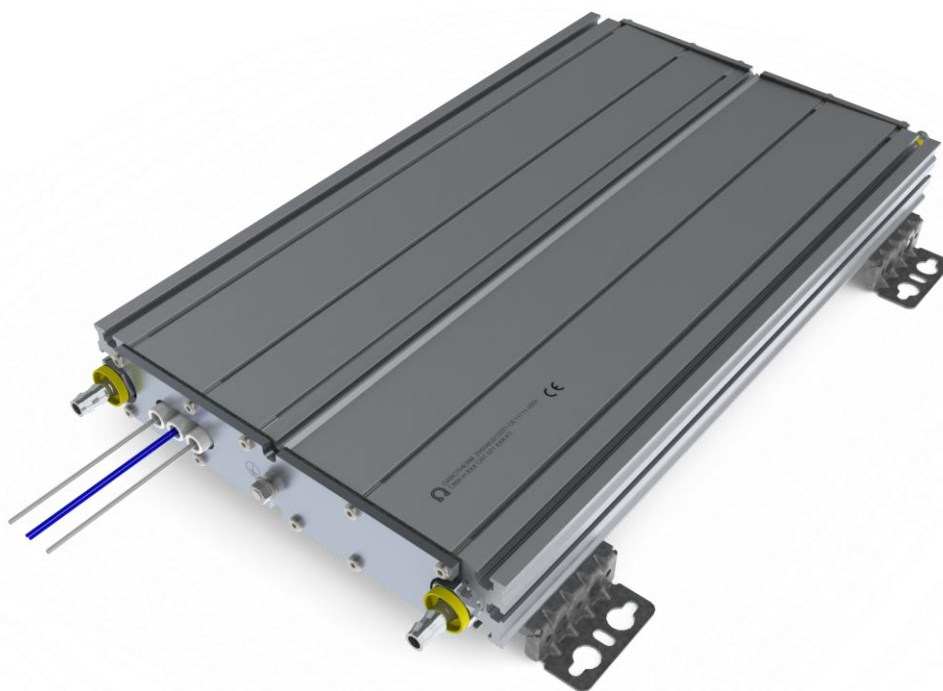


ALPHA CBW-H / CBW-V

ALUMINIUM HOUSED COMPACT HARMONIC FILTER RESISTOR
IP50 / IP65



The **CBW** is a **Water Cooled Resistor**. It combines the advantage of water cooling with the high pulse load ability of the traditional aluminum housed Alpha resistors. The **CBW** can easily be fitted into compact constructions. It is possible to stack several resistors close without distance when resistor banks are required.

The steady state power range from **1.7kW to 6.7kW / component** (depending on the cooling). Danotherm has developed **Thermal models** for all resistor types and resistor values. By using these models, Danotherm is able to predict the temperature rises of the resistor wire and the surface for all possible load situations.

Danotherm offer the assistance to customers to find the optimal solution for any application.

CBW resistors are optionally available with connection box in different design for different cable sizes and from IP50 to IP65.

Applications

The water cooled resistor **CBW** is very well suited as a harmonic filter resistor where continuous power dissipation is required. For other applications like **LVRT** (Low Voltage Ride Through) for wind turbines Danotherm refer to separate brochure for CBT/CBS - model.

Construction

The resistor elements for high resistance types are wire wound on mica support sheets. Lower resistance elements are made with helix wound wire elements. The outer housing is an aluminium profile insulated with micanite sheets on all inner surfaces. The resistor elements are fixed symmetrical in the profile by ceramic insulators. This ensures a symmetric expansion of the resistors and a maximum stability to high load impulses. The aluminium profile with the fixed resistor element is filled with quartz sand. This ensures a minimum change of the resistor surface temperature even if the resistor element reaches its maximum temperature during a pulse load.

The standard cables are 300 mm PTFE, style depending on rated voltage.

Water Cooling

Water cooling is via two extruded holes/tubes along the outer edges of the profile and heat transfer via the profile.

This ensures a simple water system and that the resistors are stackable. The centre of the resistor reaches a minor temperature increase at steady state load. If this cannot be tolerated the surface can be insulated.

Resistance Value Range

Please see table 1.

Mounting

It is recommended to mount the resistors in a vertical position with the in- and outlet at the top side to prevent air bubbles to be trapped. When the channels are in parallel the outlets should be upwards. If mounted in other direction precaution must be taken to avoid air bubbles in the cooling tubes.

Cooling liquid flow

The needed cooling liquid flow depends on the cooling liquid used and the dissipated power that the liquid needs to absorb. The formula for water flow is given by:

$$Q = \frac{P \cdot 860}{\Delta T \cdot 0,85}$$

Where

Q is flow in litres per hour

P is power in kW

ΔT is difference in temperature between inlet and outlet ;

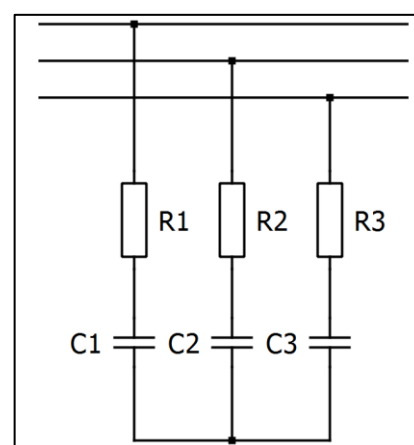
0,85 takes into account that not all water is effectively in contact with the cooling tubes.

If water/glycol 60%/40% is used then the outcome needs to be multiplied by a factor of 1,5.

General Specifications		
Temperature Coefficient		< ± 100 ppm
Dielectric strength:	Standard	3500 VAC @ 1 minute
	On demand	6000 VAC @ 1 minute
Working Voltage	Standard	1000 VAC; 1400VDC
Isolation Resistance:		>20 M Ω
Temperature of cooling water		0°C - 80°C
Temperature of cooling water-glycol		0°C - 80°C
Pressure:		Working: 6 bar; Test: 10 bar
Environmental		-40°C - 90°C
De-rating depending on water inlet temp.:		Linear: 20°C = Pn to 50°C = 0,75*Pn
Thermo watch (optional)		30°C / 160°C / 180°C / 200°C, 2A, 250VAC NC
PT 100 (optional)		2 Wire/ 3 Wire; With/Without Shield; Cable 300mm

CBW-C(H) (T)	min. Ohm value [m Ω]	max. Ohm value [Ω]
CBW 210	40	2500
CBW 260	60	3500
CBW 330	90	5000
CBW 400	120	7000
CBW 460	150	8000
CBW 560	190	120
CBW 660	230	150
CBW 760	280	160

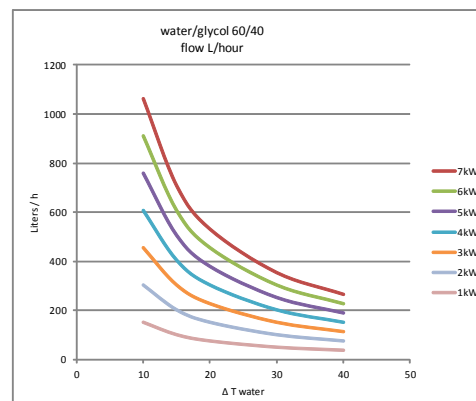
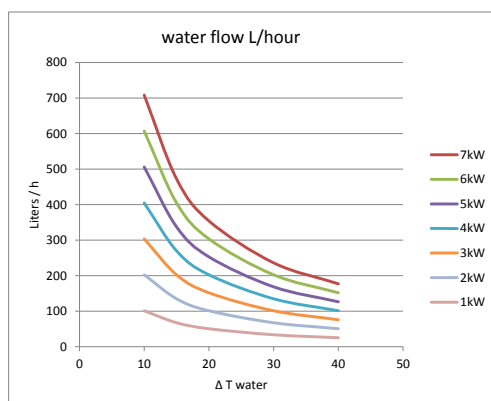
Table 1



Low pass filter

flow l/h	ΔT water					ΔT water/glycol 60/40				
	10	15	20	30	40	10	15	20	30	40
7kW	708	472	354	236	177	1062	708	531	354	266
6kW	607	405	304	202	152	911	607	455	304	228
5kW	506	337	253	169	127	759	506	379	253	190
4kW	405	270	202	135	101	607	405	304	202	152
3kW	304	202	152	101	76	455	304	228	152	114
2kW	202	135	101	68	51	304	202	152	101	76
1kW	101	68	51	34	25	152	101	76	51	38

Table 2

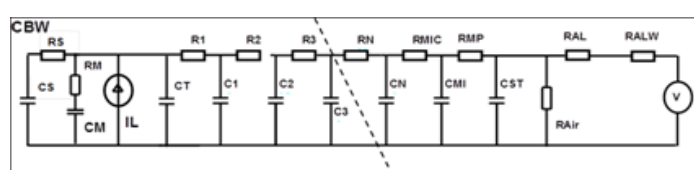
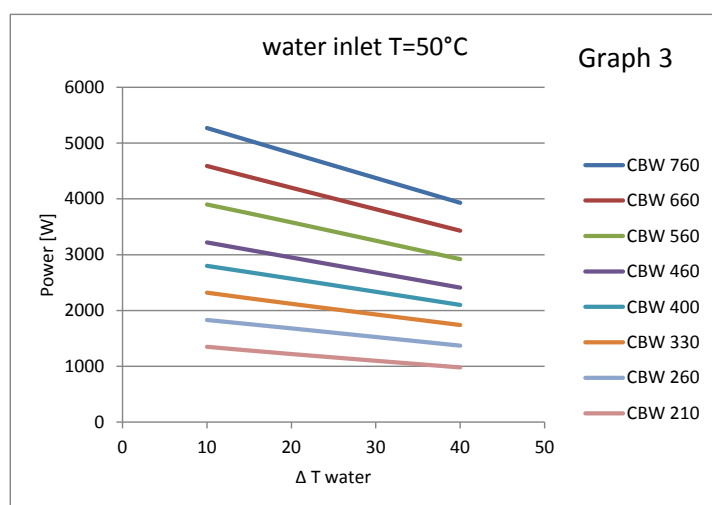
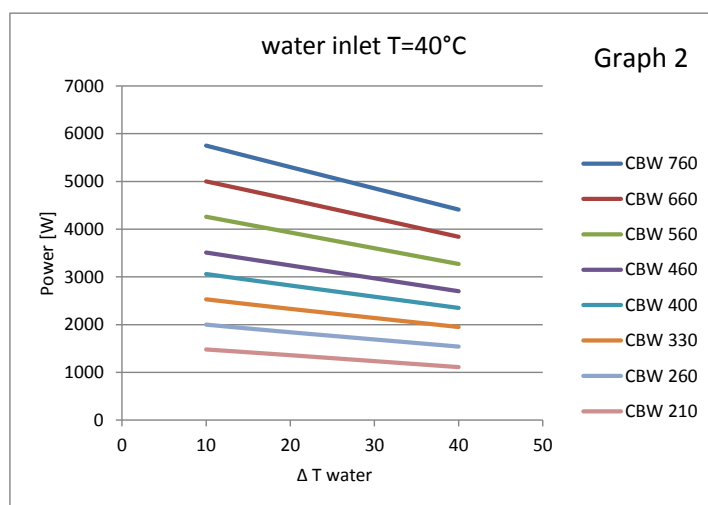
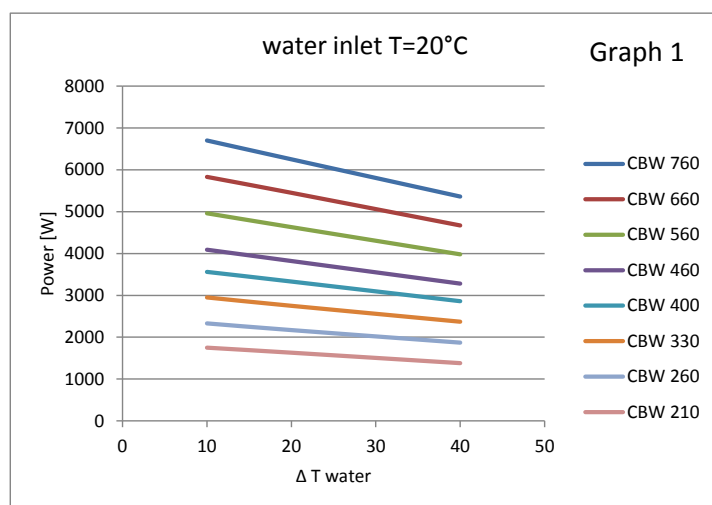


Maximum power dissipation

The maximum continuous power depends on the absolute value of the water inlet temperature and also on the increase of the water temperature which is directly dependent of the water flow. Table 3 shows the maximum continuous power at given water inlet temperatures and different ΔT . Graphs 1, 2 and 3 show the continuous power values at water inlet temperature of 20°C / 40°C and 50°C and all ΔT between 10 and 40°C. All values are based on the thermal model of the resistors as shown below.

CBW-C(H) (T)	max. surface temp.	maximum power at water inlet T=20°C [W]			maximum power at water inlet T=40°C [W]			maximum power at water inlet T=50°C [W]		
		ΔT water [K]			ΔT water [K]			ΔT water [K]		
		10	20	40	10	20	40	10	20	40
CBW 210	160	1750	1630	1380	1480	1360	1110	1350	1220	980
CBW 260	170	2330	2170	1870	2000	1840	1540	1830	1680	1370
CBW 330	170	2950	2750	2370	2530	2330	1950	2320	2120	1740
CBW 400	170	3560	3330	2860	3060	2820	2350	2800	2570	2100
CBW 460	170	4090	3820	3280	3510	3240	2700	3220	2950	2410
CBW 560	170	4960	4630	3980	4260	3930	3270	3900	3580	2920
CBW 660	170	5830	5450	4670	5000	4620	3840	4590	4200	3430
CBW 760	170	6700	6250	5360	5750	5300	4410	5270	4820	3930

Table 3

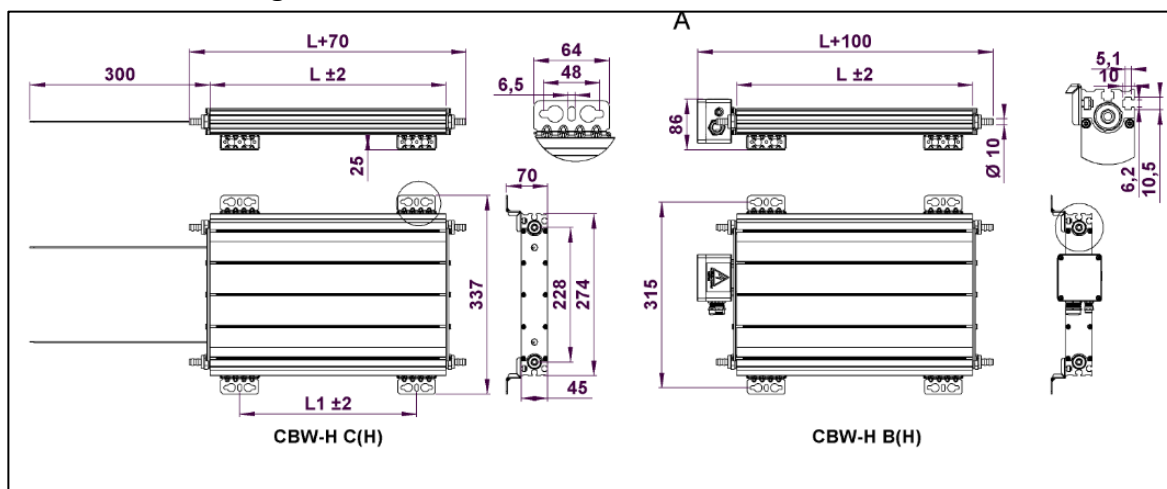


Thermal model

Pressure drop

The pressure drop depends strongly on the used water nipples. Many customers use their own water nipples so it is difficult to give standard values. For resistor CBW460 with SW22x45,5 and a flow of 120 litres per hour the pressure drop is 55mBar per channel, 110mBar in total for 2 cooling tubes in series.

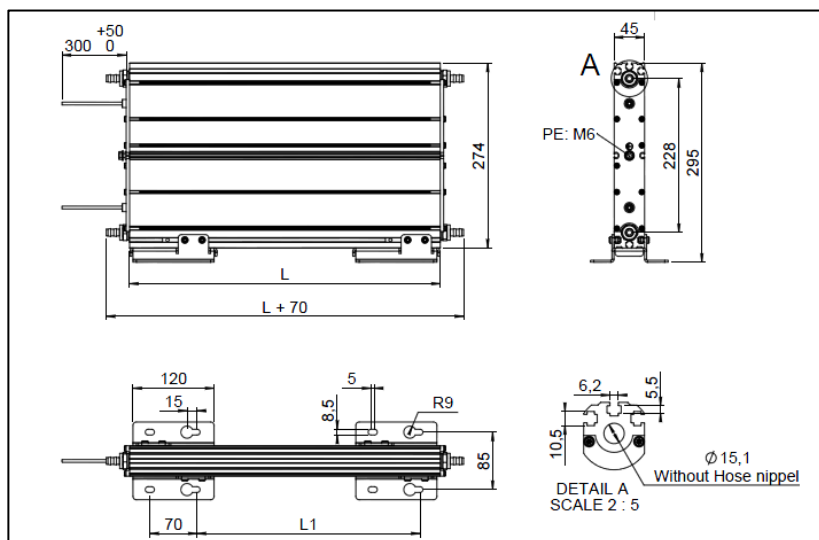
Horizontal mounting



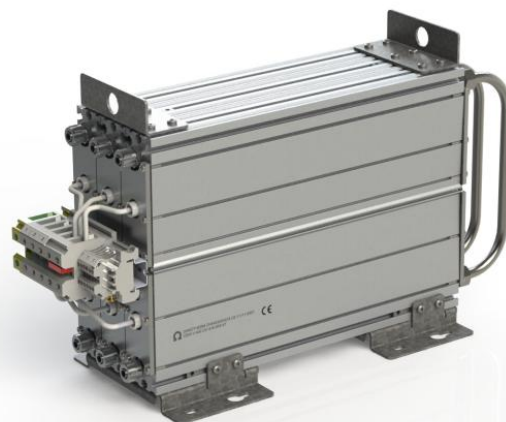
Type	L mm	L1 mm	W Kg	Type	L mm	L1 mm	W Kg
CBW-H 210 C (H) (T)	210	110	6.4	CBW-H 560 C H (T)	560	460	14.7
CBW-H 260 C (H) (T)	260	160	7.6	CBW-H 660 C H (T)	660	560	17.1
CBW-H 330 C (H) (T)	330	230	9.2	CBW-H 760 C H (T)	760	660	19.5
CBW-H 400 C (H) (T)	400	300	10.9	CBW-H 860 C H (T)	860	760	22.0
CBW-H 460 C (H) (T)	460	360	12.3	CBW-H 960 C H (T)	960	860	24.4

Longest possible type 1000mm

Vertical mounting



Please contact Danotherm with
your request
danotherm@danotherm.dk



Type identification:

Please specify your CBW resistor as follows

CBW-H 660 C (H) (T) 22R 0 0 1

- Last digits XXX > 400: Customer specified version, otherwise:
- Number of profiles
- Thermo watch temperature: **3**=80°; **4**=100°; **5**=130; **6**=160; **7**=180; **8**=200°C
- 2 = No grid; 3 = Protection grating
- Ohm Value (Examples: **2R2** = 2.2Ω; **22R** = 22 Ω; **220R** = 220Ω; **1K0** = 1.0 kΩ)
- **T**: Thermo watch
- **H**: Helix wire element (Specified by Danotherm)
- **Connection C**: Cables **B**: IP65 Connection Box
- Length of resistor profile in mm
- **H**: Horizontally mounted profile **V**: Vertical mounted profile