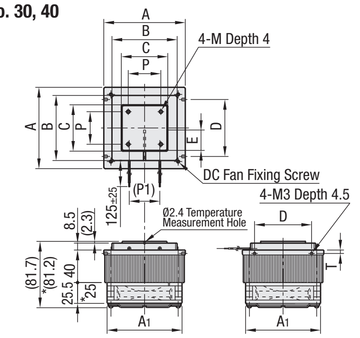
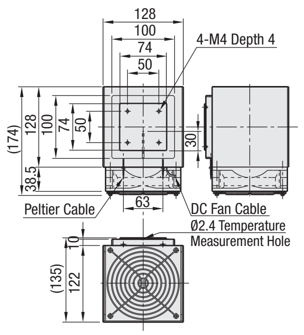
Peltier Cooling Unit

PELT





*(81.2), 25: Dimensions for PELT40.

Part Number		A	A_1	B	C	D	T	P	(P_1)	E	M	Mass (g)
Type	No.											
PELT	30	80	80	60	30	50	4.2	20	24	15	M3	450
	40	100	92	80	55	70	4.2	40	38	25	M4	700
	70	—	—	—	—	—	—	—	—	—	—	2300

Part Number Example

Part Number
PELT40

Specification

No.	30	40	70
Cooling Capacity (W)	18	35	80
Max. Temp. Gaps (°C)	48	45	48
Peltier Heat Resistance Temp. (°C)	120		
DC fan Allowable Temp. (°C)	70		
Heating Capacity (W)	36	70	140
Rated Voltage (V)	12	12	24
Starting Current (A)	4	6.3	6.5
Noise (dB)	35	37	39
Allowable Load (N)	200	300	500
Operating Temp. Range (°C)	-20~+70		
Operating Humidity (0%RH)	85 or Less		

Terminology

Cooling Capability: The amount of heat it can remove (cool) at full capacity. Please choose Unit No. so that the heat amount is at cooling capability or less. (Refer to how to select on the following page.)

Maximum Temperature Difference: It is temperature difference between room temperature and the cooled surface. It might vary depending on the room temperature.

(Ex.: With No. 30 and at room temperature 25°C, the maximum controllable operation temperature is 25-48= -23°C)

- The values are representative values and not guaranteed.
- Allowable Load is a value when load is applied evenly. Do not apply unbalanced load.
- While the upper temperature limit for the Peltier itself is 120°C, be sure to operate at the temperature which does not exceed the allowable temperature (70°C: temperature for continuous use) for DC fan.

Features

– A unit product has brought ease of use of a Peltier device which simultaneously provides cooling and heating by direct-current.

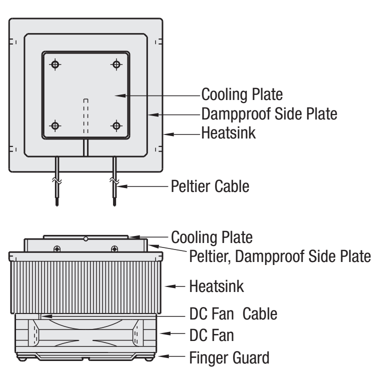
– Using in combination with a controller designed for Peltier Cooling Unit **(P.3751)** enables easy control.

Principle

With a DC current, temperature difference occurs on the Peltier element, and A side will be cooled, and B side will be heated (Drawing 1). If the electrical polarity is reversed, A side will be heated and B side will be cooled. (Fig. 2)

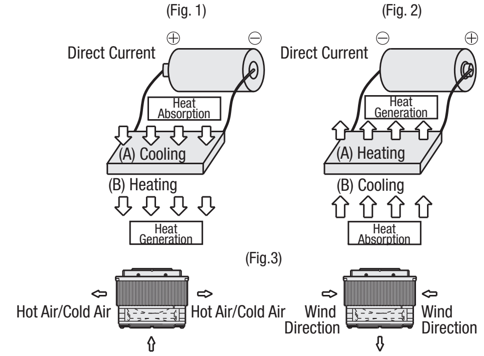
Basic Structure

A unit product with DC fan and heat sink assembled in a Peltier device.



*The PELT40 DC fan cable entry/exit position has changed from the right-hand side to the left-hand side.

Parts	Material
Peltier	Semiconductor device having Bismuth, Telluride as chief material packaged with ceramic.
Heatsinks	6063 Aluminum Alloy
DC Fan	ABS Resin, PBT Polybutylene Terephthalate Synthetic-resin
Cooling Plate	5052 Aluminum Alloy



As for direction of the wind, as Figure 3 shows, it can be used from any direction. (heat efficiency is same.)

Precautions for Use

- Please do NOT stop heat radiation fan while using Peltier Cooling Units. It might cause damage due to the rise of temperature of Peltier element.
- Please ensure to connect power source to correct polarity. Observe the voltage remains within the rated value. If it is below the standard, the heat radiation fan might stop. Combination use with Misumi's Cooling Peltier controller **(P.3751)** is recommended for safety use.
- Be sure that impact or excess load is not applied to the Peltier device. (Please refer to allowable load of below specifications.)
- Apply insulation to cooling surface to prevent due condensation. Wipe off water droplets when condensation occurs. Continuous use might cause inside erosion because of the water infiltration into Peltier element.
- Please insert temperature sensor into Ø2.4 hole for temperature measurement and fix it with silicon adhesive bond or similar things.

Selection Method

This is a calculation when most appropriate heat exchanger is used at a cooling side. Values change depending on performance of heat exchanger.

$$Q_1\ (W) = \frac{\text{(Current Temperature T(r°C) - Achieving Temperature Tc (°C)) x Heat Conductivity K (W/m-K) x Surface Area S } (m^2)}{\text{Thickness of Insulating Plate T (m)}}$$

Ex.) Urethane form used as insulator. Thermal conductivity (K) = 0.03 (W/m - K), thickness (T) = 30 (mm) = 0.03 (m).

Ex.) To lower current temperature (Tr) = 25°C to achieve temperature inside the cooling box (Tc) = 5°C

1) Obtain the surface area S (m^2) of the box to cool.
   Ex.) For a box with inner dimensions of 270 x 210 x 420 (mm)
   S (m^2) = (0.27 x 0.21 + 0.42 x 0.21 + 0.42 x 0.27) x 2 = 0.52 (m^2)

2) Calculate the heat Q1(W) that comes in via heat insulating material by the following formula.

$$Q_1\ (W) = \frac{(25(°C) - 5(°C) \times 0.03\ (W/m - K) \times 0.52\ (m^2)}{0.03\ (m)}$$

= 10.4 ≈ 10(W)

3) Determine the heat generated by the stirring fan and the amount of loss from heat exchange Q_2 (W).
   Ex.) Q_2 = 10 (W)
   (Though it is difficult to obtain precise figures as these differ depending on fan type or insulating property, general value range is 5–15(W). When fan speed is decreased value of Q_2 is reduced.)

4) Determine the heat generated by the heat source in the box Q_3 (W).
   Ex.) Q_3 = 5 (W) when a motor generating 5 watts of heat is in the box. (Applicable only when there is a heat source such as a motor or IC board. When the box is empty, Q_3 = 0 (W))

5) Calculate the total heat amount U (W). (Appropriate safety coefficient is 0.6–0.8.)

$$U(W) = \frac{(Q_1 + Q_2 + Q_3)}{\text{Safety Factor}} = \frac{(10 + 10 + 5)}{0.7}$$

= 35.7 ≈ 36 (W)

6) Choose the best unit from the heat absorption property of the unit in the graph.
   Ex.) Choose No.70 whose heat absorption capacity beyond 40 W on the T (Tr-Tc) = 20°C line.

Ex.) To lower current temperature (Tr) = 25°C to achieve temperature inside the water tank (Tc) = 15°C

1) Obtain the surface area S (m^2) of the water tank to cool.
   Ex.) For cinner dimensions of water tank 60 x 60 x 100 (mm)
   S(m^2) = (0.06 x 0.06 + 0.06 x 0.1 + 0.06 x 0.1) x 2 = 0.031 (m^2)

2) Calculate the heat Q1(W) that comes in via heat insulating material by the following formula.

$$Q_1\ (W) = \frac{(25(°C) - 15(°C) \times 0.03\ (W/m - K) \times 0.031\ (m^2)}{0.03\ (m)}$$

= 0.31 (W) ≈ 0.3 (W)

3) Determine the heat generated by the stirring pump and the amount of loss from heat exchange Q_2 (W).
   Ex.) Q_2 = 10 (W)
   (Though it is difficult to obtain precise figures as these differ depending on fan type or insulating property, general value range is 5–15 (W). The values of Q_2 is also lowered by decreasing the pump output.)

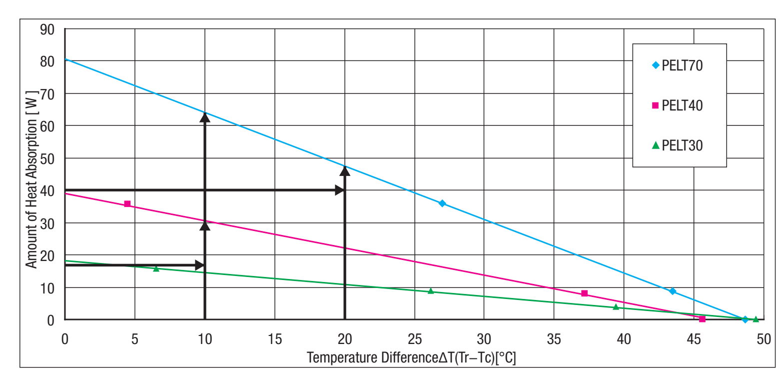
4) Determine the heat generated by the heat source in the water tank Q_3 (W).
   Ex.) When the water tank is empty Q_3 = 0 (W)
   (When heat source is in the water tank define its calorific value as Q_3 (W).)

5) Calculate the total heat amount U(W). (Appropriate safety coefficient is 0.6–0.8.)

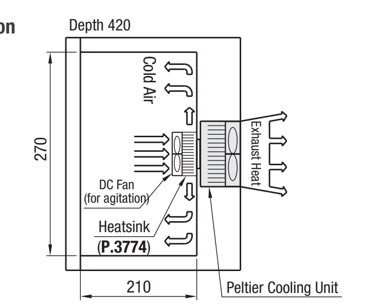
$$U(W) = \frac{(Q_1 + Q_2 + Q_3)}{\text{Safety Factor}} = \frac{(0.3 + 10 + 0)}{0.6}$$

= 17.2 ≈ 17(W)

6) Choose the best unit from the heat absorption property of the unit in the graph.
   Ex.) Choose No.40 whose heat absorption capacity beyond 15 W on the T (Tr-Tc) = 10°C line.

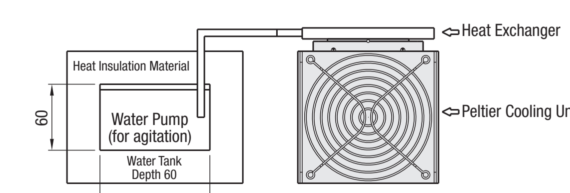


Application Example



(Example at the time of cooling)

*DC fan (for agitation) shall be provided at customer's end.



*Heat Exchanger will be provided at customer's end.

(Example at the time of cooling)