



DANOTHERM™



The Medium and High Voltage Resistor Collection

- Resistors for MV and HV filter, NER and brake applications

- Natural air / forced air cooled and liquid cooled
- Suited for harsh environmental conditions
- From 1.9kV up to 72.5kV working voltage



DANOTHERM™

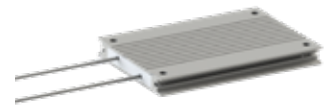
Welcome to the world of Medium and High Voltage resistors



WHHB



HVB



HCH



HVBS



WHB32



RB



PR



Load bank



NER

Content

Type	Power/Energy	Working Voltage	Dielectric strength	IP	Cooling	Page
PR	250-800W	5kVAC-5.2KVAC	7kV/12kV	IP00	heatsink	6
RB	100/250W	1.9kVAC / 2.3kVAC	5kV	IP00	heatsink	10
WHHB	25kW	4.7kVAC / 6.6kVDC	20kV	IP00/IP65	de-ionised water	13
WHBS	3-6kW	1.0-3.0kVAC	10kV	IP00/IP65	water cooled	14
HVB	150-570kJ	4.5kVAC / 6.4kVDC	10kV	IP65	natural air	15
HVBW	150-570kJ	4.5kVAC / 6.4kVDC	10kV	IP65	water cooled	16
HCV	500W	4.5kVAC / 6.4kVDC	10kV	IP00/IP65	natural air	17
Loadbank	10-1000kW	4.8-72.5kVAC		IP00-IP23	natural / forced air	20
Filter/NER	5-100kW	12-72.5kVAC		IP00-IP23	natural air	21
HVBS	850-3500W	3kVAC / 4.2kVDC	10kV	IP50/IP54	natural air	23
HVS	1600-4600W	3kVAC / 4.2kVDC	10kV	IP50/IP54	natural air	23
HCH	160-300W	1500VDC	4.5kV	IP50/IP65	natural air	25
NER	10-1000kJ	6-36kVAC		IP00-IP23	natural air	21

This brochure is the collection of all the High Voltage resistors that are designed and produced by Danotherm Resistor Division. The Resistor Division Group comprises of:



BACKER
FACSA



BACKER
REBA



Some HV resistor families are standard. You will find them with their references in this brochure. Other HV resistor families, like HV steel grid load banks, HV steel grid filter and HV Neutral Earthing Resistors are produced according customers specifications. For these families you find example images.

All resistors are tested on insulation resistance, dielectric withstand voltage and Ohm value. For any special test and or with very high voltage levels that do not fit within the scope of Danotherm's testing facility, it is possible to make use of an external lab.

The data in this brochure gives the basic information. For customized resistors out of these basic specifications, please contact us. We are experts in customizing and developing new solutions. For more information, please contact Danotherm at info@danotherm.dk

Whatever your request is, Danotherm Resistor Division will guide you to the optimum solution.



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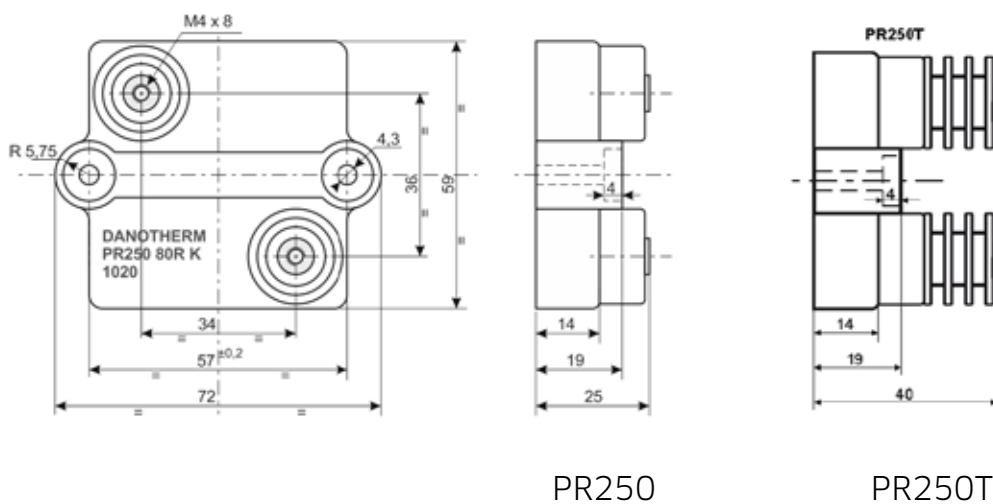


PR 250 / 600 / 800

General specifications PR250

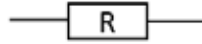
Type	remark	PR250	PR250T
Power rating	@ heatsink 100°C	250W	
Max power	not trimmed @ 70°C	500W	
Resistance range	E12	1R0 to 1M0 *	
Tolerance	standard	10%	
	optional	up to 1%	
Temperature coefficient		±100 ppm/K	
Max working voltage		5000 VAC	
Working temperature range		-55°C - +155°C	
Dielectric strength		7000VAC	12000VAC
Insulation resistance	@ 500V	> 10 ⁵ MΩ	
Creepage distance		42mm	65mm
Airgap distance		16mm	29mm
Partial discharge		< 10pC @ 5000VAC	
Self inductance		80nH	
Capacitance to heatsink	typical	120pF	
Overload	10s	4xP _n	
Thermal resistance		0.15K/W	
Thermal grease	required	> 1W/mK	
Heatsink flatness		0.05mm	
Heatsink surface finish		6.3µm	
Max torque for contacts		2Nm	
Max torque for mounting		2Nm	
Weight		100g	130g
Cable terminals	optional		

* For out of range or non-standard values, please contact Danotherm



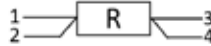
Configurations

PR250



PR250

PR251



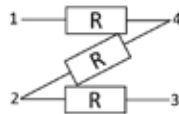
PR252



PR253



PR254



PR250T



PR251 - PR254

Heatsink calculation

PR resistors series must be mounted on a heatsink to take full advantage of the power capability. The maximum thermal resistance of the heatsink can be calculated by the following formula:

$$P = \frac{\Delta T}{R_{TH\ j-c} + R_{TH\ c-h} + R_{TH\ h-a}}$$

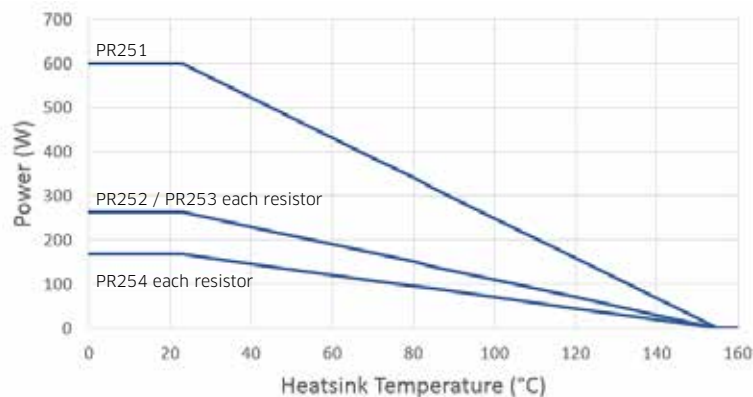
P is dissipated power in the resistor in Watts.

ΔT is the difference between maximum working temperature (155°C) and room temperature.

$R_{TH\ j-c}$ is the thermal resistance of the resistor between junction and case.
0.15K/W for PR250

$R_{TH\ c-h}$ is the thermal resistance between the base plate of the resistor and the heatsink. This value is determined by the thickness and the properties of the paste, and the surface area size. Recommended is a paste with conductivity of 1W/mK or better.

$R_{TH\ h-a}$ is the thermal resistance of the heatsink to ambient. This value is given by the manufacturer of the heatsink.



General specifications PR600 / PR800

Type	remark	PR600	PR600T	PR800	PR800T
Power rating	@ Bottom base 85°C	600W		800W	
Max power	consult Danotherm	700W		950W	
Resistance range	E12	1R0 to 1M0 *			
Tolerance	standard	10%			
	optional	up to 1%			
Temperature coefficient		±150 ppm/K			
Max working voltage		5000 VAC		5200VAC	
Working temperature range		-55°C - +155°C			
Dielectric strength		7000VAC	12000VAC	7000VAC	12000VAC
Insulation resistance	@ 500V	> 10 ⁵ MΩ			
Creepage distance		42mm	65mm	42mm	65mm
Airgap distance		16mm	29mm	16mm	29mm
Partial discharge		< 10pC @ 5000VAC			
Self inductance		80nH			
Parallel capacitance		40pF			
Capacitance to heatsink	typical	110pF		150pF	
Overload	10s	1kW			
Thermal resistance		0.115K/W		0.11K/W	
Thermal grease	required	> 1W/mK			
Heatsink flatness		0.05mm			
Heatsink surface finish		6.3µm			
Max torque for contacts		2Nm			
Max torque for mounting		2Nm			
Weight		95g	120g	100g	125

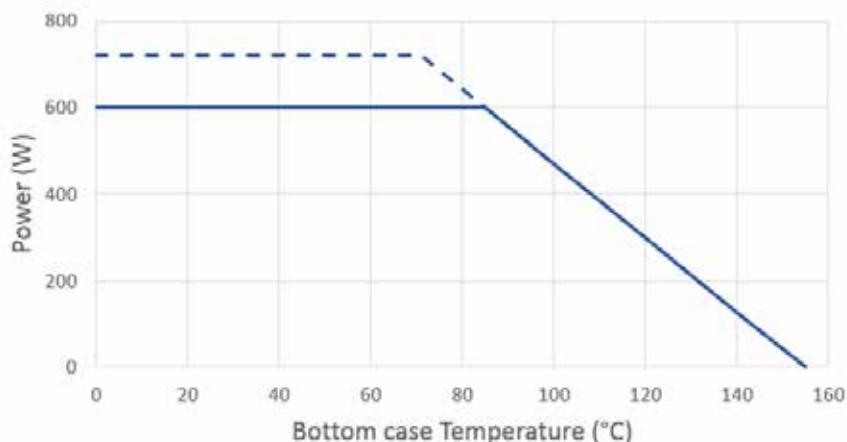
* For out of range or non-standard values, please contact Danotherm

Pulse load / overload capability.

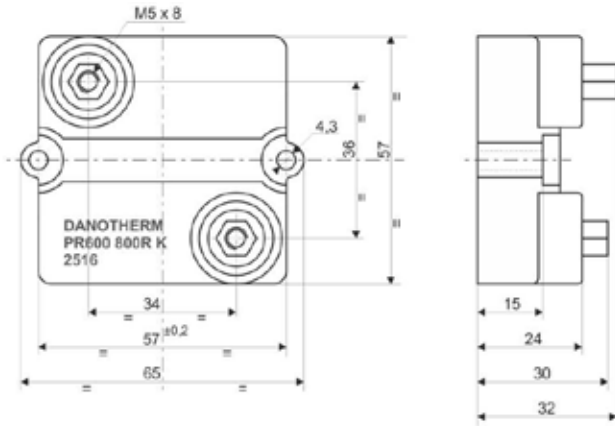
PR series resistors can be overloaded during a certain time. The energy the resistor can take is in relation to the duration of the overload. For repetitive overloads, a minimum cooldown time must be observed before the resistor can take another pulse load.

For high demands on overload capabilities, metal thick film versions are available. Please, contact Danotherm for additional options at info@danotherm.dk

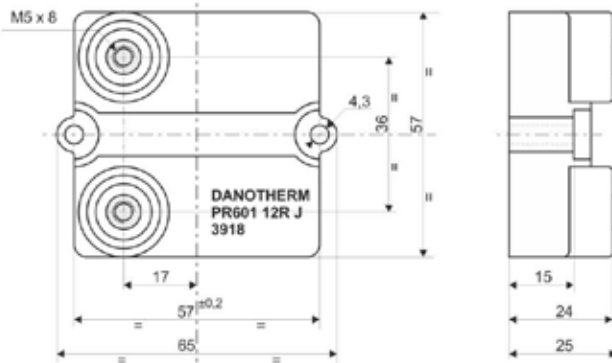
For each PR series, an energy-time graph is available and can be send to you on request. Please, contact the Danotherm sales office at info@danotherm.dk



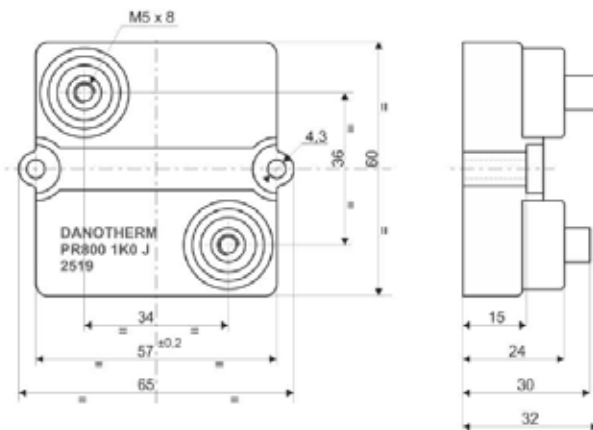
PR600 / PR601



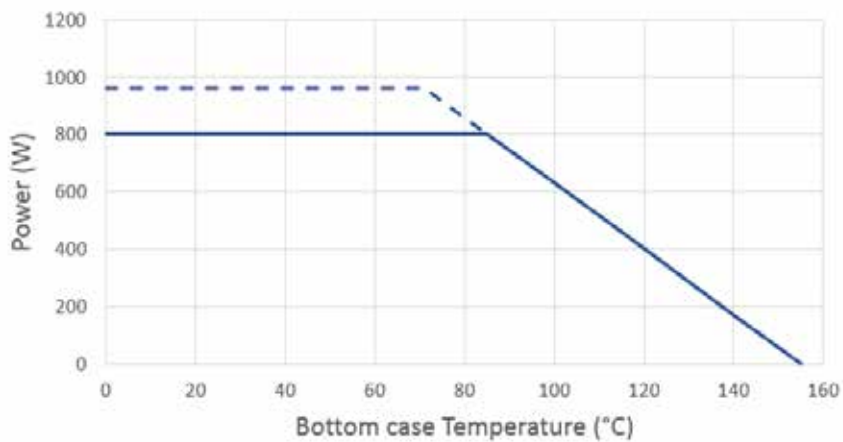
PR600



PR601



PR800

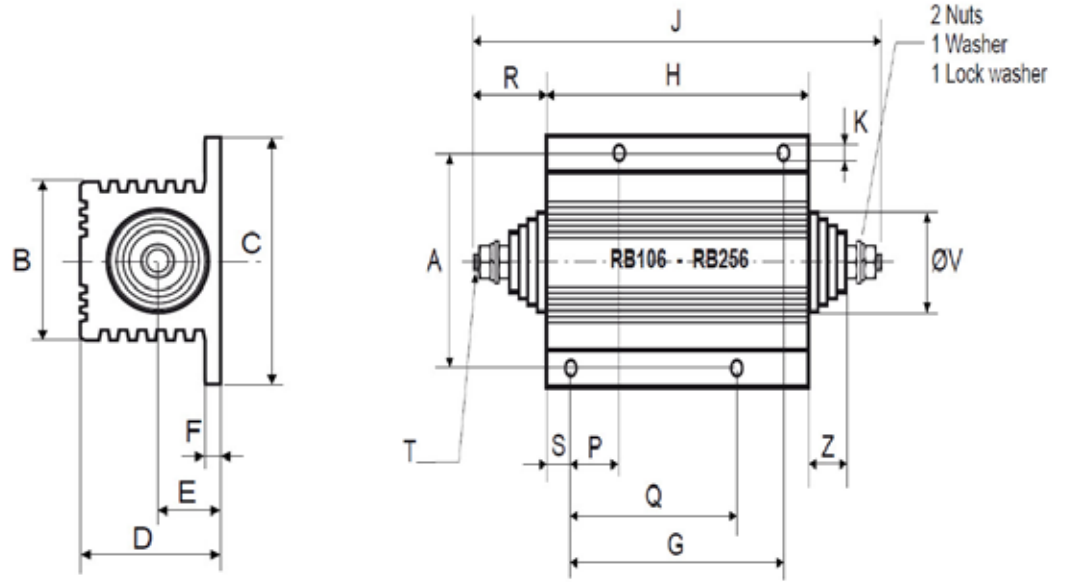


PR800

General specifications RB

Type	RB106	RB256
Ohm values, E24 series	10 11 12 13 15 16 18 20 22 24 27 30	
	33 36 39 43 47 51 56 62 68 75 82 91	
Inductivity	low inductive types with Ayton-Perry winding available	
Tolerance	±5%	
on request	up to ±1%	
Min. Ohm value	0.1	0.1
Max. Ohm value	70k	120k
Thermal drift		
- $0.1 < R < 1$	100 ppm/K	
- $1 < R < 20$	50 ppm/K	
- $R > 20$	30 ppm/K	
Insulation Resistance	> 10 GΩ	
- after moisture test	> 1 GΩ	
Large creepage distance	22mm	25mm
Working voltage	1900V	2300V
Dielectric strength VAC, 1 min, 50Hz	5000V	5000V
Nominal Power		
- with heatsink	100W	250W
- without heatsink	40W	100W
Overload	5xPn @ 5 s	
Operating temperature range	-55°C till + 250°C	
Derating	outside temperature range and/or with reduced heatsink	
Terminals		
- pull test	10 lb.	
- max torque	3Nm	4Nm
Soldarability	in accordance with method 208, MIL-STD-202	
Materials		
- core	ceramic steatite or alumina centerless ground	
- resistive wire	copper-nickel or nickel-chrome alloy	
- end caps	stainless steel	
- encapsulant	high temperature thermosetting compound	
- housing	anodised aluminium	
- standard terminals	stainless steel	
Weight	500g	900g

Type	A	B	C	D	E	F	G	H	J	K	P	Q	R	S	T	V	Z
RB106	57.1	46	71.5	44.5	20	5	69.8	89	139	4.8	-	-	25	9.6	M5	32	12
RB256	63.5	54	76	55.6	25.5	6.3	98.4	114	178	4.8	22.2	76.2	32	7.8	M6	32	16
Tol.	± 0.2	± 0.5	± 0.5	± 0.5	± 0.5	± 0.5	± 0.2	± 0.5	± 2	± 0.2	± 0.2	± 0.2	± 0.2	± 0.5	-	-	-



$$P_{max} = P_{nom} \cdot \left\{ 1 - \frac{T_{Heat\ sink} - T_{nom.\ Heat\ sink}}{250 - T_{nom.\ Heat\ sink}} \right\}$$



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WHHB / WHBS / HVB / HVBW / HCV

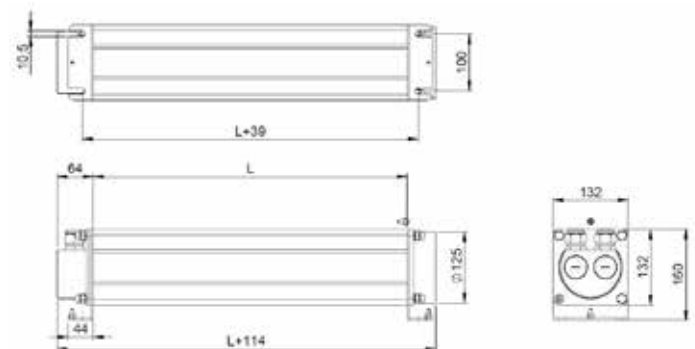
General specifications WHHB

Type		
Nominal power	standard	25 kW
Working voltage		4.7 kVAC / 6.6 kVDC
Dielectric strength @ 50Hz, 1 min.		20 kVAC
Resistance tolerance	standard	± 10%
	optional	± 5%
Max. current	50 mm ²	160 A
	250 mm ²	500 A
Protection degree		IP00 / IP65
Cooling fluid		Deionised water or deionised water-glycol
- Conductivity of fluid		≤ 2 µS/cm
- Maximum fluid inlet temperature		* 60 °C
- ΔT inlet/outlet (recommended)		≤ 15 K
- Pressure drop @ 30L/min.		≤ 0.5 bar
Materials		
- housing (not in contact with fluid)	standard	anodized aluminium
- resistor elements		nickel chrome alloy
Operating pressure		6 bar @ 55 °C
Test pressure		10 bar @ 20 °C

Dimensions WHHB with 50mm² connectors

Type	Power [kW]	L [mm]	Weight [kg]
WHHB 550	6 - 25	550	≈ 15

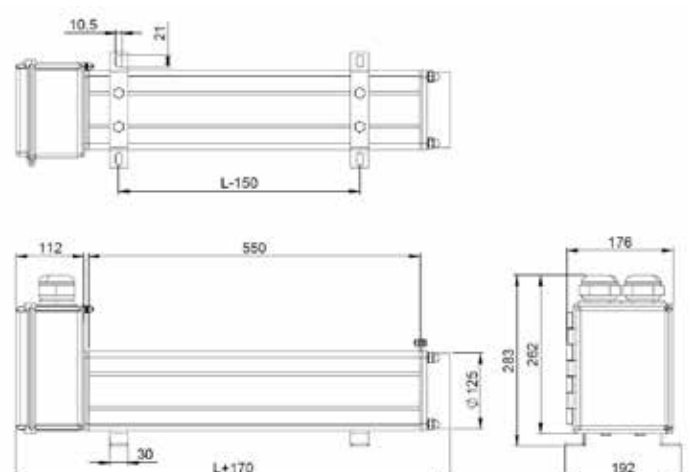
Ohmic range 1Ω - 200Ω



Dimensions WHHB with 250mm² connectors

Type	Power [kW]	L [mm]	Weight [kg]
WHHB 550	6 - 25	550	≈ 20

Ohmic range 45mΩ - 900mΩ

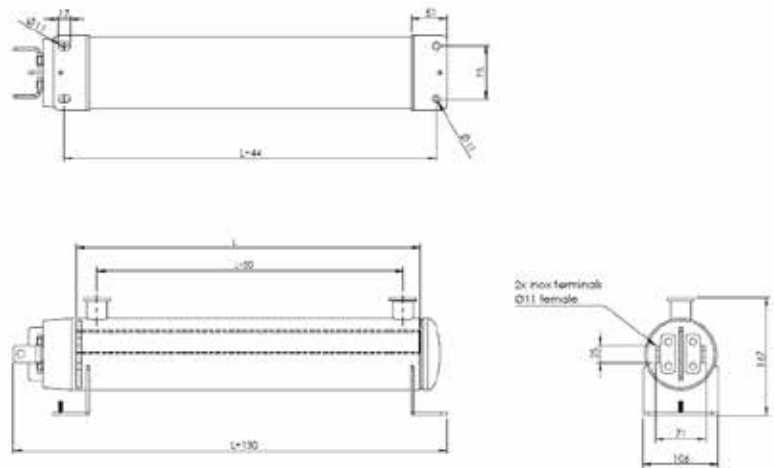


* depends on cooling fluid pressure and additives

General specifications WHBS

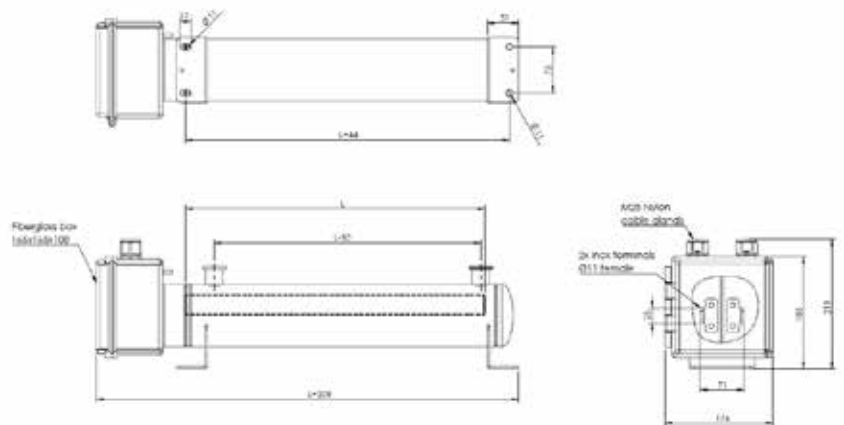
Nominal power		3 kW - 6 kW
Working voltage		1000 VAC - 3000 VAC
Dielectric strength @ 50Hz, 1 min.		10 kVAC
Insulation resistance @ 5000 VDC	dried condition	>> 20 MΩ
Overload @ 1s pulse / hour		20 x Pn (depends on Ω value)
Overload @ 5s pulse / hour		10 x Pn (depends on Ω value)
Resistance tolerance	standard	± 10%
	<i>optional</i>	± 5% / ± 3%
Time constant for heating up		60 s
Protection degree		IP00/IP65
Maximum liquid inlet temperature		*60 °C
ΔT inlet/outlet (recommended)		10 K - 20 K
Operating pressure		6 bar @ 55 °C
Test pressure		10 bar @ 20 °C
acc. EN 13445		16 bar @ 20 °C
Pressure drop @ 9L/min		0.5 bar
Cooling fluid		fresh water / water-glycol
Material (tank fully welded) EN15085	standard	AISI 304

Type	L	Weight
WHBS 32.4.485	485 mm	12 kg



Type	L	Weight
WHBS 32.4.485	485 mm	15 kg

with connection box



Type		
Energy rating 5s*	HVB 70.400.1	150 kJ - 285 kJ
	HVB 70.400.2	300 kJ - 570 kJ
Resistance tolerance		± 10%
temperature coefficient		100 ppm/K
Working voltage		4.5kVAC / 6.4kVDC
Dielectric strength @ 50 Hz, 1 min.		10 kVAC
Insulation resistance @ 5 kVDC	dried condition	>> 20 MΩ
Connection	standard	Radox cable 1000 mm
Protection degree		IP65
Cooling		natural air cooled
Material housing		anodised aluminum



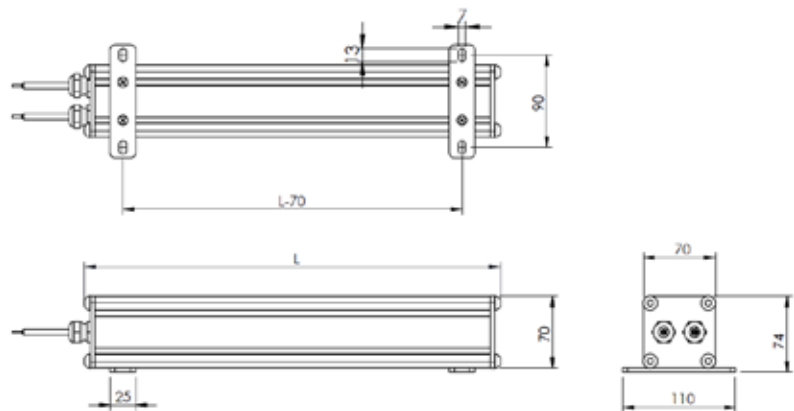
HVB 70.400.1



HVB 70.400.2

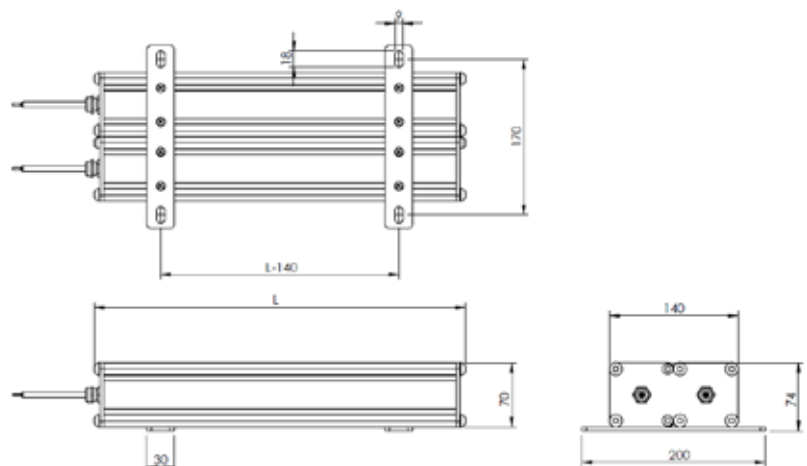
Dimensions HVB 70.400.1

Type	L	Weight
HVB 70.400.1	400 mm	4.5 kg



Dimensions HVB 70.400.2

Type	L	Weight
HVB 70.400.2	400 mm	9 kg



* depends on Ohmic value

General specifications HVBW

Type		
Energy rating 5s*	HVBW 70.400.1	150 kJ - 285 kJ
	HVBW 70.400.2	300 kJ - 570 kJ
Resistance tolerance		± 10%
temperature coefficient		100 ppm/K
Working voltage		4.5kVAC / 6.4kVDC
Dielectric strength @ 50 Hz, 1 min.		10 kV
Insulation resistance @ 5 kVDC	dried condition	≥20 MΩ
Connection	standard	Radox cable 1000 mm
Protection degree		IP65
Cooling		natural air cooled
Material housing		stainles steel AISI316L



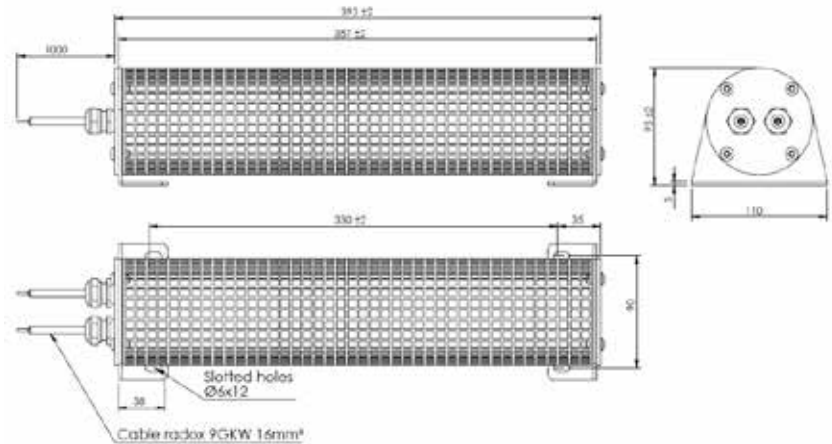
HVBW 70.400.1



HVBW 70.400.2

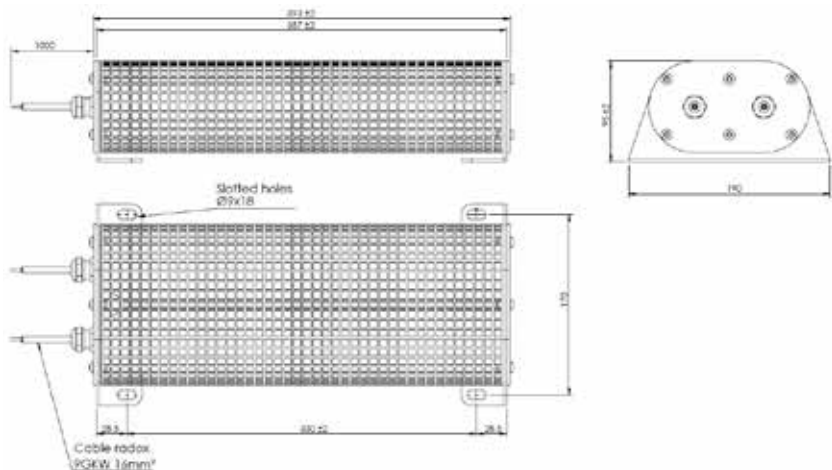
Dimensions HVBW 70.400.1

Type	L	Weight
HVBW 70.400.1	400 mm	4.5 kg



Dimensions HVBW 70.400.2

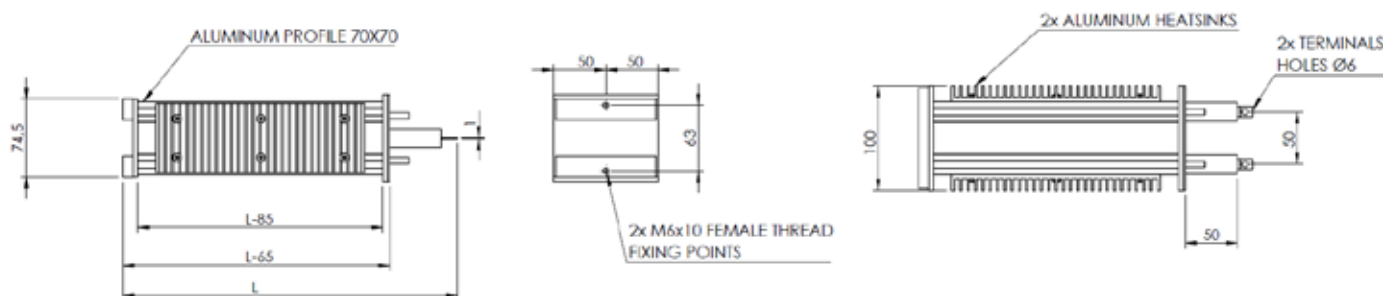
Type	L	Weight
HVBW 70.400.2	400 mm	9 kg



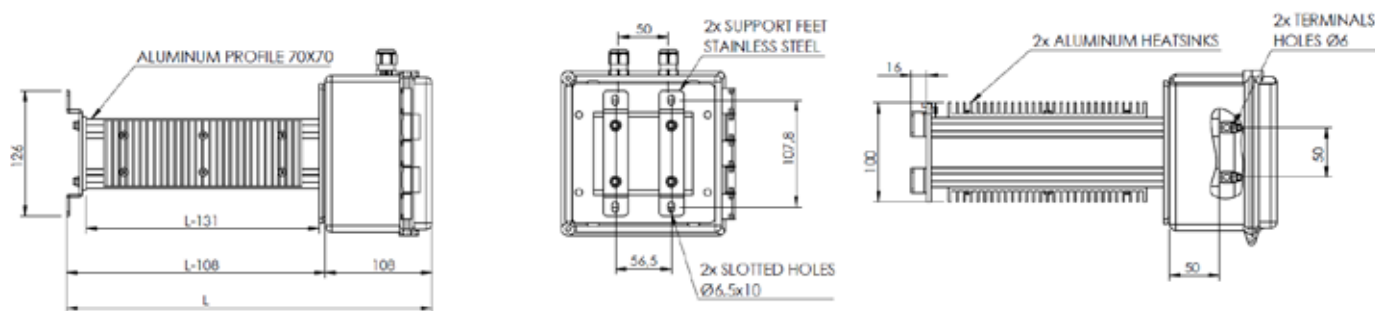
* depends on Ohmic value

Type		
Pnom		500W
Overload		40 - 80 x Pnom
Resistance tolerance		± 10%
temperature coefficient		100 ppm/K
Working voltage		4.5 VAC / 6.4 VDC
Dielectric strength @ 50 Hz, 1 min.		10 kV
Insulation resistance @ 5 kVDC	dried condition	≥20 MΩ
Connection	standard	Radox cable 1000 mm
Protection degree		IP00/IP65
Cooling		natural air cooled
Material housing		anidized aluminium / stainless steel AISI316L

Type	L	Weight
HCV 300 IP00	320 mm	4 kg

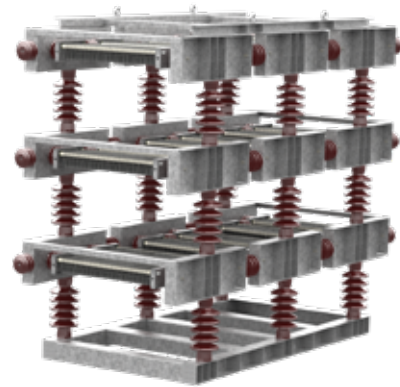


Type	L	Weight
HCV 300 B IP65	369 mm	6 kg





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HV Filter / NER / Load banks

General specifications	
Resistor active parts material	AISI 304 / AISI 310 / Cr-Al / AISI 430
Resistor tolerance	±10%, other on request
Connections	Cable / bushings
Thermal drift	depending on active material
IP rating	IP00 - IP54
Cabinet metal surface treatment	Galvanized or painted
Optional	current transformers, switches, contactors, (PLC) control systems.
Testing	Dielectric test

Routine testing	
Ohm value	Wheatstone bridge
Insulation resistance between enclosure and resistor	High Voltage tester
Dielectric test 50Hz / 1 min, IEC 60298:1990	High Voltage tester
Inductance value	
metal surface thickness of galvanization	
Dimensional check	

Directives	
IEEE 32-1972	Terminology and testing of NER
EDF HN 64-S-50	French standard for NER
IEC 60071-1	Insulation coordination
IEC 60529	Ingress Protection
CIGRE WG 14.30 section 17	Filter resistors
IEE std C57.32-2015	Derating altitude



HV Loadbanks

Type	
Working voltage / system voltage	4.8-72.5kV
Power range	10-1000kW
Ingress protection	IP00 / IP13 / IP20 / IP23
Cooling	natural air / forced air

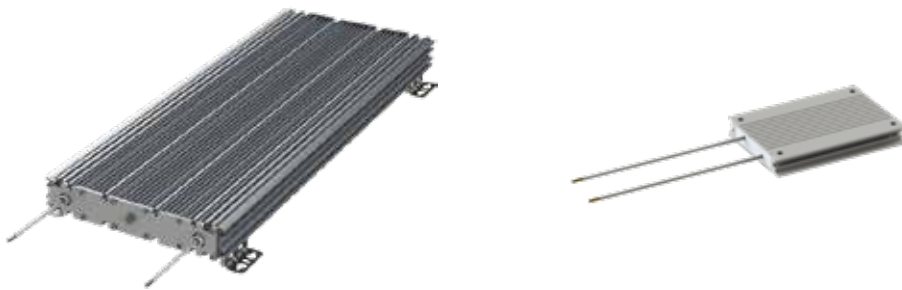


Each HV resistor is customized. Shown images are only illustrative.

Filters and Neutral Earthing Resistors

Type	FRC	NER
Working voltage / system voltage	12 / 17.5 / 24 / 36 / 52 / 72.5	6 / 12 / 17.5 / 24 / 36 kV
Power range		
Ohm range		
Dielectric strength		
BIL (Basic Insulation Level)		
Ingress protection	IP00 / IP13 / IP20 / IP23	
Cooling	natural air	





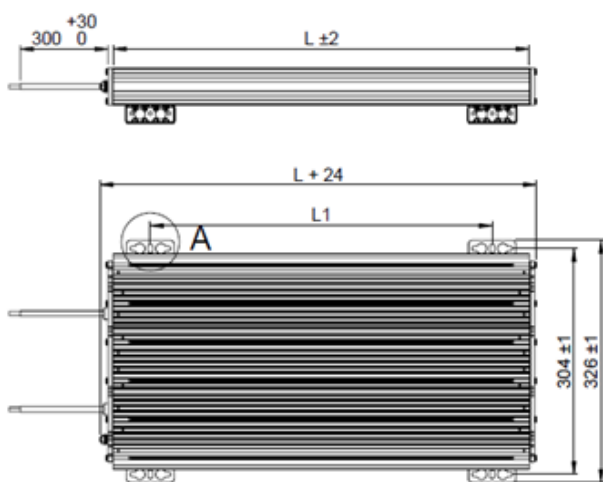
HVS / HVBS / HCH

Overload capability HVBS / HVS

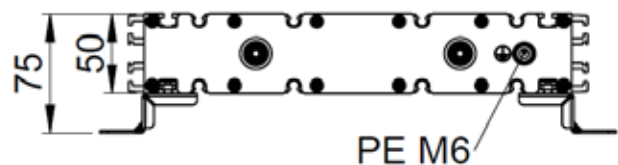
		One single square pulse each 1800s							
Type	duty 5 seconds kW	Max temp °C	duty 10 seconds kW	Max temp °C	duty 20 seconds kW	Max temp °C	duty 40 seconds kW	Max temp °C	
HVBS 300 15R	22.4	60	15.4	65	11	75	8	90	
HVBS 370 12R	41.3	65	27.8	75	19.3	85	13.9	110	
HVBS 440 10R	66	70	43.6	80	29.3	95	20.6	120	
HVBS 520 8R0	81	75	54	85	37.1	100	26.6	130	
HVBS 620 6R0	120	80	77	90	51	110	35.8	130	
HVBS 720 5R0	155	80	98	90	65	110	45.1	140	
HVBS 820 4R0	185	85	115	95	77	110	53	140	
HVBS 920 3R5	270	95	165	110	105	120	69	150	
HVBS 1000 3R0	300	95	180	110	115	130	77	150	
Type	One single triangular pulse each 1800s								
HVBS 300 15R	48	60	33	65	23	75	16	95	
HVBS 370 12R	88	65	59	75	41	90	29	110	
HVBS 440 10R	145	75	93	85	62	100	43	120	
HVBS 520 8R0	175	75	115	85	77	100	54	130	
HVBS 620 6R0	255	80	165	90	110	110	74	140	
HVBS 720 5R0	330	85	210	95	135	110	94	140	
HVBS 820 4R0	400	85	250	95	160	120	110	140	
HVBS 920 3R5	570	100	350	110	220	130	145	160	
HVBS 1000 3R0	640	100	390	110	245	130	160	160	
Type	One single square pulse each 1800s								
	duty 5 seconds kW	Max temp °C	duty 10 seconds kW	Max temp °C	duty 20 seconds kW	Max temp °C	duty 40 seconds kW	Max temp °C	
HVS 360 9R0	65	75	39	85	24	95	16	115	
HVS 430 8R0	85	75	50	85	33	95	22	115	
HVS 490 7R0	120	80	70	90	44	100	29	125	
HVS 590 6R0	170	85	100	95	60	105	40	125	
HVS 690 5R0	295	100	165	110	95	120	60	140	
HVS 790 4R0	315	85	180	90	105	100	65	115	
HVS 890 3R5	450	105	250	110	145	120	90	140	
HVS 990 3R0	600	110	330	120	185	130	110	145	
Type	One single triangular pulse each 1800s								
HVS 360 9R0	135	80	85	90	50	100	34	120	
HVS 430 8R0	180	80	110	85	70	100	46	120	
HVS 490 7R0	255	85	150	95	95	105	60	125	
HVS 590 6R0	360	90	210	95	130	110	85	130	
HVS 690 5R0	615	105	350	115	205	125	125	145	
HVS 790 4R0	660	90	380	95	225	105	140	120	
HVS 890 3R5	935	105	525	115	305	125	185	145	
HVS 990 3R0	1250	115	690	120	395	135	235	155	

General specifications HVBS/HVS

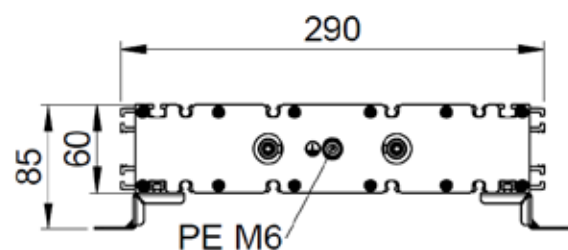
Temperature coefficient:		100 ppm/K
Dielectric strength	HVBS	7000 VAC @ 1 minute
	HVS	10000 VAC @ 1 minute
Insulation resistance:		> 20MΩ
Overload: @ 1 sec pulse / hour		70 - 250 x (depending on resistor)
Overload: @ 5 sec pulse / hour		20 - 60 x (depending on resistor)
Environmental:		- 40 °C / +70 °C
De-rating cable version		Linear: 40°C = Pn to 70°C = 0.85 * Pn
De-rating vertical mounting		no de-rating
De-rating horizontal mounting		0.8 * Pn
De-rating at high altitudes	1000 m	no de-rating
	1500 m	0.94 * Pn
	3000 m	0.82 * Pn
Mounting instructions		It is recommended to keep a distance of 200mm to the nearest object to prevent heating of a neighboring component.
		If two or more brake resistors are mounted next to each other the distance between these should be 400mm. If this is less then the nominal power needs to be de-rated.
Cooling		The nominal power of the resistors refers to cooling conditions with Free Natural Air Cooling.
Vibration		Acc. To EN 60068-2-6 frequency range 1 - 100Hz Acceleration / Amplitude
	1 - 13 Hz	± 1mm
	13 - 100 Hz	@ ± 0.7G
Corrosive resistance		Acc. IEC 60721-3-3/3K3 (C2 medium) 200 hours cyclic salt mist IEC 60068-2-52
Connection recommendations		To minimize EMC interference screened cables are recommended. in particular with any PWM brake pattern.
Resistance tolerance		± 10% (optional 5%)
Working voltage		3000VAC/4200VDC
Time constant for heating up resistor		1000-3000s



HVBS / HVS



HVBS



HVS

General specifications HCH

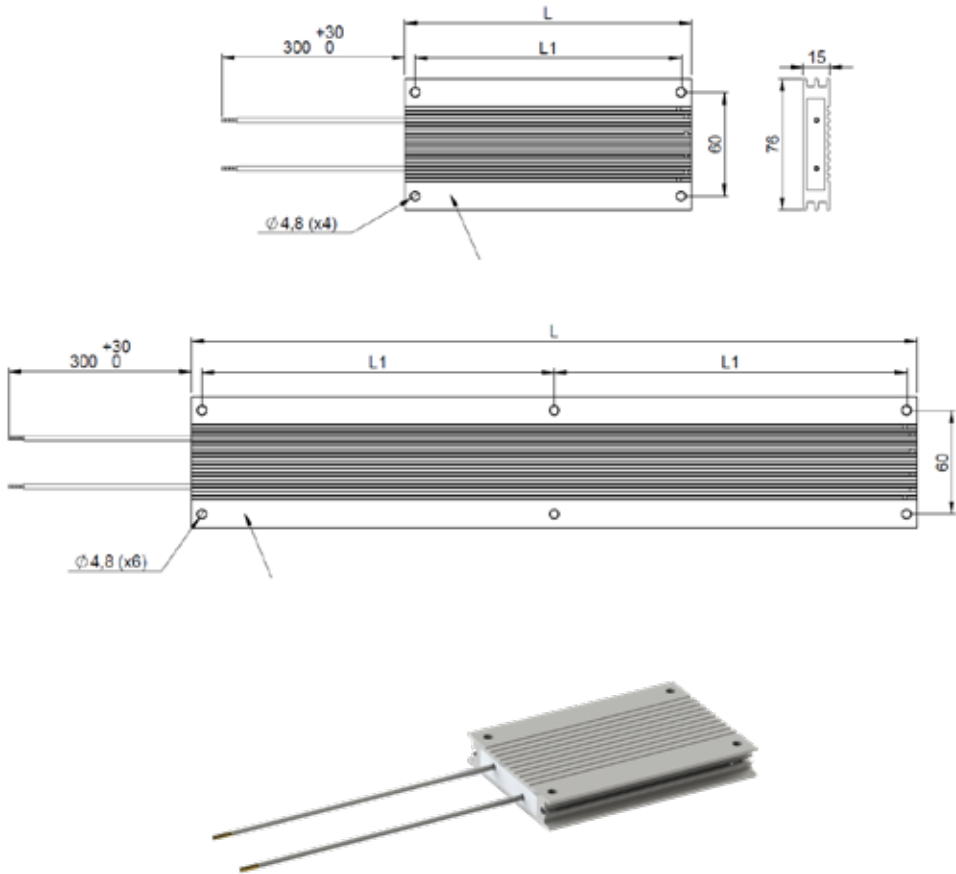
Type	P _{nom} [W]	Ohmic range [Ω]	Weight [g]	Inductivity [μH]	L ± 2mm	L1 ± 0.5mm
HCH 166	160	25-400	350	3 - 20	166	154
HCH 201	185	30-600	470	4 - 35	201	154
HCH 270	260	45-850	620	5 - 45	270	258
HCH 320	300	55-1000	790	6 - 50	320	2x154

Temperature coefficient:		100 ppm/K
Dielectric strength		4500 VAC @ 1 minute
Insulation resistance:		> 1000MΩ
Overload: @ 1 sec pulse / 120s		50 - 65 x (depending on resistor)
Overload: @ 5 sec pulse / 120s		20 - 25 x (depending on resistor)
Environmental:		- 40 °C / +70 °C
De-rating cable version		Linear: 40°C = P _n to 70°C = 0.85 * P _n
De-rating vertical mounting		no de-rating
De-rating horizontal mounting		0.8 * P _n
De-rating at high altitudes	1000 m	no de-rating
	1500 m	0.94 * P _n
	3000 m	0.82 * P _n
Mounting instructions		It is recommended to keep a distance of 200mm to the nearest object to prevent heating of a neighboring component.
		If two or more brake resistors are mounted next to each other the distance between these should be 400mm. If this is less then the nominal power needs to be de-rated.
Cooling		The nominal power of the resistors refers to cooling conditions with Free Natural Air Cooling.
IP rating		IP50 - IP65
Cable		AWG14, 20kV, 250°C
Vibration		Acc. To EN 60068-2-6 frequency range 1 - 100Hz Acceleration / Amplitude
	1 - 13 Hz	± 1mm
	13 - 100 Hz	@ ± 0.7G
Corrosive resistance		Acc. IEC 60721-3-3/3K3 (C2 medium) 200 hours cyclic salt mist IEC 60068-2-52
Connection recommendations		To minimize EMC interference screened cables are recommended. in particular with any PWM brake pattern.
Resistance tolerance		± 10% (optional 5%)
Working voltage		1500VDC
Time constant for heating up resistor		1000s

Type	Square pulse each 120s				
	duty 1 seconds [kW]	duty 5 seconds [kW]	duty 10 seconds [kW]	duty 20 seconds [kW]	duty 40 seconds [kW]
HCH 166 C 001 25R	5	2.4	1.7	0.9	0.45
HCH 201 C 001 30R	6	3	2.1	1	0.55
HCH 270 C 001 45R	8.8	4.3	3	1.5	0.75
HCH 320 C 001 55R	10.8	5.3	3.5	1.7	0.89

Type	e-curve pulse each 120s				
	Tau 1 second [kW]	Tau 5 seconds [kW]	Tau 10 seconds [kW]	Tau 20 seconds [kW]	Tau 40 seconds [kW]
HCH 166 C 001 25R	11.4	4.8	3.4	1.8	0.95
HCH 201 C 001 30R	13.7	5.8	4.2	2.2	1
HCH 270 C 001 45R	20	8.6	6	3	1.5
HCH 320 C 001 55R	24.7	10.4	7.1	3.5	1.8

Pulse load table.
HCH is ideally suited for capacitor charge applications.



$$p(t) = P_{max} \cdot e^{-2t/\tau} \qquad E = \frac{\tau}{2} \cdot P_{max} \qquad \tau = R \cdot C$$

Overview of the ALPHA resistor family (IP00-IP65)



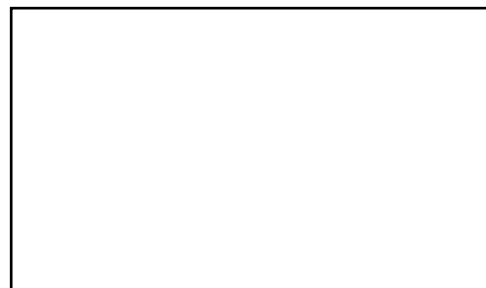
Power: 60-410W	Power: 85W - 1.7kW	Power: 410W - 12kW	Power: 445W-15kW	Power: 860W-25kW
	9-150kJ @5s	25-550kJ @5s	80kJ-2.5MJ @5s	6.4kJ-1.1MJ @5s
- Applications	- Applications	- Applications	- Applications	- Applications
Charge / Discharge	High Pulse load	High Pulse load	High Pulse load	Short recovery time
Brake	Brake	Brake	Brake	Brake
Filter	Filter	Filter	Medium voltage	Filter
Charge / Discharge	Charge / High Pulse	Charge / High Pulse	Charge / High Pulse	High Pulse

Other resistor types from Danotherm (IP00-IP65)



Multi purpose	Outdoor & Marine	Filter	Medium & HV	Filter & load
Power: 100W-5kW	Power: 1-500kW	Power: 4-200kW	Power: 500W->	Power: 5kW-1.5MW
Ceramic wirewound	Steel tube	Wirewound	Steel grid	Steel tube

Official Danotherm dealer



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 05OCT2022