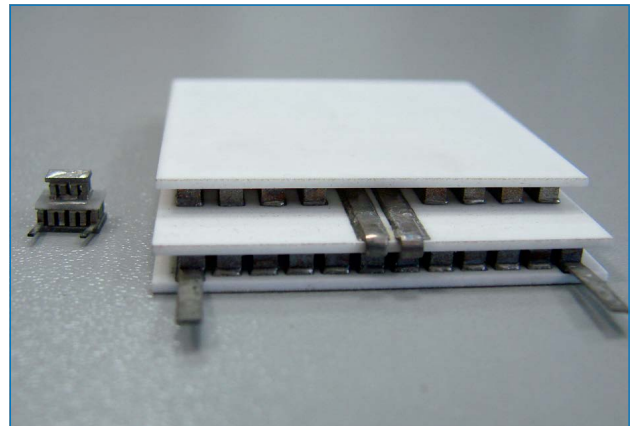


Multistage thermoelectric coolers

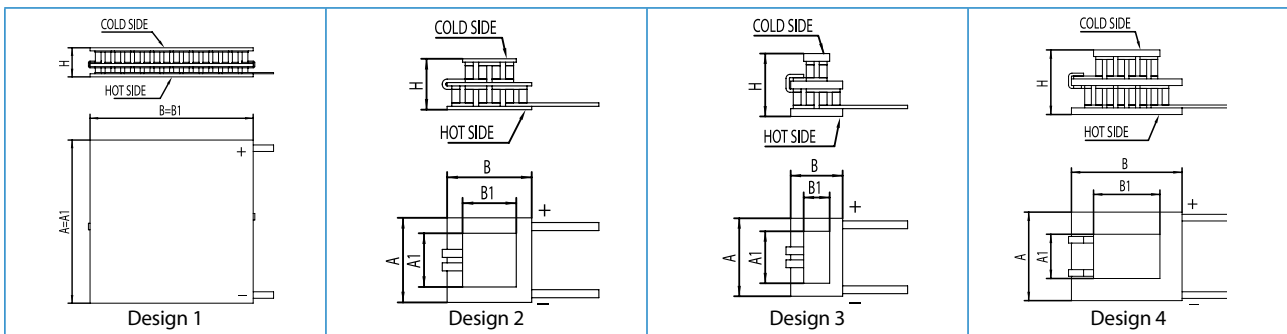
Multistage TECs are useful when usual one-stage TECs are not able to provide required temperature difference. Additional stages increase achievable ΔT but also leads to more power consumption and reduction of efficiency of the thermoelectric system. KRYOTHERM produces high efficient two stages TECs with ΔT up to 94K and unique cooling capacity up to 95W. Optimized thermoelectric materials are used for cascades of three and four stage TECs. It allows reaching the maximum value of ΔT . KRYOTHERM produces multistage TECs with ΔT up to 140 K, optimal dimensions and low power consumption.

Applications:

- CCD-matrix and infrared photodetectors cooling;
- hand held thermal viewer;
- x-ray spectrometers;
- blood and blood plasma transportation refrigerators;
- low temperatures thermostats;
- scientific and laboratory equipment;
- thermocalibrators;
- low noise amplifier freezers;
- oil clouding-point testers;
- ice-water coolers;
- dew point sensors.



Two stage TEC



Two stage thermoelectric coolers

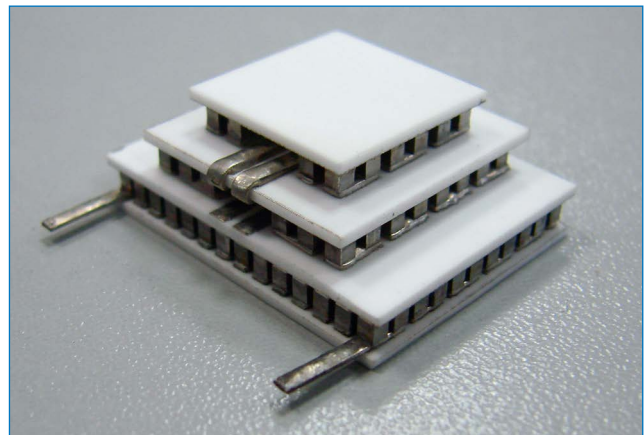
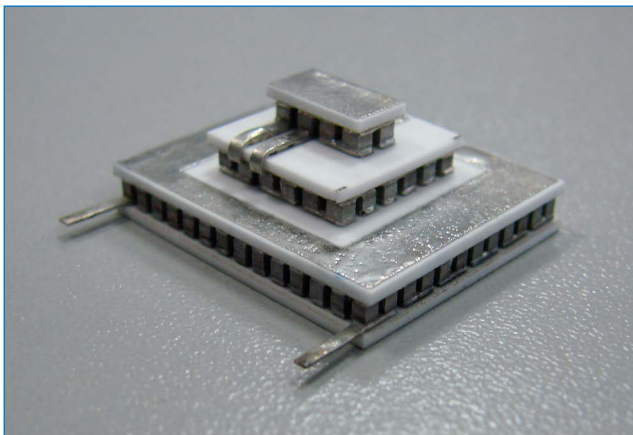
Type	I _{max} , (Amps)	Q _{max} , (Watts)	U _{max} , (Volts)	ΔT_{max} , (K)	R _{ac} , (Ohm)	Dimensions, mm					Design
						A	B	A1	B1	H	
TB-2-(11-4)-1,5	1,0	0,4	1,3	93	1,26	6,0	4,0	4,0	2,0	6,7	3
TB-2-(11-4)-1,2	1,2	0,5	1,3	92	1,55	6,0	4,0	4,0	2,0	6,1	
TB-2-(11-4)-1,0	1,5	0,6	1,3	92	0,85	6,0	4,0	4,0	2,0	5,7	
TB-2-(17-4)-1,5	1,1	0,4	2,0	94	1,85	6,0	8,0	2,0	4,0	6,7	4
TB-2-(17-4)-1,2	1,3	0,5	2,0	93	1,50	6,0	8,0	2,0	4,0	6,1	
TB-2-(17-4)-1,0	1,6	0,6	2,0	91	1,26	6,0	8,0	2,0	4,0	5,7	
TB-2-(31-8)-1,5	1,1	0,9	3,6	93	3,40	8,0	10,0	4,0	4,0	6,7	
TB-2-(31-8)-1,2	1,3	1,1	3,6	92	2,70	8,0	10,0	4,0	4,0	6,1	
TB-2-(31-8)-1,0	1,6	1,3	3,6	91	2,25	8,0	10,0	4,0	4,0	5,7	
TB-2-(31-12)-1,5	1,0	1,1	3,7	93	3,60	8,0	10,0	4,0	6,0	6,7	
TB-2-(31-12)-1,2	1,2	1,4	3,7	92	2,85	8,0	10,0	4,0	6,0	6,1	

To be continued on the **page 22**.

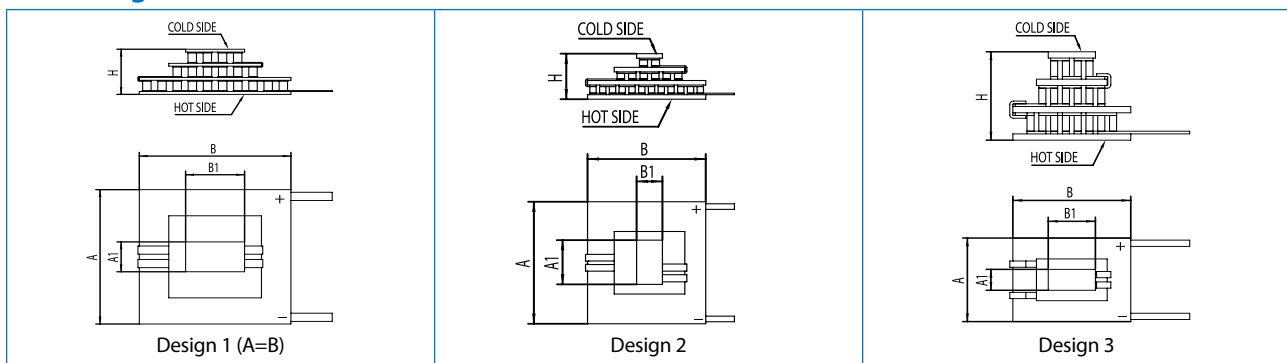


Multistage thermoelectric coolers

Type	I _{max} , (Amps)	Q _{max} , (Watts)	U _{max} , (Volts)	ΔT _{max} , (K)	R _{ac} , (Ohm)	Dimensions, mm					Design
						A	B	A1	B1	H	
TB-2-(31-12)-1,0	1,4	1,6	3,7	91	2,40	8,0	10,0	4,0	6,0	5,7	4
TB-2-(59-18)-1,5	1,1	1,8	7,1	94	6,70	12,0	12,0	6,0	6,0	6,7	2
TB-2-(59-18)-1,2	1,3	2,2	7,1	93	5,30	12,0	12,0	6,0	6,0	6,1	
TB-2-(59-18)-1,0	1,5	2,6	7,0	92	4,35	12,0	12,0	6,0	6,0	5,7	
TB-2-(127-127)-1,3	2,8	16,1	15,4	83	4,70	30,0	30,0	30,0	30,0	8,8	
TB-2-(127-127)-1,15	5,8	34,0	15,4	84	2,30	40,0	40,0	40,0	40,0	8,5	1
TB-2-(127-127)-1,15 (BULLFINCH)	8,8	31,0	8,9	87	1,05	40,0	40,0	40,0	40,0	7,5	
TB-2-(199-199)-0,8	10,2	95,0	24,0	84	2,30	40,0	40,0	40,0	40,0	6,8	



Three stage TECs



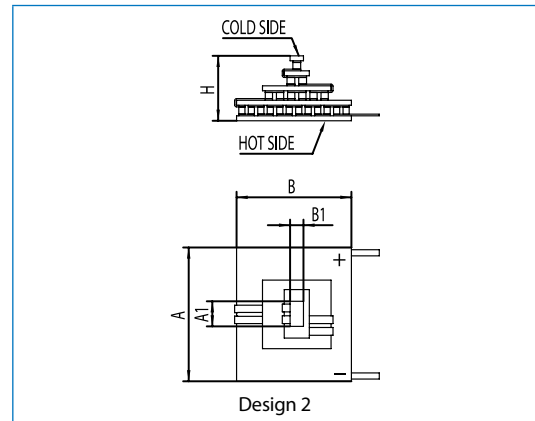
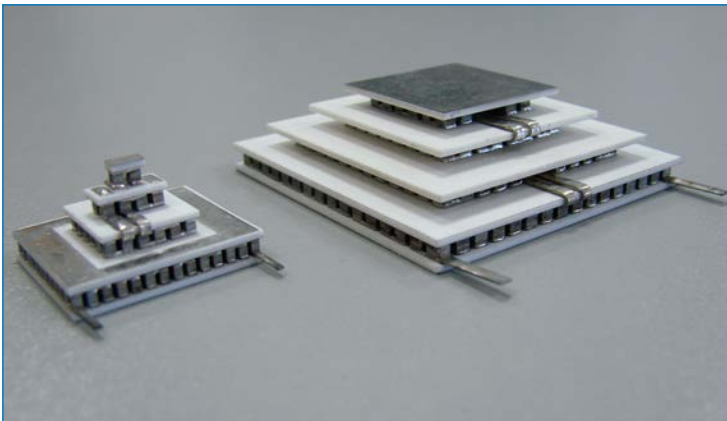
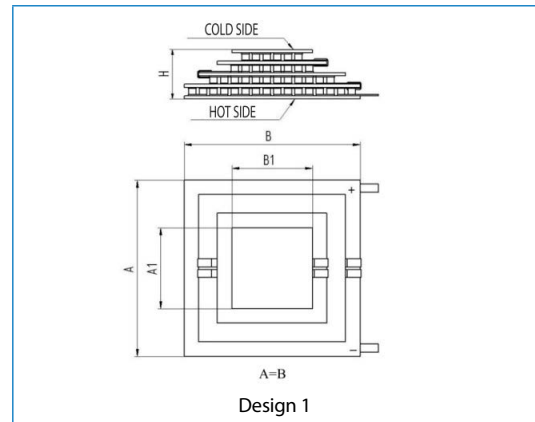
Three stage thermoelectric coolers

Type	I _{max} , (Amps)	Q _{max} , (Watts)	U _{max} , (Volts)	ΔT _{max} , (K)	R _{ac} , (Ohm)	Dimensions, mm					Design
						A	B	A1	B1	H	
TB-3-(31-11-4)-1,5	0,9	0,4	3,5	109	5,40	8,0	10,0	2,0	4,0	9,3	3
TB-3-(31-11-4)-1,2	1,1	0,5	3,5	108	4,30	8,0	10,0	2,0	4,0	8,4	
TB-3-(31-11-4)-1,0	1,3	0,6	3,5	107	3,60	8,0	10,0	2,0	4,0	7,8	
TB-3-(49-17-4)-2,5	6,3	3,3	5,3	113	0,9	36,0	36,0	8,0	14,0	16,0	
TB-3-(59-17-4)-1,5	1,0	0,5	6,8	114	7,20	12,0	12,0	2,0	4,0	9,3	1
TB-3-(59-17-4)-1,2	1,2	0,6	6,8	113	5,80	12,0	12,0	2,0	4,0	8,4	
TB-3-(59-17-4)-1,0	1,4	0,7	6,8	112	4,80	12,0	12,0	2,0	4,0	7,8	
TB-3-(83-18-4)-1,3	3,7	2,5	10,0	118	2,35	24,0	20,6	8,7	4,5	10,8	2

Multistage thermoelectric coolers



Four stage TECs



Four stage thermoelectric coolers

Type	I _{max} , (Amps)	Q _{max} , (Watts)	U _{max} , (Volts)	ΔT _{max} , (K)	R _{ac} , (Ohm)	Dimensions, mm					Design
						A	B	A1	B1	H	
TB-4-(59-31-11-4)-1,5	0,8	0,4	6,9	118	8,90	12,0	12,0	2,0	4,0	12,2	1
TB-4-(59-31-11-4)-1,2	1,0	0,5	6,9	117	7,15	12,0	12,0	2,0	4,0	11,0	
TB-4-(59-31-11-4)-1,0	1,1	0,6	6,9	116	5,95	12,0	12,0	2,0	4,0	10,2	
TB-4-(83-18-4-1)-1,3	3,7	0,8	10,0	138	2,37	24,0	20,6	4,5	2,4	13,6	2
TB-4-(127-71-31-17)-1,65	6,8	14,8	14,1	107	2,05	48,0	48,0	22,0	22,0	15,0	1
TB-4-(199-97-49-17)-1,5	6,7	16,9	23,6	111	3,45	62,0	62,0	20,0	20,0	14,5	

Standard and additional options for single-stage miniature coolers

Description	Notation (*)	Note
Substrates material		
Alumina Al ₂ O ₃ (BK-96)	-	Standard performance
Aluminium nitride (AlN)	N	Heat conductivity > 180 W/m·K
Operating and mounting temperatures		
Operating temperature up to 120 °C (standard), max Mounting temperature ≤ 130 °C**	HT(120)	Standard performance. Melting point of TEC's solder T=139°C
Operating temperature up to 150 °C, max Mounting temperature ≤ 170 °C**	HT(150)***	Melting point of TEC's solder T=183°C (Pb-Sn)***

To be continued on the **page 24**.



Multistage thermoelectric coolers

Parallelism and flatness of mounting surfaces		
Flatness 0,1 mm; Parallelism 0,15 mm	L4	Standard performance. Height tolerance $\pm 0,35$ mm
Flatness 0,02 mm; Parallelism 0,03 mm	L1****	Height tolerance $\pm 0,05$ mm
Flatness 0,015 mm; Parallelism 0,02 mm	L2****	Height tolerance $\pm 0,025$ mm
Metallization of cold and (or) hot sides		
Metallization of cold (mc) and (or) hot side of TEC with solder tinning	mc95, mh95, mm117 etc.	Melting temperatures 95 °C, 117 °C, 139 °C or 183 °C
Gold plating	mcAu, mhAu, mmAu	0,2-1 micron thickness
Nickel plating	mcNi, mhNi, mmNi	
Other standard and additional options		
Sealants: epoxy, silicon, urethane, conformal coating	Cc	
Tolerance of Rac value		$\pm 15\%$
Tolerance of length (dimensions A, A1) and width (dimensions B, B1)		+0,5/-0,2mm
Tolerance of height		$\pm 0,35$ mm (standart performance)
Type and length of lead wires (standard length 120 mm)	-	Up to customer's requirements
Connectors attachment	-	
TEC could be mounted on heatsink, cold block or into the electronic devices enclosure	-	

- (*) – the notations shown are used to notate additional options in the cooler name (please refer to System of Notation below);
 (**) – the maximum mounting temperature influence on the TEC must not exceed 2 minutes;
 (***) – attention! This option does not meet ROHS requirements;
 (****) – to be agreed.

System of notation:

A universal abbreviation is used to notate multistage TECs:

TB-n-(N1-N2-N3-N4)-h, where:

TB — product abbreviation — thermoelectric battery (TEC);

n — number of stages in the TEC;

N — number of thermocouples in the TEC:

(N1-N2) is used for two stage TECs;

(N1-N2-N3) — for three stage TECs;

(N1-N2-N3-N4) — for four stage TECs;

h — height of the thermoelectric element of the bottom stage (in millimeters).

For example: TB-2-(11-4)-1,0 HT (200) mmAu N denotes a two-stage thermoelectric cooler with max operating temperature 200°C, that consists of 11 thermocouples (22 thermoelectric elements) in the base stage and 4 thermocouples in the second stage, every element has the cross-section of 1x1 mm. The TEC is made on a aluminium nitride substrate. Cold and hot sides are metallized with golden coating.

Environment safety features:

The thermoelectric coolers do not contain lead or any other forbidden materials according to RoHS directive requirements.



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