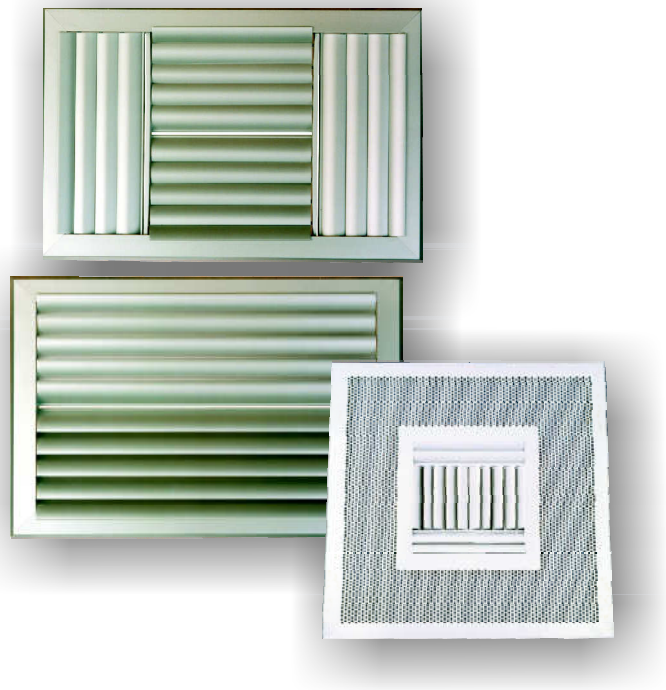
INDEX



GENERAL FEATURES

Air terminal devices of series OK are ceiling grilles (diffusers) with adjustable blades. They are manufactured in four different types :

-OK1: air discharge towards one direction

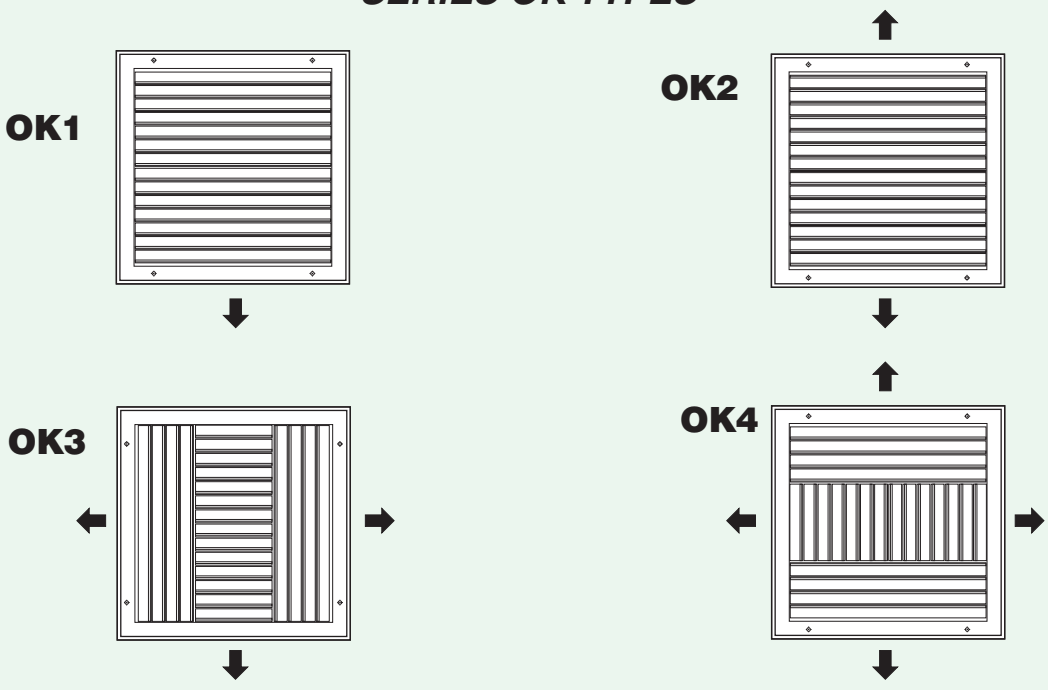
-OK2: air discharge towards two directions

-OK3: air discharge towards three directions

-OK4: air discharge towards four directions

Air grilles of series OK are used for air supply in low-height rooms of up to 5 m height. They may also be used for return air applications. Their blades are adjustable allowing for air jet regulation. They may be equipped with volume flow regulating dampers of D series. Their blades can be bridged making air jet adjustment easier. They are manufactured at any size, however their usual dimensions are shown in the table of p. OK2.
Anodized aluminum profile of 12 μm anodic depth is used for their construction, providing long life. Alternatively, electrostatic painting in a variety of colors is available.
Their general configuration is shown in the next figure, while their dimensions are given in the figure of page OK2.

SERIES OK TYPES



CEILING GRILLES SERIES OK - DIMENSIONS

The dimensions of the grilles of series OK are shown in the following figure. For selection and ordering purposes their nominal opening dimensions AXB are used.

FOUR DIRECTIONS DISCHARGE GRILLE -OK4-

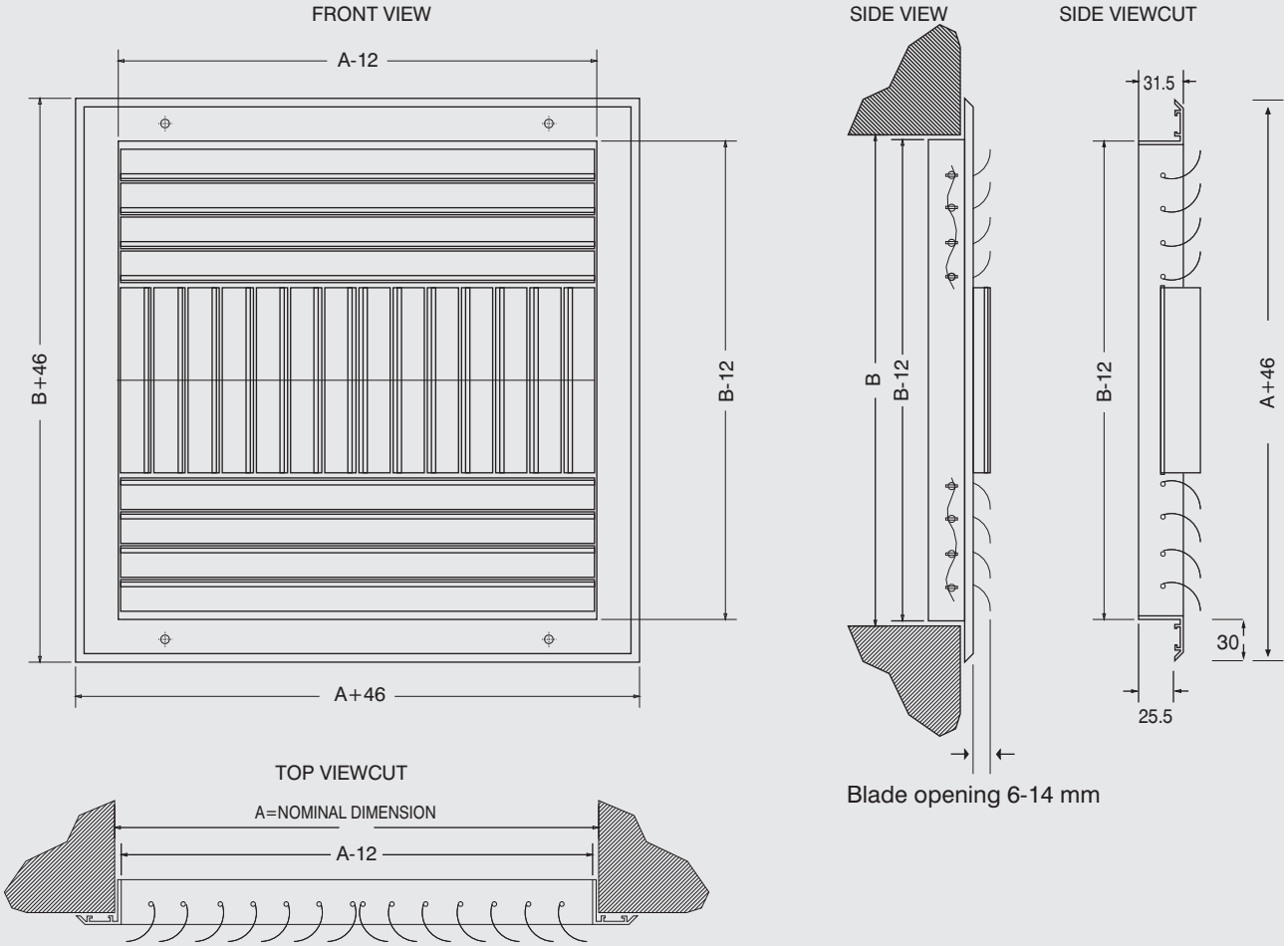


Table of most common nominal dimensions of series OK ceiling grilles (shaded areas).

W[cm] \ H[cm]	15	20	25	30	35	40	45	50	55	60	70	80	90	100
15	■	■	■	■	■	■	■	■	■	■				
20	■	■	■	■	■	■	■	■	■	■	■	■		
25	■	■	■	■	■	■	■	■	■	■	■	■	■	■
30	■	■	■	■	■	■	■	■	■	■	■	■	■	■
35	■	■	■	■	■	■	■	■	■	■	■	■	■	■
40	■	■	■	■	■	■	■	■	■	■	■	■	■	■
45	■	■	■	■	■	■	■	■	■	■	■	■	■	■
50	■	■	■	■	■	■	■	■	■	■	■	■	■	■
55	■	■	■	■	■	■	■	■	■	■	■	■	■	■
60	■	■	■	■	■	■	■	■	■	■	■	■	■	■
70		■	■	■	■	■	■	■	■	■	■	■	■	■
80		■	■	■	■	■	■	■	■	■	■	■	■	■
90			■	■	■	■	■	■	■	■	■	■	■	■
100			■	■	■	■	■	■	■	■	■	■	■	■

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Shape of the air jet

Possible air jet configurations using OK series grilles are shown in figures 1&2. The blades of the grilles are adjustable, allowing for jet modification to either vertical direction (when used for heating of spaces having large height) or horizontal direction parallel to the ceiling (when used for cooling). All intermediate jet direction configurations may be accomplished through adequate blade positioning. In case of horizontal air discharge, the air jet upon meeting an obstacle (e.g. wall), or another air jet, forms a downflow air stream - see figure 2 -.

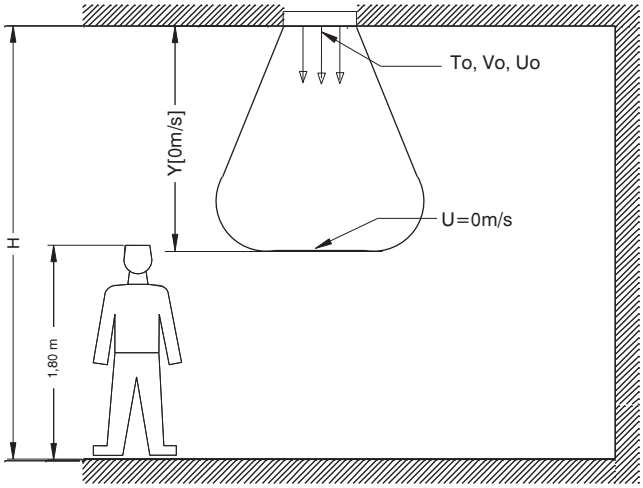

Figure 1. Vertical air jet direction - heating mode

Selection of series OK grilles

While selecting grilles of OK series it is important that the air jet conditions at distance Y from the ceiling are within specifications (e.g. CEN-CR-1752).
For the selection of OK series ceiling grilles the diagrams of pages OK4 ÷ OK15 are used. The grilles' selection is based on their equivalent diameter. The equivalent diameter can be found for each grille type from the corresponding tables. For grille types of more than one air jet directions the air volume flow towards each direction is not the same and can be estimated using the relevant tables.
The selection diagrams provide data for the following parameters:

- Throw of the air jet
- Air velocity along the jet centerline
- Air velocity along the jet centerline for downflow jets resulting either from two impinging jets or from a jet impinging on the wall.
- Pressure drop
- Mean air velocity at the grille
- Noise
- Temperature at the jet centerline

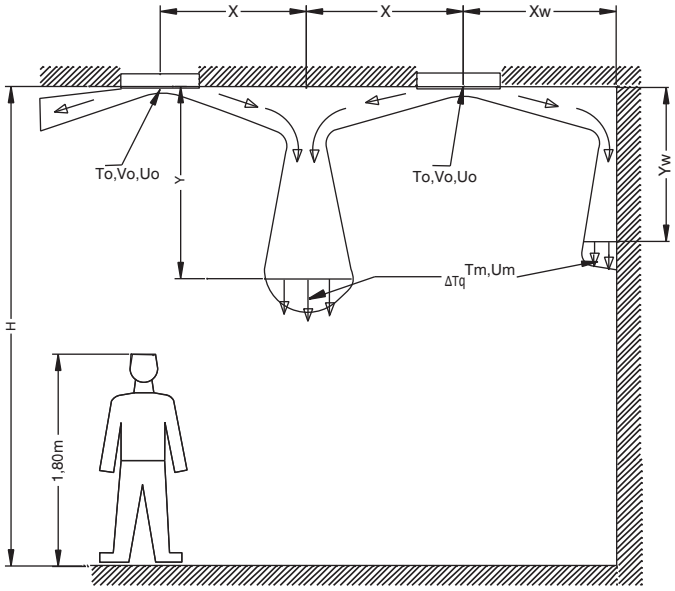

Figure 2. Horizontal air jet direction - cooling mode

For return air applications using OK series grilles the diagrams of pages OK4 ÷ OK15 may be used for the estimation of the required pressure drop. The resulting noise should be reduced by 7,5 dBA. The recommended noise levels to be used for grille selection are the following:

Sound rooms, libraries, studios	under 30dBA
Offices, homes, hospital rooms, churches, hotel rooms, theaters	25 to 35dBA
Public buildings, restaurants, public places, banks	30 to 40dBA
Factories, gyms, shops, etc	35 to 50dBA

The values are indicative and may not represent every case

Nomenclature

Vo[m^3/h]: Air volume flow
Um [m/s]: Air jet centerline velocity at distance Y or Ym from the ceiling
Uo [m/s]: Air velocity at the grille
D_{eq} [m]: Grille equivalent diameter
X,Xw [m] : Half of the horizontal distance between grilles, or horizontal distance between the grille and the wall, respectively
Y,Yw [m] : Vertical distance from the ceiling for impinging air jets or jet impinging to a wall, respectively
H [m]: Room height
ΔP [Pa]: Pressure drop
N [dBA]: Noise level
ΔT_q : Temperature difference ratio ΔT_q = (Tm Tr)/(To Tr)
To [°C] : Air inlet temperature
Tm [°C] : Air jet temperature at distance Y or Ym from the ceiling
Tr [°C] : Return air temperature
B [m] : Air throw (distance from the grille where the air jet has a velocity of 0,5 m/s)

CEILING GRILLES - SERIES OK1 - quick selection

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Selection example

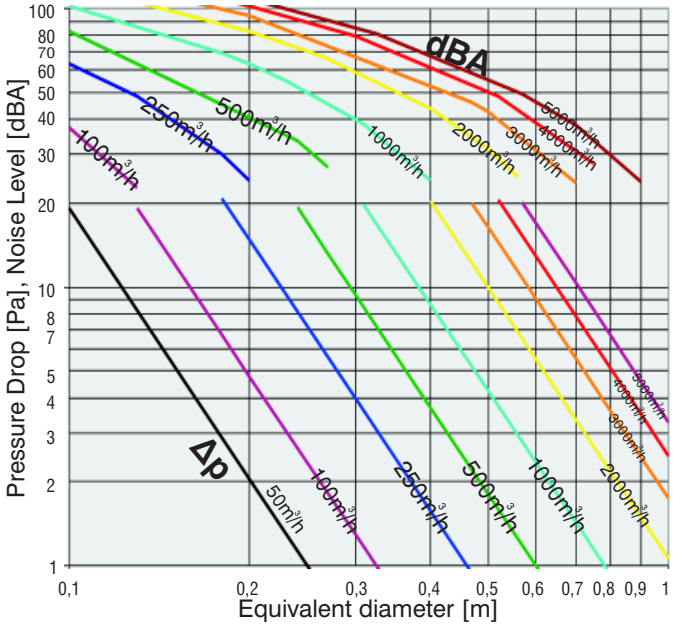
For an office to be properly ventilated 5000 m³/h of air are required. with acceptable noise level of 35 dBA. What is the appropriate size of type OK1 grilles to cover the previous need?

From the noise level diagram for throw parallel to the ceiling one may find that by using five identical OK1 grilles with 1000 m³/h air flow each, the equivalent diameter of the grilles should be larger or equal to D_{eq}=0,5 m. Thus, from the adjacent table it is obvious that one may select grilles of dimensions 45X45 or 40X50 or 80X25. For these grilles the operational data are the following :
Pressure drop Δp around 14 Pa, Air velocity at the grille around Uo=3,5 m/s, Air throw B of around 8 m (free jet parallel to the ceiling).
If the same grilles are to be used for vertical air throw - blades at 14mm position - then the noise level N decreases to below 20 dBA and pressure drop Δp to 4 Pa.

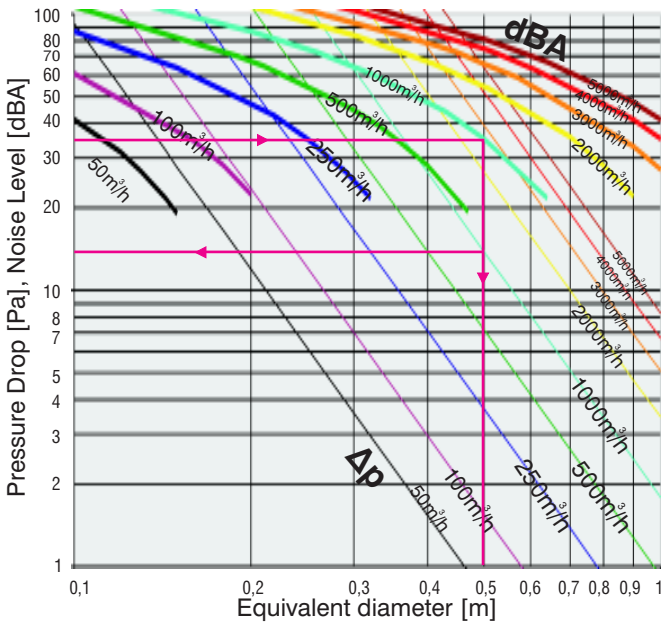
	15	20	25	30	35	40	45	50	60	70	80	90	100
15	17	20	22	24	26	28	29	31	34				
20	20	23	25	28	30	32	34	36	39	42	45		
25	22	25	28	31	33	36	38	40	44	47	50	54	56
30	24	28	31	34	37	39	41	44	48	52	55	59	62
35	26	30	33	37	40	42	45	47	52	56	60	63	67
40	28	32	36	39	42	45	48	50	55	60	64	68	71
45	29	34	38	41	45	48	51	54	59	63	68	72	76
50	31	36	40	44	47	50	54	56	62	67	71	76	80
60	34	39	44	48	52	55	59	62	68	73	78	83	87
70		42	47	52	56	60	63	67	73	79	84	90	94
80		45	50	55	60	64	68	71	78	84	90	96	101
90			54	59	63	68	72	76	83	90	96	102	107
100			56	62	67	71	76	80	87	94	101	107	113

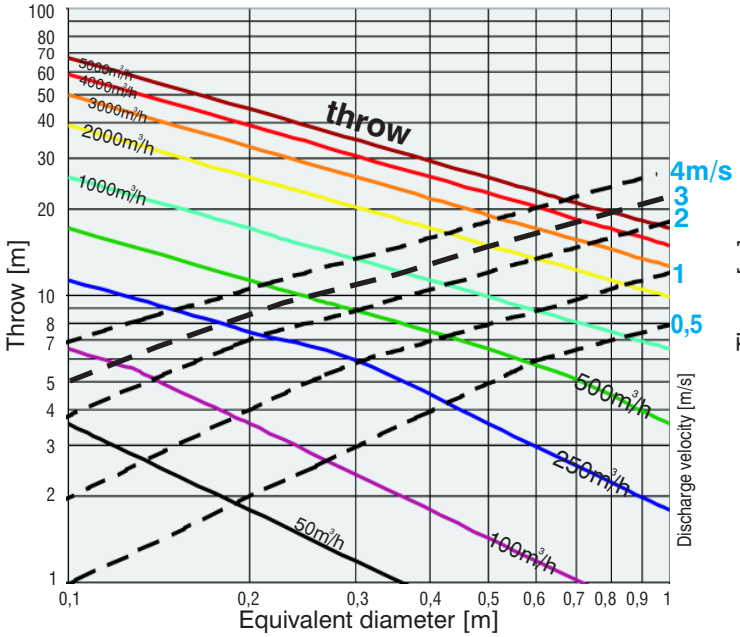
(Dimensions in cm)

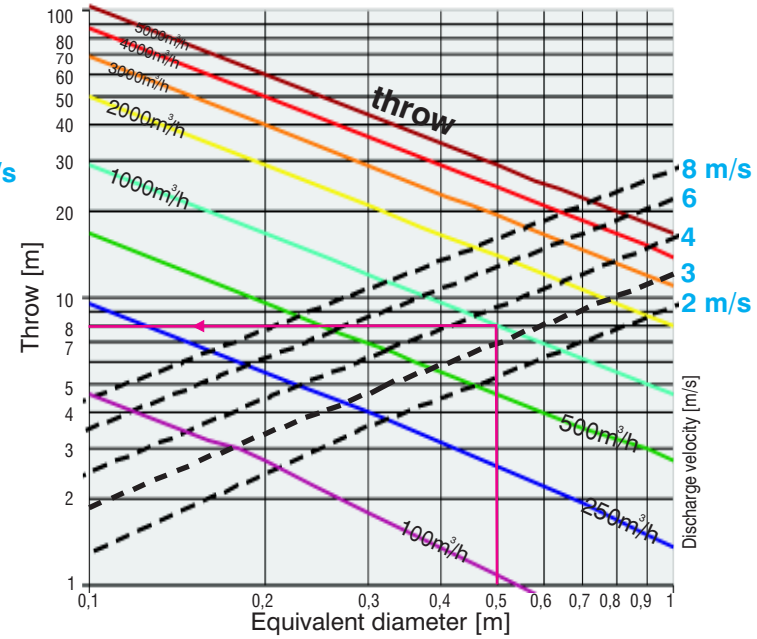
Vertical throw blades at 14mm position



Throw parallel to the ceiling blades at 8 mm position -







Selection example

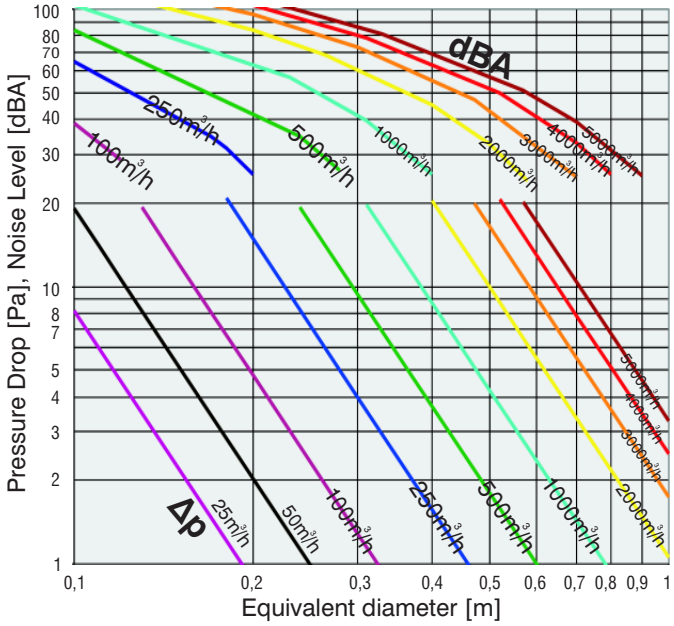
For an office to be properly ventilated 5000 m³/h of air are required with acceptable noise level of 35 dBA. What is the appropriate size of type OK2 grilles to cover the previous need?

From the noise level diagram for throw parallel to the ceiling one may find that by using ten identical OK2 grilles with 500 m³/h air volume flow each, the equivalent diameter of the grilles should be D_{eq}=0,36 m. From the adjacent table the appropriate grille dimensions are 30X35 or 40X25, or 20X50. For these grilles the operational data are the following :
Pressure drop Δp around 20 Pa, Air velocity at the grille Uo around 3,8 m/s, Air throw B of around 4,5 m (free jet parallel to the ceiling).
If the same grilles are to be used for vertical air throw - blades at 14mm position - then the noise level N decreases to below 20 dBA and pressure drop Δp to 5,5 Pa.

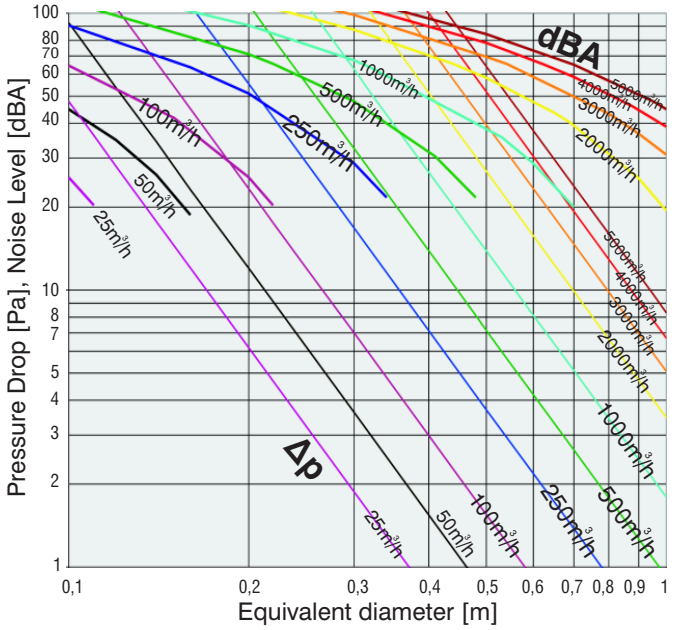
	15	20	25	30	35	40	45	50	60	70	80	90	100
15	17	20	22	24	26	28	29	31	34				
20	20	23	25	28	30	32	34	36	39	42	45		
25	22	25	28	31	33	36	38	40	44	47	50	54	56
30	24	28	31	34	37	39	41	44	48	52	55	59	62
35	26	30	33	37	40	42	45	47	52	56	60	63	67
40	28	32	36	39	42	45	48	50	55	60	64	68	71
45	29	34	38	41	45	48	51	54	59	63	68	72	76
50	31	36	40	44	47	50	54	56	62	67	71	76	80
60	34	39	44	48	52	55	59	62	68	73	78	83	87
70		42	47	52	56	60	63	67	73	79	84	90	94
80		45	50	55	60	64	68	71	78	84	90	96	101
90			54	59	63	68	72	76	83	90	96	102	107
100			56	62	67	71	76	80	87	94	101	107	113

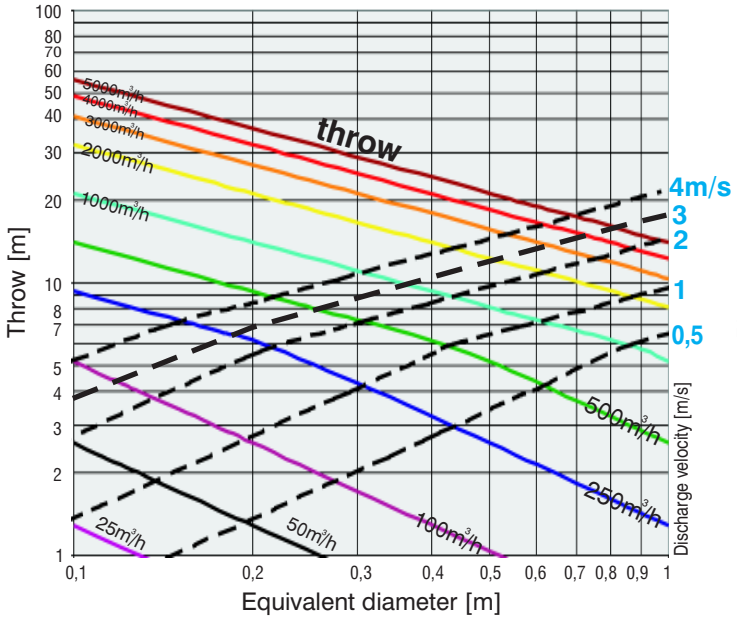
(Dimensions in cm)

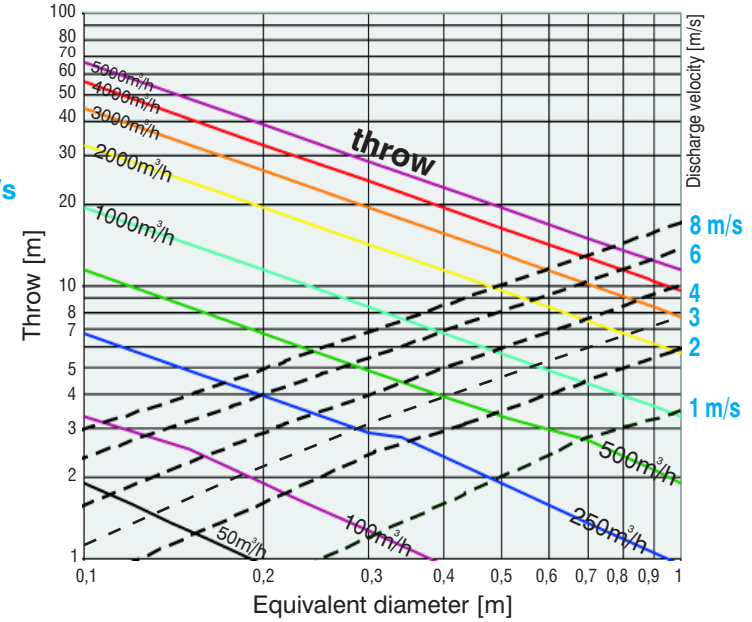
Vertical throw blades at 14mm position



Throw parallel to the ceiling blades at 8 mm position -







Selection example

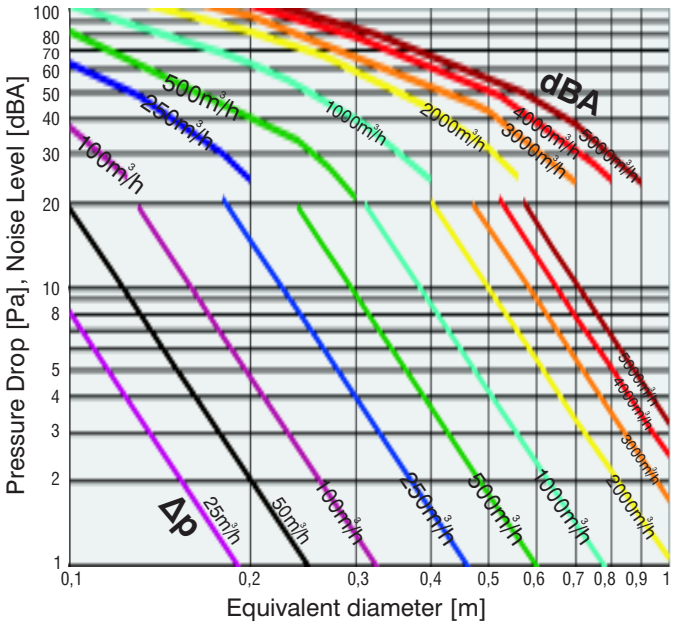
For an office to be properly ventilated 5000 m³/h of air are required with acceptable noise level of 35 dBA. What is the appropriate size of type OK3 grilles to cover the previous need?

From the noise level diagram for throw parallel to the ceiling one may find that by using ten identical OK3 grilles with 500 m³/h air flow each, the equivalent diameter of the grilles should be D_{eq}=0,36 m. From the adjacent table the appropriate grille dimensions are 30X35 or 40X25 or even 20X50. For these grilles the operational data are the following :
Pressure drop Δp around 8 Pa, Air velocity at the grille Uo around 3,5 m/s, Air throw B of around 3,1 m (free jet parallel to the ceiling).
If the same grilles are to be used for vertical air throw - blades at 14mm position - then the noise level N decreases to below 20 dBA and pressure drop Δp to 5 Pa.

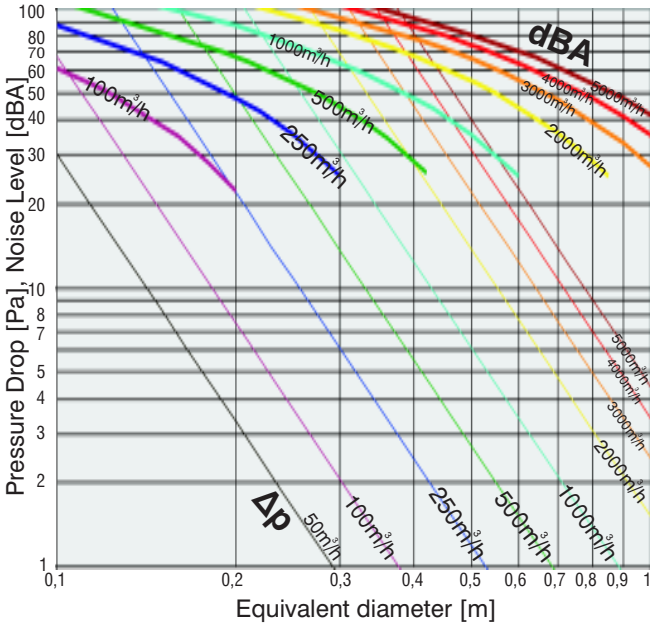
	15	20	25	30	35	40	45	50	60	70	80	90	100
15	17	20	22	24	26	28	29	31	34				
20	20	23	25	28	30	32	34	36	39	42	45		
25	22	25	28	31	33	36	38	40	44	47	50	54	56
30	24	28	31	34	37	39	41	44	48	52	55	59	62
35	26	30	33	37	40	42	45	47	52	56	60	63	67
40	28	32	36	39	42	45	48	50	55	60	64	68	71
45	29	34	38	41	45	48	51	54	59	63	68	72	76
50	31	36	40	44	47	50	54	56	62	67	71	76	80
60	34	39	44	48	52	55	59	62	68	73	78	83	87
70		42	47	52	56	60	63	67	73	79	84	90	94
80		45	50	55	60	64	68	71	78	84	90	96	101
90			54	59	63	68	72	76	83	90	96	102	107
100			56	62	67	71	76	80	87	94	101	107	113

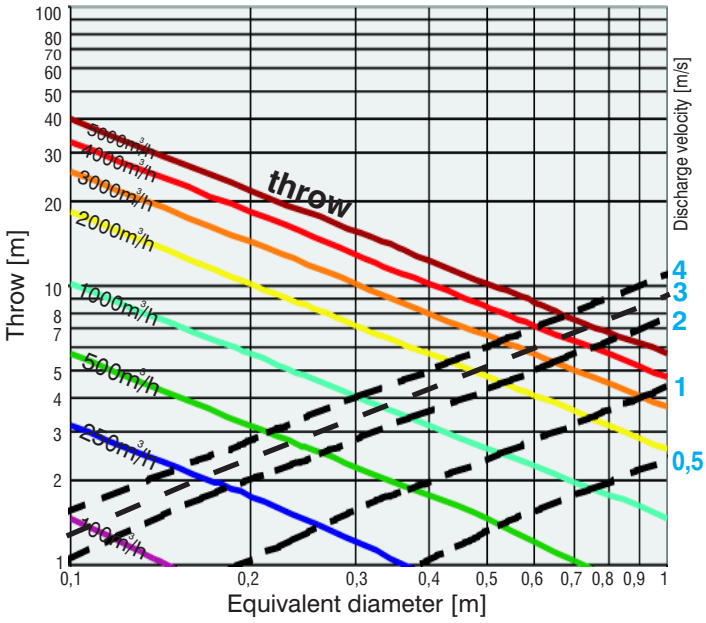
(Dimensions in cm)

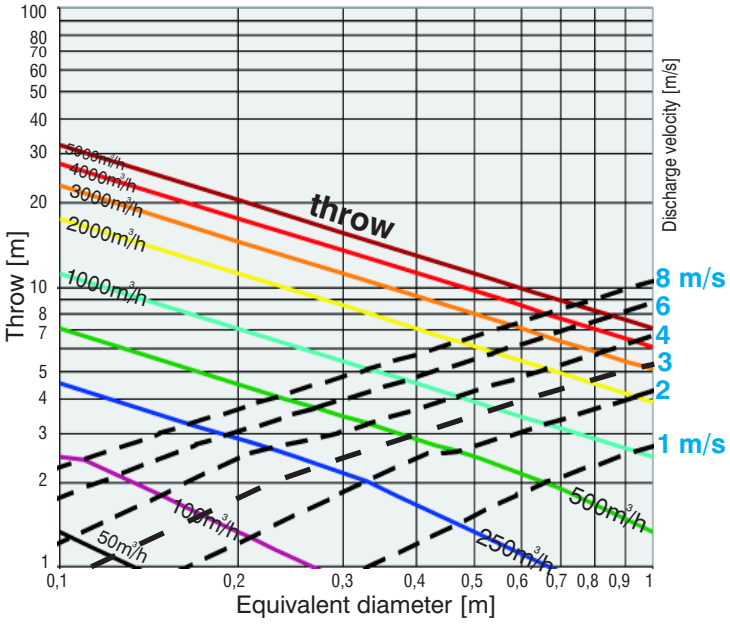
Vertical throw blades at 14mm position



Throw parallel to the ceiling blades at 8 mm position -







CEILING GRILLES - SERIES OK4 - quick selection

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Selection example

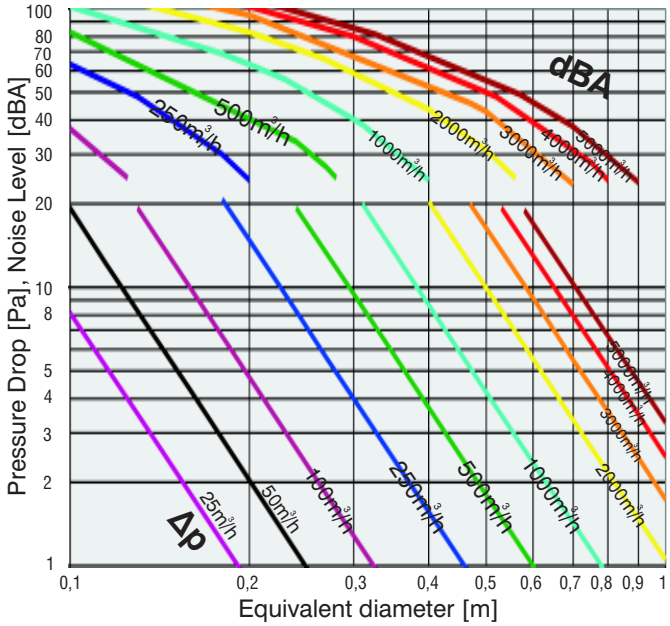
For an office to be properly ventilated 5000 m³/h of air are required with acceptable noise level of 35 dBA. What is the appropriate size of type OK4 grilles to cover the previous need?

From the noise level diagram for throw parallel to the ceiling one may find tha by using ten identical OK4 grilles with 500 m³/h air flow each, the equivalent diameter of the grilles should be D_{eq}=0,45 m. From the adjacent table the appropriate grille dimensions are 35X45 or even 60X25. For these grilles the operational data are the following :
Pressure drop Δp around 4,5 Pa, Air velocity at the grille Uo around 3,7 m/s, Air throw B of around 2,6 m (free jet parallel to the ceiling).

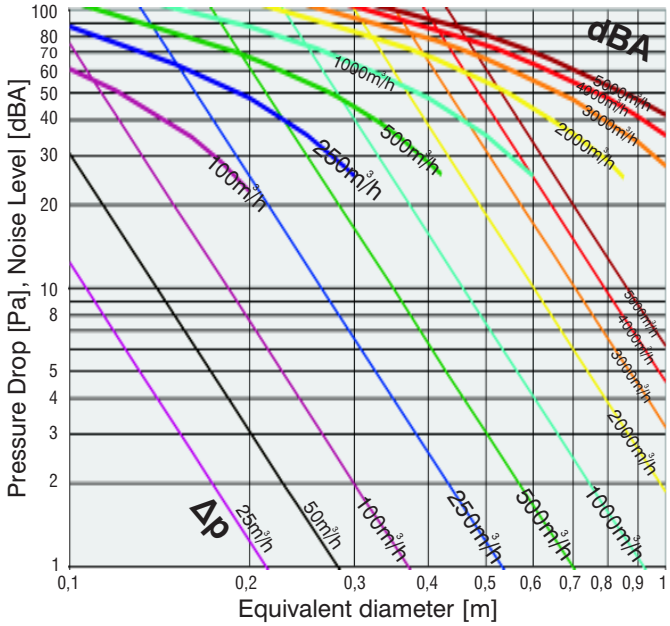
	15	20	25	30	35	40	45	50	60	70	80	90	100
15	17	20	22	24	26	28	29	31	34				
20	20	23	25	28	30	32	34	36	39	42	45		
25	22	25	28	31	33	36	38	40	44	47	50	54	56
30	24	28	31	34	37	39	41	44	48	52	55	59	62
35	26	30	33	37	40	42	45	47	52	56	60	63	67
40	28	32	36	39	42	45	48	50	55	60	64	68	71
45	29	34	38	41	45	48	51	54	59	63	68	72	76
50	31	36	40	44	47	50	54	56	62	67	71	76	80
60	34	39	44	48	52	55	59	62	68	73	78	83	87
70		42	47	52	56	60	63	67	73	79	84	90	94
80		45	50	55	60	64	68	71	78	84	90	96	101
90			54	59	63	68	72	76	83	90	96	102	107
100			56	62	67	71	76	80	87	94	101	107	113

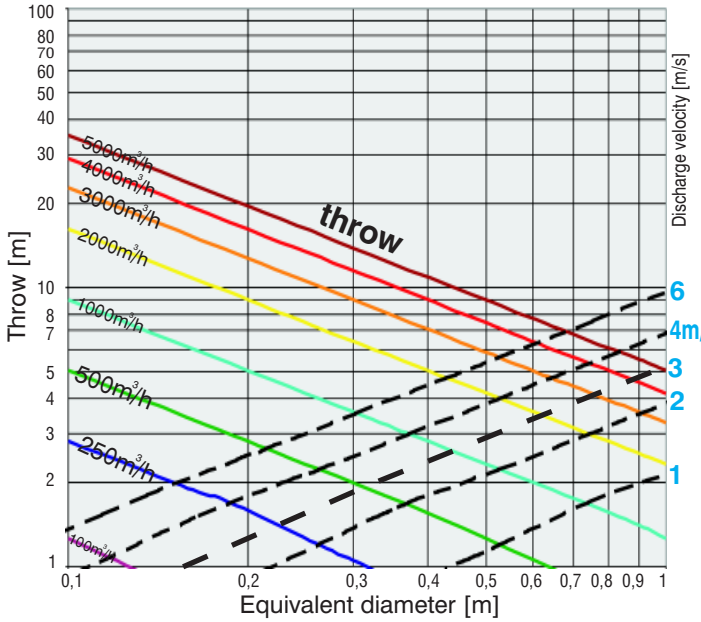
(Dimensions in cm)

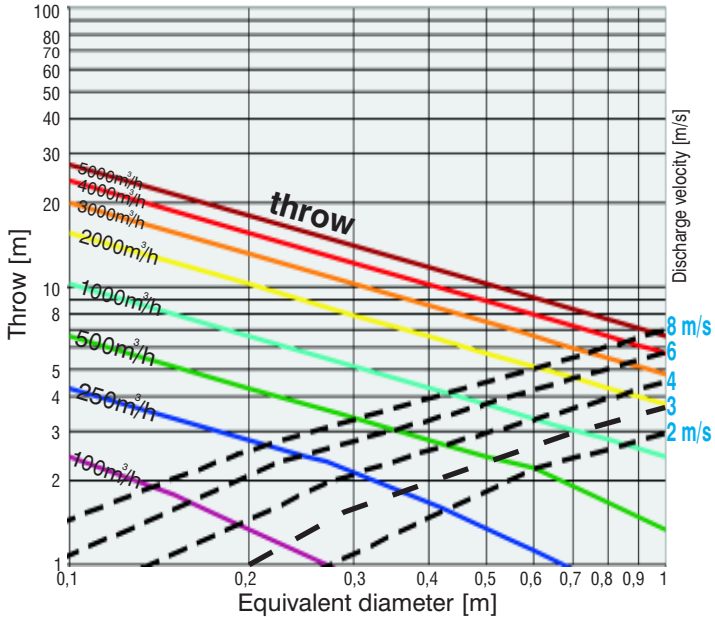
Vertical throw blades at 14mm position



Throw parallel to the ceiling blades at 8 mm position -







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Selection example - detailed calculation of the air jet characteristics

What are the air jet characteristics resulting from the use of OK1 grilles with nominal dimensions 250X300 mm and for air volume flow rate of 500 m³/h ? If the distance of the above grilles is 2X = 7m, at which distance Y from the ceiling the air velocity Um = 0,5 m/s and what is the temperature Tm at this point if the air inlet temperature is 35°C and the room temperature 20°C?

The equivalent diameter of the 250x300 mm OK1 grille is found from table OK1 to be $D_{eq} \simeq 0,31$ m. From Diagram 1 for an equivalent diameter of Deq = 0,31 m and volume flow rate of Vo = 500 m³/h, moving horizontally to Diagram 2 we reach the line corresponding to Um = 0,5 m/s. From this position moving vertically towards Diagram 4, distance Y = 1,4m is found for 2X = 7m (x=3,5m). From Diagram 5 for Deq = 0,31 m and Vo = 500 m³/h, moving horizontally to Diagram 6 and for distance 7 m, ΔTq is calculated around 0,01. Thus, Tm is almost the same as the room temperature.

What are the adequate OK1 grille dimensions for ventilating a room of height H = 3,8 m while placed at a distance 2X = 7m, with Vo = 250 m³/h, so that the final air jet velocity to be 0,3 m/s at height 0,5m over the people moving area - 1,8 m from the floor - ?

The vertical distance from the ceiling Y should be less than 3,8 - 0,5 - 1,8 = 1,5 m. For this distance and from the line corresponding to distance 2X = 7m from Diagram 4, moving vertically to Diagram 2 up to Um = 0,3 m/s and then horizontally to Diagram 1, one reads for Vo = 250 m³/h an equivalent diameter Deq = 0,26 m. From Table OK1 and for this diameter it is found that the grille should be of dimensions 15X35 or even 25X20 cm.

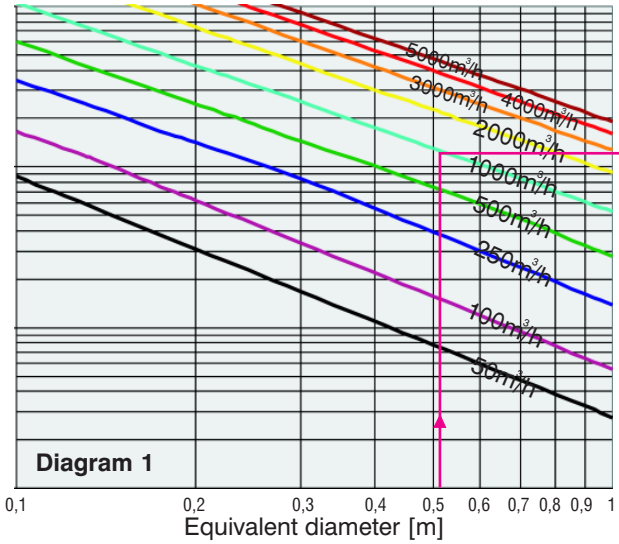
Vertical air discharge - Heating mode

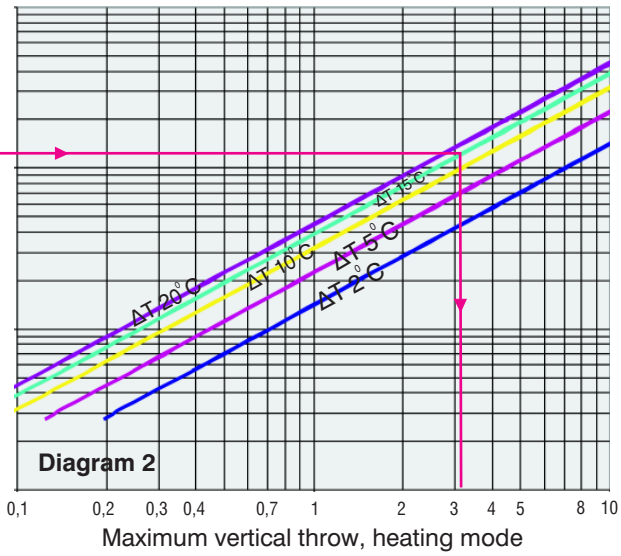
What is the maximum throw using a series OK1 grille of dimensions 450X450mm for vertical air stream of 1000 m³/h and ΔT = 15° C?

From Table OK1 the equivalent diameter is found to be 0,51 m. For this diameter and Vo = 1000 m³/h moving horizontally from Diagram 1 to Diagram 2 and for ΔT = 15° C, a vertical throw of Y = 3,1 m is calculated.

Yw=0,532 y

Vertical throw - 14 mm Blade opening





	15	20	25	30	35	40	45	50	60	70	80	90	100
15	17	20	22	24	26	28	29	31	34				
20	20	23	25	28	30	32	34	36	39	42	45		
25	22	25	28	31	33	36	38	40	44	47	50	54	56
30	24	28	31	34	37	39	41	44	48	52	55	59	62
35	26	30	33	37	40	42	45	47	52	56	60	63	67
40	28	32	36	39	42	45	48	50	55	60	64	68	71
45	29	34	38	41	45	48	51	54	59	63	68	72	76
50	31	36	40	44	47	50	54	56	62	67	71	76	80
60	34	39	44	48	52	55	59	62	68	73	78	83	87
70		42	47	52	56	60	63	67	73	79	84	90	94
80		45	50	55	60	64	68	71	78	84	90	96	101
90			54	59	63	68	72	76	83	90	96	102	107
100			56	62	67	71	76	80	87	94	101	107	113

TABLE OK1 : EQUIVALENT DIAMETER (in cm)