



AEROGRAMMI

DESIGN AND MANUFACTURE OF GRILLES AND SPECIAL AIR CONDITIONING COMPONENTS



CEILING SWIRL DIFFUSER

MLD



GENERAL



MLD is a round swirl diffuser with adjustable blades. Because of the shape of the main body and the way of the blade adjustment, the diffuser presents big adaptability, so it is possible to use MLD diffuser in small and big heights with small or big air volume supply, in heating or cooling. Consists of a cylindrical body made by aluminium and eight trapezoid blades, convergent to the center, made by steel. In the center there is the mechanism for the blade angle adjustment under a plastic cover. The diffuser is painted electrostatically in color RAL 9010 but is possible to be painted and in other RAL color.

In the case where we have relatively small installation height and big air volume supply we can use the MLD-DW version where the cylindrical body is double. See more details in the last page.

ADJUSTMENT

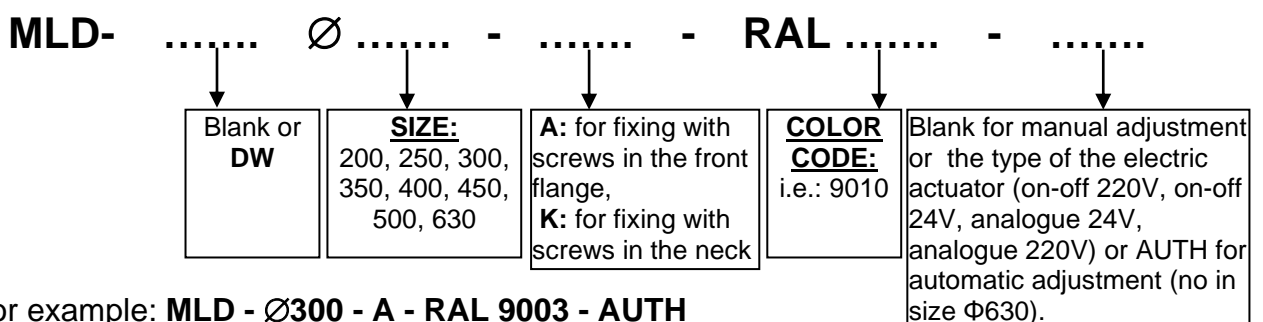
We can regulate the blades corner **manually** as standard (see instructions in last page). In alternative we can use for the blades corner adjustment:

- Mechanism which **adjusts automatically the corner of the blades according to the supply air temperature** (-AUTH). For supply air temperature below 20°C the blades are in the cooling position, from the 20°C to the 28°C the blades corner changes slowly and reaches the heating position where remains for temperatures bigger than 28°C. The advantages of this method are: a) The installation of the diffuser is exactly the same with the manual adjusted version, b) costs less than the same diffuser with electric actuator, c) we don't have the material and labor cost of the electric installation (wires, switches, potentiometers, fuses etc) and d) after the installation there is no need someone to do something about the adjustment of the diffuser. Details in page 11. Not for size 630.

- **Electric actuator** on-off (24V or 220V) or analogue (24V or 220V, control signal 0-10V). For details, wire connections and restrictions see page 11.

WAY OF ORDER

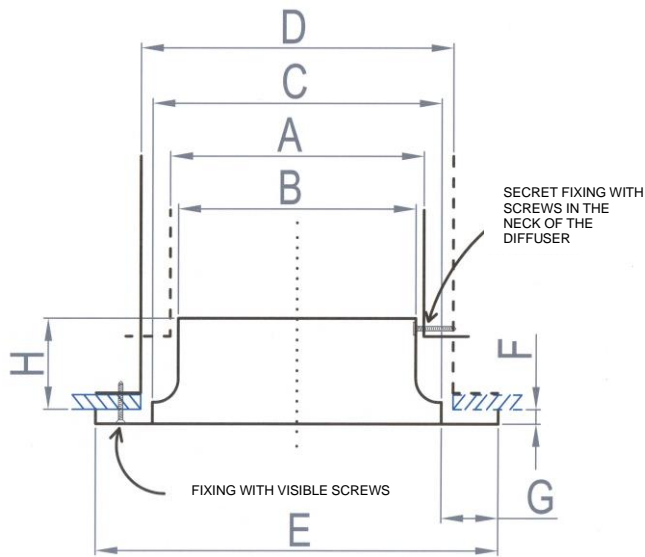
For the order of the diffusers MLD we use the following string of letters and numbers.



For example: **MLD - Ø300 - A - RAL 9003 - AUTH**

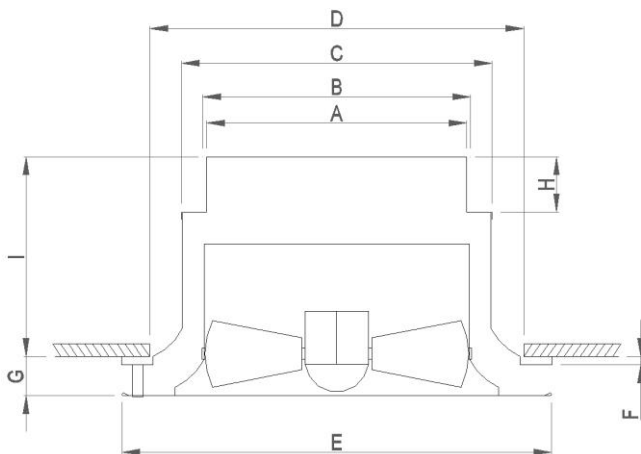
When you order MLD with electric actuator or automatic adjustment you must inform us for the installation height, the air volume supply and the ΔT in heating and cooling. This way we will make the proper adjustments in the diffuser.

DIMENSION TABLES



MLD

SIZE	Ø A	Ø B	Ø C	Ø D	Ø E	F	G	H
200	200	195	250	255	310	8	30	132
250	250	245	300	305	360	8	30	132
300	300	295	350	355	410	8	30	132
350	350	345	400	405	460	8	30	132
400	400	395	450	455	510	8	30	132
450	450	445	500	505	560	8	30	132
500	500	495	553	558	622	8	34	200
630	630	625	674	684	740	8	34	200



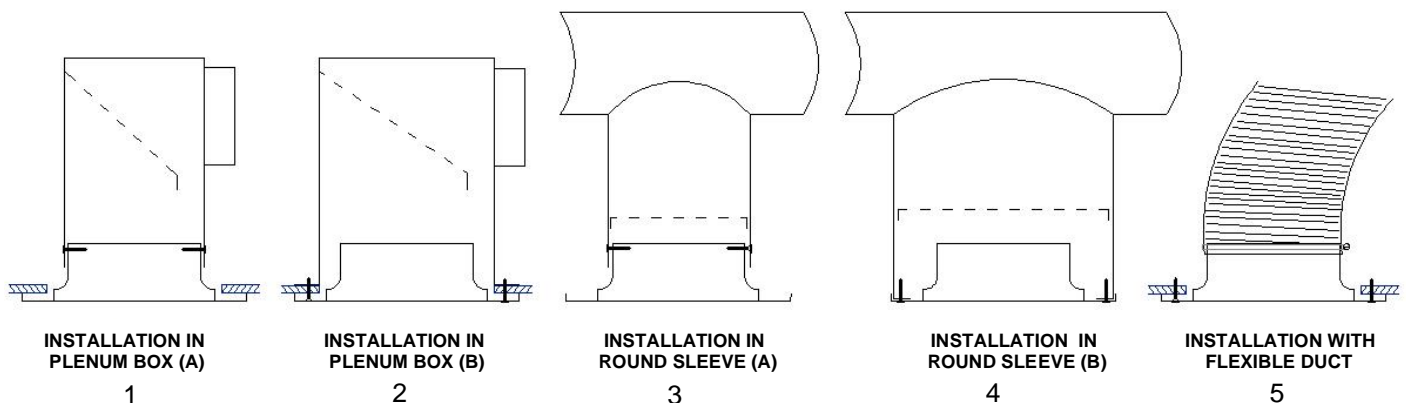
MLD-DW

SIZE	A	B	C	D	E	F	G	H	I
200	195	200	250	305	360	8	41	60	193
250	245	250	300	355	410	8	41	60	193
300	295	300	350	405	460	8	41	60	193
350	345	350	400	455	510	8	41	60	193
400	395	400	450	505	560	8	41	60	193

INSTALLATION

The diffuser installation is possible a) in false ceiling using a plenum box (1,2), b) in round sleeve after a round or rectangular visible air duct (3,4) c) in false ceiling using flexible duct (5).

In the first case the diffuser is fixed with screws either from the external flange (visible fixing) either from the neck (secret fixing), in this case the plenum box is fixed by wire cords in the ceiling. In the second case the diffuser is fixed with screws from the external flange or the neck, depends on the sleeve diameter.



In the third case the diffuser is fixed in the false ceiling with screws in the external flange and in the back is connected the flexible duct.

In any case, like every diffuser, we must take care the supply air to reach equalized in the diffuser. If we have plenum box we must install perforated equalizing grid. If we have sleeve this must have length at least three diameters or equalizing grid. If we have flexible duct this must be vertical for length of three diameters. The equalizing grid must have big free area to avoid big pressure drop. If we have damper before the diffuser this must be at a distance of three diameters or before the equalizing grid.

CALCULATION EXAMPLE

For the calculation of the **MLD** diffuser we use the selection diagrams of the next pages. The first of the diagrams is an example of a full calculation. The sizes which appear in the diagrams are described in the following table. The sizes which their symbols are in grey background are the data where we must know to make the calculation.

DESCRIPTION OF SIZES MENTIONED IN THE SELECTION DIAGRAMS

SYMBOL	SIZE	MEAS. UNIT.
T_h:	Supply air temperature in heating (in the diffuser)	°C
T_{rh}:	Room air temperature in heating	°C
T_c:	Supply air temperature in cooling (in the diffuser)	°C
T_{rc}:	Room air temperature in cooling	°C
ΔT_h:	Temperature deference of supply – room air in heating	K
ΔT_c:	Temperature deference of room - supply air in cooling	K
V_{room}:	Total air volume supply in the room via MLD diffusers	m ³ /h
V_{sup}:	Air volume supply per diffuser	m ³ /h
n:	Number of MLD diffusers	pcs
h:	Installation height	m
a:	Minimum distance between diffusers	m
v_x:	Air velocity, in cooling, in height 1,8m from the floor	m/sec
v_o:	Air velocity in the neck of the diffuser	m/sec
v_x/v_o:	Ratio of air velocity in height 1,8m to the air velocity in the diffuser, in cooling	
a_h:	Blade corner in heating	°
a_{is}:	Blade corner in isothermal	°
a_c:	Blade corner in cooling	°
Δp_h:	Pressure drop in the diffuser in heating	Pa
Δp_{is}:	Pressure drop in the diffuser in isothermal	Pa
Δp_c:	Pressure drop in the diffuser in cooling	Pa
Lw_h:	Noise from the diffuser in heating	dB(A)
Lw_{is}:	Noise from the diffuser in isothermal	dB(A)
Lw_c:	Noise from the diffuser in cooling	dB(A)

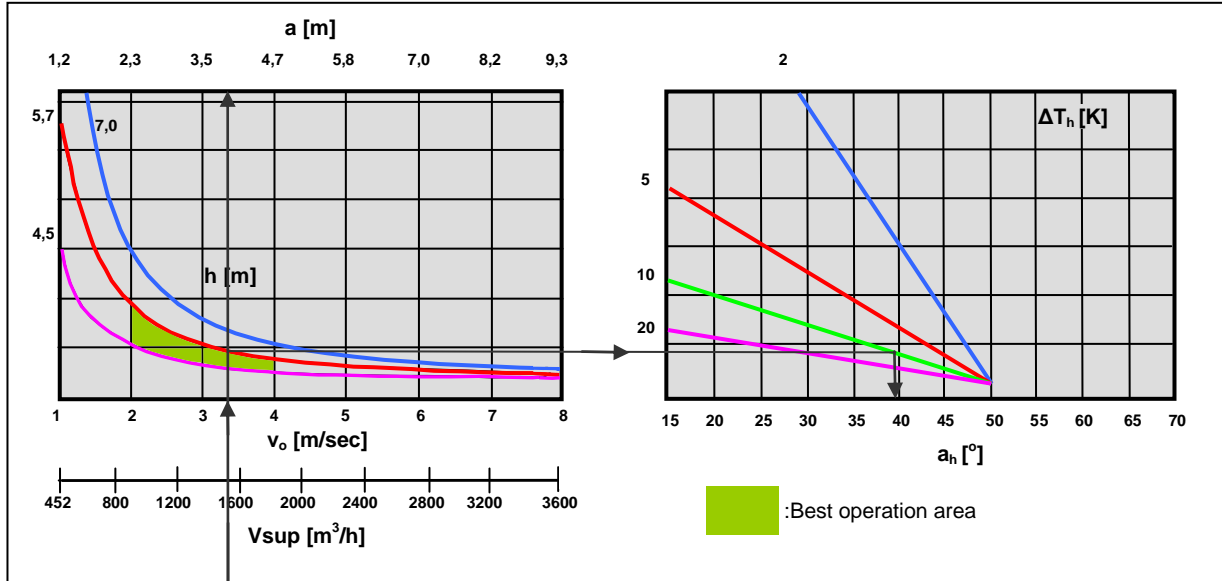
As we see in the example of the next page we start from the **V_{sup}** line and we proceed according to the arrows vertical (upwards and downwards) changing direction in the known values of the **h**, **ΔT_h**, **ΔT_c**, **v_x**. This way we take the results. For the pressure drop and the noise we have values for the blade corners 30°, 45°, 60°. Usually from the calculations we take different corners from these. So based in the values we take for the corners 30°, 45°, 60° we calculate with interference the values of the noise and the pressure drop for the case where we study.

MLD-Ø400 ROUND CEILING SWIRL DIFFUSER

EXAMPLE



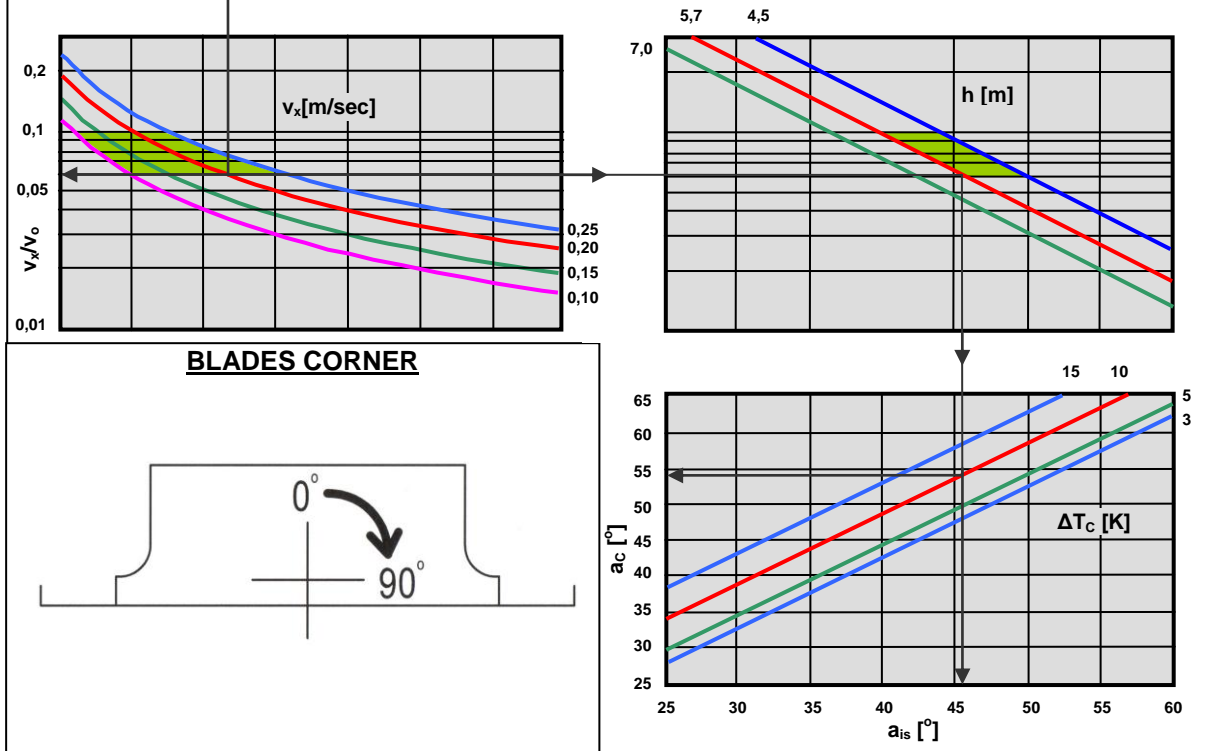
Heating



VALUES

- $T_h = 32$ [°C]
- $T_{rh} = 22$ [°C]
- $T_c = 15$ [°C]
- $T_{rc} = 25$ [°C]
- $\Delta T_h = 10$ [K]
- $\Delta T_c = 10$ [K]
- $V_{room} = 15000$ [m³/h]
- $V_{sup} = 1500$ [m³/h]
- $n = 10$ [pcs]
- $h = 5,7$ [m]
- $a = 3,95$ [m]
- $v_x = 0,2$ [m/sec]
- $v_o = 3,35$ [m/sec]

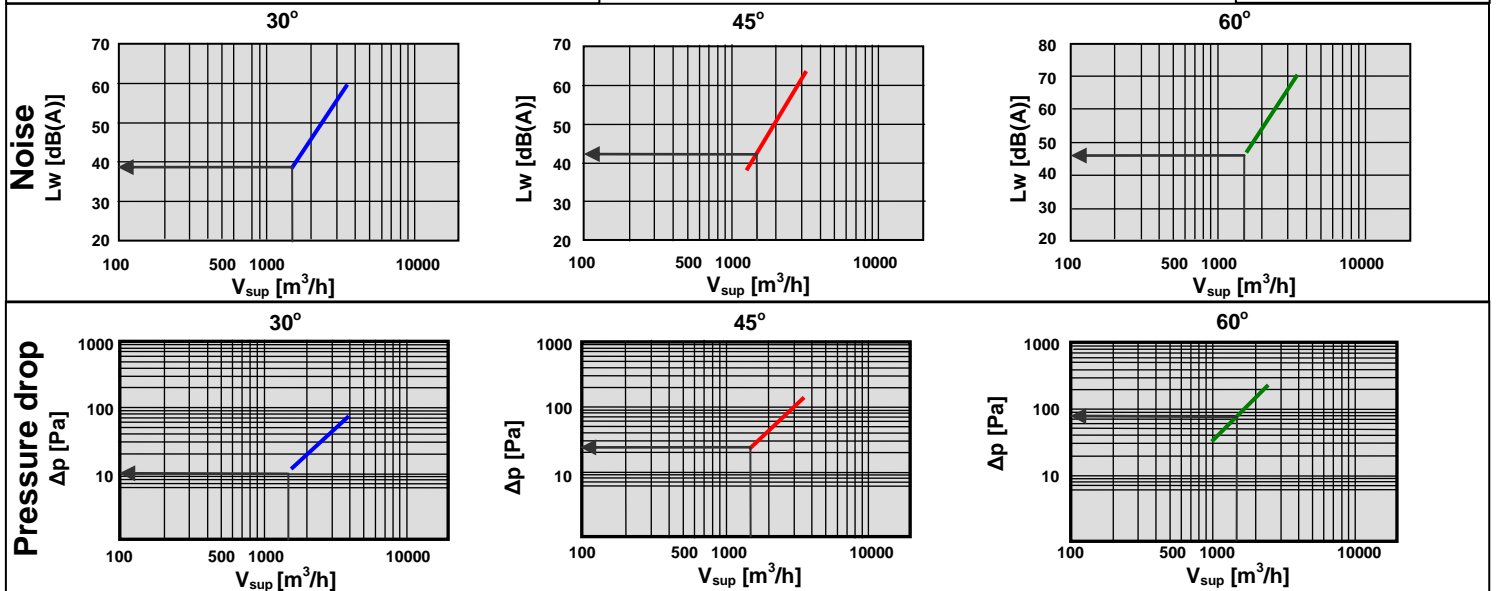
Cooling/Isothermal



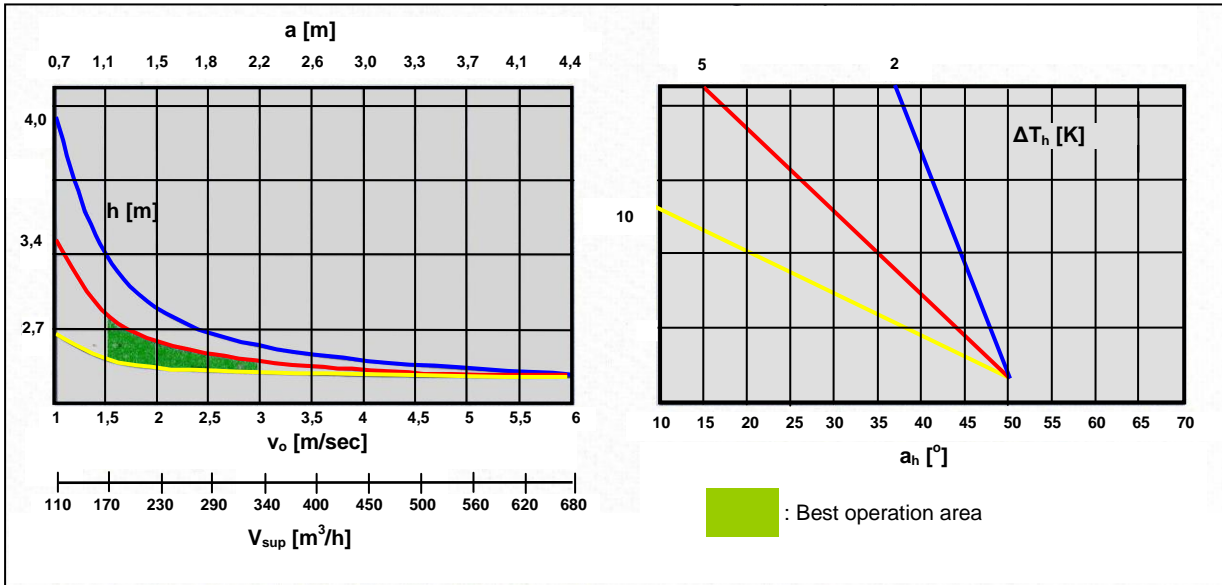
- $v_x/v_o = 0,06$
- $a_h = 39$ [°]
- $a_{is} = 46$ [°]
- $a_c = 54$ [°]
- $\Delta p_h = 19$ [Pa]
- $\Delta p_{is} = 26$ [Pa]
- $\Delta p_c = 55$ [Pa]
- $Lw_h = 40$ [dB(A)]
- $Lw_{is} = 42$ [dB(A)]
- $Lw_c = 45$ [dB(A)]

USEFUL EQUATIONS

$\Delta T_h = T_h - T_{rh}$ [K]
 $\Delta T_c = T_{rc} - T_c$ [K]
 $n = V_{room} / V_{sup}$ [pcs]

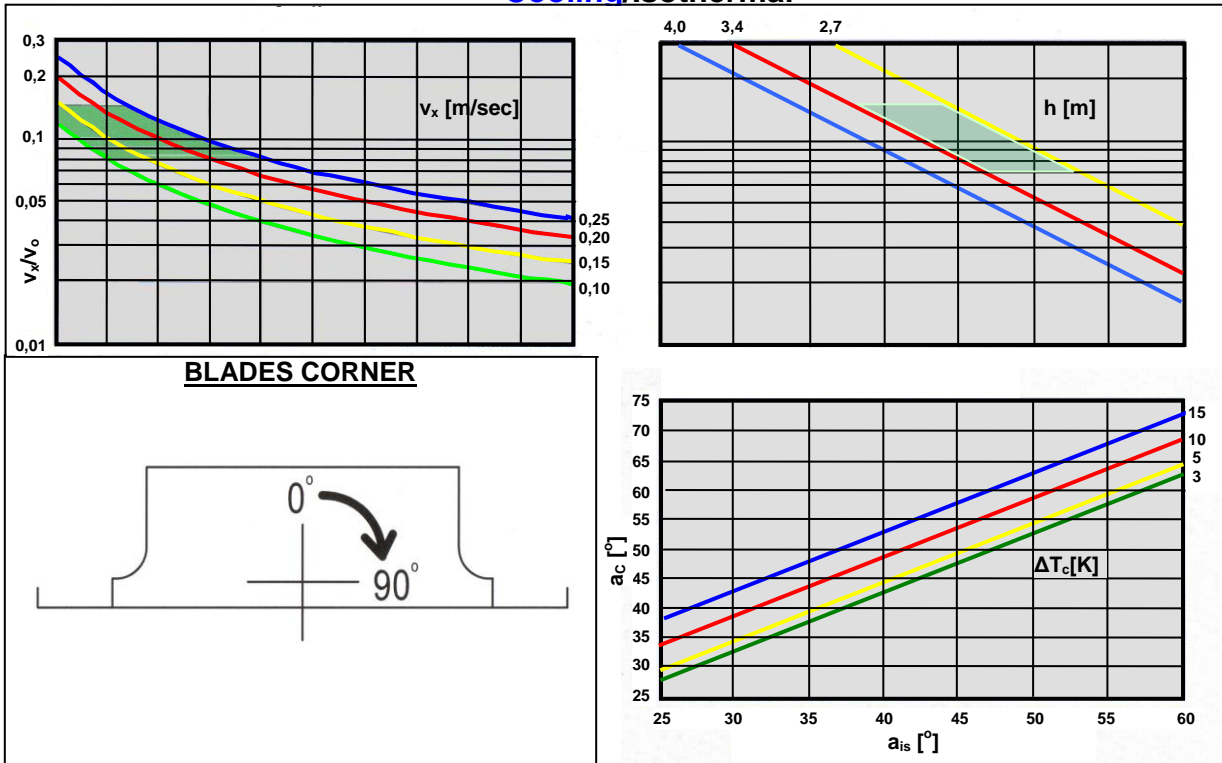


Heating



VALUES	
T_h	= _____ [°C]
T_{rh}	= _____ [°C]
T_c	= _____ [°C]
T_{rc}	= _____ [°C]
ΔT_h	= _____ [K]
ΔT_c	= _____ [K]
V_{room}	= _____ [m³/h]
V_{sup}	= _____ [m³/h]
n	= _____ [pcs]
h	= _____ [m]
a	= _____ [m]
v_x	= _____ [m/sec]
v_o	= _____ [m/sec]

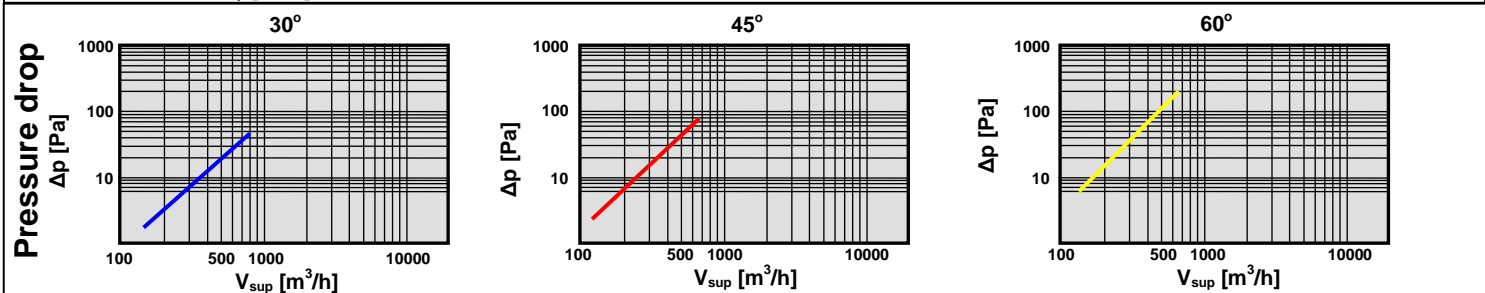
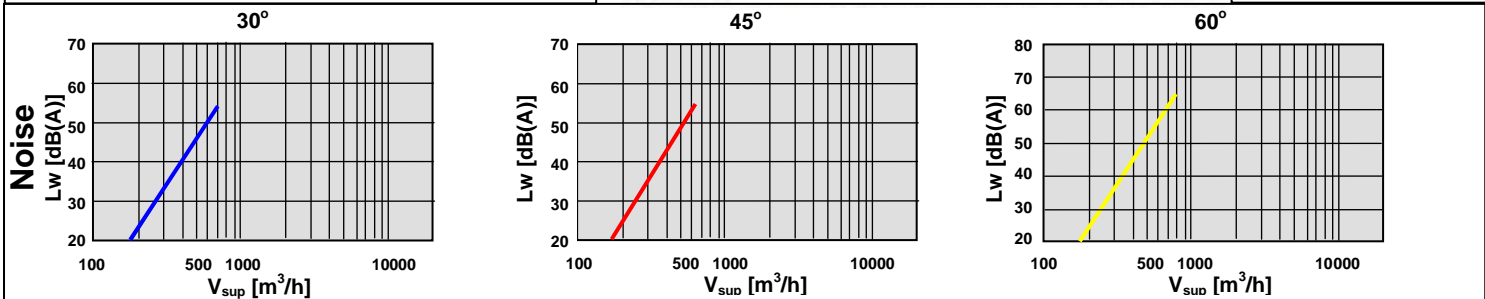
Cooling/Isothermal



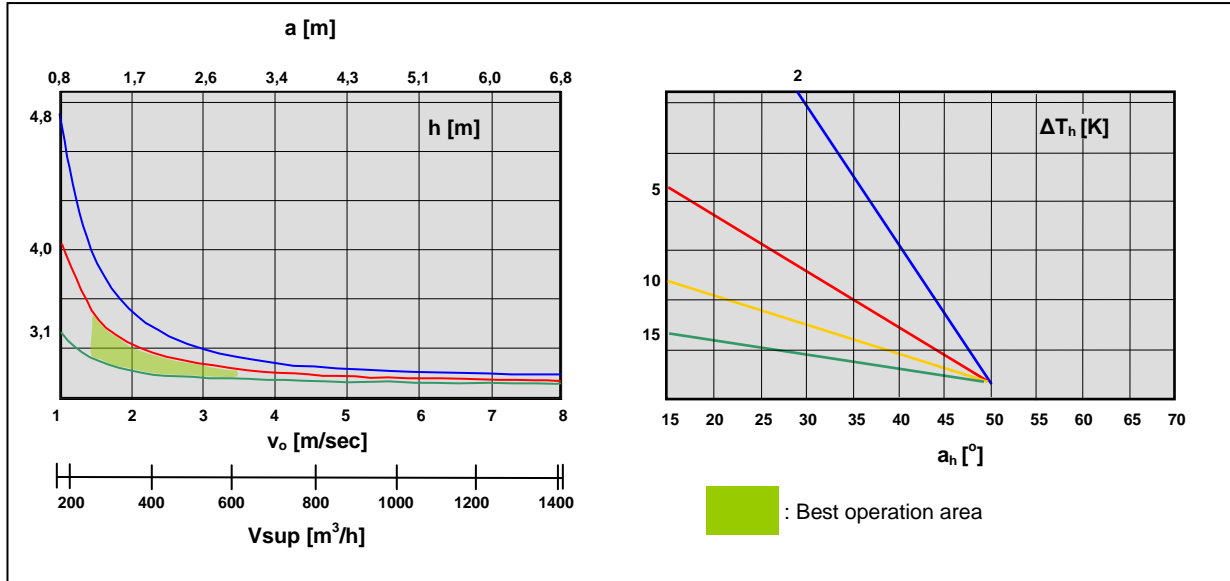
v_x/v_o	= _____
a_h	= _____ [°]
a_{is}	= _____ [°]
a_c	= _____ [°]
Δp_h	= _____ [Pa]
Δp_{is}	= _____ [Pa]
Δp_c	= _____ [Pa]
Lw_h	= _____ [dB(A)]
Lw_{is}	= _____ [dB(A)]
Lw_c	= _____ [dB(A)]

USEFUL EQUATIONS

$\Delta T_h = T_h - T_{rh}$ [K]
 $\Delta T_c = T_{rc} - T_c$ [K]
 $n = V_{room} / V_{sup}$ [pcs]



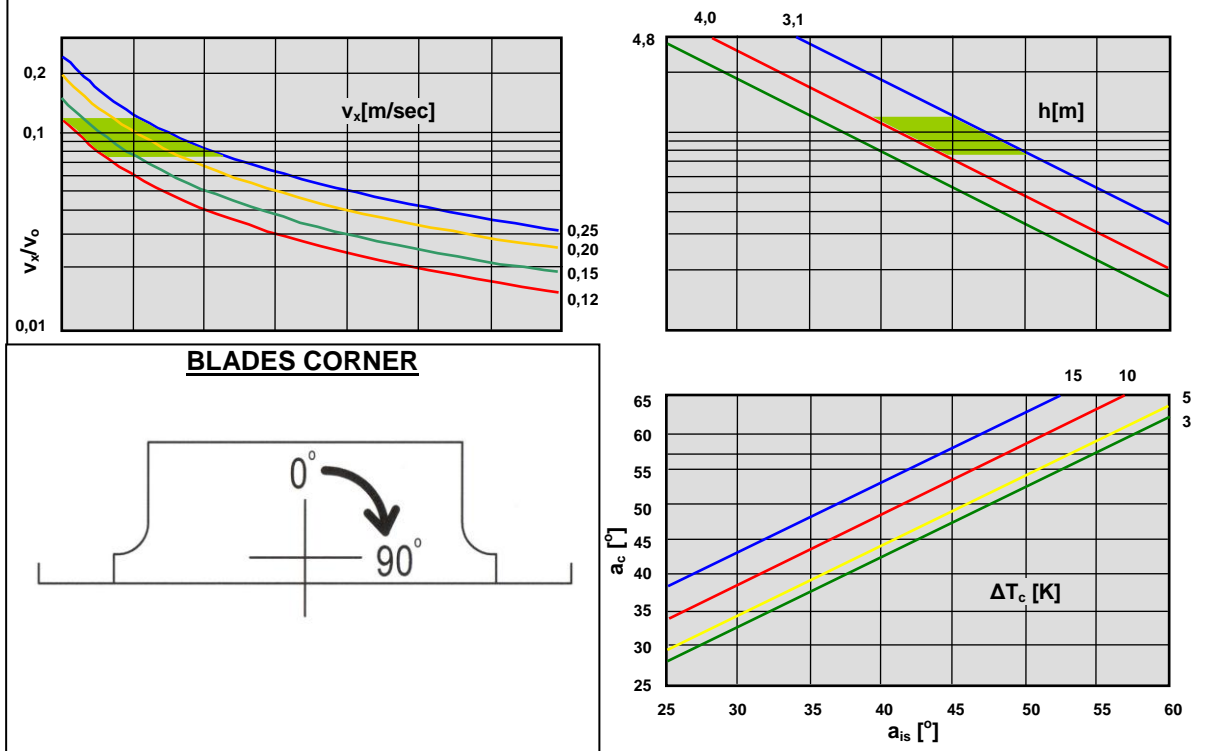
Heating



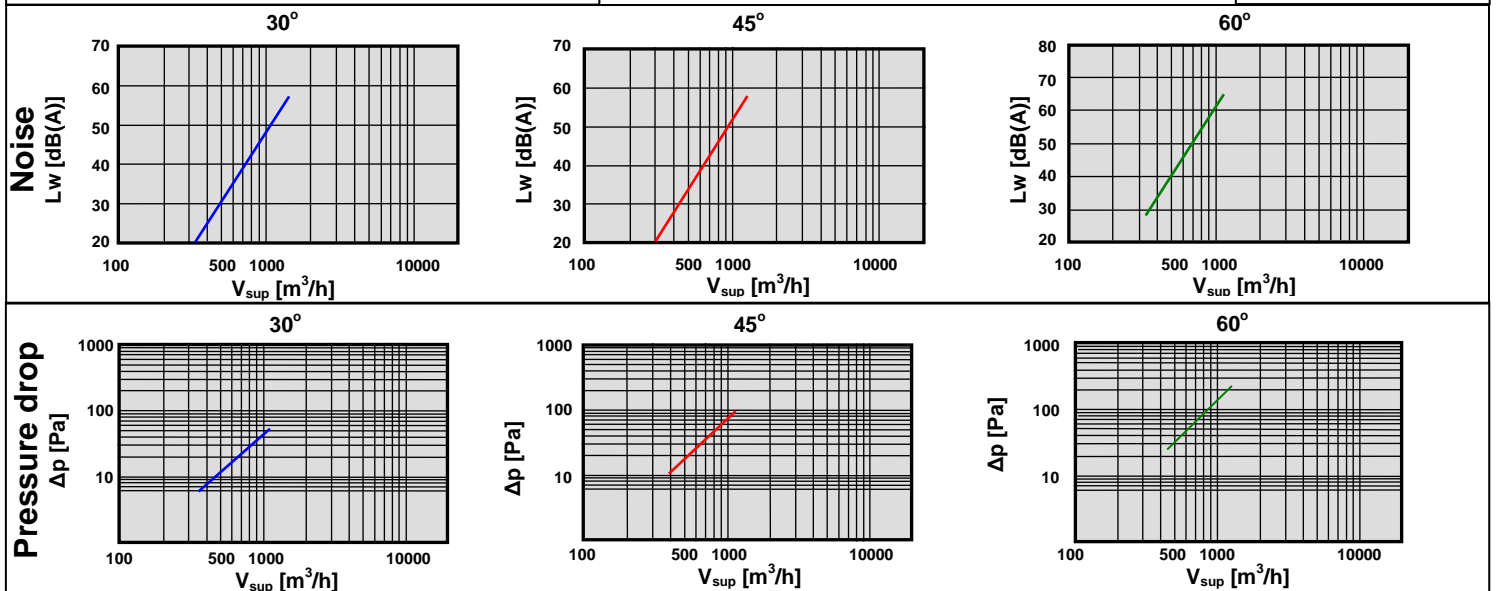
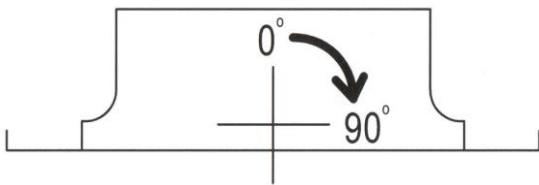
VALUES

- $T_h = \underline{\hspace{2cm}}$ [°C]
 - $T_{rh} = \underline{\hspace{2cm}}$ [°C]
 - $T_c = \underline{\hspace{2cm}}$ [°C]
 - $T_{rc} = \underline{\hspace{2cm}}$ [°C]
 - $\Delta T_h = \underline{\hspace{2cm}}$ [K]
 - $\Delta T_c = \underline{\hspace{2cm}}$ [K]
 - $V_{room} = \underline{\hspace{2cm}}$ [m³/h]
 - $V_{sup} = \underline{\hspace{2cm}}$ [m³/h]
 - $n = \underline{\hspace{2cm}}$ [pcs]
 - $h = \underline{\hspace{2cm}}$ [m]
 - $a = \underline{\hspace{2cm}}$ [m]
 - $v_x = \underline{\hspace{2cm}}$ [m/sec]
 - $v_o = \underline{\hspace{2cm}}$ [m/sec]
 - $v_x/v_o = \underline{\hspace{2cm}}$
 - $\alpha_h = \underline{\hspace{2cm}}$ [°]
 - $\alpha_{is} = \underline{\hspace{2cm}}$ [°]
 - $\alpha_c = \underline{\hspace{2cm}}$ [°]
 - $\Delta p_h = \underline{\hspace{2cm}}$ [Pa]
 - $\Delta p_{is} = \underline{\hspace{2cm}}$ [Pa]
 - $\Delta p_c = \underline{\hspace{2cm}}$ [Pa]
 - $Lw_h = \underline{\hspace{2cm}}$ [dB(A)]
 - $Lw_{is} = \underline{\hspace{2cm}}$ [dB(A)]
 - $Lw_c = \underline{\hspace{2cm}}$ [dB(A)]
- #### USEFUL EQUATIONS
- $\Delta T_h = T_h - T_{rh}$ [K]
 - $\Delta T_c = T_{rc} - T_c$ [K]
 - $n = V_{room} / V_{sup}$ [pcs]

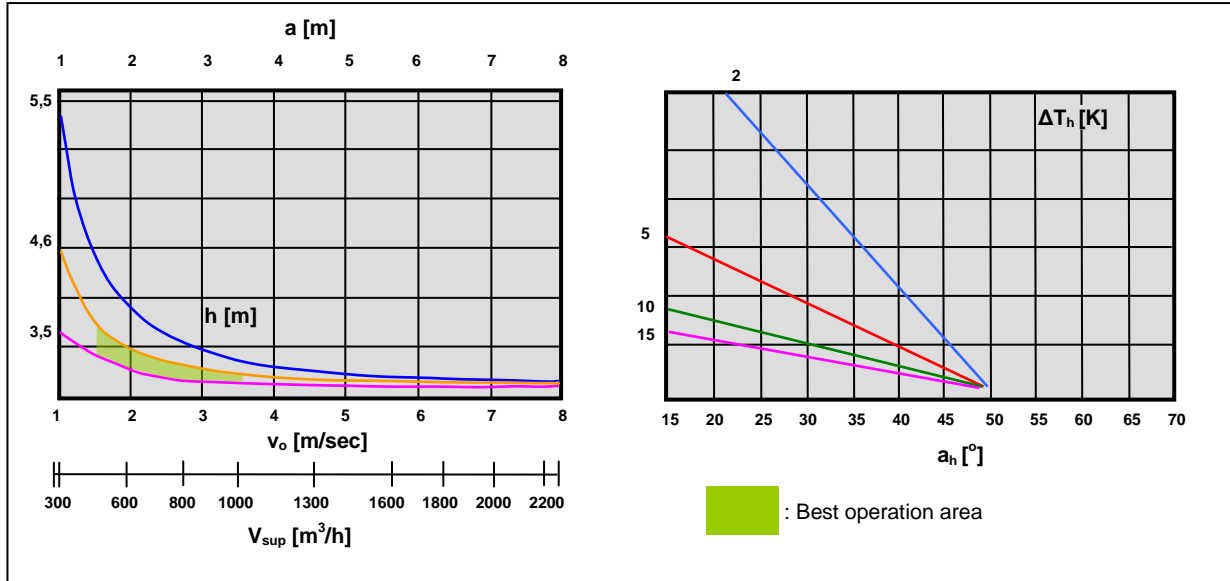
Cooling/Isothermal



BLADES CORNER



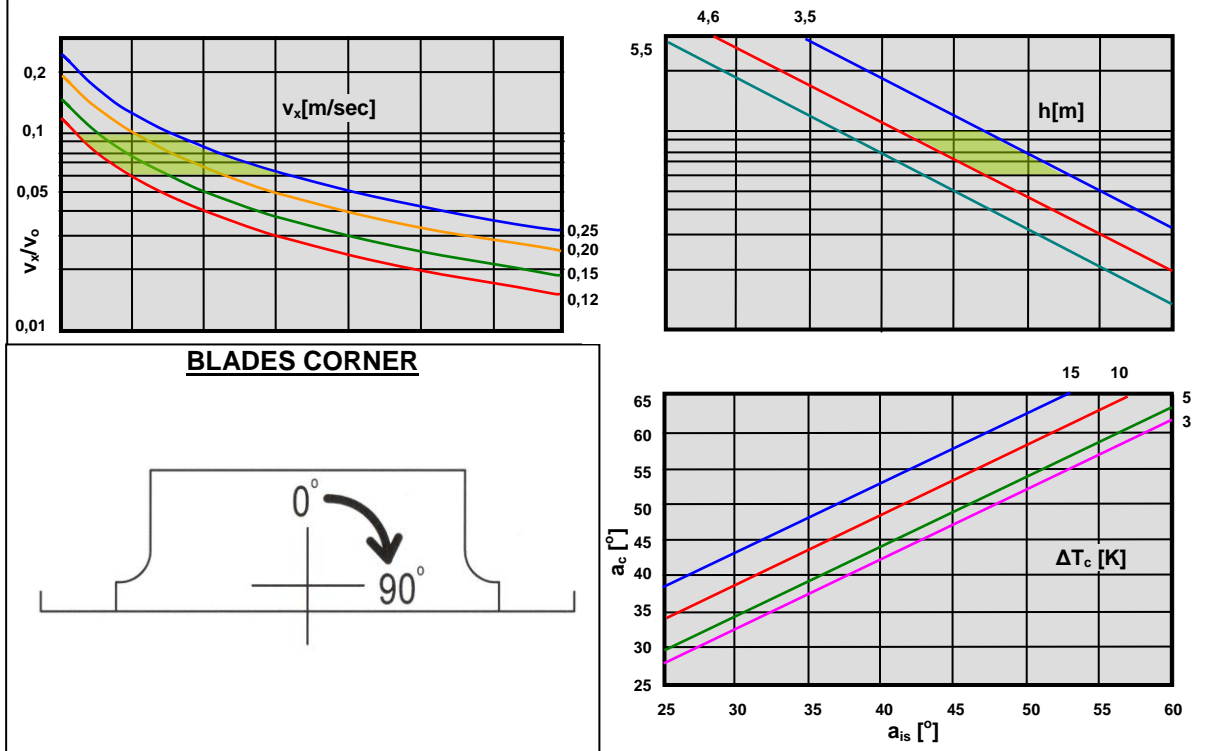
Heating



VALUES

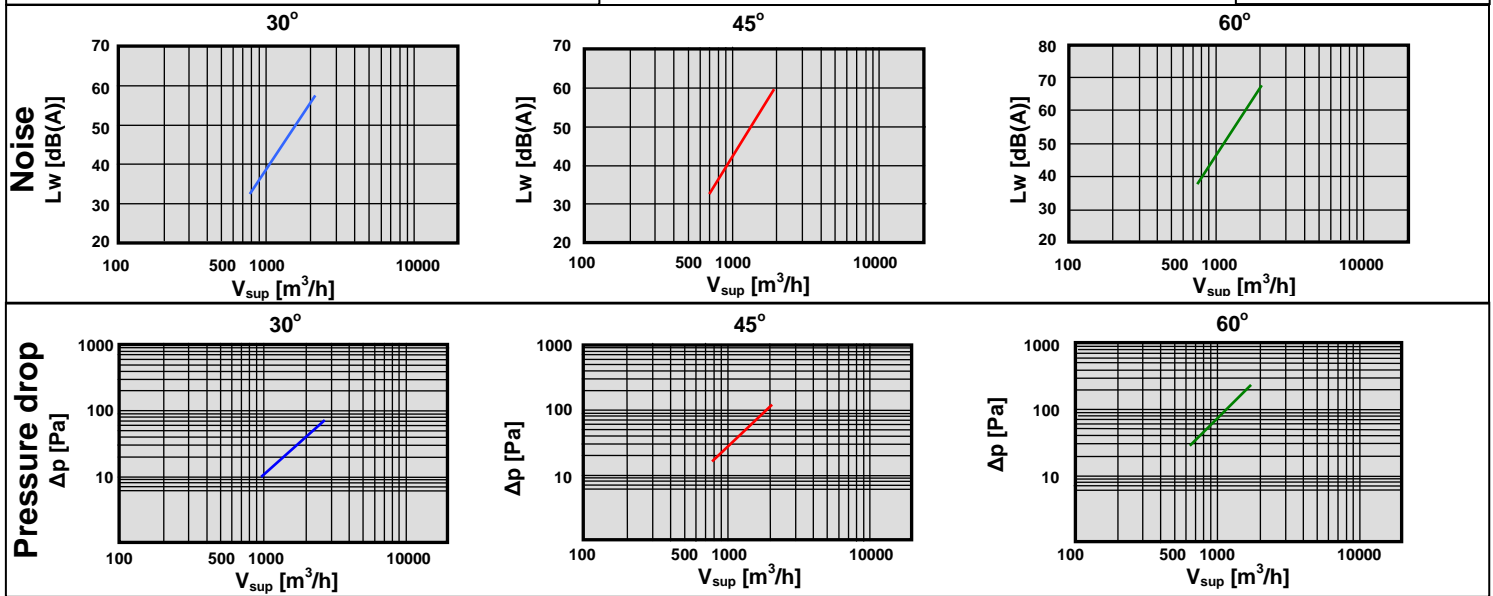
- $T_h = \underline{\hspace{2cm}}$ [°C]
- $T_{rh} = \underline{\hspace{2cm}}$ [°C]
- $T_c = \underline{\hspace{2cm}}$ [°C]
- $T_{rc} = \underline{\hspace{2cm}}$ [°C]
- $\Delta T_h = \underline{\hspace{2cm}}$ [K]
- $\Delta T_c = \underline{\hspace{2cm}}$ [K]
- $V_{room} = \underline{\hspace{2cm}}$ [m³/h]
- $V_{sup} = \underline{\hspace{2cm}}$ [m³/h]
- $n = \underline{\hspace{2cm}}$ [pcs]
- $h = \underline{\hspace{2cm}}$ [m]
- $a = \underline{\hspace{2cm}}$ [m]
- $v_x = \underline{\hspace{2cm}}$ [m/sec]
- $v_o = \underline{\hspace{2cm}}$ [m/sec]

Cooling/Isothermal

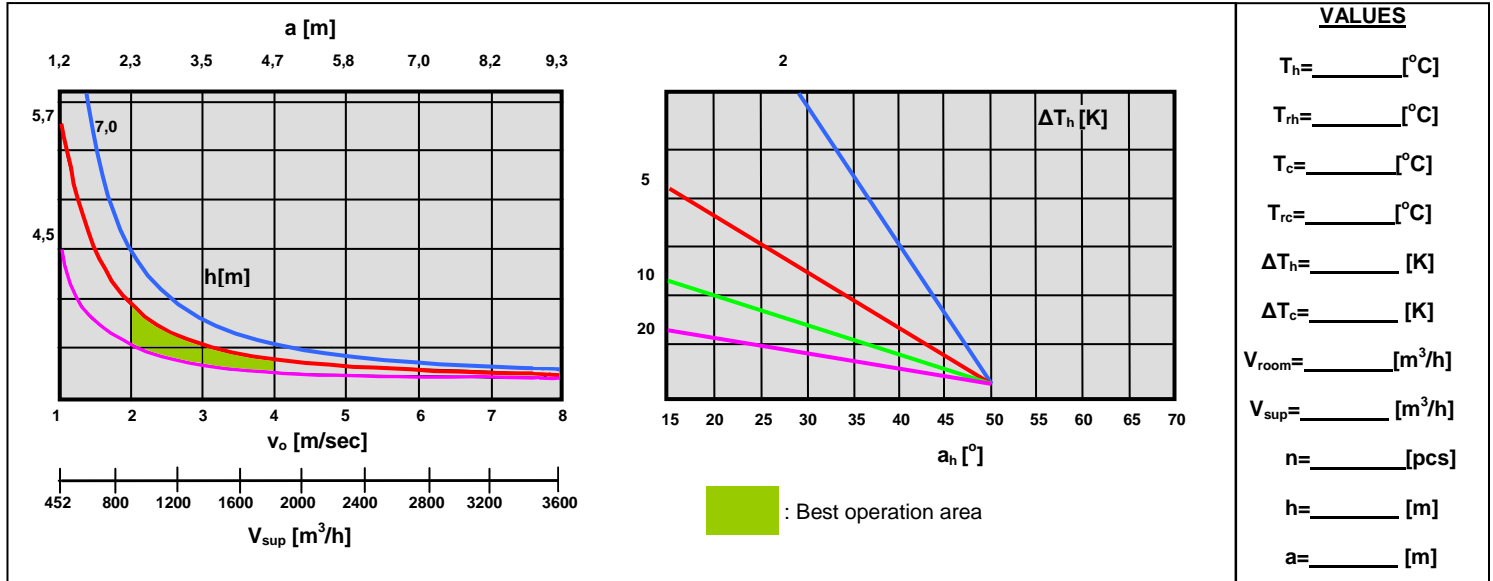


USEFUL EQUATIONS

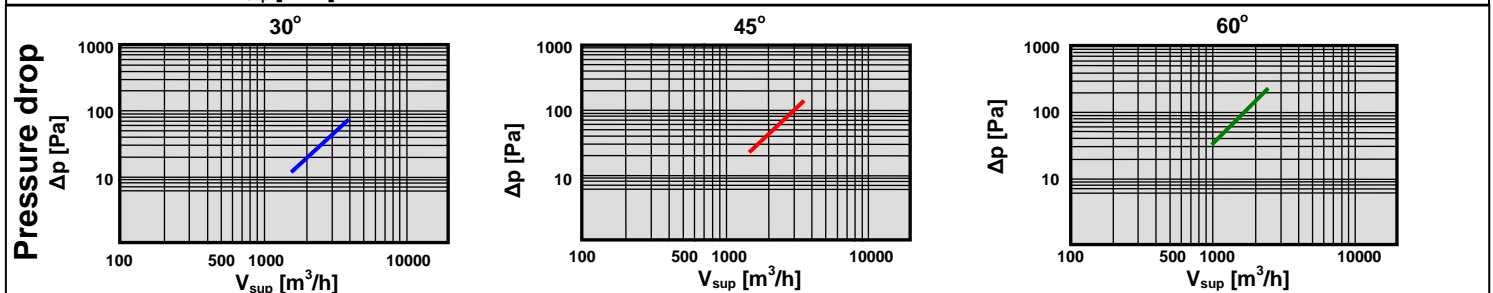
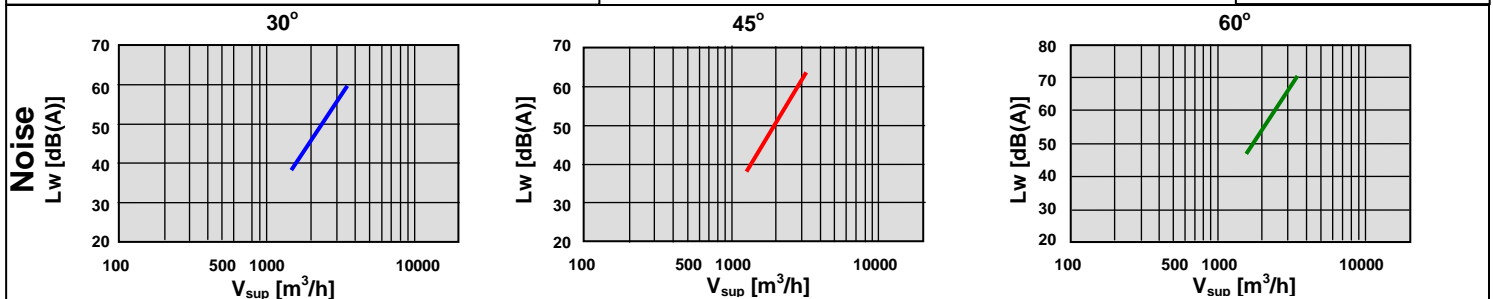
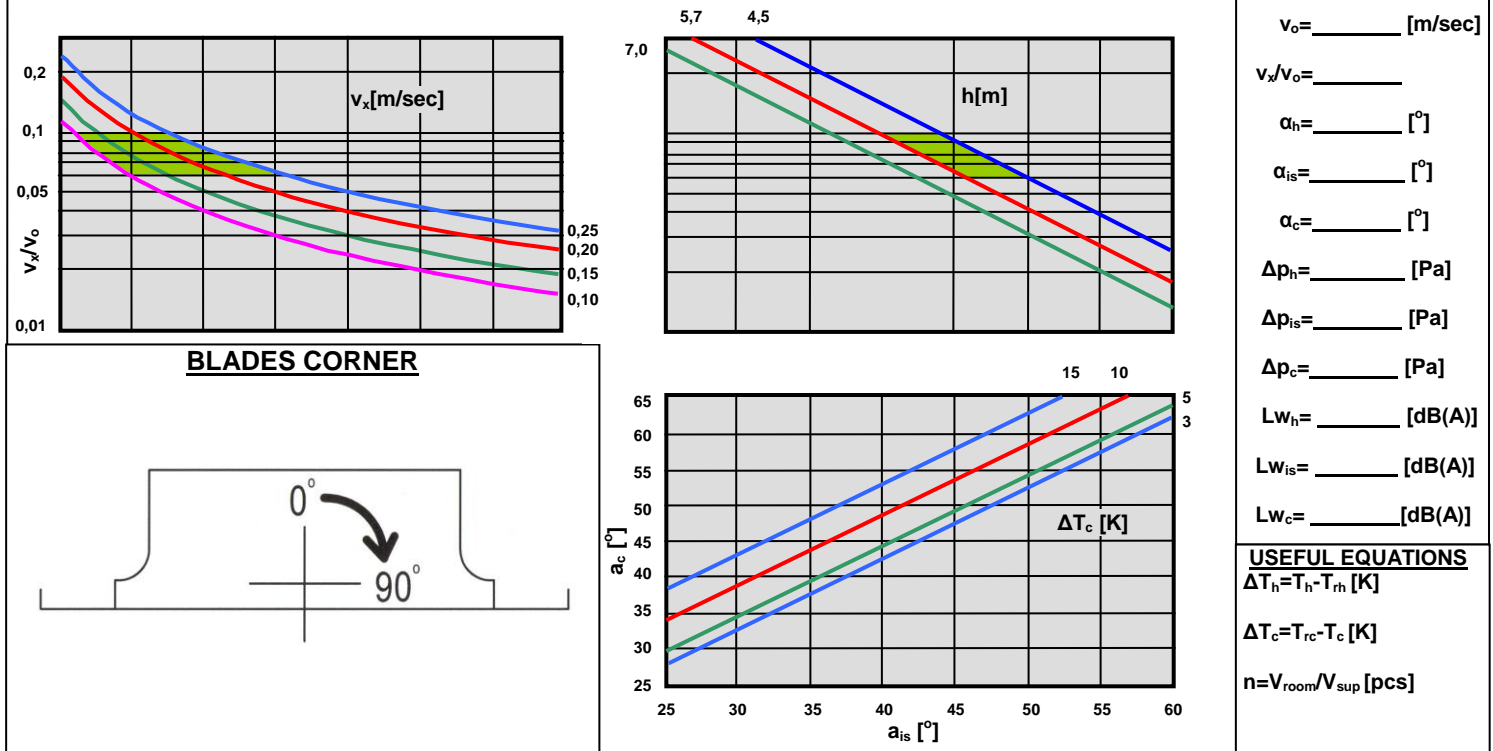
- $\Delta T_h = T_h - T_{rh}$ [K]
- $\Delta T_c = T_{rc} - T_c$ [K]
- $n = V_{room} / V_{sup}$ [pcs]



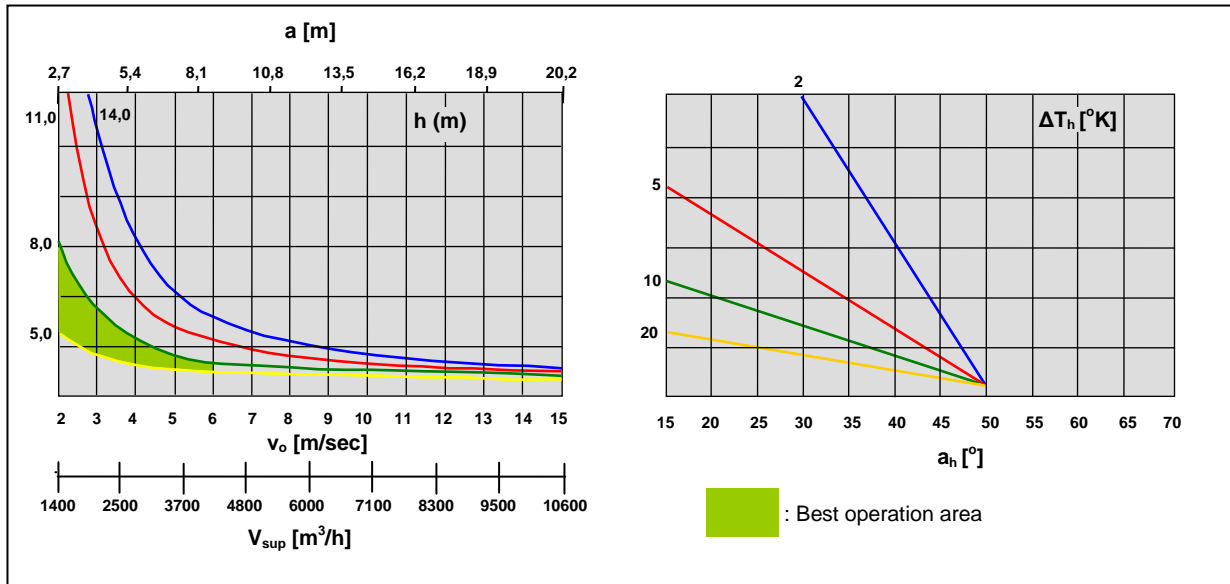
Heating



Cooling/Isothermal



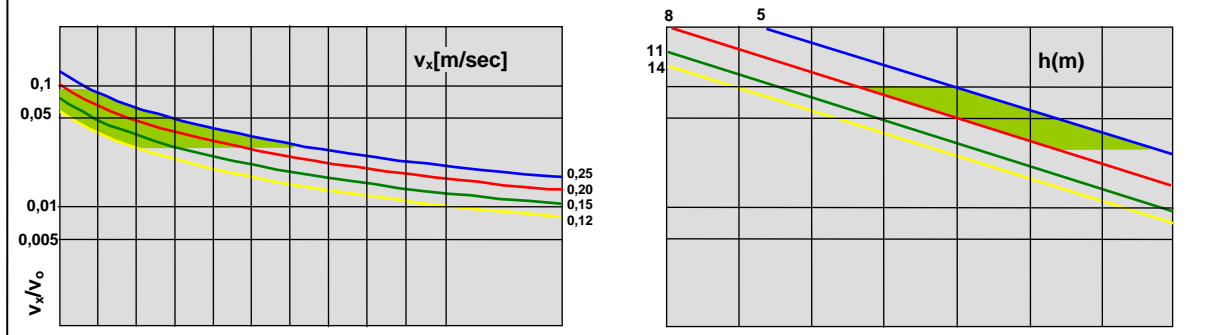
Heating



VALUES

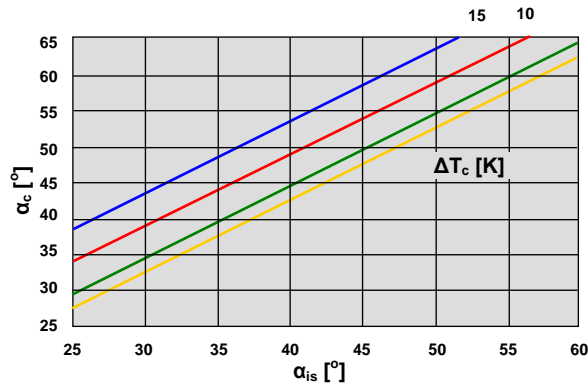
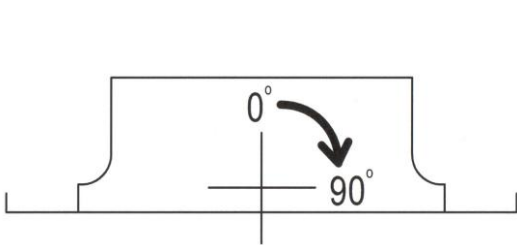
$T_h = \underline{\hspace{2cm}} [^{\circ}C]$
 $T_{rh} = \underline{\hspace{2cm}} [^{\circ}C]$
 $T_c = \underline{\hspace{2cm}} [^{\circ}C]$
 $T_{rc} = \underline{\hspace{2cm}} [^{\circ}C]$
 $\Delta T_h = \underline{\hspace{2cm}} [K]$
 $\Delta T_c = \underline{\hspace{2cm}} [^{\circ}K]$
 $V_{room} = \underline{\hspace{2cm}} [m^3/h]$
 $V_{sup} = \underline{\hspace{2cm}} [m^3/h]$
 $n = \underline{\hspace{2cm}} [pcs]$
 $h = \underline{\hspace{2cm}} [m]$
 $a = \underline{\hspace{2cm}} [m]$
 $v_x = \underline{\hspace{2cm}} [m/sec]$
 $v_o = \underline{\hspace{2cm}} [m/sec]$

Cooling/Isothermal



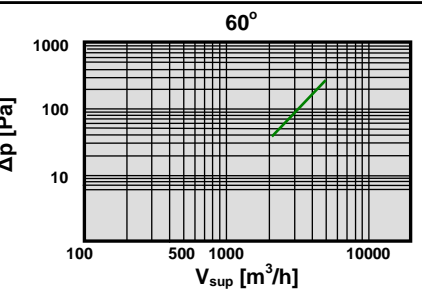
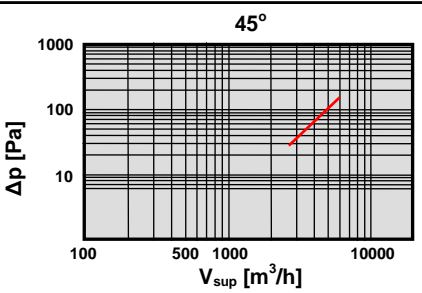
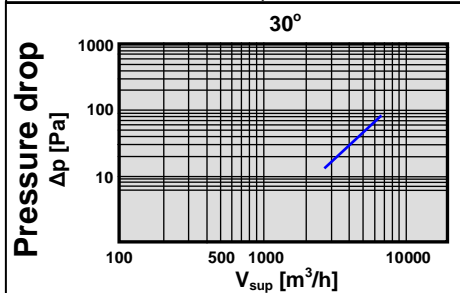
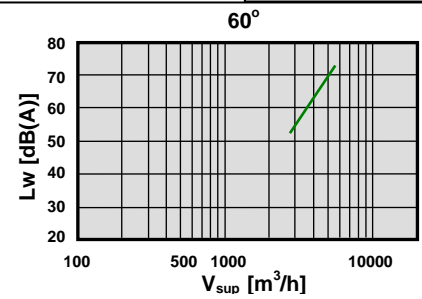
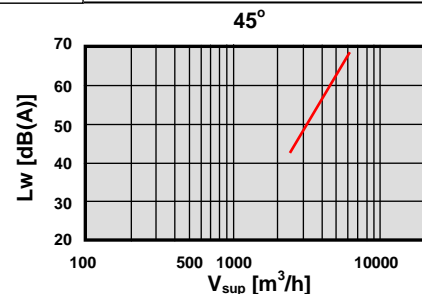
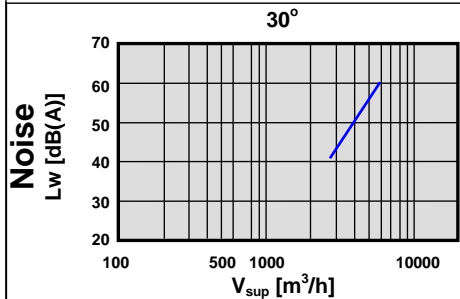
$\Delta p_h = \underline{\hspace{2cm}} [Pa]$
 $\Delta p_{is} = \underline{\hspace{2cm}} [Pa]$
 $\Delta p_c = \underline{\hspace{2cm}} [Pa]$
 $Lw_h = \underline{\hspace{2cm}} [dB(A)]$
 $Lw_{is} = \underline{\hspace{2cm}} [dB(A)]$
 $Lw_c = \underline{\hspace{2cm}} [dB(A)]$

BLADES CORNER



USEFUL EQUATIONS

$\Delta T_h = T_h - T_{rh} [^{\circ}K]$
 $\Delta T_c = T_{rc} - T_c [^{\circ}K]$
 $n = V_{room} / V_{sup} [pcs]$



BLADES CORNER ADJUSTEMENT WITH ELECTRIC ACTUATOR



There are two types of electric actuators, which are used to adjust the blades corner (for diameter Ø250 and up): On-off (2 point) or analogue. The on-off actuators allow us through a switch who gives or interrupts the electric power in the contact No 3, to put the blades in two different corners (cooling-heating) calculated by the diagrams of the previous pages. The analogue actuators allow us, through a 0-10V potentiometer connected in the contact No 3, to adjust the blades corner in any position between 2 corners limits (cooling-heating) calculated by diagrams of the previous pages. In the analogue actuators the signal of the contact No 5 is used to read the actuator position (position feedback).

For the electric actuators:

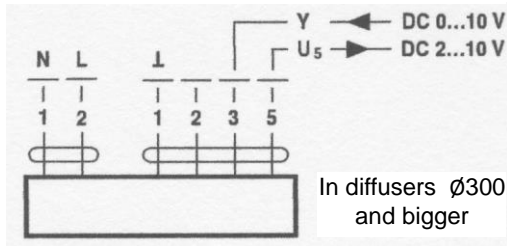
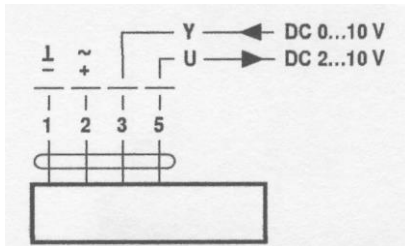
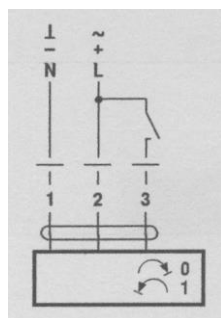
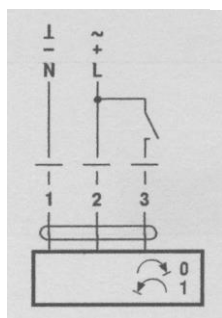
Max. Temperature: 50°C, Max. Relative Humidity: 95%

AC 220V ON-OFF

AC/DC 24V ON-OFF:

AC/DC 24V ANALOGUE

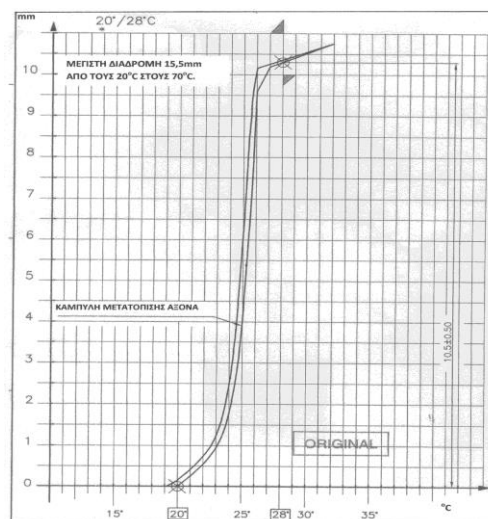
AC 220V ANALOGUE



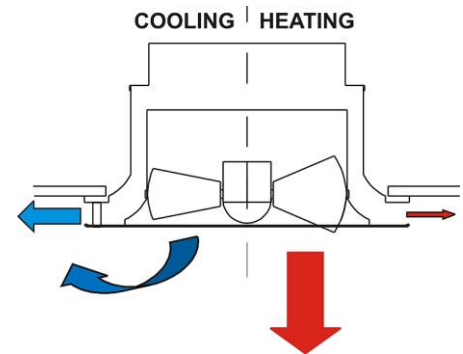
AUTOMATIC BLADES ADJUSTMENT WITH THERMAL ACTUATOR



The automatic blades adjustment is achieved through a mechanism, which moves an axis, according to the supply air temperature. This movement is intense in the temperature area of 20-28°C, and very small outside this area. Considering that the supply air temperature is usually less than 20°C in cooling and more than 28°C in heating we can use this phenomenon with a proper motion transmission mechanism to adjust automatically the blades corner in the values calculated by the diagrams of the previous pages. Not for size 630.



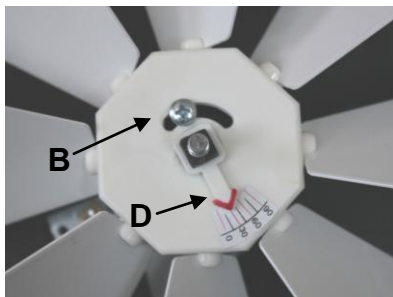
MLD-DW



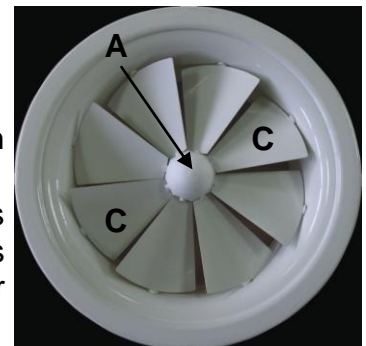
In the MLD type swirl diffuser while the blades are being closed the pressure drop and the noise increase, because the free surface of the diffuser decreases. So, the pressure drop and the noise in cooling are higher than heating. This takes place too little in the MLD-DW type, because of its double wall design, while at the same time the vertical throw in heating is not affected (so long as the blades are in a little more vertical position than the blades of simple MLD).

In heating the blades are near to the vertical position, so the air flow doesn't meet too much resistance during exiting the diffuser. A little amount of air leaks from the side of the diffuser through the double wall. In cooling, when the blades are being closed the air flow meets much resistance, so an important part of its amount leaks from the side of the diffuser through the double wall, therefore the air exiting velocity is lower in the cooling (in comparison with the simple MLD). So the pressure drop, the noise and the air velocity in the occupied zone are lower.

GUIDELINES FOR THE MANUAL DIFFUSER ADJUSTMENT

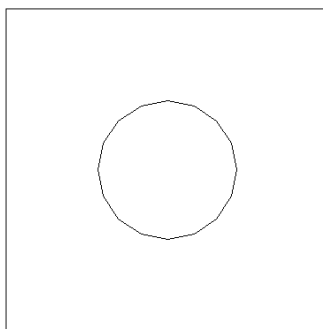


- We unscrew and remove the hemispherical cup **(A)** in the centre of the diffuser.
- We unscrew a little the screw **(B)** which is into the "C" shaped slot.
- We rotate an opposite positioned blades pair **(C)** to adjust the corner of all the blades in the desired value (We see the corner with the arrow **(D)**).



- We tight the screw **(B)** to fix the blades in the desired position.
- We screw again the cup **(A)**.

MLD(-DW) IN PLATE SPR



SPR

When we want to install the diffusers MLD, MLD-DW in false ceiling with dimensions 600X600 mm we can use the plate SPR.

SPR is a steel plate with thickness 1mm and outside dimensions 595X595mm with round hole in the center for diffuser installation. The plate and the diffuser are electrostatically painted in RAL color.

Possible nominal diffuser dimensions for installation in SPR:

- For MLD: 200, 250, 300, 350, 400, 450.
- For MLD-DW: 200, 250, 300, 350, 400.