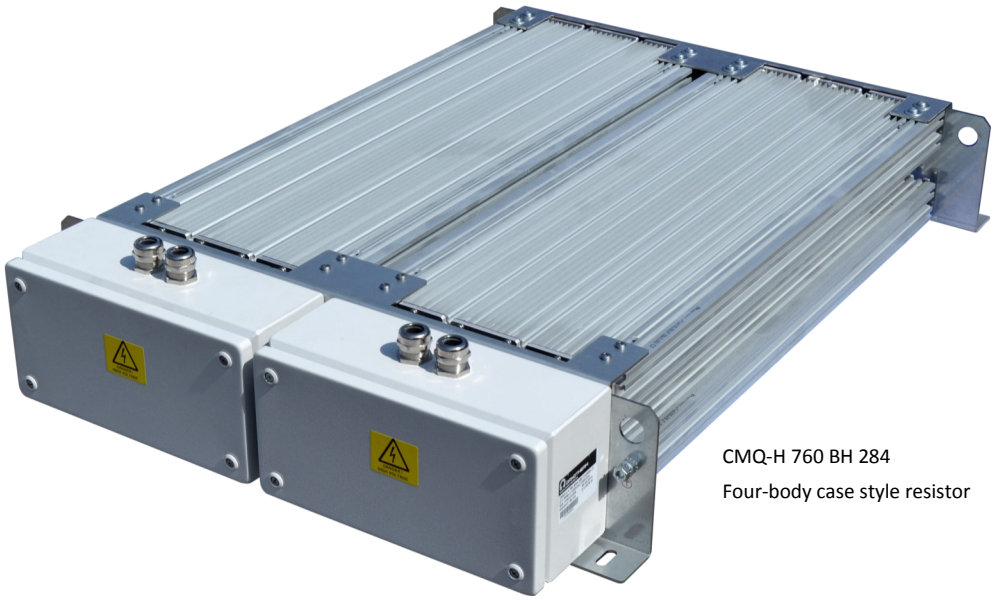
CMQ

Compact Alpha Power Resistor

14.5kW - 504kW

(73kJ - 2.5MJ) / body case style

5/1800s pulse load



CMQ-H 760 BH 284

Four-body case style resistor

The CMQ-H and **CMQ-V 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 **800W** to **4150W** per body case style and up to 20 bodies can be combined in one unit. The pulse-load capability is up to 380 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. CMQ resistors have thermal time-constants of about one hour.

Specially reinforced versions are available for **Low Voltage Ride Through - LVRT** as Energy Dump Resistors for **Wind Turbine** applications.

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.

CMQ resistors are optionally available with different terminal boxes for various cable sizes and from IP20 to IP54 and in special cases, to IP65.

These special data-sheets are available on request.

Construction

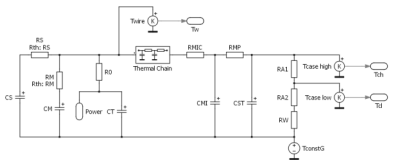
The resistors are designed as follows:
The resistor elements are made with helix-wound wire elements mounted in special ceramic fixtures. The outer housing is an extruded aluminium profile electrically insulated with micanite sheets on all inner surfaces. The resistor elements are fixed symmetrically 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.

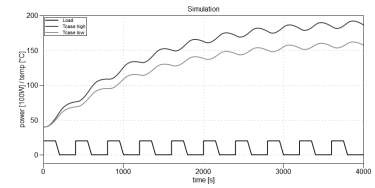
Accessories

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 CMQ Compact Alpha Power Resistor has a very high pulse-load capability for 1 second, exceeding 380 times the steady-state load power (depending on resistor type and ohmic value). This makes the CMQ 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.

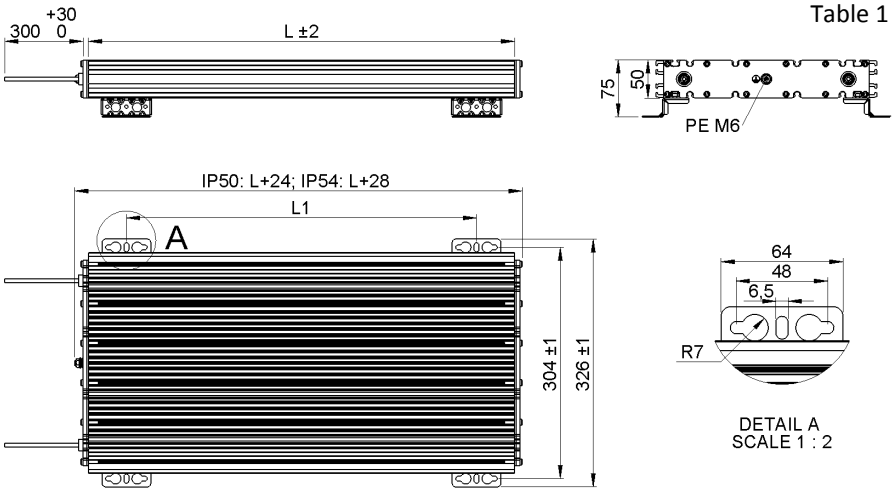




Pn [W] @ 40°C According UL508						
CMQ-BH(T)-XXX	1 body Pn [W] @ 40°C According UL508 Max surface 250°C	RΩ	1 body Max surface temp 190 °C	2 bodies Max surface temp 250 °C	3 bodies Max surface temp 250 °C	4 bodies Max surface temp 250 °C
TS: Thermal switch	no TS	± 10%	TS	no TS	no TS	no TS
CMQ 210	800	0.02 - 30	555			
CMQ 260	1100	0.04 - 50	855			
CMQ 330	1500	0.065 - 80	1090			
CMQ 400	1900	0.07 - 100	1320	2925	4350	5800
CMQ 460	2200	0.09 - 140	1520	3375	5000	6650
CMQ 560	2700	0.12 - 170	1850	4090	6050	8050
CMQ 660	3100	0.15 - 210	2180	4825	7100	9450
CMQ 760	3500	0.18 - 250	2660	5875	8500	11300
CMQ 860	3850	0.2 - 300	3060	6750	10000	13300
CMQ 960	4150	0.25 - 340	3420	7575	11200	14900

General specifications		
Temperature Coefficient:		< ± 100 ppm
Dielectric strength	Standard	3500 VAC @ 1 minute
	On demand	6000 VAC @ 1 minute
Working voltage	Standard	1000 VAC / 1400 VDC
Isolation Resistance:		> 20 MΩ / body
Overload:@ 1 sec pulse / hour		80 - 225 x (depending on resistor)
Overload:@ 5 sec pulse / hour		30 - 60 x (depending on resistor)
Environmental:		- 40 °C - 90 °C
De-rating cable version		Linear: 40°C = Pn@250°C to 70°C = 0,85 * Pn@250°C
De-rating TW 200°C version		Linear: 40°C = Pn@190°C to 70°C = 0,80 * Pn@190°C
De-rating TW 180°C version		Linear: 40°C = 0,85 * Pn@190°C to 70°C = 0,75 * Pn@190°C
De-rating vertical mounting		no de-rating
De-rating horizontal mounting		0,8 * Pn
Thermal switch (optional)		130 / 160 / 180 / 200 °C, 2A, 250 VAC NC

Table 1



Type	L ± 2 [mm]	L1 ± 2 [mm]
CMQ-H 210 CH(T) 0(X)1 XXR KT	210	110
CMQ-H 260 CH(T) 0(X)1 XXR KT	260	160
CMQ-H 330 CH(T) 0(X)1 XXR KT	330	230
CMQ-H 400 CH(T) 0(X)1 XXR KT	400	300
CMQ-H 460 CH(T) 0(X)1 XXR KT	460	360
CMQ-H 560 CH(T) 0(X)1 XXR KT	560	460
CMQ-H 660 CH(T) 0(X)1 XXR KT	660	560
CMQ-H 760 CH(T) 0(X)1 XXR KT	760	660
CMQ-H 860 CH(T) 0(X)1 XXR KT	860	760
CMQ-H 960 CH(T) 0(X)1 XXR KT	960	860

Table 2

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

- Last digits XXX > 400: Customer specified version, otherwise:
- Number of bodies **1**, **2**, **3** or **4**
- 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: 2R2 = 2.2 Ω, 22R = 22 Ω, 220R = 220 Ω, 2k2 = 2.2 kΩ
- **T** = Thermal switch (NC)
- Wire element (t.b.d. by Danotherm) **E** = parallel, **H** = series, **N** = 4S2P
- 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

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CMQ-CH(T)	square pulse each 120 seconds, ambient temp. = 40°C									
	duty 1 second [kW]	Max surface temp. [°C]	duty 5 second [kW]	Max surface temp. [°C]	duty 10 second [kW]	Max surface temp. [°C]	duty 20 second [kW]	Max surface temp. [°C]	duty 40 second [kW]	Max surface temp. [°C]
CMQ 210	53.7	205	17.3	265	9.2	270	4.6	270	2.3	270
CMQ 260	95	230	26.9	275	13.4	275	6.7	275	3.4	275
CMQ 330	135	245	36.3	280	18.1	285	9	280	4.5	280
CMQ 400	182	265	45	290	22.5	290	11.3	290	5.6	290
CMQ 460	263	295	53	295	26.3	295	13.1	295	6.6	295
CMQ 560	310	300	65	305	32.5	305	16.3	305	8.1	305
CMQ 660	390	315	77.5	315	38.8	315	19.4	315	9.7	315
CMQ 760	470	325	95	325	47.5	325	23.8	325	11.9	325
CMQ 860	550	335	110	335	55	335	27.5	335	13.8	335
CMQ 960	620	345	125	345	62.5	345	31.3	345	15.6	345
	square pulse each 1800 seconds, ambient temp. = 40°C									
	duty 1 second [kW]	Max surface temp. [°C]	duty 5 second [kW]	Max surface temp. [°C]	duty 10 second [kW]	Max surface temp. [°C]	duty 20 second [kW]	Max surface temp. [°C]	duty 40 second [kW]	Max surface temp. [°C]
CMQ 210	75	70	32	95	22	110	14.8	130	9.9	160
CMQ 260	144	75	56	105	38.5	125	25.5	150	16.8	180
CMQ 330	202	80	76	110	55	135	39	165	26.3	200
CMQ 400	284	85	101	110	74	140	52.5	175	35.5	210
CMQ 460	476	100	160	135	109	160	72	190	46.5	220
CMQ 560	532	100	174	125	124	155	87	190	58.5	230
CMQ 660	704	105	222	135	156	160	109	200	73	240
CMQ 760	920	110	282	140	194	170	134	210	89	250
CMQ 860	1264	125	380	160	252	190	168	225	107	260
CMQ 960	1712	140	504	175	324	200	204	235	128	270
	triangle pulse each 1800 seconds, ambient temp. = 40°C									
	duty 1 second [kW]	Max surface temp. [°C]	duty 5 second [kW]	Max surface temp. [°C]	duty 10 second [kW]	Max surface temp. [°C]	duty 20 second [kW]	Max surface temp. [°C]	duty 40 second [kW]	Max surface temp. [°C]
CMQ 210	158	70	65	95	47.5	115	32.5	140	21.5	165
CMQ 260	300	80	116	110	82	130	56	160	36.8	190
CMQ 330	420	80	152	110	112	135	83	170	58	210
CMQ 400	592	85	204	115	148	140	110	180	79	220
CMQ 460	992	100	332	135	230	165	157	200	102	235
CMQ 560	1100	100	356	130	248	155	182	200	129	245
CMQ 660	1455	105	456	135	316	165	228	205	161	250
CMQ 760	1888	115	584	145	400	175	284	215	196	260
CMQ 860	2625	130	792	160	528	195	364	235	238	280
CMQ 960	3520	140	1056	180	688	210	448	245	280	280
$p(t) = P_{max} . e^{-t/\tau}$	$\tau = \frac{R.C}{2}$	logoritmic pulse each 1800 seconds (e-curve), ambient temp. = 40°C, total energy					$E = \tau . P_{max}$			
	Tau 1 second [kJ]	Max surface temp. [°C]	Tau 5 second [kJ]	Max surface temp. [°C]	Tau 10 second [kJ]	Max surface temp. [°C]	Tau 20 second [kJ]	Max surface temp. [°C]	Tau 40 second [kJ]	Max surface temp. [°C]
CMQ 210	126	90	292	150	400	180	532	220	704	250
CMQ 260	236	110	508	180	696	210	912	250	1152	280
CMQ 330	316	110	680	180	1016	230	1440	270	1600	280
CMQ 400	432	120	896	190	1344	240	1952	290	1984	290
CMQ 460	720	150	1424	230	1952	280	2304	300	2304	300
CMQ 560	776	140	1520	220	2224	270	2880	300	2912	300
CMQ 660	1008	160	1936	230	2784	290	3456	320	3456	320
CMQ 760	1312	170	2448	250	3488	300	4032	330	4096	330
CMQ 860	1792	200	3264	280	4480	330	4608	340	4608	340
CMQ 960	2416	230	4224	320	5120	350	5120	350	5120	350

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 5 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 for a train of pulses of 1 to 40 seconds duty time (on-time) and cycle times of 120 seconds or 1800 seconds be found, corresponding to the duty cycle which brings the resistor wire temperature to its rated thermal maximum of 1000°C.

Danotherm offers standard solutions for one to six resistor bodies combined in one compact *resistor unit* with pulse-withstand capability of 3MW (15MJ) and also OEM versions with a maximum of 20 bodies. 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
- high IP classes
- fail-safe capabilities (on request)
- low noise levels.

Triple-body unit CMQ-V XXX BHT 283
Pnom. = 4350—11200 W, IP 54
Connection box with 3 cable glands

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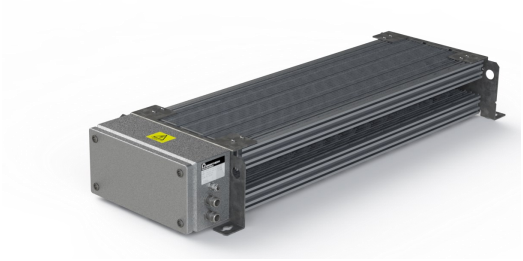
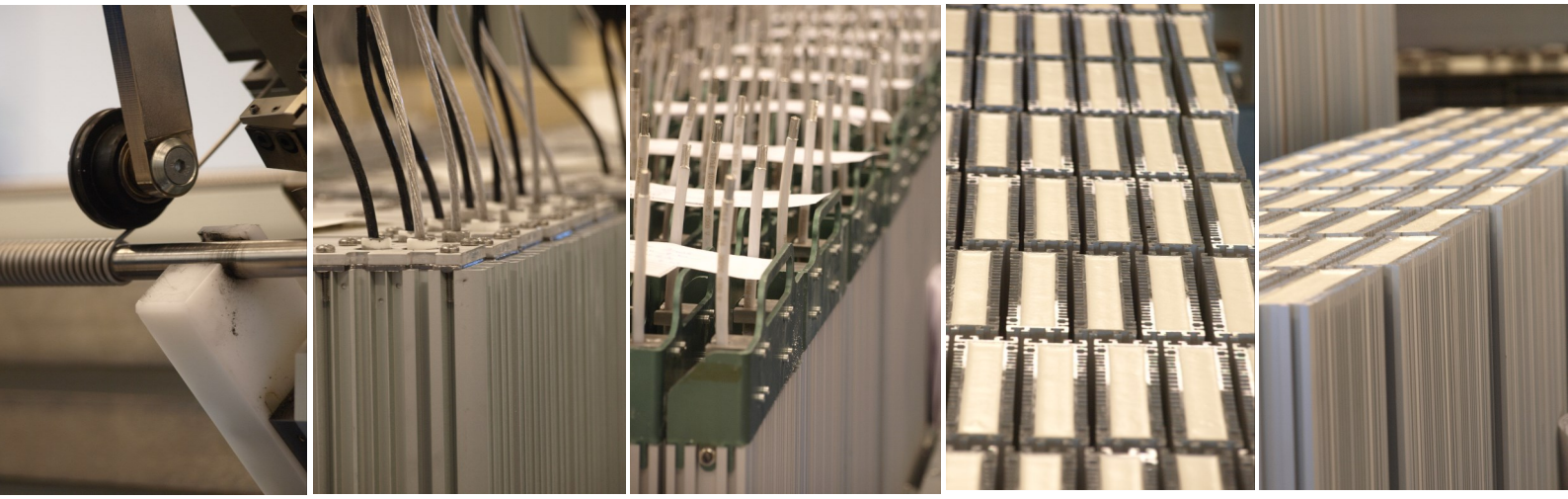


CMQ-H XXX BHT 282

unit CMQ-BHT
Pnom. = 2925—7575 W double-body unit (282)
Pnom. = 5800—14900 W four-body unit (284)
B-type Connection Box with 3 cable glands
IP 54 protection class

CMQ-H XXX BHT 284



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