SANYO DENKI

Sanyo Denki America

Cooling Systems Division

Fan Selection

Introduction

With the advent of high power electronics, thermal management through forced convection is becoming a common necessity. There is a multitude of cooling products on offer, with a variety of form factors from which to choose.

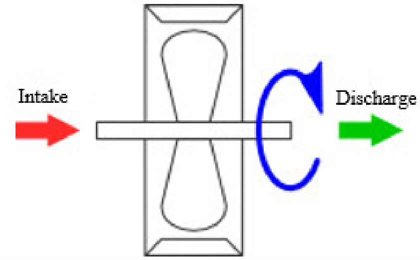
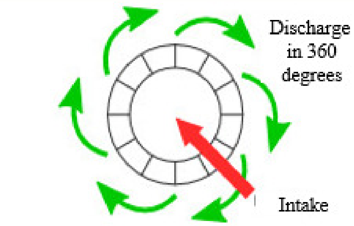
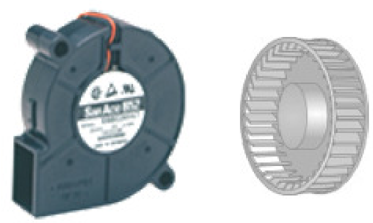
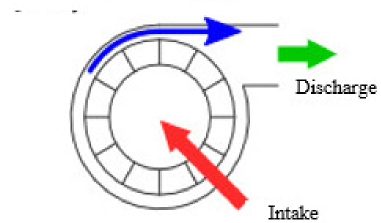
Proper selection of a forced convection solution, whether it is a fan or blower, affects many system design characteristics, such as power budgets, acoustic levels, and cost.

This air mover selection guide aims to simplify the process of finding the best solution for your cooling requirements.

Cooling System Division

Step #1 - Structure

Classification by structure: there are two types of cooling fan structure:

Fan type	Appearance and blade shape	Structure
Axial fan		
Centrifugal fan		
Blower (sirocco fan)		

Axial fans are suited for generating airflow in one direction or axis.

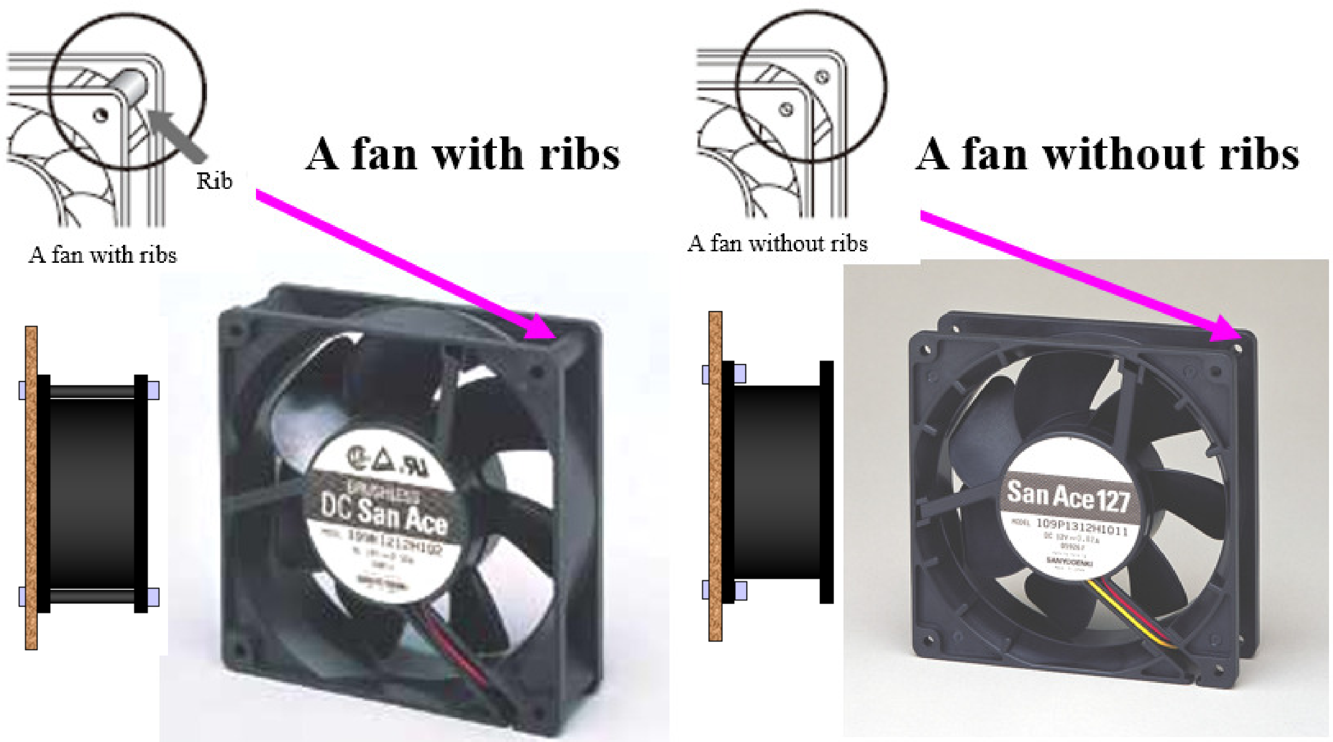
Blowers and centrifugal fans provide a 90º change in airflow direction.

Step #1 - Structure

If you have selected an axial fan, we offer ribbed vs ribless frames.

Ribbed frames are used with longer fasteners.

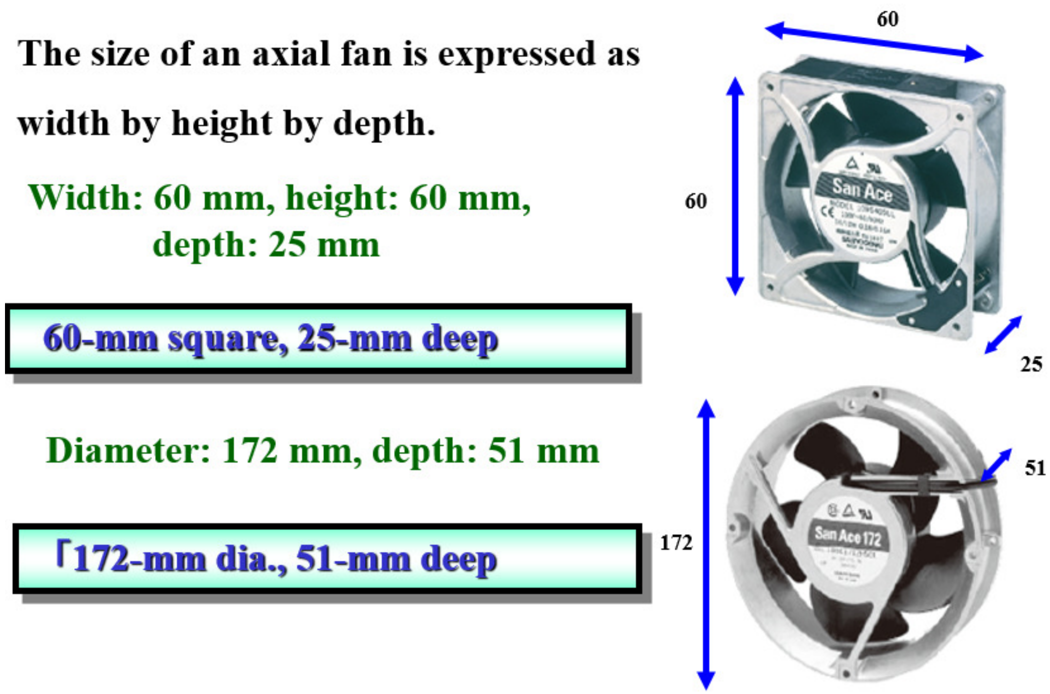
A rib is a tube that connects two screw holes on the front and back of the fan frame.



Step #2 - Size

The main constraint of choosing the right fan is amount of space available in your system to accommodate one or multiple units.

If you are considering an axial fan:



A larger cross-sectional size result sin higher airflow.

A thicker depth results in more pressure performance.

Step #2 - Size

Choosing a size for blowers or centrifugal fans is slightly different

The size of a blower or centrifugal fan is expressed as diameter by depth.

Diameter: 175 mm, depth: 69 mm

175-mm dia., 69-mm deep

Diameter: 97 mm, depth: 33 mm

97-mm dia., 33-mm deep

A larger diameter results in higher airflow.

A thicker depth results in more pressure performance.

Step #3 – Operational Parameters

The next important decision would be how to power up the unit.

Voltage: DC (5 V, 12 V, 24 V, 48 V) or AC (100V, 115V, 200V, 230V)

Air movers are able to provide output signals, and also take an pulse width modulated input signal to control speed.

Sensor or Control:

- None (2-wire fan)
- Tach or Pulse Sensor (3-wire fan) - 2 pulses per revolution
- Low speed sensor (3-wire fan) – Signals when fan meets rpm
- Lock Rotor Sensor (3-wire fan) - High signal when impeller locks
- PWM Control (4-wire fan) - Pulse Width Modulation for speed control

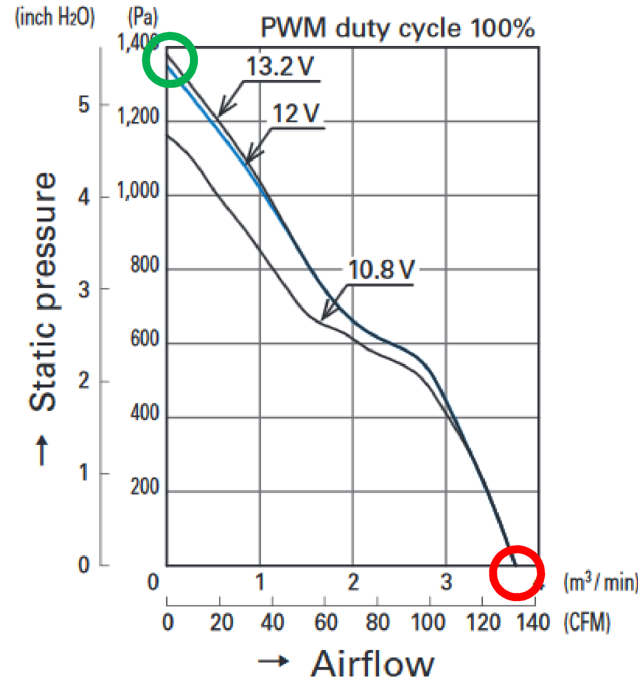
Two other important parameters to note are the power draw of the fan, and also the sound pressure level. You should verify your power budget and acceptable sound pressure limits for your system.

Step #4 – Cooling Performance

Air mover performance is dictated by the airflow and pressure generated by the unit, which is shown in Pressure-Airflow, or PQ, curves that correspond to each fan.

The extreme left point of the PQ curve represents zero airflow and maximum pressure.

The extreme right point of the PQ curve represents zero pressure and maximum airflow.



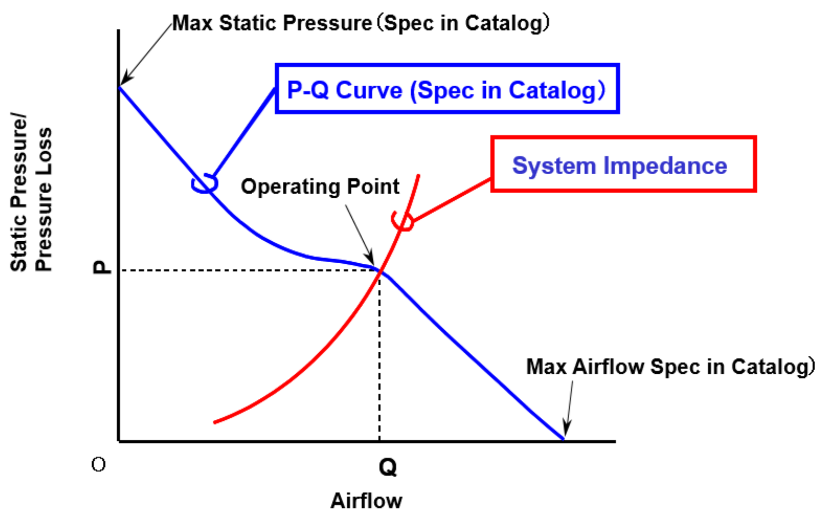
These two points are listed as the reference maximum airflow and pressure values for fans or blowers by all fan vendors.

However, there is no practical use of a fan at either reference point.

Step #4 – Cooling Performance

An air mover realistically operates in a chassis somewhere on the PQ curve, and not at the maximum airflow or pressure points.

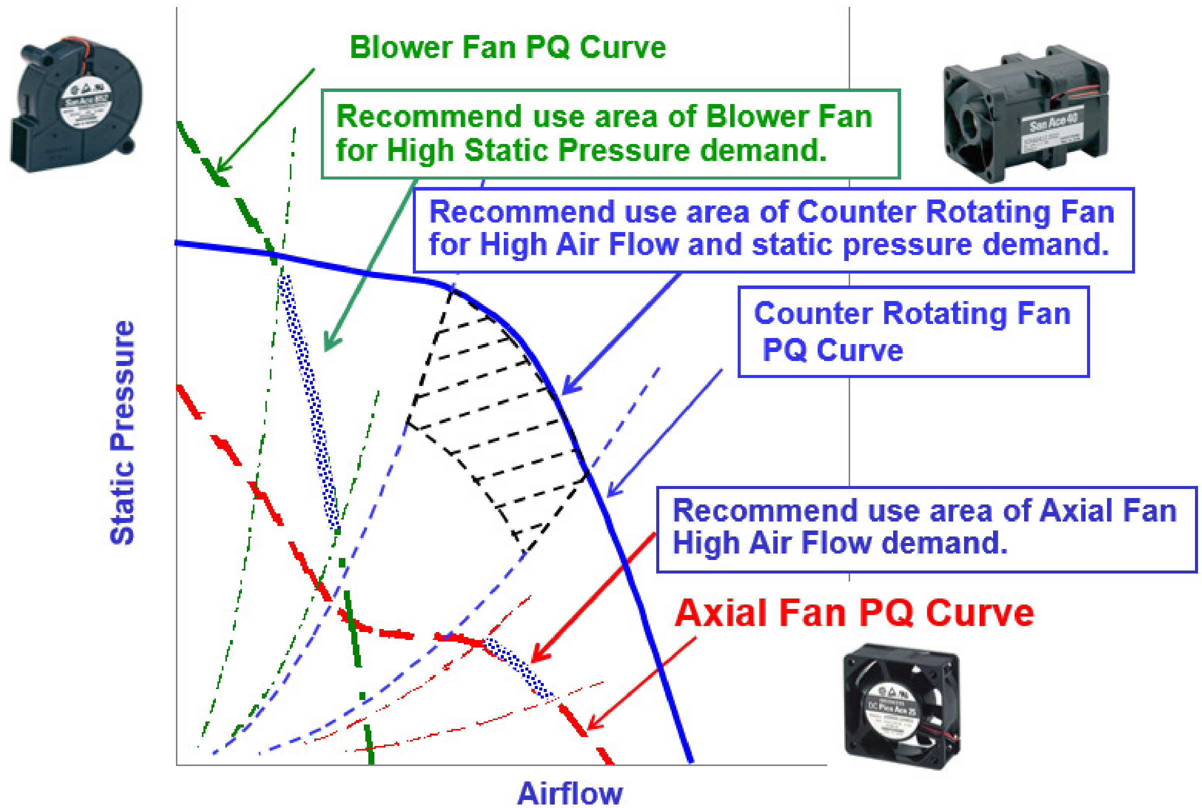
Every chassis has a specific system impedance, which is its restriction to airflow and pressure. A system impedance curve should be created.



The actual operating point is determined by intersecting the system impedance curve with the PQ curve.

If the operating airflow and pressure values are too low or high, another fan PQ curve should be reviewed for a match.

Step #4 – Cooling Performance



The shape of a fan's or blower's PQ curve strongly affects performance.

A PQ curve that is more convex offer higher pressure versus airflow.

Different fan configurations result in different PQ curve shapes.

Step #5 – Environmental Concerns

The operating environment of a fan or blower plays a major role on its survivability and operational life.

Proper consideration must be made to expected fan life, ingress protection, and high or low temperature survivability, for example.

IP68 Fan

Wide Temp Fan

Oil Proof Fan

Long Life Fan

IP54 Fan

Low Vibration Fan

Summary

If the preceding steps for fan selection were performed, you should now have a good fan or blower model for which to start your evaluation.

An important thing to note is that a fan or blower behaves very differently when operated in a chassis, as opposed to its performance from a flow simulation or on a spec sheet. The actual system pressure load on a fan will reveal the real power draw, sound pressure, and PQ performance while installed in a chassis.

Therefore, it is always recommended that fan samples are physically tested in a system to ensure that the appropriate thermal margins are achieved.

Thank You!