# 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

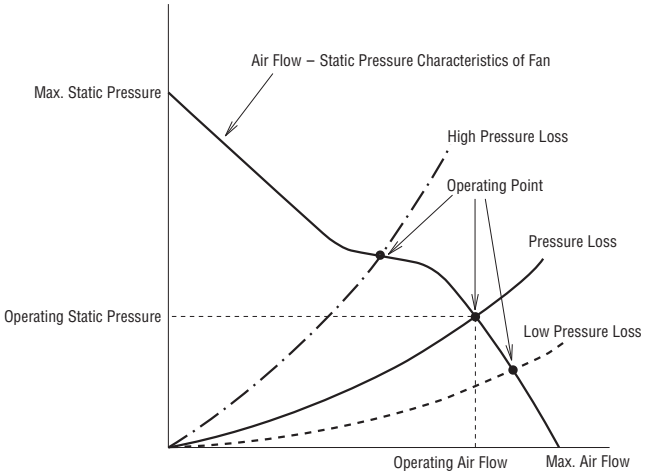
Determine the amount of heat generated internally by the machinery.

### ●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 | $W$<br>$H$<br>$D$ | Width 700 mm<br>Height 1000 mm<br>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 | | $\Delta T$ | 20°C<br>Ambient temperature $T_1$: 25°C<br>Internal permissible temperature $T_2$: 45°C |
| Total Heat Generation | | $Q$ | 450 W |
| Power Supply | | | 60 Hz 115 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.

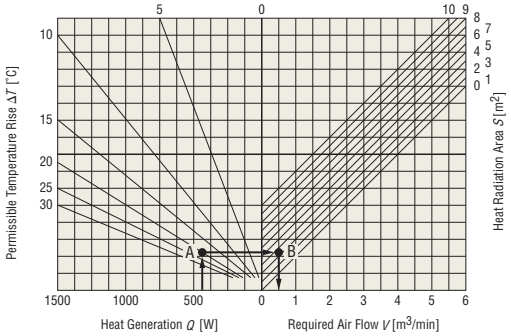
#### ◇Obtaining by Calculations

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

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 $\Delta T$ (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 **MU925M-21** is selected.

**MU925M-21** 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 115 | 60 | 8 | 0.1 | 2700 | 1 | 44 | 36 |