

# Thermoelectric solutions



**Our standard range is wide enough  
to satisfy 8 out of 10 customers**



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*But what about the other two? We leave them in the capable hands of our design engineers (see overleaf).*

*Compact, efficient and reliable, our products have been put to the test in scores of applications – often under trying conditions.*

*Our PowerCool range is ideal for OEM users. We provide everything you need to get your thermoelectric system up and running.*

*Welcome to Supercool.*



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For more information on the market's leading thermoelectric modules, order our TEM catalog.



# Custom design and engineering

Although we offer the widest range of standard thermoelectric cooling systems on the market, we realize that a standard solution will not always meet your needs. So, if your application requires special attention – and many do – you’ve come to the right place.

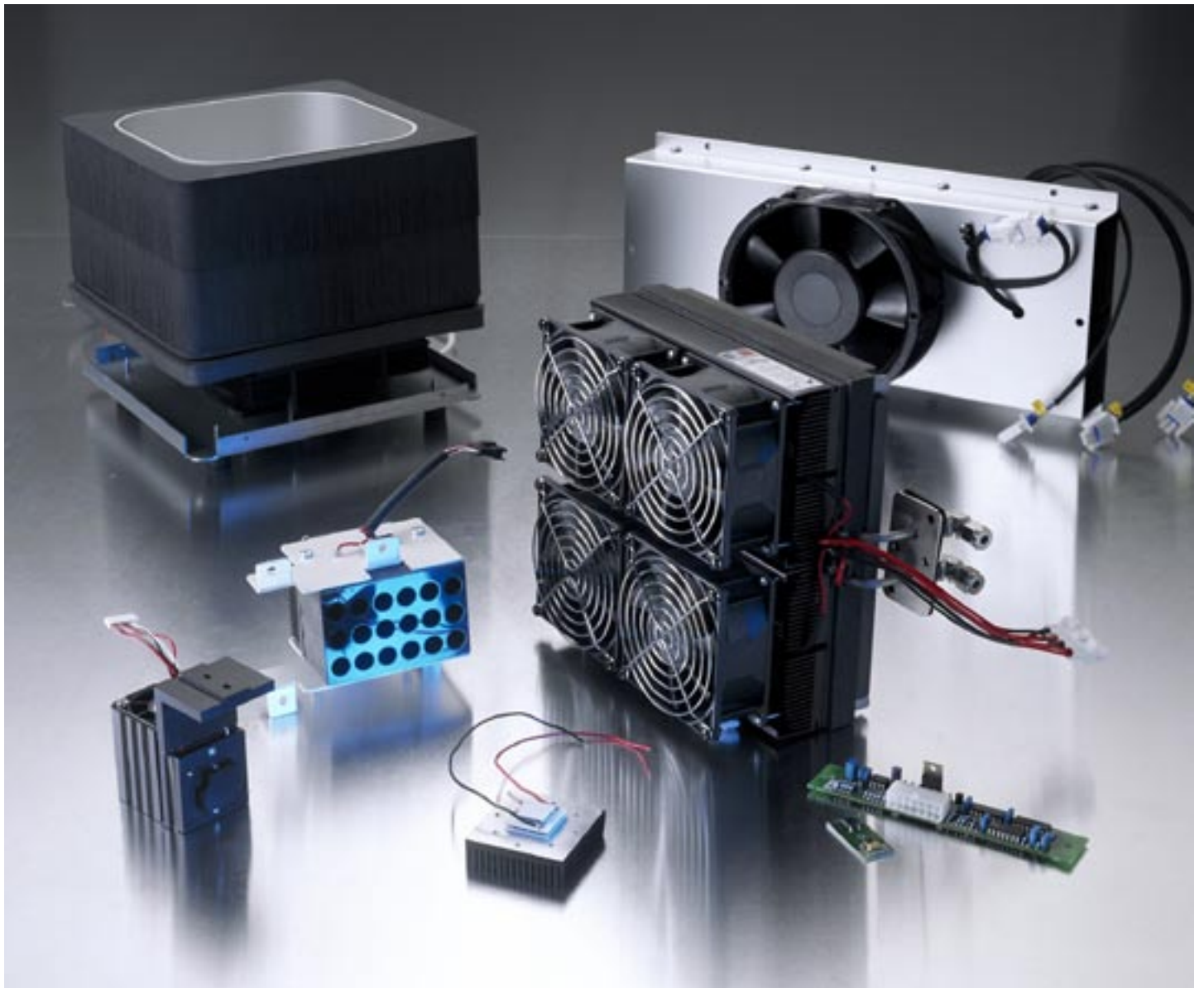
## Finding a solution quickly

Our lengthy application experience allows us to find the optimal custom solution – with a minimum of time wasted. We’ll help you conduct thermal design studies to define your demands. Our engineers will then work closely with your personnel to implement the solution. This process is greatly speeded up by our access to a wide array of thermoelectric ‘building blocks.’

## Why do it yourself?

Some companies decide to go it alone and design their own coolers. Perhaps you’re among them. Our advice can be summed up in one word. Don’t.

We have a much better idea. Why not let us bring together what we do best with what you do best? By combining our expertise in thermoelectrics with the knowledge you have of your business, you can optimize your thermal management. We carry out application studies to ensure you get the very best. And if your project calls for it, we will test-run solutions in our climatic chamber.



*Above you'll find a selection of recent projects where customers really put our engineers to the test.*



## 25 years of innovation

Over the past 25 years, we've acquired a wealth of know-how. To keep us right on the cutting-edge, we not only have a well-equipped R&D department at our disposal, but we also partner with some of the world's most progressive companies in our field.

### Product development without end

The beating heart of our assemblies is the market's finest range of thermoelectric modules – optimized for unrivaled performance. Our temperature controllers – from basic ON/OFF to advanced programmable PID regulation – are all designed and tested on our premises. What's more, our in-house designed heat sinks deliver superior performance and economy – thanks to novel extrusion technology.

To ensure our products deliver the best possible quality and performance, we conduct extensive design studies and testing in our thermal laboratory.

### Flexible production

Our manufacturing process is highly efficient – from prototyping to large-volume production. Modular design allows flexibility and rapid delivery. Skilled and experienced personnel are complemented by advanced computerized testing throughout the process.



*Work station with automatic computer testing.*



## Our assemblies have to operate just about everywhere

Today it's widely accepted that thermoelectrics enjoy virtually limitless potential. That's why our solutions have seen action all over the world. They take blistering heat and corrosive damp. They withstand shocks and vibrations. They manage thermal cycling and provide absolute accuracy. Yet they never lose their cool. Why? Partly because we employ solid-state technology. And partly because we know thermoelectrics.

### Electronics and industrial

Whether you're cooling a single component or an entire cabinet, we're confident we have just the solution you're looking for. We provide robust units for outdoor applications and compact coolers for components.

#### Application examples:

- Laser/photronics
- Cabinet cooling (indoors and outdoors)
- Process fluid cooling.

### Medical and laboratory

Our wide range of small and medium-size units handle most applications – from keeping samples cool to stabilizing temperatures in sensitive instruments. Our PID controllers help you maintain exactly the right temperature.

#### Application examples:

- Analytical instruments
- Medical lasers
- Laboratory equipment
- PCR-thermal cycling.

### Food and beverage

Maintaining the right temperature is crucial when you handle food and beverages. We provide a comprehensive selection of assemblies to help keep your products fresh – all the way from producer to consumer.

#### Application examples:

- Point-of-sale vitrines
- Beverage coolers
- Small refrigerators
- Mobile food containers.

## Otherwise we wouldn't have many customers

We have a lot of customers all over the world. Some, like Nortel, Roche and Volvo, for example, are among the world's largest corporations. We're pretty sure they would go elsewhere if our products couldn't deliver dependable performance.

But there's a lot more to our offer than just hardware and software.

### **Supercool in reality...**

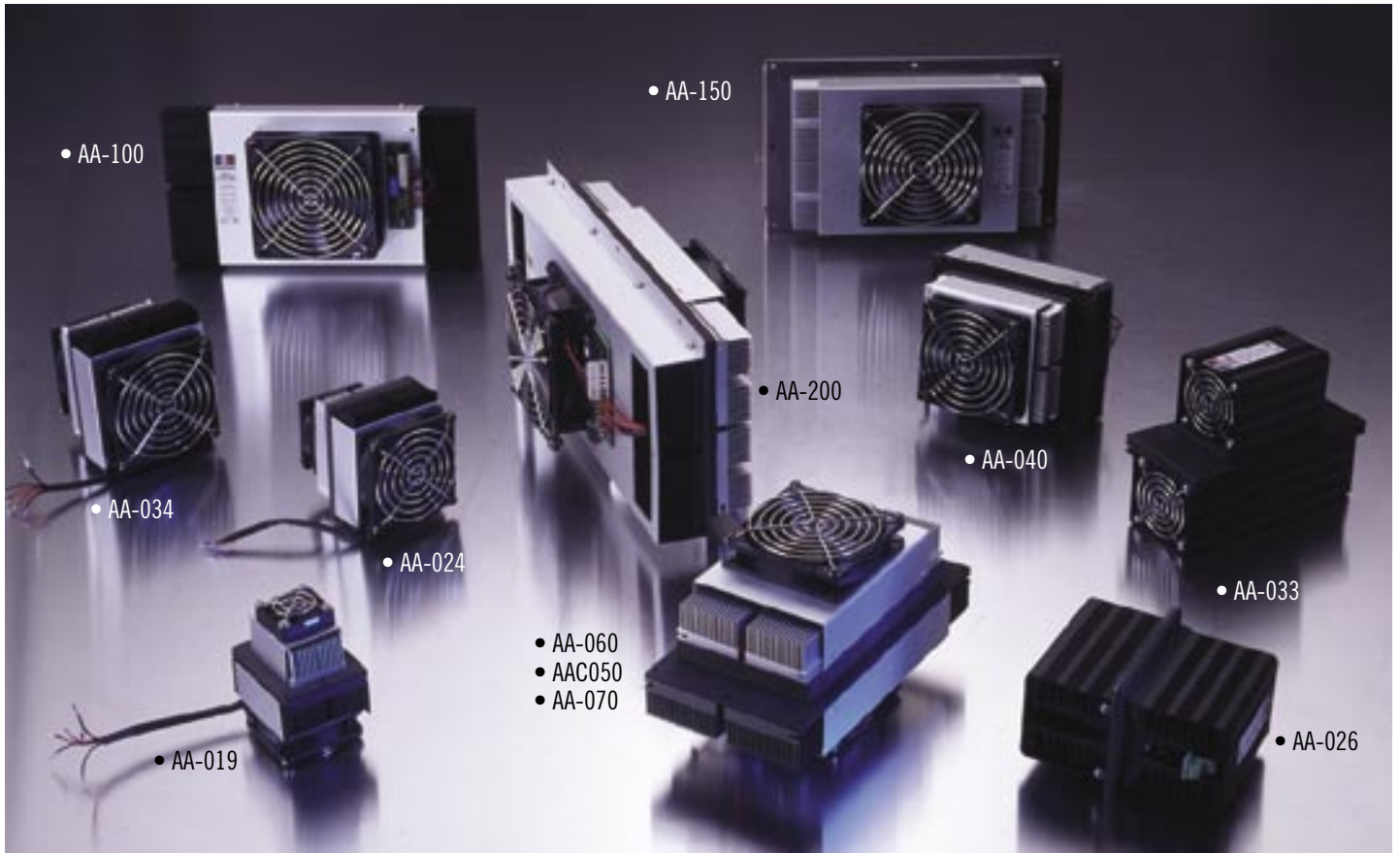
Though we have operations in Sweden and the United States, it's only through our international network of partners and representatives that we can offer you a global service. Their commitment to quality, service and integrity has established Supercool as a global supplier of thermoelectric solutions. You're never too far from Supercool – wherever you are.

### **...and in virtual reality**

[www.supercool.com](http://www.supercool.com) is much more than simply a shop-window for us. This is where you go for the latest news as well as tips and advice on how to best manage your thermal challenges. As a customer, you'll have access to a variety of technical drawings, schematics and much more.

### **Cool by nature**

Environmental legislation is getting ever tougher. But once you opt for thermoelectrics you need never worry that you've chosen a cooling system that has a negative impact on the environment. That's because electricity triggers the cooling process; there are no CFCs and no need for refills.



Features: All-in-one, plug and play. Can be mounted in any direction. For cooling and heating. Temperature controllers can be integrated with larger coolers. Reliable and virtually maintenance-free.

## Air-Air systems (AA)

Air-Air coolers are used to cool (or heat) objects in containers. Heat is absorbed and dissipated by heat exchangers equipped with fans. Simply cut a hole, plug in the assembly and connect it to a power source. Our Air-Air coolers are designed for dependable, compact performance.

### Tunnel Series

Two of our smallest coolers, AA-026 and AA-033, are based on a patented ‘tunnel’ concept, ideal for applications where the air-flow has to travel in a tunnel direction. Other models are available on request.

These products are typically used to cool analytical instruments,

small electronics enclosures and mini-refrigerators.

### PowerCool Series

Available in 12 standard versions divided into 8 sizes, our PowerCool range delivers performance from 20 W to 193 W. All models are optimized for a variety of voltages,  $\Delta T$  and efficiency. Moisture protected versions are optional (see Fans, page 17).

We also provide a selection of temperature controllers. For more information, see pages 14-15.

Typical applications include cooling electronics cabinets, analytical instruments, commercial refrigeration and food transportation boxes.

### Product specifications

Part # -V*-	Cooling Power P <sub>c</sub> max (W)	P <sub>c</sub> Curve type	Current (A)	Power input (W)	Ambient max (°C)	Weight (kg)	Dimensions (mm)					
							Lw	Lc	Ww	Wc	Hw	Hc
AA-019-12-22	20	B	2.3	28	52	0.3	80	60	60	40	63	38
AA-024-12-22	25	A	2.4	29	51	0.6	100	80	80	60	63	55
AA-026-12-22	25	D	3.7	44	39	1.0	107	97	84	65	72	67
AA-033-12-22	32	A	3.7	44	48	1.4	180	97	84	65	71	67
AA-034-12-22	33	A	3.5	42	49	0.9	120	100	100	80	64	57
AA-040-12-22	41	C	6.3	76	48	1.8	160	120	122	102	71	76
AA-040-24-22	39	C	2.6	62	52	1.8	160	120	122	102	71	76
AAC050-24-22	49	E	4.7	113	47	2.7	230	180	122	102	71	80
AA-060-12-22	58	B	6.2	74	51	2.5	230	180	122	102	71	81
AA-060-24-22	58	B	3.1	74	51	2.5	230	180	122	102	71	81
AA-070-24-22	71	A	3.8	91	48	2.5	230	180	122	102	71	81
AA-100-24-22	102	C	5.6	134	49	4.0	300	230	152	122	78	83
AA-150-24-22	143	A	7.9	190	48	4.1	300	250	180	152	84	83
AA-200-24-22	193	C	11.3	271	46	7.0	400	350	180	152	89	89

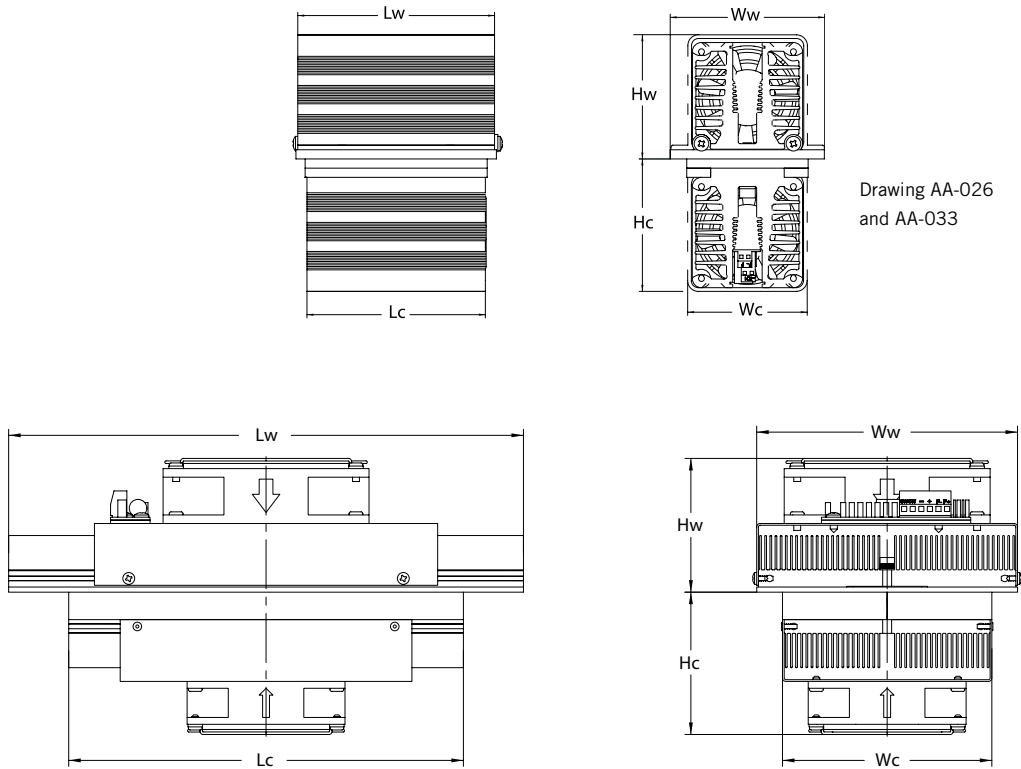
\*= Nominal Voltage (V DC)

Specifications apply to ambient temperature 32°C and nominal Voltage.

Tolerances  $\pm 10\%$



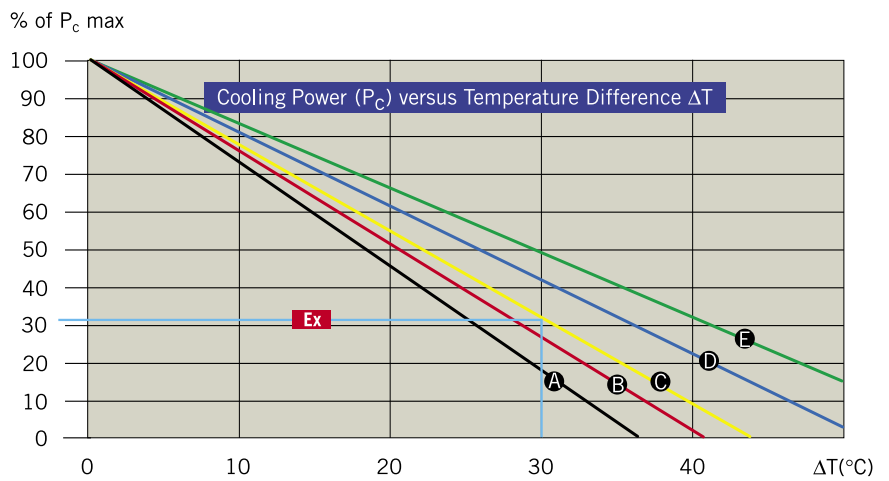
AA-drawings



Drawing AA-026 and AA-033

For detailed drawings, please visit our website

Ex = Example: At ambient 32°C and cooled space temperature 2°C ( $\Delta T = 30^\circ\text{C}$ ) the AA-100-24-22 (curve C) cools by 32% of its maximum effect, which gives  $P_c = 102 \times 0.32 = 32.6 \text{ W}$  ( $\pm 10\%$ )



AIR-LIQUID SYSTEM

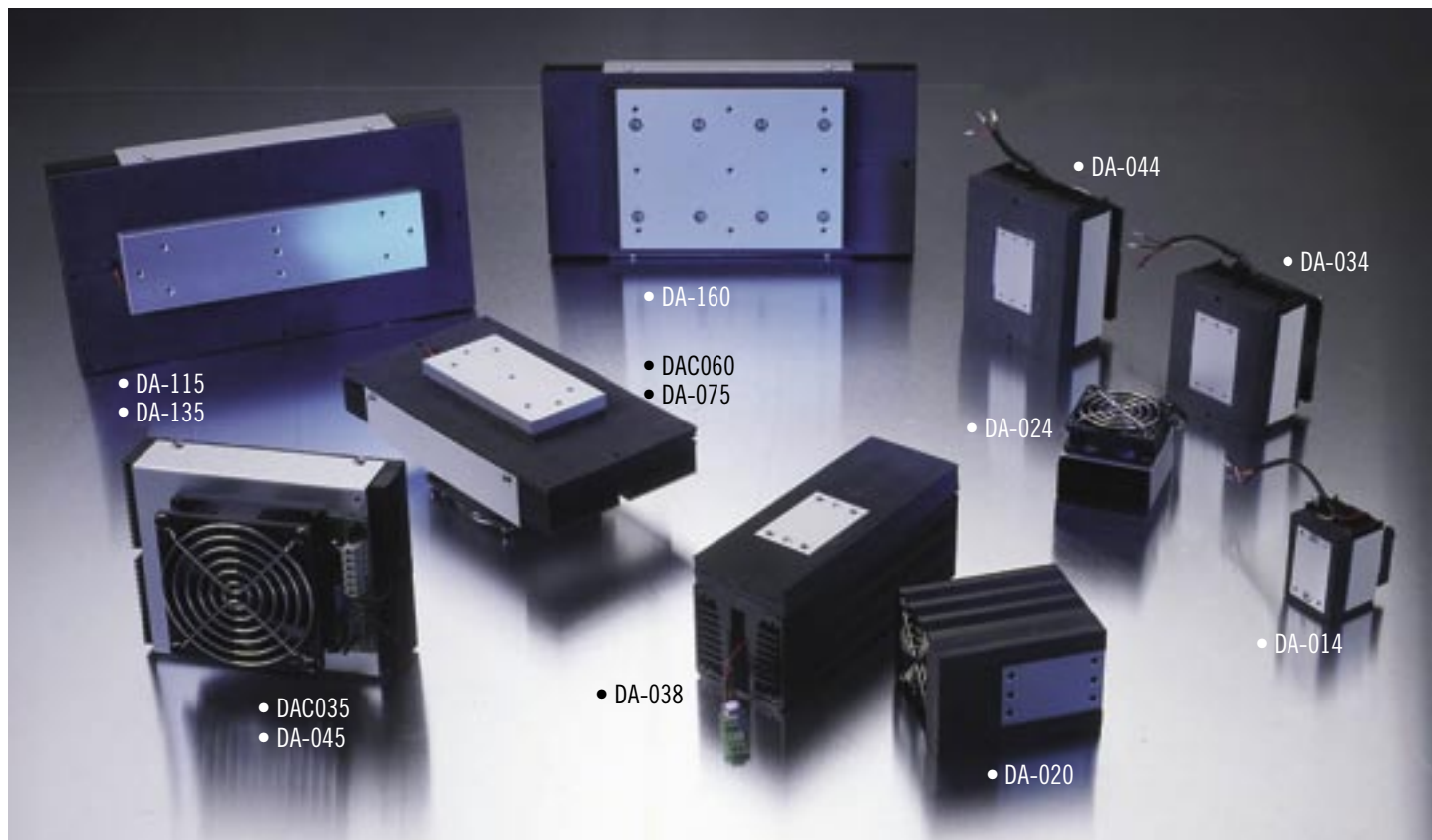


**Air-Liquid systems (AL)**

Air-Liquid coolers are ideal when you need high performance in a compact design. The heat is absorbed by an air heat sink on the cold side and then dissipated to a liquid on the warm side. The liquid circuit is normally of a recirculating type, equipped with a pump and a liquid-to-air heat exchanger to remove the heat into the ambient air.

Our AL design allows you to place the unit in a cooled area with only an 'outlet' for liquid tubing and electrical connections.

For more information, refer to our Liquid-Air assemblies on page 12-13. These units can also be used as AL units by simply reversing polarity on the TE modules. Contact Supercool for more information on optimized AL-units.



Features: Compact design allows for integration with existing equipment. Versatility, cools enclosures, liquid or objects directly. Easy interfacing to cooled object, all you need are screws and a flat surface. Temperature controllers can be integrated with larger coolers. High reliability, minimum maintenance

## Direct-Air systems (DA)

Direct-Air assemblies are used in three key applications, including cooling/heating: 1.) Objects directly on the cold plate, or objects on an additional cold plate of your own design. 2.) Enclosures by attaching a thermal conductive container to the cold plate. 3.) Liquids by attaching a thermal conductive tank or liquid heat sink to the cold plate.

The heat is absorbed by the cold plate, pumped through the TE modules and then dissipated to the air by an air heat sink. Our Direct-Air coolers deliver compact and reliable cooling.

### Tunnel Series

Two of our smallest coolers, DA-020 and DA-038, are based

on a patented ‘tunnel’ concept, suitable for applications where the airflow has to travel in a tunnel direction. Other models are available on request. These products are typically used to cool analytical instruments, lasers, small electronics enclosures and mini-refrigerators.

### PowerCool Series

Available in 13 standard versions divided into 8 sizes, our PowerCool range delivers cooling power from 12 W to 160 W. All models are optimized for a variety of voltages,  $\Delta T$  and efficiency. Typical applications include cooling electronics, analytical instruments, lasers and commercial refrigeration.

### Product specifications

Part # _V*_	Cooling Power P <sub>C</sub> max (W)	P <sub>C</sub> Curve type	Current (A)	Power input (W)	Ambient max (°C)	Weight (kg)	Dimensions (mm)					
							Lw	Lc	Ww	Wc	Hw	Hc
DA-014-12-02	12	D	1.8	22	44	0.2	60	50	40	30	42	11
DA-020-12-02	19	C	2.7	32	44	0.6	97	62	65	40	68	14
DA-024-12-02	24	C	2.4	29	48	0.3	80	60	60	40	56	13
DA-034-12-02	34	B	2.6	31	46	0.5	100	60	80	40	58	14
DAC035-12-02	31	E	4.8	58	54	1.2	160	60	122	60	71	20
DA-038-12-02	38	A	3.6	43	43	1.2	180	62	65	40	67	14
DA-044-12-02	42	B	3.8	46	46	0.6	120	60	100	40	59	13
DA-045-12-02	48	D	6.1	73	46	1.2	160	60	122	60	71	15
DA-045-24-02	45	D	2.5	60	50	1.2	160	60	122	60	71	15
DAC060-24-02	58	E	4.6	110	48	1.8	230	120	122	60	71	20
DA-075-12-02	71	C	7.2	86	49	1.7	230	120	122	60	71	15
DA-075-24-02	71	C	3.7	89	49	1.7	230	120	122	60	71	15
DA-115-24-02	113	C	5.8	139	47	2.9	300	220	152	60	78	16
DA-135-24-02	135	A	6.9	166	42	2.9	300	220	152	60	78	16
DA-160-24-02	160	B	7.4	178	46	3.5	300	180	152	130	84	16

\*= Nominal Voltage (V DC)

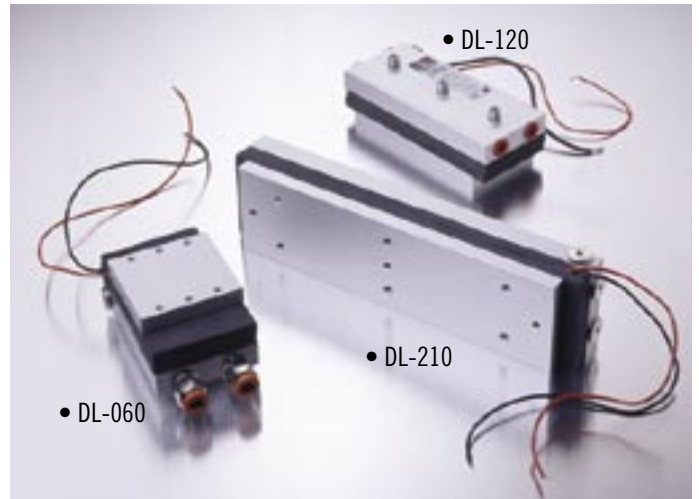
Specifications apply to ambient temperature 32°C and nominal Voltage.

Tolerances ±10%

## Direct-Liquid systems (DL)

Direct-Liquid assemblies are used to cool or heat either objects attached directly to the cold plate, or enclosures by attaching a thermal conductive container to the cold plate. Heat is dissipated to a liquid on the warm side. The liquid circuit is normally of a recirculating type with a pump and a liquid-to-air heat exchanger removing the heat into the ambient air. By using an efficient heat exchanger and one or more DL-assemblies a very powerful yet compact system is created.

Our standard assemblies are optimized for high cooling capacity and efficiency rather than maximum  $\Delta T$ . Typical applications include temperature cycling of electronic components, laser cooling and analytical instruments.

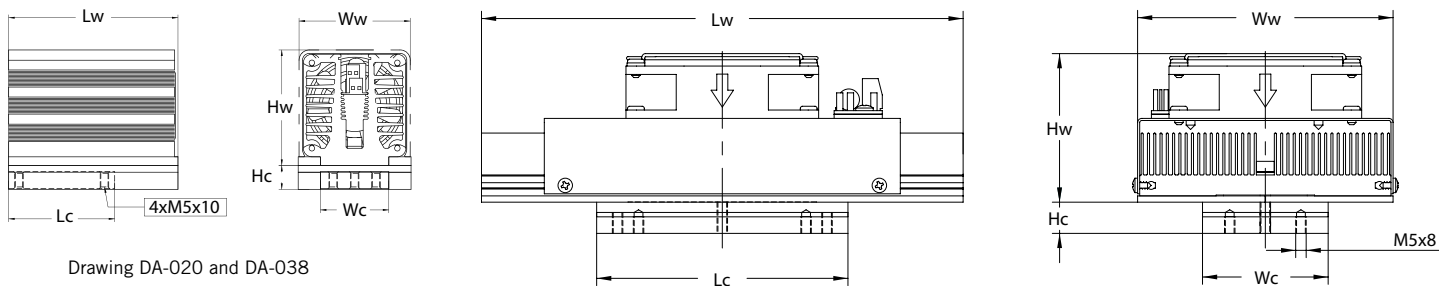


### Product specifications

Part # -V*-	Cooling Power $P_C$ max (W)	$P_C$ Curve type	Current (A)	Power input (W)	Ambient max ( $^{\circ}C$ )	Weight (kg)	Dimensions (mm)					
							Lw	Lc	Ww	Wc	Hw	Hc
DL-060-12-00	59	C	4.2	50	63	0.4	100	60	60	60	15	24
DL-120-24-00	122	C	4.2	101	62	0.7	140	120	60	60	15	24
DL-210-24-00	207	C	8.1	194	62	1.3	240	220	60	60	15	24

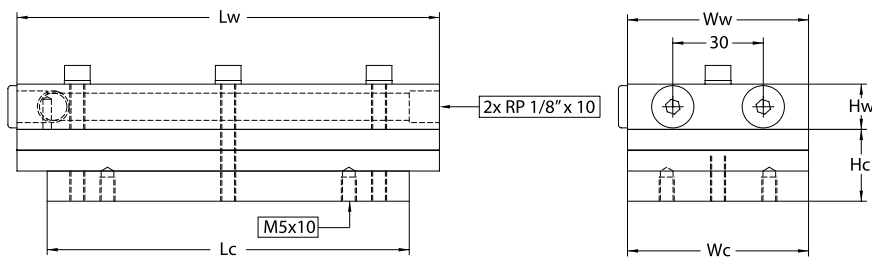
\*= Nominal Voltage (V DC)  
 Specifications apply to warm side  
 Liquid temperature  $32^{\circ}C$  and  
 nominal Voltage.  
 Tolerances  $\pm 10\%$

### DA-drawing



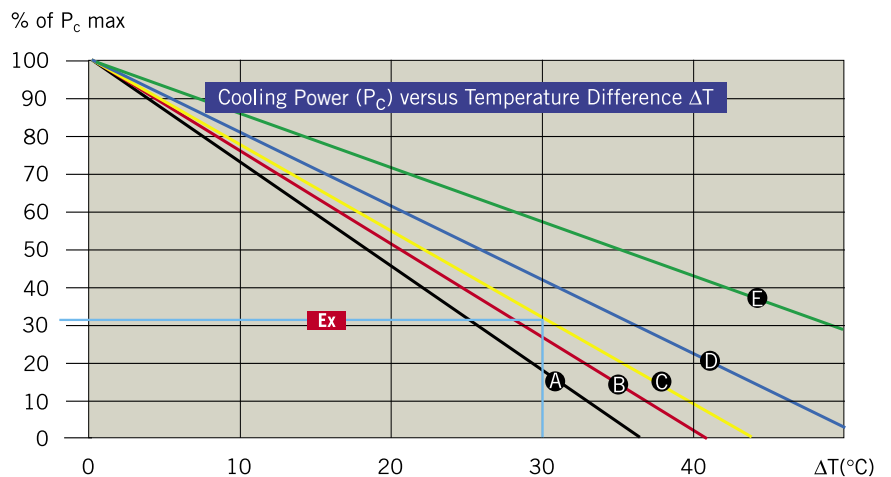
Drawing DA-020 and DA-038

### DL-drawing



For detailed drawings, please  
 visit our website

Ex =Example: At ambient  $32^{\circ}C$  and cooled space  
 temperature  $2^{\circ}C$  ( $\Delta T = 30^{\circ}C$ ) the DA-075-24-02  
 (curve C) cools by 32% of its maximum effect, which  
 gives  $P_C = 71 \times 0.32 = 22.7 (\pm 10\%)$





Features: Compact design offers excellent possibilities for integration with existing equipment. Efficient liquid heat sink thanks to inserted turbulators. Temperature controllers can be integrated with larger coolers. High reliability, minimum maintenance.

## Liquid-Air systems (LA)

Liquid-Air assemblies are used to cool or heat a liquid (or gas) flowing through a heat sink. The liquid heat sink is designed for a recirculating system. The heat is absorbed by the liquid heat sink, pumped through the TE modules, and then dissipated to the air by an air heat sink.

Available in five standard versions, our PowerCool range delivers cooling performance from 24 W to 160 W. Our Liquid-Air coolers provide compact and reliable cooling/heating. To improve heat transfer, turbulators are inserted into the liquid channels. However, for higher liquid flow rates these may have to be removed to reduce pressure drop.

Our liquid heat sinks are made of anodized aluminum. Should your application call for another material in contact with your media, use a DA-assembly and mount your own liquid heat sink.

### Typical applications:

- Cooling of tissue or other areas of the body in laser or microwave thermo therapy.
- Cooling/heating in capillary electrophoresis.
- Cooling of power lasers and other sensitive electronics.

### Product specifications

Part # -V*-	Cooling Power P <sub>C</sub> max (W)	P <sub>C</sub> Curve type	Current (A)	Power input (W)	Ambient max (°C)	Weight (kg)	Dimensions (mm)					
							Lw	Lc	Ww	Wc	Hw	Hc
LA-024-12-02	24	B	2.4	29	48	0.4	80	80	60	60	64	15
LA-045-12-02	43	B	4.1	49	52	1.3	160	100	122	60	71	20
LA-075-24-02	71	B	3.7	89	49	1.8	230	140	122	60	71	20
LA-115-24-02	113	B	5.8	139	47	3.0	300	240	152	60	78	20
LA-160-24-02	160	A	7.4	178	46	3.5	300	200	152	136	84	20

\*= Nominal Voltage (V DC)

Specifications apply to ambient temperature 32°C and nominal Voltage.

Tolerances ±10%

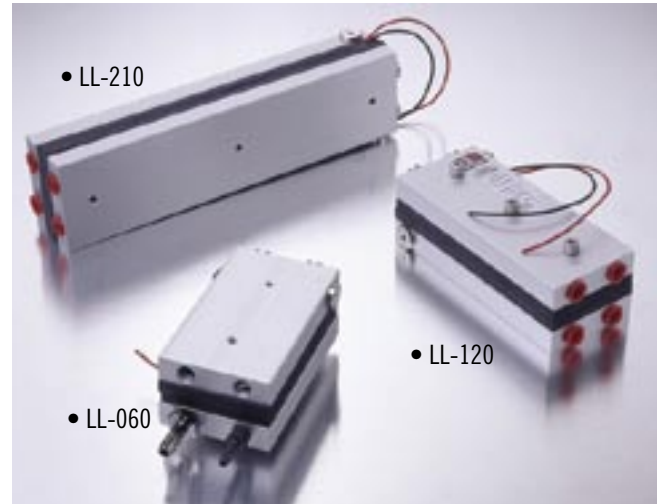
## Liquid-Liquid systems (LL)

Liquid-Liquid assemblies are used to cool or heat liquids (or gases) passing through a heat sink. Heat is dissipated to a liquid on the warm side. The liquid circuit is normally of a recirculating type with a pump and a liquid-to-air heat exchanger to remove the heat into the ambient air. By using an efficient heat exchanger and one or more LL-assemblies, a powerful yet compact system is created.

The liquid heat sinks are made of anodized aluminum. In the event that your application calls for another material in contact with your media, use a DL assembly and mount your own liquid heat sink using that material. To improve heat transfer, turbulators are inserted into the liquid channels.

The standard assemblies are optimized for high cooling capacity and efficiency rather than maximum  $\Delta T$ .

Typical applications are medical and analytical equipments, cooling/heating of process fluids.



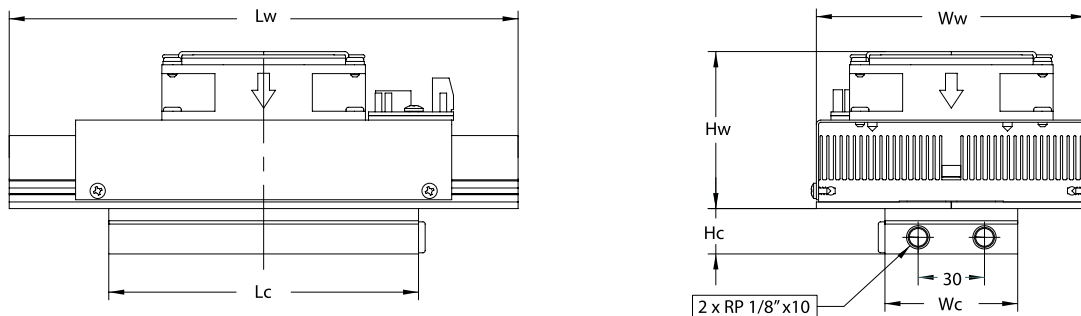
### Product specifications

Part # -V*-	Cooling Power $P_C$ max (W)	$P_C$ Curve type	Current (A)	Power input (W)	Ambient max ( $^{\circ}C$ )	Weight (kg)	Dimensions (mm)					
							Lw	Lc	Ww	Wc	Hw	Hc
LL-060-12-00	61	B	4.2	50	63	0.5	100	100	60	60	15	29
LL-120-24-00	122	B	4.2	101	62	0.8	140	140	60	60	15	29
LL-210-24-00	208	B	8.1	194	62	1.4	240	240	60	60	15	29

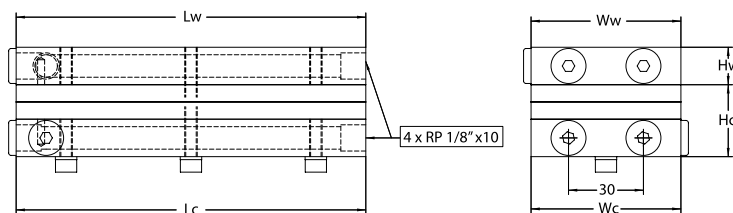
\*= Nominal Voltage (V DC)

Specifications apply to warm side  
Liquid temperature  $32^{\circ}C$  and  
nominal Voltage. Tolerances  $\pm 10\%$

### LA-drawing



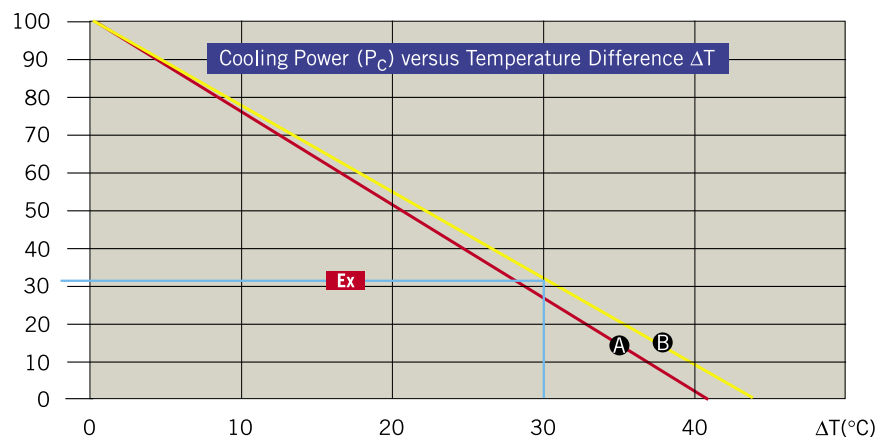
### LL-drawing



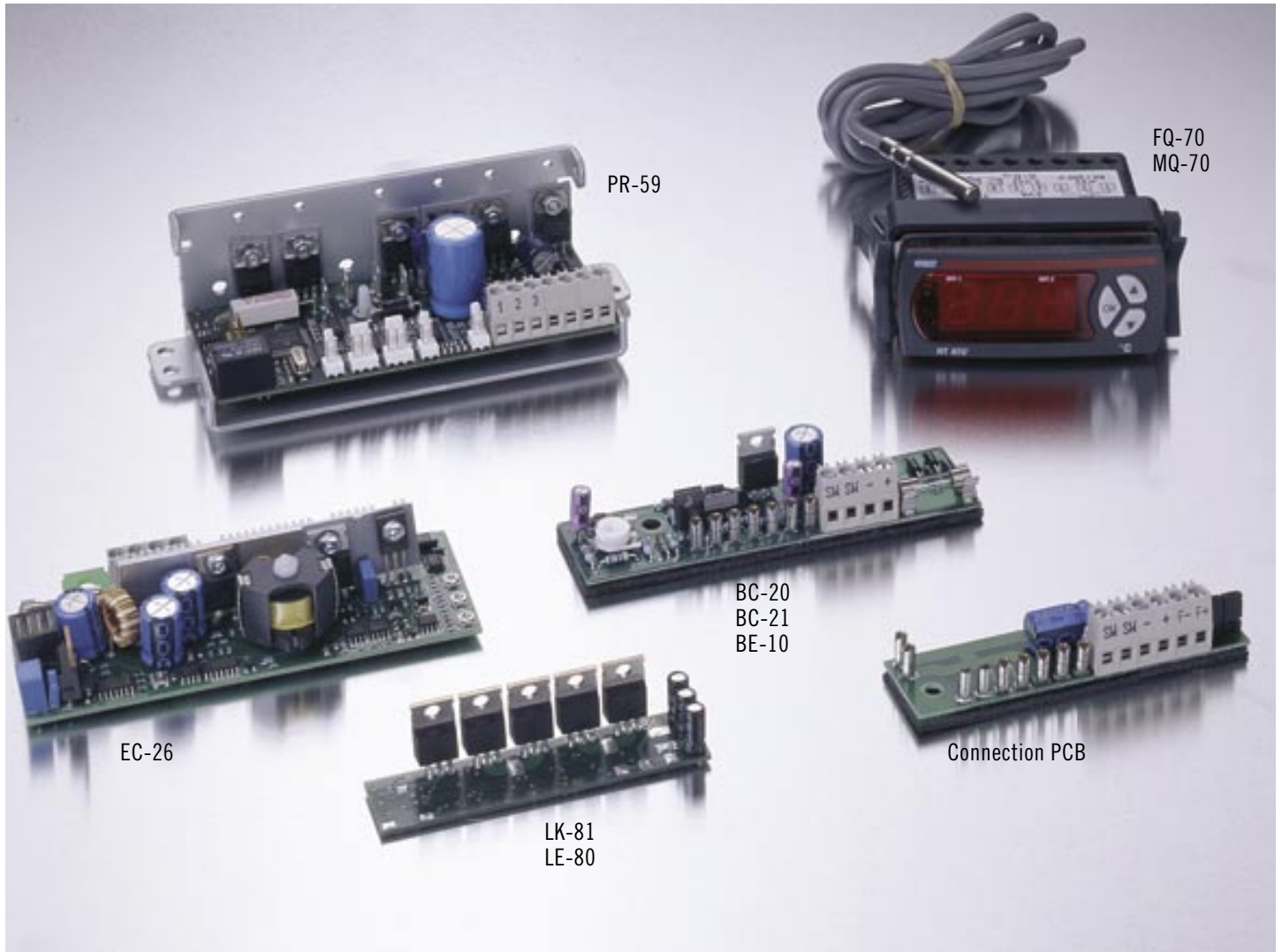
For detailed drawings, please  
visit our website

Ex =Example: At ambient  $32^{\circ}C$  and cooled  
space temperature  $2^{\circ}C$  ( $\Delta T = 30^{\circ}C$ ) the  
LA-045-12-02 (curve B) cools by 32% of  
its maximum effect, which gives  
 $P_C = 43 \times 0.32 = 13.8 \text{ W } (\pm 10\%)$

% of  $P_C$  max



## Temperature controllers



### Designed for TE systems

We offer a wide range of temperature controllers, from basic ON/OFF to advanced PC programmable versions. Our in-house designed models (except panel mount) provide not only temperature control, but also system functions, including separate fan control, low voltage protection and alarm. We're confident we can find the ideal controller for your application – regardless of whether it's a battery operated system, outdoor electronics cabinet, wine cabinet or an analytical instrument.

### Assemblies without controllers

All assemblies supplied without temperature controller (except DL, LL, and the smallest PowerCool assemblies) have a connection PCB. Fans always have to be powered separately. If you want to use the assembly for cooling and heating, reverse the polarity on the TE-modules, but not on the fans. All assemblies with power input above 48 W feature an Over-Heating-Thermostat (OHT) for protection in case of poor venting on the warm side. The OHT is set to cut off at a heat sink temperature of  $75^{\circ}\text{C} \pm 4^{\circ}\text{C}$ .

**Serial transistor controllers – affordable and versatile:**

Serial transistor controllers provide accuracy and efficiency at an affordable price. These products feature ON/OFF mode as standard, but can be used for proportional regulation mode (option) when greater efficiency and temperature stability are required. In that case, maximum power consumption is 50 W. Controllers are available for 12 or 24 V DC and can be integrated with assemblies above 50 W cooling power (except DL and LL models).

The temperature setting is fixed, but should you need to adjust it, use the trim potentiometer on the PCB.

For battery-operated systems, low voltage protection is included. Custom settings are available.

**Available versions: BC-20, BC-21 and BE-10.**

**Proportional PWM controllers – for high efficiency:**

PWM controllers with filtered output offer optimum efficiency and temperature stability. The temperature is set at 5°C but can be adjusted from 0 to 15°C.

Available for 24 V only, this compact controller is ideal for analytical instruments and battery operated applications.

Low and high voltage protection, Economy mode, as well as Automatic Cool Down™ ensure top performance for battery-operated systems. Custom settings are available.

The controller is mainly for mounting remotely. Ask us if you want to integrate it into an assembly.

**Available versions: EC-26**

**Programmable controllers – with temperature display**

Flexible panel mount controller for temperatures ranging from -50°C to 90°C with display and thermometer function.

There's one model for cooling only and a reversible model for keeping a constant temperature when the ambient temperature fluctuates.

You can safely wire it yourself. Apart from the desired temperature, you can also program regulation mode, hysteresis, temperature alarm, calibration and more.

Internal relays for 8 Amp continuously. The controllers operate on either 12 or 24 V DC.

**Available versions: FQ-70 and MQ-70.**

**Cool/Heat controllers – for outdoor cabinets:**

This fully integrated controller is designed for cooling and heating outdoor electronic cabinets where accuracy is not crucial, but reliability, simplicity and low cost are. The controller automatically keeps your electronics warm in wintertime and cool in the summer. Can handle currents up to 20 A.

A signal output indicates if the TE modules are active or not.

Available for heating below 5°C and cooling above 35°C (LE-80), or heating below 10°C and cooling above 25°C (LK-81). LK-81 includes low voltage protection and is designed for temperature control of batteries and electronics.

These controllers can be integrated with the biggest AA-assemblies (AA-100 to AA-200)

**Available versions: LK-81 and LE-80.**

**PC programmable PID controller – for the most challenging requirements:**

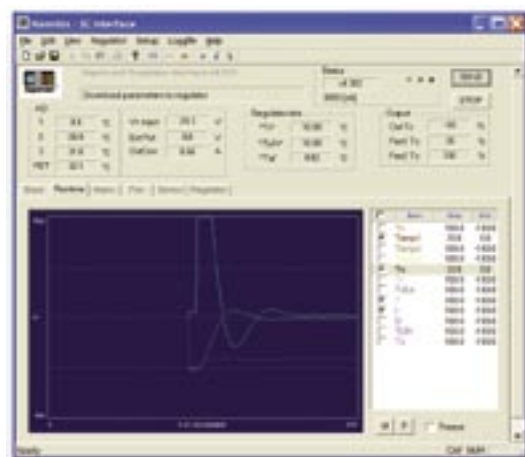
The PR-59 controller is built for reversible control of thermo-electric assemblies/systems with high temperature accuracy. The controller regulates temperature (TEMs), two programmable fan outputs and an alarm relay. The RS232 interface allows you to read and control parameters and settings in real-time. The controller can also be used as a stand-alone unit. Easy to use PC programming software is included. See picture below.

Can handle loads up to 15 A, or up to 450 W in standard version.

Temperature resolution of 0.05°C is achieved with a standard NTC sensor. Other sensors (NTC, PT) can be used as well.

Typical applications include analytical instruments, laser diodes, thermal chambers/baths and thermocyclers.

**Available versions: PR-59.**



Snapshot of graphical user interface showing run time graph of temperatures and PID parameters for PR-59.

**Product specifications**

Part #	Regulation type	I max A	Voltage V	Settings °C	Trim from °C	Accuracy ± °C	Hysteresis °C	Low Voltage Protection
BC-20	Serial transistor	8	12/24	5	0 to 20	1.5	1	no
BC-21	Serial transistor	8	12/24	5	0 to 20	1.5	1	yes
BE-10	Serial transistor	8	12/24	35	25 to 50	2	2	no
EC-26	PWM	7	24	5	0 to 15	1.5	0.5	yes
FQ-70	Relay	8	12-24	-50 to 90	Program	0.5	Program	no
MQ-70	Relay + Reversibel	8	12-24	-50 to 90	Program	0.5	Program	no
LK-81	Serial transistor	20/10	24/48	Cool>25°C, Heat<10°C	none	2.0	3	yes
LE-80	Serial transistor	20/20	12/24	Cool>35°C, Heat<5°C	none	2.0	3	no
PR-59	PWM	15	12/24	Sensor dependent	Software selectable	Sensor dependent	Software selectable	Software selectable



## Power supplies

All thermoelectric assemblies operate on low voltage DC current. This translates into high safety and simpler approval procedures. What's more, we offer a variety of stand-alone and built-in power supplies. All types are universal for 115 V AC or 230 V AC, and

are available in other versions (voltage, output power) for larger quantities.

The good news is that the stand-alone models don't have to be installed by qualified personnel.

### Specifications

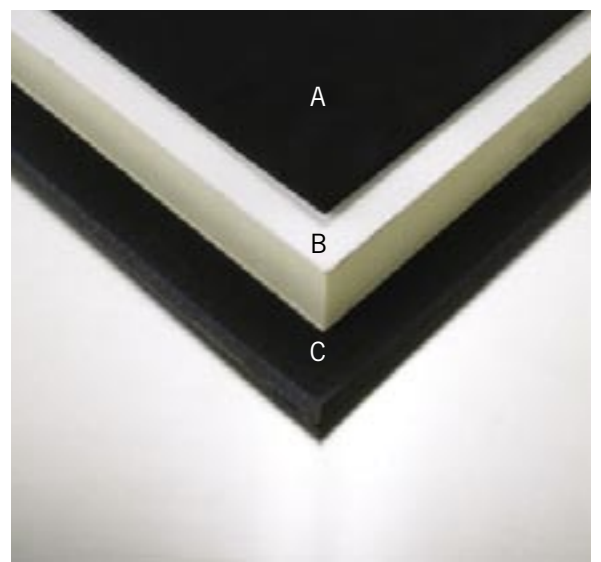
Part#	Input Voltage (V AC)	Output voltage (V DC)	Current max. (A)	Power max. (W)	Weight (kg)	Dimensions WDH (mm)	Max. ambient @ 100% load	Max. ambient @ 60% load	Mains connection	Output terminals
Stand-alone type										
NSE-066-12V	90-264	12	5.5	66	0.55	147 x 75.5 x 43.2	30°C	50°C	Cord	DC-plug 2.1 mm center pin
NSE-192-24V	88-132/176-264 <sup>1</sup>	27	8.0	216	1.4	140 x 150 x 86	40°C	60°C	Cord	4 mm lab-plug-sockets
Built-in type										
NSO-060-12V	85-264	12	5.0	60	0.6	97 x 159 x 38	40°C	55°C	Screw terminal	Screw terminal
NSO-100-12V	85-264	12	8.5	100	0.6	99 x 179 x 45	50°C	60°C	Screw terminal	Screw terminal
NSO-150-24V	85-264	24	6.5	150	0.8	110 x 199 x 50	45°C	50°C	Screw terminal	Screw terminal
NSO-240-24V	88-132/176-264 <sup>1</sup>	24	10.0	240	1.2	93 x 190 x 65	50°C	60°C	Screw terminal	Screw terminal

<sup>1</sup>Auto switch

## Insulation material

Whether you need to insulate a refrigerator or an electronic enclosure, Supercool provides environmentally friendly, CFC-free material. With its PVC coating and low heat conductivity, sandwiched polyurethane offers excellent supporting construction for refrigeration boxes or cabinets, while self-adhesive polyethylene (you have a choice of two thicknesses: 5 and 15 mm) can readily be applied in the walls of an existing enclosure.

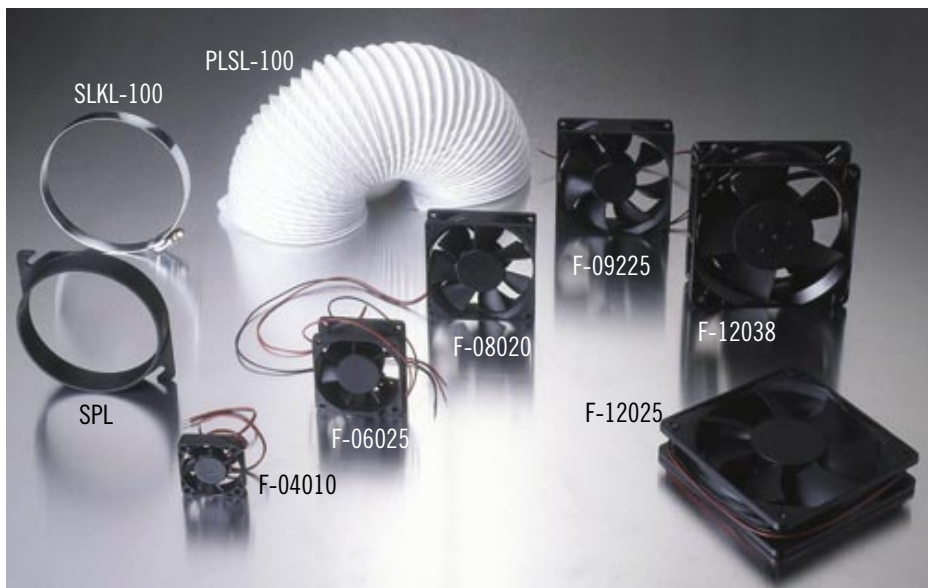
Part #	Material	Dimensions mm	Heat conductivity k (W/m°C)
A ISO-A05-009-G	Self-adhesive dark grey Polyethylene (LDPE)	300 x 300 x 5	0.044
C ISO-A15-009-G	Self-adhesive dark grey Polyethylene (LDPE)	300 x 300 x 15	0.044
C ISO-A15-100-G	Self-adhesive dark grey Polyethylene (LDPE)	1000 x 1000 x 15	0.044
B ISO-S45-035-V	Sandwiched, white PVC coated Polyurethane	590 x 600 x 45	0.025
B ISO-S45-071-V	Sandwiched, white PVC coated Polyurethane	590 x 1200 x 45	0.025





## Fans and accessories

Supercool offers a range of DC fans. These are not only suitable as spare part fans, but also for general usage in your application. Some fans are available with IP55 moisture protection. The axial flow design facilitates mounting one or more fans directly onto a heat sink, providing a compact design. Moreover, in order to enhance air guidance, you also have the possibility of guiding the inlet air to your fan by a flexible hose and airduct flange (suitable for 92 x 92 mm fans only) mounted on the cooler. This way you can improve the cooling performance of your application when the cooler is built into the equipment.

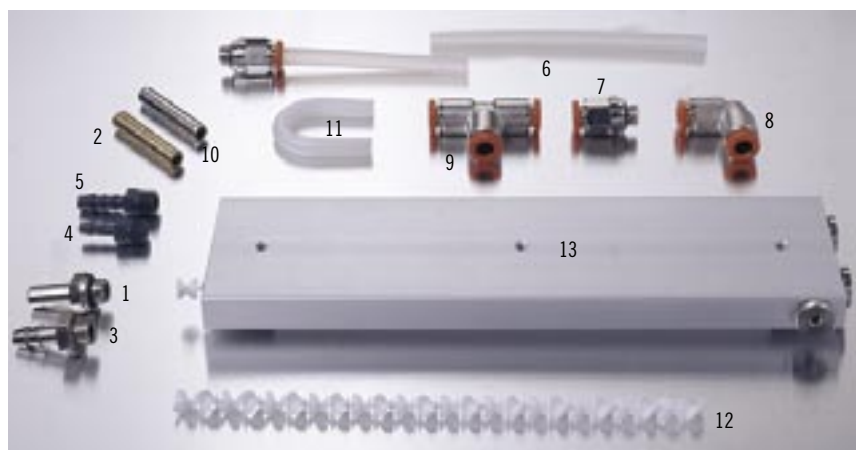


### Fan characteristics:

- Brushless type
- Ball bearings
- Stalling and reverse polarity protection
- Operating Voltage V DC nominal  $\pm 10\%$
- Expected service life at 25°C = 50.000 hrs L10

Part#	Item	Dimensions/note
PLSL-100	Flexible Hose	100
SLKL-100	Hose Clamp	for 100 hose
SPL	Air Duct Flange	for 100 hose

Part#	Dimensions mm	Voltage V DC nom	Current A	Air flow		Static Pressure		Noise dB	Moisture protection
				CFM	m <sup>3</sup> /h	inch water	Pascal		
F-04010-12-2	40 x 40 x 10	12	0.1	6.7	11.6	0.098	24.5	25.0	none
F-06020-12-2	60 x 60 x 20	12	0.16	16.3	27.7	0.135	33.5	31.0	none
F-06025-12-2	60 x 60 x 25	12	0.23	23.2	39.4	0.188	46.9	32.3	none
F-06025U12-2	60 x 60 x 25	12	0.27	28.3	48.1	0.246	61.3	37.0	none
F-06025-24-2	60 x 60 x 25	24	0.15	23.2	39.4	0.185	46.1	32.3	none
F-08020-12-2	80 x 80 x 20	12	0.24	27.3	46.4	0.136	33.8	32.4	none
F-09220-12-2	92 x 92 x 20	12	0.25	32.8	55.8	0.106	26.4	32.8	none
F-09220-24-2	92 x 92 x 20	24	0.14	32.8	55.8	0.104	26.0	32.8	none
F-09225-12-2	92 x 92 x 25	12	0.25	52.5	89.3	0.131	32.6	35.0	none
F-09225-12-3	92 x 92 x 25	12	0.25	52.5	89.3	0.131	32.6	35.0	IP55
F-09225U12-2	92 x 92 x 25	12	0.39	60	102	0.163	40.7	39.4	none
F-09225-24-2	92 x 92 x 25	24	0.15	52.5	89.3	0.129	32.1	35.0	none
F-09225-24-3	92 x 92 x 25	24	0.15	52.5	89.3	0.129	32.1	35.0	IP55
F-09225U24-2	92 x 92 x 25	24	0.21	60	102	0.163	40.7	39.4	none
F-12025-24-2	120 x 120 x 25	24	0.19	85.2	144	0.136	33.8	39.1	none
F-12032-24-2	120 x 120 x 32	24	0.25	108	183	0.215	53.5	43.3	none
F-12038-24-2	120 x 120 x 38	24	0.4	120	204	0.320	79.8	48.0	none
F-12038-24-3	120 x 120 x 38	24	0.4	122	207	0.394	98.1	48.0	IP55
F-12038X24-2	120 x 120 x 38	24	0.6	190	323	0.5	125	60.0	IP55



No.	Part #	Description	Fits into No:
1.	L-ADAP-8-1/8	Adapter, 1/8"	13 + 8, 9
2.	L-NIPA-8	Adapting nipple 8 mm	7, 8, 9
3.	L-NIPP-8-1/8	Nipple 8 mm, 1/8" *	13
4.	L-PNIPP-4-1/8	Plastic nipple 4 mm, 1/8" *	13
5.	L-PNIPP-6-1/8	Plastic nipple 6 mm, 1/8" *	13
6.	L-PRÖR-8	Plastic tubing, O.D. 8 mm	7, 8, 9
7.	L-SANS-8-1/8	Push-in-I-connector, 1/8"	13 + 6, 7, 11
8.	L-SKPL-8-L	Push-in-L-joint	1, 10 + 2, 6, 10
9.	L-SKPL-8-T	Push-in-T-joint	1, 10 + 2, 6, 10
10.	L-SKRV-8-I	Joint coupler	7, 8, 9 + 7, 8, 9
11.	L-PSKRV-8-U	Heat sink U-joint	7 (2X)
12.	L-TURBO-8	Heat sink turbulator, L = 290 mm	
13.	.....	Liquid heat sink with 1/8" threads	.....

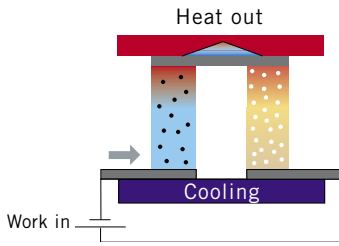
\*4, 6 and 8 mm refers to the inner diameter of the tubing.

## Liquid quick connections

For fast and flexible tubing of the liquid side of any system. High quality, laboratory design details of non-corrosive material. O-ring sealing and hose can withstand 8 Bar pressure. We also provide two plastic (Polyamide) nipples for superior chemical resistance as well as for tubing with internal dimensions of 4 and 6 mm.

All standard liquid coolers are equipped with turbulators for optimum thermal transfer. In the event of limited pump pressure or significant liquid flow rates, you may have to remove the turbulators.

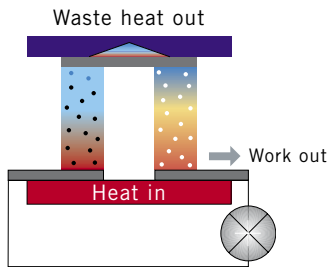
**Thermoelectrics and how it works**



**Heat Pump (Refrigerator) Peltier (1834)**

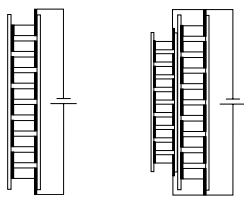
The thermoelectric Peltier effect is the most direct way to utilize electricity to pump heat. Electric current (work input) forces the matter to approach a higher energy state (black dots) and heat is absorbed (cooling).

The energy is released (heating) as the matter approaches a lower energy state (white dots). The net cooling or heating effect is proportional to the electric current and Peltier coefficient.



**Power Generator Seebeck (1822)**

Thermoelectric material can also be used to generate electricity. Some of the heat input is converted to electric current (work), as the higher energy matter (black dots) releases energy and cools to a lower energy state (white dots). The net work is proportional to the temperature difference and Seebeck coefficient.



Single stage      Multistage

**Thermoelectric modules**

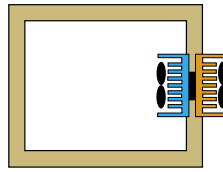
The material used at working temperatures up to 150°C is normally bismuth telluride, doped to obtain p (positive) and n (negative) semi-conducting properties.

A number of pn-couples, thermally parallel and electrically in series, are sandwiched between ceramic plates.

The maximum temperature differential ( $\Delta T_{max}$ ) between the cold and the warm side of a Supercool single stage module is up to 75°C at warm side temperatures of 25°C or  $\Delta T = 85^\circ\text{C}$  at a warm side temperature of 50°C. By increasing the number of stages in a multistage arrangement, you also increase maximum  $\Delta T$ .

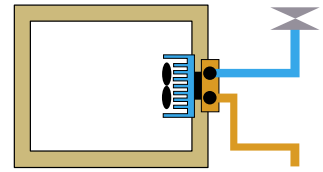
**Guidelines for selecting your TE system**

Below you see different types of TE assembly principles and how they can be employed. What type of assembly is suitable for your application?



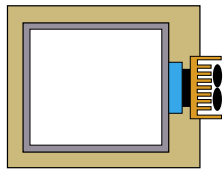
**AA = Air to Air system**

Air in an enclosure is cooled and the heat is dispersed to the surrounding Air.



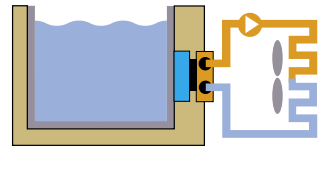
**AL = Air to Liquid system**

Air in an enclosure is cooled and the heat is dissipated to the Liquid from a tap.



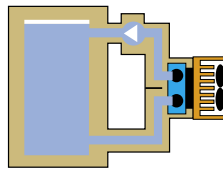
**DA = Direct to Air system**

Solid surfaces are cooled Directly and the heat is dissipated to the surrounding Air.



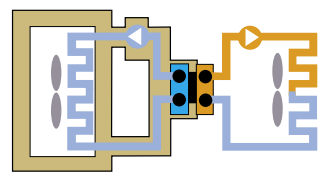
**DL = Direct to Liquid system**

The solid surface is cooled Directly (it can then cool any other substance). The heat is dispersed to a Liquid.



**LA = Liquid to Air system**

The Liquid circuit is cooled gradually and the heat is dispersed to the surrounding Air.

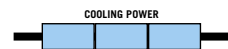
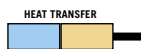


**LL = Liquid to Liquid system**

The Liquid circuit is cooled gradually and the heat is dispersed to a Liquid.



For a detailed description of our assembly product code, please visit our website.

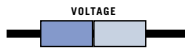


**Heat transfer methods**

The Cold Side can be designed as follows:  
 A = Air cooling. D = Direct cooling of solid.  
 L = Liquid cooling. The warm side is normally cooled by an Air heat sink (A). However, Liquid heat sinks (L) can be used when you need a compact system or in a laboratory, for example, where process water is available.  
 All our heat sinks are made of aluminum extrusions with excellent thermal transfer. Furthermore, anodization provides superior environmental protection. And if your application calls for custom designed heat exchangers, be sure to ask us. They're available on request.

**Cooling (heating) power**

When you know the cooling power ( $P_C$ ) needed at a maximum specified temperature difference ( $\Delta T$ ) in your application, you can select the correct size and type of TEA. For information on cooling power versus  $\Delta T$ , we refer you to the diagrams for each assembly type.  
 According to the Carnot principle, heating power:  $P_h = P_C + \text{Power input}$ . You'll find the power input in the respective product specifications.  
 When a  $\Delta T$  greater than the capacity of single stage systems is required, we supply assemblies with 2-stage TE modules. More or less any cooler can be cascaded on request.

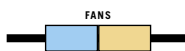


**Voltage**

As the thermoelectric principle requires DC voltage, our TE assemblies are intended for DC operation only. All standard assemblies are designed for either 12 or 24 V DC operation. However, we also supply 48 V DC versions of larger assemblies and 5 V versions of the smallest assemblies.

Input voltage for the standard fans has to be within  $\pm 10\%$  of nominal voltage and with max. 5% ripple for optimum functionality and service life. Do NOT use switched PWM voltage for the fans.

Input voltage for the TEMs can be reversed for heating, regulated down to 0 V DC and up to  $\pm 110\%$  of nominal voltage. For switched PWM voltage, use a PWM frequency above 5 kHz to prevent service life reduction due to thermal cycling effects on the TE modules.



**Fans**

The fan is the only moving part in a thermoelectric assembly (Air systems). Consequently,

there's an obvious correlation between the service life of the fan and the service life of the assembly. All standard fans are brushless with ball bearings.

Expected service life at 25°C is 50,000 hours (L10). We also provide fans with IP55 moisture protection, high performance fans with a service life of 100,000 hours (L10) or other fans suitable for your application. For more information, see page 17 or contact Supercool.



**Temperature control**

Supercool offers a broad range of controllers for a variety of applications.

Below are some aspects to consider when selecting a controller for your application:

- Required temperature accuracy and hysteresis
- Temperature range of your application
- Max. current requirements
- Is your application only for cooling or cooling/heating (reversible)
- Requirements regarding system efficiency (COP)

- Need for programming communication (RS232) or display of set values
- Need for alarm signal outputs, low voltage protection etc.

*Please see page 14-15 for a description of available controllers.*

**In order to maximize the reliability and service life of your TE system, bear in mind the following:**

- When regulating in ON/OFF mode make sure cycle time is 60 sec. or more
- If you use your own PWM-controller make sure the switching frequency is 5 kHz or more
- Do NOT use switched PWM voltage for the fans. Use separate true DC power input for fans.
- In critical applications, we recommend our EC-26 or PR-59 (see page 14-15) to minimize thermal stress.

**Guidelines for installing your TE assembly**

**General:**

- Minimize thermal losses and condensation by insulating all possible cold surfaces in your system (DA, DL, LA, LL).
- Secure good ventilation on the warm side (AA, DA, LA). Separate the inlet air from outlet air, if necessary by using air-ducts and hosing (see page 17). If the warm side is built-in, make sure the inlet air comes from the outside.
- Be sure to use an external fuse with a rating of at least 150% of nominal current.

**AA assemblies**

- For non-insulated (electronic) cabinets, the warm air on the warm side must not heat up the cabinet, while cold air on the cold side should not blow directly onto the cabinet.
- Check that the enclosure is sealed and that there is a tight fit between assembly and cabinet.

- For insulated cabinets, make sure you have sufficient insulation and that there are no cold bridges.
- In a condensing environment, be sure to mount the cold side heat sink fins in a vertical position in order to drain the condensation.

**DA/DL assemblies**

- The cooled object is attached to the cold plate with 4-9 screws. Apply a thin layer of thermal conductive compound between surfaces.
- To ensure optimum performance, the flatness of the cooled object should be 0.05 mm/100 mm.
- When cooling a container or tank, use 3-5 mm of Al sheet (or equivalent) to ensure good thermal transfer. If you use a stainless steel tank, remember to mount an Al sheet with a larger surface area than the cold plate to improve thermal transfer.

**LA/LL assemblies**

- For superior performance even at lower liquid flow rates, or when a gas is cooled, turbulators are inserted into the liquid channels. Should your application call for a lower pressure drop, the turbulators can be removed.
- Recommended liquid flow on the warm side is 2 lit/min or more. Lower liquid flow rates lead to a slight reduction in cooling power.
- Recommended liquids are water with glycol or Fluorinert (3M).
- Remember to use a pump with the lowest thermal leakage and heat generation.
- Be sure to insulate the liquid heat sink and tubing to reduce thermal leakage.

# Supercool on the Internet

To find out more about Supercool, our products and solutions, visit us at [www.supercool.com](http://www.supercool.com).

We've also posted a complete list of representatives on our website, including contact details.



## The market's leading thermoelectric modules

Thanks to unrivaled material characteristics, our thermoelectric modules deliver truly outstanding performance (max  $\Delta T$  up to 75°C). And with over 120 standard TEMs available off-the-shelf, we've covered just about every known application. Our range includes modules of every conceivable size

– from the tiniest miniature modules to high-power density TEMs delivering cooling power up to 340 W. For those of you with special demands, we'll customize a solution on request.

*For more information, order our TEM catalog.*



[www.supercool.com](http://www.supercool.com)

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