Selection Calculations For Cooling Fans

Selection Procedure

This section describes the basic selection procedure for ventilation and cooling indicated in the usage procedure for the cooling fan.

Specifications and Conditions of the Equipment

Clarify what the interior temperature (˚C) should be adjusted to in the equipment design.

Heat Generation within the Equipment

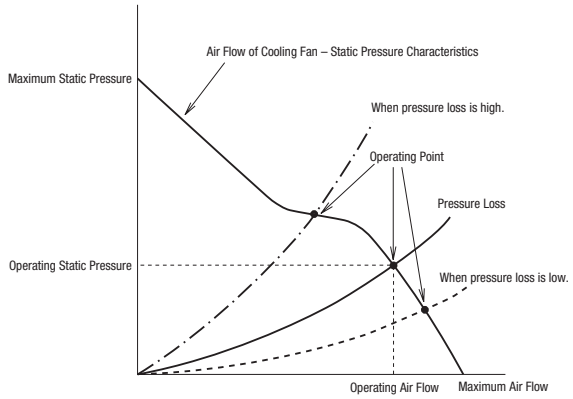
Calculate the sum total of heat generation from the heat generating products inside the equipment.

Calculate Required Air Flow

Calculate the required air flow based on the generated amount of heat, the degree decrease, and the point at which the ambient temperature became apparent.

Selection of Cooling Fans

Select a cooling fan according to the required air flow. Obtain the air flow of the cooling fan when it is installed based on the air flow – static pressure characteristics of the cooling fan and the pressure losses of the equipment. Generally, calculating the equipment pressure loss is difficult, so select a cooling fan in which the maximum air flow is 1.3 to 2 times of your required air flow.



Air Flow – Static Pressure Characteristics

Selection Flow Chart for Cooling Fans

Clarify the required conditions of the equipment

Clarify what the interior temperature (˚C) should be adjusted to based on the warranty operating temperature of the internal parts and components of the equipment.

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Calculate the amount of heat

Calculate the amount of heat generated internally from the rated output power and efficiency of the heat generating products inside the equipment.

↓

Calculate the required air flow

Calculate the required air flow in order to set the desired temperature.

↓

Selection of Cooling Fans

Select a cooling fan that has a maximum air flow that is 1.3 to 2 times of your required air flow.

Selection Example – Ventilation and Cooling of Control Box –

Specifications of Control Box

Item		Code	Specifications
Installation Environment			Factory Floor
Control Box	Size	W H D	Width 700 mm Height 1,000 mm Depth 400 mm
	Surface Area	S	2.37 m^2✻
	Material		SPCC
	Overall Heat Transfer Coefficient	U	5 W/ (m^2/K)
Permissible Temperature Rise		ΔT	20˚C Equipment Ambient Temperature T_1 25˚C Permissible Internal Temperature T_2 45˚C
Total Heat Generation		Q	450 W
Power Supply			50 Hz 220 VAC

✻Calculated with the formula below. (assuming that the whole periphery is open)

Surface area of control box S = side area + top area

$$= 1.8 \times H \times (W + D) + 1.4 \times W \times D$$

(1) Calculating the Required Air Flow

This section describes a way to obtain this figure using calculations and an easy way to obtain it using a graph.

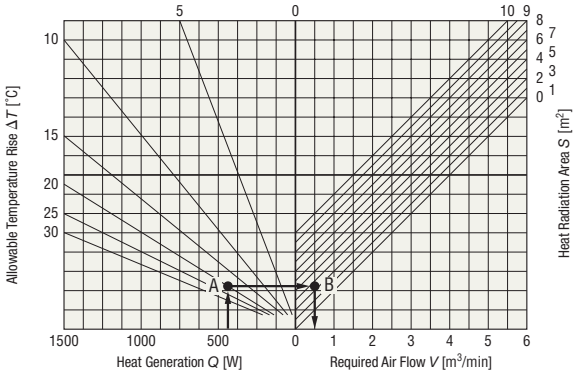
◇Obtaining by Calculations

$$V = 1 \div 20 \times (Q \div \Delta T - U \times S) \times Sf$$
$$= 1 \div 20 \times (450 \div 20 - 5 \times 2.37) \times 2$$
$$\fallingdotseq 1.07 \text{ [m}^3\text{/min]}$$

When the required air flow is calculated, you must consider internal pressure loss. Generally, the pressure loss within the control box is unknown, so the air flow at the operating point is assumed to be 50% of the maximum air flow, taking into account a safety factor $Sf = 2$.

◇Obtaining by Graph

① Calculate the intersection point A of the amount of heat generation Q 450 W and the allowable temperature rise ΔT 20˚C.
② Draw a horizontal axis from the intersection point A (starting point).
③ Calculate the intersection point B of the horizontal line and surface area S 2.37 m^2.
④ The required air flow (approx. 0.5 [m^3/min]) can be obtained by drawing a vertical line from intersection point B as shown on the graph.
⑤ From the reasons described above, the required air flow 1.00 [m^3/min] can be derived by taking into account a value twice the safety factor Sf.



Graph to Determine Required Air Flow

(2) Selection of Cooling Fans

Select the **MU** Series axial flow fan **MU1225M-51** from the results.

MU1225M-51 Specifications

Voltage VAC	Frequency Hz	Current A	Input W	Speed r/min	Maximum Air Flow m^3/min	Maximum Static Pressure Pa	Noise Level dB(A)
Single-Phase 220	50	0.07	10.0	2250	1.4	32	33
Single-Phase 230	50	0.07	12.0	2250	1.4	32	33
Single-Phase 230	60	0.07	9.5	2600	1.7	31	37