CVS

Compact Alpha Power Resistor

110kW - 620kW

(550kJ - 3.1MJ) / body case style

5/1800s pulse load

The CVS-H resistors with optional **integrated thermal supervision** from the Danotherm high power range of **ALUMINIUM-HOUSED COMPACT BRAKE ALPHA RESISTORS** are electrically insulated compact resistors. They can easily be fitted into compact constructions and are especially designed to withstand high pulse-loads. The aluminium construction ensures that surface temperatures are kept low (see Table 3) such that any accumulated dust will not burn and trigger smoke alarms.

Steady-state power ratings range from **1575W** to **4350W** per body case style and up to 20 bodies can be combined in one unit. The pulse-load capability is up to 600 times the nominal power for a duty cycle of one second per hour, depending on the ohmic value and resistor wire, which allows several MWs of pulse-load to be absorbed. CVS resistors have thermal time-constants of about one hour.

CVS type resistors are ideally suited for high pulse load applications like **Low Voltage Ride Through - LVRT** as Energy Dump Resistors for **Wind Turbine** applications and emergency brake resistors for (Organic Rankine Cycle) Turbines.

Danotherm has developed **thermal models** for all resistor types and resistor values which allow the prediction of temperature rise of both the internal resistor wire and the housing surface for all possible load profiles. This simulation capability is part of Danotherm's applications support to help customers find the optimum solution for their designs.

CVS resistors are optionally available with different terminal boxes for various cable sizes and from IP20 to IP54 and in special cases, to IP65. Special data-sheets are available on request.

DAN EN15.5021R0
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Construction

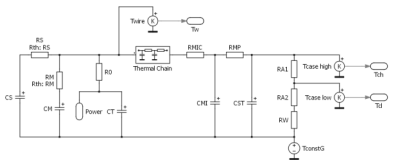
The resistors are designed as follows:
The resistor elements are made with helix-wound wire elements mounted in special ceramic fixtures. The outer housing is an extruded aluminium case, electrically insulated with micanite sheets on all inner surfaces. The resistor elements are fixed symmetrically in the housing by ceramic insulators which ensures symmetric expansion of the resistors and a maximal surge-withstand capability. Aluminium housings with fixed resistor elements are filled with Al_2O_3 or SiO_2. This ensures a minimal change of resistor surface-temperature even at maximal pulse rating (minimized temperature cycles). Standard cables are 300 mm AWG 10 – AWG 4, 1000V but non-standard cables (different types, lengths, connectors …) can also be supplied, on request.

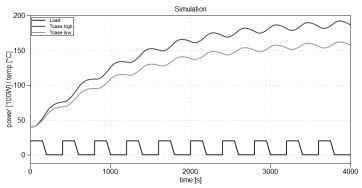
Accessories

The resistor can be customized with respect to the following features: connection style (open terminals or connection box), IP class, horizontal or vertical mounting, thermal supervision (a PT-100 temperature sensor or NC thermal switch) can be fitted, in which case the maximal surface-temperature near the cables will be 200°C.

Thermal simulations

A power-time graph of the application is the start for each resistor selection which Danotherm inputs to thermal simulation models. The CVS Compact Alpha Power Resistor has a very high pulse-load capability for 1 second, up to 600 times the steady-state load power (depending on resistor type and ohmic value). This makes the CVS ideal for high pulse-load application like LVRT (Low Voltage Ride Through) and other high load-dumps from drives applications. Danotherm uses sophisticated simulation models that predict the behaviour of the power resistors under any given load conditions. This shortens the user's design-time and ensures the highest reliability because the resistor can be customized to the exact application requirements.





Pn [W] @ 40°C According UL508						
CBS-BH(T)-XXX	1 case housing Pn [W] @ 40°C According UL508 Max surface 250°C no TS	R [Ω] min - max ± 10%	1 case housing Max surface temp 190 °C TS	2 case housings Max surface temp 250 °C no TS	3 case housings Max surface temp 250 °C no TS	4 case housings Max surface temp 250 °C no TS
CVS 330	1575	70 mR - 6R	1140			
CVS 400	1995	90 mR - 8R	1390	3070	4560	5830
CVS 460	2310	110 mR - 10R	1600	3540	5250	6820
CVS 560	2830	150 mR - 13R	1940	4290	6350	8400
CVS 660	3250	180 mR - 16R	2290	5050	7450	9550
CVS 760	3670	220 mR - 20R	2790	6160	8900	11500
CVS 860	4040	260 mR - 23R	3210	7080	10500	13650
CVS 960	4350	290 mR - 26R	3590	7950	11750	14700

General specifications		
Temperature Coefficient:		< ± 100 ppm
Dielectric strength	standard	3500 VAC @ 1 minute
Working voltage	standard	1000 VAC / 1400 VDC
Isolation Resistance:		> 20 MΩ / profile
Overload:@ 1 sec pulse / hour		400 - 800 x (depending on resistor)
Overload:@ 5 sec pulse / hour		100 - 150 x (depending on resistor)
Environmental:		- 40 °C - 70 °C
De-rating:		Linear: 40 °C = Pn to 70 °C = 0,75 * Pn
Thermal switch (optional)		130 / 160 / 180 / 200 °C, 2A, 250 VAC NC
Resistance tolerance		± 10%
Working voltage	cable version	UL: 1000VAC. IEC: 1000VAC / 1400VDC
	conn. Box	UL: 600VAC. IEC: 690VAC / 1100VDC
Time constant for heating up resistor		2000 - 4000s
Thermo watch (optional)	Thermal switch	130 / 160 / 180 / 200 °C. 2A. 250 VAC NC
Minimum measuring voltage		2V
Minimum measuring current		10mA
Insulation resistance		> 20MΩ / body
Rated current / voltage		2.5A @ 250 VAC cos φ=1
Dielectric voltage		2500VAC

Table 1

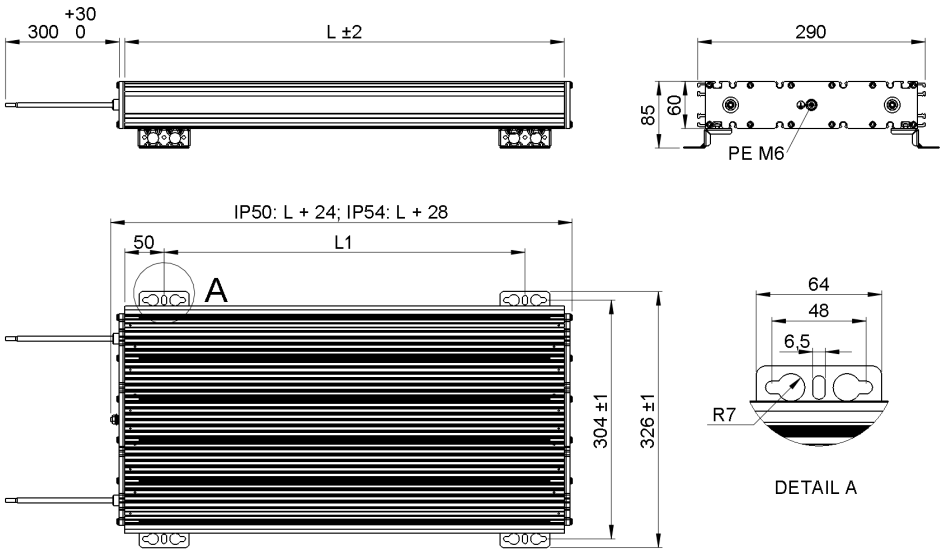


Table 2

CVS-H 400 CH(T) 22R 2 8 1

Last digits XXX > 400: Customer specified version, otherwise:
Number of bodies **1**, **2** or **3**
Thermal switch temperature: **3**=80°C; **4**=100°C; **5**=130°C; **6**=160°C; **7**=180°C; **8**=200°C; 9=PT100
0=cable connection; **2**=connection box
Ohm value (Examples: 0R08 = 0.08 Ω, 0R2 = 0.2 Ω, 2R2 = 2.2 Ω, 12R = 12 Ω
T = Thermal switch (NC)
Wire element (t.b.d. by Danotherm) **E** = parallel, **H** = series, **N** = 2S3P
Connector; Box: **0** = IP00; **D** = IP20; **B** = IP65, **C** = cable version
Length of resistor body in mm. (210, 260, 330, 400, 460, 560, 660, 760, 860, 960)
H = Horizontal mounting feet, **V** = Vertical mounting feet

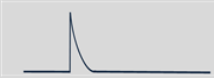
CVS	One single pulse each 1800 seconds									
	P 1 second [kW]	Max surface temp.	P 5 seconds [kW]	Max surface temp.	P 10 seconds [kW]	Max surface temp.	P 20 seconds [kW]	Max surface temp.	P 40 seconds [kW]	Max surface temp.
330	508	100	111	105	62	110	36	125	23	145
400	669	105	146	110	81	120	48	130	30	155
460	893	115	193	120	106	130	62	140	38	165
560	1479	140	312	145	168	155	93	170	55	190
660	1879	150	396	155	212	165	118	175	70	200
760	2366	155	494	160	263	170	146	185	85	210
860	2426	145	512	150	274	160	154	175	91	200
960	2959	155	624	165	332	170	185	185	109	210
	P 1 second [kW]	Max surface temp.	P 5 seconds [kW]	Max surface temp.	P 10 seconds [kW]	Max surface temp.	P 20 seconds [kW]	Max surface temp.	P 40 seconds [kW]	Max surface temp.
330	1023	100	228	105	128	115	76	130	47	150
400	1339	105	298	110	168	120	100	135	62	160
460	1792	115	392	120	220	130	129	145	80	170
560	2963	140	631	150	345	160	195	175	116	200
660	3760	150	801	155	435	165	246	185	146	210
760	4696	155	991	160	542	175	305	190	179	220
860	4822	145	1026	150	561	160	320	180	193	210
960	5942	160	1253	165	681	175	385	195	229	220
Single pulse e-curve, peak power	$p(t) = P_{max} . e^{-t/\tau}$				$E = \tau . P_{max}$		$\tau = \frac{R.C}{2}$			
	τ = 1 second [kW]	Max surface temp.	τ = 5 second [kW]	Max surface temp.	τ = 10 second [kW]	Max surface temp.	τ = 20 second [kW]	Max surface temp.	τ = 40 second [kW]	Max surface temp.
330	569	105	151	130	91	145	57	175	37	210
400	748	110	199	135	121	155	76	185	49	230
460	989	120	259	145	155	170	96	200	62	240
560	1588	150	397	175	231	200	139	230	87	280
660	2023	160	498	185	290	210	174	240	108	290
760	2524	165	621	195	357	220	212	250	131	300
860	2611	155	653	180	380	200	230	240	144	290
960	3156	165	789	195	456	220	271	250	169	310

Table 3

Pulse-load

The ability to withstand pulse-loads varies with resistor size and length and diameter of the internal resistor wire. As such, it is impossible to create standard graphs that would apply for most customers' applications. In some cases, the load-profile will be the combination of a square and a triangular pulse, such as is the case with Low Voltage Ride Through (LVRT) and Emergency Brake situations, as encountered in the Wind Power industry.

On request, Danotherm performs simulations based on the actual application and for guidance, has produced tables for various load-profiles for resistors with standard wire (but these are only examples). The table shown above is based on a 2.6 ohm resistor with standard wire thickness. Depending on the application, resistor construction can be adapted to optimally match the application.
In the table above, the peak power during 1 to 40 seconds duty time (on-time) and cycle times of 1800 seconds can be found, which brings the resistor wire temperature to its rated thermal maximum of 1000°C.

Danotherm offers standard solutions for one to three resistor bodies combined in one compact *resistor unit* with pulse-energy capability of 9MJ. Depending on the electrical connection, the IP class ranges from IP 20 to IP 65. Connection can be via a terminal box, DIN-rail terminals or cable lugs. These resistor types are also offered in high-voltage versions.

The salient features of Alpha resistors are that they have:

- small dimensions
- low-temperature surfaces in operation
- high pulse-load capabilities
- high vibration capabilities
- no external electrically-live parts

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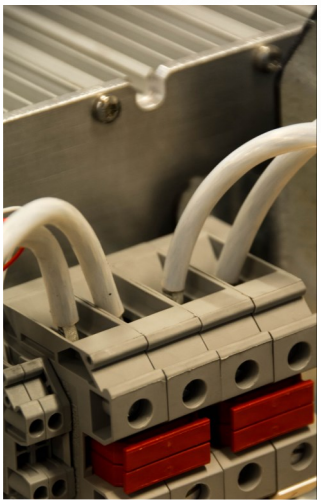

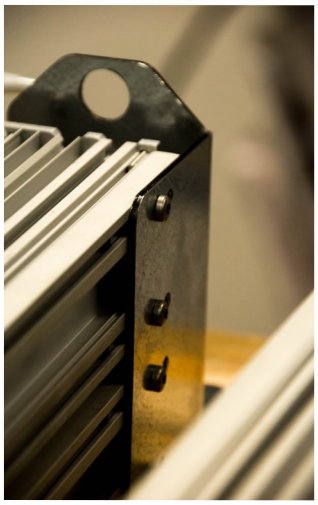

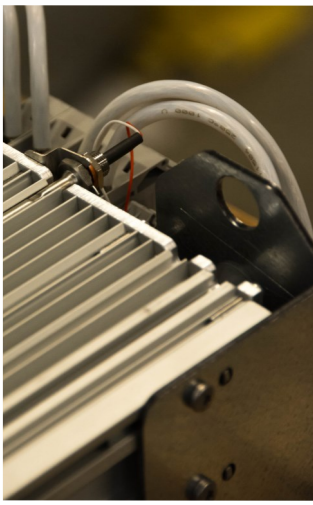

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