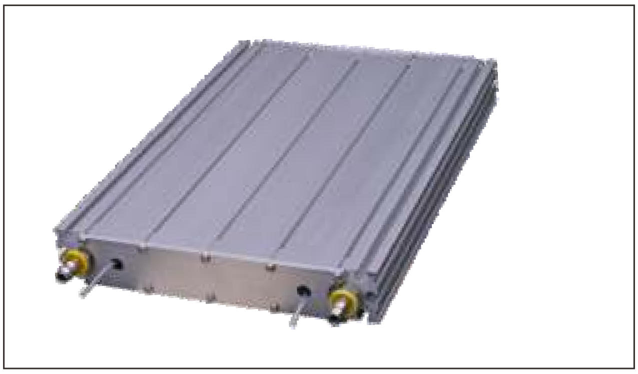
GBW Aluminum Power Resistors



Feature

The GBW 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 GBW 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)
KWX has developed Thermal models for all resistor types and resistor values. By using these models,KWX is able to predict the temperature rises of the resistor wire and the surface for all possible load situations.
KWX offer the assistance to customers to find the optimal solution for any application.
GBW resistors are optionally available with connection box in different design for different cable sizes and from IP50 to IP65.

Applications

The water cooled resistor GBW 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 KWX refer to seperate brochure for GBT/GBS - 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 isolated 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 quarts 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 can not be tolerated the surface can be insulated.

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.

GBW Aluminum Power Resistors

Ordering Information

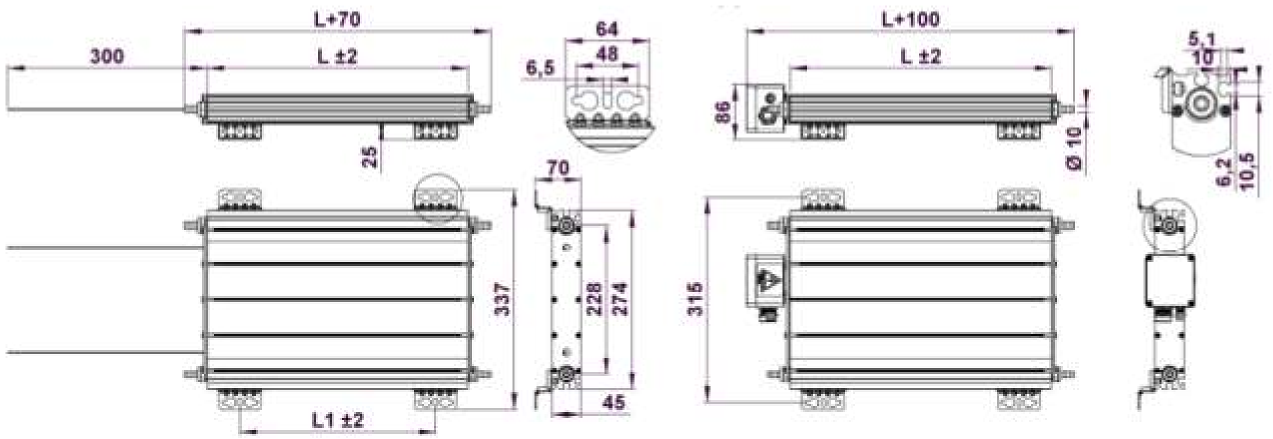
Please specify your GBW Brake resistor as follows

GBW 660 C (H) (T) 22R 0 0 1

- Last digits XXX > 400: Customer specified version, otherwise:
- Thermo watch temperature: 3=80℃; 4=100℃; 5=130℃; 6=160℃; 7=180℃; 8=200℃
- Ohm Value (Examples: 2R2 = 2.2Ω; 22R = 22 Ω; 220R = 220Ω; 1K0 = 1.0 kΩ)
- T: Thermo watch
- H: Helix wire element (Specified by KWX)
- Connection C: Cables B: IP 65 Connection Box
- Length of resistor profile in mm
- H: Horizontally mounted profile

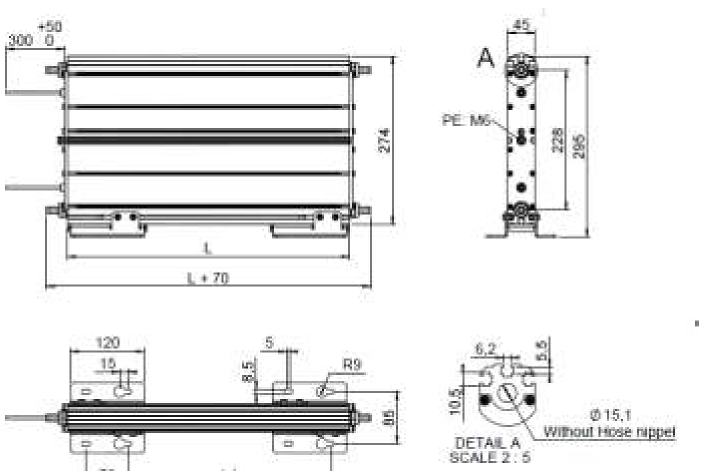
Dimensions

Horizontal mounting



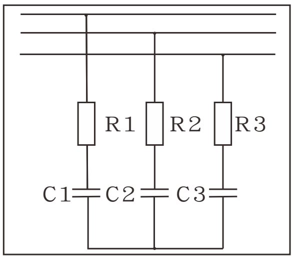
Type	L(mm)	L1 (mm)	WKg	Type	L(mm)	L1 (mm)	WKg
GBW210C(H)(T)	210	110	6.4	GBW560CH(T)	560	460	14.7
GBW260C(H)(T)	260	160	7.6	GBW660CH(T)	660	560	17.1
GBW330C(H)(T)	330	230	9.2	GBW760CH(T)	760	660	19.5
GBW400C(H)(T)	400	300	10.9	GBW860CH(T)	860	760	22.0
GBW460C(H)(T)	460	360	12.3	GBW960CH(T)	960	860	24.4

Vertical mounting



Resistance Value Range

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



Performance

General Specifications	
Temperature Coefficient:	< ± 100ppm
Dielectric strength: Standard:	3500VAC 1 minute
On Demand	6000 VAC 1 minute
Working Voltage: Standard	1000VAC;1400VDC
Isolation Resistance:	> 20 MΩΩ
Temperature of cooling water	0℃ ~ 80℃
Temperature of cooling water-glycol	0℃ ~ 80℃
Pressure:	Working: 6 bar; Test: 10 bar
Environmental	-40℃ ~ 90℃
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

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:

$$Q = \frac{P.860}{\triangle T.0,85}$$

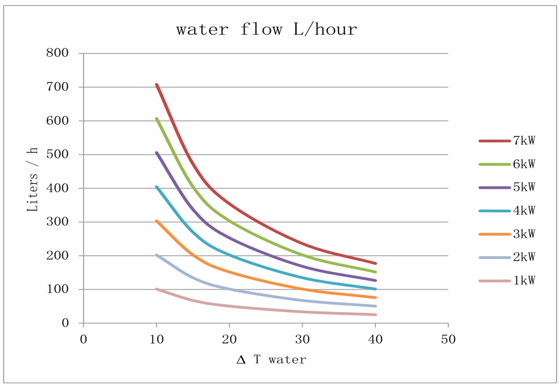
Where

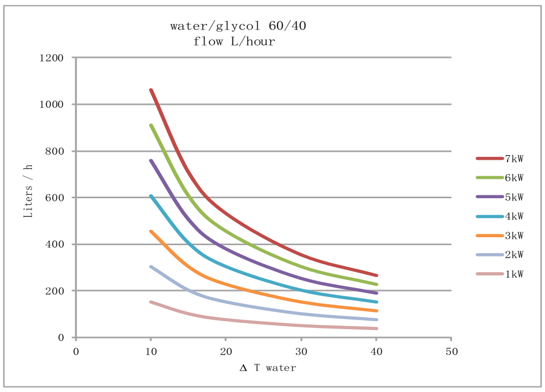
Q is flow in litres per hour P is power in kw

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.

Flow1/h	△T water					△T 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



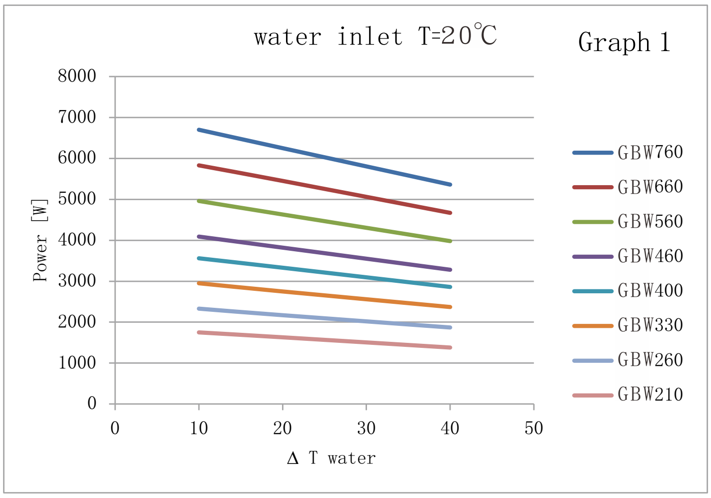


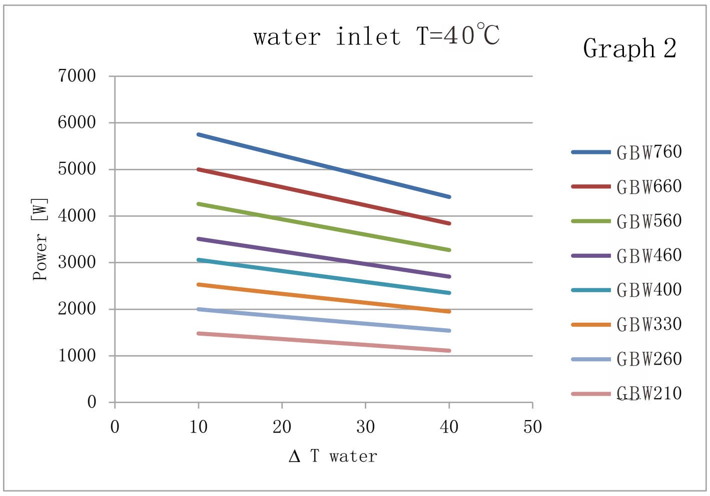
Maximum power dissipation

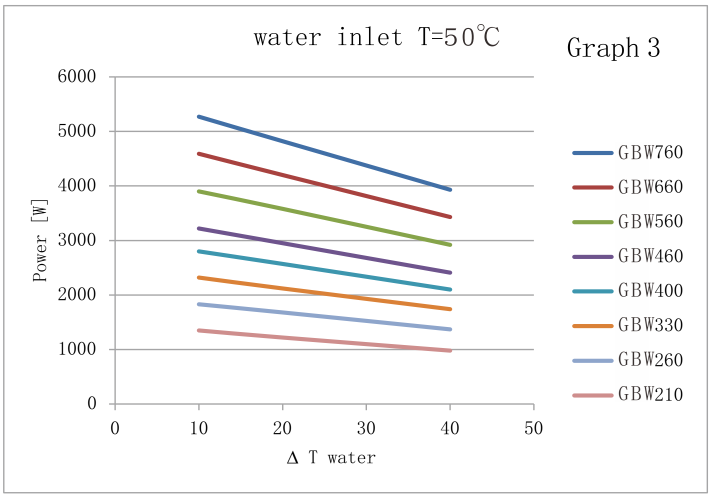
The maximum continuous power depends on the absolute value of the water inlet temperature and also on the increase of the water temperature which is directly dependent of the water flow. Table 3 shows the maximum continuous power at given water inlet temperatures and different T. Graphs 1, 2 and 3 show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

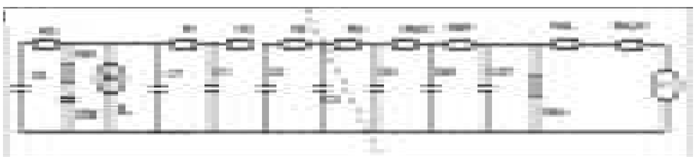
GBW-C(H) (T)	max. surface temp.	maximum power at water inlet T=20℃ [W]			maximum power at water inlet T=40℃ [W]			maximum power at water inlet T=50℃ [W]		
		ΔT water [K]			ΔT water [K]			ΔT water [K]		
		10	20	40	10	20	40	10	20	40
GBW210	160	1750	1630	1380	1480	1360	1110	1350	1220	980
GBW260	170	2330	2170	1870	2000	1840	1540	1830	1680	1370
GBW330	170	2950	2750	2370	2530	2330	1950	2320	2120	1740
GBW400	170	3560	3330	2860	3060	2820	2350	2800	2570	2100
GBW460	170	4090	3820	3280	3510	3240	2700	3220	2950	2410
GBW560	170	4960	4630	3980	4260	3930	3270	3900	3580	2920
GBW660	170	5830	5450	4670	5000	4620	3840	4590	4200	3430
GBW760	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 GBW460 withSW22x45,5 and a flow of 120 litres per hour the pressure drop is 55mBar per channel, 110mBar in total for 2 cooling tubes in series.