5. Example of fan selection

Selecting Procedure

This section describes basic methods of selecting typical ventilation and cooling products based on their use.

1. Device specifications and conditions

Determine what in the internal temperature of the device should be.

2. Heat generation within the device

Determine the amount of heat generated internally by the device.

3. Calculate required air volume

Once you have determined the amount of heat generated, the number of degrees the temperature is to be lowered and what the ambient temperature should be, calculate the air volume required.

4. Selecting a fan

Select a fan using the required air flow. The air flow of a mounted fan can be found from the fan's air-flow vs. static-pressure characteristics and pressure loss of the object to be cooled, as shown in Fig 1. It is difficult to calculate the device's pressure loss, so an estimation for the maximum air flow of 1.3 to 2 times the required air flow may be used.

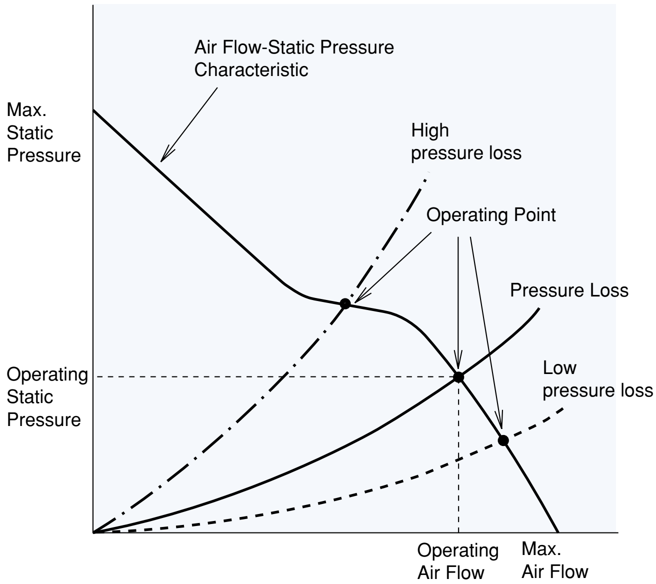


Fig. 1

Fan Selection Flowchart

Determine the device's requirements

Determine how many degrees to lower the internal temperature based on the guaranteed operating temperatures of the device's internal components and elements.

↓

Calculate the amount of heat produced

Calculate the amount of heat produced internally.

↓

Calculate the required air flow

Calculate the volume of air required to ventilate the heated air.

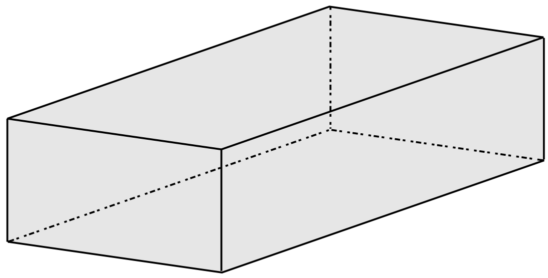
↓

Select a fan

Select a fan with a maximum air flow of 1.3 to 2 times the required air volume.

Example Selection

In this example, an appropriate cooling fan is selected to cool a DC power supply inside a cabinet. The fan's power comes directly from an AC power supply, so select an AC fan.



Output: Po=DC24V, 7.5A
Efficiency: η=70%
Maximum temperature within the device: maximum 70˚C
Ambient temperature: 30˚C

Cabinet with DC power supply

① *Heat Generated Within Device*

With an output of P_O (W), an efficiency of η and a loss of P_L (W):

$$P_0 = \eta \cdot (P_0 + P_L)$$

$$P_L = P_0 \cdot \frac{1-\eta}{\eta}$$

$$= 24 \times 7.5 \times \frac{1-0.7}{0.7} = 77 (W)$$

Therefore, the loss is 77 (W). And same value of heat is generated.

② *Calculate the Required Air Flow*

$$V = \frac{Q}{\rho \cdot C_p \cdot (T - T_a)}$$

$$= \frac{77}{1.1 \times 1000 \times (70-30)}$$

$$= 1.75 \times 10^{-3} \ (m^3/s)$$

$$= 6.3 \ (m^3/h)$$

$$= 0.1 \ (m^3/min)$$

Where,
The required air flow is: V (m^3/s)
The heat generated is: Q (W)
The air density is: ρ (about 1.1kg/m^3)
The specific heat of air is: Cp (about 1000J/(kg˚C))

③ *Select a Fan*

Select a fan with a maximum air flow twice that of the required air flow found in step ②. The **MU825S-53** has a maximum air flow of 0.45 (m^3/min), which is larger than 0.1 × 2 = 0.2 (m^3/min).

④ *Check the Temperature Within the Device*

Check the temperature within the device when the **MU825S-53** is used. If the ventilated air flow is half the fan's maximum air flow, or 0.23 (m^3/min), then

$$T = \frac{Q}{\rho \cdot Cp \cdot V / 60} + Ta$$

$$= \frac{77}{1.1 \times 1000 \times 0.23 / 60} + 30$$

$$= 48°C$$

Since the design target is 70˚C, there is a margin of 22˚C.