Selection Calculations For Cooling Fans

Selection Procedure

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

●Specifications and Conditions of the Machinery

Determine the required internal temperature of the machinery.

●Heat Generation Within the Device

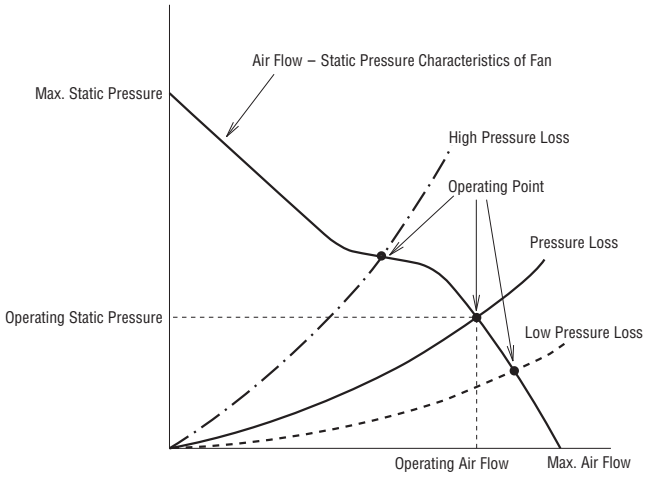
Determine the amount of heat generated internally by the machinery.

●Calculate Required Air Flow

Calculate the air flow required once you have determined the heat generation, the number of degrees the temperature must be lowered and what the ambient temperature should be.

●Selecting a Fan

Select a fan using the required air flow. The air flow of a mounted fan can be found from the air flow – static pressure characteristics and the pressure loss of the machinery. It is difficult to calculate the pressure loss of the machinery, so a fan with a maximum air flow of 1.3 to 2 times as the required air flow may be used.



Air Flow – Static Pressure Characteristics

Fan Selection Procedure

Determine the requirements of the machinery
Determine how many degrees to lower the internal temperature based on the guaranteed operating temperatures of the internal components and elements of the machinery.

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Calculate the amount of heat produced
Calculate the amount of heat generated internally from the input/output of the machinery, efficiency, etc.

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Calculate the required air flow
Calculate the air flow required for desired temperature.

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

Example of Selection – Ventilation and Cooling of Control Box

Specification of Control Box

Item		Letter	Specifications
Installation Environment			Factory Floor
Control Box	Size	W H D	Width 700 mm Height 1000 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 Ambient temperature T_1: 25°C Internal permissible temperature T_2: 45°C
Total Heat Generation		Q	450 W
Power Supply			50 Hz 230 VAC

*Calculated by the formula below (assuming that all periphery is open) :
Surface of control box = side area + top area
$= 1.8 \times H \times (W + D) + 1.4 \times W \times D$

●Required Air Flow

The following explains a calculation method using the formula and a simple calculation method using the graph.

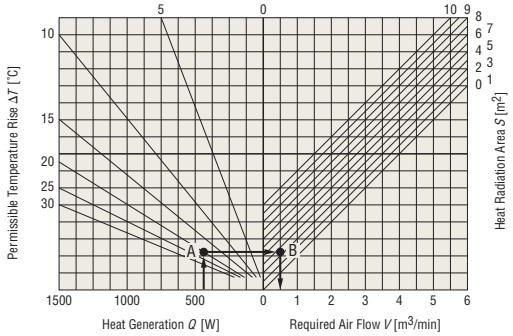
◇Obtaining by Calculations

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

Internal pressure loss must be considered when calculating the required air flow.
In general, pressure loss inside the control box is not known. Therefore, the air flow at the operation point is assumed as 50% of the maximum air flow and a safety factor $Sf = 2$ is applied.

◇Obtaining by a Graph

① Search for the cross point A between heat generation Q (450 W) and permissible temperature rise ΔT (20°C).
② Draw a line parallel with the horizontal axis from point A.
③ Search for the cross point B between the parallel line and surface area S (2.37 m^2) line.
④ Draw a line perpendicular to the horizontal axis from point B. Required air flow is approximately 0.5 m^3/min.
⑤ Allow for a safety factor (Sf) of 2 times. Required air flow will be 1.00 m^3/min.



Graph to Determine Required Air Flow

●Applicable Fans

Based on the above, **MU** Series **MU1025S-51** is selected.

MU1025S-51 Specifications

Input Voltage VAC	Frequency Hz	Input W	Current A	Speed r/min	Max. Air Flow m^3/min	Max. Static Pressure Pa	Noise Level dB (A)
Single-Phase 230	50	11.0	0.06	2500	1.2	39	35