mills, foundries, shipyards and mines are typical areas where the Euclid™ resistors have been successfully used on cranes, hoists, locomotives, lift trucks, conveyors, slurry pumps and other electrically powered equipment.

## Type K Features

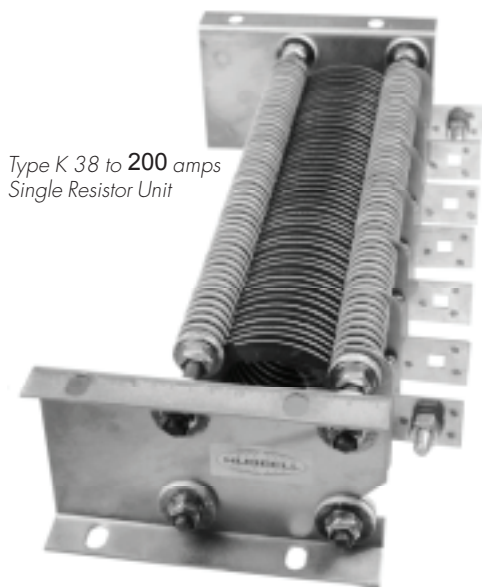
The Type K1 resistors have a single coil resistance element and are available in ratings ranging from 38 to 200 amperes.

- Continuous stainless steel element.
- No welded element joints, no hot spots.
- Mill-type construction.
- Nonbreakable, all steel and mica components.
- Element floats on insulated steel spacers; expands and contracts freely.
- No distortion with temperature rise.
- 200 ampere capacity without paralleling.
- High thermal capacity absorbs high current surges.
- Ample taps for resistance selection. Heavy, stainless steel terminals.
- Average 7652 watts per single unit.
- Designed to NEMA resistor standards.
- Double insulation to ground.

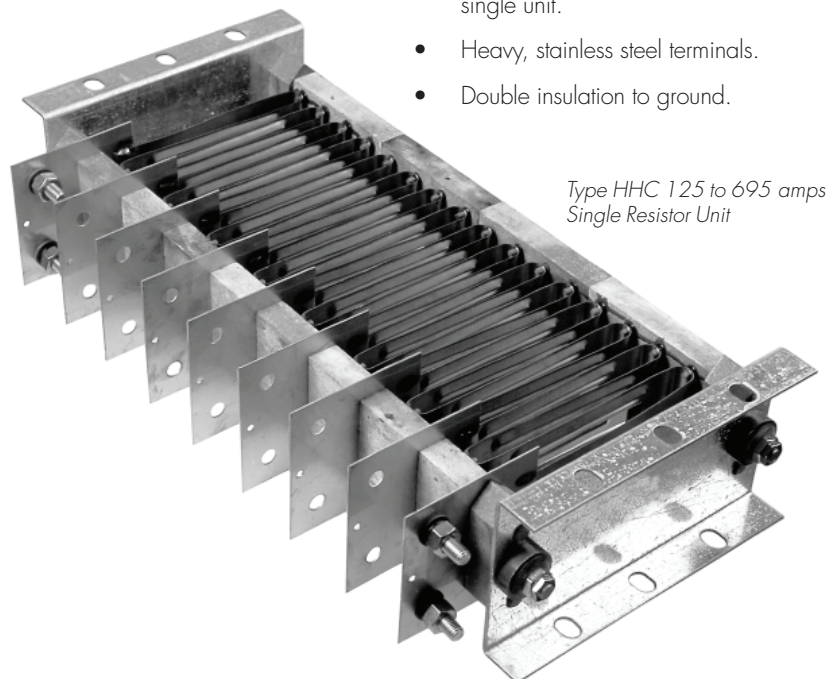
## Type HHC Features

The Type HHC resistors use a folded ribbon resistance element and are available in ratings ranging from 200 to 695 amps. High current ratings (up to 695 amps) virtually eliminate the need to parallel resistor units on large h.p. applications, yielding a substantial cost and space savings.

- Continuous, stainless steel resistive element.
- No welds to cause mechanical or electrical failures.
- Rugged, steel end plates designed for universal mill mounting.
- Designed to NEMA resistor standards.
- Strip floats on steel supports permitting free expansion/contraction.
- Inorganic, nontracking insulating materials insuring insulation integrity even in conductive dust and moisture laden atmospheres.
- 1000 volt insulation to ground. (Z length only)
- Designed for effective convection of forced air cooling.
- Average 8500 watts per single unit.
- Heavy, stainless steel terminals.
- Double insulation to ground.



Type K 38 to 200 amps  
Single Resistor Unit



Type HHC 125 to 695 amps  
Single Resistor Unit

Specifications

## Type K (3004) Description

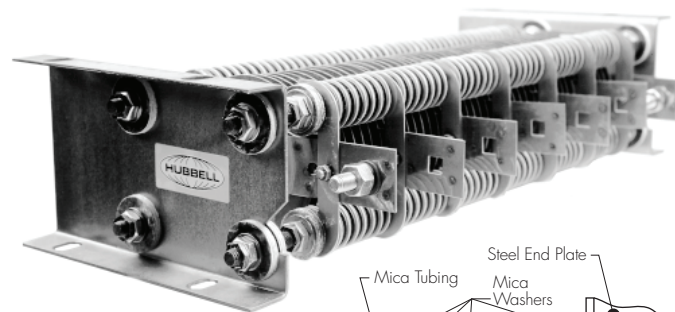
The resistive elements of the Type K units are formed from a continuous strip of 406 stainless steel wound in an edgewise manner. The element has a high degree of resistance to oxidation even at elevated temperatures. The temperature coefficient of the coil is so slight that it is considered negligible for most applications. The weld-free helix provides a uniform cross section of material throughout the coil eliminating hot spots. The element coil is supported by full length, noncorrosive rod bolt assemblies. Insulated steel spacers support the continuous element allowing free expansion, eliminating stress, distortion and direct contact with mica insulation.

Specially engineered stainless steel terminals provide positive electrical connections to the element. Each terminal is shaped so that, when

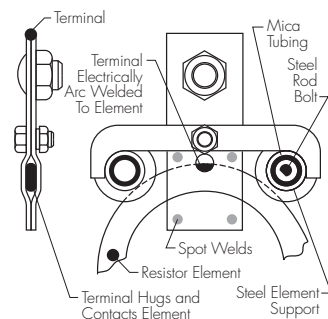
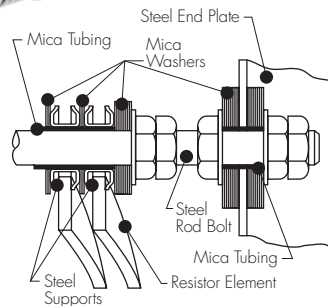
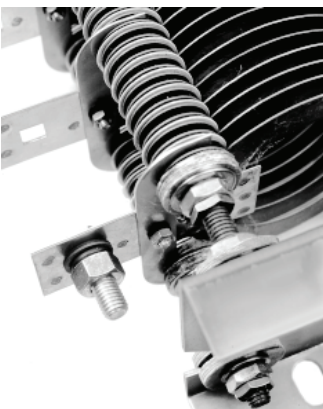
the ends are spot welded, the terminal is forced to mechanically hug the element making a firm, stable contact. In addition, the terminal is arc welded to the element further insuring positive electrical connection.

Standard resistors are equipped with seven terminals. A stainless steel Bridging Member is bolted to each terminal and rod bolt assembly for added durability and to resist wrenching and heavy electrical leads.

The resistive element and rod bolt assemblies are supported by two heavy steel channel end plates. These noncorrosive plates are available for universal mounting and can be readily stacked or rack mounted in 25½" (Y length) and 26½" (Z length) units.



The Type K construction throughout is aimed at providing positive electrical operation and a long service life.



## Type HHC (3005) Description

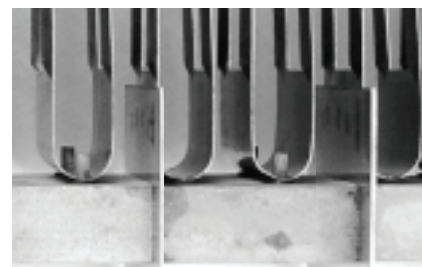
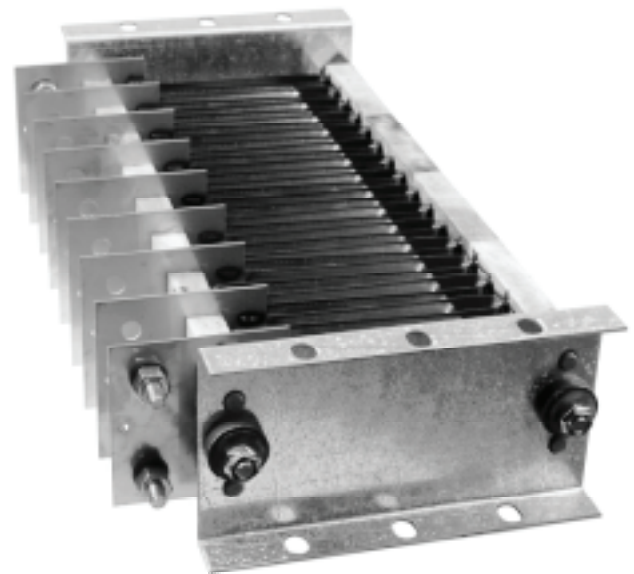
The unique resistive element of the Type HHC supplies a uniform thickness throughout its continuous length. The width and thickness of the continuous strip and the spacing between folds have been computer selected for each unit, optimizing their ratings.

The 3½" to 4¾" wide, continuous type, 406 stainless steel resistive element is supported at each fold by two steel pins embedded in a high strength, inorganic insulator. The steel ribbon is electrically isolated from the supporting rod bolt. The supporting rod, in turn, is insulated from the end plates by a high temperature insulator. All insulators are interlocked with each other and with the end plates to provide rigidity to the unit. The insulators are high quality, inorganic, nontracking moldings. Their nonwetting surface and tapered construction of the end

plate insulators insure insulation integrity even in conductive dust and moisture laden atmospheres.

The supporting mechanism (end plates, rod bolts, supporting insulators and pins) provides "floating support" of the element for free expansion and contraction. Airflow for effective convective cooling or forced ventilation is unrestricted by the support elements. Standard resistors are equipped with nine terminals for the 200–225 amp banks and seven terminals for the 255–695 amp banks.

Rugged noncorrosive end plates of 11 gauge, channel formed steel secure the rod bolts. Each end frame provides six elongated bolt holes for mounting and stacking versatility. The Type HHC Resistor is available in 25½" (Y length) and 26½" (Z length) units.



The stainless steel resistive element is supported at each fold by two steel pins embedded in a high strength, inorganic insulator.

# Euclid™ 3004 Type K Coils

DISCOUNT CODE EL

Continuous Amps	Ohms/Frame	Z Length - 26.5" Long		Y Length - 25.5" Long			
		Universal Mill Frame Resistor w/ Universal End Plates		Short Mill Frame Resistor w/ Universal End Plates		Short Frame Resistors w/ Euclid End Plates	
		Old Catalog Number	Part Number	Old Catalog Number	Part Number	Old Catalog Number	Part Number
		<b>\$3,494</b>		<b>\$3,494</b>		<b>\$3,494</b>	
38	5.030	Z38W5030GB	HC30856-001	-	HC30855-401	Y38W5030GB	HC30855-001
41	3.900	Z41W3900GB	HC30856-002	-	HC30855-402	Y41W3900GB	HC30855-002
48	3.230	Z48W3230GB	HC30856-003	-	HC30855-403	Y48W3230GB	HC30855-003
53	2.500	Z53W2500GB	HC30856-004	-	HC30855-404	Y53W2500GB	HC30855-004
62	1.990	Z62W1990GB	HC30856-006	-	HC30855-406	Y62W1990GB	HC30855-006
66	1.620	Z66W1620GB	HC30856-007	-	HC30855-407	Y66W1620GB	HC30855-007
72	1.480	Z72W1480GB	HC30856-009	-	HC30855-409	Y72W1480GB	HC30855-009
77	1.210	Z77W1210GB	HC30856-010	-	HC30855-410	Y77W1210GB	HC30855-010
80	1.020	Z80W1020GB	HC30856-011	-	HC30855-411	Y80W1020GB	HC30855-011
86	0.970	Z86W970GB	HC30856-012	-	HC30855-412	Y86W970GB	HC30855-012
95	0.808	Z95W808GB	HC30856-015	-	HC30855-415	Y95W808GB	HC30855-015
98	0.680	Z98W680GB	HC30856-016	-	HC30855-416	Y98W680GB	HC30855-016
101	0.595	Z101W595GB	HC30856-017	-	HC30855-417	Y101W595GB	HC30855-017
109	0.542	Z109W542GB	HC30856-018	-	HC30855-418	Y109W542GB	HC30855-018
117	0.463	Z117W463GB	HC30856-021	-	HC30855-421	NA	NA
120	0.405	Z120W405GB	HC30856-022	-	HC30855-422	Y120W405GB	HC30855-022
124	0.357	Z124W357GB	HC30856-023	-	HC30855-423	NA	NA
139	0.322	Z139W322GB	HC30856-026	-	HC30855-426	NA	NA
143	0.282	Z143W282GB	HC30856-027	-	HC30855-427	NA	NA
147	0.248	Z147W248GB	HC30856-028	-	HC30855-428	NA	NA
156	0.235	Z156W235GB	HC30856-030	-	HC30855-430	Y156W235GB	HC30855-030
171	0.206	Z171W206GB	HC30856-033	-	HC30855-433	Y171W206GB	HC30855-033
174	0.181	Z174W181GB	HC30856-034	-	HC30855-434	Y174W181GB	HC30855-034
178	0.162	Z178W162GB	HC30856-035	-	HC30855-435	Y178W162GB	HC30855-035
190	0.141	Z190W141GB	HC30856-037	-	HC30855-437	Y190W141GB	HC30855-037
195	0.126	Z195W126GB	HC30856-038	-	HC30855-438	Y195W126GB	HC30855-038
200	0.114	Z200W114GB	HC30856-039	-	HC30855-439	Y200W114GB	HC30855-039

Type K Adjustable Terminal Clamp use P/N 29103-000 List Price \$174 each; Discount Code EL.

Unmounted Terminal Assembly consists of necessary Mounting Hardware (P/N 65130-005 List Price \$24 each; Discount Code EL) to mount customer supplied terminal lugs for one resistor terminal.

Prices Subject to Change without Notice.



# Euclid™ 3005 Type HHC Coils

DISCOUNT CODE EM

Continuous Amps	Ohms/Frame	Z Length - 26.5" Long		Y Length - 25.5" Long			
		Universal Mill Frame Resistor w/ Universal End Plates		Short Mill Frame Resistor w/ Universal End Plates		Short Frame Resistors w/ Euclid End Plates	
		Old Catalog Number	Part Number	Old Catalog Number	Part Number	Old Catalog Number	Part Number
		<b>\$3,494</b>		<b>\$3,494</b>		<b>\$3,494</b>	
200	.150	-	HC53357-023	-	HC53356-023	-	-
225	.121	-	HC53357-024	-	HC53356-024	-	-
255	.112	HHC255Z	HC53357-001	HHC255Y	HC53356-001	NA	NA
295	.096	HHC295Z	HC53357-002	HHC295Y	HC53356-002	NA	NA
350	.072	HHC350Z	HC53357-003	HHC350Y	HC53356-003	NA	NA
395	.057	HHC395Z	HC53357-004	HHC395Y	HC53356-004	NA	NA
445	.046	HHC445Z	HC53357-005	HHC445Y	HC53356-005	NA	NA
500	.032	HHC500Z	HC53357-006	HHC500Y	HC53356-006	NA	NA
695	.017	HHC695Z	HC53357-008	HHC695Y	HC53356-008	NA	NA

Unmounted Terminal Assembly consists of necessary Mounting Hardware (P/N 65130-007 List Price **\$38** each; Discount Code EM) to mount customer supplied terminal lugs for one resistor terminal. In accordance with NEMA standards, ratings are based on a single unit operating in free air at a temperature rise not to exceed 375°C.

**Note:** HHC coils 125 amp through 225 amp are recommended for continuous duty. For intermittent duty, use 3004 Type K coils.

# Bolted Galvanized Racks & Enclosures for Z Length SSRM, K1 & HHC Type Resistors

DISCOUNT CODE EL

Max No. of Standard Mill Resistor Frames (26.5" Long)	Open Rack		Indoor Screened Enclosure		Outdoor Vented Enclosure		Price Additions	
	Part No.	List Price	Part No.	List Price	Part No.	List Price	Mount Resistor Frames in Rack or Enclosure w/o Interwiring	Mount & Interwire Resistor Frames in Rack or Enclosure
2	HC82668-003	<b>\$1,560</b>	HC82668-013	<b>\$6,302</b>	HC82668-023	<b>\$6,552</b>	<b>\$250</b>	<b>\$624</b>
3	HC82668-003	<b>\$1,560</b>	HC82668-013	<b>\$6,302</b>	HC82668-024	<b>\$7,426</b>	<b>\$358</b>	<b>\$968</b>
4	HC82668-004	<b>\$2,028</b>	HC82668-014	<b>\$7,644</b>	HC82668-025	<b>\$8,424</b>	<b>\$468</b>	<b>\$1,310</b>
5	HC82668-005	<b>\$2,464</b>	HC82668-015	<b>\$9,204</b>	HC82668-026	<b>\$10,108</b>	<b>\$578</b>	<b>\$1,654</b>
6	HC82668-006	<b>\$2,808</b>	HC82668-016	<b>\$10,670</b>	HC82668-027	<b>\$11,732</b>	<b>\$686</b>	<b>\$1,996</b>
7	HC82668-007	<b>\$3,244</b>	HC82668-017	<b>\$12,168</b>	HC82668-028	<b>\$13,354</b>	<b>\$976</b>	<b>\$2,340</b>
8	HC82668-008	<b>\$3,588</b>	HC82668-018	<b>\$13,478</b>	HC82668-029	<b>\$14,820</b>	<b>\$904</b>	<b>\$2,684</b>
9	HC82668-009	<b>\$4,056</b>	HC82668-019	<b>\$15,038</b>	HC82668-030	<b>\$16,536</b>	<b>\$1,014</b>	<b>\$3,026</b>
10	HC82668-010	<b>\$4,492</b>	HC82668-020	<b>\$16,380</b>	-	-	<b>\$1,124</b>	<b>\$3,370</b>

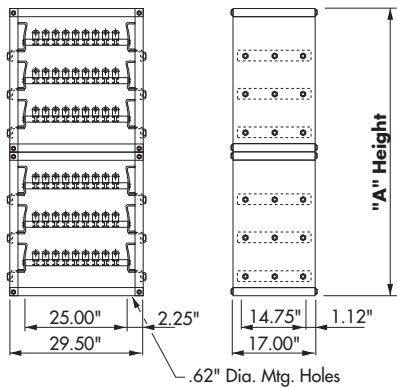
**Note:** Does not include the price of the resistor units.

Prices Subject to Change without Notice.

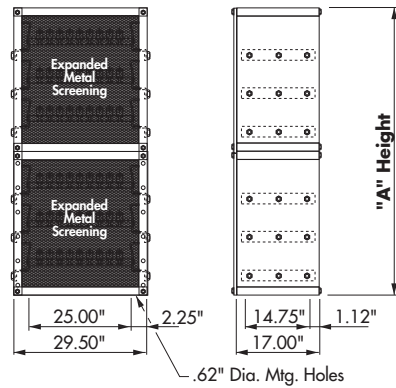


# Dimensions for K1 & HHC Resistors Rack & Frames

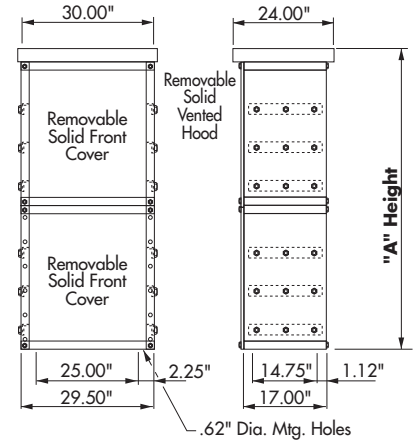
## Open Rack



## Indoor Screened Rack



## Outdoor Rack



K1 & HHC Resistor Rack Heights - "A"			
No. of Resistors	Open	Indoor	Outdoor
2	21.50	22.10	30.93
3	29.50	30.10	38.93
4	37.50	38.10	46.93
5	45.50	46.10	54.93
6	53.50	54.10	62.93
7	61.50	62.10	70.93
8	69.50	70.10	78.93
9	77.50	78.10	86.93
10	85.50	86.10	

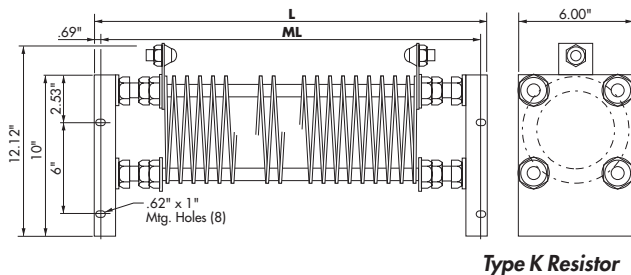
All dimensions are in inches.

The Indoor Enclosures have a solid top and the height includes the bolt height shown on the outline drawing, making them 0.6 inches higher than the Open Racks.

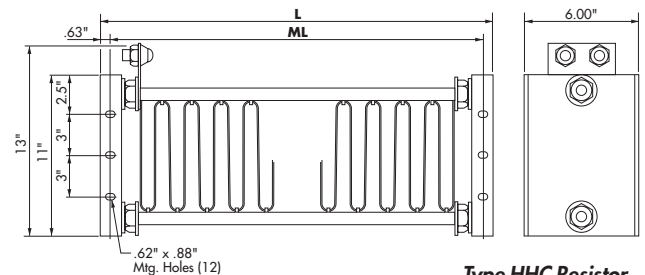
The Outdoor (VWP) Enclosures include ventilation space (use 3 high rack for two resistors, etc.) plus the spacer, cover thickness and bolt heights making them 1.43 inches higher than the Open Rack.

## Resistor Lengths

Code	Type K		Type HHC	
	L	ML	L	ML
Z	26.50"	25.12"	26.50"	25.25"
Y	25.50"	24.12"	25.50"	24.25"



Type K Resistor



Type HHC Resistor

Resistor Design Information

Hubbell resistors are used on any AC or DC power or control circuit. The resistors are corrosion resistant and built to work in severe environments. Hubbell Resistors can be used on high vibration applications such as traveling cranes or other movable equipment.

Hubbell resistors are manufactured with a resistance tolerance of ±10%. For most applications the coefficient of resistivity has a negligible effect and can be ignored.

Resistors are rated in accordance with NEMA and IEEE standards. Wattage ratings are based upon the assumption that the resistor is operating in free air at altitudes of <6000 feet and at a temperature rise not to exceed 375°C (675°F) in a 40°C (104°F) ambient.

It takes a few steps to properly select the correct Hubbell resistor for a given application:

1. Determine resistance in ohms.
2. Determine the power in watts to be dissipated by the resistor.
3. Determine the proper size resistor — SSR (length 3, 4, 5, 6, 7), K or HHC — based on volts, current, ohms, watts, altitude, grouping, circuit conditions.
4. Select the most suitable unit and the desired mounting.

**Determine Resistance in Ohms**

- a. The resistance can be determined by Ohm's Law

$$R \text{ in ohms} = \frac{E \text{ in volts}}{I \text{ in amperes}}$$

- b. This formula can be used to determine the required current if the voltage and resistance are known.

$$I = \frac{E}{R}$$

- c. In addition,  $E = IR$

**Determine Power in Watts to be Dissipated**

Power can be determined from several formulas all of which derive from Ohm's Law.

- a. When resistance and current are known,

$$P \text{ in watts} = I^2R$$

- b. When resistance and voltage are known,

$$P \text{ in watts} = \frac{E^2 \text{ in volts}}{R \text{ in ohms}}$$

- c. When current and voltage across the resistor are known,

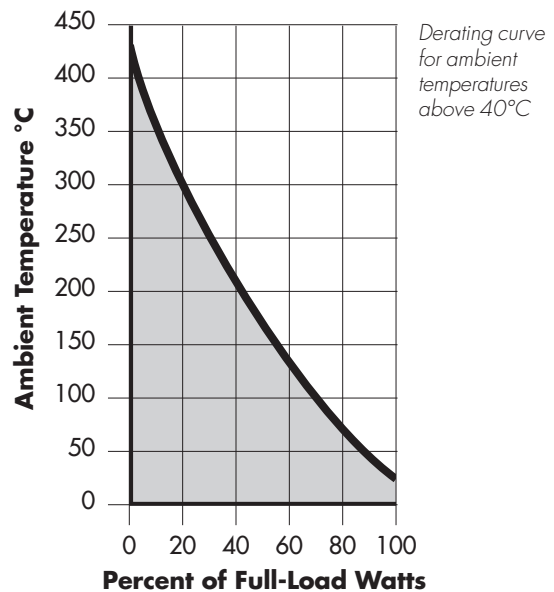
$$P \text{ in watts} = IE$$

In all cases, current is in amperes and voltage is in volts.

**Determine proper size resistor based on volts, current, ohms, watts, altitude, grouping, circuit conditions.**

The previous discussion has assumed that a single resistor was to be used within its voltage ratings, with power applied continuously and that it was located in free air at 40°C at sea level. The following takes into account variations of these factors. For further help contact the factory directly.

- a. Hubbell resistors are designed for a maximum of 600 volts (except Z length HHC coils are rated 1000 volts) between terminals. For higher voltages connect two or more resistor units in series so voltage drop across any one resistor unit is 600 volts or less.
- b. Altitude — For applications at altitudes up to 6000 feet, the listed ratings are applicable. Between 6000–15000 feet derate to 75% of the standard watt ratings, or derate to 86% of the current rating.
- c. Ambient Temperature — For ambient temperatures above 40°C, derate resistors in accordance with chart below.



# Class Numbers of Resistors for Nonreversing Service and Reversing Nonplugging Service Without Armature Shunt or Dynamic Braking

Approximate Percent of Full-Load Current on First Point Starting From Rest	Duty Cycles						
	5 Seconds On 75 Seconds Off	10 Seconds On 70 Seconds Off	15 Seconds On 75 Seconds Off	15 Seconds On 45 Seconds Off	15 Seconds On 30 Seconds Off	15 Seconds On 15 Seconds Off	Continuous Duty
25	111	131	141	151	161	171	91
50	112	132	142	152	162	172	92
70	113	133	143	153	163	173	93
100	114	134	144	154	164	174	94
150	115	135	145	155	165	175	95
200+	116	136	146	156	166	176	96

When an armature shunt resistor is added, the class number shall include the suffix "AS". For example, Class 155-AS is a resistor which includes an armature shunt and which will allow an initial inrush of 150% with the armature shunt open. When a dynamic braking resistor is added, the class number shall include the "DB". For example, Class 155-DB.

# Class Numbers of Resistors for Continuous Duty Speed Regulating Services with Direct Current Shunt Motors and AC Wound Rotor Motors

Percent Speed Reduction	Percent of Rated Motor Torque at Reduced Speed						
	40	50	60	70	80	90	100
5	405	505	605	705	805	905	1005
10	410	510	610	710	810	910	1010
15	415	515	615	715	815	915	1015
20	420	520	620	720	820	920	1020
25	425	525	625	725	825	925	1025
30	430	530	630	730	830	930	1030
35	435	535	635	735	835	935	1035
40	440	540	640	740	840	940	1040
45	445	545	645	745	845	945	1045
50	450	550	650	750	850	950	1050

The stability of the motor speed obtained by simple rheostatic control is dependent upon the stability of the load on the motor. The degree of instability is directly proportional to the amount of speed reduction. Variations in load have a greater proportional effect on the speed when the load is light. For these reasons, the table has not been carried beyond a speed reduction of 50% and a load torque of 40%.

With a direct current shunt motor, the percent of rated motor current which obtained at the reduced speed is assumed to be the same as the percent of rated torque. With a direct current series motor operating at less than 100% current, the percent of torque is less than the percent of current. With a wound rotor motor and resistor in the motor circuit, the percent of rated rotor (secondary) current which is obtained at the reduced speed is assumed to be the same as the percent of rated torque.

A speed regulating resistor is so designed that it may be operated continuously at any point in the speed regulating range when the load follows its normal speed-torque curve. When additional resistance is

required to obtain the starting current specified, the additional portion of the resistor shall be designed for a duty cycle selected from the table above. The resulting resistor may be completely specified by a compound number. For example, 154/850 designates a resistor which is designed for starting and speed regulating duty. The starting section is designed to allow 100% of full-load current on the first point, starting from rest, and a duty cycle of 15 seconds on and 45 seconds off. The regulating section is designed to give 50% speed reduction at 80% of rated torque and for continuous duty when the load follows its normal speed-torque curve.

When used for reversing plugging service add the suffix "P". For example, 162-P. The class numbers apply to the complete resistor, but the duty cycles apply to the accelerating resistor only. Reversing plugging service is not recommended with Class 11x, 13x or 14x.

When used for DC dynamic lowering service add the suffix "DL". For example, 162-DL. Dynamic lowering service is not recommended with Class 11x, 13x or 14x.



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