

Cressall Resistors

ES, HP and DBR Series Braking Resistors



Molea AS

Cressall Braking Resistors - Reliable and Cost Effective!

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.

We offer a standard range of braking resistors from Cressall Resistors, all offered on short lead times. We can also supply non-standard units, especially adapted to your specific application or requirement.

Application Considerations

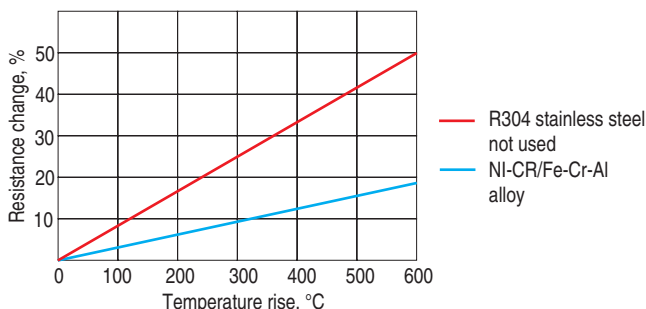
The DC link of an AC variable speed drive can absorb ca 3-5% of the regenerated braking power. Higher braking powers can be absorbed by a braking resistor connected across the DC link. The external braking resistor is switched On/Off by the drive braking module.



Energy generated by braking is absorbed into the resistor elements causing them to heat up. As the elements cool, the energy is dissipated.

Resistor Design

Cressall braking resistors are based on two types of resistor elements, HP Coils, spiral wirewound on ceramic former, and ZC Coils, edgewound coiled strip on ceramic former. Both elements offer high overload capacity and rapid cooling. The resistance material is Ni-Cr or Fe-Cr-Al alloys. The alloys have low changes in resistance over the temperature range, max 18%. Designs using



Resistance change over temperature range for different resistance materials. High resistance increases results in less effective braking.



Braking resistor for hoist application during final testing

R304 stainless steel can increase in resistance by as much as 50% resulting in less effective braking.

The enclosures are made of galvanized steel. HP and DBR Series enclosures are also available in stainless steel. Ingress protection is IP 20, HP and DBR Series can be equipped with an optional canopy to make IP 21.

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 drive applications the switching voltage is around 700 V, Cressall braking resistors can operate up to 1000 V.

Braking energy determined from the energy generated by each braking. If detailed information of the braking energy is not available, braking energy can be estimated as equal to

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

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

Duty cycle, number of brakings per time unit.

Thermal capacity

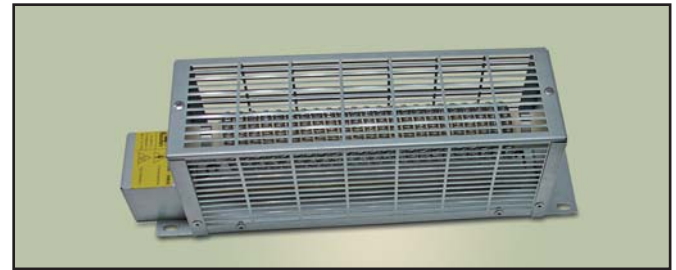
Extensive research and testing of individual resistor element make it possible to predict the temperature rise in the resistor for any application. Contact us for assistance.

ES Series, 0,6 - 4,5 kW Continuous

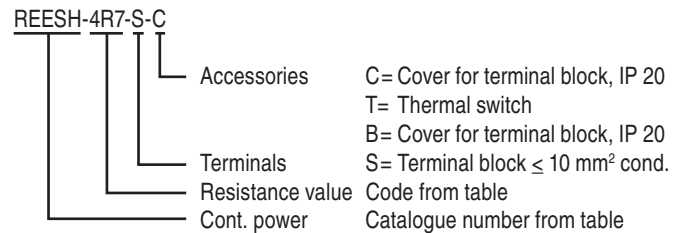
- Spiral wirewound resistor element on ceramic former
- Negligible audio noise
- Low inductance
- Temperature stable design, low increase of resistance value
- Optional thermal switch
- Terminal block mounted at one end of the enclosure, cover for terminal block, accessory, allow for ingress protection IP 20

Catalogue Numbers

Catalogue No.	Rated continuous power, kW					
	0,6	1	1,5	2	3	4,5
	REESH	REEST	REES1	REEST2	REES2	REES3
Resistance value, Ω	Code for resistance value - add to catalogue number					
3,9						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	10R	10R	10R
12	12R	12R	12R	12R	12R	12R
15	15R	15R	15R	15R	15R	15R
18	18R	18R	18R	18R	18R	18R
20	20R	20R	20R	20R	20R	20R
22	22R	22R	22R	22R	22R	22R
24	24R	24R	24R	24R	24R	24R
27	27R	27R	27R	27R	27R	27R
30	30R	30R	30R	30R	30R	30R
33	33R	33R	33R	33R	33R	33R
39	39R	39R	39R	39R	39R	39R
40	40R	40R	40R	40R	40R	40R
47	47R	47R	47R	47R	47R	47R
50	50R	50R	50R	50R	50R	50R
56	56R	56R	56R	56R	56R	56R
68	68R	68R	68R	68R	68R	68R
75	75R	75R	75R	75R	75R	75R
82	82R	82R	82R	82R	82R	82R
100	100R	100R	100R	100R	100R	100R
120	120R	120R	120R	120R	120R	120R
150	150R	150R	150R	150R	150R	150R
180		180R	180R	180R	180R	180R
220		220R	220R	220R	220R	220R
270		270R	270R	270R	270R	
330					330R	



A complete catalogue number is created as follows



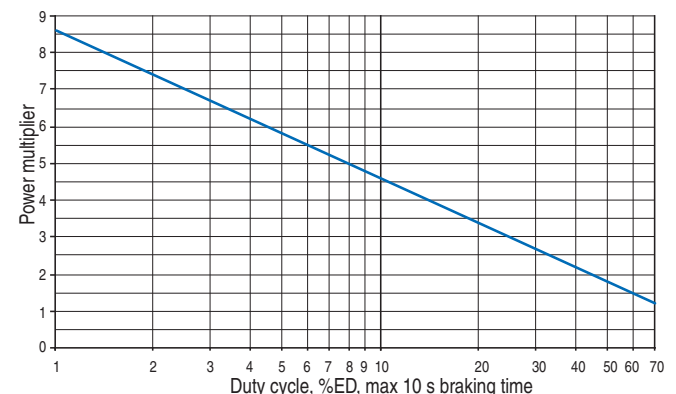
Examples

1,5 kW braking resistor, 10Ω with terminal block and terminal cover will be REES1-10R-S-B.

Duty Cycle

Continuous power rating can be exceeded when power is applied for less than 100% of the time. The graph below gives a duty cycle based on 10 s on time against a "power multiplier". Multiply the resistor's continuous power rating by the "power multiplier" number to calculate power. A derating factor of 0,8 should be applied to

- REESH (0,6 kW) resistors with resistance value $\geq 39 \Omega$
- REEST1 (1 kW) resistors with resistance value $\geq 68 \Omega$
- REES1 (1,5 kW) resistors with resistance value $\geq 100 \Omega$
- REEST2 (2 kW) resistors with resistance value $\geq 150 \Omega$
- REES2 (3 kW) resistors with resistance value $\geq 220 \Omega$



Example: 10 s in 100 s is defined as a 10% duty cycle, %ED, which gives a power factor of 4,6. REES1 braking resistors are rated 1,5 kW continuous and can be rated $1,5 \times 4,6 = 6,9 \text{ kW}$ for 10% ED. If resistance is $\geq 100 \Omega$, then the power rating is reduced to $6,9 \times 0,8 = 5,5 \text{ kW}$.

HP Series, 1,5 - 4,5 kW Continuous

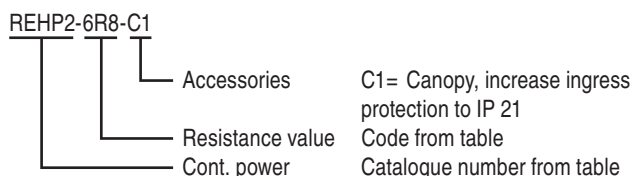
- Spiral wirewound resistor element on ceramic former
- Negligible audio noise
- Low inductance
- Temperature stable design, low increase of resistance value
- Thermal switch included as standard
- Canopy to make IP 21 available as an option

Catalogue Numbers

Catalogue No.	Rated continuous power, kW		
	1,5 REHP1	3 REHP2	4,5 REHP3
Resistance value, Ω	Code for resistance value - add to Cat. No.		
3,9			3R9
4,7		4R7	4R7
5,6		5R6	5R6
6,8		6R8	6R8
8,2		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
39	39R	39R	39R
40	40R	40R	40R
47	47R	47R	47R
50	50R	50R	50R
56	56R	56R	56R
68	68R	68R	68R
75	75R	75R	75R
82	82R	82R	82R
100	100R	100R	100R
120	120R	120R	120R
150	150R	150R	150R
180	180R	180R	180R
220	220R	220R	220R
270	270R	270R	
330		330R	



A complete catalogue number is created as follows



Examples:

1,5 kW braking resistor, 10 Ω will be REHP1-10R.

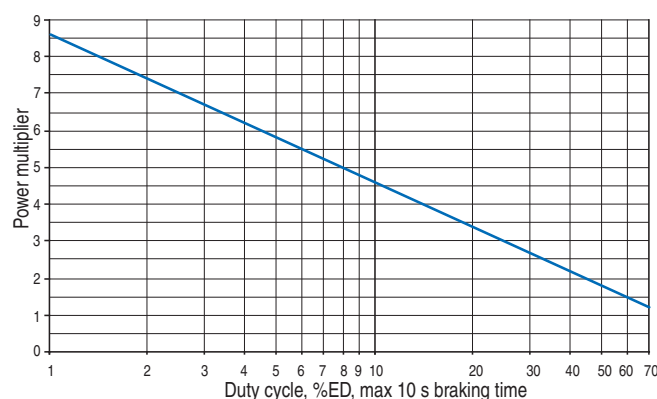
4,5 kW braking resistor, 6,8 Ω with canopy will be REHP3-6R8-C1.

Contact us for braking resistors with enclosures made of stainless steel.

Duty Cycle

Continuous power rating can be exceeded when power is applied for less than 100% of the time. The graph below gives a duty cycle based on 10 s on time against a "power multiplier". Multiply the resistor's continuous power rating by the "power multiplier" number to calculate power. A de-rating factor of 0,8 should be applied to

- REHP1 (1,5 kW) resistors with resistance value $\geq 100 \Omega$
- REHP2 (3 kW) resistors with resistance value $\geq 220 \Omega$



Example: 10 s in 100 s is defined as a 10% duty cycle, %ED, which gives a power factor of 4,6. REHP1 braking resistors are rated 1,5 kW continuous and can be rated $1,5 \times 4,6 = 6,9$ kW for 10% ED. If resistance is $\geq 100 \Omega$, then the power rating is reduced to $6,9 \times 0,8 = 5,5$ kW.

DBR Series, 6 - 18 kW Continuous

- Spiral wirewound or edgewound coiled strip resistor element on ceramic former
- Low inductance
- Temperature stable design, low increase of resistance value
- Thermal switch included as standard
- Versions with enclosure made of stainless steel
- Canopy to make IP 21 available as an option

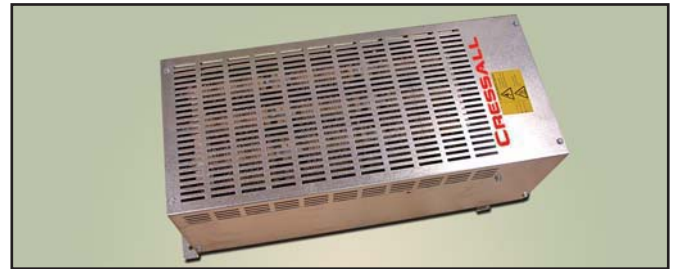
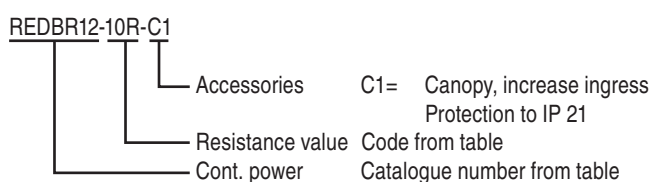
Catalogue Numbers

	Rated continuous power, kW			
	6	9	12	18
Catalogue No.	REDBR12	REDBR18	REDBR24	REDBR36

Resistance value, Ω Code for resistance value - add to Cat. No.

1,5				1R5
1,8				1R8
2,2				2R2
2,7				2R7
3,3	3R3	3R3	3R3	3R3
3,9	3R9	3R9	3R9	3R9
4,7	4R7	4R7	4R7	4R7
5,6	5R6	5R6	5R6	5R6
6,8	6R8	6R8	6R8	6R8
8,2	8R2	8R2	8R2	8R2
10	10R	10R	10R	10R
12	12R	12R	12R	12R
15	15R	15R	15R	15R
18	18R	18R	18R	18R
20	20R	20R	20R	20R
22	22R	22R	22R	22R
24	24R	24R	24R	24R
27	27R	27R	27R	
30	30R	30R	30R	
33	33R	33R	33R	
39	39R	39R		
40	40R	40R		
47	47R	47R		
50	50R	50R		
56	56R			
68	68R			
75	75R			
82	82R			
100	100R			

A complete catalogue number is created as follows



Examples

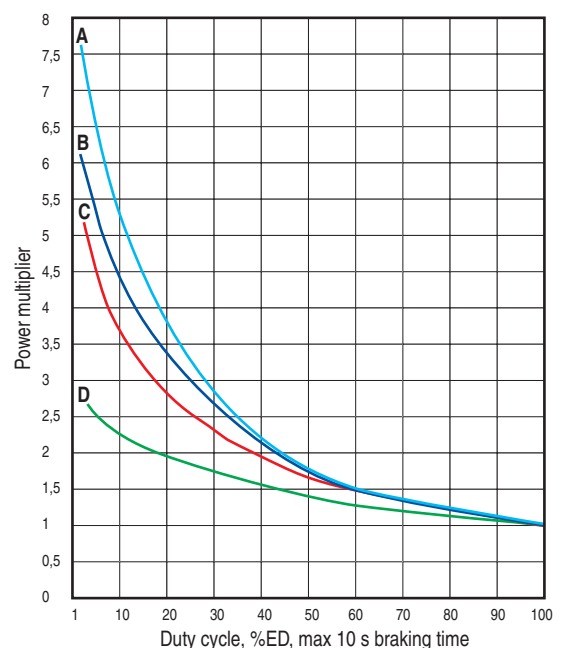
6 kW braking resistor, 10 Ω will be REDBR12-10R.

12 kW braking resistor, 6,8 Ω with canopy will be REDBR24-6R8-C1.

Contact us for braking resistors with enclosures made of stainless steel.

Duty Cycle

Continuous power rating can be exceeded when power is applied for less than 100% of the time. The graph below gives a duty cycle based on 10 s on time against a "power multiplier". Multiply the resistor's continuous power rating by the "power multiplier" number to calculate power.



Resistor type	Curve to be used	
REDBR12 (6 kW)	$\leq 5,6 \Omega$, curve B 14-22 Ω , curve B Others, curve D	6-12 Ω , curve A 24-30 Ω , curve C
REDBR18 (9 kW)	$\leq 6,8 \Omega$, curve B 20-30 Ω , curve B	7,5-18 Ω , curve A Others, curve D
REDBR24 (12 kW)	$\leq 3 \Omega$, curve B Others, curve B	3,2-24 Ω , curve A
REDBR36 (18 kW)	$\leq 4 \Omega$, curve A	Others, curve B

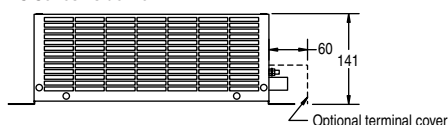
Example: 10 s in 100 s is defined as a 10% duty cycle, %ED, which gives a power factor of 4,4 with curve B. REDBR12 braking resistors are rated 6 kW continuous and can be rated $6 \times 4,4 = 26,4$ kW for 10% ED.

Technical Data

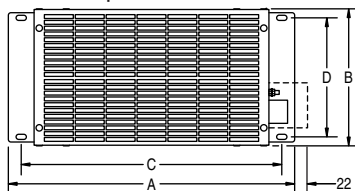
	ES-S/ES-P Series	HP Series	DBR Series
Resistor Data			
Design, resistor elements	Spiral wirewound on ceramic former	Spiral wirewound on ceramic former	Spiral wirewound/Edgewound coiled strip on ceramic former
Cooling	Naturally air cooled	Naturally air cooled	Naturally air cooled
Resistance material	Ni-Cr/Fe-Cr-Al alloys	Ni-Cr/Fe-Cr-Al alloys	Ni-Cr/Fe-Cr-Al alloys
Resistance change, 20-620°C	Ca +18%	Ca +18%	Ca +18%
Manufacturing tolerance, resistance value	0 - +5%	0 - +10%	0 - +10%
Temperature rise element/issuing air	Ca 600/200°C	Ca 600/200°C	Ca 600/200°C
Rated operating voltage	1000 V	1000 V	1000 V
Thermal switch			
Installed	Factory installed option	Yes	Yes
Temperature range, open/re-close	Ca 250/210°C	Ca 250/210°C	Ca 150/135°C
Rated voltage/current	250 VAC/7 A	250 VAC/7 A	250 VAC/7 A
Terminals			
Power terminals	Screw terminals max 10 mm ² conductor	Screw terminals max 10 mm ² conductor	M8 screw for cable lugs
Earth terminal	M4 screw for cable lug	M6 screw for cable lug	M6 screw for cable lug
Thermal switch	6,3 mm quick connectors	6,3 mm quick connectors	6,3 mm quick connectors
Enclosure			
Enclosure material	Steel, galvanized	Steel, galvanized	Steel, galvanized
Ingress protection, IEC 60529	Resistor compartment IP 20 Terminals, cable comp. IP 00, IP 20 with cover	IP 20, IP 21 with canopy IP 20, IP 21 with canopy	IP 20, IP 21 with canopy IP 20, IP 21 with canopy
Temperature rise, enclosure surface	Ca 200°C	Ca 200°C	Ca 200°C
Standard	CE, RoHC	CE, RoHC	CE, RoHC

Dimensions ES Series, mm

ES Series - side view



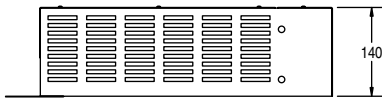
ES Series - top view



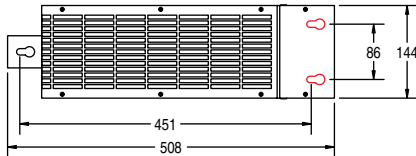
Power kW	Dimensions, mm				Weight kg/each
	A	B	C	D	
0,6	265	121	236	92	1,5
1	345	121	315	92	2
1,5	445	121	415	92	2,4
2	345	213	315	185	3,5
3	445	213	415	185	4,2
4,5	445	307	415	276	5,8

Dimensions HP-Series, mm

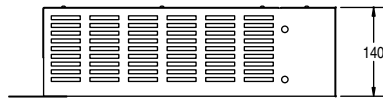
HP Series 1,5 kW - side view



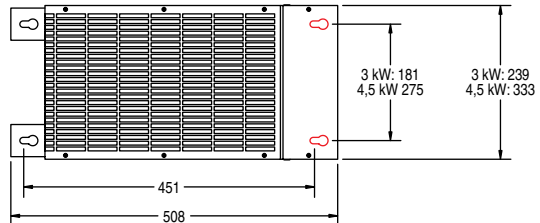
HP Series 1,5 kW - top view



HP Series 3-4,5 kW - side view



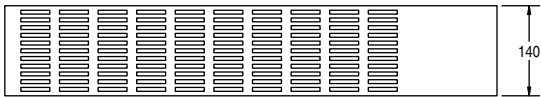
HP Series 3-4,5 kW - top view



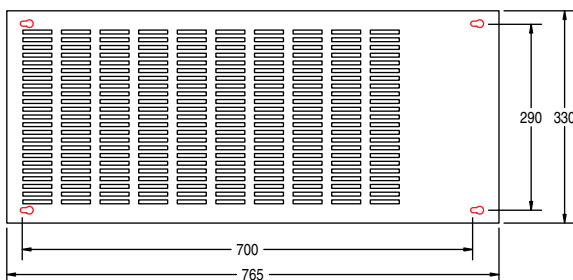
Contact us for dimensions on braking resistors with canopy installed
Weight/each: 1,5 kW: 4 kg, 3 kW: 6,9 kg, 4,5 kW: 9 kg

Dimensions DBR-Series, mm

DBR Series 6 kW - side view



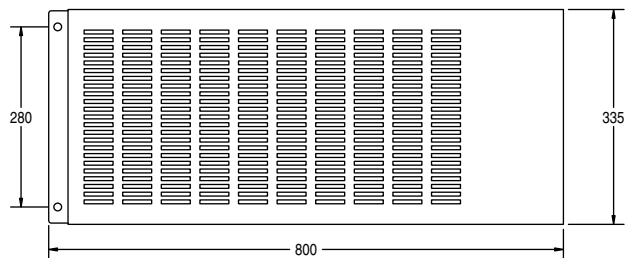
DBR Series 6 kW - top view



DBR Series 9-18 kW - side view



DBR Series 9-18 kW - top view



Contact us for dimensions on braking resistors with canopy installed
Weight/each: 6 kW: 16 kg, 9 kW: 25 kg, 12 kW: 28 kg, 18 kW: 35 kg

Installation Considerations

The braking resistors get hot in 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.



Correct mounting

ES, HP & DBR Series 6 kW

A: Horizontally, solid bottom down, best

B: Horizontally on side, best

C: Vertically, cable compartment down, good



Correct mounting

DBR Series 9 - 18 kW

A: Horizontally, bottom down

Braking resistors with canopy installed must be mounted horizontally.

Larger Braking Resistors

Cressall have the capacity to supply larger braking resistors based on standard design blocks with power ratings up to several megawatts. We offers

- Naturally air cooled or forced cooled designs
- Metal enclosed resistor elements
- Water cooled units
- Units for installation in hazardous locations
- Marine versions



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