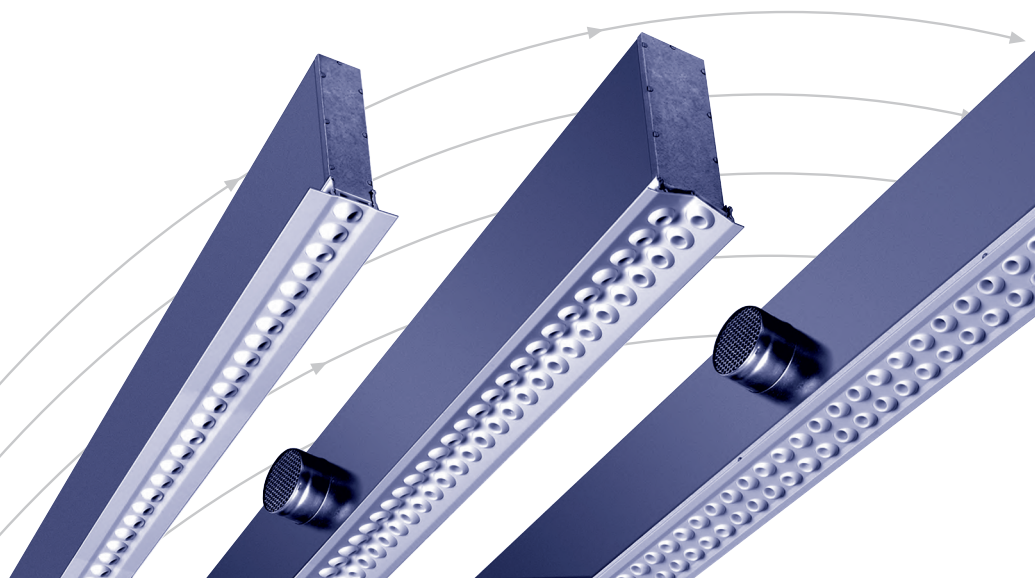


# Ball diffuser rail

Type KS



**TROX<sup>®</sup> TECHNIK**



The art of handling air

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## Application

Ball diffuser rails are supply air elements, which can be incorporated into ceilings especially aesthetically. They are suitable for air conditioning systems in open-plan offices, class rooms, laboratories, booking halls, etc. The adjustment possibilities for the individual ball jets are well-nigh unlimited, because they can be set to blow in any desired direction. The ball rails can be supplied in single or double-row versions.

Ball diffuser rails are suitable for:

- systems with constant air volume
- systems with variable air volume (VAV)  
min. air volume = 25% of the max. air quantity
- $\Delta T$ : - 12 to 10 K

## Safety instructions

### CAUTION!

**Damage to the product due to improper handling. Check the device for damage and contamination prior to operation!**

Improper handling may lead to considerable material damage of the product.

- Do not use any acid or abrasive cleaning agents.
- Adhesives from sticky tape may lead to colour damage.
- Excessive moisture may lead to colour damage and corrosion.
- Use only cleaning agents, greases and oils that are expressly specified.

### CAUTION!

**Risk of injury from sharp edges and corners, ridges and thin-walled sheet metal parts!**

- Proceed carefully with all work.
- Wear protective gloves, safety shoes and protective helmet.

### WARNING!

**Danger from incorrect use. Misuse of the product may lead to dangerous situations.**

The product must not be used:

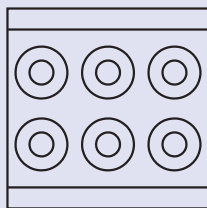
- in areas subject to explosion hazards;
- in the open air without sufficient protection against weather effects;
- in atmospheres that may have a damaging and/or corrosive effect on the product due to scheduled or unscheduled chemical reactions.

## Realisation

Ball diffuser rails are made of aluminium profiles with a coloured matt-finish according to RAL 9010, 25% brilliance. The desired air discharge setting is adjusted at works. Subsequent resetting of the ball jets can be made with the aid of a setting pin. The ball rails can also be supplied in other RAL colours. The plenum box is made of galvanised steel. Fixed resistance FW0066 in the tube connection. Special designs on request.

### Standard model

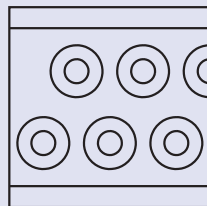
Balls arranged in parallel (F79 + W100)



### Special model

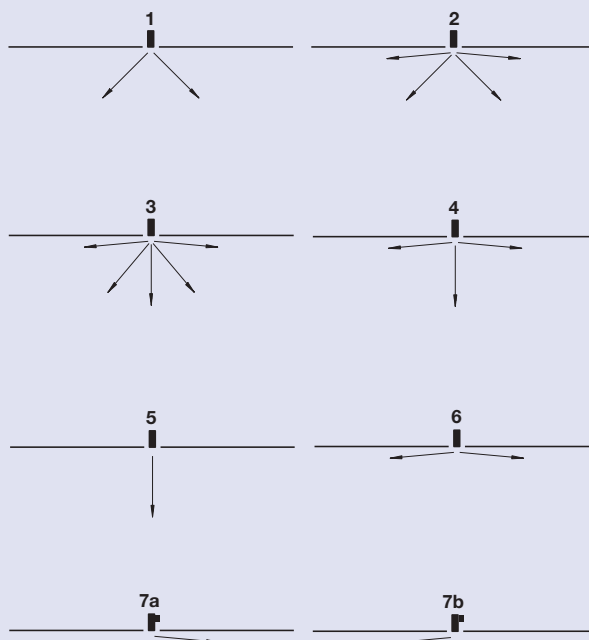
Ball diffusers offset (with VF79 + VW100)

Designation: **V**



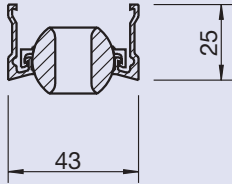
Standard model of KS2 WK 100

## Discharge positions

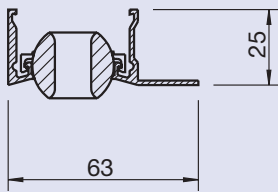


## Ball rails, single row

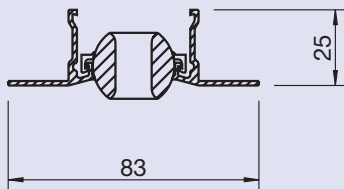
### KS1 F43



### KS1 WE63

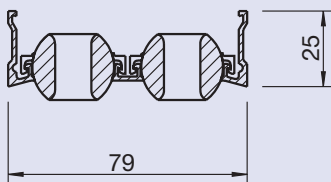


### KS1 W83

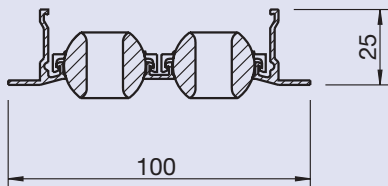


## Ball rails, double row

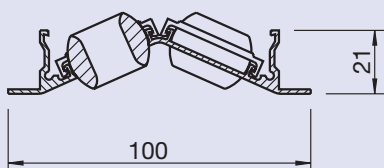
### KS2 F79



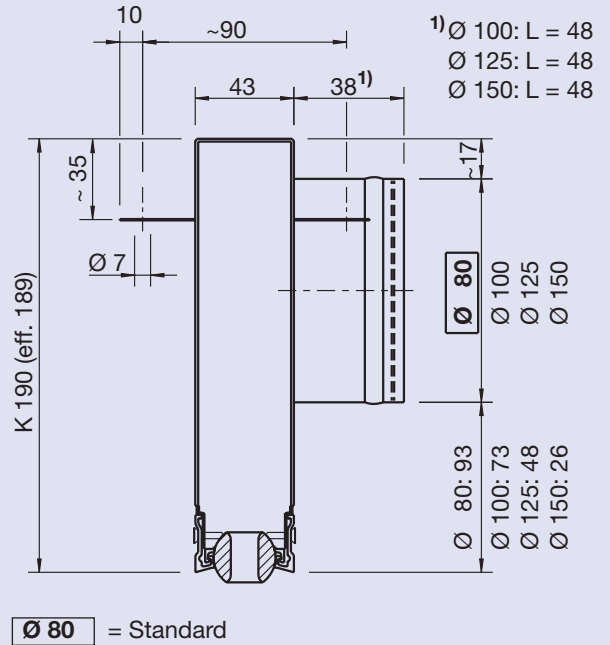
### KS2 W100



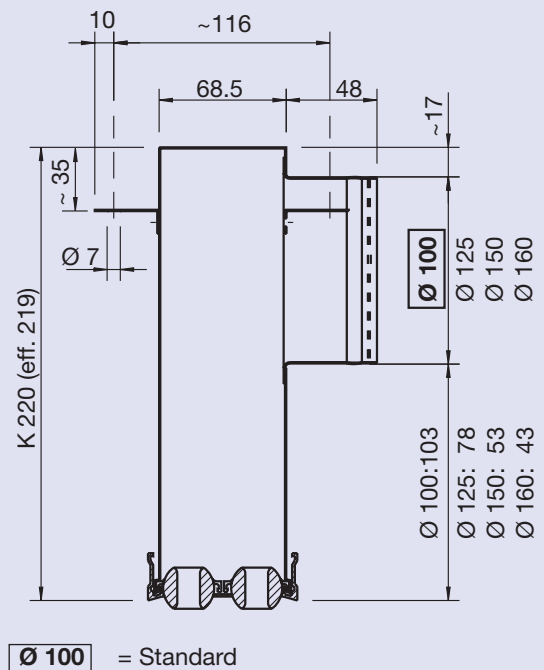
### KS2 WK100



## With plenum box KS1 F43 K190



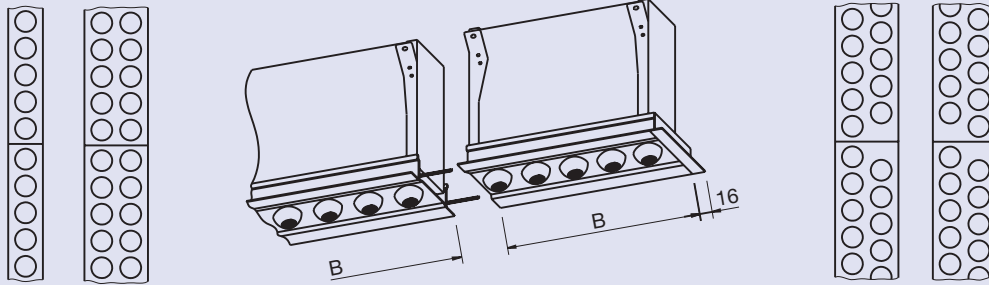
## With plenum box KS2 F79 K220



# Dimensions · Installation

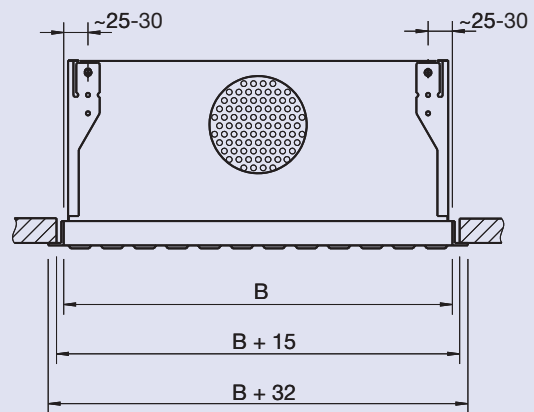
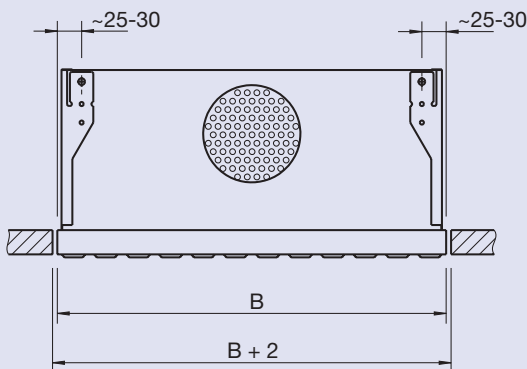
Lengths in excess of 2000 mm are supplied in sections. Longitudinal measurement B, where possible, divided by 33.3. They can be connected flush to form a continuous rail with the aid of grooved pins.

Attachment brackets for ball diffuser rails without connection boxes has to be ordered separately (surcharge).

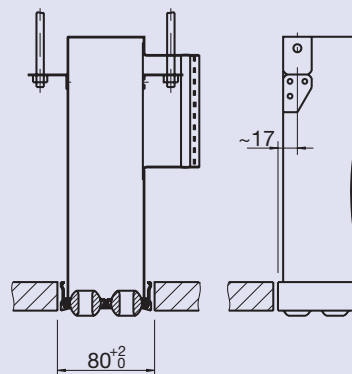
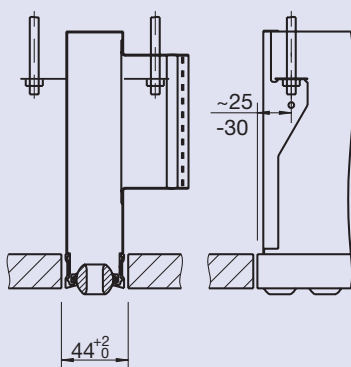


Recess dimensions **without** transversal angle

Recess dimensions **with** transversal angle (B + 15)

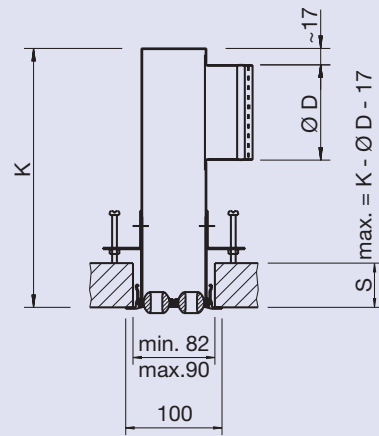
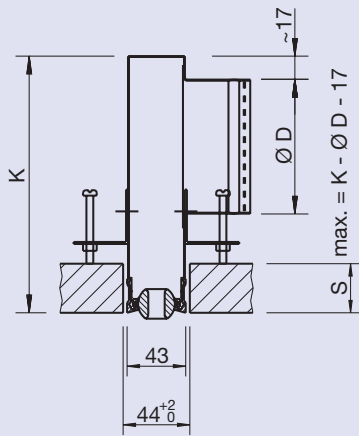


## Standard models



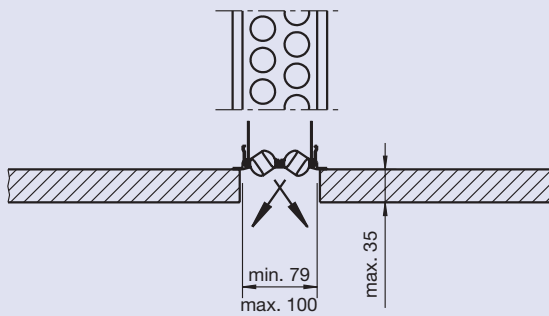
Attachment material, building contractors' supply

## Special attachment angles on request

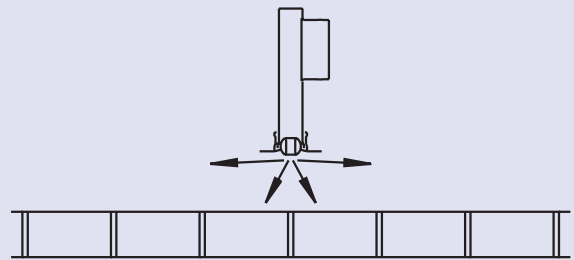


## Installation in a ceiling recess

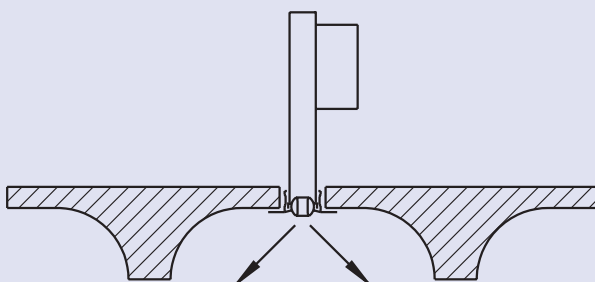
Ball diffuser rows in offset arrangement



## Installation over open grid ceiling



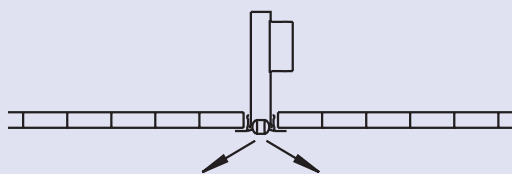
## Installation between protruding ceiling elements



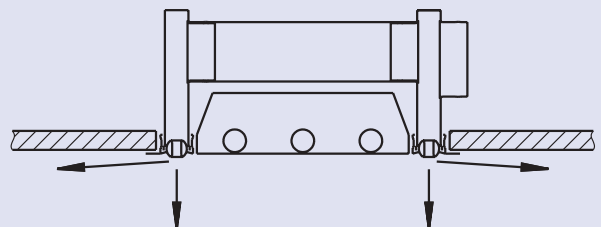
## KS1 special



## Installation flush with lower edge of grid ceiling



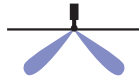
## Installation in lighting fixtures



# Quick selection

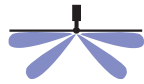
## Type KS1

### Position 1



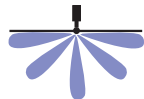
Dimension [mm]	A <sub>eff</sub> [m²]	q <sub>v</sub> [l/s,m]	8.3	11.1	13.9 nominal		16.7	19.4	22.2	25.0				
		Ṃ [m³/h,m]	30	40	50		60	70	80	90				
KS1 pos 1	0.0034	p <sub>t</sub> [Pa]	9	15	23		33	45	58	73				
		L <sub>wA</sub> [dB(A)]	<20	21	26		31	35	38	41				
		L <sub>0.5</sub> /L <sub>0.3</sub> [m]	-	-	-	1.4	1.4	1.5	1.4	1.7	1.5	1.9	1.6	2.2
		v̄ <sub>H1</sub> [m/s]		0.13	0.15	0.14	0.18	0.16	0.21	0.19	0.25	0.21	0.28	0.24
Distance	A	[m]		2.8	2.8	3.0	2.8	3.4	2.9	3.9	3.2	4.4	3.5	5.0

### Position 2



Dimension [mm]	A <sub>eff</sub> [m²]	q <sub>v</sub> [l/s,m]	8.3	11.1	13.9	16.7 nominal		19.4	22.2	25.0				
		Ṃ [m³/h,m]	30	40	50	60		70	80	90				
KS1 pos 2	0.0028	p <sub>t</sub> [Pa]	13	23	36	52		71	93	118				
		L <sub>wA</sub> [dB(A)]	<20	25	30	35		39	42	45				
		L <sub>0.5</sub> /L <sub>0.3</sub> [m]	-	-	-	1.4	1.4	1.5	1.4	1.6	1.5	1.8	1.6	2.1
		v̄ <sub>H1</sub> [m/s]		0.08	0.10	0.09	0.11	0.11	0.14	0.12	0.16	0.14	0.19	0.16
Distance	A	[m]		2.8	2.7	3.0	2.8	3.3	2.9	3.7	3.2	4.1	3.4	4.6

### Position 3



Dimension [mm]	A <sub>eff</sub> [m²]	q <sub>v</sub> [l/s,m]	8.3	11.1	13.9	16.7 nominal		19.4	22.2	25.0				
		Ṃ [m³/h,m]	30	40	50	60		70	80	90				
KS1 pos 3	0.0028	p <sub>t</sub> [Pa]	10	17	27	38		53	69	87				
		L <sub>wA</sub> [dB(A)]	<20	25	30	35		39	42	45				
		L <sub>0.5</sub> /L <sub>0.3</sub> [m]	-	-	-	1.4	-	1.4	1.4	1.6	1.4	1.8	1.5	2.0
		v̄ <sub>H1</sub> [m/s]		0.09	0.10	0.13	0.12	0.15	0.13	0.18	0.15	0.20	0.18	
Distance	A	[m]		2.7	2.9	2.8	3.2	2.9	3.5	3.1	3.9	3.3	4.4	

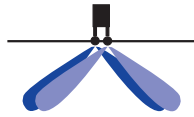
### Positions 6 + 7



Dimension [mm]	A <sub>eff</sub> [m²]	q <sub>v</sub> [l/s,m]	8.3	11.1	13.9 nominal		16.7	19.4	22.2	25.0				
		Ṃ [m³/h,m]	30	40	50		60	70	80	90				
KS1 pos 6 + 7	0.0017	p <sub>t</sub> [Pa]	13	22	33		47	64	82	103				
		L <sub>wA</sub> [dB(A)]	23	30	35		40	43	47	49				
		L <sub>0.5</sub> /L <sub>0.3</sub> [m]	-	-	-	1.5	1.4	1.6	1.4	1.7	1.5	1.9	1.6	2.1
		v̄ <sub>H1</sub> [m/s]		0.11	0.14	0.13	0.17	0.15	0.20	0.16	0.23	0.18	0.25	0.19
Distance	A	[m]		3.0	2.9	3.2	2.9	3.5	2.9	3.8	3.1	4.3	3.4	4.8

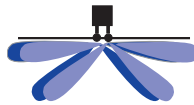
## Type KS2

### Position 1



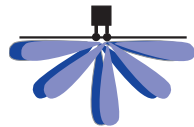
Dimension [mm]	A <sub>eff</sub> [m <sup>2</sup> ]	q <sub>v</sub> [l/s,m]	13.9	16.7	19.4 nominal 70	22.2	25.0	27.8	30.6	33.3
		Ḃ [m <sup>3</sup> /h,m]	50	60	70	80	90	100	110	120
KS2 pos 1	0.0067	p <sub>t</sub> [Pa]	9	12	16	21	27	33	40	47
		L <sub>wA</sub> [dB(A)]	<20	<20	23	26	29	32	34	36
		L <sub>0,5</sub> /L <sub>0,3</sub> [m]	1.5   1.6	1.5   1.8	1.5   2.0	1.6   2.2	1.7   2.4	1.9   2.6	2.0   2.9	2.1   3.1
		v̄ <sub>H1</sub> [m/s]	0.16   0.15	0.18   0.16	0.20   0.18	0.23   0.19	0.25   0.20	0.27   0.22	0.29   0.23	0.32   0.25
Distance	A	[m]	2.9   3.3	3.0   3.6	3.1   4.0	3.2   4.3	3.5   4.8	3.7   5.2	4.0   5.7	4.3   6.2

### Position 2



Dimension [mm]	A <sub>eff</sub> [m <sup>2</sup> ]	q <sub>v</sub> [l/s,m]	13.9	16.7	19.4	22.2	25.0	27.8 nominal 100	30.6	33.3
		Ḃ [m <sup>3</sup> /h,m]	50	60	70	80	90	100	110	120
KS2 pos 2	0.0057	p <sub>t</sub> [Pa]	8	12	16	21	27	33	40	47
		L <sub>wA</sub> [dB(A)]	<20	21	25	29	32	34	37	39
		L <sub>0,5</sub> /L <sub>0,3</sub> [m]	-   1.6	1.5   1.7	1.5   1.8	1.6   2.0	1.7   2.1	1.8   2.3	1.9   2.5	2.0   2.6
		v̄ <sub>H1</sub> [m/s]	0.09	0.10   0.10	0.12   0.11	0.13   0.12	0.15   0.13	0.16   0.14	0.18   0.15	0.20   0.17
Distance	A	[m]	3.1	3.0   3.4	3.1   3.6	3.2   3.9	3.4   4.2	3.6   4.6	3.8   4.9	4.0   5.3

### Position 3



Dimension [mm]	A <sub>eff</sub> [m <sup>2</sup> ]	q <sub>v</sub> [l/s,m]	13.9	16.7	19.4	22.2	25.0 nominal 90	27.8	30.6	33.3
		Ḃ [m <sup>3</sup> /h,m]	50	60	70	80	90	100	110	120
KS2 pos 3	0.0057	p <sub>t</sub> [Pa]	8	12	16	21	27	33	40	47
		L <sub>wA</sub> [dB(A)]	<20	21	25	29	32	34	37	39
		L <sub>0,5</sub> /L <sub>0,3</sub> [m]	-   1.5	-   1.6	1.5   1.7	1.5   1.8	1.6   2.0	1.7   2.1	1.8   2.3	1.9   2.5
		v̄ <sub>H1</sub> [m/s]	0.10	0.11   0.11	0.13   0.12	0.15   0.13	0.16   0.14	0.18   0.16	0.20   0.17	0.22   0.18
Distance	A	[m]	2.9	3.1	3.0   3.4	3.0   3.7	3.2   4.0	3.4   4.3	3.6   4.6	3.8   4.9

### Positions 6 + 7



Dimension [mm]	A <sub>eff</sub> [m <sup>2</sup> ]	q <sub>v</sub> [l/s,m]	13.9	16.7	19.4 nominal 70	22.2	25.0	27.8	30.6	33.3
		Ḃ [m <sup>3</sup> /h,m]	50	60	70	80	90	100	110	120
KS2 pos 6 + 7	0.0035	Δp <sub>t</sub> [Pa]	10	15	20	26	33	40	48	57
		L <sub>wA</sub> [dB(A)]	21	25	29	32	35	38	40	42
		L <sub>0,5</sub> /L <sub>0,3</sub> [m]	-   1.7	1.6   1.8	1.6   1.9	1.7   2.1	1.8   2.3	1.9   2.5	2.1   2.8	2.2   3.0
		v̄ <sub>H1</sub> [m/s]	0.10	0.13   0.12	0.16   0.13	0.18   0.14	0.20   0.16	0.22   0.17	0.24   0.18	0.26   0.19
Distance	A	[m]	3.4	3.3   3.6	3.3   3.9	3.4   4.2	3.6   4.6	3.9   5.1	4.1   5.5	4.4   6.0

# Quick selection

## Type KS2WK100

### Position 6

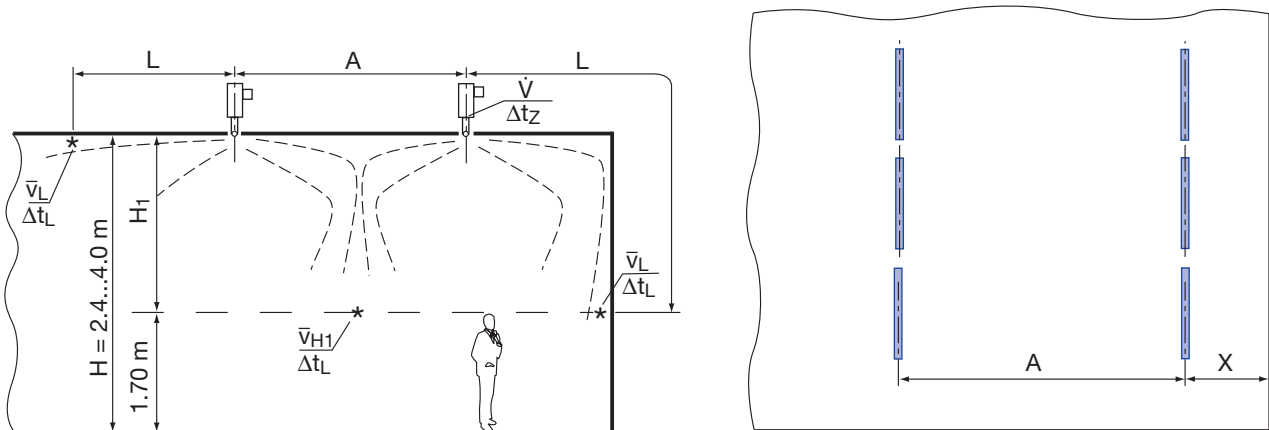


Dimension [mm]	A <sub>eff</sub> [m²]	q̇ <sub>v</sub> [l/s,m]	13.9	16.7	19.4	22.2	25.0 nominal 90		27.8	30.6	33.3							
		Ṡ [m³/h,m]	50	60	70	80			100	110	120							
KS2WK100 pos6	0.0063	p <sub>t</sub> [Pa]	8	11	15	20	25		30	37	43							
		L <sub>wA</sub> [dB(A)]	<20	<20	23	26	29		31	33	35							
		L <sub>0.5</sub> /L <sub>0.3</sub> [m]	-	-	-	1.7	1.7	1.8	1.6	1.9	1.7	2.1	1.8	2.3	1.9	2.5	2.0	2.8
		v̄ <sub>H1</sub> [m/s]				0.11	0.14	0.13	0.16	0.14	0.19	0.15	0.21	0.17	0.24	0.18	0.26	0.19
Distance	A	[m]				3.4	3.3	3.6	3.3	3.8	3.4	4.2	3.5	4.6	3.7	5.0	4.0	5.5

**Base to v̄<sub>H1</sub>:** room height H = 2.9 m  
 height of occupied zone = 1.7 m  
 H<sub>1</sub> = 1.2 m  
 distance A look table  
 difference of temperature = -8.0 K



# Definitions

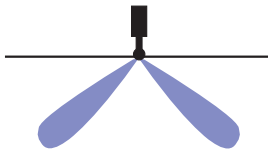


L	m	Distance $(X + H_1)$ blowing against the wall
$L_{0.5}/L_{0.3}$	m	Distance in relation to the final velocities 0.3 m/s or 0.5 m/s
$\dot{q}_v$	l/s	Volume flow rate per diffuser
$\dot{V}$	m <sup>3</sup> /h	Volume flow rate per diffuser
$\dot{V}_{\text{nominal}}$	m <sup>3</sup> /h	Nominal volume flow rate with VAV: $V_{\text{max}} = 1.19 \cdot \dot{V}_{\text{nominal}}$
$v_{\text{eff}}$	m/s	Eff. discharge velocity
A	m	Distance between the axes of two diffusers
X	m	Distance between diffuser centre and wall
H	m	Room height
$H_1$	m	Distance between ceiling and occupied zone
$\bar{v}_{H1}$	m/s	Mean flow velocity of room air between two diffusers in ceiling distance $H_1$
$\bar{v}_L$	m/s	Mean flow velocity of room air between wall in ceiling distance $H_1$
$t_R$	°C	Room air temperature
$t_L$	°C	Jet air temperature
$\Delta t_z$	K	Difference between room air and supply air temperature
$\Delta t_L$	K	Difference between room air and jet air temperature at distance $L = A/2 + H_1$ $L = X + H_1$
$A_{\text{eff}}$	m <sup>2</sup>	Effective air outlet surface area
$\Delta p_t$	Pa	Total pressure drop (supply air)
$L_{wA}$	dB(A)	A-weighted sound power level
$L_{wNC}$		NC rating of sound power level $L_{wNC} = L_{wA} - 6 \text{ dB}$
$L_{wNR}$		$L_{wNR} = L_{wNC} + 2 \text{ dB}$
$L_{pA}, L_{pNC}$		A-weighting or NC curve respectively of room sound power level $L_{pA} \sim L_{wA} - 8 \text{ dB}$ $L_{pNC} \sim L_{wNC} - 8 \text{ dB}$
$L_{\text{wokt}}$	dB	Sound power level in the octave-centre frequencies
$\Delta L$	dB	Insertion attenuation in the octave-centre frequencies
$\Delta L_A$	dB	Octave-centre frequencies, correction value
f	Hz	Octave-centre frequencies
FW0066		Fixed resistance: plenum box without perforated plate, spigot 66%

# Technical Data

## Type KS1

### Position 1



### Correction table, octave-centre frequencies

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta LA$	-5	+6	-1	-9	-18	<-20	<-20	[dB]

### Insertion attenuation (incl. end reflection)

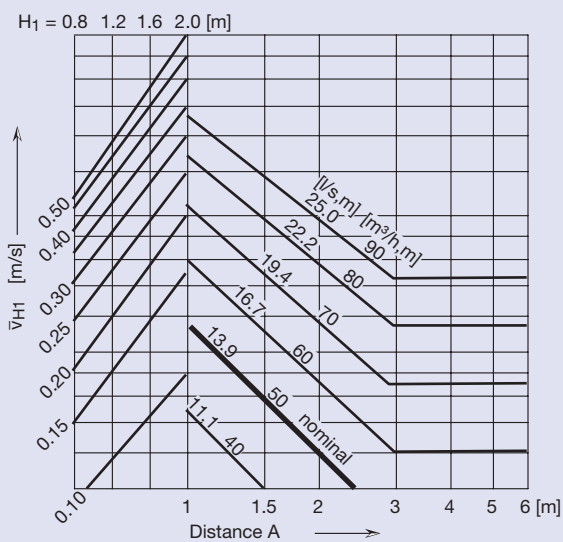
Interior of box not insulated

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta L$	24	17	15	15	16	22	22	[dB]

### Room air velocity

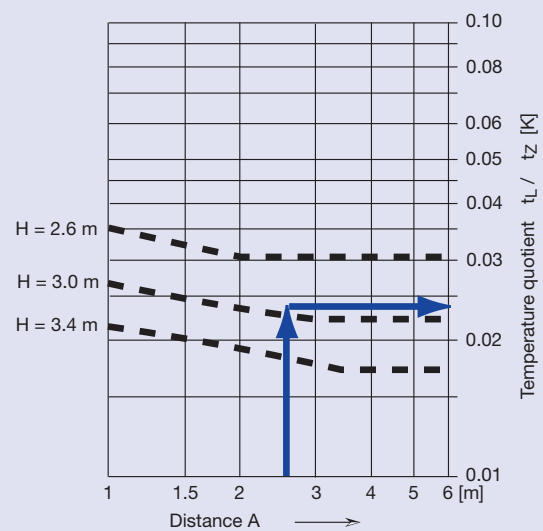
#### Isotherm

$\bar{v}_{H1}$



### Temperature quotient

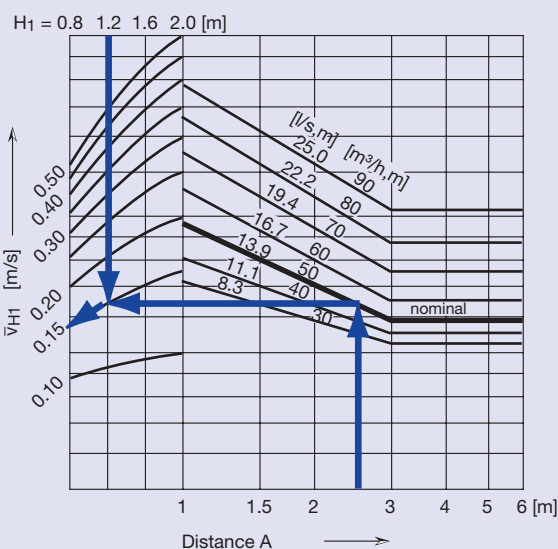
$\Delta t_L / \Delta t_z$



### Room air velocity

$\Delta t_z = -8 K$

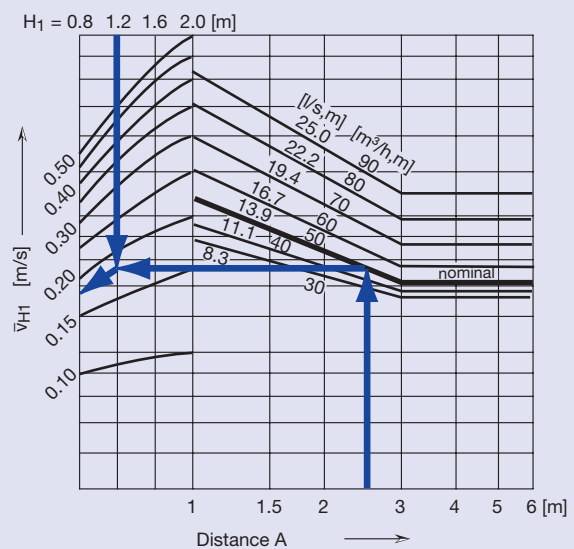
$\bar{v}_{H1}$



### Room air velocity

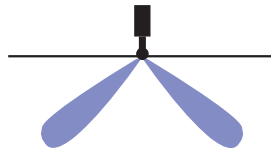
$\Delta t_z = -12 K$

$\bar{v}_{H1}$

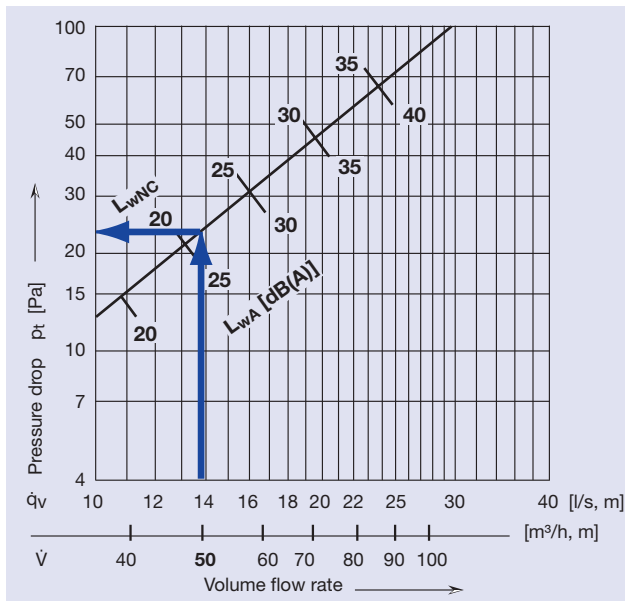


## Type KS1

### Position 1

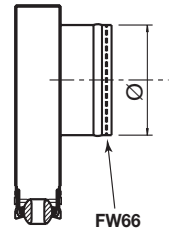


### Sound power level and pressure drop



### Eff. air outlet surface area

$$A_{\text{eff}} = 0.0034 \text{ m}^2$$



### Correction of the sound power level $L_{wA}$ and the pressure drop $\Delta p_t$

Spigot	Length [mm]					
	1000		1500		2000	
$\varnothing$ [mm]	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -
1 × 80	0	1	+5	1.6	+8	2.5
1 × 100	-4	0.7	+2	1.0	+6	1.4
1 × 125	-5	0.6	0	0.8	+5	1.0
2 × 80	-6	0.6	-1	0.8	+3	1.0
2 × 100	-8	0.5	-4	0.6	-1	0.7
2 × 125	-8	0.5	-5	0.6	-2	0.6

### Example

#### Given

Type KS1...K190 (FW0066) pos. 1	1 × $\varnothing$ 80 mm	$\dot{q}_v$
Volume flow rate	13.9 l/s, m	$\dot{V}$
	50 m <sup>3</sup> /h, m	H
Room height	2.9 m	H <sub>1</sub>
Occupied zone height	1.7 m	A
Distance to the ceiling	1.2 m	$\Delta t$
Distance between diffusers	2.5 m	
Difference of temperature	- 12 K / - 8 K / 0 K	

#### Solution

Sound power level	26 dB(A)	$L_{wA}$
Limite curve	21	$L_{wNC}$
Pressure drop	24 Pa	$\Delta p_t$

### Octave spectrum

f	125	250	500	1000	2000	4000	8000	[Hz]
$L_{wA}$	26	26	26	26	26	26	26	[dB(A)]
$\Delta L_A$	-5	+6	-1	-9	-18	<-20	<-20	[dB]
$L_{wOkt}$	21	32	25	17	<15	<15	<15	[dB]

### Insertion attenuation see p. 12

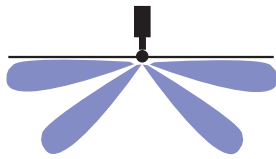
Room air velocity 1.7 m over ground		
at - 12 K	= 0.18 m/s	$\bar{v}_{H1}$
at - 8 K	= 0.15 m/s	$\bar{v}_{H1}$
at Isotherm	= <0.10 m/s	$\bar{v}_{H1}$

Difference of temperature	0.024	$\Delta t_L / \Delta t_z$
$(t_R - t_L)$ at $\Delta t_L - 8 \text{ K} = 0.024 \times 8 =$	$\sim 0.2 \text{ K}$	$\Delta t_L$

# Technical Data

Type KS1

Position 2



Correction table, octave-centre frequencies

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta LA$	-5	+6	-1	-9	-18	<-20	<-20	[dB]

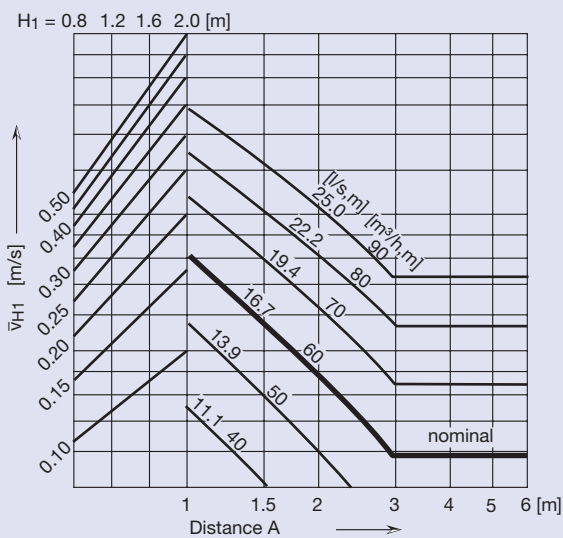
Insertion attenuation (incl. end reflection)

Interior of box not insulated

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta L$	24	17	15	15	16	22	22	[dB]

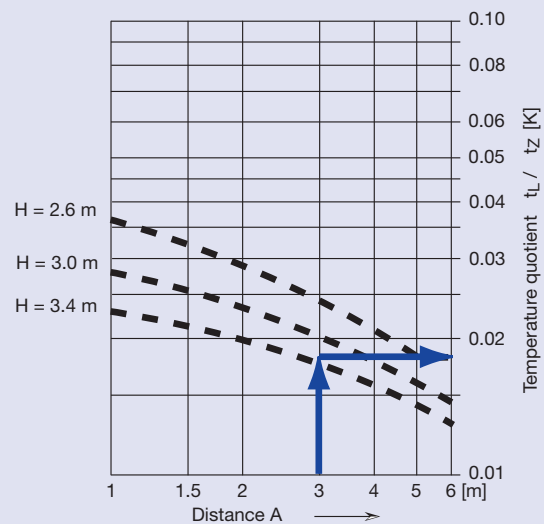
Room air velocity  
Isotherm

$\bar{v}_{H1}$



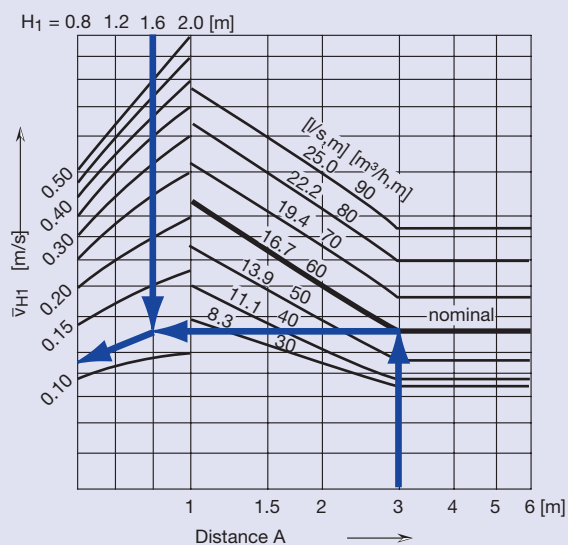
Temperature quotient

$\Delta t_L / \Delta t_z$



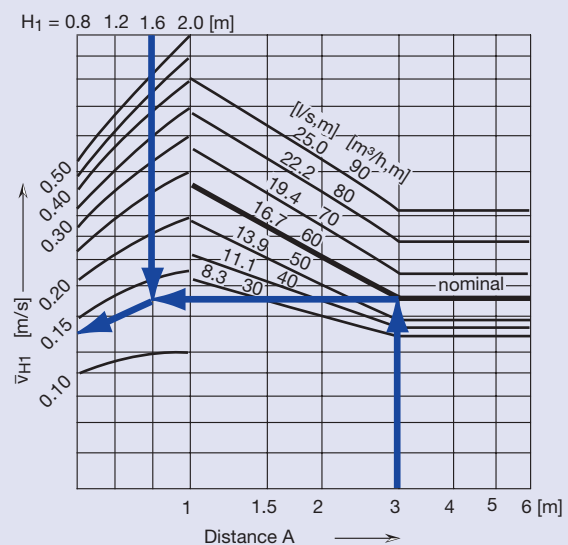
Room air velocity  
 $\Delta t_z = -8 K$

$\bar{v}_{H1}$



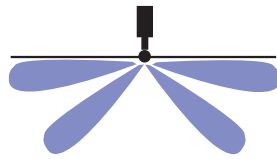
Room air velocity  
 $\Delta t_z = -12 K$

$\bar{v}_{H1}$

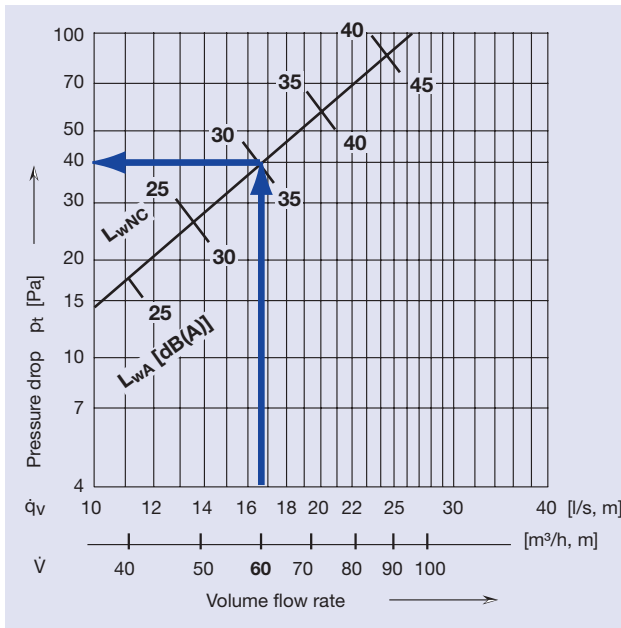


## Type KS1

## Position 2

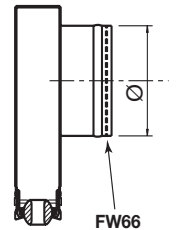


## Sound power level and pressure drop



## Eff. air outlet surface area

$$A_{\text{eff}} = 0.0028 \text{ m}^2$$



## Correction of the sound power level $L_{wA}$ and the pressure drop $\Delta p_t$

Spigot $\varnothing$ [mm]	Length [mm]					
	1000		1500		2000	
	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -
1 x 80	0	1	+5	1.6	+8	2.4
1 x 100	-1	0.8	+3	1.1	+7	1.4
1 x 125	-1	0.7	+3	0.8	+7	1.0
2 x 80	-3	0.6	0	0.8	+3	1.0
2 x 100	-4	0.6	-1	0.6	+2	0.8
2 x 125	-4	0.5	-1	0.6	+2	0.8

## Example

### Given

Type KS1...K190 (FW0066) pos. 2	1 x $\varnothing$ 80 mm	
Volume flow rate	16.7 l/s, m	$\dot{q}_v$
	60 m³/h, m	$\dot{V}$
Room height	3.3 m	H
Occupied zone height	1.7 m	
Distance to the ceiling	1.6 m	$H_1$
Distance between diffusers	3.0 m	A
Difference of temperature	- 12 K / - 8 K / 0 K	$\Delta t$

### Solution

Sound power level	35 dB(A)	$L_{wA}$
Limite curve	30	$L_{wNC}$
Pressure drop	24 Pa	$\Delta p_t$

## Octave spectrum

f	125	250	500	1000	2000	4000	8000	[Hz]
$L_{wA}$	35	35	35	35	35	35	35	[dB(A)]
$\Delta L_A$	-5	+6	-1	-9	-18	<-20	<-20	[dB]
$L_{wOkt}$	30	41	34	26	17	<15	<15	[dB]

## Insertion attenuation see p. 14

Room air velocity 1.7 m over ground

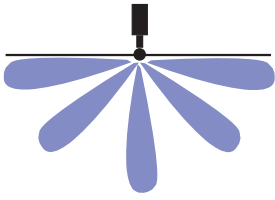
at - 12 K	=	0.14 m/s	$\bar{v}_{H1}$
at - 8 K	=	0.12 m/s	$\bar{v}_{H1}$
at Isotherm	=	<0.10 m/s	$\bar{v}_{H1}$

Difference of temperature	0.018	$\Delta t_L / \Delta t_z$
$(t_R - t_L)$ at $\Delta t_L - 8 \text{ K} = 0.018 \times 8 =$	$\sim 0.2 \text{ K}$	$\Delta t_L$

# Technical Data

Type KS1

Position 3



Correction table, octave-centre frequencies

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta LA$	-5	+6	-1	-9	-18	<-20	<-20	[dB]

Insertion attenuation (incl. end reflection)

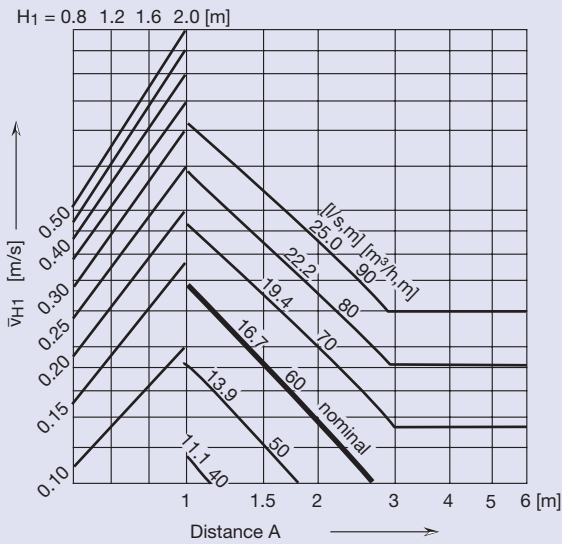
Interior of box not insulated

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta L$	24	17	15	15	16	22	22	[dB]

Room air velocity

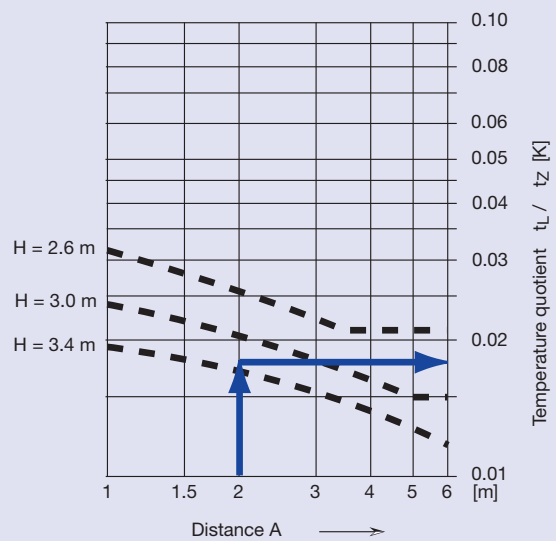
Isotherm

$\bar{v}_{H1}$



Temperature quotient

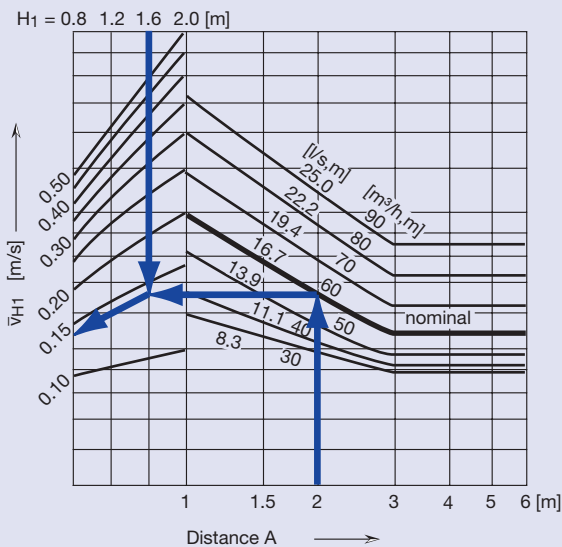
$\Delta t_L / \Delta t_z$



Room air velocity

$\Delta t_z = -8 K$

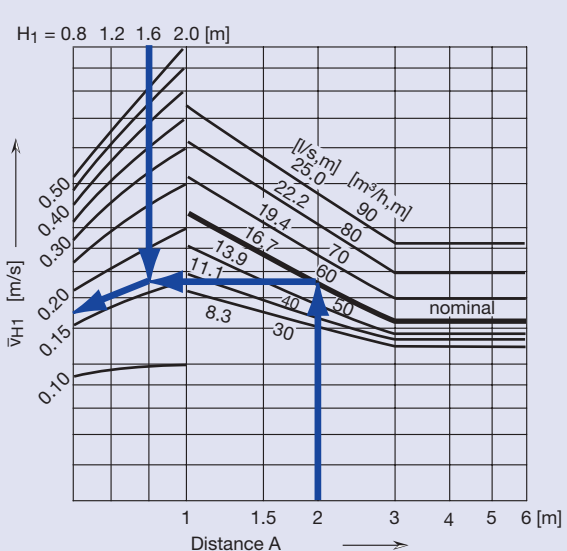
$\bar{v}_{H1}$



Room air velocity

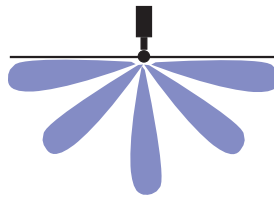
$\Delta t_z = -12 K$

$\bar{v}_{H1}$



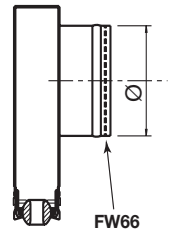
## Type KS1

### Position 3

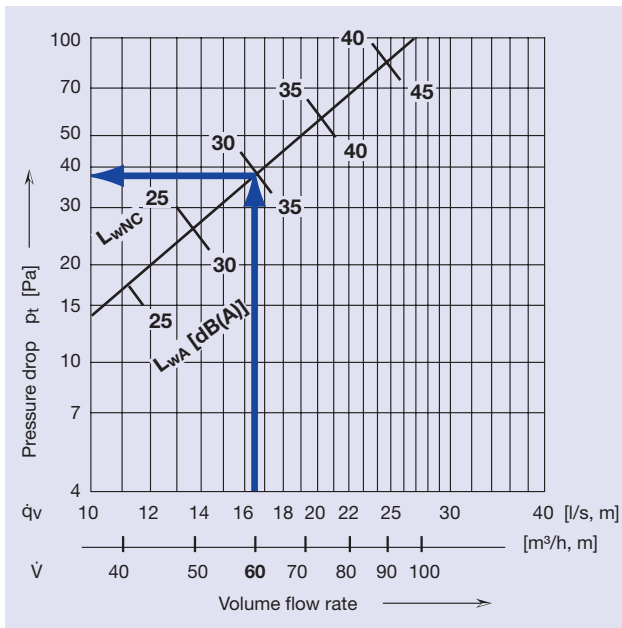


Eff. air outlet surface area

$$A_{\text{eff}} = 0.0028 \text{ m}^2$$



### Sound power level and pressure drop



### Correction of the sound power level $L_{wA}$ and the pressure drop $\Delta p_t$

Spigot	Length [mm]					
	1000		1500		2000	
$\varnothing$ [mm]	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -
1x 80	0	1	+5	1.6	+8	2.4
1x100	-1	0.8	+3	1.1	+7	1.4
1x125	-1	0.7	+3	0.8	+7	1.0
2x 80	-3	0.6	0	0.8	+3	1.0
2x100	-4	0.6	-1	0.6	+2	0.8
2x125	-4	0.5	-1	0.6	+2	0.8

### Example

#### Given

Type KS1...K190 (FW0066) pos. 3	1 x $\varnothing$ 80 mm	
Volume flow rate	16.7 l/s, m	$\dot{q}_v$
	60 m³/h, m	$\dot{V}$
Room height	3.3 m	H
Occupied zone height	1.7 m	
Distance to the ceiling	1.6 m	$H_1$
Distance between diffusers	2.0 m	A
Difference of temperature	- 12 K / - 8 K / 0 K	$\Delta t$

#### Solution

Sound power level	35 dB(A)	$L_{wA}$
Limite curve	30	$L_{wNC}$
Pressure drop	39 Pa	$\Delta p_t$

### Octave spectrum

f	125	250	500	1000	2000	4000	8000	[Hz]
$L_{wA}$	35	35	35	35	35	35	35	[dB(A)]
$\Delta L_A$	-5	+6	-1	-9	-18	<-20	<-20	[dB]
$L_{wOkt}$	39	41	34	26	17	<15	<15	[dB]

### Insertion attenuation see p. 16

Room air velocity 1.7 m over ground

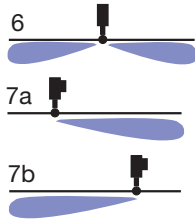
at - 12 K	=	0.17 m/s	$\bar{v}_{H1}$
at - 8 K	=	0.14 m/s	$\bar{v}_{H1}$
at Isotherm	=	<0.10 m/s	$\bar{v}_{H1}$

Difference of temperature	0.018	$\Delta t_L / \Delta t_z$
$(t_R - t_L)$ at $\Delta t_L - 8 \text{ K} = 0.018 \times 8 =$	$\sim 0.2 \text{ K}$	$\Delta t_L$

# Technical Data

## Type KS1

Positions 6 + 7



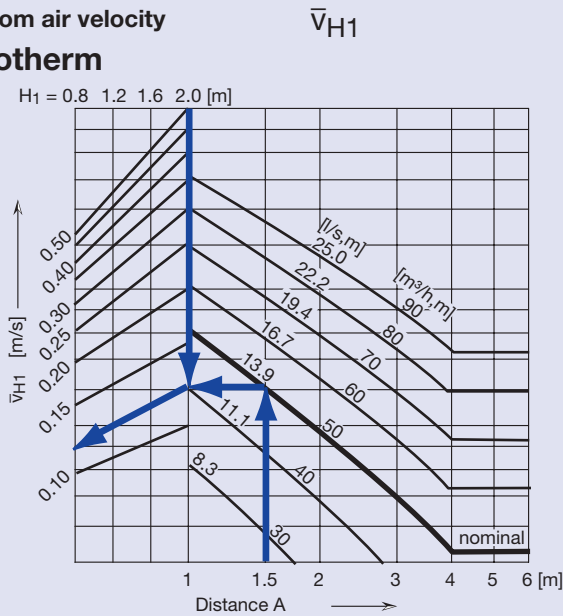
### Correction table, octave-centre frequencies

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta LA$	-5	+6	-1	-9	-18	<-20	<-20	[dB]

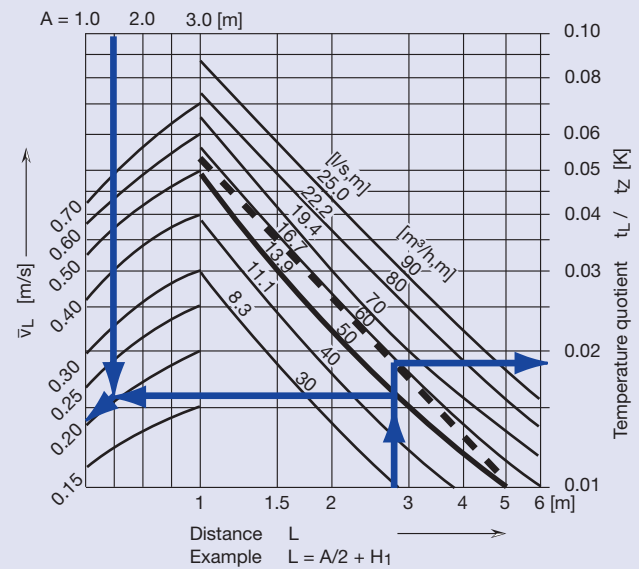
### Insertion attenuation (incl. end reflection) Interior of box not insulated

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta L$	24	17	15	15	16	22	22	[dB]

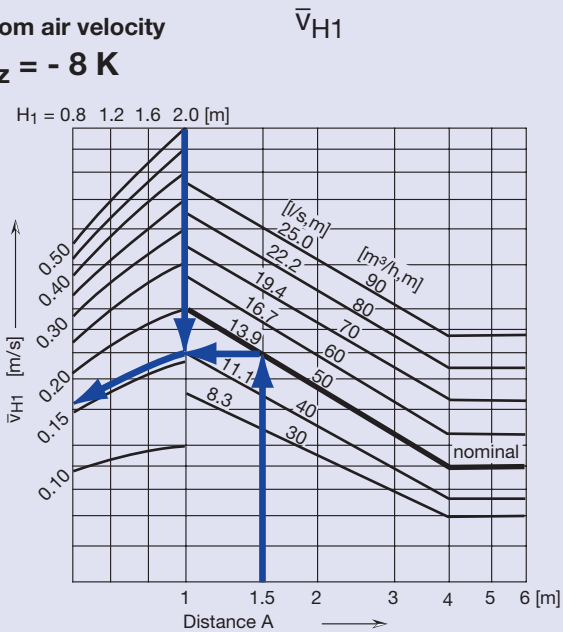
### Room air velocity Isotherm



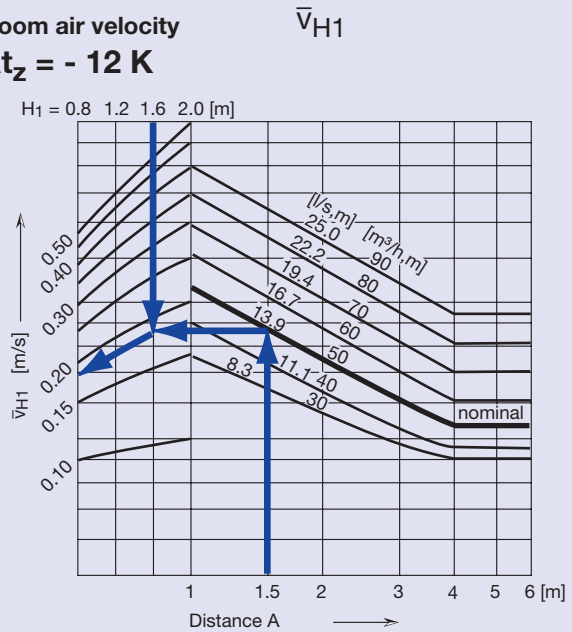
### Room air velocity by the wall $\Delta t_z = -8 \text{ K}$



### Room air velocity $\Delta t_z = -8 \text{ K}$



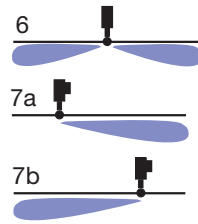
### Room air velocity $\Delta t_z = -12 \text{ K}$





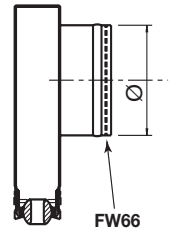
## Type KS1

Positions 6 + 7

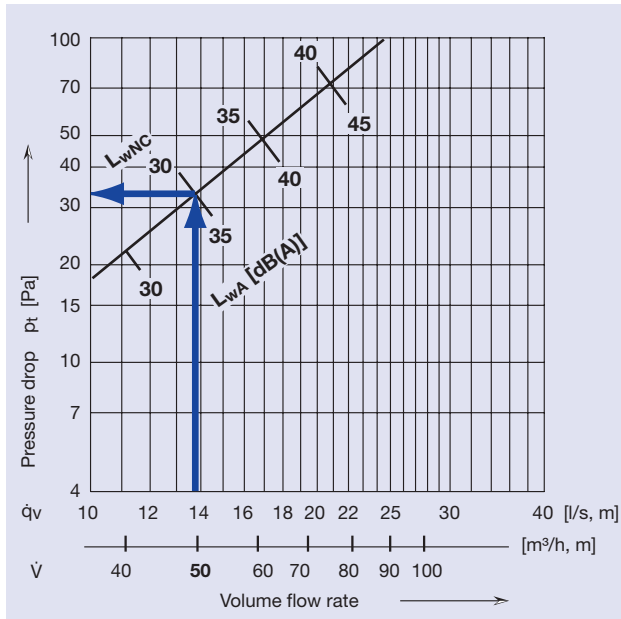


Eff. air outlet surface area

$$A_{\text{eff}} = 0.0017 \text{ m}^2$$



## Sound power level and pressure drop



Correction of the sound power level  $L_{wA}$  and the pressure drop  $\Delta p_t$

Spigot $\varnothing$ [mm]	Length [mm]					
	1000		1500		2000	
	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -
1x 80	0	1	+4	1.5	+7	2.1
1x100	0	0.8	+4	1.1	+7	1.4
1x125	0	0.7	+3	0.9	+7	1.1
2x 80	-2	0.7	+1	0.8	+3	1.0
2x100	-2	0.6	0	0.7	+3	0.8
2x125	-2	0.6	0	0.7	+3	0.7

## Example

### Given

Type KS1...K190 (FW0066) pos. 6 + 7 1 x  $\varnothing$  80 mm  
 Volume flow rate 13.9 l/s, m  $\dot{q}_v$   
 50 m<sup>3</sup>/h, m  $\dot{V}$   
 Room height 3.7 m H  
 Occupied zone height 1.7 m  
 Distance to the ceiling 2.0 m H<sub>1</sub>  
 Distance between diffusers 1.5 m A  
 Difference of temperature - 12 K / - 8 K / 0 K  $\Delta t$

### Solution

Sound power level 35 dB(A)  $L_{wA}$   
 Limite curve 30  $L_{wNC}$   
 Pressure drop 33 Pa  $\Delta p_t$

## Octave spectrum

f	125	250	500	1000	2000	4000	8000	[Hz]
$L_{wA}$	35	35	35	35	35	35	35	[dB(A)]
$\Delta LA$	-5	+6	-1	-9	-18	<-20	<-20	[dB]
$L_{wOkt}$	30	41	34	26	17	<15	<15	[dB]

## Insertion attenuation see p. 18

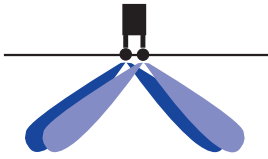
Room air velocity 1.7 m over ground  
 at - 12 K = 0.18 m/s  $\bar{v}_{H1}$   
 at - 8 K = 0.16 m/s  $\bar{v}_{H1}$   
 at Isotherm = 0.12 m/s  $\bar{v}_{H1}$

Difference of temperature 0.019  $\Delta t_L / \Delta t_z$   
 $(t_R - t_L)$  at  $\Delta t_L - 8 \text{ K} = 0.019 \times 8 = \sim 0.2 \text{ K}$   $\Delta t_L$

# Technical Data

## Type KS2

### Position 1



### Correction table, octave-centre frequencies

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta LA$	-5	+6	-1	-9	-18	<-20	<-20	[dB]

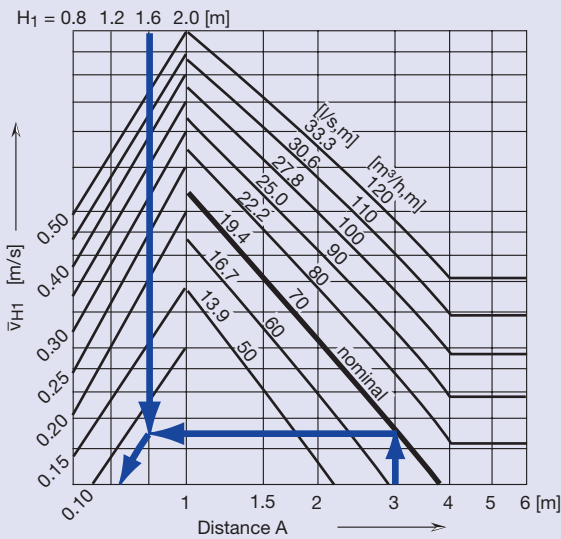
### Insertion attenuation (incl. end reflection)

Interior of box not insulated

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta L$	21	13	16	11	16	15	29	[dB]

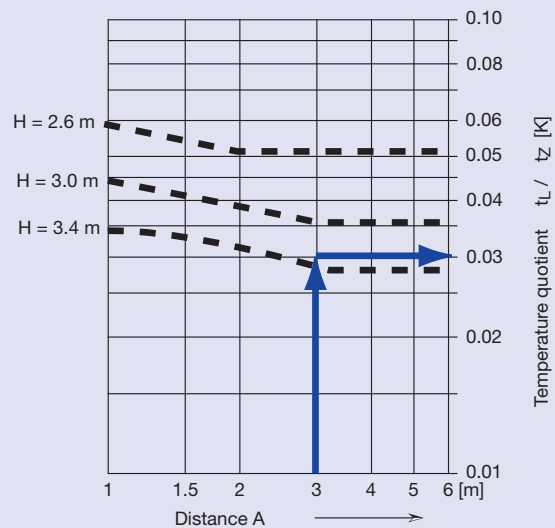
### Room air velocity Isotherm

$\bar{v}_{H1}$



### Temperature quotient

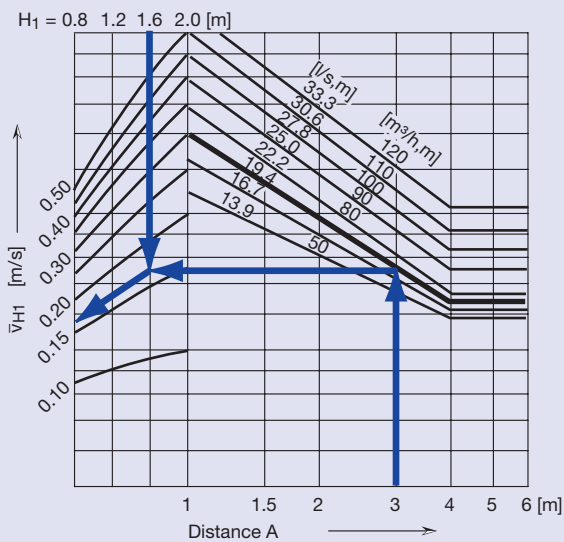
$\Delta t_L / \Delta t_z$



### Room air velocity

$\Delta t_z = -8 \text{ K}$

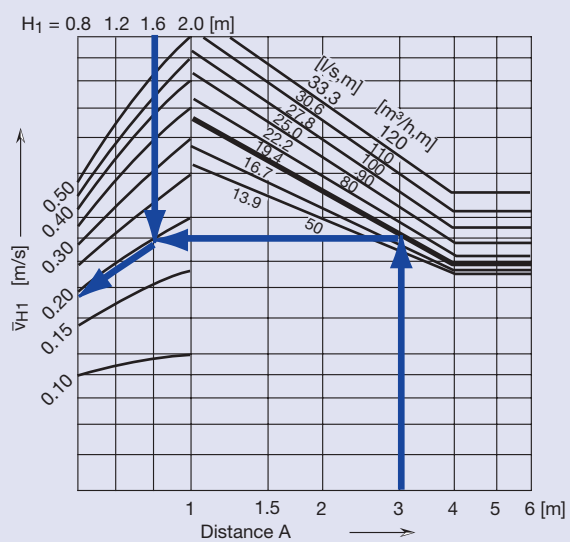
$\bar{v}_{H1}$



### Room air velocity

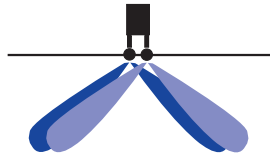
$\Delta t_z = -12 \text{ K}$

$\bar{v}_{H1}$

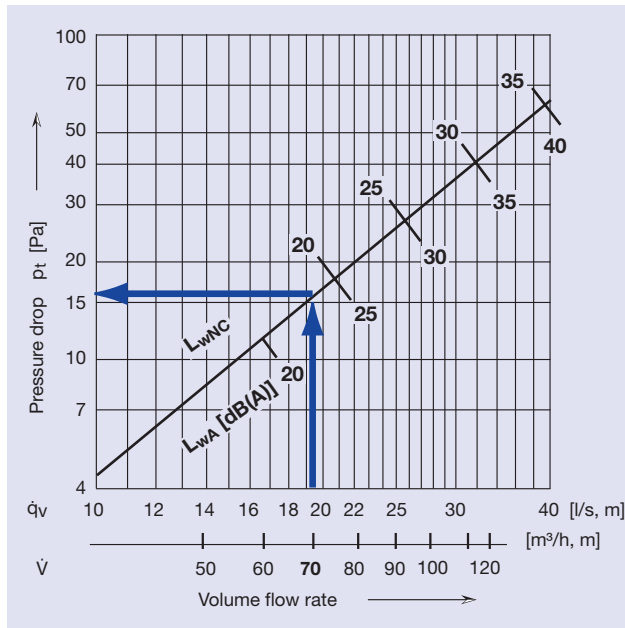


## Type KS2

### Position 1

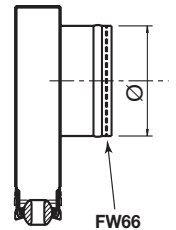


### Sound power level and pressure drop



### Eff. air outlet surface area

$$A_{\text{eff}} = 0.0067 \text{ m}^2$$



### Correction of the sound power level $L_{wA}$ and the pressure drop $\Delta p_t$

Spigot	Length [mm]					
	1000		1500		2000	
$\varnothing$ [mm]	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -
1x 80	+9	1.8	+18	3.6	+25	6.1
1x100	0	1	+9	1.8	+17	2.8
1x125	-7	0.7	+2	1.0	+10	1.5
2x 80	-1	0.7	+6	1.2	+12	1.8
2x100	-9	0.5	-3	0.7	+3	1.0
2x125	-13	0.4	-8	0.5	-4	0.7

### Example

#### Given

Type KS2...K220 (FW0066) pos. 1	1 x $\varnothing$ 100 mm	
Volume flow rate	19.4 l/s, m	$\dot{q}_v$
	70 m <sup>3</sup> /h, m	$\dot{V}$
Room height	3.3 m	H
Occupied zone height	1.7 m	
Distance to the ceiling	1.6 m	$H_1$
Distance between diffusers	3.0 m	A
Difference of temperature	- 12 K / - 8 K / 0 K	$\Delta t$

#### Solution

Sound power level	23 dB(A)	$L_{wA}$
Limite curve	18	$L_{wNC}$
Pressure drop	16 Pa	$\Delta p_t$

### Octave spectrum

f	125	250	500	1000	2000	4000	8000	[Hz]
$L_{wA}$	23	23	23	23	23	23	23	[dB(A)]
$\Delta L_A$	-5	+6	-1	-9	-18	<-20	<-20	[dB]
$L_{wOkt}$	18	29	22	14	<14	<14	<14	[dB]

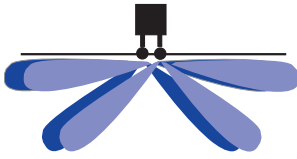
### Insertion attenuation see p. 20

Room air velocity 1.7 m over ground		
at - 12 K	=	0.19 m/s $\bar{v}_{H1}$
at - 8 K	=	0.16 m/s $\bar{v}_{H1}$
at Isotherm	=	<0.10 m/s $\bar{v}_{H1}$
Difference of temperature		0.03 $\Delta t_L / \Delta t_z$
$(t_R - t_L)$ at $\Delta t_L - 8 \text{ K} = 0.03 \times 8 =$		$\sim 0.3 \text{ K}$ $\Delta t_L$

# Technical Data

Type KS2

Position 2



Correction table, octave-centre frequencies

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta LA$	-5	+6	-1	-9	-18	<-20	<-20	[dB]

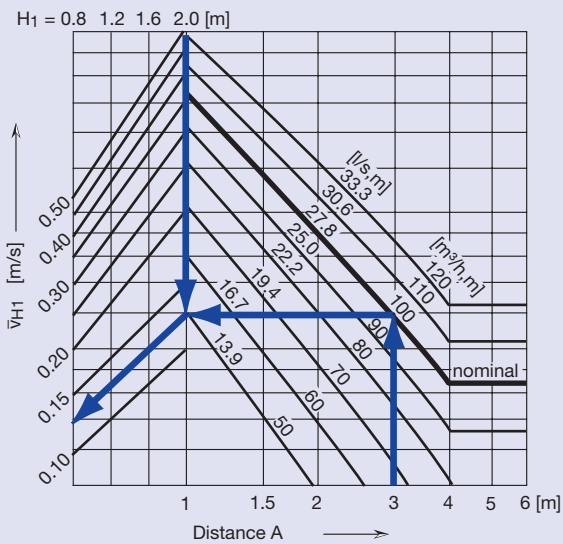
Insertion attenuation (incl. end reflection)

Interior of box not insulated

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta L$	21	13	16	11	16	15	29	[dB]

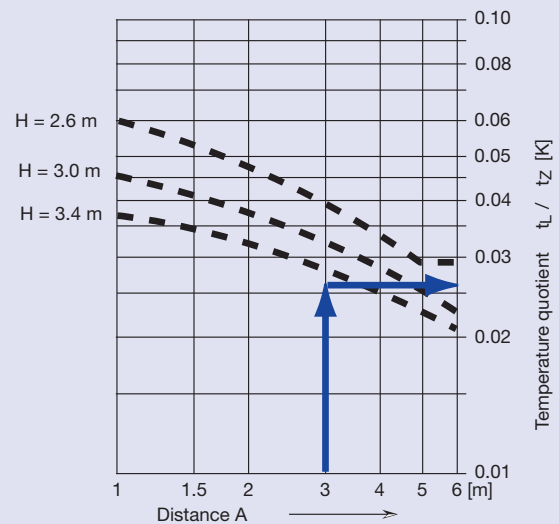
Room air velocity

Isotherm



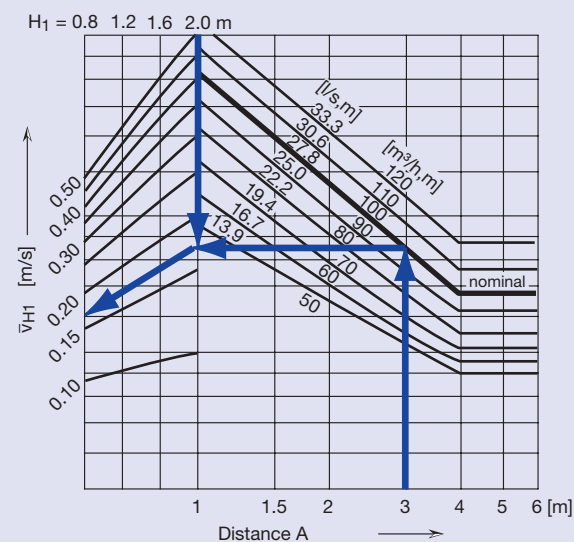
Temperature quotient

$\Delta t_L / \Delta t_z$



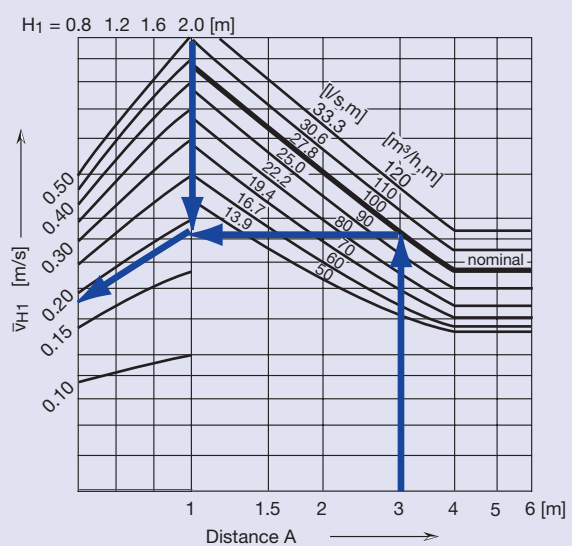
Room air velocity

$\Delta t_z = -8 \text{ K}$



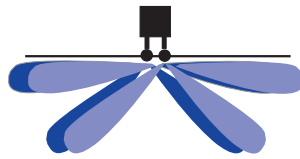
Room air velocity

$\Delta t_z = -12 \text{ K}$

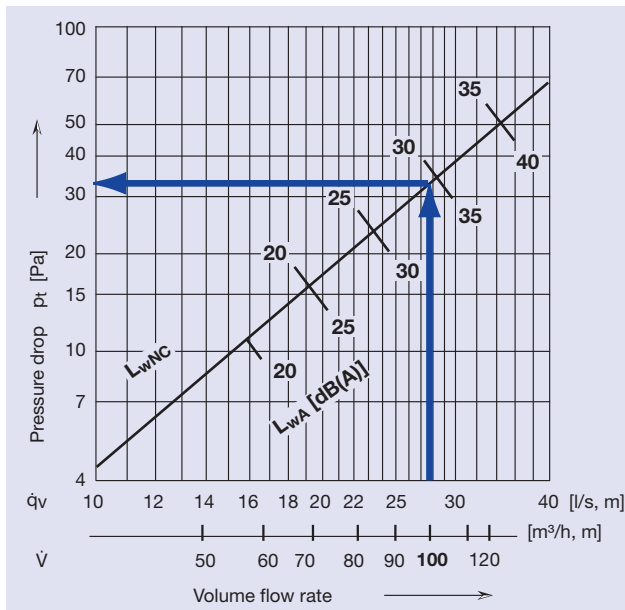


## Type KS2

### Position 2

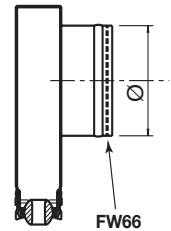


### Sound power level and pressure drop



### Eff. air outlet surface area

$$A_{\text{eff}} = 0.0057 \text{ m}^2$$



### Correction of the sound power level $L_{wA}$ and the pressure drop $\Delta p_t$

Spigot $\varnothing$ [mm]	Length [mm]					
	1000		1500		2000	
	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -
1 × 80	+7	1.7	+16	3.4	+23	5.6
1 × 100	0	1	+8	1.7	+15	2.7
1 × 125	-3	0.7	+4	1.0	+10	1.5
2 × 80	-2	0.7	+5	1.2	+10	1.7
2 × 100	-6	0.5	-2	0.7	+3	1.0
2 × 125	-7	0.5	-3	0.6	0	0.7

### Example

#### Given

Type KS2...K220 (FW0066) pos. 2	1 × $\varnothing$ 100 mm
Volume flow rate	27.8 l/s, m $\dot{q}_v$ 100 m³/h, m $\dot{V}$
Room height	3.7 m H
Occupied zone height	1.7 m
Distance to the ceiling	2.0 m $H_1$
Distance between diffusers	3.0 m A
Difference of temperature	- 12 K / - 8 K / 0 K $\Delta t$

#### Solution

Sound power level	34 dB(A)	$L_{wA}$
Limite curve	29	$L_{wNC}$
Pressure drop	34 Pa	$\Delta p_t$

### Octave spectrum

f	125	250	500	1000	2000	4000	8000	[Hz]
$L_{wA}$	34	34	34	34	34	34	34	[dB(A)]
$\Delta L_A$	-5	+6	-1	-9	-18	<-20	<-20	[dB]
$L_{wOkt}$	29	40	33	25	16	<14	<14	[dB]

### Insertion attenuation see p. 22

Room air velocity 1.7 m over ground

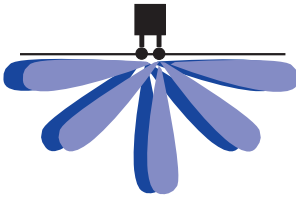
at - 12 K	=	0.19 m/s	$\bar{v}_{H1}$
at - 8 K	=	0.17 m/s	$\bar{v}_{H1}$
at Isotherm	=	0.13 m/s	$\bar{v}_{H1}$

Difference of temperature	0.026	$\Delta t_L / \Delta t_z$
$(t_R - t_L)$ at $\Delta t_L - 8 \text{ K} = 0.026 \times 8 =$	$\sim 0.2 \text{ K}$	$\Delta t_L$

# Technical Data

Type KS2

Position 3



Correction table, octave-centre frequencies

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta LA$	-5	+6	-1	-9	-18	<-20	<-20	[dB]

Insertion attenuation (incl. end reflection)

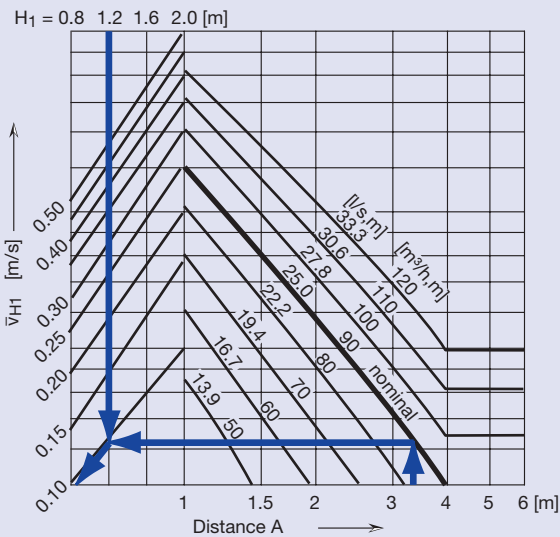
Interior of box not insulated

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta L$	21	13	16	11	16	15	29	[dB]

Room air velocity

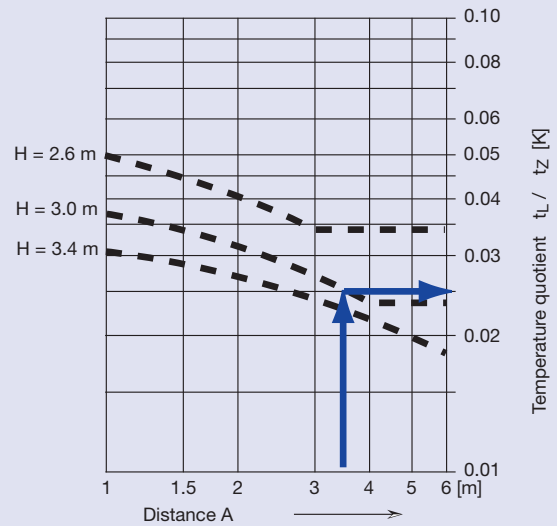
Isotherm

$\bar{v}_{H1}$



Temperature quotient

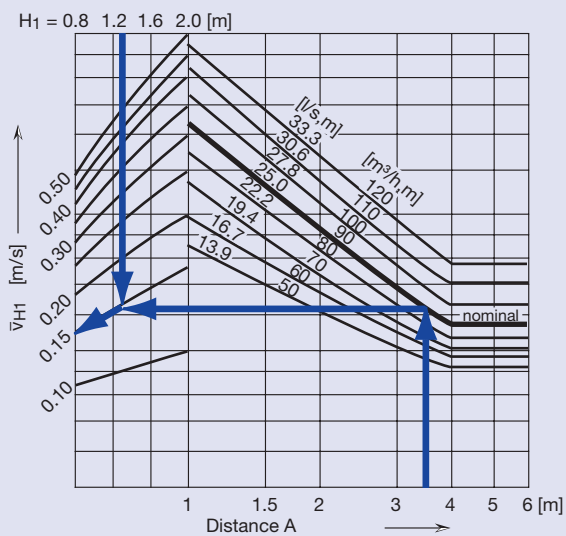
$\Delta t_L / \Delta t_z$



Room air velocity

$\Delta t_z = -8 K$

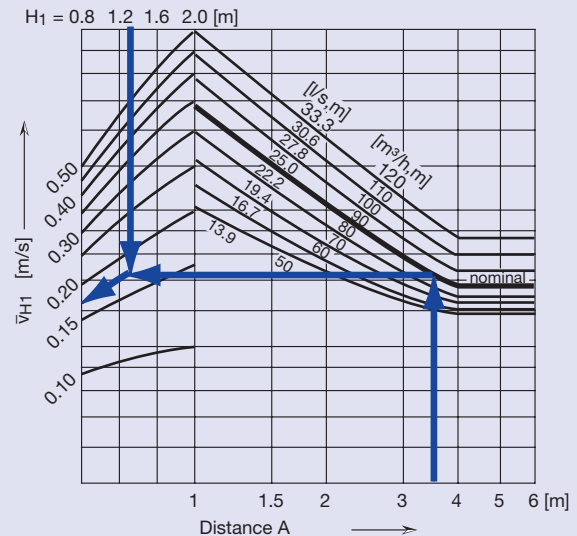
$\bar{v}_{H1}$



Room air velocity

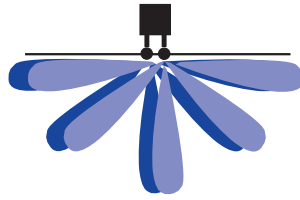
$\Delta t_z = -12 K$

$\bar{v}_{H1}$



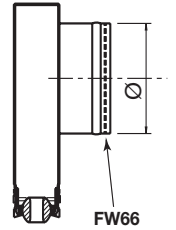
## Type KS2

### Position 3

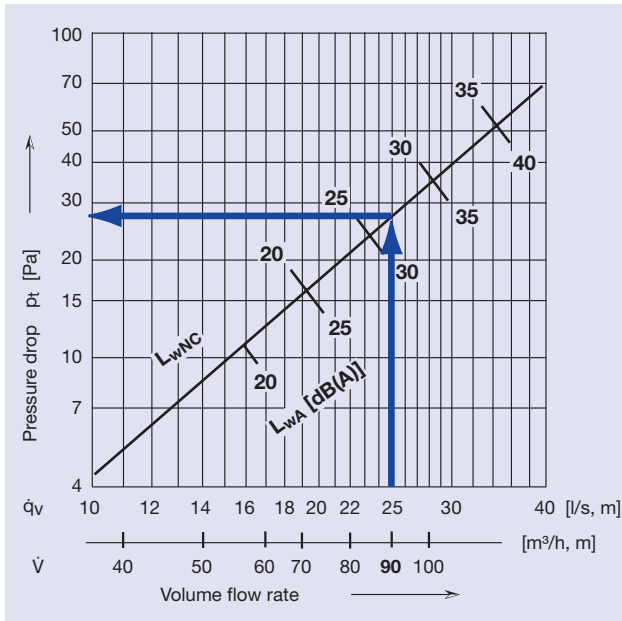


Eff. air outlet surface area

$$A_{\text{eff}} = 0.0057 \text{ m}^2$$



### Sound power level and pressure drop



Correction of the sound power level  $L_{wA}$  and the pressure drop  $\Delta p_t$

Spigot	Length [mm]					
	1000		1500		2000	
$\varnothing$ [mm]	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -
1x 80	+7	1.7	+16	3.4	+24	5.7
1x100	0	1	+8	1.7	+16	2.7
1x125	-3	0.7	+4	1.0	+10	1.5
2x 80	-2	0.7	+5	1.2	+10	1.7
2x100	-6	0.5	-2	0.7	+3	1.0
2x125	-7	0.5	-3	0.6	0	0.7

### Example

#### Given

Type KS2...K220 (FW0066) pos. 3	1 x $\varnothing$ 100 mm	$\dot{q}_v$
Volume flow rate	25.0 l/s, m	$\dot{V}$
	90 m³/h, m	
Room height	3.0 m	H
Occupied zone height	1.7 m	
Distance to the ceiling	1.3 m	$H_1$
Distance between diffusers	3.5 m	A
Difference of temperature	- 12 K / - 8 K / 0 K	$\Delta t$

#### Solution

Sound power level	31 dB(A)	$L_{wA}$
Limite curve	26	$L_{wNC}$
Pressure drop	28 Pa	$\Delta p_t$

### Octave spectrum

f	125	250	500	1000	2000	4000	8000	[Hz]
$L_{wA}$	31	31	31	31	31	31	31	[dB(A)]
$\Delta LA$	-5	+6	-1	-9	-18	<-20	<-20	[dB]
$L_{wOkt}$	26	37	30	22	<15	<15	<15	[dB]

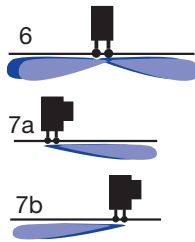
### Insertion attenuation see p. 24

Room air velocity 1.7 m over ground			
at - 12 K	=	0.17 m/s	$\bar{v}_{H1}$
at - 8 K	=	0.15 m/s	$\bar{v}_{H1}$
at Isotherm	=	<0.10 m/s	$\bar{v}_{H1}$
Difference of temperature		0.025	$\Delta t_L / \Delta t_z$
$(t_R - t_L)$ at $\Delta t_L - 8 \text{ K} = 0.025 \times 8 =$		-0.2 K	$\Delta t_L$

# Technical Data

## Type KS2

Positions 6 + 7



### Correction table, octave-centre frequencies

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta LA$	-5	+6	-1	-9	-18	<-20	<-20	[dB]

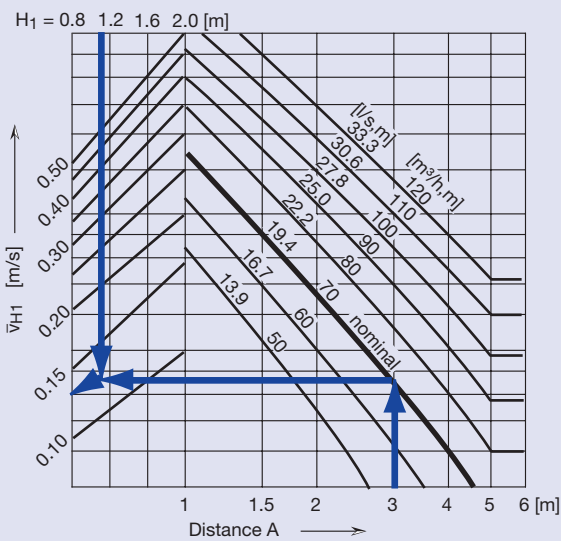
### Insertion attenuation (incl. end reflection)

Interior of box not insulated

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta L$	21	13	16	11	16	15	29	[dB]

### Room air velocity Isotherm

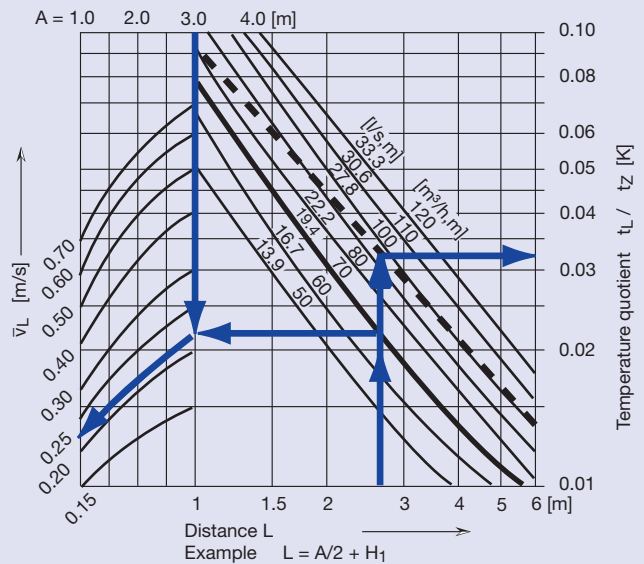
$\bar{v}_{H1}$



### Room air velocity by the wall

$\Delta t_z = -8 \text{ K}$

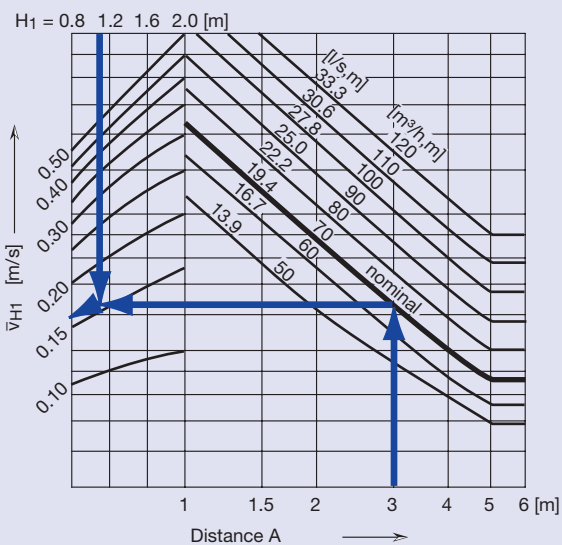
$\bar{v}_L$



### Room air velocity

$\Delta t_z = -8 \text{ K}$

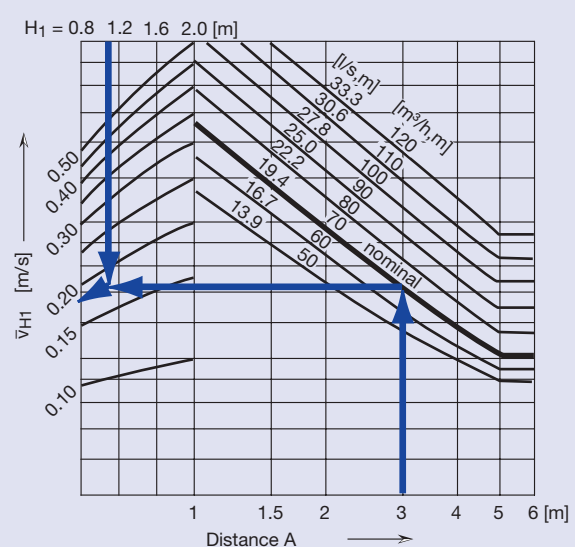
$\bar{v}_{H1}$



### Room air velocity

$\Delta t_z = -12 \text{ K}$

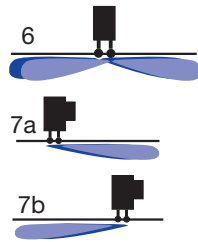
$\bar{v}_{H1}$





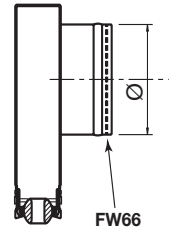
## Type KS2

Positions 6 + 7

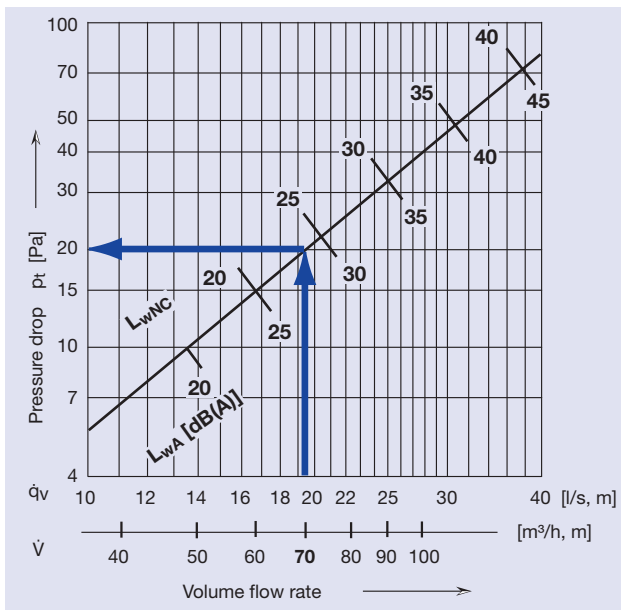


Eff. air outlet surface area

$$A_{\text{eff}} = 0.0035 \text{ m}^2$$



## Sound power level and pressure drop



Correction of the sound power level  $L_{wA}$  and the pressure drop  $\Delta p_t$

Spigot $\varnothing$ [mm]	Length [mm]					
	1000		1500		2000	
	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -
1x 80	+4	1.6	+13	3.0	+20	4.9
1x100	0	1	+7	1.6	+13	2.4
1x125	-1	0.7	+5	1.0	+10	1.4
2x 80	-3	0.8	+2	1.1	+7	1.6
2x100	-5	0.6	-1	0.8	+3	1.0
2x125	-5	0.5	-1	0.6	+2	0.7

## Example

### Given

Type KS2...K220 (FW0066) pos. 6+7, 1 x  $\varnothing$  100 mm  
 Volume flow rate 19.4 l/s, m  $\dot{q}_v$   
 70 m<sup>3</sup>/h, m  $\dot{V}$   
 Room height 2.8 m H  
 Occupied zone height 1.7 m  
 Distance to the ceiling 1.1 m H<sub>1</sub>  
 Distance between diffusers 3.0 m A  
 Difference of temperature - 12 K / - 8 K / 0 K  $\Delta t$

### Solution

Sound power level 28 dB(A)  $L_{wA}$   
 Limite curve 23  $L_{wNC}$   
 Pressure drop 20 Pa  $\Delta p_t$

## Octave spectrum

f	125	250	500	1000	2000	4000	8000	[Hz]
$L_{wA}$	28	28	28	28	28	28	28	[dB(A)]
$\Delta L_A$	-5	+6	-1	-9	-18	<-20	<-20	[dB]
$L_{wOkt}$	23	34	27	19	<15	<15	<15	[dB]

## Insertion attenuation see p. 26

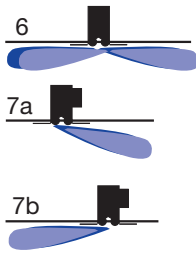
Room air velocity 1.7 m over ground  
 at - 12 K = 0.19 m/s  $\bar{v}_{H1}$   
 at - 8 K = 0.17 m/s  $\bar{v}_{H1}$   
 at Isotherm = 0.14 m/s  $\bar{v}_{H1}$

Difference of temperature 0.033  $\Delta t_L / \Delta t_z$   
 ( $t_R - t_L$ ) at  $\Delta t_L - 8 \text{ K} = 0.033 \times 8 = \sim 0.3 \text{ K}$   $\Delta t_L$

# Technical Data

## Type KS2WK100

Positions 6 + 7



### Correction table, octave-centre frequencies

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta LA$	-5	+6	-1	-9	-18	<-20	<-20	[dB]

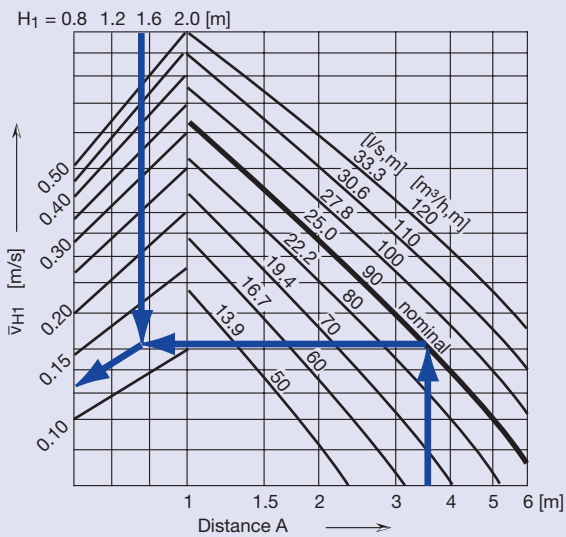
### Insertion attenuation (incl. end reflection)

Interior of box not insulated

f	125	250	500	1k	2k	4k	8k	[Hz]
$\Delta L$	21	13	16	11	16	15	29	[dB]

### Room air velocity Isotherm

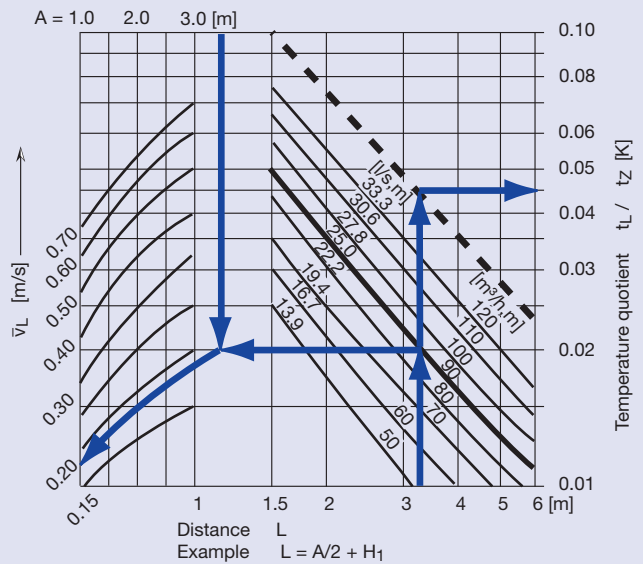
$\bar{v}_{H1}$



### Room air velocity by the wall

$\Delta t_z = -8 K$

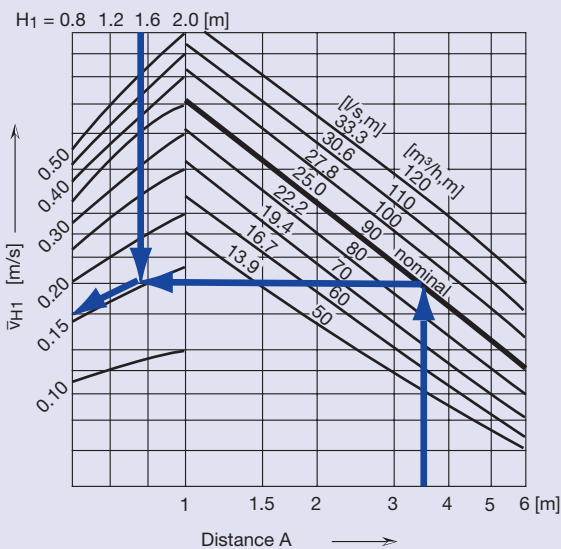
$\bar{v}_L$



### Room air velocity

$\Delta t_z = -8 K$

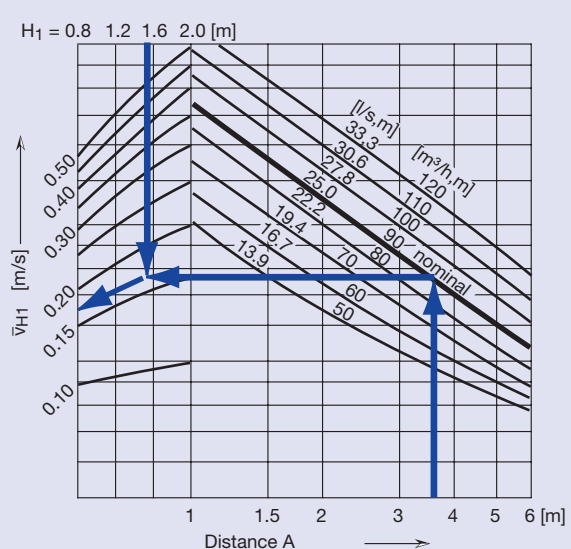
$\bar{v}_{H1}$



### Room air velocity

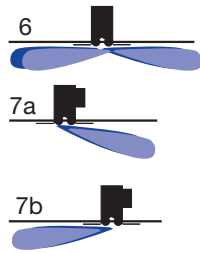
$\Delta t_z = -12 K$

$\bar{v}_{H1}$



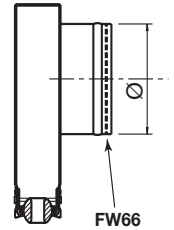
## Type KS2WK100...K220

Positions 6 + 7

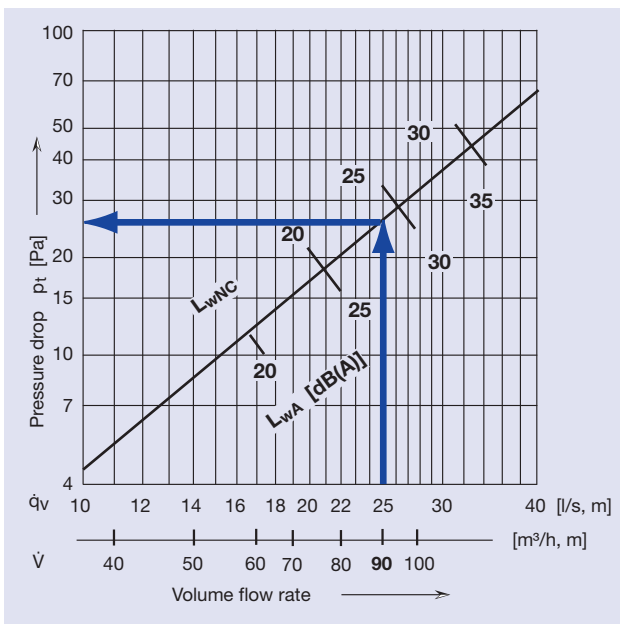


Eff. air outlet surface area

$$A_{\text{eff}} = 0.0063 \text{ m}^2$$



## Sound power level and pressure drop



Correction of the sound power level  $L_{wA}$  and the pressure drop  $\Delta p_t$

Spigot $\varnothing$ [mm]	Length [mm]					
	1000		1500		2000	
	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -	$L_{wA}$ [dB]	$f_{pt}$ -
1x 80	+9	1.8	+18	3.6	+25	6.1
1x100	0	1	+9	1.8	+17	2.8
1x125	-7	0.7	+2	1.0	+10	1.5
2x 80	-1	0.8	+6	1.2	+12	1.8
2x100	-9	0.5	-3	0.7	+3	1.0
2x125	-13	0.4	-8	0.5	-4	0.7

## Example

### Given

Type KS2WK100...K220 (FW0066)		
pos.6+7	1 x $\varnothing$ 100 mm	
Volume flow rate	25.0 l/s, m	$\dot{q}_v$
	90 m <sup>3</sup> /h, m	$\dot{V}$
Room height	3.2 m	H
Occupied zone height	1.7 m	
Distance to the ceiling	1.5 m	$H_1$
Distance between diffusers	3.5 m	A
Difference of temperature	- 12 K / - 8 K / 0 K	$\Delta t$

### Solution

Sound power level	29 dB(A)	$L_{wA}$
Limite curve	24	$L_{wNC}$
Pressure drop	26 Pa	$\Delta p_t$

## Insertion attenuation see p. 28

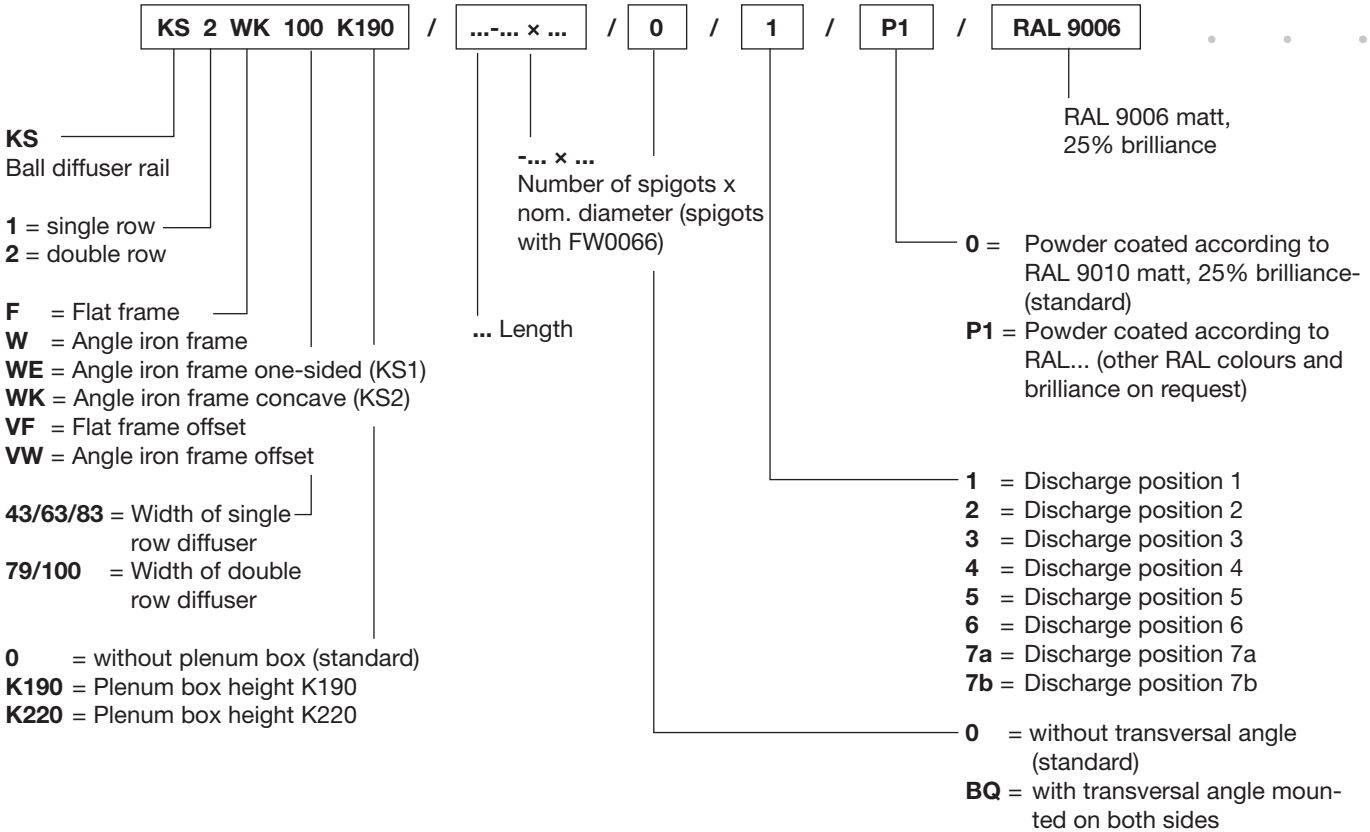
Room air velocity 1.7 m over ground		
at - 12 K	=	0.18 m/s $\bar{v}_{H1}$
at - 8 K	=	0.16 m/s $\bar{v}_{H1}$
at Isotherm	=	0.13 m/s $\bar{v}_{H1}$
Difference of temperature	0.045	$\Delta t_L / \Delta t_z$
$(t_R - t_L)$ at $\Delta t_L - 8 \text{ K} = 0.045 \times 8 =$	$\sim 0.4 \text{ K}$	$\Delta t_L$

## Octave spectrum

f	125	250	500	1000	2000	4000	8000	[Hz]
$L_{wA}$	29	29	29	29	29	29	29	[dB(A)]
$\Delta LA$	-5	+6	-1	-9	-18	<-20	<-20	[dB]
$L_{wOkt}$	24	35	28	20	<15	<15	<15	[dB]

# Order details

## Order codes



## Order examples

45 off KS1 WE 43 / 2000 / BQ / 2

40 off KS2 W 79 K220 / 1000 / BQ / 1 / P1 / RAL9006

## Text for tendering purposes

Ball diffuser rails with swivelling ball jets. Adjustment range of discharge direction 360° on all sides.

Consequently, they may be set to blow in small single jets or in one compact air jet. Air jet control along ceiling or in a room.

Also suitable for installation in a ceiling recess with offset ball arrangement. Air discharge suitable for variable air quantities of 100 to 25%.

Air diffuser consisting of swivelling ball jets made of synthetic material, which are held aluminium profiles by means of a clamping device. Setting of balls according to customer's instructions, pre-set at works. Connection box (with/without insulation) with round tube connection and integrated fixed resistance FW0066 including 4 aluminium brackets of galvanised metal sheet. Visible areas with matt lacquered finish according to RAL 9010, 25% brilliance.