ÖSTBERG
HEALTHY INDOOR CLIMATE
WITH ENERGY EFFICIENT VENTILATION

PRODUCT CATALOGUE 2015

FANS

AIRTREND Limited
Predstavništvo u Beogradu
Kumanovska 14, 11000 Beograd
Tel: 011/3836886, 3085740
Faks: 011/3444113
e-mail: gobrid@eunet.rs
web: www.airtrend.rs

ENERGY EFFICIENT VENTILATION

Östberg is one of the leading producers of radial fans in the world.
In the early 1970s, the founder and owner of the company designed the first circular and rectangular in-line radial duct fans in history with external rotor motors and straight-through airflow (180°).
We have continued to develop new products and today offer a wide product range of centrifugal in-line duct fans, roof fans, wall fans and energy recovery units.
Our goal is to always offer the highest-quality products at competitive prices.
The company is certified according to the quality and environment standards ISO 9001 and ISO 14001. These high demands guarantee an efficient and rational production of high-standard fans.
All our fans are tested before delivery, which gives us 100% control of production.
Air quality directly affects the way we feel, not only physically but also mentally.
Therefore use high-quality products from Östberg in order to achieve a healthy indoor climate with energy-efficient ventilation.

The following two symbols are used in this catalogue:

Products marked with the AC and EC symbols are approved for use in the EU, EFTA & EEA countries.

I the following chapter "General Fan Facts" we give some simple explanations, so you can get the most out of reading this catalogue.
Östberg's product catalogue contains a great deal of information. If you choose a product from this catalogue, it is important to understand how this information should be used to ensure that you receive the product that you are expecting.
It is also important to know what standards have been used to compile the measurement data. This is particularly important if you would like to compare fans from different manufacturers, as the results may vary depending on the measuring standards used.

FAN WHEELS AND FAN MOTORS **402**
PRESSURE/FLOW DIAGRAMS **403**
POWER/FLOW DIAGRAMS **404**
SOUND DATA **405**

FAN WHEELS AND FAN MOTORS

FAN WHEELS
Östberg use radial fans in our products. In a radial fan the air stream is angled 90°, the supply air enters in an axial direction and leaves the fan wheel in a radial direction. They have either backward or forward curved impeller blades. In addition to impeller size, fan rotation speed (rpm) is a determining factor in the resulting pressure and flow.
High rotation speeds lead to high flow and pressure, but higher rotation speeds also generate more sound and consume more energy.

FORWARD CURVED IMPELLER (F wheel)
Fans with forward curved impellers provide a compact solution and are most competitive at relatively high pressures, where they also have their highest efficiency. It is important when choosing a fan with a forward curved impeller to ensure that it is correctly positioned in the area shown in the diagram (Fig. 1, 2 and 3).
At low pressure and high airflow, a forward curved impeller requires a great deal of power from the motor, but the motors are often not designed for this. This is shown with a dotted line in the pressure/flow diagram and referred to as "prohibited work area". Within this area, the motor overheats very quickly. One drawback of forward curved impellers is that dirt and impurities easily get caught on the concave side of the impeller, which impairs capacity and can cause imbalance. If the impeller gets dirty, it must be cleaned, which can be rather difficult. But a fan with a swing-out function makes this easier.
Forward curved impellers are used in some of our fans, such as RK duct fans, IRE insulated duct fan, RF and DF single and double inlet centrifugal fans and our ATEX certified fans RFTX and RKX.

BACKWARD CURVED IMPELLER (B wheel)
If you choose a fan with backward curved impeller with the same pressure and flow as a fan with forward curved impeller, the fan with backward curved impeller will be larger than the forward curved.
The advantage of choosing this type of fan is that the backward curved impellers have higher efficiency, which means that the fan consumes less energy at the same pressure and flow. The backward curved impeller has the highest power consumption where the efficiency rate is best (see Fig. 1, 2 and 3).
Another advantage of these fans is that the impeller does not get dirty as fast as the forward curved, and they are significantly easier to clean when they do.
Backward curved impellers are used in our CK, LPKB and RKB duct fans, IRB insulated duct fans, roof fans TKC/S, TKV/H and in our wall fans CV, KV and RS.

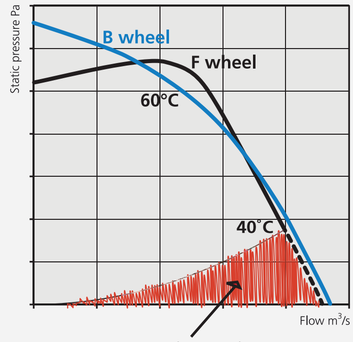
FAN MOTORS
The Östberg range includes products with single-phase or 3-phase AC and EC motors.
All Ostberg products marketed in Europe meets the ErP Directive.
Products with a power consumption above 125W at highest total efficiency must meet the ErP Directive, these products have "ErP" in the type designation.
Products with a power consumption below 125W are not subject to this Directive.
The ErP Directive (Energy related Products) is a law that sets a minimum efficiency of energy using products. This is to reduce the energy use and thereby carbon dioxide emissions.
The first edition for fans was published in 2011 (EU No. 327/2011), which required the minimum efficiency of fans (motor with fan wheel). The requirements came into effect in 2013 and were then updated for 2015. Not ErP approved fans can still be used in markets outside Europe.
This energy limiting law has accomplished a shift in the fan motor range, from the conventional AC motor to EC motors, since these have a better efficiency.

AC MOTOR
The products in Östbergs range with AC motor have "AC" in the type designation.
An induction motor is an electric motor were the rotor speed is asynchronous with the input voltage frequency.

EC MOTOR
The products in Östbergs range with EC motor have "EC" in the type designation.
The EC motor (Electronically Commutated) has an electronic control unit integrated in the motor which increases efficiency by optimally controlling the windings magnetization in the motor in ratio to the rotor.

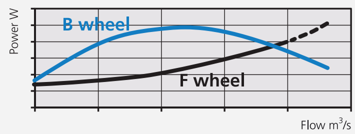
When comparing an F wheel and a B wheel at corresponding flow and pressure, the diagrams shows tha F wheel has a higher pressure and the B wheel gives a better efficiency.

FIG. 1.



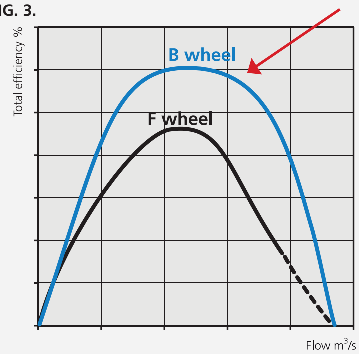
It is important when choosing a fan with a forward curved impeller to ensure that it is correctly positioned in the area shown in the diagram. At low pressure and high airflow, a forward curved impeller requires a great deal of power from the motor. This is shown with a dotted line in the pressure/flow diagram and referred to as "prohibited work area". Within this area, the motor overheats very quickly.

FIG. 2.



The backward curved impellers has the highest power consumption where the efficiency rate is best.

FIG. 3.



A fan with backward curved impeller have higher efficiency, which means that the fan consumes less energy at the same pressure and flow.

The Östberg range includes products with AC and EC motors. Products marked with the AC and EC symbols are approved for use in the EU, EFTA & EEA countries.

PRESSURE/FLOW DIAGRAMS

FIG. 4.

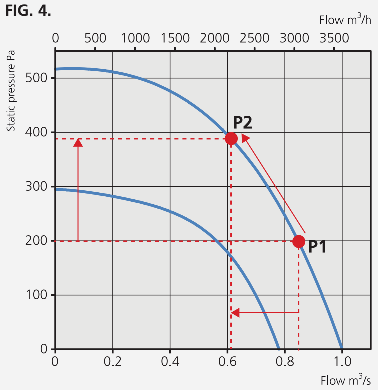


FIG. 5.

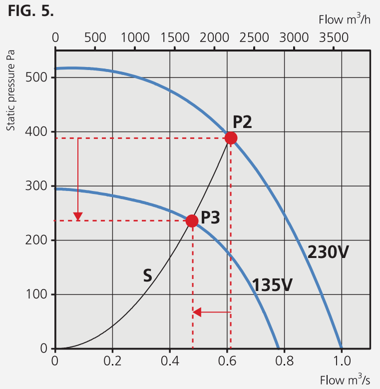
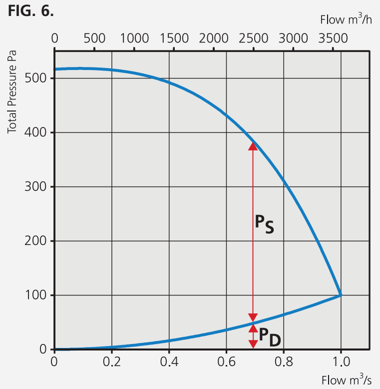


FIG. 6.



The fan diagrams can also be shown in Total pressure. Total pressure (Pt) = Static (Ps) + Dynamic pressure (Pd). Note what pressure is shown for right data.

When choosing a fan, you must first find out the volume of air the fan is going to transport. Then you have to determine what pressure drop the fan will overcome at this flow. Using this data, you can then choose the size of the fan type you have decided.

REDUCED FLOW WHEN INCREASED PRESSURE, FIG. 4

The point in the diagram that shows the current flow and pressure is called the fan's **working point**, which is indicated in this example by **P**.

As the pressure is increasing in the system, the working point will move along the fan curve and a lower flow will be obtained. Working point **P1** is moved to **P2**.

This will increase the power consumption.

REDUCED FLOW WHEN SPEED CONTROLLED, FIG. 5.

The **System line** (**S**) describes the total ventilation system (ducts, silencers, dampers, diffusers, etc.).

Along this system line, the working point moves from **P2** to **P3** as the rotation speed (voltage) is changed. Distinct voltage steps with e.g. a transformer, 135V and 230V in this example, produces different fan diagrams, "rotation speed diagrams".

This will reduce the power consumption.

PRESSURE IN DUCT, FIG. 6 AND 7.

A fan's pressure is the work the fan performs in addition to supplying a specific flow. A fan's pressure can be presented as total pressure or static pressure.

Static pressure is the pressure that in the duct works at right angles to the duct wall in relation to the pressure outside the duct.

Dynamic pressure works in the duct's longitudinal direction and is dependent on the air velocity in the duct. It is the static current pressure that is dimensioned when choosing a fan for a system. It is the static pressure drop that is calculated for the duct system during the pressure drop calculation.

The static pressure added to the dynamic pressure is the fan's total pressure.

The dynamic pressure, Pd, is calculated as follows:

$Pd = \rho * v^2/2$

ρ = air density, kg/m³

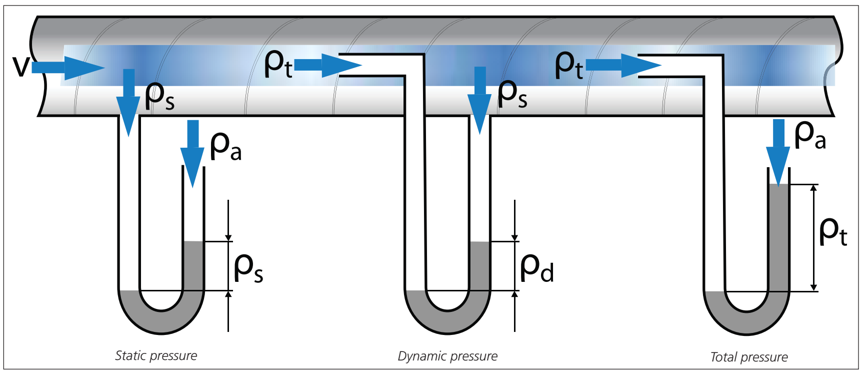
v = air velocity, m/s

Our fan diagrams are shown in **Static pressure**, Pascals (Pa). It is this pressure that must overcome the pressure losses of the ventilation system.

The diagram shows the fan capacity at various points according to the pressure created by ductwork system.

The digram shows the pressure in Pascals (Pa) on the vertical axis and airflow in cubic metres/seconds (m³/s) on the horizontal axis.

FIG. 7.



POWER/FLOW DIAGRAMS

Once you have chosen a fan, the power/flow diagram will show you the amount of power the fan will consume at a certain flow, which will assist you in choosing an energy efficient alternative (Fig. 8).

The electrical equipment, such as rotation speed regulators and fan circuit breakers, must be dimensioned according to technical data/rating, which will specify maximum power consumption (input) and operating current consumption within the permitted working area.

If the current consumption is higher than the rated current, the motor will be overloaded, which considerably shortens the motor's service life. If the winding temperature is too high, the motor's overheating protection will be activated and the motor will stop.

We always specify the motor's input power, but there are fan manufacturers who incorrectly give the motor's output power instead.

You should therefore also compare current consumption figures from different fan manufacturers.

At start-up, current consumption is higher than rated current for a short time. This is called starting current. Fans with large impellers have longer starting current times. Fans with F-wheels have the highest current consumption at low pressures (Fig. 9), and fans with B-wheels have the highest current consumption in the middle of the curve (Fig. 10).

TEMPERATURE OF TRANSPORTED AIR

In pressure/flow diagrams or in the table of technical data there are facts about highest temperature of transported air (Fig. 11). All of our fan motors have insulation class F which means that the thermal contact disconnects the power when the winding temperature is maximum 155°C. At this winding temperature the life time of the ball bearings is not optimal. This is why the ambient temperature is shown at a lower winding temperature so the life time of ball bearings becomes optimal. The winding temperature variates in the diagrams and depending on differences in power/current consumption. The temperatures in our diagrams are given at the highest winding temperature.

At high current consumption, the most heat is generated in the motors. This heat must be cooled away so that the motor's service life is not affected. Most of our fans have their motors located in the airstream and are cooled by this airstream. If the air that moves past the motor is too warm, it will not sufficiently cool the motor. For this reason, the highest recommended ambient/air temperatures for the fan are provided. If the fan is used at higher temperatures, its service life will be shortened considerably and the fan's overheating protection will activate.

The temperatures are shown in the curve at the pressure and flow where the ambient temperature is lowest. The motor can handle higher temperatures at other pressures and flows. Motors with F-wheels, for example, are used at higher pressures.

SPECIFIC FAN POWER, SFP

The SFP is a measurement for the size of the total power at a specific flow/pressure and is calculated in kW/l/second (Fig. 12).

FIG. 8.

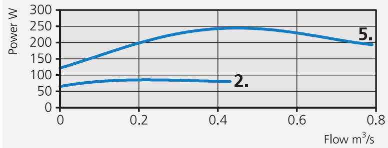
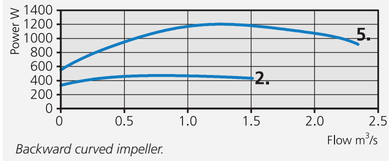
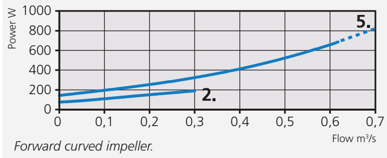


FIG. 9.



Backward curved impeller.

FIG. 10.



Forward curved impeller.

FIG. 11.

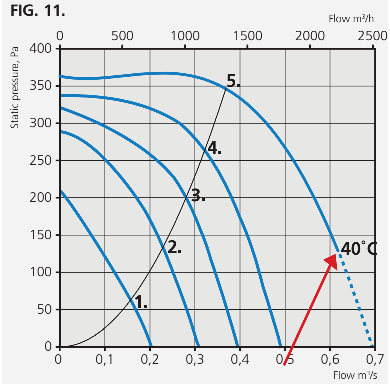
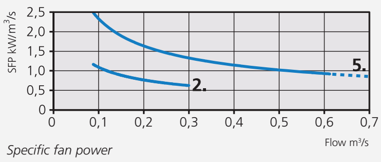
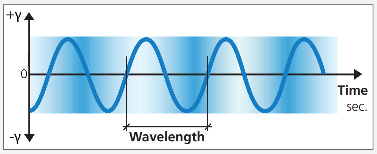


FIG. 12.



Specific fan power

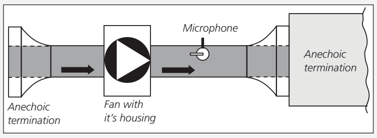
SOUND DATA



Wavelength for a pure tone.
Sound wavelength λ is calculated as λ = c / f where f is frequency in Hz and c is the speed of sound in m/s.

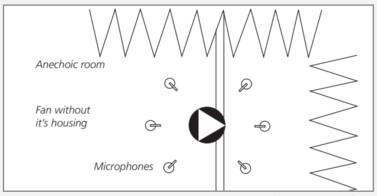
Octave band	Middle frequency Hz	Band limits Hz	Wave-length m
1	63	44-88	5.396
2	125	88-177	2.720
3	250	177-354	1.360
4	500	354-707	0.680
5	1000	707-1410	0.340
6	2000	1410-2830	0.170
7	4000	2830-5660	0.085
8	8000	5660-11300	0.043

FIG. 13.



***ISO method:** Measurements conducted inside a duct with specified design and non-reflecting connection. Measurements and calculations conducted in 1/1 octave band.*

FIG. 14.



***AMCA method:** Measurement conducted on free-standing fan in fully soundproof room. Results in lower sound levels.*

FIG. 15.

Octave band Hz	63	125	250	500
Inaccuracy dB	+–5,0	+–3,4	+–2,6	+–2,6
Octave band Hz	1000	2000	4000	8000
Inaccuracy dB	+–2,6	+–2,9	+–3,6	+–5,0

The sound level that we experience is the intensity of the pressure fluctuations that the sound consists of. Pressure fluctuations can be measured and given in Pascals, Pa, and are called sound pressure.
The lowest sound that the human ear can register is a pressure difference of 0.00002 Pa (hearing threshold).
The highest pressure is 20 Pa (pain threshold).
To make it easier to report sound levels, a logarithmic scale is used instead of Pascals. This scale is called Bell, or more commonly, decibel, and is abbreviated dB. The decibel scale ranges from 0 dB (hearing threshold) to 120 dB (pain threshold). One advantage of this is that the human ear registers sound levels logarithmically, which means that a difference of 1 dB is perceived equally across the entire scale. An increase of 6 dB equals a doubling of sound pressure, but an increase of 10 dB is required for us to perceive this increase as having doubled.
The human ear can discern a 3 dB difference in sound pressure.

SOUND DATA
In our catalogues, we give the sound power level Lw(A) and sound pressure level Lp(A) for sound in ducts and sound that is transmitted to the surroundings (through the fan casing).
Values are measured in accordance with ISO 3741 for sound transmitted to the surroundings from the fans, or ISO 5136 for measurements of sound power level to the ducts.
Note that measurements conducted according to another standard may differ from the measurement data in these ISO standards.
We conduct sound measurements according to the ISO method, in which the fan is measured in its casing to provide the most realistic values. (Fig.13.)
Measurements conducted on free-standing fans without casing result in lower sound levels.
In Application of Manufacturers' Sound Data, industry organization ASHRAE in the US states that:"Measurements conducted on free-standing fans have 5-10 dB lower sound levels in octave bands from 250 Hz, and lower sound levels than fans in fan casing." (Fig.14.)

MEASUREMENT INACCURACY
In conjunction with the preparation of its measuring method for sound power levels in ducts, ISO analyzed inaccuracy in various octave bands (90% reliability). (Fig.15.)

SOUND POWER LEVEL
Sound power level, **Lw(A)**, is used to calculate the sound generated from the entire ventilation system. The system consists of components such as dampers, ducts, diffusers, grilles, etc., all of which contribute to the total sound power for the entire system.
The sound power level is a calculated value that specifies the source intensity or the acoustic power emitted; it does not indicate how strongly the sound is perceived. Sound power level is reported in octave bands **63-8000 Hz** and as a logarithmic composite sum **Lw(A)tot**.

SOUND PRESSURE LEVEL
Sound pressure level, **Lp**, indicates how the sound is perceived. It is calculated in relation to a reference sound pressure, **P**, which is the hearing threshold, as follows:

Lp = 10 log $(P/P_0)^2$ Lp = 20 log P/P_0
Were **$P_0 = 2 \times 10^{-5}$ (Pa)**

Sound pressure varies according to distance and direction from the source of the sound. The acoustic properties of the surroundings also affect sound pressure.
The sound pressure level is presented for a normally soundproofed room with an equivalent absorption area of 20 m².
A difference of 7 dB corresponds to a distance of roughly 3 m to the sound source with semi-spherical propagation of sound.
In an attempt to simulate how the human ear perceives the sound at the different frequencies, it is weighted (corrected in the octave band) to weighting curve **A** which is presented as **Lp(A)** and by the unit **dB(A)**. (Fig.16.)

The **dB** scale is logarithmic and following the logarithmic addition of the above sound pressure levels, the total is 32,5 dB(A).
dBtot = 10 * log [10^(dB 1/10) + 10^(dB 2/10)]

$Lp = 10 \times lg (10^{Lp1/10} + 10^{Lp2/10} .... + 10^{LpX/10})$

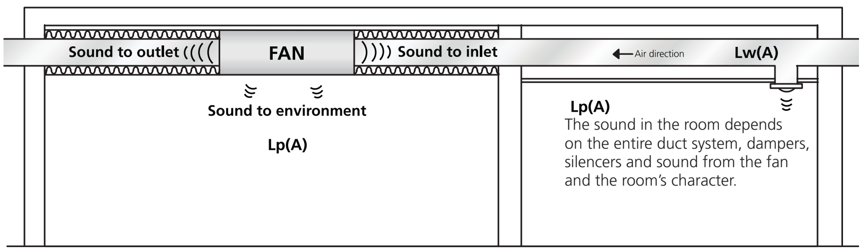


FIG. 16.

Frequency	63	125	250	500	1000	2000	4000	8000
Measured sound pressure level Lp dB	50	46	30	25	20	18	15	15
A filter	-26	-16	-9	-3	0	+1	+1	-1
A-weighted sound pressure level Lp(A) dB	24	30	21	22	20	19	16	14

Tabell A-filter