I - SELECTING A FAN

Forced convection cooling is an effective solution to dissipate heat in electronic equipment. This technical guide will help you to determine the performance of the required fan for your application.

BASIC REQUIREMENTS

VOLTAGE: The first step is to determine the nominal voltage; this can be AC or DC. ETRI fans cover all voltage ranges from 5 V to 500 V.

DIMENSIONS: Optimising performance within the available space envelope is the most important criteria. ETRI offers a complete range of fans and blowers from 25 x 25 x 10 mm up to Ø 350 mm.

DETERMINING NECESSARY AIRFLOW

Dissipated power has to be determined first. If this value is unknown, the estimation can be done by taking the power consumed by the equipment and the efficiency (which is approximately 75 % for electronics equipment).
Example :
Consumed power = 500 W
Power to be dissipated : 500 x 25 % = 125 W

The graph below (fig1) shows how to calculate the airflow according to the dissipated power, using the formula:

$$\text{Airflow (l/s)} = \frac{P(W)}{1,2 \times \Delta t}$$

This calculation does not take into consideration pressure drop, which has a direct impact on the airflow. Pressure drop is defined in the next paragraph.

CALCULATING NECESSARY STATIC PRESSURE

Each component mounted in the equipment opposes a resistance to air circulation. These accumulated resistances are called "pressure drop". The pressure drop is balanced by the fan static pressure which is expressed in mmH_2O or in Pa.
The necessary airflow of the fan must be specified at a certain static pressure.

Pressure drop is not easily calculable, especially in complex equipment. In cooling applications, pressure drop can be calculated according to duct diameter, length, bends or other deviations.
Here is one basic principle to calculate pressure drop:
A specified fan, which air performance is known, is mounted on the equipment. The air speed can be measured at the outlet of the equipment with an anemometer. The airflow is calculated as follows:

A = Airflow (l/s)
O = Outlet Section (cm^2)
S = Air Speed (m/s)

$$A = \frac{S \times O}{10}$$

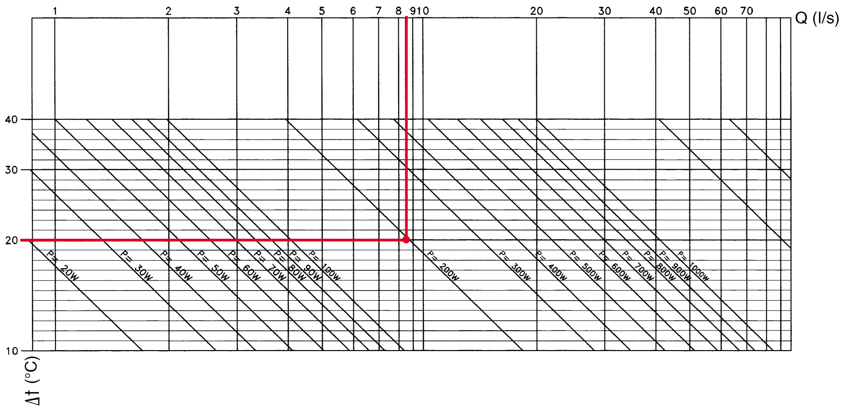
The static pressure, corresponding to the measured airflow, can therefore be read on the fan performance curve.
The value of this static pressure is the second parameter to consider when selecting a fan.

Fig.1 - Determining necessary airflow

P: represents the power to be dissipated (in watts)
Δt: represents the temperature difference between internal temperature of the equipment and ambient temperature
Q: represents the airflow of the fan = $\frac{P(W)}{1,2 \times \Delta t}$ L/s

THE AIRFLOW IS DETERMINED BY THE PROJECTION ON THE GRAPH BELOW FROM THE INTERSECTION POINT OF THE LINES W AND Δt ON THE AIRFLOW SCALE.

Example: Power to be dissipated: 200 W
Δt: 20°C
Necessary airflow to cool is: 8,5 l/s



Technical guide

CHOOSING THE APPROPRIATE FAN OR BLOWER WITH THE WORKING POINT

The combination of necessary airflow and static pressure gives a value which is called working point. It is now very easy to choose the appropriate fan or blower, by selecting a model in the catalogue, which curve meets the working point (see fig 2).

OPTIMISING FAN SELECTION

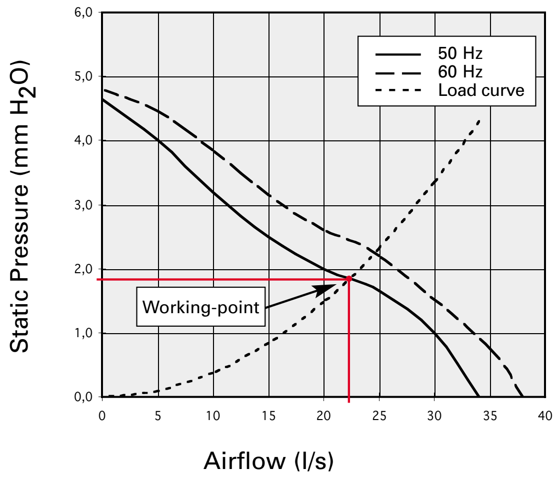
If the air requirement is high, and available space limited, it is possible to double the airflow at free delivery by putting two fans in parallel or to increase the pressure by putting two fans in series.

The noise level will then increase by approximately 3dBA depending on the fan model.

The next chapter shows the benefits of the different fan designs.

Example:
Working point: 22 l/s at 1,8 mm H_2O

Fig.2



About fans performance:

Values indicated in this catalogue are based on free delivery (no pressure value) and shutoff (no flow condition).