# AIRCOL®

VENTILATION TECHNOLOGIES

**2016-2017**
PRODUCT CATALOGUE

# AKSA MOTOR FAN


Silent solution for ventilation

**Decorative Aspirators** | **Industrial Fans** | **AC Motors**


Focused on continuous growth, AKSA MOTOR FAN company has been serving the heating, ventilation and air conditioning sector through an innovative approach for more than 20 years. Manufacturing shaded-pole and external rotor (with capacitor) AC drive motor groups and domestic and industrial fan groups, AKSA MOTOR FAN gradually raises the level of its success by adopting the "Quality and Customer Satisfaction First" principle for its every product. The company carries on to increase its production rate, level of product quality and product diversity, and aims to expand its daily manufacturing capacity to 15.000 pieces in its 20,000 m² indoor manufacturing facilities thanks to the significant investments made for improving the technological infrastructure of the company. Performing all design, product development, manufacturing, sales, marketing and after-sales activities in-house, AKSA MOTOR FAN offers high value-added services with an exceptional sense of resolution and determination.

AKSA MOTOR FAN carries out its all manufacturing activities with national capital and workforce and puts its products on both domestic and international markets under the AIRCOL® brand. Exporting 60% of its products, the company tries to transfer its leadership at home to the international markets. Thanks to our long-standing know-how and experience, we feel the proud of being a pioneering company in the heating, ventilation and air conditioning sector.

**Confidence & Quality-focused Manufacturing + Excellence in Manufacturing**


# Leading Company of the Industry

**Aksa Motor Fan aims to become a leading member of the industry thanks to the basic values on which the activities of the company stand.**

**Financial resources of Aksa Motor Fan**
Aksa Motor Fan is capable of smoothly managing R&D (Research and Development) and PD (Product Development) activities and making investments on the manufacturing infrastructure of the company as a consequence of using its financial resources independently and in the most efficient manner.

**Innovative technologies**
Aksa Motor Fan constantly works hard for being a company which shapes the sector by developing innovative technologies.

**Quality-focused manufacturing**
Aksa Motor Fan operates with the awareness that quality must be maintained in every stage from design to delivery.

**Customer satisfaction**
Aksa Motor Fan visits its customers in their actual workplaces with a team of technically competent sales representatives and meets their requirements with a diversified range of products.

**Highly experienced management and technical staff**
Aksa Motor Fan tries to create a corporate environment in which everybody state their opinions comfortably by constantly encouraging teamwork through its experienced staff of executives. This is because the company believes that real success can be achieved only with an approach dominated by respect and understanding.

# EXCELLENCE IN MANUFACTURING



**Reliability**
Aksa Motor Fan maintains its high reputation before both its customers and suppliers by attaching great importance to creating a mutual trust environment in any work it carries out.

**Quick response logistics**
Aksa Motor Fan is able to produce nearly all components of its products in house and the company offers the advantage of fast and reliable services thanks to its firm position as manufacturer.

**Environmental awareness**
Aksa Motor Fan uses environment friendly and highly recyclable raw materials in its manufacturing facilities in order to maintain the ecological balance.

AIRCOL®

# We Export
## to more than 40 countries!

AKSA MOTOR FAN exports its products to more than 40 countries and rapidly advances to become Turkey's door opening to the world in its field of activity.

**Exporting 60% of the goods manufactured by the company, Aksa Motor Fan presents its products to the international markets in more than 40 countries.**

**Research and Development**

In this stage of business, which we consider as a process of discovery for novel information and techniques not applied before, AKSA MOTOR FAN tries to develop optimum designs in terms of both cost and customer satisfaction by conducting innovative research on the target product.

Sincerely believing the strength of university-industry cooperation, AKSA MOTOR FAN always support its engineers and other employees working in the R&D and Product Development departments in their post graduate and doctorate studies. In this way, the company paves the way for development of innovative technologies by combining the potentials offered by the academic world and the private industry.

# From Concept To Manufacturing

**Planning for excellence...**

All studies for a proposed product are started with the development of a detailed concept. Our experienced technical team consisting of engineers and technicians firstly focuses on the functional features of a product such as operation conditions, energy efficiency, performance, sound level, ease of installation. Basic parameters of the concept are determined in consequence of the detailed studies conducted on these features.

Customers of AKSA MOTOR FAN also play an important role on this process. Discussions made with the users provide our designers the opportunity to hear many valuable opinions at first hand. Thus, any product developed by the company is built on firm foundations from the very beginning, at the stage of concept designing.

**Computer aided design: Simulations and Analyses...**

It is the duty of our design team to realize a concept developed within the company. In the light of the data obtained, products are designed down to the last detail with computer aid, by use of CAD/CAM software. Each component of products are designed with utmost accuracy and made ready for simulations and analyses to be carried out.

After the solid modeling is accomplished, the product is subjected to mechanical resistance simulations. If the design proves to be successful in these simulations, the product is analyzed by use of the Computational Fluids Dynamic (CFD) and the Finite Elements Analysis (FEA) methods until the most efficient air flow pattern, performance curves and desired efficiency are obtained. Afterwards, the product is evaluated in consideration of the analysis data in order to reach the optimum design. As a result of these long and arduous studies, optimum computer design is obtained for the proposed product.

From Concept to Manufacturing...

**Prototype building and testing under real conditions...**

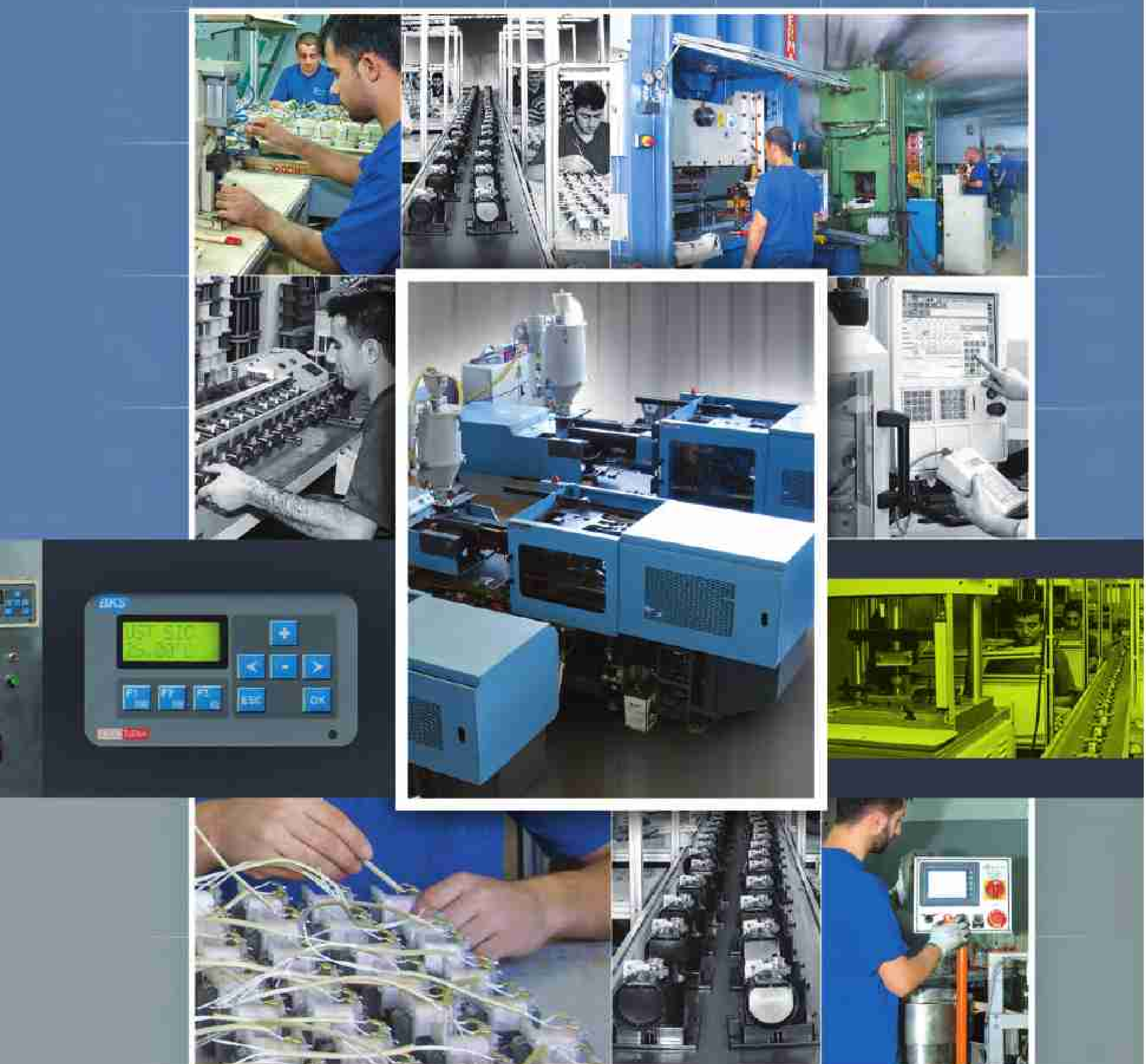
Prototype building is a significant complementary stage of the designing process. In this stage, the design prepared in the computer environment is developed into a prototype with high accuracy and nearly perfect conformity to the commercial version of the product in order for the tests to be applied under real operating conditions. With exact model preparation through fast prototyping, potential problems are ensured to be recognized and eliminated at the early stage of designing.

For the purpose of making sure that they deserve to carry the AKSA MOTOR FAN brand and the AIRCOL® trademark, products prototypes are subjected to the most demanding tests by the company's quality department. Various tests performed on prototypes under the conditions set by international standards provide us very valuable information for developing excellent products. In the light of these information, deficiencies of designs are eliminated if any and optimum designs are developed in terms of real operating conditions. After successfully passing all these stages, a design is finally ready for being converted into a commercial product.

# Manufacturing...

Detailed manufacturing processes are prepared when a design qualifies for being developed into a commercial product. In this stage, the product is mass manufactured by use of the most efficient manufacturing techniques and advanced technologies. As a company certificated in 1998 for the ISO 9001 Quality Management System applied, AKSA MOTOR FAN carries out manufacturing in a factory having closed area of 20.000 m² and an upgraded technological infrastructure.

Thanks to the pre-manufacturing, intermediate and final controls performed during the process, products equipped with AKSA MOTOR FAN quality becomes ready for being delivered to the customers.



Always one step ahead
with **AKSA MOTOR FAN...**

# From Manufacturing to the Customer

As in the case of manufacturing, AKSA MOTOR FAN carries out also sales and customer services activities with a focus on high-quality and satisfaction.

Being able to meet almost every need of its customers with a diversified product range, AKSA MOTOR FAN performs sales in the domestic and international markets through a network of agencies and regional sales teams. When necessary, technically competent sales representatives of the company make site visits for solving the problems within the shortest time possible. You can contact us for receiving information on the most suitable products for different uses, efficiency calculations and other technical details and find the optimum solution for your case. Our customers can easily reach us on the web or through phone calls whenever they need.

Operating with a completely national workforce and manufacturing capacity and being located in a highly strategic region of the world, AKSA MOTOR FAN stays ahead of the game in terms of making FAST and RELIABLE deliveries, and the company makes use of this advantage in increasing customer satisfaction to the highest level.

AKSA MOTOR FAN participates in both local and international trade fairs organized for the heating, ventilation and air conditioning sector in order to keep its finger on the pulse of the industry and enhancing relationships with customers and suppliers.


### Quality at material entrance...

By the help of confidence based relationships with the suppliers, purchasing department of the company provides highest quality input materials in the most economical and fastest manner and shows utmost diligence for the purchase of raw materials.

Purchased raw materials and components are subjected to detailed tests by the quality control department in the company's own laboratories in order to be sure that they are suitable for use. Only raw materials and components which prove to be successful in these tests are delivered to manufacturing facilities. This way, quality is assured already before starting production.

| | | |
|---|---|---|
| AKSA MOTOR FAN has been awarded the internationally accepted ISO 9001 quality management certificate, which acts as an assurance for the continuity of the product and service quality offered to the customers. Quality management system applied by the company has been updated according to ISO 9001:2000 norms. | All of our products are awarded the certificate of conformity by the Turkish Standards Institute (TSE). Our products' quality level and conformity to international norms are semiannually inspected by the Institute. | Our products have been awarded quality certificates by VDE. |

## Reliability, high quality and maximum performance in

# SOLUTIONS FOR YOU

From our point of view, quality is the level of meeting demands and expectations of the customers. We operate in a systematical and planned way in order to the move this level to new heights.

### Quality in Manufacturing...

After the assembly is completed, mechanical and electrical parameters of each product is checked at intermediate and final inspection points. Only products successfully passing these inspection points can reach the customer. In addition, random samples taken from the group of inspected products are subjected to detailed quality checks in order to minimize potential defects and quality-focused manufacturing process is completed.

### Quality in Delivery

Being aware that it is required to maintain the level quality obtained in manufacturing during all processes until the product is delivered to the customer, AKSA MOTOR FAN is always one step ahead thanks to fast and reliable logistic services.

CE

KEMA REGISTERED QUALITY DEKRA

RoHS

Our products carry the CE mark which indicates conformity to the norms of European Economic Community (EEC).

Our products have been awarded quality certificates by KEMA.

Our products have been awarded quality control confirmation certifications by Intertek Laboratories which offers independent and accredited testing, surveillance inspection and certification services in the international market.

# General Information on Ventilation

In this section, we present the definitions of certain terms widely used in ventilation applications.

**Fan Flow Rate [Q]:**
Fan flow rate is the amount of air transferred by a fan per unit time. It is usually defined in m³/hour or C.F.M. (cubic feet per minute). Flow rate figures given in this catalogue for the products are the values provided when air flows freely without any obstacle in front of the fan.

**Fan Speed [N]:**
Fan speed is the number of turns made by the fan per unit time. It is generally defined in rpm, as the number of full turns in one minute.

**Fan Pressure [P]:**
Fan pressure is the pressure affecting on unit area during air transfer by the fan. It is generally defined in Pascal (Pa) or millimeter water column (mmWC). (1 mmWC = 9,8 Pa)

**Static Pressure [ $P_S$ ]:**
Static pressure is the pressure which the fan must supply to overcome the resistance to airflow caused by air ducts, filters and other elements of the ventilation system.

**Dynamic Pressure [ $P_D$ ]:**
Dynamic pressure is the pressure applied on unit area caused by the movement of the air transferred during the operation of a fan, based on air transfer speed.

**Total Pressure [ $P_T$ ]:**
Total pressure is the arithmetical total of static and dynamic pressure values [$P_T = P_S + P_D$]. Please see page 21 for pressure loss calculations and examples of implementations.

**Power consumption:**
Power consumption is the amount of electric power required for the operation of the fan under certain conditions. Maximum power consumption of each product is specified in this catalogue.

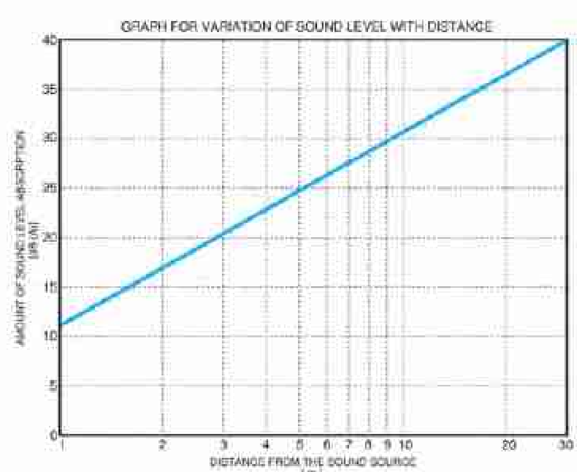
**Efficiency:**
Efficiency defines the amount of air that can be transferred by the fan against negative direction pressure forces. Since the products included in this catalogue have optimum body and fan designs, they operate with high efficiency when they are installed with suitable air inlets and outlets.

**Sound Level:**Human ear perceives sounds through the surrounding air molecules. Sound sources propagate sound in waves by vibrating the air. The waves reaching our ear initiate the hearing process by vibrating the eardrum. Sound level is defined in dB[A] for ventilation systems.

**Sound Power [$L_w$]:** The amount of energy consumed by the sound source for propagating a sound.

**Sound Pressure [$L_p$]:** The magnitude of the vibrations created by a sound source in the air. Sound pressure value changes based on the distance from the sound source.

THIS GRAPH SHOWS THE VARIATION OF SOUND LEVEL WITH DISTANCE FROM THE SOURCE.




## Axial Fans:

In axial fans, direction of air flow is parallel to the axis of rotation of the fan. In other words, directions of air entering the fan and exiting from it are parallel. This type of fans is mostly preferred where the amount of air to be transferred is more important than pressure losses.

## Centrifugal Fans:

In centrifugal fans, directions of air entering the fan and exiting from it are perpendicular. This type of fans provides high pressure air flow thanks to their impeller blade structures and numbers, and they are mostly preferred for applications with high amount of pressure loss.

### Fans with forward inclined blades:

Having small concave surface area and large number of blades, fans with forward inclined blades are able to provide low and medium pressure air flow. When operated beyond nominal conditions, this type of fans may cause damage because of overload on the motor. In addition, they quickly get contaminated in case of oily and dusty air transfer, since they are equipped with small blades.

### Fans with backward inclined blades:

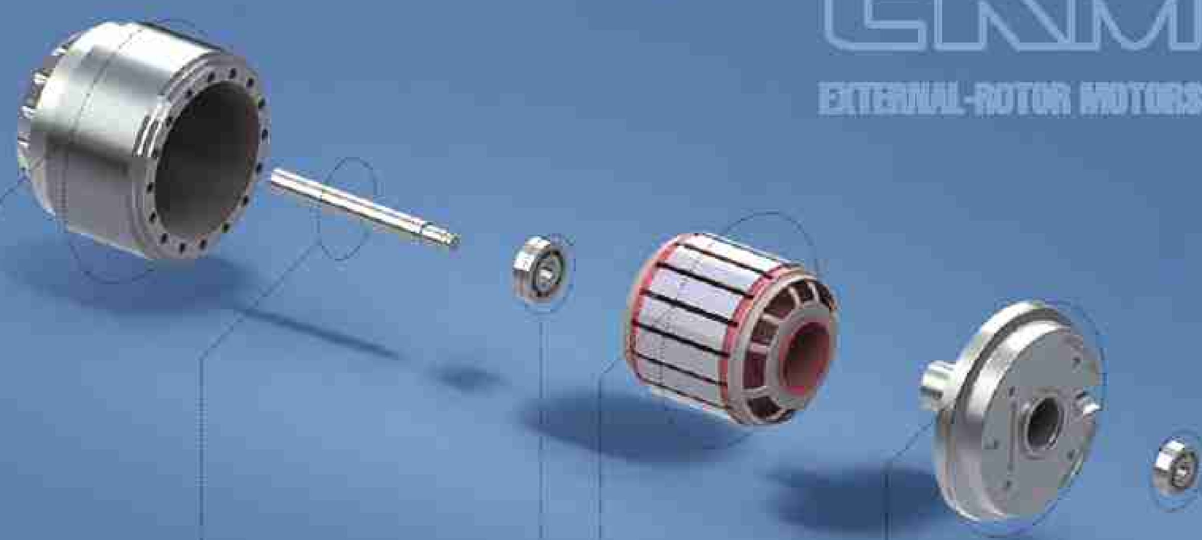
Having small number of blades with large surface areas, fans with backward inclined blades are able to provide high flow and pressure thanks to their blade design. They do not cause overload on the motor when operated without any obstruction. In addition, they are much less affected from oil and dust contamination, since they are equipped with large blades.

### Fans with straight blades:

Equipped with straight flats, this type of fans is generally used for pneumatic transfer of materials although they have small number of blades. Operation beyond nominal conditions does not cause overload on the motor.

# General Information on Motors

ERM
EXTERNAL-ROTOR MOTORS



**Rotor:**
Rotating part of the motor.

**Shaft:**
The part providing that the motor rotates around a fixed axis.

**Stator:**
Static part of the motor.

**Bottom cover:**
The part on which the bearings rest in order to act as housing for the rotor shaft.

**Bearings:**
Basically, bearings are bearings with two rings one inside the other and small balls between these two rings in order to provide rotation. Thanks to special initial lubrication, bearings do not require maintenance and operate in desired installation position, in a temperature range of -40° and +150 °C. Their estimated service life varies between 20,000 and 30,000 hours based on operating conditions.


## Motor Insulation Classes

Maximum operating temperature and maximum temperature rise values for motors were standardized by NEMA (National Electrical Manufacturers Association) and several insulation classes were defined accordingly. Ambient temperature is accepted to be 40 °C in this classification.

**MOTOR INSULATION CLASSES**

| Insulation Class | Maximum Allowed Operating Temperature | |
|---|---|---|
| A | 105 °C | 221 °F |
| E | 120 °C | 248 °F |
| B | 130 °C | 266 °F |
| F | 155 °C | 311 °F |
| H | 180 °C | 356 °F |

## Motor Speed and Number of Poles

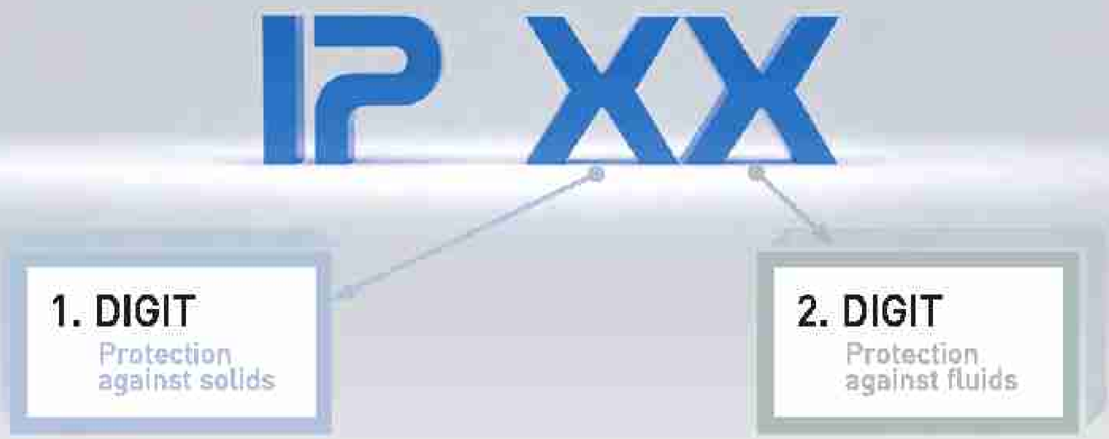
Number of poles in a motor is related to the design of winding in the stator and it is an important factor affecting the speed and torque of the motor. Higher number of poles decreases the motor speed while increasing the amount of torque offered. The relation between number of poles and motor speed is shown in the table below.

**MOTOR SPEED AND NUMBER OF POLES**

| Number of Poles | Motor Speed (rpm) |
|---|---|
| 2 | 2800 |
| 4 | 1400 |
| 6 | 900 |
| 8 | 700 |
| 12 | 450 |
| 16 | 350 |

# Electrical and Mechanical Protection Level IP (International Protection Rate)

**IP protection classes define protection levels of electric equipments against contact with solids and fluids, as mentioned in the internaitonal IEC 60529 standard. IP protection class of an equipment is specified with a two digits number as shown below:**




Protection level of a product is determined by selecting corresponding numbers from the tables given below (example: IP44). If none of the protection classes defined in the tables are suitable for the product, the symbol "X" is used for the corresponding digit (example: IPX4). In general, higher numbers means better protection for the product.

**AGAINST SOLIDS**

| | |
|---|---|
| 0 | No protection |
| 1 | Protection against solids with a diameter larger than 50 mm (back of the hand) |
| 2 | Protection against solids with a diameter larger than 12.5 mm (fingers) |
| 3 | Protection against solids with a diameter larger than 2.5 mm (hand tools) |
| 4 | Protection against solids with a diameter larger than 1 mm (fingers) |
| 5 | Protection against dust particles |
| 6 | Dust-proof (no dust contamination) |

**AGAINST FLUIDS**

| | |
|---|---|
| 0 | Waterproofing |
| 1 | Protection against dripping water |
| 2 | Protection against dripping water up to vertical angle of 10° |
| 3 | Protection against sprayed water up to vertical angle of 60° |
| 4 | Protection against splashed water from all directions |
| 5 | Protection against pressurized water from all directions |
| 6 | Protection against pressurized water similar to sea waves from all directions |
| 7 | Protection against being temporarily submersed in water at 15-100 cm depth |
| 8 | Protection against being submersed in water at a certain depth for a long time |

**Protection Classes:**
All electrical equipments are included in one of the following four insulation classes based on their design:

**Class 0 :** No protection.

**Class I :** All metal parts are grounded.

**Class II :** Double protection against human contact with electricalcomponents. No grounding is required.

**Class III :** The product is fed by a SELV (Separated or Safety Extra-Low Voltage) power supply. There is no risk of electric shock in case of human contact with electrical components.

# Symbols for Product Properties

## OPERATING SYMBOLS

| | |
|---|---|
| | Standard operation |
| | Standard operation or operation through parallel connection with a lamp |
| | Operation with a pull cord switch |
| | Time-delayed operation |
| | Automatic shutter |
| | Mechanical shutter |
| | Silent operation |
| | Colored cover option |
| | Operation with thermic protection |
| | Operation at desired speed and revolution |

## INSTALLATION SYMBOLS

| | |
|---|---|
| | Direct installation (Exhausting directly to the outside) |
| | Ducted installation |

## SAFETY SYMBOLS

| | |
|---|---|
| | Voltage/Frequency |
| | Earth connection required (Class-I) |
| | No earth connection required (Class-II) |
| | Separated or safety extra-low voltage protection (Class-III) |
| | IP Protection Class |
| | Protection against dripping water (IPX2) |
| | Protection against water splash (IPX4) |
| | Minimum & maximum operating temperatures |

## CERTIFICATION SYMBOLS

| | |
|---|---|
| | TSE approved |
| | CE certificate awarded |

Professional solutions fit for your needs...

# Products

## General Information

**Voltage/Frequency:**
Standard operating voltage and frequency for our products are 230V/50Hz. Depending on your choice, products operating with 110V/60Hz can be also manufactured.

**Insulation and Protection Classes:**
Our products are included in insulation and protection classes suitable for their intended uses according to the EN-60335 and EN-60034 standards. In this catalogue, insulation and protection classes can be found in the technical properties section for each product.


**Shock Tests:**
Shock tests for the products are performed in accordance with the EN 60068-2-27 standard.

**Vibration Tests:**
Vibration tests for the products are performed in accordance with the EN 60068-2-6 standard.

**Balance Quality:**
Balance tests for the products are performed in accordance with the EN 1940-G6.3 standard. Depending on the demands of our customers, higher accuracy balance tests can be also performed for specific applications.

**Performance Curves:**
Pressure and air flow data used for the performance curves of products included in this catalogue are measured in test rooms arranged in compliance with the DIN-24163 standard. Air density value is taken to be $\rho$ =1,2 kg/m³ @ 20°C for these measurements.

**Sound Pressure Level:**
Sound levels of the products included in this catalogue were measured based on the following, in accordance with the EN 45635-1 standard:
Domestic Fans: 3 meters
Industrial Fans:
- Axial Type: 3 meters
- Centrifugal Type: 1.5 meters

## Why Do We Need Extract Fans?

The air we breathe is one of our most essential needs. When it is thought that in average we breathe 24,000 times a day, the importance of having clean air can be easily understood.

Today, people spend 85% of their lives in closed spaces such as offices and homes. Contamination of air in these spaces with dust, cigarette smoke, mold, moisture, unnoticed heavy metals, pollens, viruses, bacteria and acarus may cause various health problems. Thus, EXTRACT FANS are needed for enhancing indoor air quality which directly affects human health and working performance, in other words, for cleaning the air breathed and most importantly, for maintaining the freshness of air.

Four steps explained below must be followed for being able to design a ventilating system capable of providing the required indoor air quality and to select the right extract fan for the system designed.

**(A)** Four Basic Steps for Fan Selection

1) Calculating required air flow volume.
2) Determining suitable sound level (acoustic calculation).
3) Calculating pressure losses.
4) Selecting the right fan by the help of fan performance curves.

**(B)** Additional Factors Affecting Fan Selection

- Electrical connection properties of the fan (voltage, frequency, number of phases, etc.).
- Dimensions of the fan.
- Installation type of the fan (wall type, ceiling type, etc.).
- Operation options for the fan (time-delayed, speed regulator, accessories of the product, etc.).

**In addition to the four basic steps given under title (A) above, additional factors given under title (B) must be also considered for exhaust fan selection:**

# Calculating Required Air Flow Volume

The first step for designing a ventilation system is determination of the amount of air (air flow volume) required for the indoor space. Amount of air required to be given to or drawn from the space varies based on several criteria such as the volume of the place, average number of persons using the place, contaminating factors affecting the place, level of humidity and thermal balance.

For air flow calculations, the criterion most suitable for the place must be determined and correct results must be obtained by use of the formula given for the determined criteria. For example, calculation for a room must be made based on the volume of the room, while number of persons using the place is more important for public use areas such as cinemas or theatres. In certain cases, amount of air flow required for the place can depend on more than one criterion. In such cases, separate calculations must be performed for each criterion and highest calculation result must be applied for the design.

Based on each criterion, required flow rates can be calculated by use of the following formulas.

**Calculation of air flow volume based on air change rate:**
In this case, amount of air required for the place depends on the habitable geometrical volume of the place and air change rate. Required amount of air (air flow volume) can be calculated with the following formula:

***$Q = V_0 \times H_d$ [m³ / hour]***
*Q : Air flow volume [m³ / hour]*
*$V_0$ : Geometrical volume of the place ($V_0$ = G x D x Y) [m³]*
*$H_d$ : Air change rate*

(Recommended air change rates are given in Table-1.)

TABLE-1

| Place | $H_d$ / hour Min - Max | Place | $H_d$ / hour Min - Max |
|---|---|---|---|
| Barns | 6 - 10 | Conference Halls | 8 - 12 |
| Surgery rooms | 6 - 8 | Coiffeurs | 10 - 15 |
| Workshops | 8 - 10 | Libraries | 3 - 5 |
| Shopping centers | 6 - 10 | Dry cleaners | 20 – 30 |
| Ballrooms | 10 - 12 | Laboratories | 4 - 6 |
| Banks | 2 - 4 | Stores | 6 - 20 |
| Bathrooms | 6 -10 | Engine rooms | 20 - 30 |
| Billiard rooms | 10 - 15 | Dairy farms | 15 - 20 |
| Waiting rooms | 5 - 8 | Carpenters | 10 – 20 |
| Paint shops | 30 – 60 | Printing houses | 15 – 25 |
| Mosques | 2 - 6 | Motels | 10 - 15 |
| Laundry rooms | 15 – 25 | Museums | 4 - 6 |
| Storehouses | 4 - 6 | Offices | 4 – 6 |
| Resting rooms | 6 - 30 | Living rooms | 4 - 8 |
| Joiners | 8 - 12 | Game rooms | 10 – 15 |
| Foundries | 20 – 30 | Pet shops | 15 – 30 |
| Discos | 15 - 20 | Pizza houses | 8 - 12 |
| Shops | 8 – 12 | Pubs | 10 – 15 |
| Kitchens (domestic) | 10 – 15 | Restaurants | 5 – 10 |
| Toilets (domestic) | 8 - 12 | Kitchens (restaurant) | 15 - 30 |
| Factories | 8 – 15 | Exhibition halls | 5 – 8 |
| Bakeries | 10 – 25 | Greenhouses | 4 – 10 |
| Photocopy rooms | 10 - 16 | Classrooms | 2 - 4 |
| Galvanic baths | 25 – 30 | Cinemas | 6 – 8 |
| Garages | 6 - 8 | Dressing rooms | 8 - 12 |
| Beauty saloons | 10 - 15 | Sports centers | 6 - 12 |
| Hospitals | 4 - 6 | Supermarkets | 6 – 10 |
| Places of worship | 2 - 6 | Tanneries | 20 - 30 |
| Workplaces (general) | 8 - 10 | Repair shops | 10 - 15 |
| Cafeterias | 10 -15 | Theatres | 8 – 10 |
| Canteens | 5 - 10 | Meeting rooms | 4 - 8 |
| Vehicle body repair houses | 10 - 15 | Transformer rooms | 12 - 30 |
| Recording studios | 10 – 12 | Public toilets | 10 – 15 |
| Welding rooms | 15 - 30 | Bedrooms | 2 - 4 |
| Boiler rooms | 20 - 30 | Student dormitories | 5 - 10 |
| Storerooms | 6 – 10 | Swimming pools | 5 - 8 |

**The steps to be followed for calculating required amount of air:**
**1.Step:** Geometrical volume of the place is calculated.

***W: Width*** ***D: Depth*** ***H: Height***
*$V_0$ = W x D x H [m³]*

**2.Step:** Air change rate is determined from Table-1 for the place.

**3.Step:** Lastly, calculated space volume and the air change rate taken from Table-1 are multiplied for finding the required amount of air, and a suitable fan is selected based on the result.

**Example / Problem:**
Ventilation for the domestic kitchen

FIGURE-1

**Example / Solution:**
**1.Step: Calculating the volume of the kitchen**
***W:4 Meters*** ***D:2,5 Meters*** ***H:2,6 Meters***
*$V_0$ = 4 x 2,5 x 2,6 = 26 m³*

**2.Step: Determination of air change rate from Table-1**
Table-1 recommends an air change rate between 6 and 15 for home kitchens. We will apply $H_d$ = *13* as the average value.

**3.Step: Calculating required amount of air**
*Q = $V_0$ x $H_d$ = 26x13 = 338 m³/hour*

Based on the obtained result, model Aircol-20K providing air flow of 360 m³/hour or model Aircol-200 providing air flow of 350 m³/hour can be preferred for the above mentioned kitchen.

*Note: Pressure losses were not considered, since direct discharge type air outlet is applied in the example.*

**Calculation of air flow volume based on the number of persons using the place:**
In certain cases, amount of air required for the space depends on the number of persons using the place. In such cases, required amount of air (air flow volume) can be calculated with the following formula:

*$Q = N \times H_k$ [m³ / hour]*
*Q : Air Flow Volume [m³ / hour]*
*N : Number of persons*
*$H_k$ : Air change rate per person $\left[\frac{m^3}{\text{hour x number of persons}}\right]$*

Air change rates per person based on the type of activity and type of place are given in Table-2 and Table-3.

TABLE-2

| Type of Activity | $H_k \left[\frac{m^3}{\text{hour x number of persons}}\right]$ |
|---|---|
| Normal Activity | 20 - 25 |
| Normal Activity + Smoking | 30 - 35 |
| Light Physical Activity | 40 - 45 |
| Heavy Physical Activity | 50 - 60 |

TABLE-3

| Type of Place | $H_k \left[\frac{m^3}{\text{hour x number of persons}}\right]$ |
|---|---|
| Trade fair centers<br>Concert halls<br>Libraries<br>Supermarkets<br>Museums<br>Cinemas<br>Theatres | 20 |
| Resting rooms<br>Normal rooms<br>Conference rooms<br>Auditoriums<br>Hotel rooms<br>Offices<br>Classrooms | 30 |
| Restaurants<br>Dining halls | 40 |

**Calculation of air flow volume based on the suction rate for small particles:**
Required amount of air for industrial applications with extract fan use depends on the particles suctioned and the suction area of the extract fan, and it is calculated with the following formula.

*$Q = A_d \times V_e \times 3600$ [m³ / hour]*
*Q : Air Flow Volume [m³ / hour]*
*$A_d$ : Suction area of exhaust fan[m²]*
*$V_e$ : Suction rate [m/s]*

Air suction rates recommended for industrial applications with extract fan use are given in Table-4.

TABLE-4

| Application | Suction Rate ($V_e$) |
|---|---|
| Kitchen hoods for domestic applications | 0,15 – 0,20 m/s |
| Kitchen hoods for industrial applications | 0,20 – 0,25 m/s |
| Evaporation tanks | 0,25 – 0,50 m/s |
| Degreasing | 0,25 – 0,50 m/s |
| Welding, galvanizing, pickling | 0,50 – 1,00 m/s |
| Painting cabinet | 0,40 – 1,00 m/s |
| Sandblasting and grinding | 2,5 – 10,00 m/s |

**Calculation of air flow volume based on the transfer speed of small particles in ducts:**
In certain cases, various small particles (dust, chips, etc.) are needed to be dischaged by being transferred through ducts. In such cases, required amount of air (air flow volume) can be calculated with the following formula:

*$Q = A_k \times V_T \times 3600$ [m³ / hour]*
*Q : Air flow volume [m³ / hour]*
*$A_k$ : Cross-sectional area of the duct[m²]*
*$V_T$ : Air speed in the duct[m/s]*

Air speed values recommended for particle transfer applications are given in Table-5.

TABLE-5

| Particle Type | Transfer Speed ($V_T$) |
|---|---|
| Dust | 9 m/s |
| Flour | 13 m/s |
| Wood<br>-Thin chips<br>-Thick chips | <br>15 m/s<br>18 m/s |
| Metal:<br>-Thin chips<br>-Thick chips | <br>15 m/s<br>20-25 m/s |

**Calculation of air flow volume based on moisture content:**
Amount of air required for limiting the humidity in a place and keeping it at a certain level is calculated with the following formula:

$$Q = \frac{M_w}{\rho \times \Delta H} \quad [m^3 / hour]$$

*Q : Air Flow volume [m³ / hour]*
*$M_w$ : Amount of Water [gram/hour]*
*ρ : Air Density [kg/m³]*
*(ρ = 1,2 @ 20 °C ve 1013 mbar)*
*ΔH: Moisture content difference between the air discharged and air entering to the place [g water/kg air]*

**Air flow calculation based on heat discharge requirements:**
In certain applications, the heat accumulating in a place must be continuously discharged in order to prevent temperature rises. Transformer rooms, compressor rooms, power generator rooms, pumping rooms and boiler rooms can be given as examples to such cases, for which the amount of air required for heat discharge can be calculated with the following formula:

$$Q = 3600 \times \frac{K}{\rho \times C_p \times \Delta T} \quad [m^3/hour]$$

*Q : Air Flow Volume [m³ / hour]*
*K : Amount of heat required to be discharged [kw]*
*ρ : Air density [kg/m³]*
*(ρ = 1,2 kg/m³ @ 20 °C and 1013 mbar)*
*$C_p$ : Specific heat capacity[kj / kg.K]*
*($C_p$ = 1 @ 20 °C)*
*ΔT : Temperature difference between inside and outside air [°C]*

*Note: Roughly, transformers and electric motors convert respectively 5-10% and 5-10% of their nominal output power to heat.*

# Determining Suitable Sound Level (Acoustic Calculation)

Second step for designing a ventilation system is performing detailed acoustic calculations for the components to be used for the system (ducts, filters, attenuators, grilles, etc.) and the environment in which these components are placed.
The biggest source of sound in ventilation systems is fans. For this reason, the fan selected must have suitable sound level for the environment of use. Besides, it must be kept in mind that minimizing the length of the transfer route and number of components also decreases the level of sound propagated by a ventilation system. Table-6 shows minimum and maximum recommended sound levels for certain application areas.

TABLE-6

| Application Areas | Recommended Min/Max Sound Level (dB) |
|---|---|
| Bathrooms | 40 – 45 |
| Waiting rooms | 40 – 45 |
| Paint houses | 60 – 70 |
| Laundry rooms | 60 – 70 |
| Kitchens (domestic) | 45 – 50 |
| Kitchens (industrial) | 50 – 60 |
| Factories | 60 – 70 |
| Photocopy rooms | 50 – 60 |
| Hospitals | 35(night) - 45(day) |
| Conference halls | 40 – 45 |
| Libraries | 35 – 40 |
| Laboratories | 50 - 60 |
| Offices | 40 – 45 |
| Living rooms | 30(night) - 40(day) |
| Restaurants | 45 – 55 |
| Classrooms | 35 – 40 |
| Dressing rooms | 50 – 60 |
| Cinemas | 30 – 35 |
| Theatres | 30 – 35 |
| Meeting rooms | 45 – 50 |
| Public toilets | 50 – 55 |
| Bedrooms | 30(night) - 40(day) |
| Swimming pools | 50 - 55 |

### Absorption of Sound by the Room:

In addition to the sounds directly propagated by fans or related ventilation components, human ear perceives also the sound reflected by the environment in which the sound propagates. Since each environment has its own reflection characteristics, sound pressure level differs depending on the environment.

By use of graphics obtained through complex formulas, we are able to calculate the amount of sound absorbed in a certain area. Here, we firstly have to give the definitions for some terms:

**Directivity Factor (Q):** Defines the relation between the sound source and the point where the sound is heard.

If sound incidence angle is 45° → Q = 4
If sound incidence angle is 0° → Q = 8

**Absorption Factor ($\alpha_m$):** Defines the amount of sound absorbed in the room. Generally having values between 0.02 and 0.4, higher absorption factor values mean higher absorption capacities for the room. Table-7 shows absorption factors for some types of areas.

TABLE-7

| Areas | Absorption Factor ($\alpha_m$) |
|---|---|
| Factories | 0,02 – 0,07 |
| Kitchens | 0,03 – 0,09 |
| Restaurants | 0,05 – 0,1 |
| Schools | 0,07 – 0,1 |
| Assembly areas | 0,08 – 0,12 |
| Offices | 0,12 – 0,15 |
| Studios | 0,3 – 0,4 |

**Sound Power ($L_W$):** The amount of energy consumed by the sound source for propagation a sound.

**Sound Pressure ($L_P$):** The magnitude of the vibrations created by a sound source in the air, or in other words, the sound pressure felt in the environment.

**Amount of Sound Absorption ($\Delta L = L_W - L_P$):** The difference between the pressure of the sound at source and the pressure felt in the environment.

Amount of sound absorption is calculated through the following steps by the help of Figure-5 and Figure-6:
1-Volume of the room is calculated.
2-Suitable absorption factor for the room is determined by use of Table-7.
3-Absorption surface area ($A_m$) is found by use of the volume and absorption factor values and the graphic given in Figure-5.
4-Directivity factor (Q) and the distance from the sound source ($D_S$) are determined.
5-Lastly, amount of absorption ($\Delta L$) is found by use of the absorption surface area, directivity factor and distance from the sound source values and the graph given in Figure-6.

**Example-1:**

**Case** : Ventilation of a kitchen whose volume is 250 m³.
**1.step** : Volume : 250 m³.
**2.step** : Average value 0.05 is selected from Table-7.
**3.step** : $A_m$ is found to be 11 m² by the help of Figure-5
**4.step** : If we assume that sound incidence angle is 45° and the distance from the sound source is 4 meters, directivity factor must be 8 and $D_S$ must be 4.
**5.step** : By the help of the graph in Figure-6, amount of absorption is found to be $\Delta L$ = 4 dB.

FIGURE-2

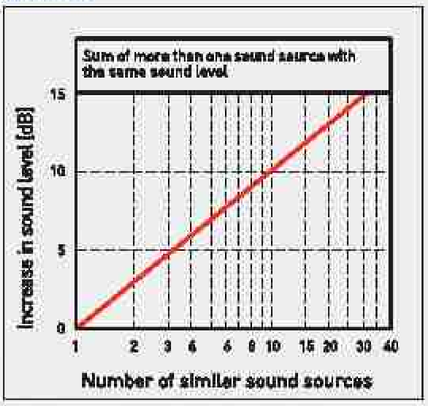



FIGURE-3

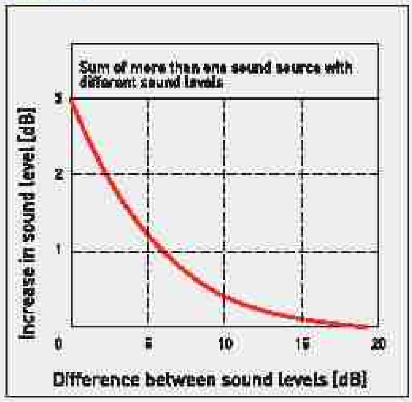



FIGURE-4

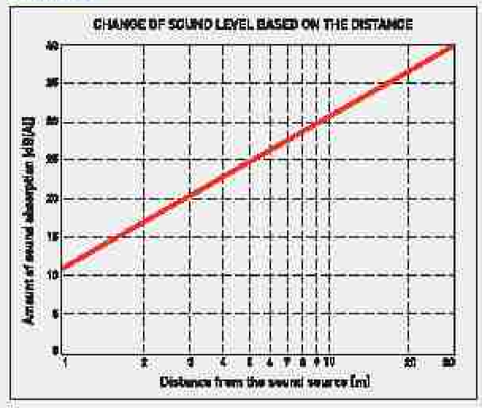




FIGURE-5:

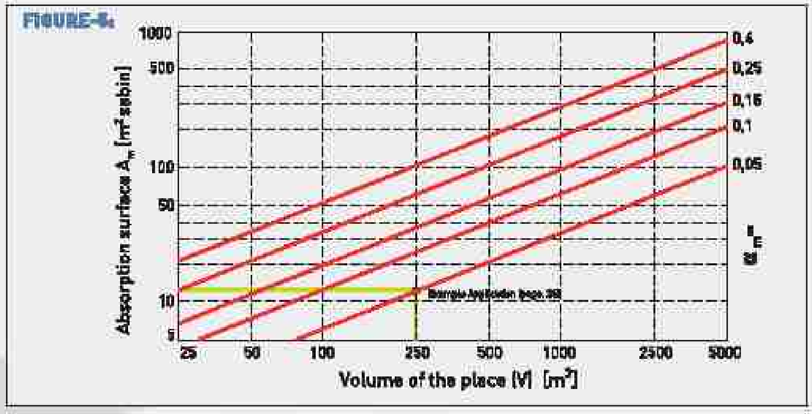
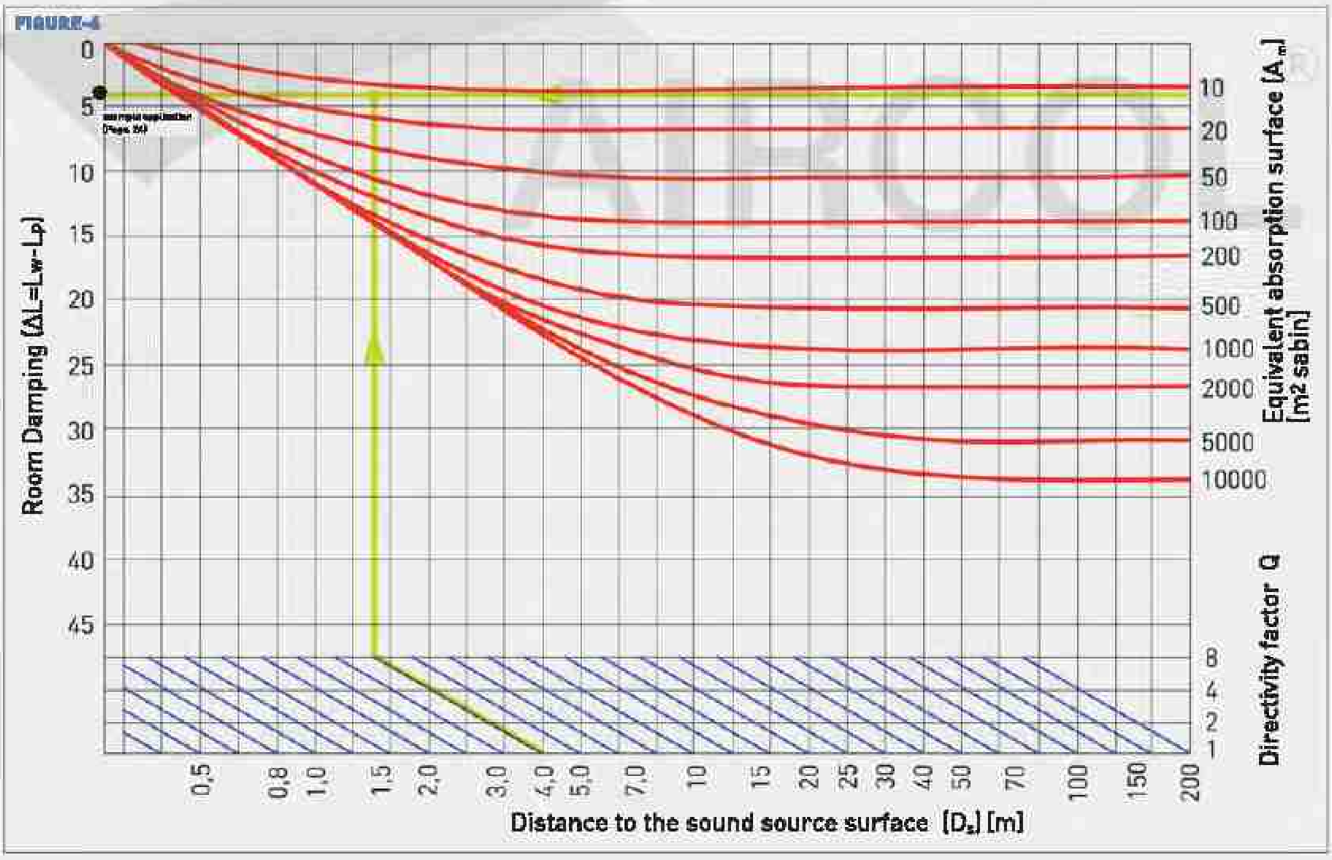
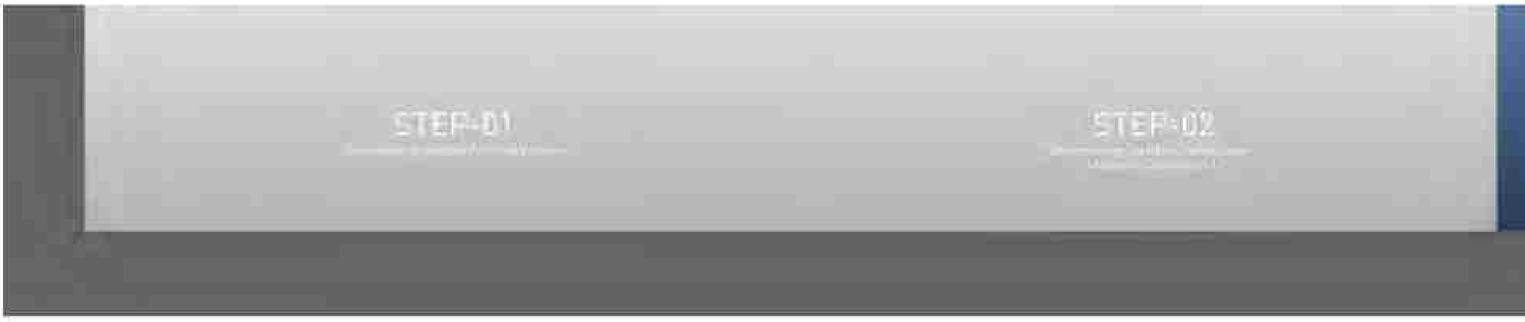



FIGURE-6






# Calculating Pressure Losses

Third step of designing a ventilation system is calculating the pressure losses caused by the components (ducts, filters, attenuators, grilles, etc.) used for the system.

Fans consume energy in order to move air through ducts and overcome negative affects of the friction on internal surfaces of ducts, elbows changing the direction of air and obstacles such as filters and outlets. For moving air with high efficiency and providing efficient ventilation, the losses caused by these obstacles must be overcome by the fans.

Pressure losses are affected by several factors such as the general design of the ventilating system, length and diameter of the ducts used, air speed and air density.

Each component included in a ventilating system causes a different amount of pressure loss. However, ventilation components can be classified in three groups in general (Figure-7):

- Ducts (with circular or rectangular cross-section)
- Fittings (90° bends, 45° elbows, reducers, etc.)
- Other ventilating components (filters, attenuator, grilles, diffusers, etc.)

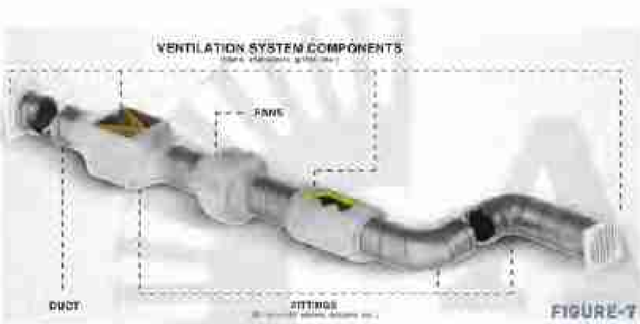



FIGURE-7

**1- Pressure losses in ducts:**
Pressure loss of a ducts is determined by the help of the nomogram graphic given in Figure-8. A nomogram graph shows the pressure loss per meter of a duct for certain air speed and duct diameter values. The nomogram graph given in Figure-8 was prepared for galvanized steel sheet ducts.

In order to make calculations for duct made of different materials, roughness factors given in Table-8 must be also considered.

$$\Delta P_d = \Delta P_1 \times L_1 \times \mu_1 + \Delta P_2 \times L_2 \times \mu_2 + \Delta P_3 \times L_3 \times \mu_3 + \ldots$$

$\Delta P_d$ : Total pressure loss caused by the ducts [ Pa]

$\Delta P_{1,2,3}$ : Pressure loss in 1 meter length [Pa/m]

$L_{1,2,3}$ : Lengths of the ducts used in the system [m]

$\mu_{1,2,3}$ : Roughness factors

For ducts having a rectangular or square cross-section, equivalent diameter values must be found by the help of the graph given in Figure-9.

**Example:**
If dimensions of a rectangular duct are w= 45 cm and h=30 cm, what is the equivalent diameter value?

Equivalent diameter is found to be 36 cm by use of the graph given in Figure-9

TABLE-8

| Level of Roughness | Example | Roughness Factor |
|---|---|---|
| Very Smooth | Glass duct | 0.8 |
| Smooth | PVC duct | 0.9 |
| | Galvanized steel sheet duct | 1 |
| Rough | Asbestos-cement duct | 1,45 |
| Very Rough | Flexible duct (aluminimum duct) | 2 |

**2- Pressure losses in fittings:**
Pressure loss of a fitting (90° elbow, 45° elbow, reducer, etc.) is determined by the help of the graphs given in Figures 10, 11, 12 and 13. Total pressure loss caused by the fittings is calculated by placing the values found in the graphs in the equation given below.

$$\Delta P_A = \Delta P_{a1} + \Delta P_{a2} + \Delta P_{a3} + \ldots$$

$\Delta P_A$ : Total pressure loss caused by fittings [ Pa]

$\Delta P_{a1,a2,a3}$ : Pressure loss caused by each fitting[ Pa]

**3- Pressure losses in other ventilation system components:**
In this step, pressure losses caused by other components of the ventilation system (attenuators, grilles, filters, dampers, etc.) are determined by the help of Table-9.

As an alternative, technical documents of each component can be separately analyzed for obtaining more accurate results. Afterwards, total pressure loss is calculated by placing values obtained for each component in the following formula.

$$\Delta P_C = \Delta P_{C1} + \Delta P_{C2} + \Delta P_{C3} + \ldots$$

$\Delta P_C$ : Total pressure loss caused by other ventilation components [Pa]

$\Delta P_{C1,C2,C3}$ : Pressure loss caused by each component [Pa]

TABLE-9

| Ventilation Component | Pressure Loss (ΔP) [Pa] |
|---|---|
| Diffusers | 30 - 60 |
| Filters | 40 - 80 |
| Grilles, mechanical shutters | 20 - 40 |
| Automatic shutters | 15 - 30 |
| Attenuators | 40 - 80 |

### 4- Dynamic Pressure:

Dynamic pressure at fan outlet:

$\Delta P_D = \frac{\rho}{2} x\, v^2$

$\Delta P_D$ : Dynamic pressure [Pa]

v : Air flow speed [m/s]

P : 1,2 kg/m³ @ 20°C and 1013 mbar

### Total Pressure Loss

Total pressure resistance against air movement of the fan is calculated by using following formula.

$\Delta P_{Total} = \Delta P_A + \Delta P_B + \Delta P_C + \Delta P_D$

**FIGURE-8**

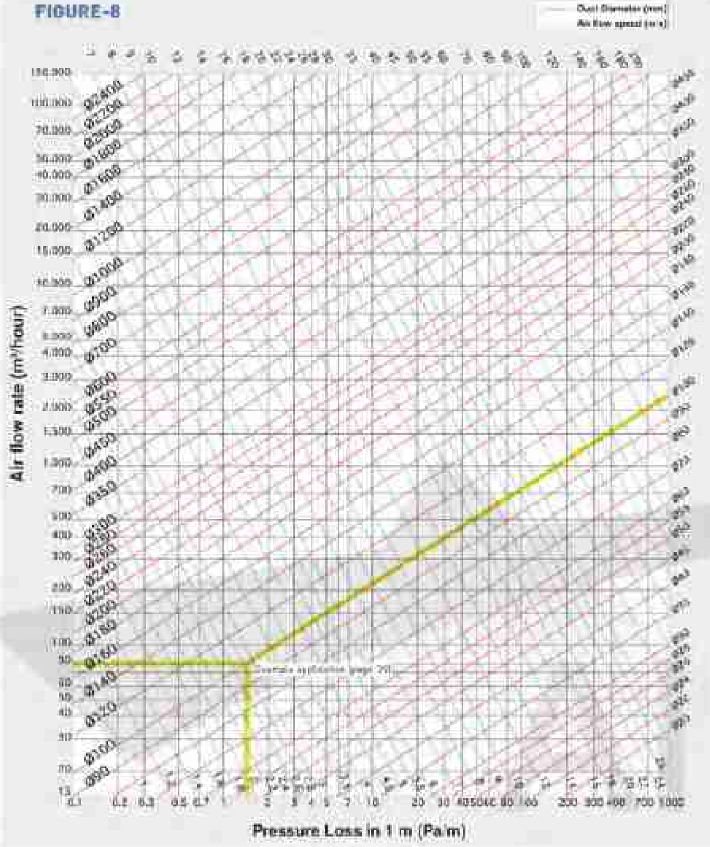
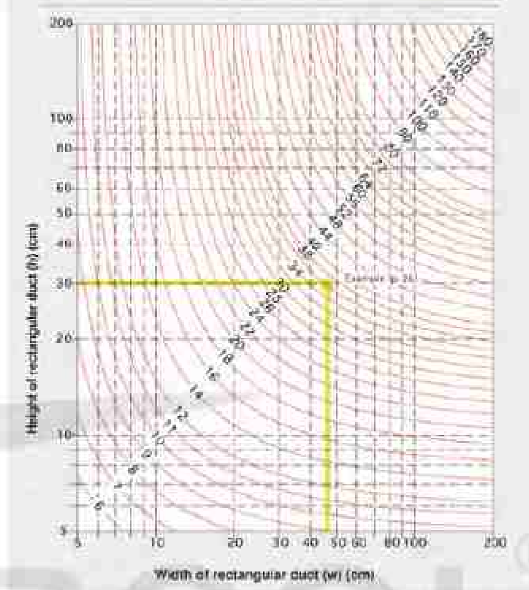



**FIGURE-9**

**Equivalent Diameter Determination Graph for Rectangular Cross-Section Ducts**



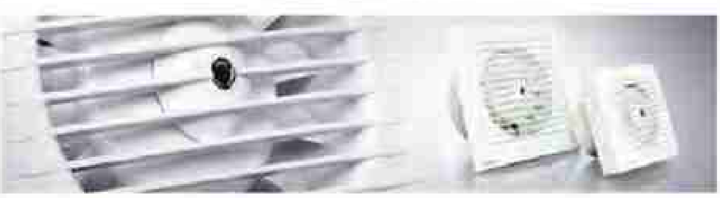



**FIGURE-12**

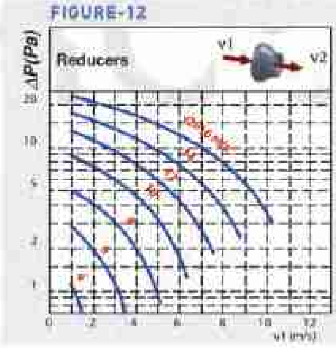



**FIGURE-10**

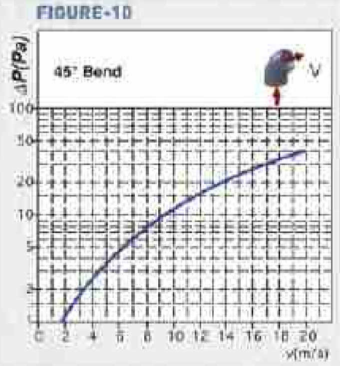



**FIGURE-11**

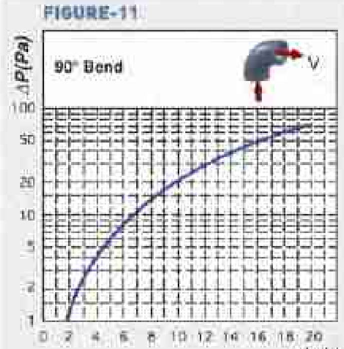
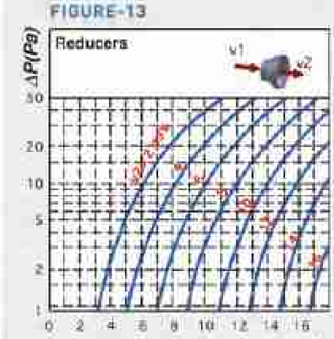



**FIGURE-13**



# Fan Selection by the Help of Fan Performance Curves

Last step in ventilation system design is the selection of the right fan by the help of performance curves, in consideration of the required air flow volume rate, acceptable sound level and pressure loss values obtained in previous steps.

### Performance Curves:

Providing data on operating characteristics of fans, performance curves are important sources of information used for selecting the right fan. Performance curves reflects the relationship between the pressure generated by the fan (static pressure or total pressure) and the amount of air transferred. In other words, they show the pressure difference values for various air flow volume rates provided by fans.

### System Resistance Curves:

System resistance curves are graphical representations of the reaction given by the components used in ventilation system (ducts, filters, attenuators, outlets, etc.) to the air movement generated by fans. System resistance curves displays parabolic behavior and they are in direct proportion to the square of air flow volume rate.

*$\Delta P = k \times Q^2$ [Pa]*

*ΔP: Pressure losses in the ventilation system [Pa]*

*k: Pressure loss factor*

*Q: Air flow volume[$m^3$ / hour]*

For fan selection, the junction point of system resistance curve and fan performance point (WP) is taken as the working point of the fan. WP point shows the amount of pressure difference for the air flow volume provided by the fan. Figure-14 shows an example of the fan performance curve, system resistance curve and working point for a fan.

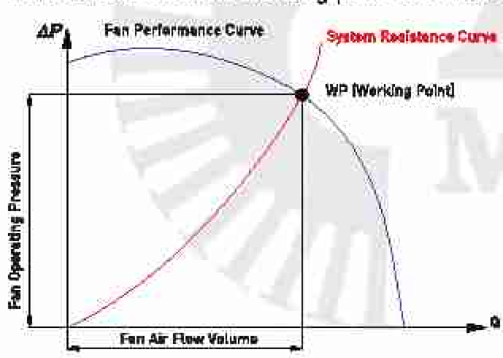



FIGURE-14

Performance curves give us a different operating zone for each fan geometry. Ideal operating zones for axial, forward inclined blade and backward inclined blade fans are shown respectively in Figure-15, Figure-16 and Figure-17. While right side of performance curves are recommended as the operating zone for axial fans for high performance and low noise, middle part of the curve is ideal for fans with forward and backward inclined blades. Recommended ideal operating zones should be taken into consideration in fan selection.

### Fan Laws

Fan laws provide us the opportunity to calculate the relationship between the changes on fan revolution (N), fan dimensions (ØD), density of the air transferred ($\rho$) and air temperature (T) parameters and air flow volume (Q), air pressure (ΔP) and consumed power ($P_w$) values of the fan. In order for the fan laws to be applicable, both fans must the similar in terms of geometrical structure.

### Change of Revolution [N]:

Change of Air Flow Volume → $Q_2 = Q_1 x \frac{N_2}{N_1}$

Change of Pressure → $\Delta P_2 = \Delta P_1 x \left[\frac{N_2}{N_1}\right]^2$

Change of Power → $P_{w2} = P_{w1} x \left[\frac{N_2}{N_1}\right]^3$

### Change of Blade Diameter [D]:

Change of Air Flow Volume → $Q_2 = Q_1 x \left[\frac{D_2}{D_1}\right]^3$

Change of Pressure → $\Delta P_2 = \Delta P_1 x \left[\frac{D_2}{D_1}\right]^2$

Change of Power → $P_{w2} = P_{w1} x \left[\frac{D_2}{D_1}\right]^5$

### Change of Air Specific Weight [ $\rho$ ] and Temperature [T = 273 + t [°C] ]:

Change of Air Flow Volume → $Q_2 = Q_1$

Change of Pressure → $\Delta P_2 = \Delta P_1 x \left[\frac{\rho_2}{\rho_1}\right] = \Delta P_1 x \left[\frac{T_1}{T_2}\right]$

Change of Power → $P_{w2} = P_{w1} x \left[\frac{\rho_2}{\rho_1}\right] = P_{w1} x \left[\frac{T_1}{T_2}\right]$

FIGURE-15
Axial Fans

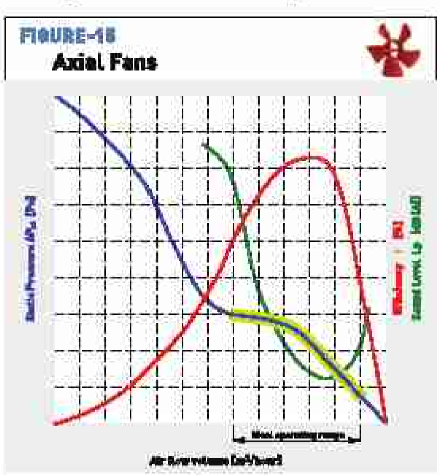


FIGURE-16
Fans with Forward Inclined Blades

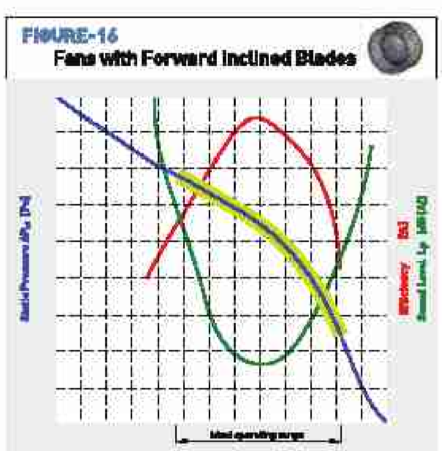
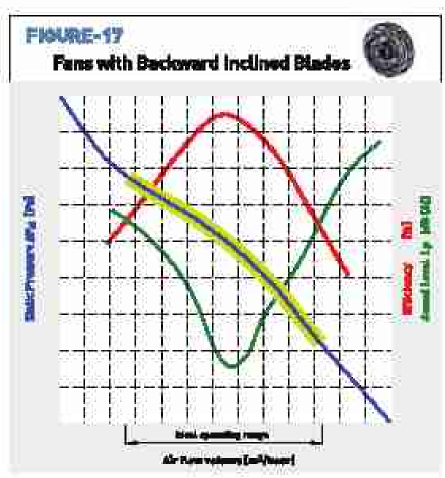


FIGURE-17
Fans with Backward Inclined Blades



# STEP-04

## Selecting the Fan by the Help of Performance Curves

**Example Application**

FIGURE-18


**Example Application - Problem:** Bathroom Ventilation
**Example Application - Solution:**

---

**Dimensions of the Room:** 3m x 2m x 2,2m
**Air Inlets and outlets:** 1 air inlet and 1 air outlet
**Duct to Be Used:** Ø 100 mm flexible aluminum duct
**Fan to Be Used:** Ceiling type extract fan with 230V/50Hz power supply and 3 minutes time delay operation.

### 1. Calculating amount of air needed:

$V_o = 3 \times 2 \times 2,2 = 13,2\ m^3$

$H_d = 6$

$Q = 13,2 \times 6 = 79,2 \cong 80\ m^3/hour$

$$v = \frac{Q}{\pi x D^2 x 900} = \frac{80}{3,14x0,1^2x900} = 2,8\ m/s$$

### 2. Acoustic calculation:

Sound pressure absorption capacity of the walls is ignored, since the volume of the space is too low( ΔL=0).

### 3. Calculating pressure losses:

**Pressure Losses in ducting:**

$\Delta P_1 = 1.5 \frac{Pa}{m}$ (figure - 8)

$L_1 = 1.5\ m$

$\mu_1 = 2$ Aluminum ducts (Table - 8)

$\Delta P_A = \Delta P_1 \times L_1 \times \mu_1 = 1.5 \times 1.5 \times 2 \cong 5\ Pa$

**Pressure Losses at Elbows:**

**1 piece of T-connection:** The connection with fan duct and main shaft.

$\Delta P_{B1} = 8\ Pa$

$\Delta P_B = \Delta P_{B1} = 8\ Pa$

**Dynamic Pressure:**

$$\Delta P_D = \frac{\rho}{2} \times v^2 = \frac{1,2}{2} \times 2,8^2 = 4,7 \cong 5\ Pa$$

**Total Pressure Loss:**

$\Delta P_{Total} = \Delta P_A + \Delta P_B + \Delta P_C + \Delta P_D = 5+8+0+5 = 18\ Pa$

### 4. Fan Selection by the Help of the Performance Curve:

In the light of the data obtained, a fan capable of generating 18 Pa minimum pressure difference at 80 m³/hour air flow volume must be chosen. AIRCOL-Spring and AIRCOL-Spring Light models are thought to be ideal solutions for the application.

**Aircol Spring** Operating Point: 80 m³/hour @ 50 Pa
Sound Level: 29 dB

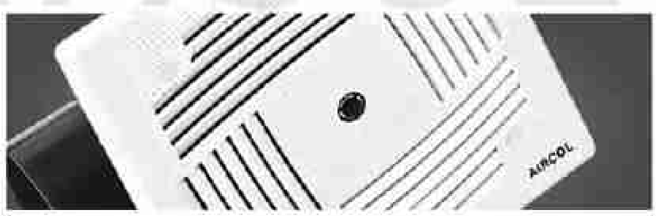
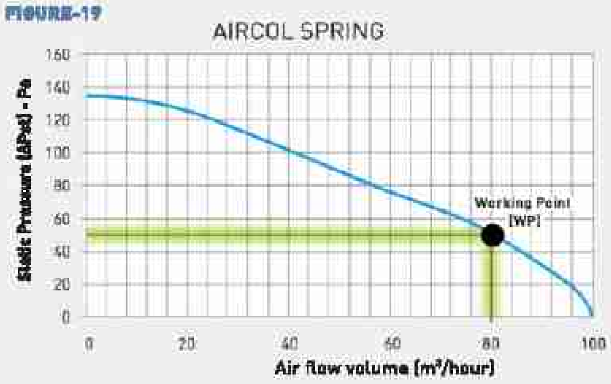
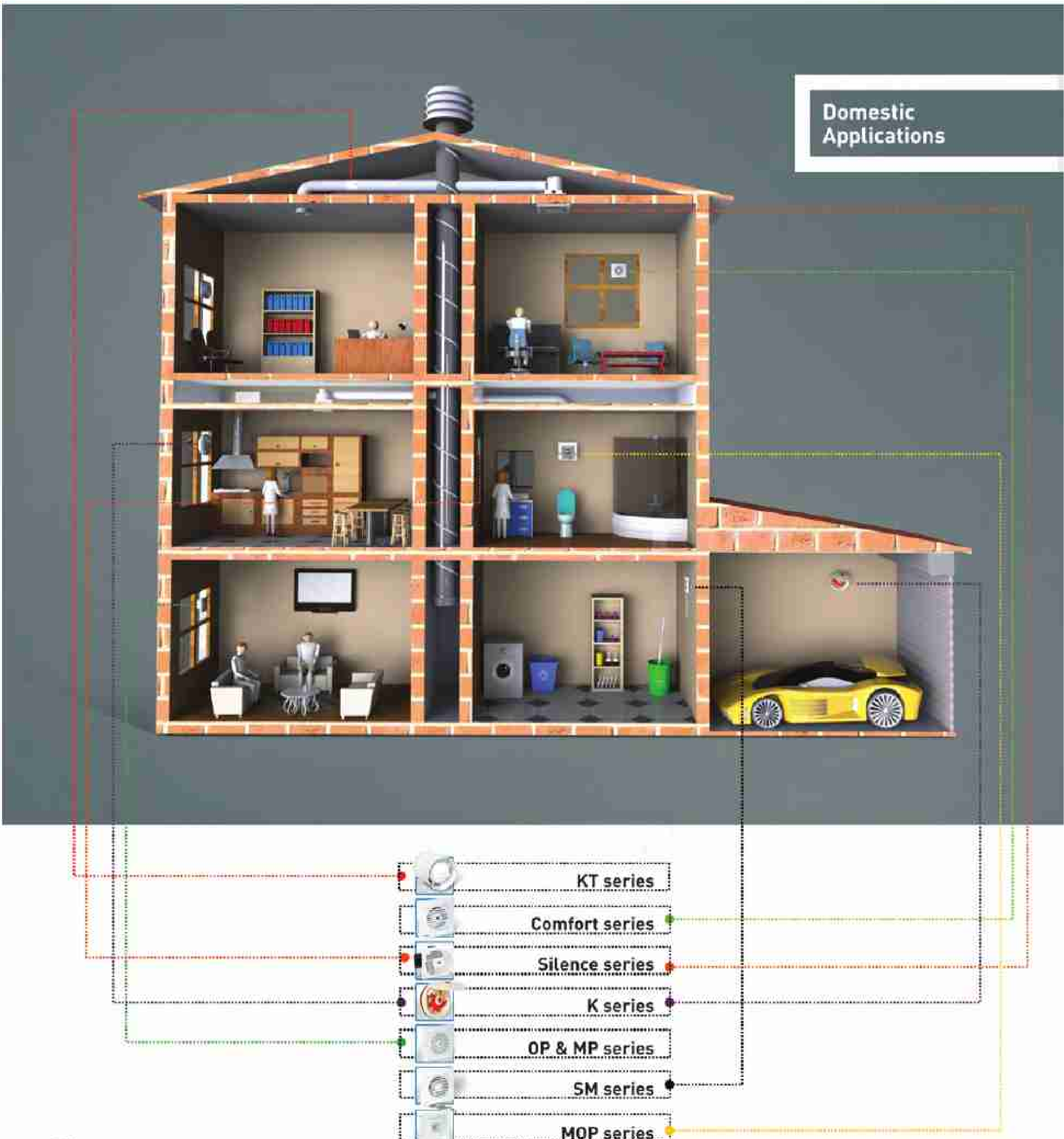



FIGURE-19

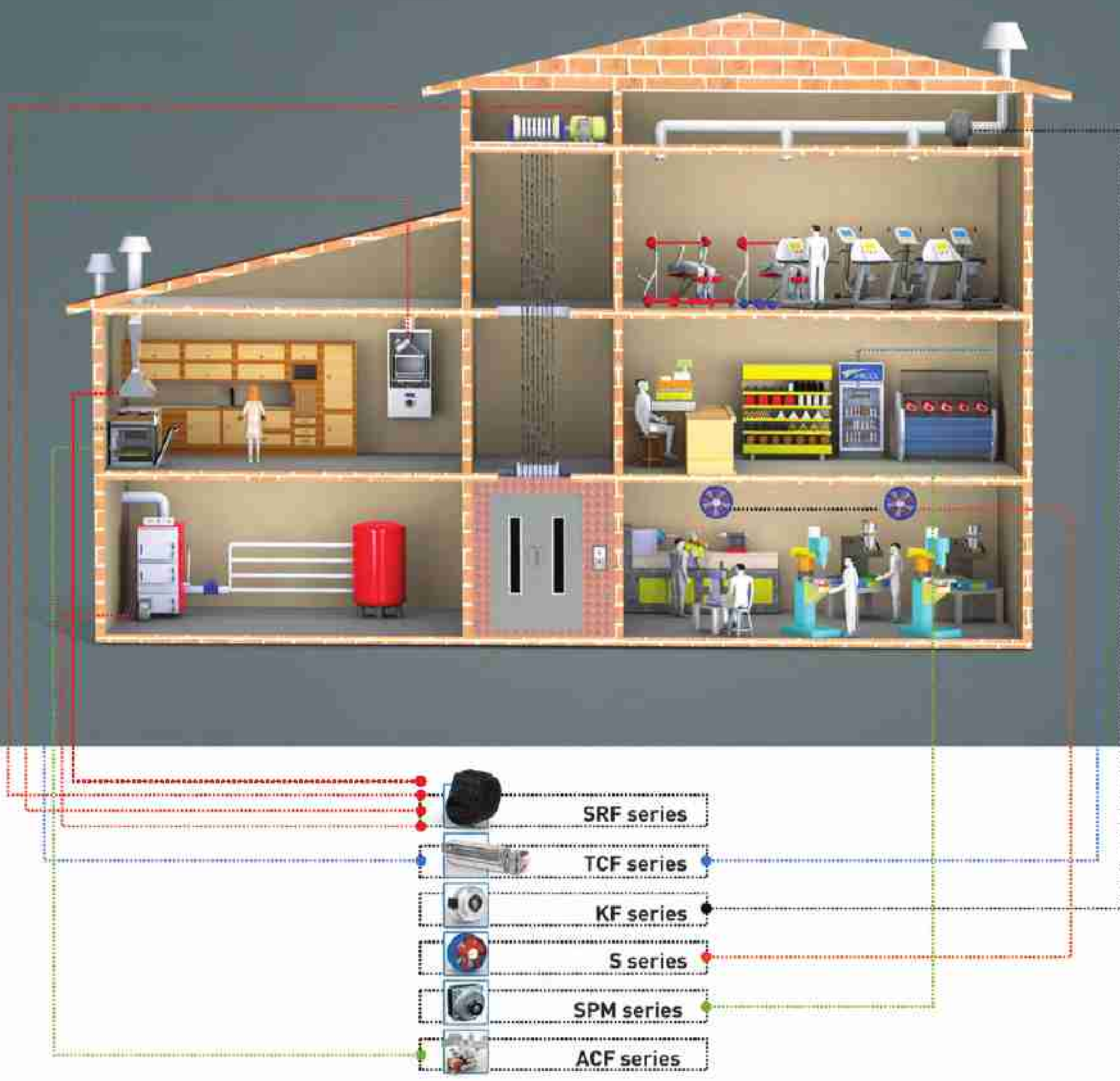


# Application Fields Overview



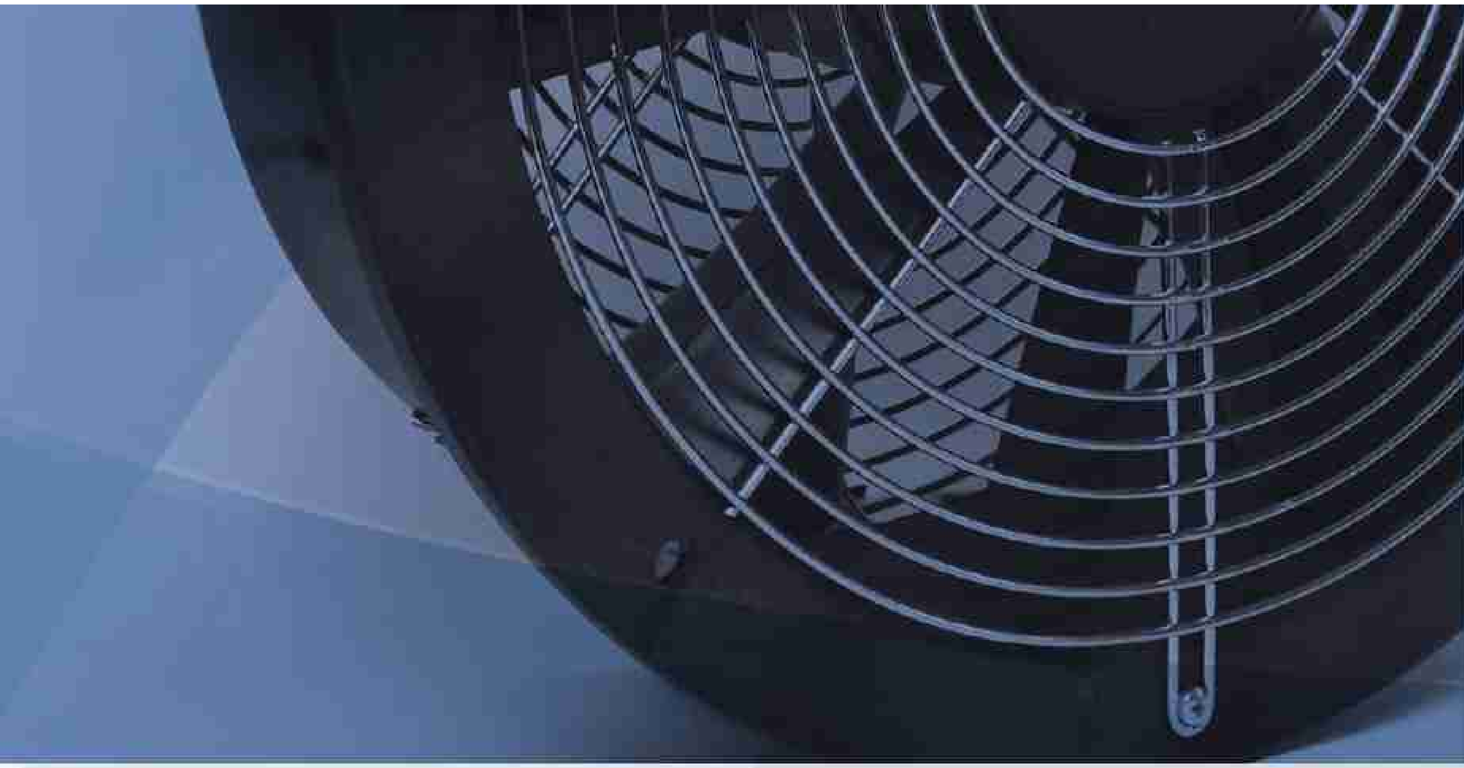
AIRCOL®

## Industrial Applications



# contents

## Domestic Fans





# Industrial Fans



# AC Motors

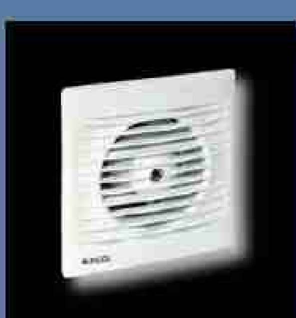


YOU DREAM
WE REALIZE


# DOMESTIC FA

## Domestic Fans

- (A) - Axial Fans
- (B) - Radial Fans
- (C) - In Line Duct Fans
- (D) - Air Extract Elements



036-037
**COMFORT SERIES**
AIRCOL – 100 / 120

038-039
**COMFORT SERIES**
AIRCOL – 150 / 200

040-041
**SM SERIES**
AIRCOL – 100 SM / 120 SM

042-043
**OP SERIES**
AIRCOL – 100 OP / 120 OP / 150 OP

044-045
**MP SERIES**
AIRCOL – 100 MP / 120 MP / 150 MP

# Domestic Fans

- Axial Fans

N S

AIRCOL
VENTILATION TECHNOLOGIES

046-047
CM SERIES
AIRCOL - 150C OP

048-049
CM SERIES
AIRCOL - 150C MP

050-051
K SERIES
AIRCOL - 20 K / 25 K

052-053
K SERIES
AIRCOL - 150 K / 200 K

YOU DREAM
WE REALIZE

# DECORATIVE EXTRA

## Decorative Extract Fans

| | |
|---|---|
| [A] - Axial Fans | [B] - Radial Fans |
| [C] - In Line Duct Fans | [D] - Air Extract Elements |


*+ performance*
*– costs...*

# Decorative Extract Fans

- Radial Fans
- In - Line Duct Fans
- Air Extract Elements

# ACT FANS

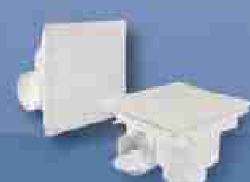
AIRCOL
VENTILATION TECHNOLOGIES

## (B) - Radial Fans

056-057
SILENCE SERIES
AIRCOL – SUMMER

058-059
SILENCE SERIES
AIRCOL - SPRING / SPRING LIGHT

060-061
SILENCE SERIES
AIRCOL – 250



062-063
SILENCE SERIES
AIRCOL – 250 F

064-065
SILENCE SERIES
AIRCOL – LUX

## (C) - In – Line Duct Fans

066-067
KT SERIES
AIRCOL – 100 KT / 120 KT / 150 KT

## (D) - Air Extract Elements

068-069
MOP SERIES
AIRCOL – 30/60 MOP / 45/120 MOP


# INDUSTRIAL FANS

## Industrial Fans

| | | |
|---|---|---|
| (A) - Axial Fans | (B) - In - Line Duct Fans | (C) - Tangential Cross Flow Fans |
| (D) - Centrifugal Blowers | (E) - Forward Inclined Centrifugal Fans | (F) - Backward Inclined Centrifugal Fans |
| (G) - Air Circulation Fans | | |

## (A) - Axial Fans

072-073
MS SERIES
AIRCOL – 200 MS / 250 MS / 300 MS

074-075
MS SERIES FRAME M
AIRCOL – 200 MS FR / 250 MS FR / 300 MS FR

76-077
S SERIES
COL – S 300 / S 400

78-079
S SERIES
IRCOL – S 450 / S 500

080-
S SERIES FRA
AIRCOL – S 3 / S 4 / S 4 / S 5

## (B) - In - Line Duct Fans

082-083
KF SERIES
AIRCOL – 150 KF / 200 KF

084-085
KF SERIES
AIRCOL – 250 KF / 315 KF

## (C) - Tangential Cross Flow Fans

086-087
TCF SERIES
AKS 30 – 300 / 360

088-0
TCF SER
AKS 30 –

090-0
TCF SER
AKS 40 –

2-0
SERIES
40 – 600 / 720

094-095
TCF SERIES
AKS 680 – 180 / 240 / 300

096-097
TCF SERIES
AKS 680 – 360 / 480 / 600

CF SE
KS 80 -

# Industrial Fans

- Axial Fans
- In - Line Duct Fans
- Tangential Cross Flow Fans
- Centrifugal Blowers
- Forward Inclined Centrifugal Fans
- Backward Inclined Centrifugal Fans
- Air Circulation Fans

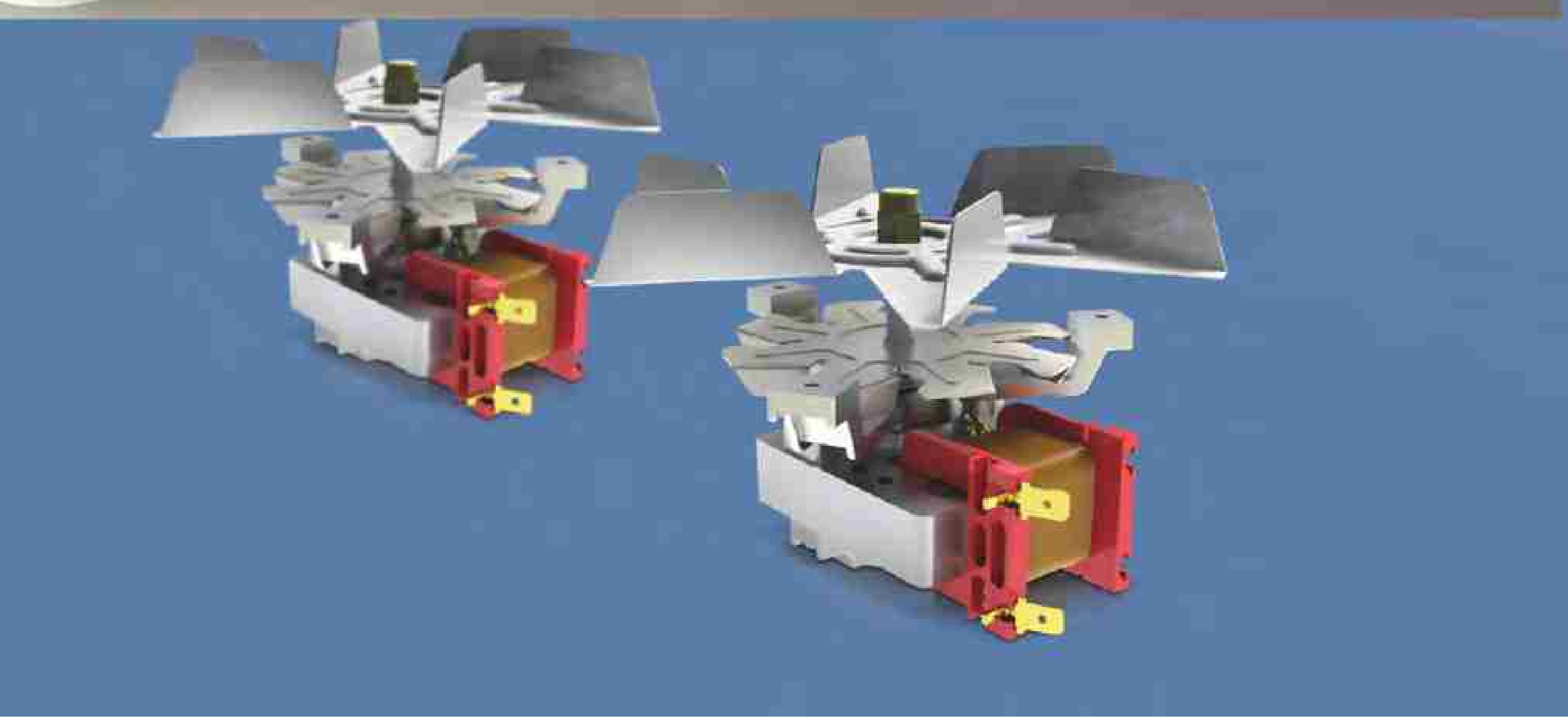
**AIRCOL®**
VENTILATION TECHNOLOGIES

YOU DREAM
WE REALIZE

# AIR CIRCULATION

## Industrial Fans

Air Circulation Fans



# Air Circulation Fans

# FANS

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# AC MOTORS

## AC Motors

- (A) - Shaded-Pole Motors
- (B) - Capacitor Start Motors

# AC Motors

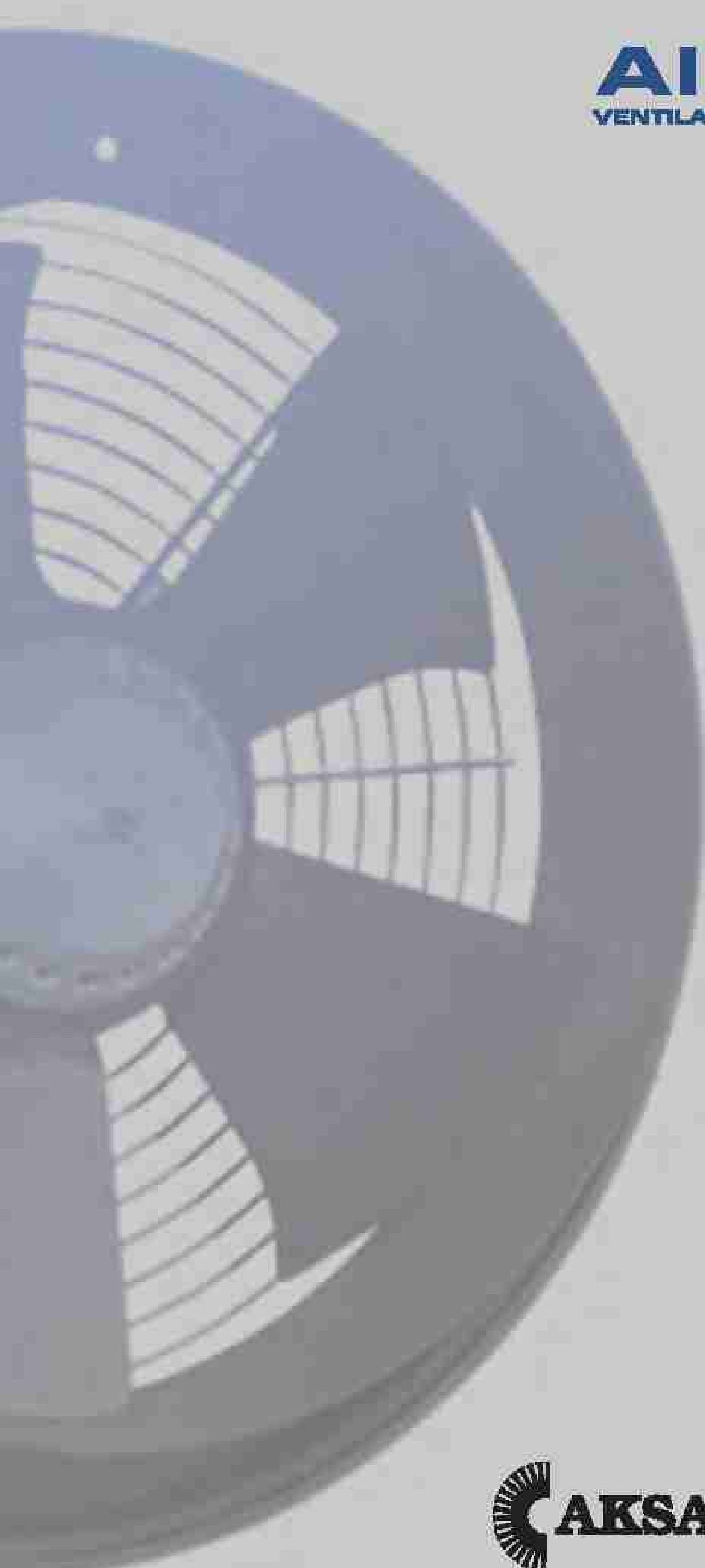
- Shaded Pole Motors
- Capacitor Start Motors

AIRCOL®
VENTILATION TECHNOLOGIES

## Shaded-Pole Motors

## Capacitor Start Motors

| 122-123 SPM SERIES | 124-125 SPM SERIES | 126-127 SPM SERIES | 128-129 CRM SERIES | 130-131 IRM SERIES |
|---|---|---|---|---|
| AKS-686M – 12, 16, 20, 25, 30, 40 | AKS-676 – 12, 16 | AKS 688-15<br>AKS 688-20<br>AKS 688-25<br>AKS 688-30<br>AKS 688-40<br>AKS 688-45 | AKS-92M – 15, 18, 25, 35, 42 | AKS-80M |



# AIRCOL®

VENTILATION TECHNOLOGIES

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