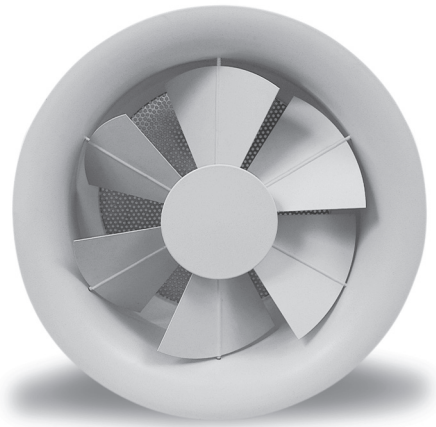
Variable swirl diffusers OD-11

Application

Diffuser is designed for air conditioning of rooms with floor to ceiling highs of 3 to 10 m and high induction requirements. It is suitable for large temperature difference between supply and room air.



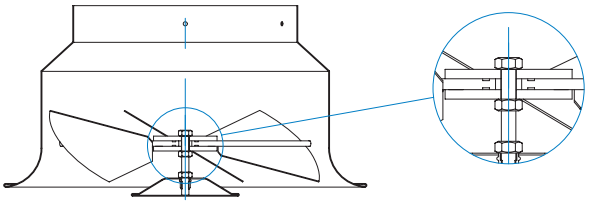
Description

Diffuser is made of housing which has a diffusing funnel mounted at the bottom. The direction of the discharged air is altered via the separately adjustable blades. The shape of the diffuser's inner part allows "Coanda" effect.

Housing consists of sheet aluminium and blades of pickled sheet steel. Complete diffuser is powder painted in RAL 9010 or any colour upon customer's request.

Individually adjustable blades OD-11

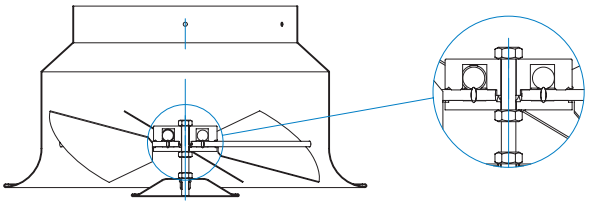
Use of the individually adjustable blades is recommended when the ventilation system is designed for the specific mode of operation and the blades can be adjusted during the diffuser installation.



Variable swirl diffuser OD-11V

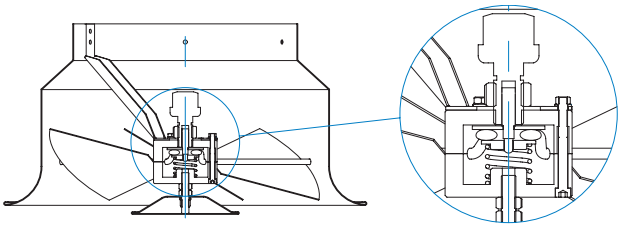
Version OD-11V has centrally adjustable blades. Blades can be manually adjustable or by the means of electric motor installed

on the outer side of the diffuser or by thermostat regulation. Diffuser is capable of altering discharge direction.



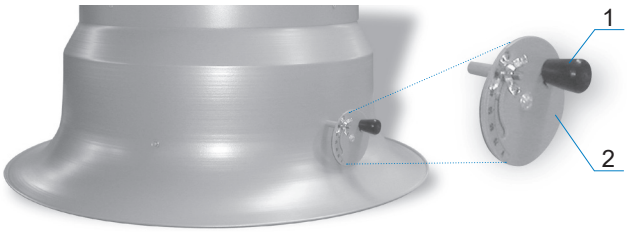
Variable swirl diffuser with the thermostat regulation OD-11V/TR

OD-11V/TR diffuser has a basic implementation of OD-11V upgraded thermostatically controlled. Automatic continuous regulation operates as a function of the temperature of air flowing through the diffuser. With additional configuration before installation to ensure optimum operation of the demands of comfort in the room.



Regulation with the OD-11V/…/RR handle

Regulation with this handle enables manual blade angle adjustment if the diffuser placement allows acess to the handle. This type of regulation is suitable for buildings with a lower number of diffusers when the ventilation system is designed for both summer and winter operation.



1.handle
2.fixing screw

Description

The ADT-2 differential thermostat with continuous analogue output is a controller that, based on the duct air temperature and room temperature signals, automatically adjusts the angle of OD-11V blades as required. One ADT-2 can operate up to 10 OD-11V units.

Operation

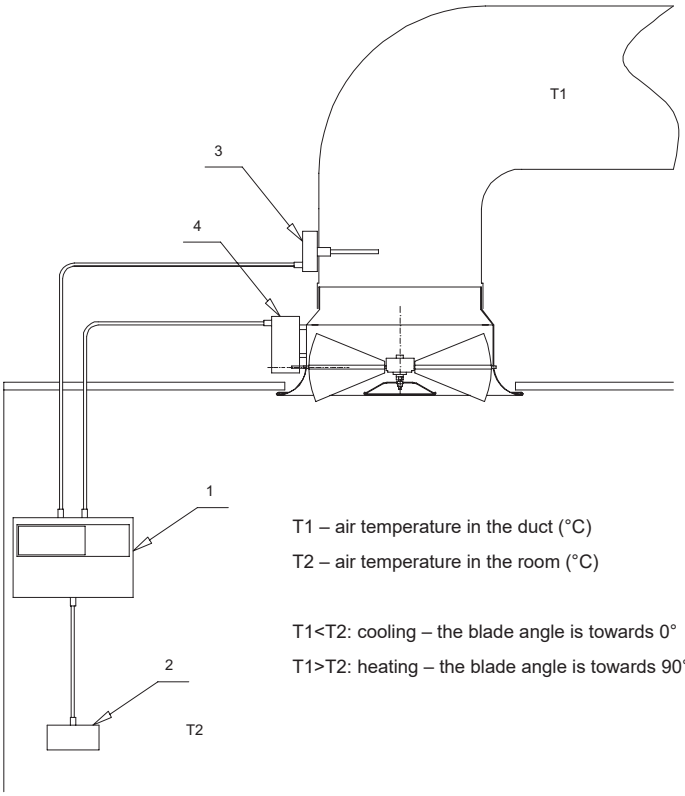
The controller compares the selected temperature curve, which is set according to the OD-11V position, desired mode of operation, etc, with data received from temperature sensors located in the air supply duct and in the room. Taking into account the desired temperature difference, the controller generates a continuous analogue 0-10V DC output signal, which is then transmitted to the OD-11V electric motor drive. Comparing the temperature, the controller automatically recognises the heating or cooling mode and sets the OD-11V accordingly. In the case the duct air temperature is higher than the roo temperature, the controller switches the OD-11V to the heating mode, i.e. to the vertical supply of warm air into the room. In the case the duct air temperature is lower than the room temperature, the controller automatically infers that the system is in the room cooling mode and accordingly generates a signal to set the OD-11V to the cooling mode.

Advantage

Applying ADT-2, the need for manual switching of a large number of OD-11V units to the proper operational mode is avoided, since the controller switches the units automatically. In this way, the efficiency of room air conditioning is enhanced as well.

ADT-2 differential thermostat

1. controller
2. room temperature sensor
3. duct temperature sensor
4. compact actuator (B3, B6, B9)



T1 – air temperature in the duct (°C)

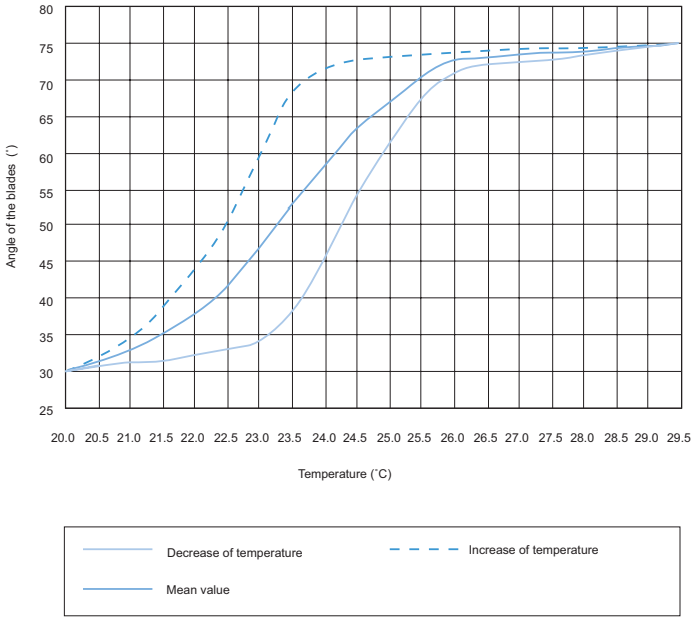
T2 – air temperature in the room (°C)

T1<T2: cooling – the blade angle is towards 0°

T1>T2: heating – the blade angle is towards 90°

Operation

At OD-11V/TR diffuser, centrally adjustable blades can be adjusted automatically with the thermostat regulation. Thermostat perceives temperature of the supply air and automatically adjusts the blades angle. No additional power supply and controls are required, so no additional wiring installation is needed. Blade angle according to the supply air temperature is shown in the chart below. A hysteresis behavior of the thermostatic head in both cooling and heating mode is shown in the chart. After the temperature is stabilized, angle of the blades is adjusted to the medium value in about 15 minutes.



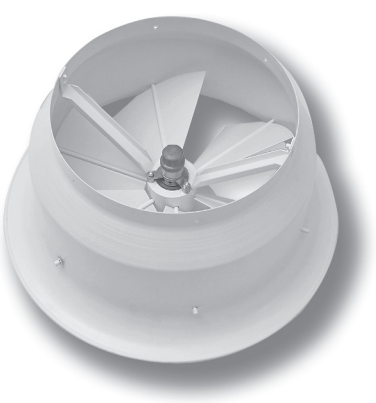
Size

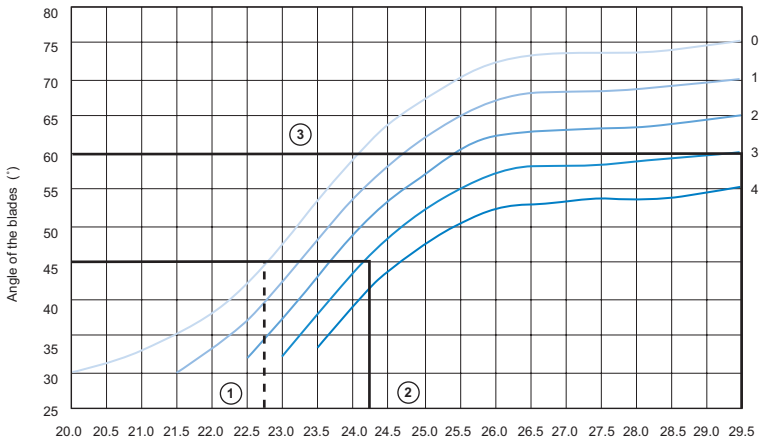
OD-11V/TR diffuser can be made in sizes 200, 250, 315, 400, 500, 630 and 800 (sizes 125 and 160 are not available).

Regulation of the initial and final blade angle

OD-11V/TR allows the regulation of the initial and final blade angle. During the selection of appropriate diffuser for certain room conditions with the Klima ADE software package, exact angles are calculated according to the installation height of the diffuser, supplied air quantity and the temperature difference between supplied and room temperature. Calculation is based on air flow speed of 0.2 m/s in the living area.

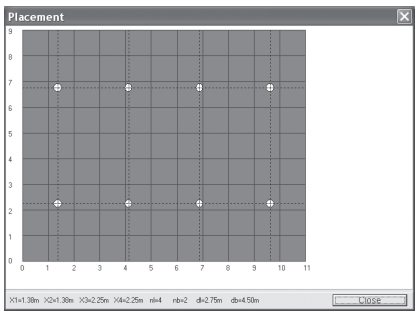
Initial blade angle is preadjusted with the special nut in the range between 30 and 50°. Automatic opening of the blades is initiated, when the temperature reaches limit value, shown in the chart according to the preadjusted angle and number of used spacers. When initial angle of 45° is preadjusted without additional spacers and final angle is 75°, blade opening temperature is between 22.5 and 23 °C (designation 1 in diagram). Final blade angle is adjusted by adding spacers below thermostatic head. Default preassembled spacer allow complete opening of the blades until 75°. By each added spacer, final angle is reduced for 5°.Adding of spacers also change the thermostatic head characteristics (average values according to the number of added spacers are shown in the chart).

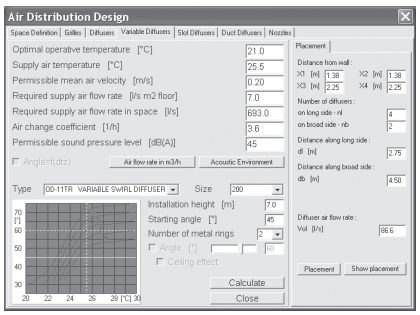


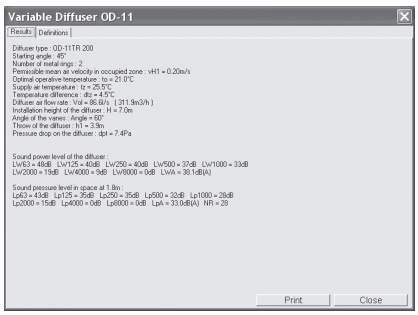


Nr. of spacers added	0	1	2	3	4
Final blade angle	75°	70°	65°	60°	55°

Calculation example of initial and final blade angle for the OD-11V/TR diffuser with the Klima ADE 5.4 software package





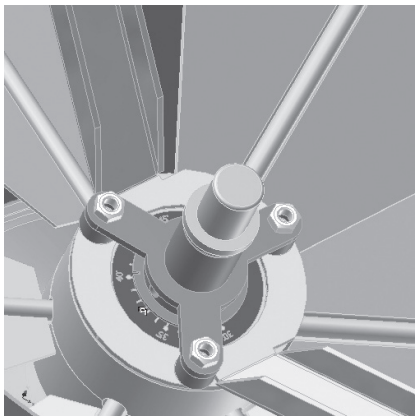


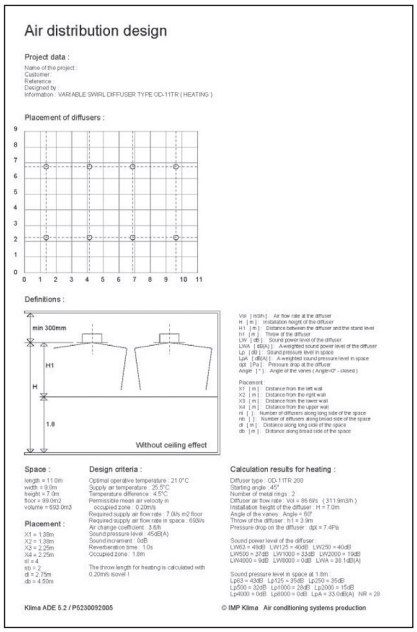
Input data:
Air quantity
Air temperature
Room size
Diffuser size

Calculation

Result of the calculation:
minimum angle in
the cooling mode = 45°

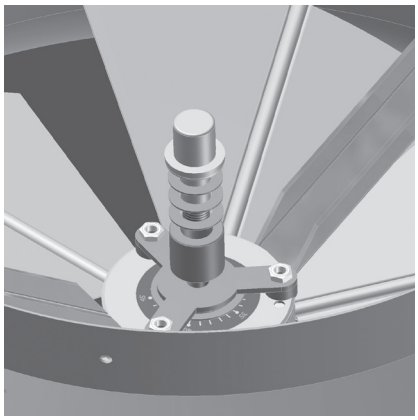
Angle adjustment (designation 2 in diagram):





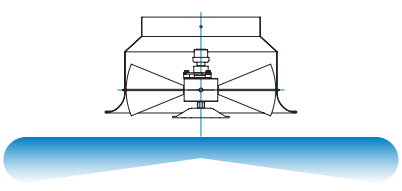
Result of the calculation:
maximum angle in
the heating mode = 60°

Angle adjustment (designation 3 in diagram):

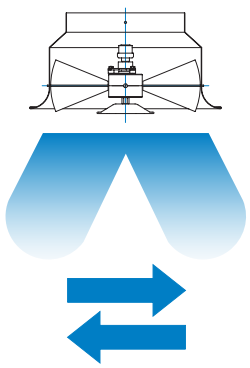


for 60° three spacers should be used

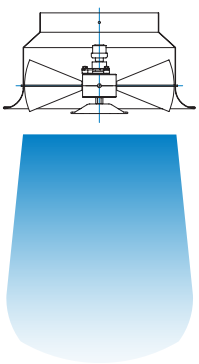
Summer: cooling



Transitionalperiod: automatic adjustment of blade angle
to the supply air temperature



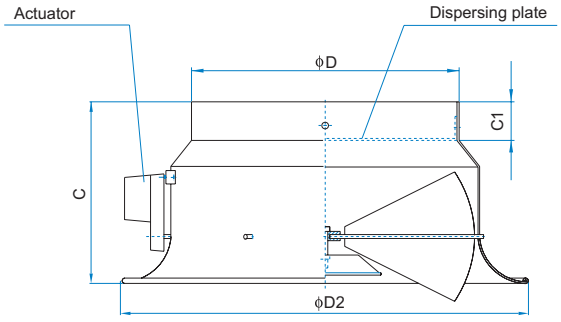
Winter: heating



Dimensions

Size	ΦD	ΦD2	C	C1	A_{ef} (m^2)
125	123	205	130	40	0.012
160	158	250	155	40	0.020
200	198	310	174	40	0.030
250	248	400	200	40	0.048
315	313	480	240	40	0.077
400	398	615	265	55	0.125
500	498	790	320	60	0.195
630	628	940	380	80	0.310
800	798	1142	555	75	0.503

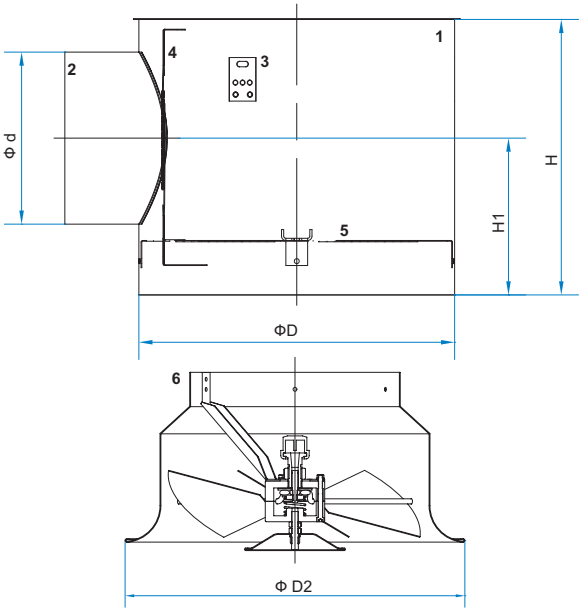
A_{ef} – efective discharge area (m^2)



Round plenum box

1.Plenum box
2.Inlet spigot
3.Suspension bracket
4.Volume control damper M
5.Dispersing plate
6.Diffuser OD-11, OD-11V, OD-11V/TR

Size	ΦD	H	H1	Φd
125	128	250	154	98
160	183	250	166	123
200	204	245	144	158
250	254	285	164	198
315	319	335	189	248
400	404	400	221	313
500	504	400	221	313
630	634	535	289	448
800	804	585	314	498



Ordering key

OD-11	/	P	/	ZR	/	M	/	I5	Size
1	2	3	4	5		6		7	8

1 Diffuser type

OD-11	Variable swirl diffuser

2 Adjustment

V	Centrally adjustable (for versions with regulation only)

3 Dispersing plate

P	Dispersing plate (not installed, if the plenum box is used for installation)tion only)

4 Diffuser regulation

TR	Thermostat regulation
R	Manual control
RR	Manual handle
B	Power driven but without actuator
B1	Actuator Belimo LM 24A (min 200-500)
B2	Actuator Belimo LM 230A (min 200-500)
B3	Actuator Belimo LM 24A-SR (min 200-500)
B4	Actuator Belimo NM 24A (for size 630)
B5	Actuator Belimo NM 230 A (for size 630)
B6	Actuator Belimo NM 24A-SR (for size 630)
B7	Actuator Belimo SM 24A (for size 800)
B8	Actuator Belimo SM 230A (for size 800)
B9	Actuator Belimo SM 24A-SR (for size 800)

5 Plenum box

ZR	Circular plenum box for air supplytion only)

6 Air volume regulation

M	Volume control damper in entry spigot

7 Insulation

I5	5 mm PE thermal insulation outside of plenum box
I9	9 mm synthetic rubber based sound & thermal insulation (-40°C - 105°C) outside of plenum box
I19	19 mm synthetic rubber based sound & thermal insulation (-40°C - 105°C) outside of plenum box

8 Dimensions

125	Minimum size for OD-11V/TR and B1-B9 is 200
160	Minimum size for OD-11V/TR and B1-B9 is 200
200	
250	
315	
400	
500	
630	
800	

Definition of symbols

Q (m³/h)	Air flow
x (m)	Horizontal distance to the wall
H (m)	Room height
H1 (m)	Distance from ceiling to occupied zone
L (m)	Throw distance (L=H1+x)
V_L (m/s)	Air velocity at the throw distance L
Δt_z (K)	Temperate difference between the supply and room air
Δt_L (K)	Difference between the core and room air temperature
Δp_t (Pa)	Pressure drop
L_{WA} (dB(A))	Sound power level
V_{H1} (m/s)	Air velocity at the H1 distance
A, B (m)	Distance between diffusers by length and by width

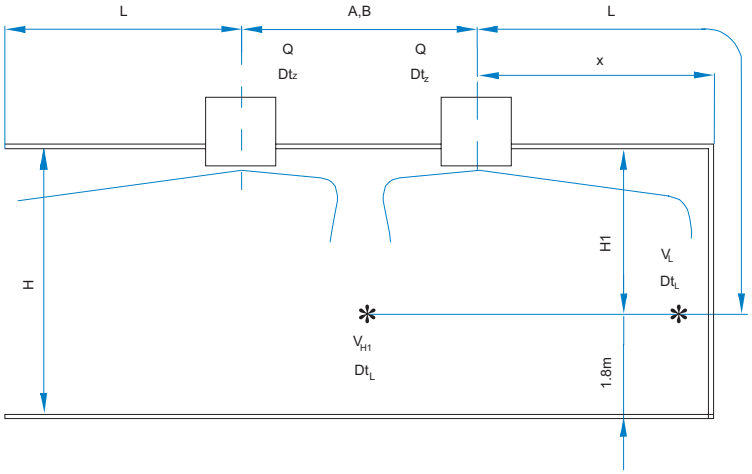
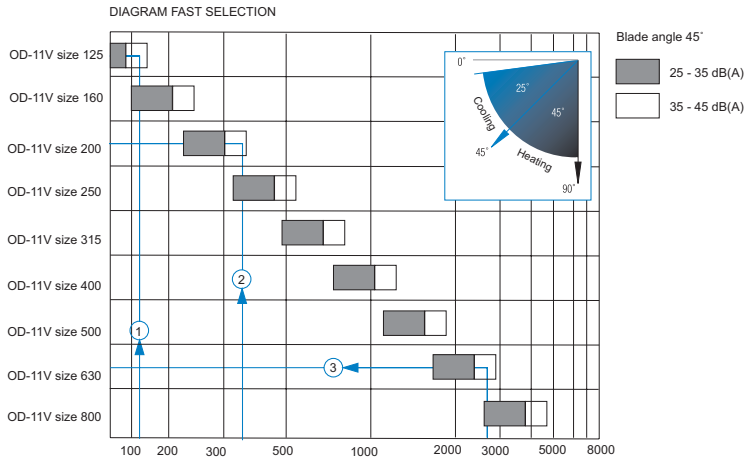


Diagram for fast selection

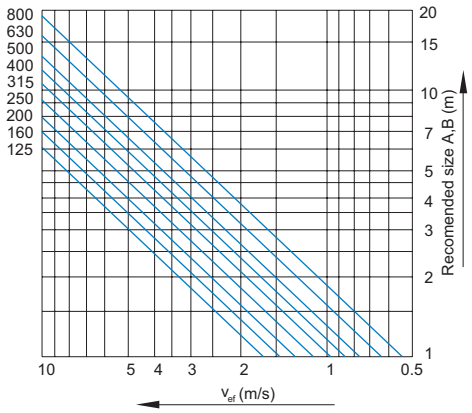
Corections

In the case of the diffuser installation in the ceiling, the velocity Vh at the level A/2+H is to be multiplied with a factor of 1.4 (due to the Coanda effect).
The above applies to the cases of heating and cooling operation with blade opening angles less than 30°.



Examples for selection 1, 2 and 3: see the following pages.

Diffuser size as a function of distance between units and effective velocity



Blade opening angle during heating and cooling operation

Calculation

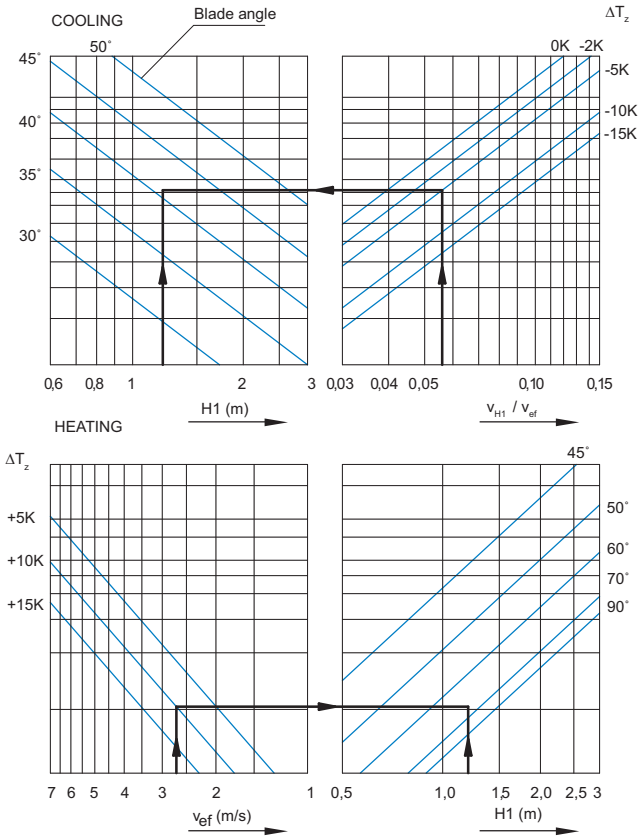
Example 1 (cooling)
Q = 160 m³/h
H = 3 m
H1 = H-1.8 = 3-1.8 = 1.2 m
vH1 = 0.2 m/s
ΔT_z = -5 K
Recommended size: 125

v_{ef} = Q/(A_{ef}×3600) = 160/(0,012×3600)
v_{ef} = 3.6 m/s
v_{H1}/v_{ef} = 0.2/3.6 = 0,056
Blade angle: 41°

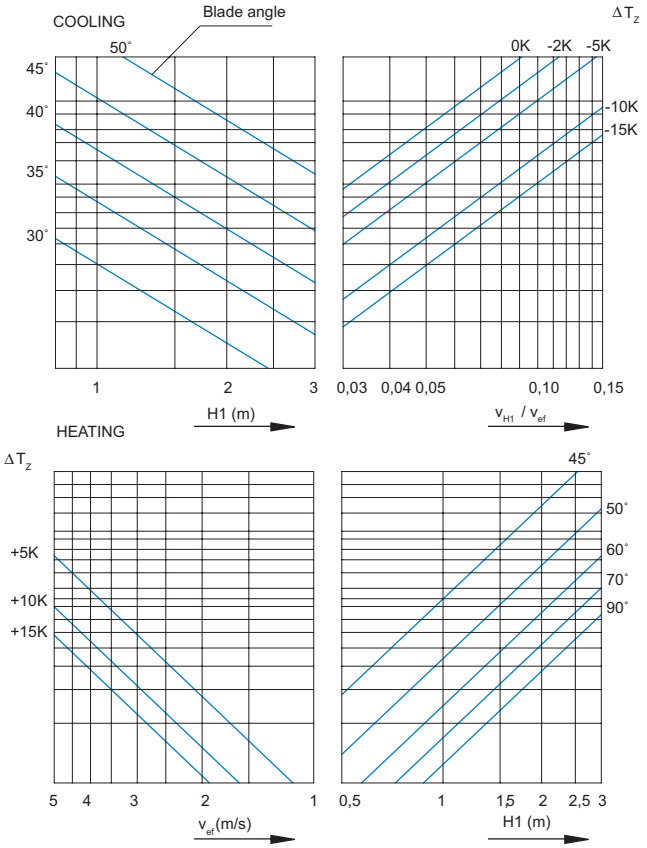
Example 1 (heating)
Q = 160 m³/h
H = 3m → H1 = 1,2 m
v_{H1} = 0.2 m/s
ΔT_z = 10 K
Recommended size: 125

v_{ef} = 2.7 m/s
Blade angle: 66 °

OD-11V 125



OD-11V 160



Blade opening angle during heating and cooling operation

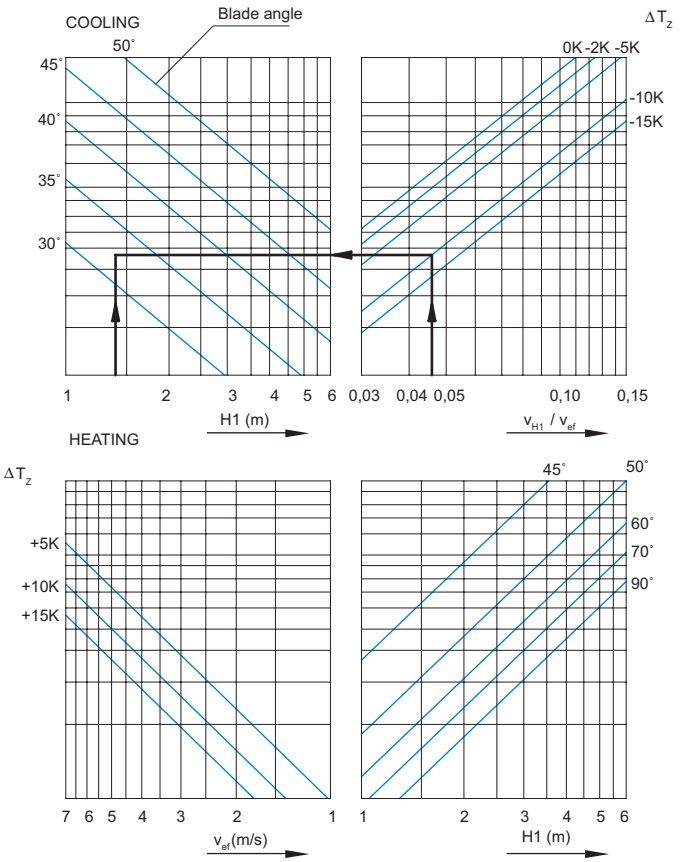
Calculation

Example 2 (cooling)
Q = 350 m³/h
H1 = 1.4 m
v_{H1} = 0.15 m/s
ΔT_z = -10 K
Recommended size: 200

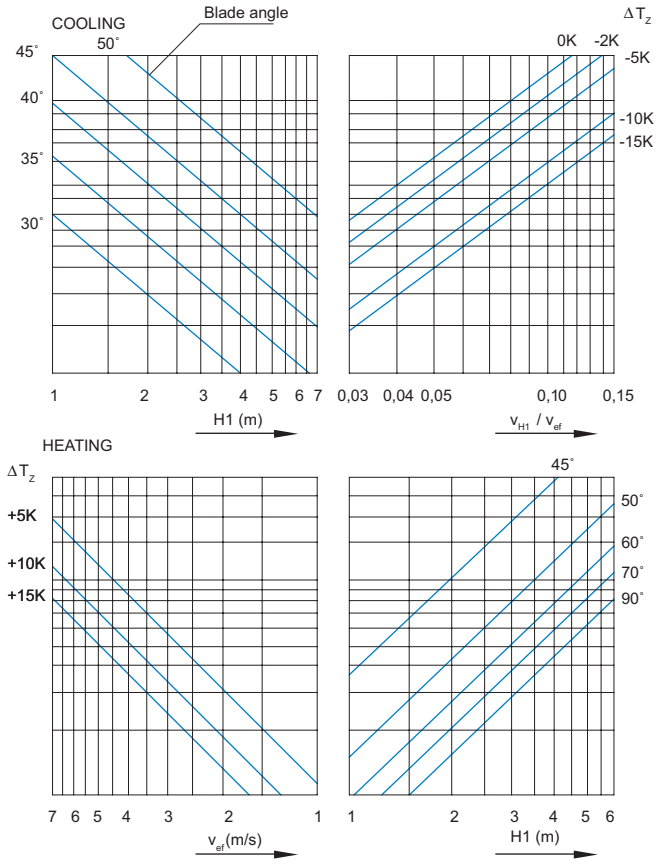
v_{ef} = Q/(Aef ×3600) = 350/(0,031×3600)
v_{ef} = 3.13 m/s
v_{H1}/v_{ef} = 0.15/3.24 = 0.046
Blade angle: 32°

((Blade angle 32° → Coanda effect)
H1 = 1.4×1.4 = 1,96 m
H = H1+1.8 = 1.96+1.8 = 3.67 m
or
H = 1.4 → v_{H1} = 0.15×1.4 = 0.25 m/s

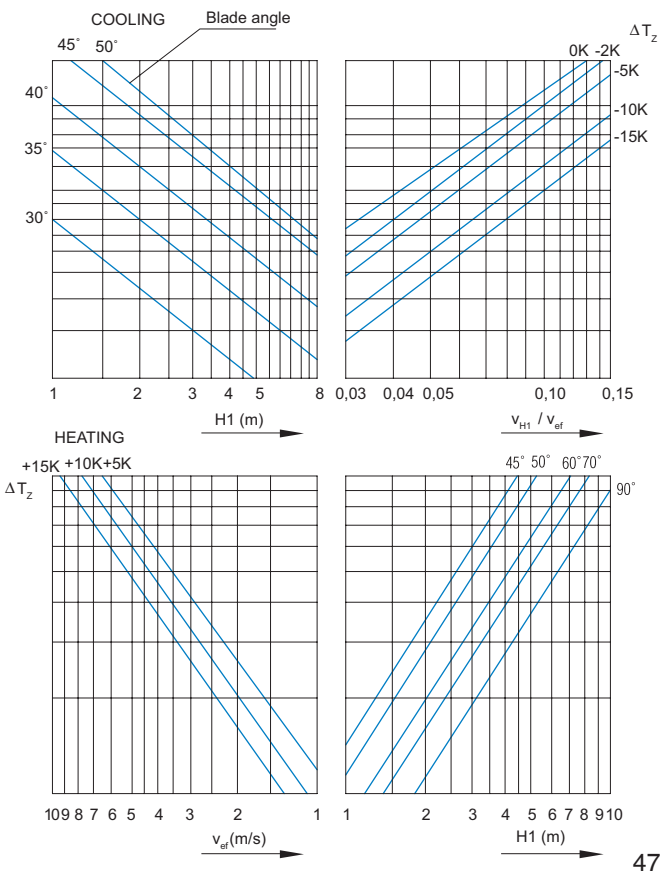
OD-11V 200



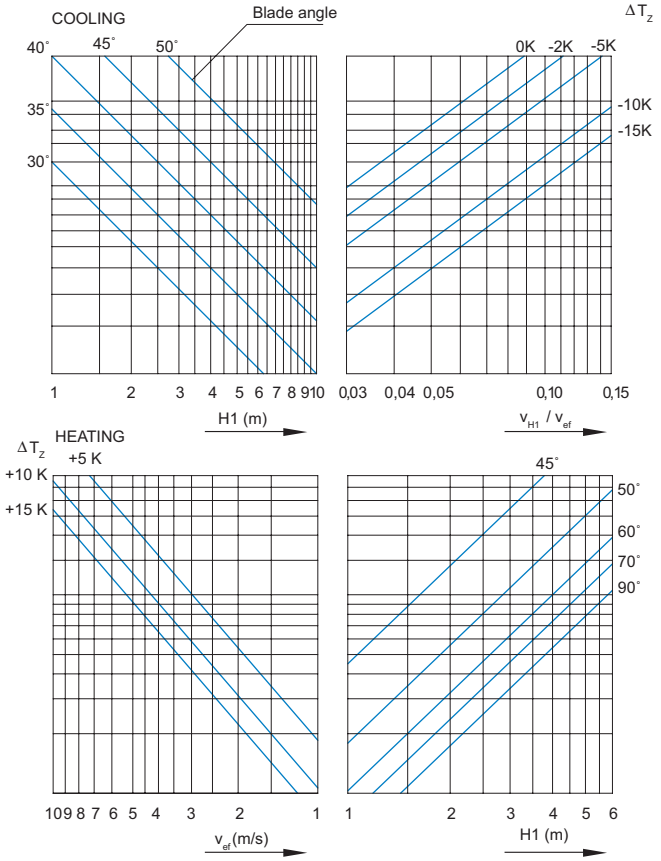
OD-11V 250



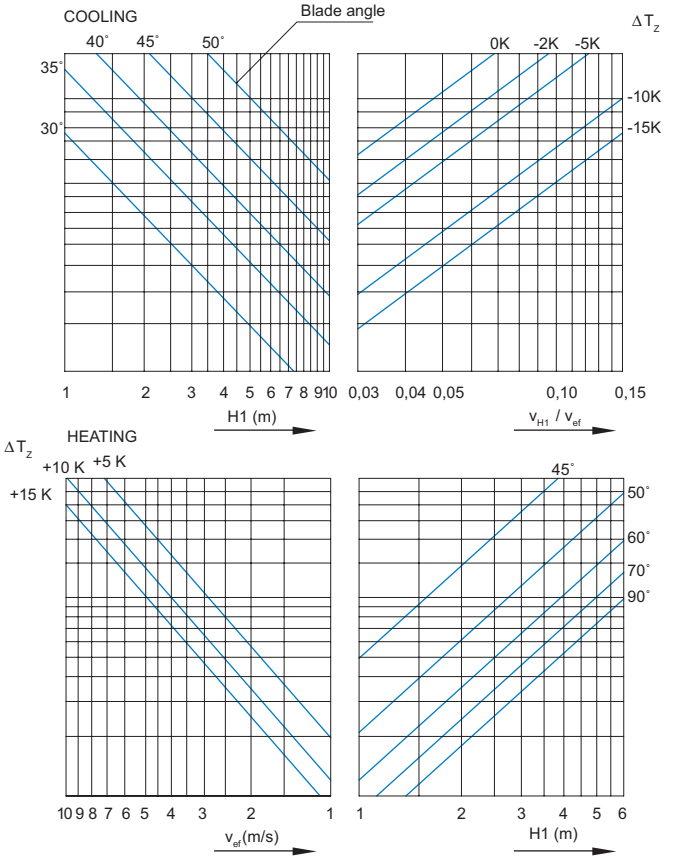
OD-11V 315



OD-11V 400



OD-11V 500

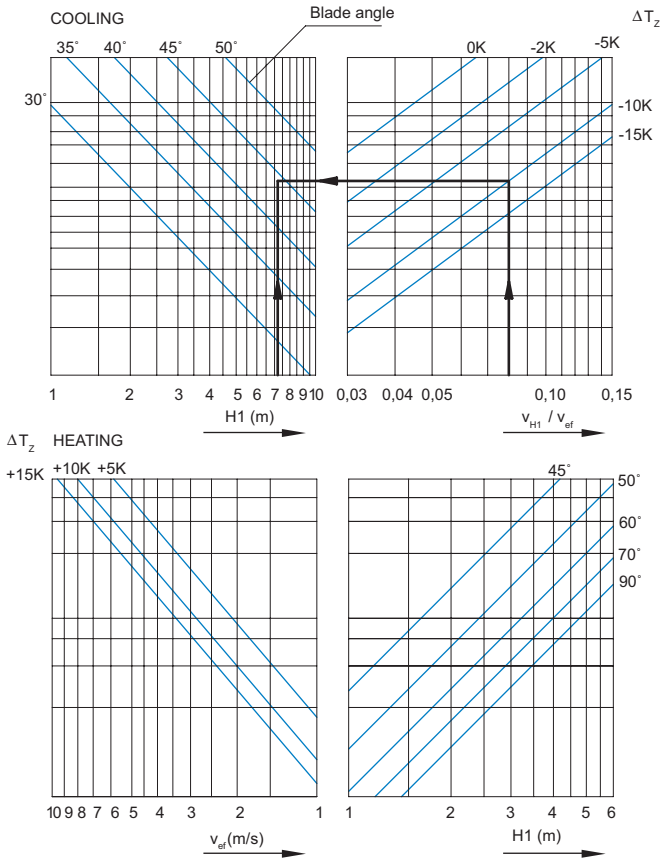


Calculation

Example 3 (cooling)
Q = 2700 m³/h
v_{H1} = 0.2 m/s
Δt_z = -10 K
H = 9 m → H1 = 9-1.8 = 7.2 m
Recommended size: 630

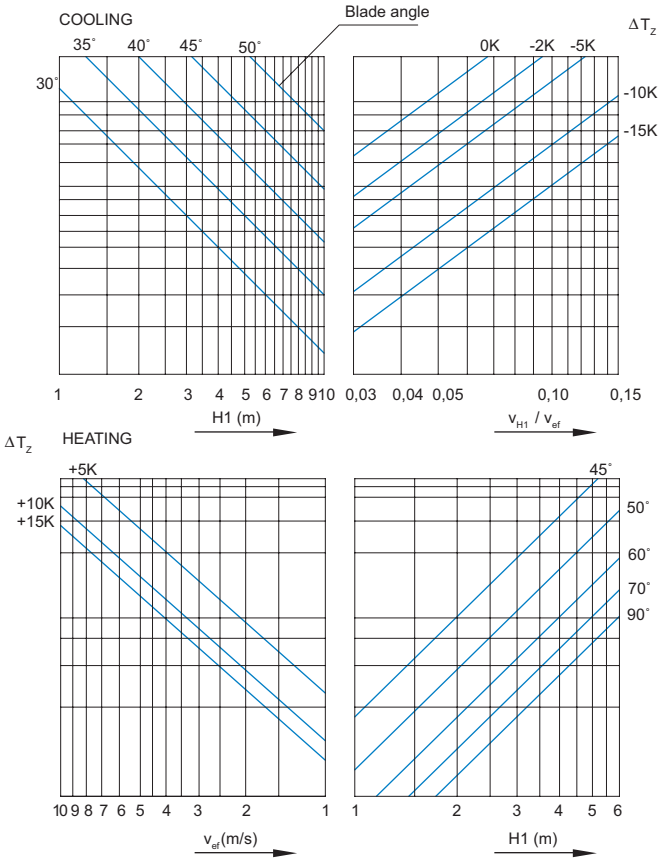
v_{ef} = Q/(Aef×3600) = 2700/(0.32×3600)
v_{ef} = 2.3 m/s
v_{H1}/v_{ef} = 0.2/2.3 = 0,08
Blade angle: 44°

OD-11V 630



Blade opening angle during heating and cooling operation

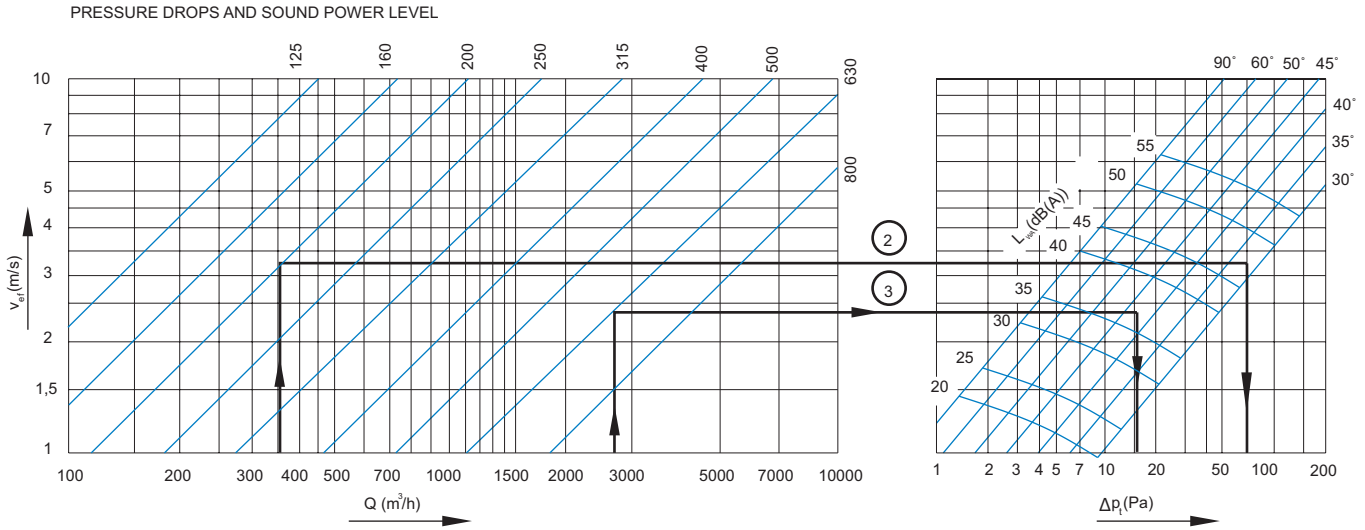
OD-11V 800



Pressure drops and sound power level

(for version with dispersing plate)

D-11V Size 125 - 800



Calculation

Example 2 (cooling)
Q = 350 m³/h
L_{WA} = 47 dB(A)
Δp = 75 Pa
Blade angle: 32°

Example 3 (cooling)
Q = 2700 m³/h
L_{WA} = 37 dB(A)
Δp = 16 Pa
Blade angle: 44°