



產品簡介 Product characteristics

EC 後向離心風機系列，風機直徑從 133mm ~ 630mm，風扇使用塑膠材質（ $\leq 250\text{ mm}$ ）或金屬材質（ $\geq 280\text{ mm}$ ），標準版性能基本涵蓋常規應用需求；產品認證：CCC，按需認證 CE、UL。

EC Backward-curved Centrifugal Fan, diameter of the fan ranges from 133mm to 630mm. The fan is made of plastic material ($\leq 250\text{mm}$) or metal material ($\geq 280\text{mm}$). The performance of the standard version basically covers the requirements of conventional applications. Product certification: CCC, on demand certification CE, UL.

產品組成 Component of product

後向離心風扇、EC 外轉子電機、導風圈

Backward-curved centrifugal fan, EC external rotor motor, Collecting ring

工作環境與適用條件 Working environment and applicable conditions

電源：單相 220V~240V，50/60Hz
三相 380V~460V，50/60Hz
控制方式：VSP（可按需 VSP/PWM，RS485）
防護等級：IP 54
絕緣等級：F
軸承：免維護軸承
工作溫度：-25~+60°C
相對濕度： $\leq 95\%$
海拔高度： $\leq 1000\text{m}$

Power supply: Single-phase 220V~240V, 50/60 Hz
Three-phase 380V~460V, 50/60 Hz
Control mode: VSP (on-demand VSP/PWM, RS485)
Protection level: IP 54
Insulation class: F
Bearings: maintenance-free bearings
Operating temperature: -25~+60°C
Relative humidity: $\leq 95\%$
Altitude: $\leq 1000\text{m}$

應用場合 Applications

新風淨化、通風換氣、空調製冷、冷凍冷藏、軌道交通、電力通信等領域。

It is widely used in air purification, ventilation system, HVAC, refrigeration, rail transit and electric Max Power communication., etc.

編碼規則 Code Regulation

<u>EC</u>	<u>190</u>	<u>A</u>	<u>1</u>
1	2	3	4

- | | | |
|---|---------------|-------------------------------------|
| 1 | EC 後向離心風機 | Backward-curved Centrifugal Fan |
| 2 | 風輪規格 | Fan Specifications |
| 3 | 型號代碼 (A-Z) 表示 | Model number code Marked with (A-Z) |
| 4 | 版本號 | Version number 1-9 |

風機性能曲線 Fan Performance Curves

風機性能曲線，能夠以圖形表示的方式，清晰地展示不同類型和不同尺寸的風機各自特點。它通常包括從**自由輸送**（即無阻礙的氣流）到**無輸送**（即氣流完全被密封的系統）的全部範圍，氣體流量 q_v 可由以下一個或多個參數表示：

靜壓 P_s
全壓 P_t
功率 N
風機靜壓效率 η_s
風機全壓效率 η_t

如下圖是一個典型的風機性能曲線。這些曲線一般均按照適當的工業測試標準進行實驗室測試，測試通常是在標準大氣狀態下進行。

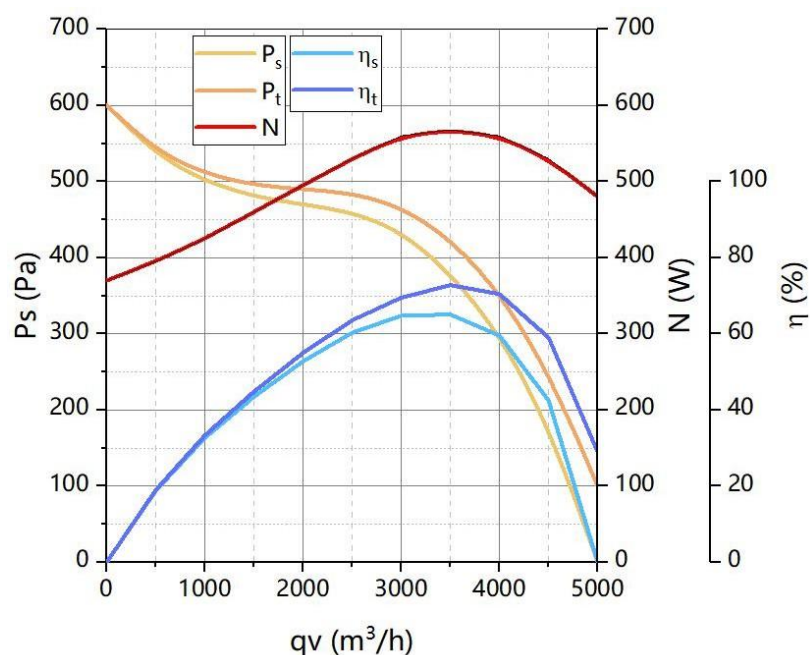
標準大氣狀態，通常是指海拔高度 0m，溫度 20°C，大氣壓力 101.325kPa 時，輸送相對濕度 50%，密度 1.2kg/m³ 的空氣。

The fan performance curves can clearly show the characteristics of different types and sizes of fans by graphical representation. It usually includes the full range from **free delivery** (unimpeded air flow) to **no delivery** (a system where the air flow is completely sealed). The gas flow rate (q_v) can be represented by one or more of the following parameters:

Static pressure	P_s
Total pressure	P_t
Power	N
Fan static efficiency	η_s
Fan total efficiency	η_t

The following figure is a typical fan performance curve. These curves are generally subjected to laboratory tests in accordance with appropriate industrial testing standards, usually under standard atmospheric conditions.

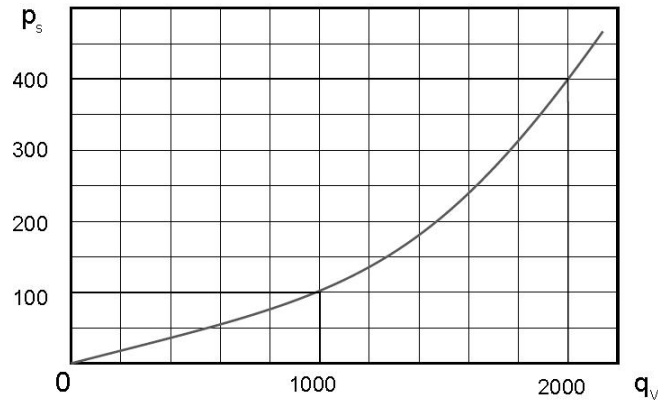
Standard atmospheric state, usually refers to the altitude of 0m, temperature 20°C, atmospheric pressure 101.325kPa, the delivery of relative humidity 50%, density 1.2kg/m³ air.



系統阻力曲線 System Resistance Curves

系統阻力是指風道系統中篩檢程式、蒸發器、冷凝器、擋板、風閥及管道沿程等所有壓力損失的總和。它通常與通過系統的氣體流量正相關。典型的系統阻力曲線如下所示。

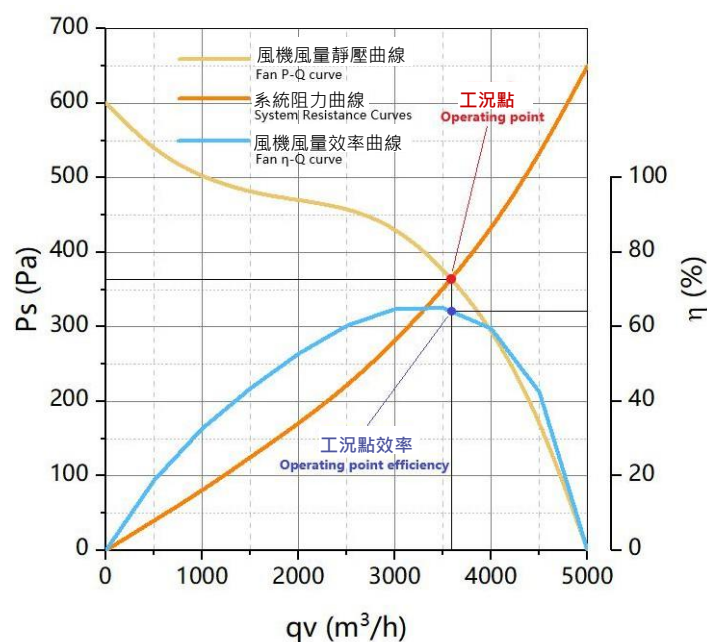
System resistance refers to the sum of all pressure losses along the filter, evaporator, condenser, baffle, air valve and pipeline in the air duct system. It is usually positively related to the flow of gas through the system. A typical system resistance curve is shown as follows:



工況點 Operating point

風機在系統運行的工況點，是由系統阻力曲線與風機風量靜壓曲線的相交點來確定的。通常結合風機的效率曲線，將工況點設置在效率曲線的高效點附近，能夠更大的發揮風機性能與節約能源。

The operating point of the fan in the system is determined by the intersection point of the system resistance curve and the fan air volume static pressure curve. Usually combined with the efficiency curve of the fan, the operating point is set near the high efficiency point of the efficiency curve, which can give greater play to the performance of the fan and save energy.



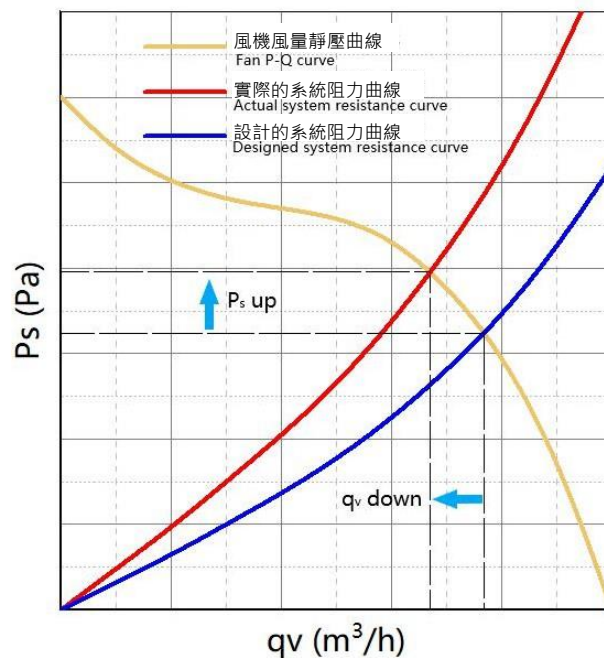
風機基礎 Fan Foundation

對於既定的風道系統，系統阻力曲線並不是一成不變的。如當篩檢程式有污物，盤管開始凝結水分，或出口調節閥改變了位置時，系統阻力曲線就會有變化。此時，對應的設計阻力與實際阻力不同，工況點將會變化，靜壓與風量將與設計點不同。

在很多情況下，風機的實際輸出與計算輸出之間有差別，它是由於系統阻力的變化而產生的，並不是風機或電機的原因。如下圖，實際系統比預設的有更多的阻力損失，則風量減少，靜壓增加。

For a given duct system, the system resistance curve is not static. If there is dirt in the filter, the coil begins to condense water, or the outlet regulator changes its position, the system resistance curve will change. In this case, the corresponding design resistance is different from the actual resistance, and the operating point will change.

In many cases, the difference between the actual output of the fan and the calculated output is caused by changes in the resistance of the system, not by the fan or motor. As shown below, the actual system has more resistance loss than the preset, so the air volume decreases and the static pressure increases.



風機選型原則 Principles of Fan Selection

風機選型時，首先要確定系統所需的風量和壓力，即工況點。我們想要得到多少風量，就需要克服相應的系統阻力。請參考“風機基礎”中工況點的確認原則。明晰工況需求後，根據圖冊可以很快確認風機的尺寸範圍。

The When selecting the fan, we should first determine the air volume and pressure required by the system, that is, the operating point. How much air volume we want to get, we need to overcome the corresponding system resistance. Please refer to the principle of confirming the operating point in "Fan Foundation". After clarifying the working conditions, the size range of the fan can be quickly confirmed according to the chart.

風機選型 Fan Selection

其次，確認安裝空間的尺寸與風機尺寸的匹配是否適宜。儘量不要在較小的空間內安裝較大尺寸的風機，這樣做會增加系統阻力，使得工況點偏移，同等風量下需要克服更大的阻力，得不償失。

再次，確認風機的使用環境，電氣環境，控制方式，安裝方式等。這些資訊請盡可能提供，給我們的業務經理與技術經理，越詳細越好。這樣就可以在滿足使用需求的條件下，匹配性價比更高的產品。

Secondly, confirm whether the size of the installation space matches the size of the fan. Try not to install a larger size fan in a smaller space, which will increase the resistance of the system and make the operating point offset. Under the same air volume, it is necessary to overcome greater resistance, which outweighs the loss.

Again, confirm the use of the fan environment, electrical environment, control mode, installation mode and so on. Please provide as much information as possible to our business manager and R&D manager, as much detail as possible. In this way, we can match products with higher cost performance under the condition of meeting the use requirements.

溫度和海拔高度對空氣的影響 Effects of Temperature and Altitude

在實際的選型過程中，有些風機的應用場合分佈在不同的海拔和溫度環境下，此時環境對氣體的密度影響很大。風機性能曲線不能直接應用於選型，需要作相應的換算調整，才能明確工況點。

溫度和海拔高度對空氣的影響，可用以下公式表示：

In the actual selection process, some fan applications are distributed in different altitudes and temperature environments, and the environment has a great impact on the density of the gas. The fan performance curve can not be directly applied to the selection, and the corresponding conversion adjustment is needed to determine the operating point. The effect of temperature and altitude on air can be expressed by the following formula:

$$\rho_1 = \rho_0 \times \left(1 - \frac{Z}{44300}\right)^{5.256} \times \frac{293}{273 + t}$$

式中： $\rho_0=1.225\text{kg/m}^3$ —— 標準大氣密度
 Z 、 t —— 當地海拔高度、溫度
 ρ_1 —— 當地大氣密度

設：

Where：
 $\rho_0=1.225\text{kg/m}^3$ —— Standard atmospheric density
 Z , t —— Local actual Altitude & Temperature
 ρ_1 —— Local atmospheric density

If：

$$\rho_1 = e \times \rho_0$$

可得：

Then：

$$e = \left(1 - \frac{Z}{44300}\right)^{5.256} \times \frac{293}{273 + t}$$

則 e 為大氣密度的修正係數，通過上式可得下表：

Then (e) is the correction coefficient of air density. From the above, the following table can be obtained:

風機選型 Fan Selection

大氣密度修正係數表 Table of correction coefficients for atmospheric density

氣溫 °C	海拔高度 Altitude : m										
Temperature	0	200	400	600	800	1000	1200	1400	1600	1800	2000
-40	1.26	1.23	1.20	1.17	1.14	1.12	1.09	1.06	1.04	1.01	0.99
-20	1.16	1.13	1.10	1.08	1.05	1.03	1.00	0.98	0.95	0.93	0.91
0	1.07	1.05	1.02	1.00	0.98	0.95	0.93	0.91	0.88	0.86	0.84
20	1.00	0.98	0.95	0.93	0.91	0.89	0.87	0.84	0.82	0.80	0.78
40	0.94	0.91	0.89	0.87	0.85	0.83	0.81	0.79	0.77	0.75	0.73
60	0.88	0.86	0.84	0.82	0.80	0.78	0.76	0.74	0.73	0.71	0.69
80	0.83	0.81	0.79	0.77	0.75	0.74	0.72	0.70	0.68	0.67	0.65

由此可知，海拔高度與溫度的變化，最後只體現在空氣的密度這一個參數的變化。

根據風機的相似理論：

Therefore, the change of altitude and temperature, it is only reflected in the change of the density of air.

According to the fan similarity theory:

$$\frac{Q_1}{Q_2} = \frac{D_1^3 n_1}{D_2^3 n_2} \quad \frac{p_1}{p_2} = \frac{\rho_1 D_1^2 n_1^2}{\rho_2 D_2^2 n_2^2} \quad \frac{N_1}{N_2} = \frac{\rho_1 D_1^5 n_1^3}{\rho_2 D_2^5 n_2^3}$$

可知，同一風機在相同轉速下，風量與空氣密度變化無關，靜壓、功率與空氣密度變化呈一次函數關係。

根據壓力損失公式、管路水頭損失公式和連續性方程：

It can be seen that at the same speed of the same fan, the airflow has nothing to do with the change of air density, and the static pressure, power and air density show a function relationship.

According to the pressure loss formula, pipeline head loss formula and continuity equation:

$$\frac{p_{w1}}{p_{w2}} = \frac{\rho_1}{\rho_2} g h_w \quad h_w = \lambda \frac{l}{d} \frac{\bar{v}^2}{2g} + \zeta \frac{\bar{v}^2}{2g} \quad \bar{v} = \frac{Q}{A}$$

可知，在同一系統下，空氣密度變化與系統總水頭損失係數 h_w 無關，空氣密度變化與系統壓力損失呈一次函數關係。

對既定風機系統，海拔高度與溫度的變化體現在空氣密度上。空氣密度的變化對性能曲線圖將呈現如下特性：風機在設計工況點的風量值始終不會變化，但靜壓與功率會隨密度線性變化，其變化比率等於大氣密度修正系數。

綜上：

當地風機風量=標準風機風量

當地風機靜壓=e*標準風機靜壓

當地風機功率=e*標準風機功率

It can be seen that under the same system, the air density change has nothing to do with the total head loss coefficient (h_w) of the system, and the air density change is a function of the pressure loss.

For a given fan system, changes in altitude and temperature are reflected in air density. The change of air density will show the following characteristics on the performance curve: the air volume value of the fan at the design working point will never change, but the static pressure and power will change linearly with the density. The rate of change is equal to the atmospheric density correction factor.

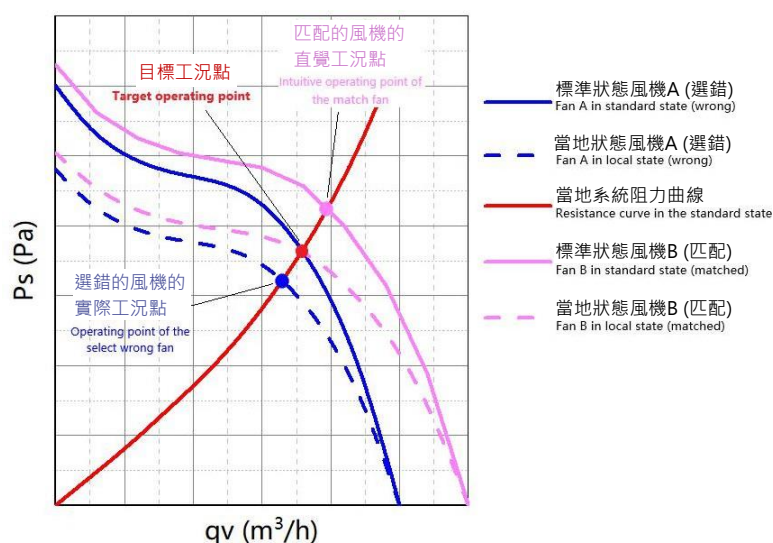
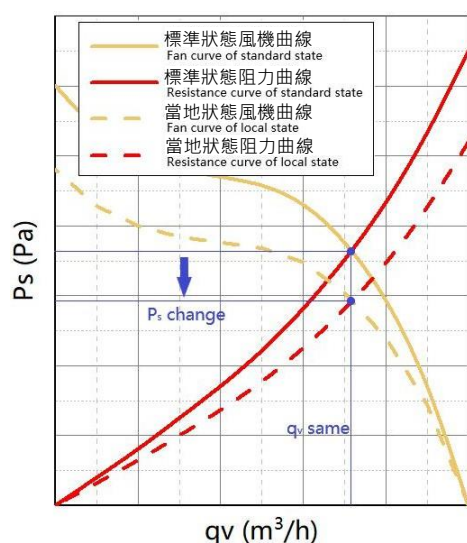
To sum up:

Local fan airflow = standard fan airflow

Local fan static pressure = e * (Standard fan static pressure)

Local fan power = e * (Standard fan power)

風機選型 Fan Selection



在當地大氣狀態與標準狀態差異較大時，如果直接使用標準大氣狀態的風機計算工況點，則所選風機在當地狀態下工作時，風機性能與設計目標會相差很大。應當由當地大氣狀態計算風機在當地的實際風機性能曲線，從而準確達成工況點匹配，選擇合適的風機。

When the difference between the local atmospheric state and the standard atmospheric state is large, if the fan with the standard atmospheric state is directly used to calculate the operating point, the performance of the selected fan will be greatly different from the design goal when the fan works in the local state. The actual fan performance curve of the fan in the local area should be calculated by the local atmospheric state, so as to accurately achieve the matching of the operating point and select the appropriate fan.

風機選型流程 Fan Selection Process

- 1、確認工況點：風量、靜壓；
- 2、確認風機類型、安裝空間尺寸；
- 3、確認風機的使用環境，電氣環境等；
- 4、由 1、2、3 點，初步篩選符合的標準產品規格；
- 5、確認控制方式，安裝方式等；
- 6、確認配件、引線、接外掛程式等；
- 7、確認認證需求；
- 8、由 5、6、7 點，確認篩選的產品是否符合需求；
- 9、若經過 8 點確認可行，可直接與業務經理下單；否則，可與業務經理提出對應需求，締約開發計畫，達成合作後進行改型開發與定制開發。

1. Confirm the operating conditions: airflow and static pressure;
2. Confirm the type of fan and the size of installation space;
3. Confirm the operating environment and electrical environment of the fan;
4. From 1, 2 and 3 points, preliminary screening meets the standard product specifications;
5. Confirm the control mode, installation mode, etc.
6. Confirm accessories, leads, connectors, etc.;
7. Confirm the certification requirements;
8. Confirm whether the screened products meet the requirements at 5, 6 and 7 points;
9. If it is confirmed feasible at 8 points, you can directly place an order with the business manager; Otherwise, corresponding requirements can be put forward with the business manager, and the development plan can be concluded. After the cooperation is reached, the modified development and customized development can be carried out.