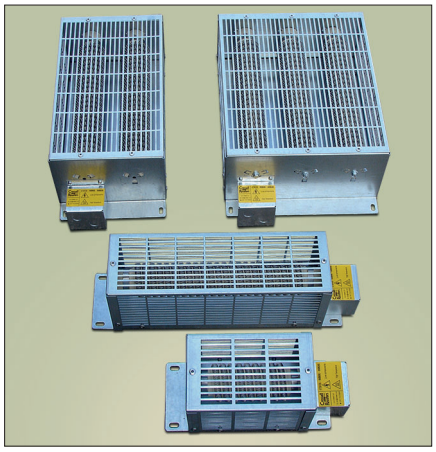
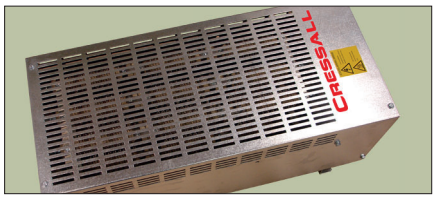
Cressall Resistors

ES and DBR Series braking resistors



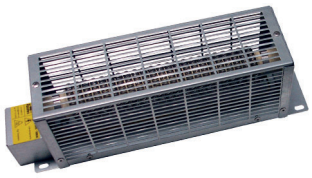


CHS controls

www.chscontrols.se

ES Series
0,6-8 kW continuous

Technical data



Resistor element	Spiral wire-wound on ceramic former
Cooling	Air, natural convection
Resistor material	Stainless steel, Kanthal D
Manufacturing tolerance	-0 - +5%
Temperature rise	Resistor ca 600°C, issuing air/enclosure ca 200°C
Rated operating voltage	1000 V
Overtemperature indication	Factory installed accessory, NC contact 240 V/7 A, 6,3 mm quick connector
Enclosure material	Steel, galvanised
Ingress protection, IEC 60529	IP 20, 6 - 8 kW also IP 21 with canopy
Terminals	0,6-4,5 kW: Ceramic terminal block ≤10 mm² conductor, M4 earth screw 6-8 kW: M8 stud, M4 earth stud
Cable entry	0,6-4,5 kW: 2x20mm sealed entries, 6-8 kW 4x20 mm sealed entries
Certificate	CE, RoHS, UKCA

Catalogue numbers - Code for resistance value - Add to catalogue number

Resistance value Ω	Rated power, continuous, kW - Catalogue numbers 0,6 REESH	1 REEST	1,5 REES1	2 REEST2	3 REES2	4,5 REES3	6 REES4	8 REES8
3,3				3R3			3R3	3R3
3,9	3R9			3R9		3R9	3R9	3R9
4,7	4R7			4R7	4R7	4R7	4R7	4R7
5,6	5R6			5R6	5R6	5R6	5R6	5R6
6,8	6R8	6R8		6R8	6R8	6R8	6R8	6R8
8,2	8R2	8R2		8R2	8R2	8R2	8R2	8R2
10	10R	10R	10R	10R	10R	10R	10R	10R
12	12R	12R	12R	12R	12R	12R	12R	12R
15	15R	15R	15R	15R	15R	15R	15R	15R
18	18R	18R	18R	18R	18R	18R	18R	18R
20	20R	20R	20R	20R	20R	20R	20R	20R
22	22R	22R	22R	22R	22R	22R	22R	22R
24	24R	24R	24R	24R	24R	24R	24R	24R
27	27R	27R	27R	27R	27R	27R	27R	27R
30	30R	30R	30R	30R	30R	30R	30R	30R
33	33R	33R	33R	33R	33R	33R	33R	33R
39	39R	39R	39R	39R	39R	39R	39R	39R
40	40R	40R	40R	40R	40R	40R	40R	40R
47	47R	47R	47R	47R	47R	47R	47R	47R
50	50R	50R	50R	50R	50R	50R	50R	50R
56	56R	56R	56R	56R	56R	56R	56R	56R
68	68R	68R	68R	68R	68R	68R	68R	68R
75	75R	75R	75R	75R	75R	75R	75R	75R
82	82R	82R	82R	82R	82R	82R	82R	82R
100	100R	100R	100R	100R	100R	100R	100R	100R
120	120R	120R	120R	120R	120R	120R	120R	120R
150	150R	150R	150R	150R	150R	150R	150R	
180	180R	180R	180R	180R	180R	180R		
220		220R	220R	220R	220R	220R		
270		270R	270R	270R	270R			
330			330R	330R	330R			

A complete catalogue number is created as follows

REESH-47R-SC-C1

Accessory	C1= Canopy, increase the ingress protection to IP 21, only 6 - 8 kW braking resistors the canopy restricts the cooling, rated power will be reduced, contact CHS Controls
Versions	SC= Terminal cover only, braking resistors 0,6 - 4,5 kW SB = Terminal cover and overtemperature indication
Resistance value	Code from table, other on request
Rated power, continuous	Catalogue number from table

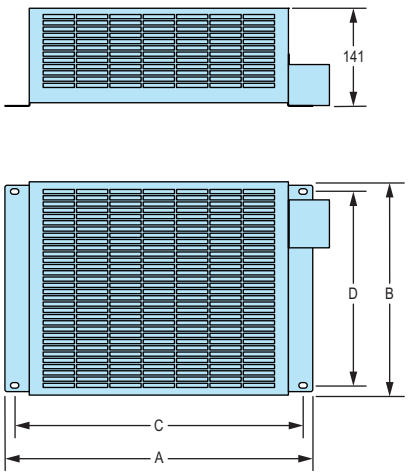
Example
0,6 kW braking resistor, 47 Ω with terminal cover only will be REESH-47R-SC

Short time load

Continuous rated power rating can be exceeded when power is applied for less than 100% of the time. The overload capacity depends on duty cycle (braking time and number of stops over time) and on the resistance value. Contact CHS Controls for application assistance.

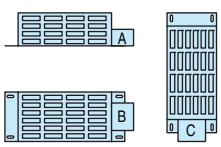
Dimensions, mm

ES Series 0,6-4,5 kW, IP 20



Rated power kW	Dimensions, mm A	B	C	D	Weight each, kg
0,6	288	121	236	92	1,4
1	367	121	315	92	1,8
1,5	467	121	415	92	2,2
2	367	213	315	185	3,5
3	467	213	415	185	4,5
4,5	467	307	415	278	6,5

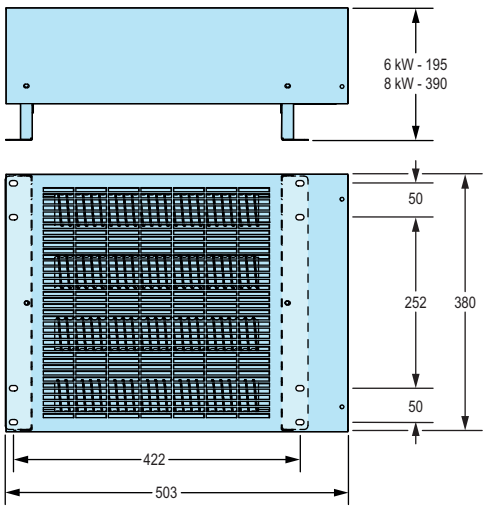
Correct mounting 0,6-4,5 kW	Correct mounting 6-8 kW



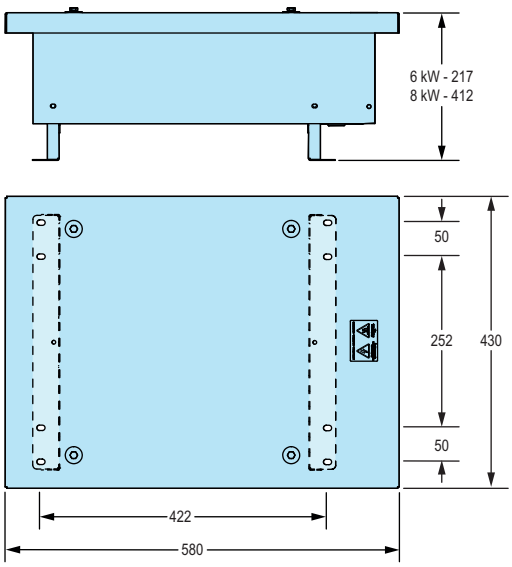
A: Horizontally, bottom down

A: Horizontally, solid bottom down, best. The overtemperature indication is calibrated for this mounting position.
B: Horizontally on side, good.
C: Vertically, cable compartment down, good.

ES Series 6-8 kW IP 20 and IP 21



IP 20 version, weight
6 kW: 8,5 kg each
8 kW: 15 kg each

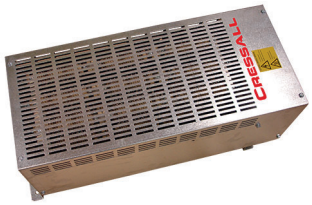


IP 21 version, weight
6 kW: 9,3 kg each
8 kW: 15,8 kg each

Note!
The braking resistor get hot during normal operation. Avoid proximity to flammable materials. Provide adequate ventilation, do not cover the units. If the braking resistor is mounted inside an enclosure, additional cooling air may be required.

DBR Series
12-25 kW continuous

Technical data



Resistor element	Spiral wire-wound on ceramic former/Edge-wound type on ceramic insulation
Cooling	Air, natural convection
Resistor element	Stainless steel, Kanthal D/Alkrothal 720/FAL 40
Manufacturing tolerance	-0 - +10%
Temperature rise	Resistor ca 600°C, issuing air/enclosure ca 200°C
Rated operating voltage	1000 V, higher on request
Overtemperature indication	Included NC contact 240 V/7 A, 6,3 mm quick connector
Enclosure material	Steel, galvanised, stainless steel on request
Ingress protection, IEC 60529	IP 20, cable compartment IP 54, IP 21 with canopy mounted, IP 23 on request
Terminals	M10 stud, M6 earth stud
Cable entry	2xM20 sealed entries, 25 kW 4xM20 sealed entries
Certificate	CE, RoHS, UKCA

Catalogue numbers
Code for resistance value - Add to catalogue number

Resistance value Ω	Rated power continuous, kW - Cataloge No. 12 REDBR24	18 REDBR36	25 REDBR54
1,5	1R5	1R5	1R5
1,8	1R8	1R8	1R8
2,2	2R2	2R2	2R2
2,7	2R7	2R7	2R7
3,3	3R3	3R3	3R3
3,9	3R9	3R9	3R9
4,7	4R7	4R7	4R7
5,6	5R6	5R6	5R6
6,8	6R8	6R8	6R8
8,2	8R2	8R2	8R2
10	10R	10R	10R
12	12R	12R	12R
15	15R	15R	15R
18	18R	18R	18R
20	20R	20R	20R
22	22R	22R	22R
24	24R	24R	24R
27	27R	27R	27R
30	30R	30R	30R
33	33R	33R	33R

A complete catalogue number is created as follows

REDBR12-10R-C1

Accessory	C1=Canopy increase the ingress protection to IP 21, the canopy restricts the cooling, rated power will be reduced, contact CHS Controls
Resistance value	Code from table, other on request
Rated power, cont.	Catalogue number from table

Example
12 kW braking resistor, 10 Ω will be REDBR24-10R.

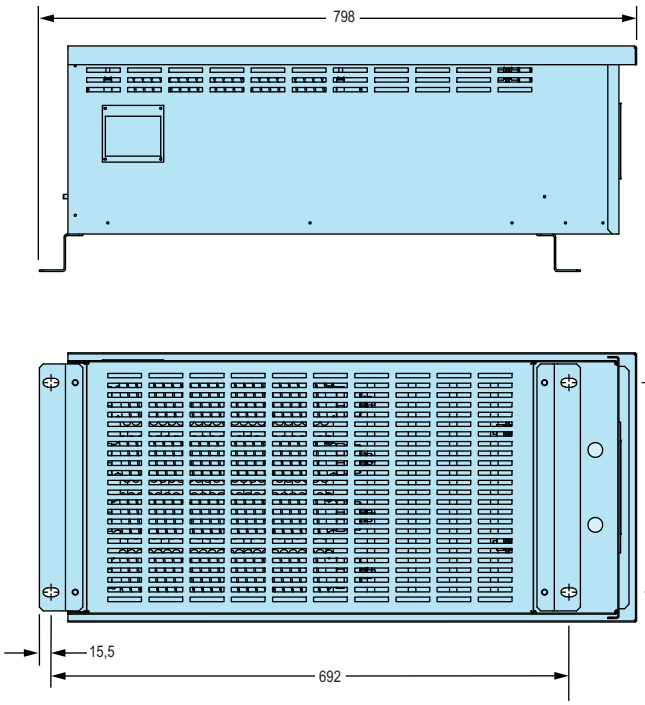
Contact CHS Controls for braking resistors with enclosure made of stainless steel and for braking resistors with higher rated operating voltage.

Short time load

Continuous rated power rating can be exceeded when power is applied for less than 100% of the time. The overload capacity depends on duty cycle (braking time and number of stops over time) and on the resistance value. Contact CHS Controls for application assistance.

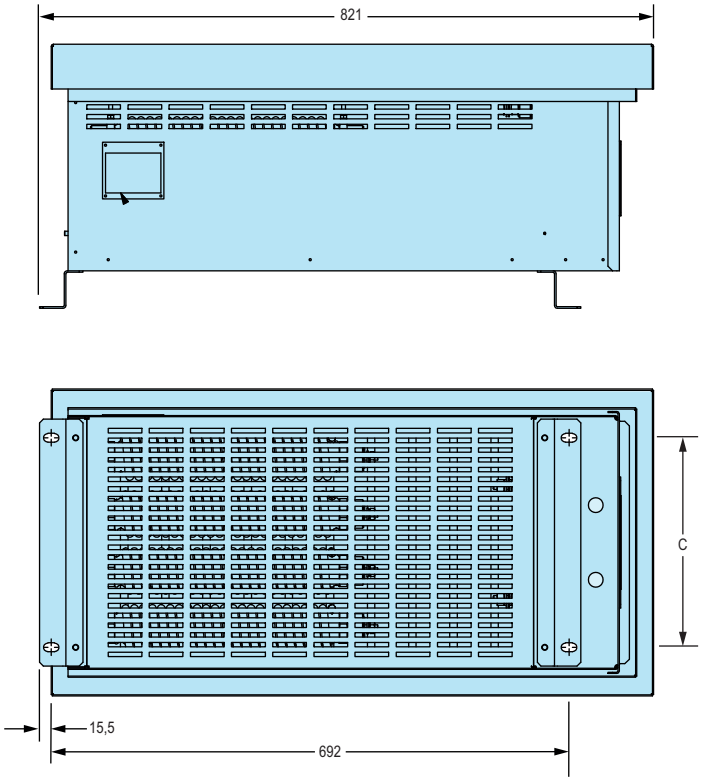
Dimensions, mm

Braking resistor ingress protection IP20



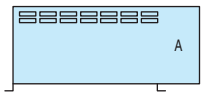
Rated power kW	Dimensions A	B	C	Weight kg, each
12	360	302	280	28
18	360	302	280	35
25	542	402	462	43

Braking resistor ingress protection IP21



Rated power kW	Dimensions A	B	C	Weight kg, each
12	410	353	280	30
18	410	474	280	37
25	592	474	462	46

Correct mounting



A: Horizontally, bottom down

Note!
The braking resistor get hot during normal operation. Avoid proximity to flammable materials. Provide adequate ventilation, do not cover the units. If the braking resistor is mounted inside an enclosure, additional cooling air may be required.

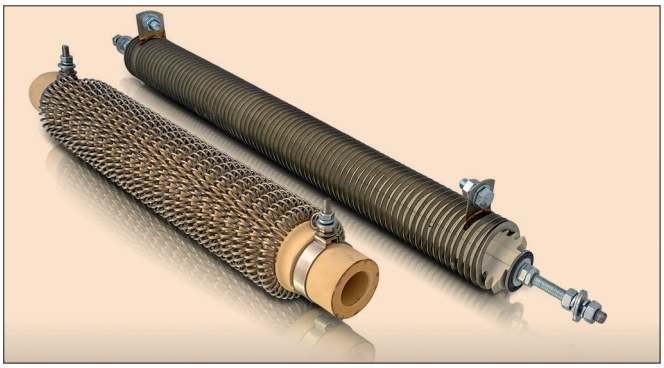
Application guide
Braking resistors

When large masses are to be stopped, these may generate energy which can be fed back into the motor or the drive system. The excess energy needs to be either re-generated or absorbed. An external braking resistor provides a compact, cost effective method of controlling braking and absorbing excess energy produced.

Application considerations
The DC link of an AC variable speed drive can absorb ca 3-5% of the regenerated braking power. Higher braking powers can be absorbed by a braking resistor connected across the DC link. The external braking resistor is switched On/Off by the drive braking module.

Energy generated by braking is absorbed into the resistor elements causing them to heat up. All the energy is used in heating the resistor, some is dissipated at once, the rest after the stop while the resistor cools. Therefore, we must know the characteristics of the duty cycle before we can specify the right size for the braking resistor.

Cooling
Most braking resistors are air cooled by self-convection. It is a cost-effective solution for most of the applications up to ca 100 kW. Forced cooled resistors may be a both a space-saving and more economical alternative. Water cooled resistors are an option for applications with relatively high continuous power.

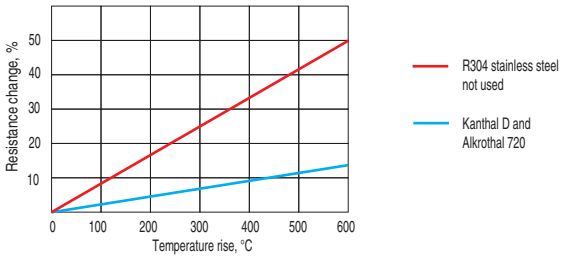


HP Coil and ZC Coil resistor element.

Resistor elements
Cressall ES Series and DBR Series are based on two types of resistor elements

- HP Coils, spiral wire-wound coils on ceramic formers
- ZC Coils, edge-wound coiled strip on ceramic insulation

Both elements offer high overload capacity and rapid cooling. High active surface area per kW in combination with excellent heat dissipation giving outstanding short-time performance for repetitive braking duties.



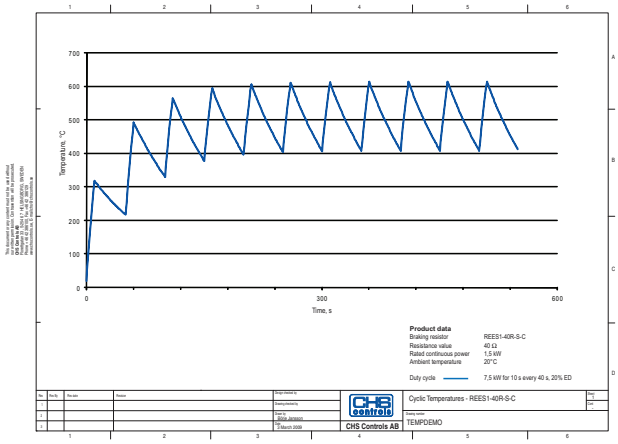
Resistance changes over the temperature range for different resistance materials. High resistance change results in less effective braking. Cressall use only materials with low temperature rise coefficient.

Cressall DBR Series braking resistors installed on a shelf above the AC variable speed drives at a paper mill.

Resistor alloys
Different alloys have different temperature rise coefficient, ie the resistance value change when the alloy is heated. Most materials have a positive temperature rise coefficient, ie the resistance value increase when the temperature rise. High changes in resistance over the temperature range resulting in less effective braking. Alloys used by Cressall have low temperature rise coefficient. There are also resistance materials that have negative temperature rise coefficient.

Manufacturing tolerance on resistance value
There is always a certain manufacturing tolerance with regards to resistance value. Most manufacturer specify manufacturing tolerance as ± of the nominal resistance value. It is important to verify that the resistance value, taken manufacturing tolerance into consideration, never goes below the minimum resistance value specified by the drive supplier.

Manufacturing tolerance for Cressall ES Series and DBR Series braking resistors is narrow and is always specified as -0 - +5/10% depending on resistor. Actual resistance value will never be below the nominal value.



The curve shows the temperature rise of the braking resistor for a certain duty cycle, in this case REES1-40R-SC for 7,5 kW, 10 s braking every 40 s, ie 20% ED.

Thermal capacity verification
Extensive research and testing of individual resistor elements make it possible to predict the temperature rise in the resistor for any application. The result is presented as a curve showing the temperature on the resistor elements. The curve can be used as verification that the braking resistor is correctly sized.

Overtemperature indication

Overtemperature indication is a factory installed option. It is normally a bi-metallic trip with a normally closed contact, sensing the temperature rise on the issuing air.

Installation, air cooled braking resistors

A braking resistor gets hot in normal operation. The temperature rise on the resistor elements may exceed 600°C, enclosure surface temperature may reach 200°C. Provide adequate ventilation, do not cover the unit, avoid proximity to flammable material.

The ventilation holes in the resistor enclosure must not be obstructed. A minimum recommended distance to other equipment is 250 mm. A resistor mounted inside an enclosure should be mounted as high as possible. The enclosure must be well ventilated. This means a minimum free air opening at the top and bottom of the enclosure of 30 cm^2/kW braking power. Force cooling may be required.

Larger resistors – higher braking power

For applications requiring higher braking power, Cressall offers designs based on either punched steel grids or expanded mesh resistor elements. With these elements we can offer flexible and cost-effective solutions for higher powers and heavy overloads.

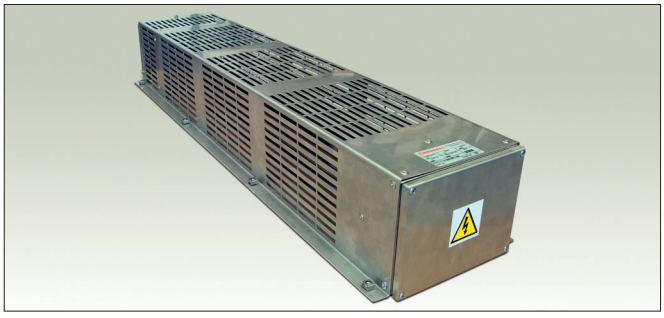
The resistors are designed to meet the customer's specified duty but are based on standard formats, meaning that design, manufacture and despatch can be in just a few weeks.

The enclosure is manufactured of pre-galvanised steel or stainless steel AISI 304 or 316. Ingress protection is normally IP 23.

Forced cooled resistors, either for vertical or horizontal installation, can be offered for even higher powers.

Marine application braking resistors

We can also supply braking resistor suitable for marine use based on mineral insulated, Incoloy sheathed corrosion resistant resistor elements. The enclosure is normally manufactured of AISI 316 stainless steel, cable compartment ingress protection IP 56.



Marine braking resistor, Incoloy corrosion resistant resistor elements installed in an enclosure made of stainless steel, AISI 316L.

EVT and EV2 water cooled braking resistors

Compact, water cooled resistors for low and medium voltage applications in automotive, traction or marine systems.

EVT and EV2 are based on a patented design that encapsulates and totally separates the resistor elements from the coolant, fresh water with or without glycol. Modular design, light weight and low volume, typically 10% of the volume and 15% of the weight of the equivalent air-cooled braking resistor. Modules can be combined to handle from 10 – 600 kW continuous power.

EVT and EV2 water cooled braking resistors.

EVT and EV2 can be supplied as individual components, frame mounted assemblies for integration in customer's systems or completely enclosed systems that include flow and temperature monitoring.

Cressall can also offer sea water cooled braking resistors.

Selection, sizing

We have the expertise to help you select the right dynamic braking resistor. Just tell us

Resistance value, specified by the drive manufacturer. The resistance value sets the rate at which the drive can put energy into the resistor - the braking power. Lower resistance value - higher braking power. Higher resistance value can be used but the braking power will be reduced proportionally.

Voltage over the resistor, for most common 400 VAC drive applications, the switching voltage is around 750 VDC, check with the drive manufacturer. Cressall ES and DBR Series braking resistors can operate up to 1000 V, higher on request.

Braking energy, determined from the energy generated by each braking. The energy is measured in J, energy over time in W (J/s=W).Since both J and W are relatively small units, is the braking energy/power normally stated in kJ/kW. The braking energy is normally constant over the braking time but for some applications, like rotating loads, is the energy exponentially decreasing over time.

If detailed information of the braking energy is not available, braking energy can be estimated as equal to

- Starting energy
- Starting time * power during starting
- Starting time * max power/2
- Starting time * drive power/2

Friction, slip etc. in the system - motor and transmission – will reduce the braking energy that the resistor must be able to handle.

Duty cycle, number of braking's per time unit. The more information we get, the better we can optimise the resistor for the current duty.

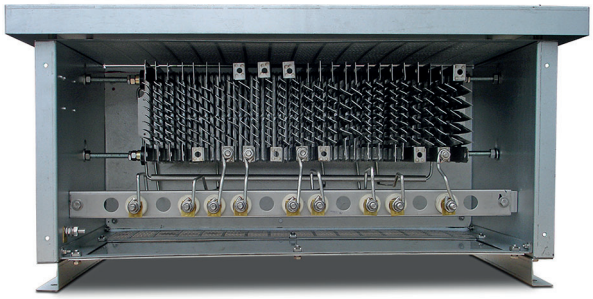
Motor control resistors

Starting resistors

Resistors are also used for motor starting to limit the inrush current. Even if electronic starters, softstarters and AC variable speed drives, have reduced the need for starting resistors, there are still applications when the resistor is a practical and cost-effective solution. We can supply resistors for most starting applications.

Wound rotor motor starting resistors

Wound rotor rotors with slip rings are still used in weaker networks or when the required load torque is very large. During start-up multiple sets of resistors are connected across the slip rings to control the starting current. We can supply rotor starting resistor for both low and medium voltage motors.



Wound rotor motor starting resistor with three sections.

Closed transition resistors for Star-Delta starters

Star-delta is a commonly-used reduced current starting method. However, one disadvantage is that a voltage spike occurs during transition from star to delta position. The voltage spike can be reduced by using three small resistors that are shortly put in circuit during start. The method is called “Closed Transition” and is commonly used in North America. We can supply resistor elements to be installed in the starter.

DC motors

DC motors are commonly used in critical applications, supplied direct from batteries. The starting resistor limit the starting current to the required level. Starting resistors can be supplied as loose resistor elements on mounting brackets or as enclosed starting resistors, ingress protection IP 20.

CHS Controls AB
Florettgatan 33, 254 67 Helsingborg, Sweden
Phone +46 42 386100, chs@chscontrols.se
www.chscontrols.se

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