

Power Resistors

Catalog 3000 • February 1998 • Replaces August 1995

SSR Resistor

Type 3003 — Standard Frame



Type 3003 — Open Frame

SSR Resistor

SSR Resistor

Type 3003 — Universal Mill Frame



Resistor Rack



K Resistor

Type 3004



Type 3005

HHC Resistor

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Specifications

Industrial Power Resistors

Euclid Type SSR—1.3 to 101 Amperes

Features

The Type SSR Industrial Power Resistor series consists of two different types of units: a hexwound unit and an edgewound unit. Both types feature continuous resistive elements supported on porcelain insulated core strips.

- Rugged shock-resisting, non-breakable construction.
- Resistor assembly floats in slotted insulators.
- Corrosion resistant materials.
- Negligible temperature coefficient of resistance.
- Assembled resistor banks provide double insulation to ground.
- Individual resistor units in an assembled bank can be replaced without disrupting adjacent units.
- A variety of standard mounting frames, brackets, and enclosures.
- Assembled frames have identical mounting dimensions to old style assemblies. (Rod bolt mount)

Description

Hexwound Resistors

For relatively light current applications, the Hexwound resistors provide 13 different current ratings in the range of 1.3 to 7.2 amperes. For each rating the resistor units are available in five different coil lengths, enabling the resistors to be selected to precisely meet the application requirements.

The Hexwound resistors consist of four basic parts, each engineered to perform a specific function. The core strip provides convenience in mounting while providing rugged support for the resistive element.

The porcelain insulators are grooved to uniformly support each turn of the wirewound resistor element. Thus, each turn is insulated from each other and from the core strip.

The terminals of the Hexwound resistor are engineered to assure sound electrical as well as mechanical connections. The terminal securely clamps to two turns of the resistor element.

The resistive element of the hexwound resistor, like in all Euclid resistors, is a continuous element.

Edgewound Resistors

For heavier current requirements, the Edgewound resistors are available in 28 different current ratings, 8.5 amps through 101 amps without paralleling elements. The Edgewound units are available in five different lengths.

Edgewound resistors are constructed of a helical coil supported by patented porcelain insulators on a steel core strip. The porcelain insulators provide the turn-to-turn and turn-to-core strip insulation.

The resistive element is formed by edgewise winding stainless steel to form a continuous helix.

The standard end terminal provided with edgewound resistors is a welded terminal. This welded terminal provides sound electrical connection to the resistive element while providing a good terminal for external connections. Intermediate taps or adjustable terminals are clamp type and can be positioned to practically any turn on the resistor.

Application

These resistors are ideally suited for use in the secondary of AC wound rotor motors for accelerating, plugging, or speed regulating service. In the primary of the AC squirrel cage motors, these resistors serve as ballast resistors to eliminate the undesirable high torque and starting current associated with this type of motor.

Industrial Power Resistors are also used in conjunction with appropriate control equipment to accelerate, plug, or dynamic brake DC motors.

Other applications for resistors include: neutral grounding resistors, AC and DC dynamic braking, load banks, current limiting, and ballast for mercury vapor lamps. The rating versatility as well as the mounting flexibility, enable the resistors to be applied in other innumerable ways.

Frames and Enclosures

Euclid power resistors can be supplied factory mounted in a variety of galvanized steel frames and enclosures; standard frames, open frames, or mill frame. Covers consist of cane metal enclosed, ventilated weatherproof enclosed or totally enclosed nonventilated.

Standard frames are supplied with resistor assemblies unless otherwise specified.



Pricing Instructions & Examples

Unassembled Resistors

Order by:

- Part Numbers of Individual Resistor Coils
- Part Numbers of Adjustable Terminals
- Part Number of Mounting Sockets and Clips
- Catalog Numbers of Frame
- Catalog Numbers of Cover (if required)

3 - Part No. 69285-006 Coils	\$92 x 3 = \$276
3 - Part No. 17578-001 Adjustable Terminals ..	\$12 x 3 = \$36
6 - Part No. 69279-001 Mtg. Sockets & Clips	No Charge*
1 - Cat. No. SSRS-35 Frame	\$100
1 - Cat. No. 1CM-35 Cover	\$160

Total — \$572

Assembled Resistors

When specified by the customer, the following factory services are available at no extra charge:

Assembly of Coils into Frames

Placement of one adjustable terminal per resistor coil, placed at the approximate ohmic value specified by the customer

Assembly of cover to standard frame, if cover is required

3 - Part No. 69285-006 Coils	\$92 x 3 = \$276
3 - Part No. 17578-001 Adjustable Terminals ..	\$12 x 3 = \$36 (Placed at 2.69 on each coil)
6 - Part No. 69279-001 Mtg. Sockets & Clips	No Charge*
1 - Cat. No. SSRS-35 Frame	\$100
1 - Cat. No. 1CM-35 Cover	\$160

Total — \$572

Special Features

The following special services are available at a modest price addition:

Resistor drawing, consisting of a connection diagram and Bill of Materials

Placement of more than one adjustable terminal per resistor coil

Interwiring between coils in a frame

Interwiring between stacked frames

For any of the above features add 10% to component price. (Coils + Frames + Adjustable Terminals)

3 - Part No. 69285-006 Coils	\$92 x 3 = \$276
3 - Part No. 17578-001 Adjustable Terminals	\$12 x 3 = \$36
6 - Part No. 69279-001 Mtg. Sockets & Clips ..	No Charge*
1 - Cat. No. SSRS-35 Frame	\$100

Sub Total — \$412

Interwiring Coils, and Placement of	\$41
Adjustable Terminal per drawing (Add 10%)	
1 - Cat. No. 1CM-35 Cover	\$160

Total — \$613

Engineered Resistor Assemblies

Hubbell Industrial Control's Engineering Staff will design resistor assemblies for your special application. Your inquiry should include (when possible) — Type of Equipment/Control Involved; Function to be Performed; Motor/Load Data including duty cycle, total ohmic value, tap locations, ampere rating, and special ambient conditions.

Note:

* — Mounting Sockets Must Be Specified On Purchase Order. Included in price of coils when coils are furnished with frame

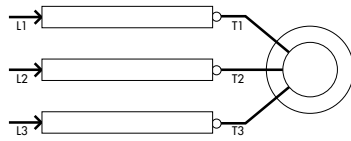
Application Information

Squirrel Cage Motor Starting

NEMA B or NEMA D w/ Ballast Resistors

Hubbell ballast resistors provide an economical and reliable means to limit the starting torque of AC squirrel cage motors. The resistors are designed to remain in the motor circuit permanently, thus eliminating costly accelerating contactors. Standard ballast resistors are designed for use with either NEMA design B or D squirrel cage motors rated 230 or 460 VAC. The NEMA B design resistors are available to limit the motor starting torque to either 70% or 100% of full load starting torque. The NEMA D resistors are set for 150% full load starting torque, field adjustable to 100%.

If special motors or torque limitations are required consult factory and provide motor hp, voltage, locked rotor current, locked rotor power factor and desired torque limit.

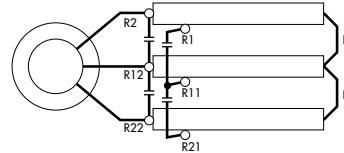


Wound Rotor Motor Starting

Three Speed w/o Permanent Slip Resistance

Step	Res. % EII	NEMA Class - 152 162	Capacity % FLC 172 92
1	78	27 30	36 47
2	27.5	47 60	75 100

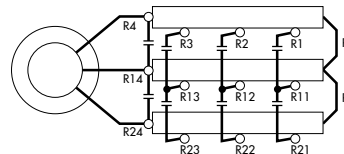
Resistors with permanent slip will have 6.5% permanent slip resistance.



Five Speed w/o Permanent Slip Resistance

Step	Res. % EII	NEMA Class - 152 162	Capacity % FLC 172 92
1	77	27 30	36 47
2	20	40 45	54 70
3	7	46 52	62 81
4	6.5	57 65	77 100

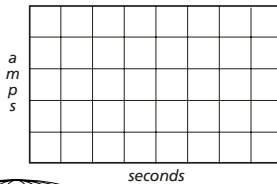
Resistors with permanent slip will have 6.5% permanent slip resistance.



Dynamic Braking

Dynamic Braking resistors are used with AC variable frequency inverter drives or DC adjustable voltage drives. The resistor provides braking torque in the motor to quickly stop the equipment. To determine your needs for this type of application, please complete the following information.

Optional Pulse Waveform



Style Required

- Best Fit
- SSR
- K
- HHC
- SSRM (Mill Frame)

Covers Required

- Open
- Open with provision for covers
- Screen
- Ventilated weatherproof
- Totally enclosed non-ventilated

Electrical Requirements

Ohms _____
 Pulse Amps _____ RMS Pulse Time _____ sec.
 Pulse Cycle Rate _____ per _____ or Off Time _____ sec.
 Min Continuous _____ amp[‡] or _____ watts[‡]
 Allowable temperature rise if other than 375°C _____ °C

[‡] Optional, or if other than determined by pulse dissipation.

Ballast Resistors

Euclid Type for NEMA B Motors

Euclid Type SSR for use with NEMA B Squirrel Cage Motors with Resistance in Three Legs — Discount E32

Hp	230 Volt, 3 Phase Ballast Resistors					
	70% Load Starting Torque			100% Load Starting Torque		
	Part Number	List Price	Frame /Coil* Size	Part Number	List Price	Frame /Coil* Size
0.25	69476-776	\$352	1/3 3	69476-788	\$352	1/3 3
0.33	69476-777	\$352	1/3 3	69476-789	\$352	1/3 3
0.5	69476-778	\$352	1/3 3	69476-790	\$352	1/3 3
0.75	69476-779	\$376	1/3 3	69476-791	\$376	1/3 3
1	69476-780	\$496	1/3 5	69476-792	\$376	1/3 3
1.5	69476-781	\$496	1/3 5	69476-793	\$424	1/3 3
2	69476-782	\$412	1/3 5	69476-794	\$352	1/3 3
3	69476-783	\$412	1/3 5	69476-795	\$352	1/3 3
5	69476-784	\$532	1/3 7	69476-796	\$352	1/3 3
7.5	69476-785	\$800	1/6 5	69476-797	\$448	1/3 5
10	69476-786	\$896	1/6 5	69476-798	\$616	1/3 7
15	69476-787	\$1,136	1/6 7	69476-799	\$896	1/6 5

Hp	460 Volt, 3 Phase Ballast Resistors					
	70% Load Starting Torque			100% Load Starting Torque		
	Part Number	List Price	Frame /Coil* Size	Part Number	List Price	Frame /Coil* Size
0.25	69476-800	\$412	1/3 5	69476-812	\$352	1/3 3
0.33	69476-801	\$412	1/3 5	69476-813	\$352	1/3 3
0.5	69476-802	\$412	1/3 5	69476-814	\$352	1/3 3
0.75	69476-803	\$412	1/3 5	69476-815	\$352	1/3 3
1	69476-804	\$412	1/3 5	69476-816	\$352	1/3 3
1.5	69476-805	\$520	1/3 7	69476-817	\$376	1/3 5
2	69476-806	\$520	1/3 7	69476-818	\$436	1/3 5
3	69476-807	\$896	1/6 5	69476-819	\$496	1/3 5
4	69477-480	\$728	1/6 5	—	—	—
5	69476-808	\$472	1/3 7	69476-820	\$412	1/3 5
7.5	69476-809	\$728	1/6 5	69476-821	\$412	1/3 5
10	69476-810	\$1,136	1/6 7	69476-822	\$800	1/6 5
15	69476-811	\$1,564	2/6 5	69476-823	\$800	1/6 5

Price Adders For Optional Covers

Frame /Coil*	Coil Size	Cane Metal	Vent'd Weatherproof
1/3	3	\$160	\$240
1/3	5	\$160	\$240
1/3	7	\$160	\$240
1/6	5	\$200	\$280
1/6	7	\$200	\$280
2/6	5	\$280	\$400

Euclid Type for NEMA D Motors

Euclid Type SSR for use with NEMA D Squirrel Cage Motors with Resistance in Three Legs — Discount E32

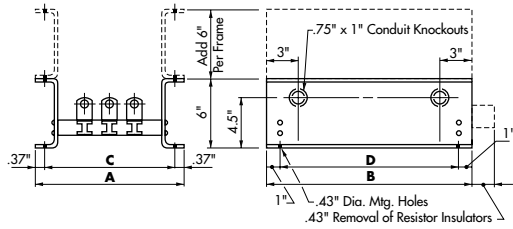
Hp	230 Volt, 3 Phase Ballast Resistors					
	Designed for 100% FLST Set for 150% FLST			Price Adders for Covers		
	Part Number	List Price	Frame /Coil* Size	Cane Metal Part Number	List Price	Vent'd WP Part Number
0.5	69479-112	\$352	1/3 3	69410-102	\$160	69412-102 \$240
0.75	69479-113	\$352	1/3 3	69410-102	\$160	69412-102 \$240
1	69479-114	\$352	1/3 3	69410-102	\$160	69412-102 \$240
1.5	69479-115	\$352	1/3 3	69410-102	\$160	69412-102 \$240
2	69479-116	\$352	1/3 3	69410-102	\$160	69412-102 \$240
3	69479-117	\$352	1/3 3	69410-102	\$160	69412-102 \$240
4	69479-118	\$448	1/3 5	69410-114	\$160	69412-114 \$240
5	69479-119	\$448	1/3 5	69410-114	\$160	69412-114 \$240
7.5	69479-120	\$448	1/3 5	69410-114	\$160	69412-114 \$240
10	69479-121	\$496	1/3 5	69410-114	\$160	69412-114 \$240

Hp	460 Volt, 3 Phase Ballast Resistors					
	Designed for 100% FLST Set for 150% FLST			Price Adders for Covers		
	Part Number	List Price	Frame /Coil* Size	Cane Metal Part Number	List Price	Vent'd WP Part Number
0.25	69479-122	\$412	1/3 5	69410-114	\$160	69412-114 \$240
0.33	69479-123	\$412	1/3 5	69410-114	\$160	69412-114 \$240
0.5	69479-124	\$412	1/3 5	69410-114	\$160	69412-114 \$240
0.75	69479-125	\$436	1/3 5	69410-114	\$160	69412-114 \$240
1	69479-126	\$436	1/3 5	69410-114	\$160	69412-114 \$240
1.5	69479-127	\$412	1/3 5	69410-114	\$160	69412-114 \$240
2	69479-128	\$412	1/3 5	69410-114	\$160	69412-114 \$240
3	69479-129	\$412	1/3 5	69410-114	\$160	69412-114 \$240
4	69479-130	\$412	1/3 5	69410-114	\$160	69412-114 \$240
5	69479-131	\$412	1/3 5	69410-114	\$160	69412-114 \$240
6	69479-132	\$412	1/3 5	69410-114	\$160	69412-114 \$240
7.5	69479-133	\$412	1/3 5	69410-114	\$160	69412-114 \$240

* — Number of Frames/Coils per Frame; See pages 12 and 13 for dimensions.

Dimensions – Frames

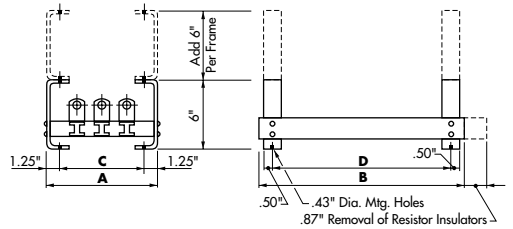
Standard Frame



Standard Frame Dimensions

No. of Coils	Coil Size	A	B	C	D
2	3	10.00"	13.12"	9.25"	11.12"
3	3	12.75"	13.12"	12.00"	11.12"
4	3	15.50"	13.12"	14.75"	11.12"
5	3	18.25"	13.12"	17.50"	11.12"
6	3	21.00"	13.12"	20.25"	11.12"
7	3	23.75"	13.12"	23.00"	11.12"
2	4	10.00"	16.06"	9.25"	14.06"
3	4	12.75"	16.06"	12.00"	14.06"
4	4	15.50"	16.06"	14.75"	14.06"
5	4	18.25"	16.06"	17.50"	14.06"
6	4	21.00"	16.06"	20.25"	14.06"
7	4	23.75"	16.06"	23.00"	14.06"
2	5	10.00"	19.00"	9.25"	17.00"
3	5	12.75"	19.00"	12.00"	17.00"
4	5	15.50"	19.00"	14.75"	17.00"
5	5	18.25"	19.00"	17.50"	17.00"
6	5	21.00"	19.00"	20.25"	17.00"
7	5	23.75"	19.00"	23.00"	17.00"
2	6	10.00"	21.93"	9.25"	19.93"
3	6	12.75"	21.93"	12.00"	19.93"
4	6	15.50"	21.93"	14.75"	19.93"
5	6	18.25"	21.93"	17.50"	19.93"
6	6	21.00"	21.93"	20.25"	19.93"
7	6	23.75"	21.93"	23.00"	19.93"
2	7	10.00"	24.87"	9.25"	22.87"
3	7	12.75"	24.87"	12.00"	22.87"
4	7	15.50"	24.87"	14.75"	22.87"
5	7	18.25"	24.87"	17.50"	22.87"
6	7	21.00"	24.87"	20.25"	22.87"
7	7	23.75"	24.87"	23.00"	22.87"

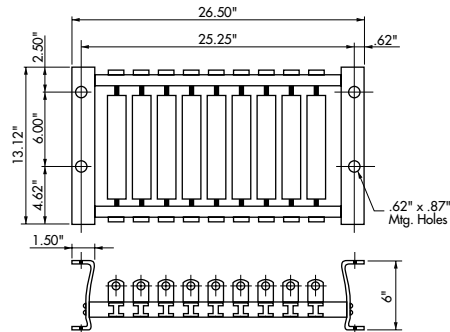
Open Frame



Open Frame Dimensions

No. of Coils	Coil Size	A	B	C	D
2	3	7.50"	13.18"	4.37"	11.12"
3	3	10.25"	13.18"	7.12"	11.12"
4	3	13.00"	13.18"	9.87"	11.12"
5	3	15.75"	13.18"	12.62"	11.12"
6	3	18.50"	13.18"	15.37"	11.12"
7	3	21.25"	13.18"	18.12"	11.12"
2	4	7.50"	16.12"	4.37"	14.06"
3	4	10.25"	16.12"	7.12"	14.06"
4	4	13.00"	16.12"	9.87"	14.06"
5	4	15.72"	16.12"	12.62"	14.06"
6	4	18.50"	16.12"	15.37"	14.06"
7	4	21.25"	16.12"	18.12"	14.06"
2	5	7.50"	19.06"	4.37"	17.00"
3	5	10.25"	19.06"	7.12"	17.00"
4	5	13.00"	19.06"	9.87"	17.00"
5	5	15.72"	19.06"	12.62"	17.00"
6	5	18.50"	19.06"	15.37"	17.00"
7	5	21.25"	19.06"	18.12"	17.00"
2	6	7.50"	22.00"	4.37"	19.93"
3	6	10.25"	22.00"	7.12"	19.93"
4	6	13.00"	22.00"	9.87"	19.93"
5	6	15.72"	22.00"	12.62"	19.93"
6	6	18.50"	22.00"	15.37"	19.93"
7	6	21.25"	22.00"	18.12"	19.93"
2	7	7.50"	24.93"	4.37"	22.87"
3	7	10.25"	24.93"	7.12"	22.87"
4	7	13.00"	24.93"	9.87"	22.87"
5	7	15.72"	24.93"	12.62"	22.87"
6	7	18.50"	24.93"	15.37"	22.87"
7	7	21.25"	24.93"	18.12"	22.87"

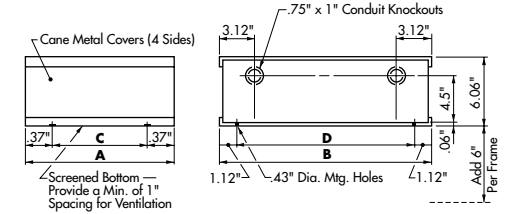
Universal Mill Frame



Accepts quantity of 9 – Size 3 Coils

Dimensions – Covers

Cane Metal Cover

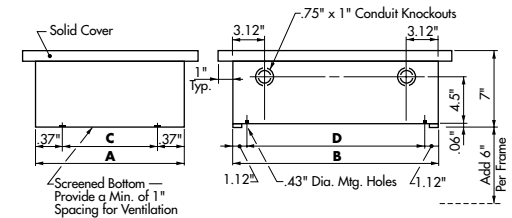


Standard Frame w/ Covers Dimensions

No. of Coils	Coil Size	A	B	C	D
2	3	10.00"	13.37"	9.25"	11.12"
3	3	12.75"	13.37"	12.00"	11.12"
4	3	15.50"	13.37"	14.75"	11.12"
5	3	18.25"	13.37"	17.50"	11.12"
6	3	21.00"	13.37"	20.25"	11.12"
7	3	23.75"	13.37"	23.00"	11.12"
2	4	10.00"	16.31"	9.25"	14.06"
3	4	12.75"	16.31"	12.00"	14.06"
4	4	15.50"	16.31"	14.75"	14.06"
5	4	18.25"	16.31"	17.50"	14.06"
6	4	21.00"	16.31"	20.25"	14.06"
7	4	23.75"	16.31"	23.00"	14.06"
2	5	10.00"	19.25"	9.25"	17.00"
3	5	12.75"	19.25"	12.00"	17.00"
4	5	15.50"	19.25"	14.75"	17.00"
5	5	18.25"	19.25"	17.50"	17.00"
6	5	21.00"	19.25"	20.25"	17.00"
7	5	23.75"	19.25"	23.00"	17.00"
2	6	10.00"	22.18"	9.25"	19.93"
3	6	12.75"	22.18"	12.00"	19.93"
4	6	15.50"	22.18"	14.75"	19.93"
5	6	18.25"	22.18"	17.50"	19.93"
6	6	21.00"	22.18"	20.25"	19.93"
7	6	23.75"	22.18"	23.00"	19.93"
2	7	10.00"	25.12"	9.25"	22.87"
3	7	12.75"	25.12"	12.00"	22.87"
4	7	15.50"	25.12"	14.75"	22.87"
5	7	18.25"	25.12"	17.50"	22.87"
6	7	21.00"	25.12"	20.25"	22.87"
7	7	23.75"	25.12"	23.00"	22.87"

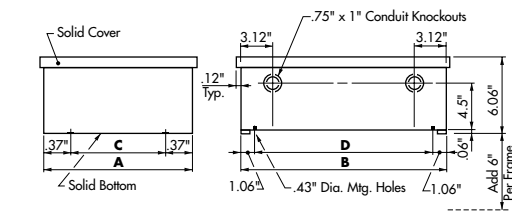
Note: Derate resistor coil amps 50% when using Totally Enclosed Non-Ventilated Covers

Ventilated Weatherproof Cover



Totally Enclosed Non-Ventilated Cover

Note: Derate resistor coil amps 50% when using Totally Enclosed Non-Ventilated Covers



Specifications

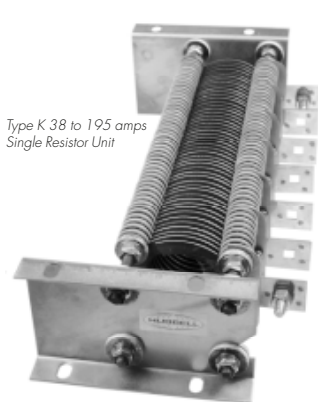
Euclid™ Power Resistors

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 milltype 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.

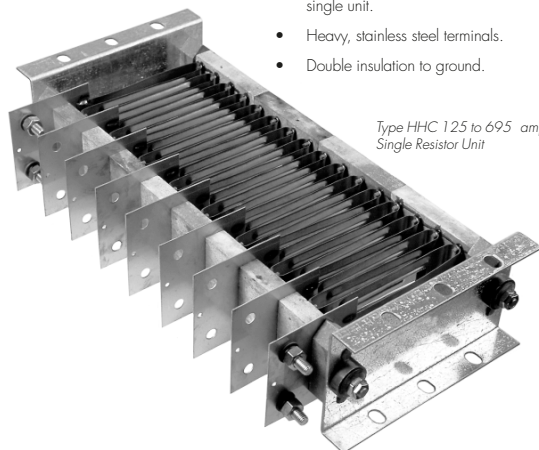


Type K 38 to 195 amp
Single Resistor Unit

Type K Features

The Type K1 resistors have a single coil resistance element and are available in ratings ranging from 38 to 195 amperes.

- Continuous stainless steel element.
- No welded element joints, no hot spots.
- Milltype construction.
- Nonbreakable, all steel and mica components.
- Element floats on insulated steel spacers; expands and contracts freely.
- No distortion with temperature rise.
- 195 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 125 to 695 amp
Single Resistor Unit

Type HHC Features

The Type HHC resistors use a folded ribbon resistance element and are available in ratings ranging from 125 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 (3004) Description

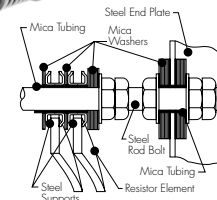
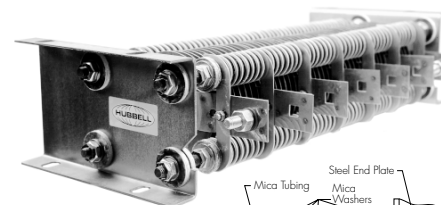
The resistive elements of the Type K units are formed from a continuous strip of 406 stainless steel wound in an edgewise manner. The element has a high degree of resistance to oxidation even at elevated temperatures. The temperature coefficient of the coil is so slight that it is considered negligible for most applications. The weldfree 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

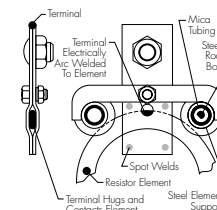
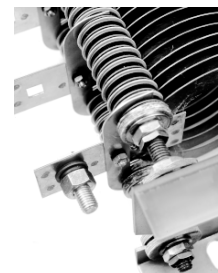
the ends are spot welded, the terminal is forced to mechanically hug the element making a firm, stable contact. In addition, the terminal is arc welded to the element further insuring positive electrical connection.

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 loads.

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.



Specifications

Type HHC (3005) Description

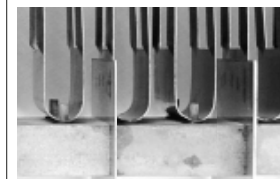
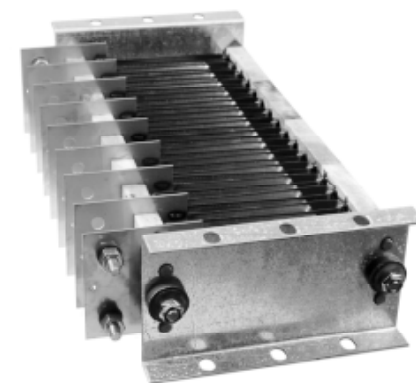
The unique resistive element of the Type HHC supplies a uniform thickness throughout its continuous length. The width and thickness of the continuous strip and the spacing between folds have been computer selected for each unit, optimizing their ratings.

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 125–225 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.

Resistor Coils

Euclid™ 3004 Type K Coils (Discount E33)

Continuous Amps	Ohms/Frame	Z Length - 26.5" Long				Y Length - 25.5" Long				List Price	Unmounted Terminal Assembly Part Number	List Price
		Universal Mill Frame Resistor w/ Euclid End Plates		Short Mill Frame Resistor w/ Universal End Plates		Short Frame Resistor w/ Euclid End Plates						
		Old Catalog Number	Part Number	Old Catalog Number	Part Number	Old Catalog Number	Part Number					
38	5.030	Z38W5030GB	30856-001	—	30855-401	Y38W5030GB	30855-001	\$1,120	65130005	\$8		
41	3.900	Z41W3900GB	30856-002	—	30855-402	Y41W3900GB	30855-002	\$1,120	65130005	\$8		
48	3.230	Z48W3230GB	30856-003	—	30855-403	Y48W3230GB	30855-003	\$1,120	65130005	\$8		
53	2.500	Z53W2500GB	30856-004	—	30855-404	Y53W2500GB	30855-004	\$1,120	65130005	\$8		
62	1.990	Z62W1990GB	30856-006	—	30855-406	Y62W1990GB	30855-006	\$1,120	65130005	\$8		
66	1.620	Z66W1620GB	30856-007	—	30855-407	Y66W1620GB	30855-007	\$1,120	65130005	\$8		
72	1.480	Z72W1480GB	30856-009	—	30855-409	Y72W1480GB	30855-009	\$1,120	65130005	\$8		
77	1.210	Z77W1210GB	30856-010	—	30855-410	Y77W1210GB	30855-010	\$1,120	65130005	\$8		
80	1.020	Z80W1020GB	30856-011	—	30855-411	Y80W1020GB	30855-011	\$1,120	65130005	\$8		
86	0.970	Z86W970GB	30856-012	—	30855-412	Y86W970GB	30855-012	\$1,120	65130005	\$8		
95	0.808	Z95W808GB	30856-015	—	30855-415	Y95W808GB	30855-015	\$1,120	65130005	\$8		
98	0.680	Z98W680GB	30856-016	—	30855-416	Y98W680GB	30855-016	\$1,120	65130005	\$8		
101	0.595	Z101W595GB	30856-017	—	30855-417	Y101W595GB	30855-017	\$1,120	65130005	\$8		
109	0.542	Z109W542GB	30856-018	—	30855-418	Y109W542GB	30855-018	\$1,120	65130005	\$8		
117	0.463	Z117W463GB	30856-021	—	30855-421	Y117W463GB	30855-021	\$1,120	65130005	\$8		
120	0.405	Z120W405GB	30856-022	—	30855-422	Y120W405GB	30855-022	\$1,120	65130005	\$8		
124	0.357	Z124W357GB	30856-023	—	30855-423	Y124W357GB	30855-023	\$1,120	65130005	\$8		
139	0.322	Z139W322GB	30856-026	—	30855-426	Y139W322GB	30855-026	\$1,120	65130005	\$8		
143	0.282	Z143W282GB	30856-027	—	30855-427	Y143W282GB	30855-027	\$1,120	65130005	\$8		
147	0.248	Z147W248GB	30856-028	—	30855-428	Y147W248GB	30855-028	\$1,120	65130005	\$8		
156	0.235	Z156W235GB	30856-030	—	30855-430	Y156W235GB	30855-030	\$1,120	65130005	\$8		
171	0.206	Z171W206GB	30856-033	—	30855-433	Y171W206GB	30855-033	\$1,120	65130005	\$8		
174	0.181	Z174W181GB	30856-034	—	30855-434	Y174W181GB	30855-034	\$1,120	65130005	\$8		
178	0.162	Z178W162GB	30856-035	—	30855-435	Y178W162GB	30855-035	\$1,120	65130005	\$8		
190	0.141	Z190W141GB	30856-037	—	30855-437	Y190W141GB	30855-037	\$1,120	65130005	\$8		
195	0.126	Z195W126GB	30856-038	—	30855-438	Y195W126GB	30855-038	\$1,120	65130005	\$8		
200	0.114	Z200W114GB	30856-039	—	30855-439	Y200W114GB	30855-039	\$1,120	65130005	\$8		

Type K Adjustable Terminal Clamp use P/N 29103-000; List Price \$56 each; Discount Schedule E33

Euclid™ 3005 Type HHC Coils (Discount E34)

Continuous Amps	Ohms/Frame	Z Length - 26.5" Long				Y Length - 25.5" Long				List Price	Unmounted Terminal Assembly Part Number	List Price
		Universal Mill Frame Resistor w/ Euclid End Plates		Short Mill Frame Resistor w/ Universal End Plates		Short Frame Resistor w/ Euclid End Plates						
		Old Catalog Number	Part Number	Old Catalog Number	Part Number	Old Catalog Number	Part Number					
125	.336	—	53357-020	—	53356-020	—	—	\$1,120	65130007	\$12		
150	.268	—	53357-021	—	53356-021	—	—	\$1,120	65130007	\$12		
175	.200	—	53357-022	—	53356-022	—	—	\$1,120	65130007	\$12		
200	.150	—	53357-023	—	53356-023	—	—	\$1,120	65130007	\$12		
225	.121	—	53357-024	—	53356-024	—	—	\$1,120	65130007	\$12		
255	.112	HHC255Z	53357-001	HHC255Y	53356-001	n/a	n/a	\$1,120	65130007	\$12		
295	.096	HHC295Z	53357-002	HHC295Y	53356-002	n/a	n/a	\$1,120	65130007	\$12		
350	.072	HHC350Z	53357-003	HHC350Y	53356-003	n/a	n/a	\$1,120	65130007	\$12		
395	.057	HHC395Z	53357-004	HHC395Y	53356-004	n/a	n/a	\$1,120	65130007	\$12		
445	.046	HHC445Z	53357-005	HHC445Y	53356-005	n/a	n/a	\$1,120	65130007	\$12		
500	.032	HHC500Z	53357-006	HHC500Y	53356-006	n/a	n/a	\$1,120	65130007	\$12		
610	.024	HHC610Z	53357-007	HHC610Y	53356-007	n/a	n/a	\$1,120	65130007	\$12		
695	.017	HHC695Z	53357-008	HHC695Y	53356-008	n/a	n/a	\$1,120	65130007	\$12		

Unmounted Terminal Assembly consists of necessary Mounting Hardware 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.



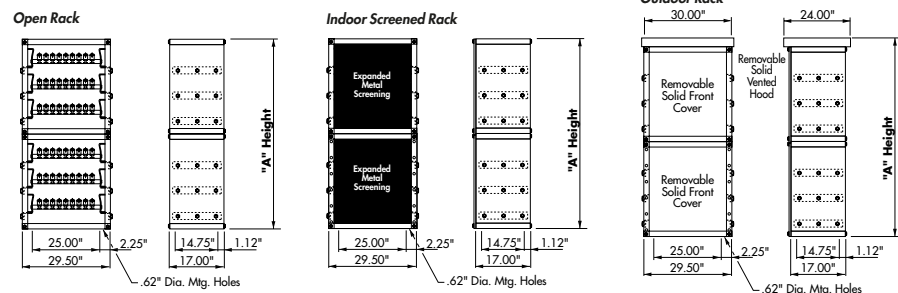
Racks & Enclosures

Bolted Galvanized Racks & Enclosures for Z Length SSRM, K1 & HHC Type Resistors (Discount E33)

Maximum 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/ Intwiring List Price	Mount & Intwires Resistor Frames in Rack or Enclosure List Price
2	82668-003	\$500	82668-013	\$2020	82668-023	\$2100	\$80	\$200
3	82668-003	\$500	82668-013	\$2020	82668-024	\$2380	\$115	\$310
4	82668-004	\$650	82668-014	\$2450	82668-025	\$2700	\$150	\$420
5	82668-005	\$790	82668-015	\$2950	82668-026	\$3240	\$185	\$530
6	82668-006	\$900	82668-016	\$3420	82668-027	\$3760	\$220	\$640
7	82668-007	\$1040	82668-017	\$3900	82668-028	\$4280	\$255	\$750
8	82668-008	\$1150	82668-018	\$4320	82668-029	\$4750	\$290	\$860
9	82668-009	\$1300	82668-019	\$4820	82668-030	\$5300	\$325	\$970
10	82668-010	\$1440	82668-020	\$5250	—	—	\$360	\$1080

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

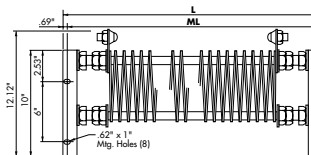
Dimensions for K1 & HHC Resistors Rack & Frames



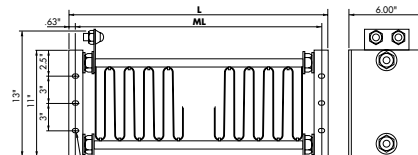
No. of Resistors	Rack Height (Dimension "A")		
	Open "A"	Indoor "A"	Outdoor "A"
2	21.50"	21.50"	30.63"
3	29.50"	29.50"	38.63"
4	37.50"	37.50"	46.63"
5	45.50"	45.50"	54.63"
6	53.50"	53.50"	62.63"
7	61.50"	61.50"	70.63"
8	69.50"	69.50"	78.63"
9	77.50"	77.50"	86.63"
10	85.50"	85.50"	—

These dimensions are approximate and should not be used for construction purposes.

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



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 $\pm 10\%$. 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,

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

- 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,

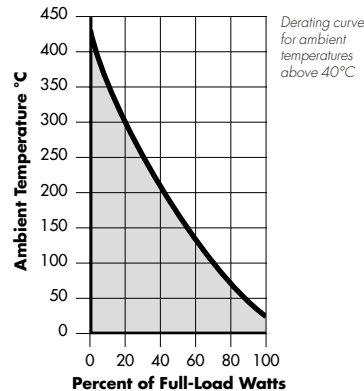
$$P \text{ in watts} = IE$$

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.

- 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.
- 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.
- 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						Continuous Duty
	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	
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 fullload 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, 162P. 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.

Resistor NEMA Class Ratings

Type SSR Resistors

Continuous Amps	NEMA Class Ampere Ratings						
	90	170	160	150	140	130	110
11	11.0	14.7	17.3	19.6	23.1	26.0	35.0
12	12.0	16.1	18.8	21.4	25.2	28.4	38.1
12.5	12.5	16.7	19.6	22.2	26.2	29.6	39.6
13	13.0	17.4	20.4	23.1	27.3	30.8	41.3
15	15.0	20.1	23.5	26.7	31.5	35.5	47.7
16	16.0	21.2	25.1	28.5	33.6	37.9	50.8
18	18.0	23.1	28.2	32.0	37.8	42.6	57.3
20	20.0	26.8	31.4	35.6	42.0	47.4	63.6
22	22.0	29.5	34.5	39.2	46.2	52.0	70.0
24	24.0	32.2	37.7	42.7	50.4	56.8	76.3
27	27.0	36.2	42.4	49.8	56.7	64.0	85.8
30	30.0	40.2	47.1	53.4	63.0	71.0	95.5
34	34.0	46.6	53.4	60.5	71.5	80.5	108.0
37	37.0	49.6	58.1	65.8	77.6	87.6	117.5
40	40.0	53.5	62.8	71.3	84.0	94.7	127.1
45	45.0	60.3	70.6	80.1	94.5	106.6	143.0
50	50.0	67.0	78.5	89.0	105.0	118.3	159.0
52	52.0	69.7	81.6	92.6	109.2	123.0	165.2
56	56.0	75.0	88.0	99.6	117.5	132.4	178.0
60	60.0	80.5	94.2	106.8	126.0	142.0	190.8
64	64.0	85.8	100.5	114.0	134.5	151.5	203.9
67	67.0	89.8	105.2	119.1	140.7	158.6	213.0
70	70.0	93.8	110.2	124.5	147.0	165.8	222.5
76	76.0	101.9	119.2	135.3	159.5	180.0	241.7
82	82.0	110.0	128.8	146.0	172.1	194.1	260.5
85	85.0	114.0	133.5	151.2	178.5	201.3	270.0
94	94.0	126.0	147.8	167.5	197.5	222.5	299.0
101	101.0	135.5	158.5	180.0	212.1	239.0	321.8

Type K Resistors

Continuous Amps	NEMA Class Ampere Ratings						
	90	170	160	150	140	130	110
38	38	51	60	67	80	90	121
41	41	54	65	72	87	97	130
48	48	65	77	87	104	118	161
53	53	71	85	96	115	131	177
62	62	85	102	115	140	159	217
66	66	90	109	123	149	170	231
72	72	98	119	134	163	185	253
77	77	105	127	143	174	198	270
80	80	109	132	149	181	206	280
86	86	118	142	160	194	221	302
95	95	130	157	177	215	244	333
98	98	134	162	182	221	252	344
101	101	138	167	188	228	260	355
109	109	149	180	203	247	280	383
117	117	160	193	218	264	301	407
120	120	164	198	223	271	309	421
124	124	170	205	230	280	319	436
139	139	190	229	259	314	357	488
143	143	196	236	266	323	368	502
147	147	201	242	273	332	378	516
156	156	213	257	290	353	401	547
171	171	234	282	318	387	440	600
174	174	238	287	324	393	448	610
178	178	244	294	331	402	457	625
190	190	260	313	353	429	488	667
195	195	267	322	362	441	501	685

Type HHC Resistors

Continuous Amps	NEMA Class Ampere Ratings						
	90	170	160	150	140	130	110
125	125	170	205	230	280	319	436
150	150	202	244	275	332	381	525
175	175	236	284	320	388	445	610
200	200	270	325	366	443	508	698
225	225	303	365	412	500	572	785
255	255	344	414	467	565	648	890
295	295	403	485	547	662	759	1042
350	350	479	577	651	787	903	1235
395	395	542	653	737	891	1022	1402
445	445	599	722	813	984	1129	1549
500	500	682	821	926	1120	1284	1762
610	610	826	995	1121	1357	1556	2136
695	695	936	1128	1272	1538	1764	2421

Prices Are Subject To Change Without Notice



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