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.

**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.

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

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

- 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**

<table>
<thead>
<tr>
<th>Item</th>
<th>Letter</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation Environment</td>
<td>W</td>
<td>Factory Floor</td>
</tr>
<tr>
<td>Control Box Size</td>
<td>H</td>
<td>Width 700 mm</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>Height 1000 mm</td>
</tr>
<tr>
<td>Surface Area</td>
<td>S</td>
<td>2.37 m² typically</td>
</tr>
<tr>
<td>Material</td>
<td></td>
<td>SPCC</td>
</tr>
<tr>
<td>Overall Heat Transfer Coefficient</td>
<td>U</td>
<td>5 W/m² K</td>
</tr>
<tr>
<td>Permissible Temperature Rise</td>
<td>ΔT</td>
<td>Ambient temperature T₁: 25°C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal permissible temperature T₂: 45°C</td>
</tr>
<tr>
<td>Total Heat Generation</td>
<td>Q</td>
<td>450 W</td>
</tr>
<tr>
<td>Power Supply</td>
<td></td>
<td>60 Hz 115 VAC</td>
</tr>
</tbody>
</table>

**Obtaining by Calculations**

\[ Q = 1.8 \times W \times (W + D) + 1.4 \times W \times D \]

\[ \Delta T = 20 \degree C \]

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 \( S_f = 2 \) 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 m²) line.
4. Draw a line perpendicular to the horizontal axis from point B. Required air flow is approximately 0.5 m³/min.
5. Allow for a safety factor \( S_f \) of 2 times. Required air flow will be 1.00 m³/min.

**Applicable Fans**

Based on the above, MU Series MU925M-21 is selected.

**MU925M-21 Specifications**

<table>
<thead>
<tr>
<th>Input Voltage VAC</th>
<th>Frequency Hz</th>
<th>Input Current A</th>
<th>Max. Speed RPM</th>
<th>Max. Air Flow m³/min</th>
<th>Max. Static Pressure Pa</th>
<th>Noise Level dB (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-Phase 115</td>
<td>60</td>
<td>8</td>
<td>0.1</td>
<td>2700</td>
<td>1</td>
<td>44</td>
</tr>
</tbody>
</table>