nad KLIMA

MADE IN CANADA

RRA

Duct diffuser

catalog 1.1.4

Borealis, Magog, Canada

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Version 2019

The Hall, 2020 Université, Montréal, Canada

RRA

Presentation and benefits

The RRA is a high induction diffuser made to address the ventilation needs of spaces with low and medium heights.

The RRA diffuser is made of galvanneal steel covered with powder coated paint. The standard manufacture size is 1500 mm (59 in) long. Alternatively, it is available in different lengths to meet your needs.

It is ideal for applications where the technology must be not only efficient but also integrated into the architectural design. With integrated eccentric rollers and/or nozzle rollers, the circular RRA diffuser offers a multitude of air direction choices.

All air conditioning and heating solutions are found in one application, which combines technology, aesthetics and comfort.

Areas of application

- Commercial industry
- Institutions
- Restaurants
- Office areas
- Entry halls, Atriums
- Theaters
- Buildings with apparent structure
- Public spaces

Benefits

- High induction diffuser which allows homogeny of the air in a room: the temperature, humidity and density
- Increased comfort in the occupied zone
- Comfortable movement of air
- Low temperature differences
- Low noise
- Eccentric rollers allow an adjustment of the airflow in a 180° range
- Possibility to change the direction of air flow after installation
- Possibility of reducing the total airflow up to 30 % in V.A.V.
- Possibility to eliminating the heating baseboard through heating by the diffuser
- Simplifies the ventilation network and reduces installation costs
- Easy adaption to systems with variable or constant airflow

Easy to maintain

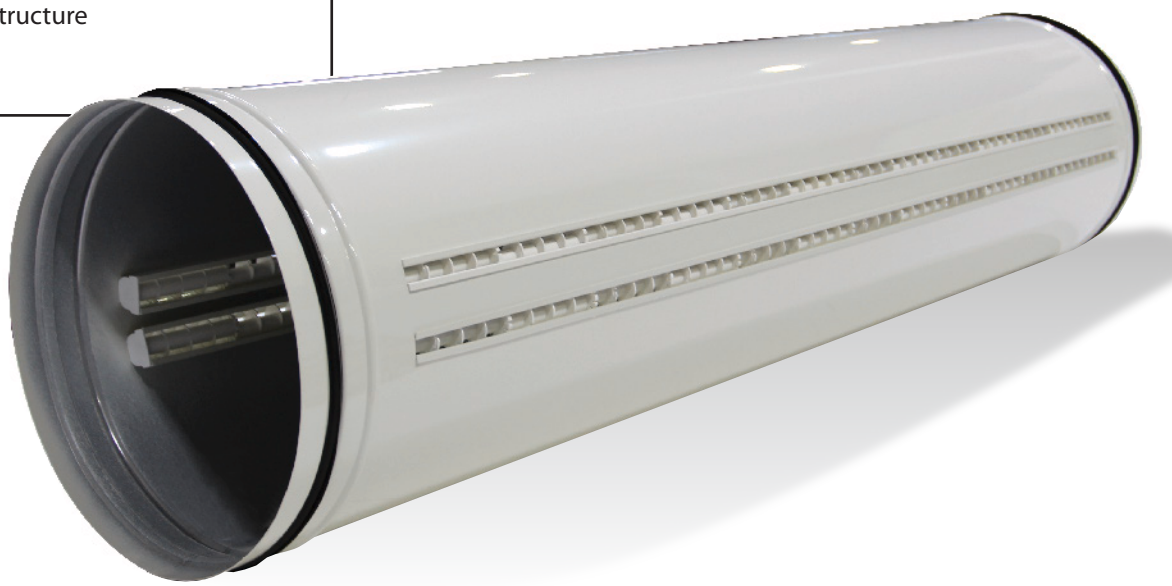
- Powder coated paint which minimizes dust collection and makes it easy to clean
- Low accumulation in the interior because dust is purged by the slots.

Durability

- The powder coated paint prevents chipping
- Sealed with PVC joint to prevent leakage and seal degradation
- Aluminum suspension rail and duct in galvanneal metal covered with a powder coated paint

Easy installation

- Installed using a suspension rail
- No sealing required
- Fewer suspension rods and installation screws



Configuration and accessories

Composition

The RRA in-duct diffuser is a smooth circular pipe on which the slots are mounted lengthwise. The number of slots is determined by the quantity of air flow and by the diameter of the duct.

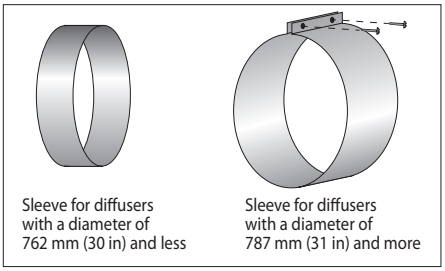
The slots contain 100 mm long ABS eccentric rollers or ABS nozzle rollers (black, cream or white). The eccentric rollers are provided with alphanumeric guides, which allow adjustment of the airflow pattern across a 180° range. The RRA diffuser is constructed in diameters from 200 mm up to 1419 mm. Metallic reinforcements are installed on the interior of ducts wider than 433 mm to maintain circular integrity.

At each end, a receiving groove fitting integrated PVC gasket ensures a proper seal.

Passive ducts without slots are available in the same dimensions as the active RRAs in order to ensure the uniformity of the duct network.

Assembly

The RRA diffuser sections are linked by connection sleeves which are adapted to the diameter of the duct.

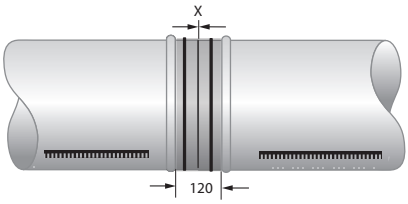


Accessories

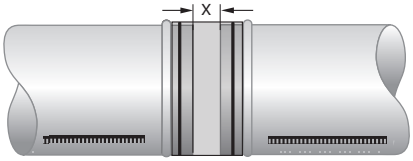
All of the standard accessories (elbows, sleeves, reducers, multi-branch connectors, etc.) are available in the precise dimensions of the ducts.

For air balancing reasons, a reducer or a balancing damper is required between multiple sections.

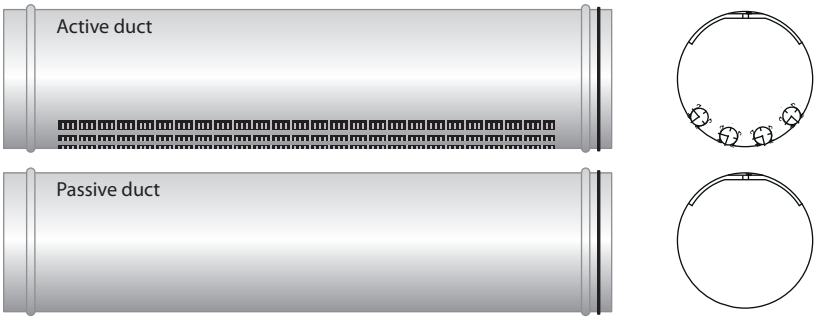
Standard Sleeve (120 mm) (No space between RRA)
X = 0



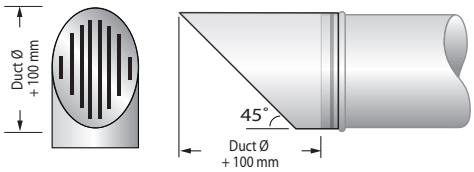
Special sleeve (space between RRA)
X = from 1 mm to 1380 mm



Active and passive ducts have small ends (male)

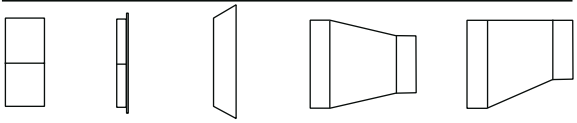


Bivelled end-cap with big end (female)

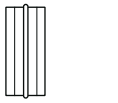


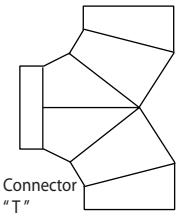
Accessories

big ends (female)

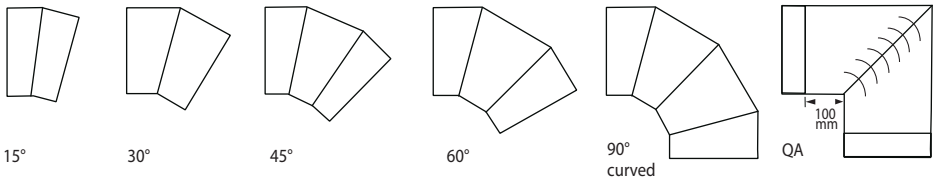


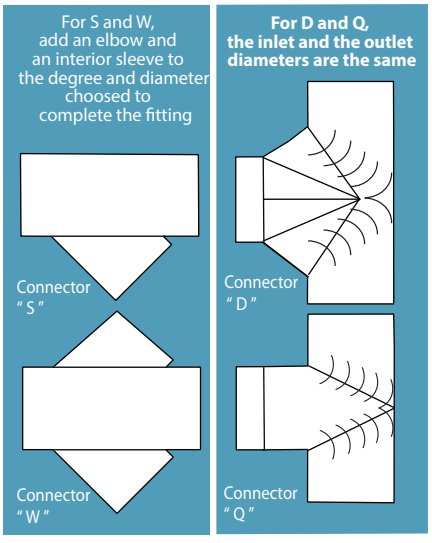
small-ends (male)





Elbows have big ends (female)





Mode of operation and direction of air flow

Mode of operation

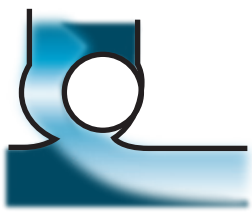
The eccentric rollers and nozzle rollers form, with the aluminum air guiding slots, an optimal flow of air.
A drop in pressure occurs when approching the surface of the rollers. As the air leaves the slot, it is stable and generates a low level of acoustic power. The flow maintains a powerful induction of ambient air.
The positioning of the eccentric rollers allows for an air jet direction adjustment, with or without reduction in the exit area. The rollers have small plates to guide the air, which support a dense airflow and maintain that air flow direction perpendicular to the roller's axis.

Setting of the air jet direction

Thanks to the shape of the eccentric rollers and adjustment dial with alphanumeric characters, the air jet's direction at the outlet of the diffuser can vary up to 180°. For each direction, there are two (2) roller positions ("reduced" or "not reduced"), as illustrated in figure E.

The length of each roller is 100 mm and they are individually adjustable. As a result, the combinations of airflow are almost infinite. In manufacturing, the ducts are individually adjusted for each project. The standard setting for the rollers is set to diffusion mode, in the positions "21" and "65" alternately. This setting produces strong induction, which can be used to meet heating and cooling needs, thereby creating high mixing levels. The nozzle rollers can only be set in the open and closed position.

Eccentric roller



Nozzle roller

As a result, the divergent mode allows jets to blow in more accurate directions. This mode also allows a longer projection of the airflow. In specific zones which are habitually difficult to cover, a specialized setting can be created. Figures C and D show the relationship between the position of the eccentric roller and the direction of the exiting airflow. Note that to maximize air projection, multiple jets can be orientated in the same direction to optimize the coverage of a zone, even when heating.

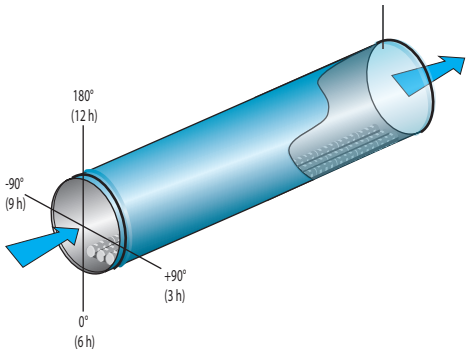
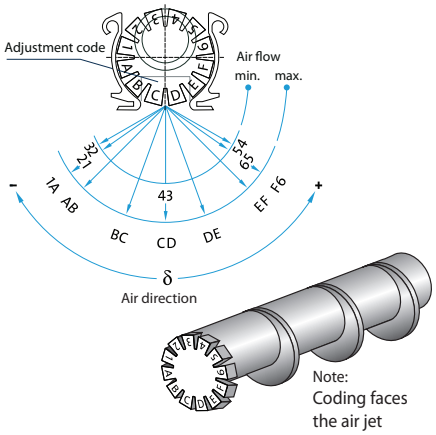
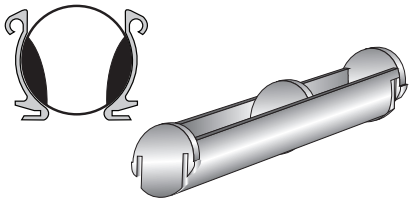


Figure E

Eccentric roller

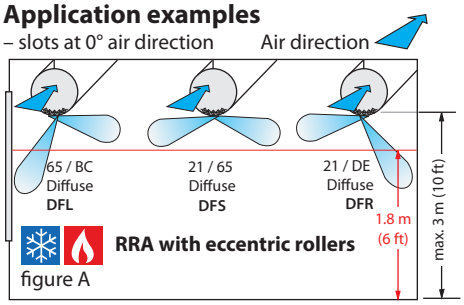


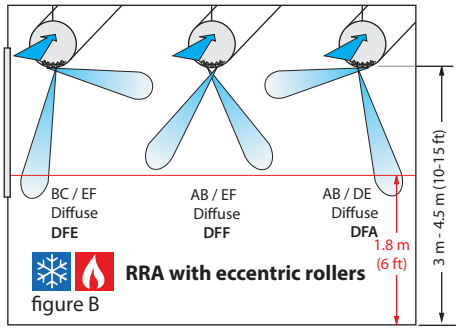
Nozzle roller

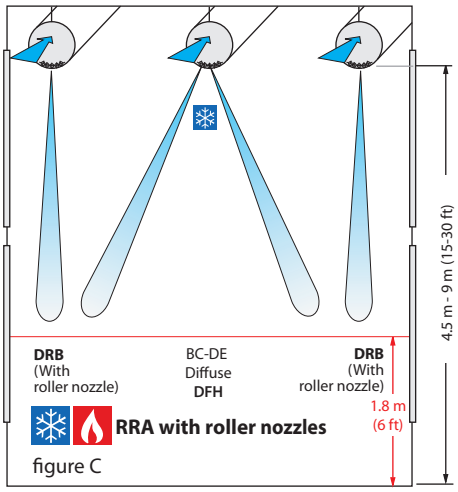


Application examples

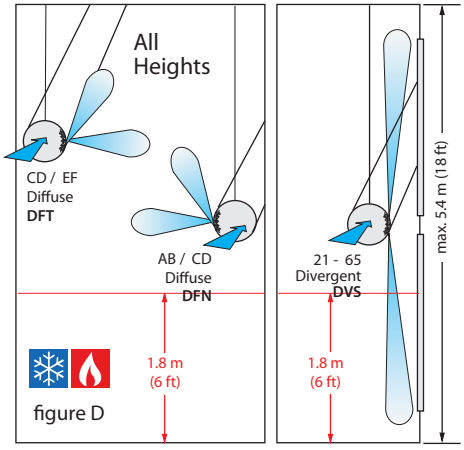
– slots at 0° air direction







Slots at +90°



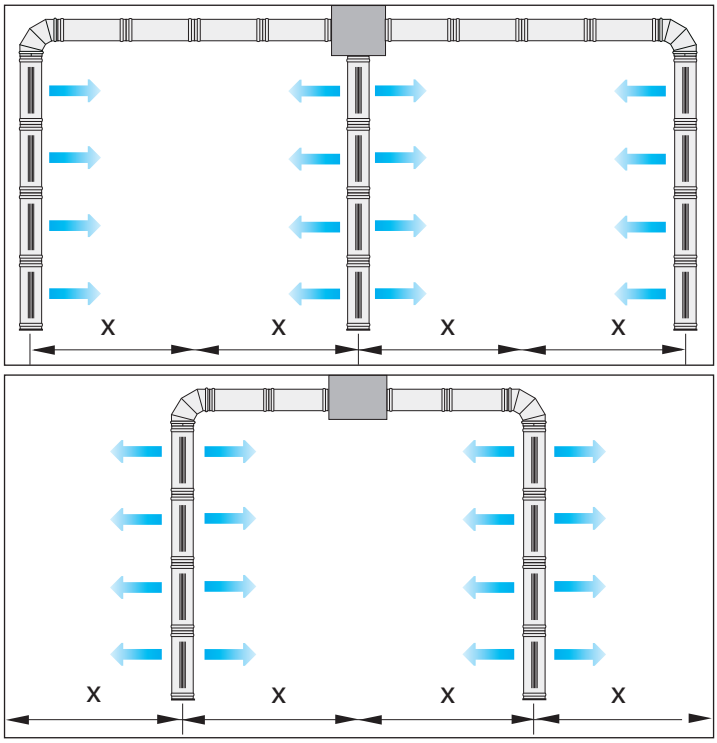
RRA with eccentric rollers and/or nozzles

Range of application

Maximum installation space

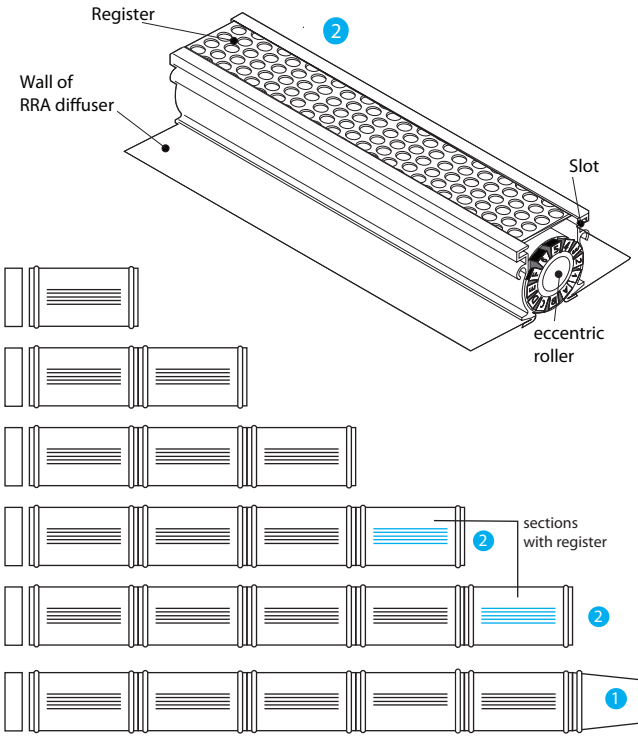
	Air flow by meter of slot of RRA $\dot{V}_o$	Installation height of of the RRA H	Recommended space between RRA X MAXIMUM
	m³/h/m (cfm/li. ft)	**m (ft)**	**m (ft)**
	50 - 100 (9 - 19)	≤ 3 (10)	5 (16)
	100 - 150 (19 - 27)	3 - 4.3 (10 - 14)	7 (22)
	150 - 170 (27 - 31)	4.3 - 7 (14 - 23)	8 (26)

Cooling only: keep the maximum distance X depending on the height, but keep the airflow by meter of the slot at 50 – 120m³/h/m.



Aerodynamic balancing and reducer placement

To optimize a uniform airflow in the RRA diffuser, the total length must not exceed 7.5 m (25 ft) without using a reducer or a balancing damper. For a diffuser greater than 7.5 meters (25 ft), a reducer must be installed at the center (see 1). Once there are more than 4.5 m (15 ft) of active ducts, it is recommended to install a register to balance the air (see 2).



Selection of the diameter

For a flow lower than 1400 cfm, use the following table:

Flow range	Ø recommended
below 280 cfm	200 mm (8 in)
281cfm to 460 cfm	251 mm (10 in)
461cfm to 650 cfm	303 mm (12 in)
651 cfm to 1100 cfm	353 mm (14 in)
1101 cfm to 1400 cfm	403 mm (16 in)

For an airflow greater than 1400 cfm, select a duct diameter (see diameters in the codification on page 18) for a maximum air speed of 1000 ft/m.

Detailed manufacturing of a transformation

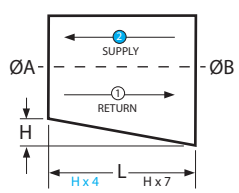
Flat on top Reducer

Orientation of the air flow

② H/L = 1/4
① H/L = 1/7

H = ØA - ØB

② L = H x 4
① L = H x 7



Detailed manufacturing of a transformation

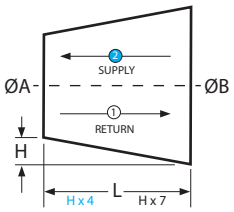
Centered Reducer

Orientation of the air flow

② H/L = 1/4
① H/L = 1/7

H = (ØA - ØB) ÷ 2

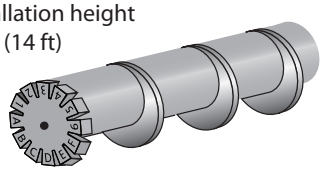
② L = H x 4
① L = H x 7



Note : The standard length of reducers is rounded to the next whole foot.
ex. : L = 1.3 ft. will be : L = 2 ft.

Selecting the number of slots
RRA with eccentric rollers

For an installation height
up to 4.3 m (14 ft)



Important:

To make the selection of RRA, the total airflow must be calculated for a 1m length of active slots.

Specifications:

Height at the bottom of the duct: H = 4 m
Airflow by diffuser: $\dot{V}o = 420\ m^3/h$
Cooling: $\Delta T = -10°C$
Heating: $\Delta T = +10°C$
Length of the RRA: $L_R = 1500$ mm

Required:

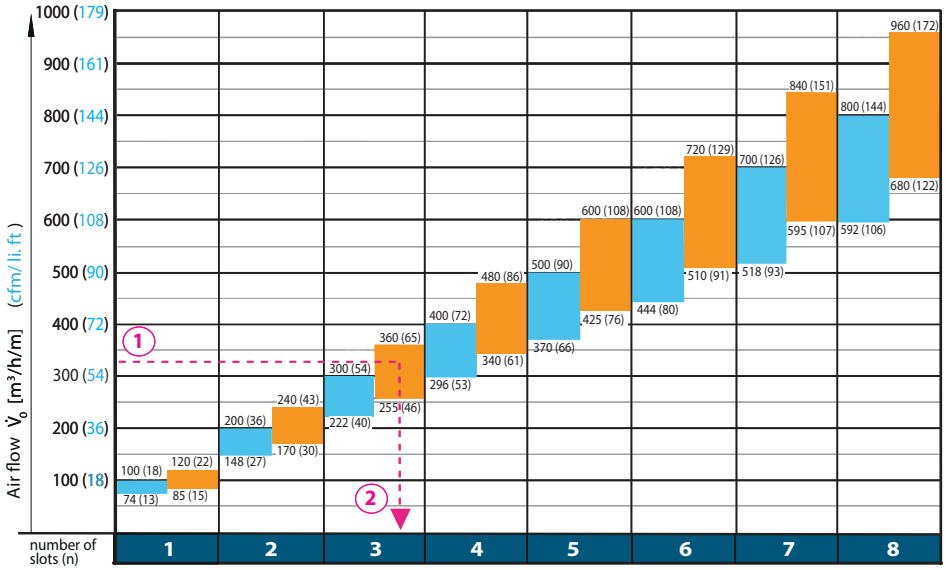
1- Airflow per meter of slot section
2- Number of slots n

Solution:

1 - The length of RRA slot is determined by the following:
$L_S = L_R - 200$ mm = 1300 mm
We find the airflow by meter of slot section:
$\dot{V}_o$ (m^3/h RRA) X F = $\dot{V}_o$($m^3/h/m$)
420 (m^3/h) X 0.77 = 323 ($m^3/h/m$) (1)

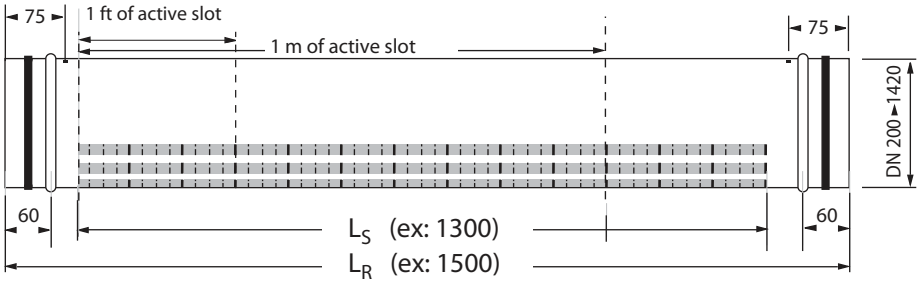
2- Using the diagram "Selecting the number of slots", for a height of 4 m and with a heating application, we find the number of slots: n = 3 (2)

Duct diameter Ø mm	in	Number of slots from 1 to ...
200	8	3
251	10	6
303	12	6
353	14	6
404	16	8
454	18	8
505	20	14
556	22	14
607	24	14
657	26	14
708	28	14
759	30	14
810	32	14



Air Flow by meter of slot of RRA $\dot{V}_0$	$m^3/h/m$/slot (cfm/li.ft/slot)
Cooling only for all heights. Heating and cooling for heights ≤ 3 m (10 ft)	74 - 100 (13-18)
Heating and cooling or heating only for heights of 3 m (10 ft) – 4.3 m (14 ft)	85 - 120 (15 - 21)

- In the case where heating mode can not be selected with initial air flow, reduce the length L_S of the slot, in accordance with the air flow per meter of recommended slot.
- In critical acoustic environment, increase the number of slots.

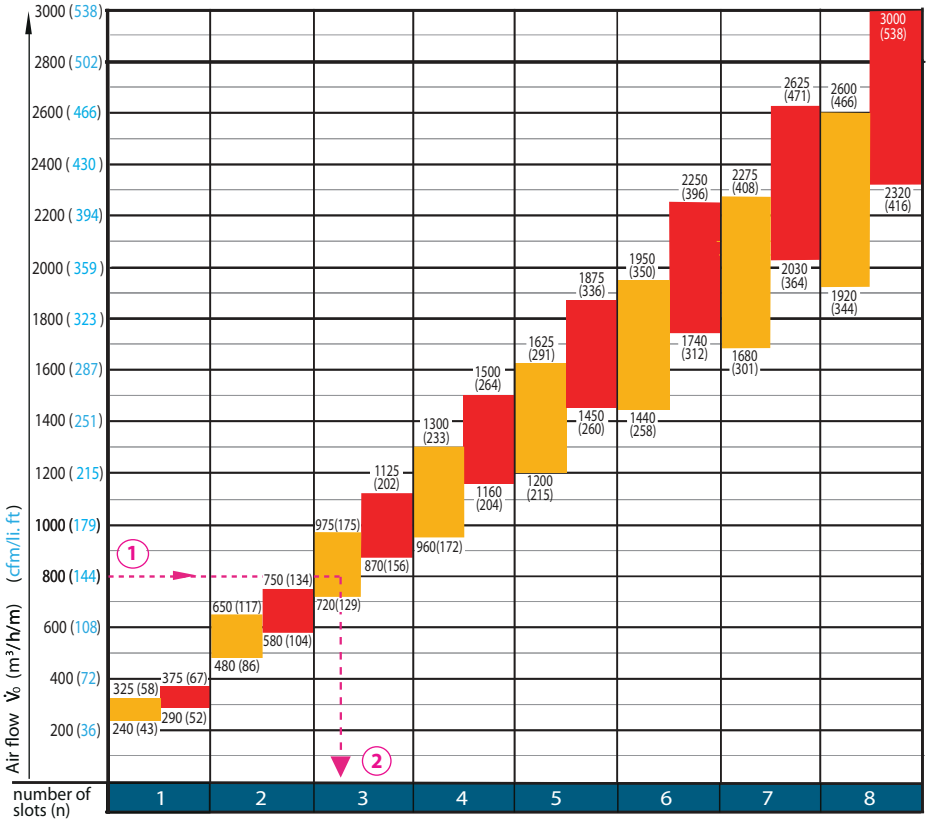


Airflow conversion by meter of slot length

$\dot{V}_o$ (m^3/h RRA) X F = $\dot{V}_o$ ($m^3/h/m$)
$\dot{V}_o$ (pcm/RRA) X F = $\dot{V}_o$ (cfm/li. ft)

	Lenght of RRA L_R	Lenght of slot L_S (mm)	(li. ft)	Multiplication Factor F ($m^3/h/m$)	(cfm/li.ft)
	1000	(800)	(2.62)	1.25	(0.382)
	1100	(900)	(2.95)	1.11	(0.339)
	1200	(1000)	(3.28)	1.00	(0.305)
(1)	1300	(1100)	(3.60)	0.91	(0.278)
	1400	(1200)	(3.94)	0.83	(0.254)
Standard	1500	(1300)	(4.27)	0.77	(0.235)
	1600	(1400)	(4.60)	0.71	(0.217)
	1700	(1500)	(4.92)	0.67	(0.203)
	1800	(1600)	(5.25)	0.63	(0.190)

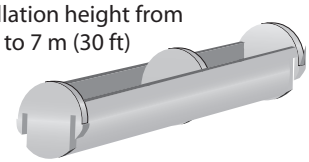
Selecting the number of slots
RRA with noozle rollers



Air Flow by RRA slot meter $\dot{V}_0$	m³/h/m/slot (cfm/li.ft/slot)
Heating only for ceiling heights of 4.3 m (14 ft) - 6.1 m (20 ft)	240 - 325 (43 - 58)
Heating only for ceiling heights of 6.1 m (20 ft) - 9 m (30 ft)	290 - 375 (52 - 67)

- In the case where heating mode can not be selected with initial air flow, reduce the length L_S of the slot in accordance with the air flow per meter of recommended slot.
- In critical acoustic environment, increase the number of slots.

For an installation height from 4.3 m (14 ft) to 7 m (30 ft)



Important:

To facilitate the selection of RRA, the total airflow should be calculated for active vents lengths of 1 m.

Specifications:

Height at the bottom of the duct: H = 5 m
Airflow by diffuser: $\dot{V}o$ = 1040 m³/h
Heating: ΔT = +10°C
Length of the RRA: L_R = 1500 mm

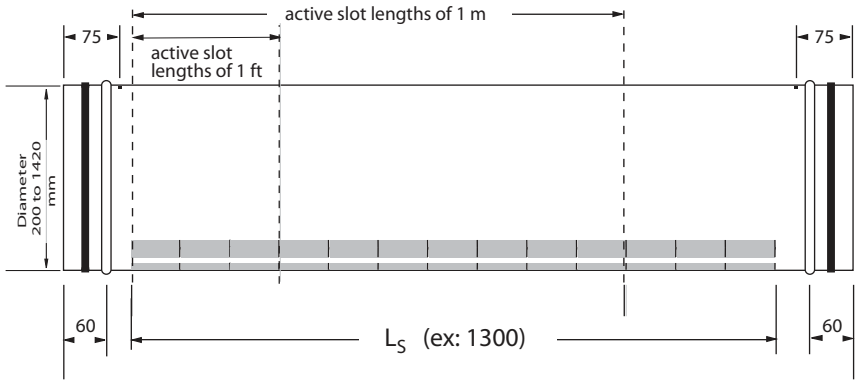
Required:

1- Airflow per meter of slot section
2- Number of slots n

Solution:

1- The RRA slot length is determined by the following:
$L_S = L_R$ - 200 mm = 1300 mm
The airflow is calculated by the number of slot section meters:
$\dot{V}_o$ (m³/h RRA) x F = $\dot{V}_o$(m³/h/m)
1040 (m³/h) x 0.77 = 800 (m³/h/m) ①

2- From the diagram "Selecting the number of slots" and for a height of 5 m in heating application, we find the number of slots: n = 3. ②



Airflow conversion by meter of slot length

$\dot{V}_o$ (m³/h/m RRA) x F = $\dot{V}_o$ (m³/h/m)

$\dot{V}_o$ (cfm/RRA) x F = $\dot{V}_o$ (cfm/li. ft)

	RRA length L_R	Slot length L_S (mm)	(li. ft)	Multiplication factor F	
	1000	(800)	(2.62)	1.25	(0.382)
	1100	(900)	(2.95)	1.11	(0.339)
	1200	(1000)	(3.28)	1.00	(0.305)
	1300	(1100)	(3.60)	0.91	(0.278)
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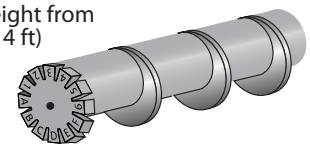
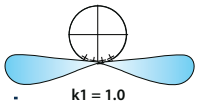
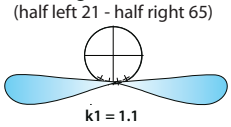
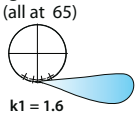
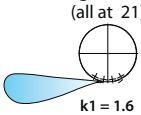
	1700	(1500)	(4.92)	0.67	(0.203)
	1800	(1600)	(5.25)	0.63	(0.190)

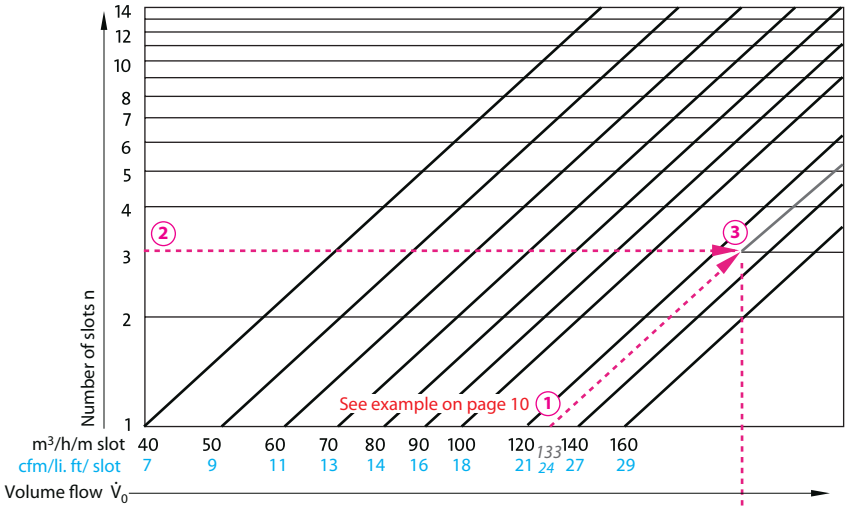
Air flow velocity diagram
RRA with eccentric rollers

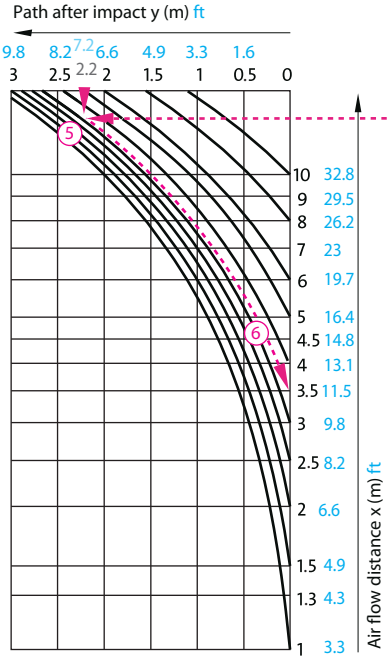
For an installation height from
3 m (10 ft) to 4.3 m (14 ft)

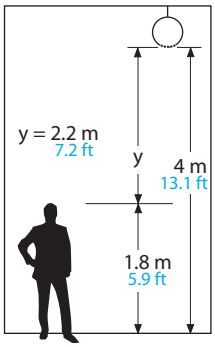


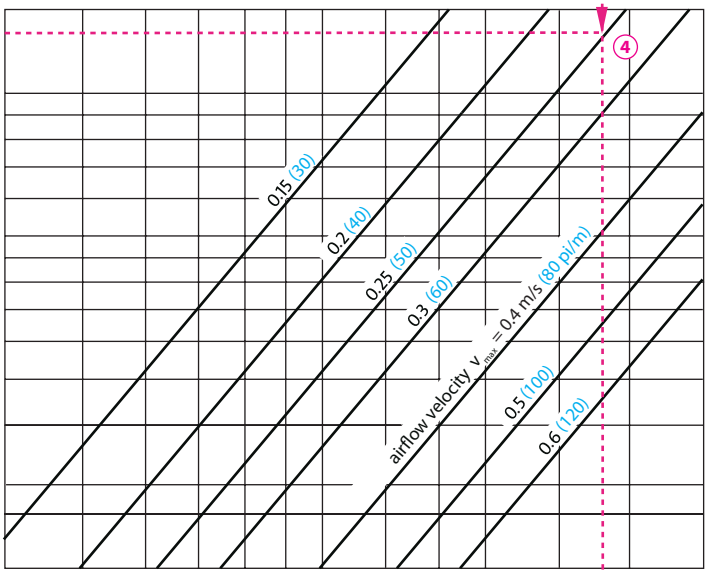
Airstream pattern (roller position) $V_{max} = k1 \times V_{max\ diagram}$

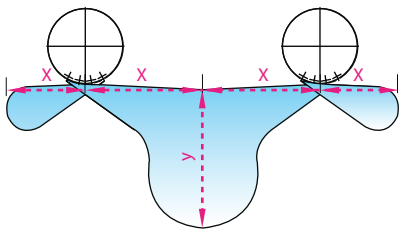
Diffuse (standard) (1x 21 / 1x 65)  k1 = 1.0	**Divergence - 2 sides** (half left 21 - half right 65)  k1 = 1.1
Divergence - 1 side (all at 65)  k1 = 1.6	**Divergence -1 side** (all at 21)  k1 = 1.6



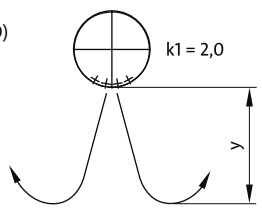


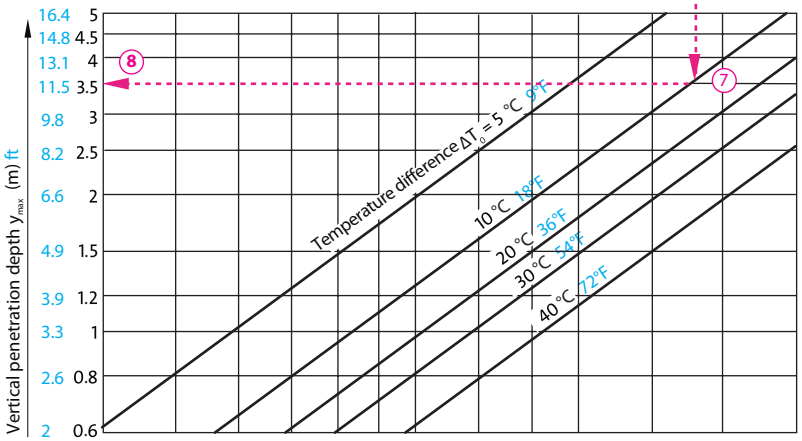




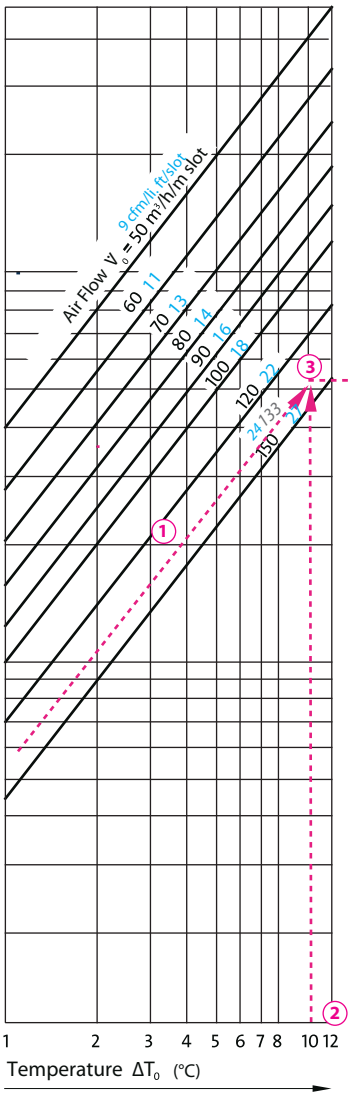


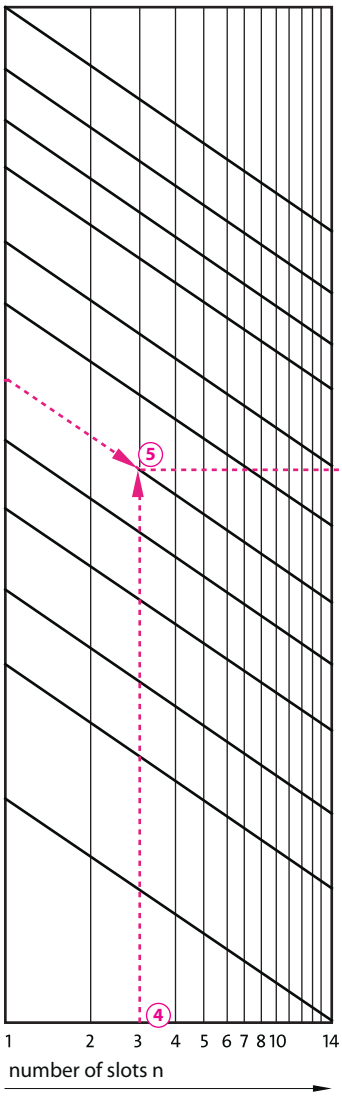
Vertical
(All CD)

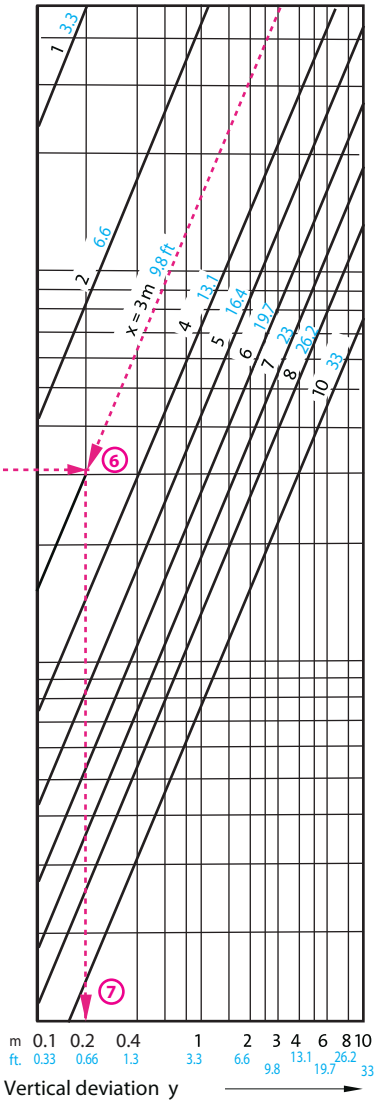


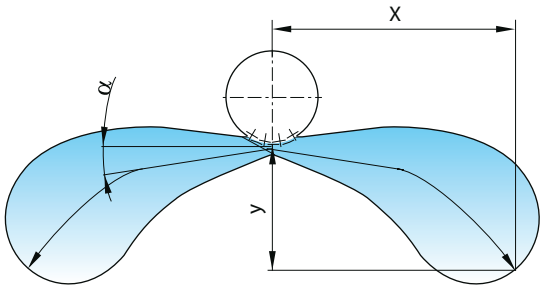


Vertical deflection
RRA with eccentric rollers

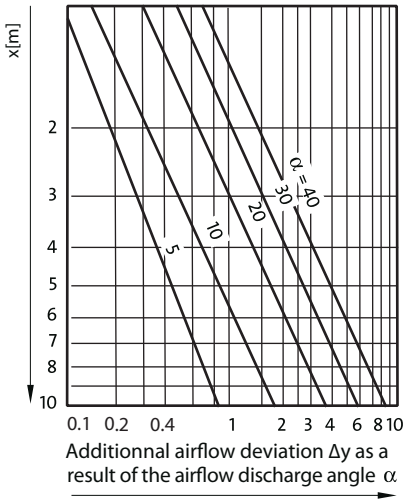






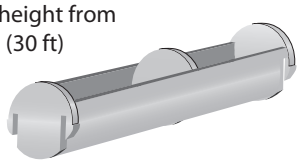


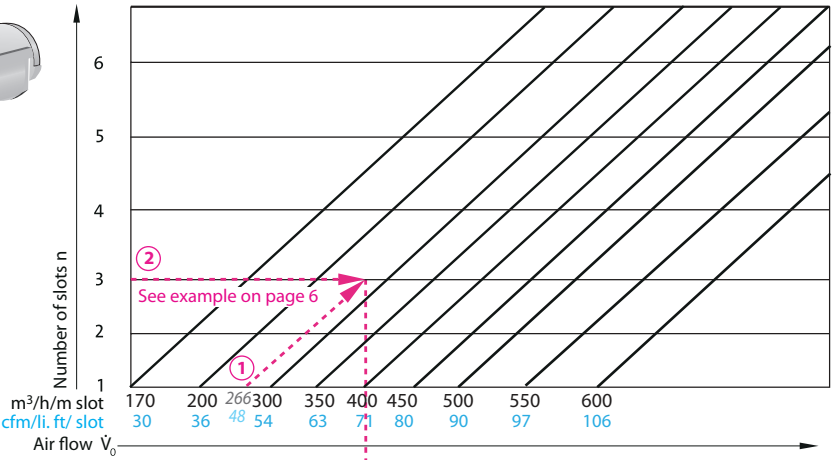
The values of y are valid for the "horizontal jet diffusion" setting.
For the setting "horizontal jet divergence", the value is multiplied by the factor 0.9.

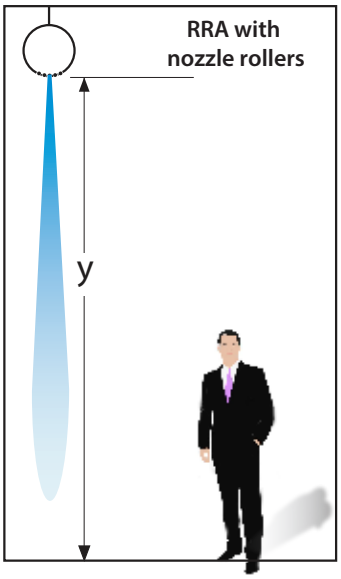


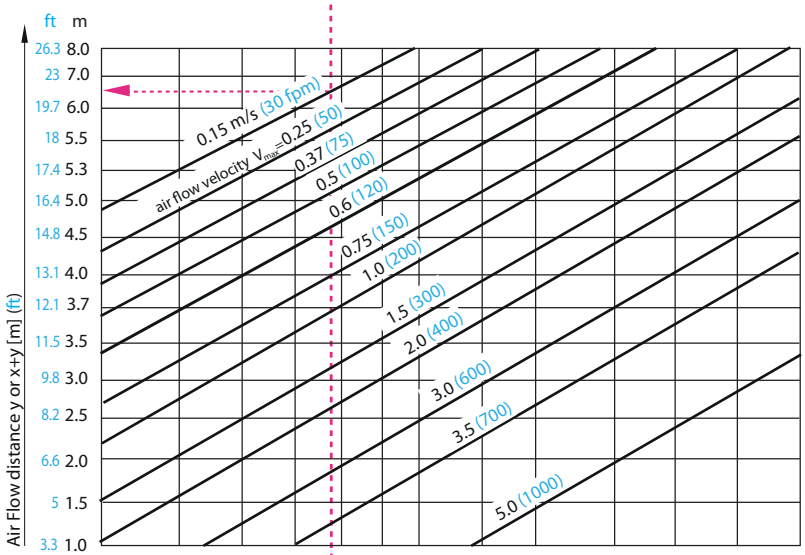
Air flow velocity diagram
RRA with nozzle rollers

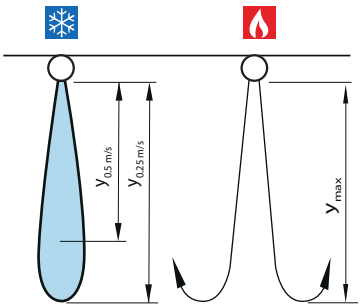
For an installation height from
4.3 m (14 ft) to 9 m (30 ft)

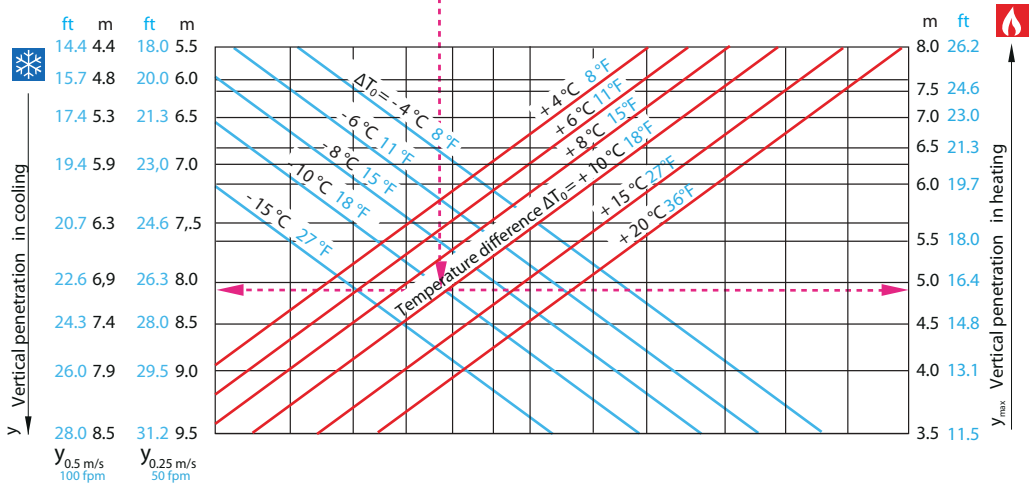






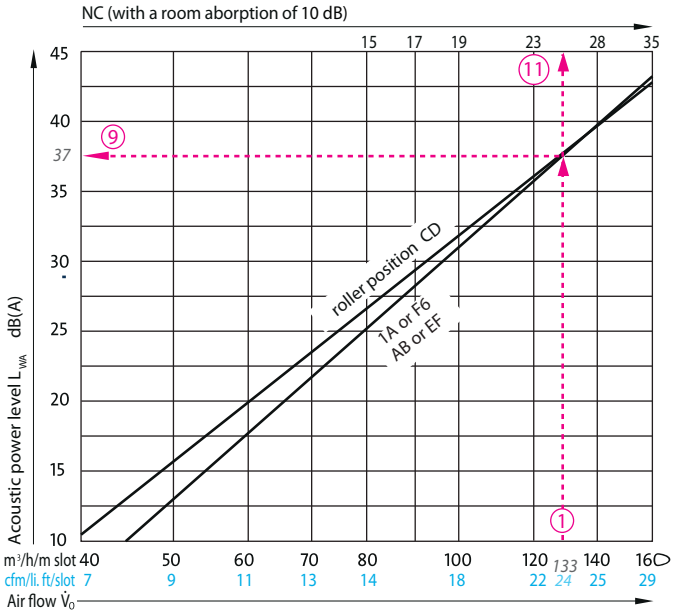






Acoustic power diagrams

RRA with eccentric rollers



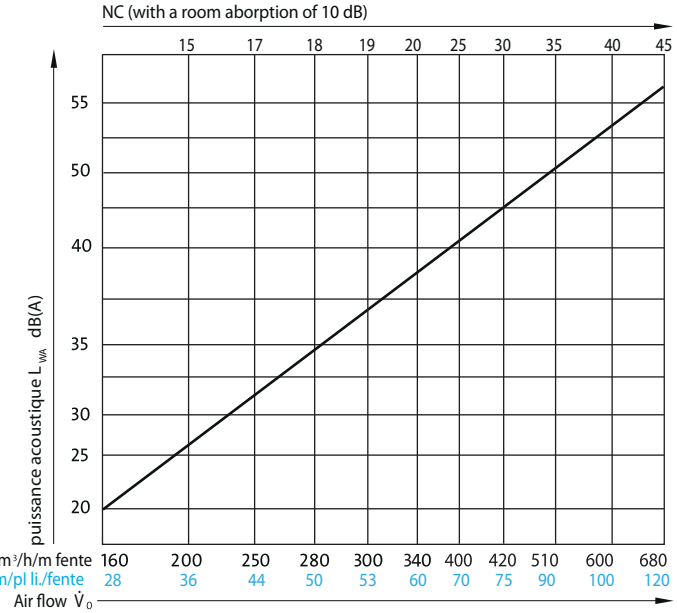
Number of slots	1	2	3	4	5	6	7
NC diagram +	0	1	2	4	5	5	6

Number of slots	8	9	10	11	12	13	14
NC diagram +	7	7	8	8	8	9	9

Number of slots n	$L_{WA} = L_{WA\ Diagram} + \Delta L_{WA}$		
	$L_R = 1000$ $L_S = 800$ ΔL_{WA}	$L_R = 1500$ $L_S = 1300$ ΔL_{WA}	$L_R = 1700$ $L_S = 1500$ ΔL_{WA}
1	0.0	2.1	2.7
2	3.0	5.1	5.7
3	4.7	6.8 (10)	7.5
4	6.0	8.1	8.8
5	7.0	9.1	9.7
6	7.8	9.8	10.5
7	8.4	10.5	11.2
8	9.0	11.1	11.8
9	9.5	11.6	12.3
10	10.0	12.1	12.7
11	10.4	12.5	-
12	10.8	12.9	-
13	11.1	13.2	-
14	11.5	13.5	-
		Standard	

L_R = Duct length L_S = Slot length

RRA with nozzle rollers



Number of slots	1	2	3	4	5	6	7
NC diagram +	0	4	7	8	9	9	10

RRA data with eccentric rollers:

- Total airflow: 2080 m³/h
- Number of RRA sections: 4
- Number of slots per RRA: 3
- Length of the RRA: L_R = 1500 mm
- Length of the slot: L_S = 1300 mm

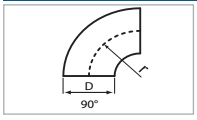
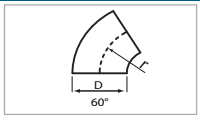
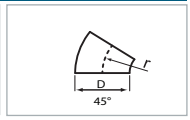
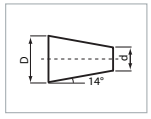
Required:

1. Air flow by meter of slot
2. Critical air flow distance X
3. Vertical penetration in heating Y_{max}
4. Acoustic power generated L_{WA} and noise criteria (NC)

Solution :

1. From total air flow, the number of section of RRA and slots, we find: (2080 m³ /h ÷ 4 RRA) ÷ 3 slots = 173 m³/h by slot
   For a 1300 mm slot length, we calculate the air flow by meter of slot
   173 m³ /h x 0.77 = 133 m³ /h/m slot (1)
2. From dimension's diagram, the air velocity in occupied area of 0.25 m/s (4) and a distance after meeting y = 4 m - 1.8 m= 2.2 m (5), we find the distance of air flow: X = 3.5 m (6) (see page 7).
3. For a temperature difference of +10 °C (7), we find the vertical penetration: Y_{max} = 3.5 m. (8)
4. From the acoustic power diagram, we read: $L_{WA\ diagram}$= 37 dB(A) (9) and a number of slots n = 3: ΔL_{WA}= 6.8 dB(A) (10)
   Finally, the acoustic power generated is:
   $L_{WA} = L_{WA\ diagram} + \Delta L_{WA}$ = 43.8 dB(A) - 10 dB(A) = 33.8 dB(A)
   Noise criteria (NC) = 25 + 2 (3 fentes) = 27 (11)

Loss of pressure

ΔP duct		ΔP$_L$* Pressure loss by diameter in elbows $\frac{r}{D}$ = 1.5						ΔP$_L$* Reducer		ΔP rollers		
Diameter of the duct D	ΔP Pressure drop by diameter of regular duct 5 m/s (1000 fpm)									Air flow for slot length of 1 meter		ΔP Loss of pressure over all rollers (1A/F6)
										Eccentric rollers	Nozzle rollers	
mm (in.)	Pa / m (" water / 100ft)	Pa	in of water	Pa	in of water	Pa	in of water	Pa	in of water	m³ /h/m (cfm/ft)		Pa (in of water)
200 (8)	1.63 (0.20)	2.5	0.010	2.0	0.007	1.5	0.005	0.8 (8)	0.003	50 (9)	100 (18)	21 (0.08)
251 (10)	1.31 (0.16)	3.6	0.011	2.1	0.008	1.6	0.006			55 (10)	110 (20)	22 (0.09)
302 (12) (7)	1.06 (0.13)	3.0	0.012	2.3	0.009	1.8	0.008			60 (11)	120 (22)	22 (0.09)
353 (14)	0.82 (0.10)	3.7	0.014	2.9	0.011	2.3	0.009			65 (12)	130 (24)	23 (0.09)
403 (16)	0.73 (0.09)	3.9	0.014	3.0	0.012	2.5	0.010			70 (13)	140 (26)	24 (0.09)
454 (18)	0.65 (0.08)	4.1	0.016	3.3	0.013	2.6	0.010			75 (13)	150 (26)	24 (0.10)
505 (20) (6)	0.57 (0.07)	4.2 (9)	0.017	3.3	0.013	2.8	0.011			80 (14)	160 (28)	25 (0.10)
556 (22)	0.49 (0.06)	4.6	0.018	3.5	0.014	3.1	0.011			85 (15)	170 (30)	26 (0.10)
607 (24)	0.41 (0.05)	5.0	0.020	3.8	0.016	3.6	0.012			90 (16)	180 (32)	27 (0.11)
657 (26) (5)	0.41 (0.05)	5.1	0.020	3.9	0.017	3.6	0.012			95 (17)	190 (34)	27 (0.11)
708 (28)	0.37 (0.045)	5.3	0.021	4.0	0.017	3.7	0.014			100 (18)	200 (36)	28 (0.11)
759 (30)	0.37 (0.045)	5.4	0.021	4.1	0.018	3.7	0.014			105 (19)	210 (38)	29 (0.12)
810 (32)	0.33 (0.040)	5.5	0.022	4.2	0.018	3.9	0.015			110 (20)	220 (40)	30 (0.12)
861 (34)	0.29 (0.035)	6.0	0.024	4.4	0.019	4.3	0.016			115 (21)	230 (42)	31 (0.12)
911 (36)	0.29 (0.035)	6.1	0.024	4.4	0.019	4.3	0.016			120 (22)	240 (44)	33 (0.13)
962 (38)	0.24 (0.030)	6.5	0.025	4.9	0.022	4.8	0.017			125 (22)	250 (44)	34 (0.14)
1013 (40)	0.24 (0.030)	6.5	0.025	4.9	0.022	4.8	0.017			130 (23)	260 (46)	35 (0.14)
1064 (42)	0.24 (0.030)	6.5	0.025	5.0	0.022	4.8	0.017			135 (24)	270 (48)	36 (0.14)
1115 (44)	0.20 (0.025)	6.9	0.027	5.3	0.023	5.3	0.018			140 (25)	280 (50)	38 (0.15)
1165 (46)	0.20 (0.025)	7.0	0.029	5.4	0.023	5.3	0.018			145 (26)	290 (52)	39 (0.16)
1216 (48)	0.20 (0.025)	7.0	0.029	5.4	0.023	5.3	0.018			150 (27)	300 (54)	40 (0.16)
1267 (50)	0.16 (0.020)	8.0	0.031	6.1	0.026	6.3	0.022			155 (28)	310 (56)	42 (0.17)
1318 (52)	0.16 (0.020)	8.1	0.032	6.2	0.026	6.3	0.022			160 (29)	320 (58)	43 (0.17)
1369 (54)	0.16 (0.020)	8.1	0.032	6.2	0.026	6.3	0.022			165 (30)	330 (60)	44 (0.18)
1419 (56)	0.16 (0.020)	8.2	0.033	6.3	0.026	6.3	0.022			170 (31)	340 (62)	45 (0.18)

*ΔP$_L$ Equivalence in length of pressure loss ** Based on ΔP = 0.82 Pa/m (0.1 in of water / 100 ft)

Correction factor for different air velocity in duct:
ΔP = F x ΔP (v = 1000 fpm)

Air velocity in duct	ΔP Pressure drop by diameter in straight duct	ΔP Pressure drop in elbows	ΔP Pressure drop in reducer	
m/s (fpm)	F	F	F	
3 (600)	0.4	0.8	0.4	
4 (800)	0.7	0.9	0.6	
5 (1000)	1.0	1.0	1.0	Recommended
6 (1200)	1.4	1.1	1.4	
7 (1400)	1.8	1.2	2.0	

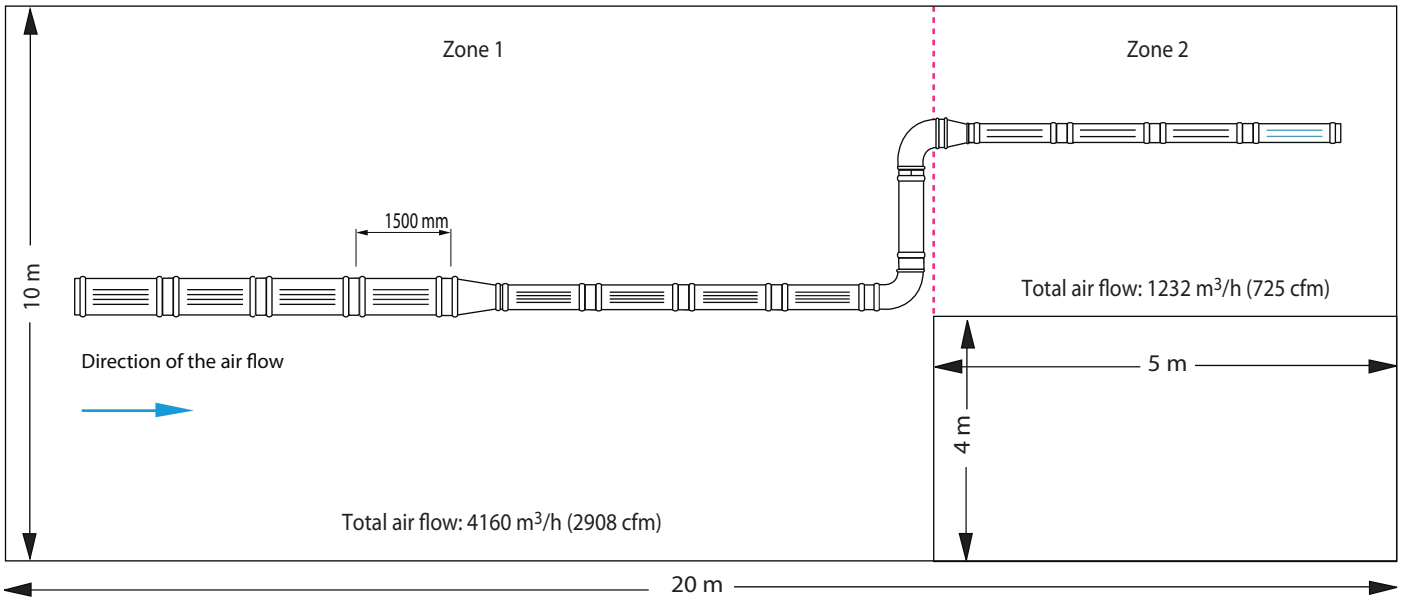
Correction factor

for different adjustments of rollers:

ΔP = F x ΔP (standard adjustment)

Roll adjustment	F
1A / F6	1.0
AB / EF	1.0
CD	1.1
21 / 65	1.1
32 / 54	1.4
CD / 65 - CD / 21	1.1

Example of calculation



Data:
Air diffusion in two zones
Air speed in the duct: 5 m/s (1000 fpm)
Temperature difference: ΔT = +10°C
Height at the bottom of the duct: 4 m

Zone 1: consists of two (2) sections
Section n° 1:
- 4 x (active RRA, L = 1500 mm, D = 657 mm)
- airflow per RRA: 520 m³/h

Section n° 2:
- 1 reducer (657 mm to 505 mm)
- 4 x (active RRA, L = 1500 mm, D = 505 mm)
- 1 x (passive RRA, L = 1500 mm, D = 505 mm)
- 2 x (90° elbow, D = 505 mm)
- airflow per RRA: 520 m³/h

Zone 2: consists of one section
- 1 reducer (505 mm to 302 mm)
- 4 x (active RRA, L = 1500 mm, D = 302 mm)
- 1 x (end cap, D = 302 mm)
- airflow per RRA: 308 m³/h

Questions:
1. What are the total airflows by meter of slot in each zone and the number of corresponding slots?

2. What is the acoustic level L_{WA} ?

3. What are the pressure losses of the installation?

Notes: For a system height of 3 m, a single RRA circular tube is sufficient to cover an area of 10 m.
The placement of vents are at 0° (6 o'clock) with the rollers set in position AB/EF (diffuse).

Solutions:
1. The total airflow by meter of slot depends on the airflow diffused by the RRA.
Zone 1: For an airflow per RRA of 520m³/h ① and a length of 1500 mm, we calculate the airflow by meter of slot:
520 m³/h x 0.77 = 400 m³/h/m
From the table "Selecting the number of slots", on page four (4) and for heating mode with a duct height of 4 m, we determine the number of slots: n = 3.②
Zone 2: the same way, we calculate the airflow by meter of slot sections:
308 m³/h x 0.77 = 237 m³/h/m
We determine the number of slots: n = 2.

2. From the diagram of acoustic power, eccentric rollers set in positions 21/65 (diffuse) and three (3) slots per RRA:
400 m³/h/m ÷ 3 = 133 m³/h/m
$L_{WA} = L_{WA\ Diagram} + \Delta L_{WA}$ =
37 + 6.8 - 10 dB(A) = 33.8 dB(A) ③

3. The system's pressure loss is due to the restriction of air going through the rollers and air friction against the inner walls of the straight ducts, elbows and reducers.

3.1 Roller pressure loss: from the "Loss of pressure" table and an airflow by meter of slot of 133 m³/h/m, we read ΔP3.1 = 35 Pa ④

3.2 Straight duct diameter pressure loss:

Zone 1, section 1
- The total length of 4 x active RRAs with a diameter of 657 mm is:
L = 4 x 1500 mm = 6 m, where:
ΔP3.2.1 = 6 m x 0.41 Pa/m = 2.5 Pa ⑤

Zone 1, section 2
- The total length of 4 x active RRAs and 1x passive RRA with a diameter of 505 mm is: L = 5 x 1500 mm = 7.5 m, where:
ΔP3.2.2 = 7.5 m x 0.57 Pa/m = 4.3 Pa ⑥

Zone 2
The total length of 4 x active RRAs with a diameter of 302 mm is:
L = 4 x 1500 mm = 6 m, where:
ΔP3.2.3 = 6 m x 1.06 Pa/m = 6.4 Pa ⑦

- The total loss of pressure in the straight ducts is: ΔP3.2 = 2.5 + 4.3 + 6.4 = 13 Pa

3.3 Loss of pressure in the reducers:
The equivalent in length of the loss of pressure for two reducers (α = 14°) is :
ΔP3.3= 2 X 0.8 Pa = 1.6 Pa ⑧

3.4 Loss of pressure in the elbows:
The loss of pressure for two (2) 90° elbows with a diameter of 505 mm is :
ΔP3.4 = 2 X 4.2 Pa = 8.4 Pa ⑨

Finally, the total loss of pressure of the system is:
ΔP3 = ΔP3.1 + ΔP3.2 + ΔP3.3 + ΔP3.4 so:
ΔP3 = 58 Pa

Dimensions and weight

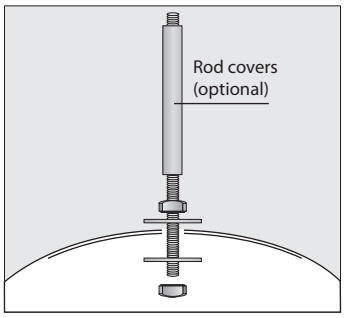
Duct length - L_R	1000	1500	1700	2000
Slot length - L_S	800	1300	1500	1800
	Weight per slot (kg)			
	0.30	0.48	0.56	0.67
	Weight of the passive RRA (kg)			
Diameter of RRA (mm)	Sheet thickness: 0.85 mm			
200	4.20	6.38	7.15	8.41
251	5.28	7.92	8.97	10.55
302	6.35	9.52	10.79	12.70
353	7.42	11.13	12.69	14.84
403	8.47	12.71	14.40	16.94
	Sheet thickness: 1.00 mm			
454	11.41	17.00	19.30	22.66
505	12.67	18.93	21.43	25.19
556	13.94	20.83	23.58	27.72
607	15.69	23.21	26.22	30.73
657	16.93	25.07	28.32	33.21
708	18.97	27.74	31.25	36.51
759	20.33	29.74	33.50	39.14
810	21.70	31.73	35.75	41.77
861	23.07	33.73	38.00	44.40
911	24.40	35.69	40.21	46.98
962	26.40	38.31	43.08	50.23
1013	27.79	40.35	45.37	52.90
1064	29.19	42.38	47.65	55.56
1115	30.59	44.41	49.93	58.22
1165	31.96	46.40	52.17	60.83
1216	33.36	48.43	54.46	63.50
1267	34.76	50.46	56.74	66.16
1318	36.16	52.49	59.02	68.82
1369	37.56	54.52	61.31	71.48
1419	38.93	56.51	63.55	74.10
		Standard		

Suspension systems

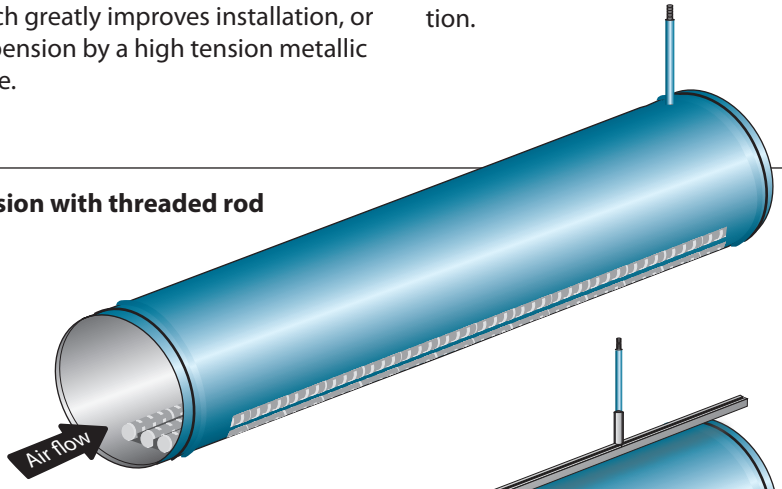
The suspension of the RRA diffuser is assured by threaded rods (3/8") provided by the installer.
Upon request, colored rod covers are supplied to cover the threaded rods. The colour is to be chosen by the architect.

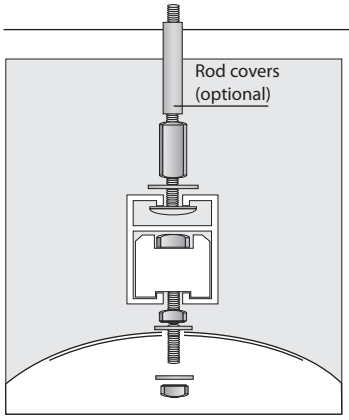
Other methods of suspension are available: an aluminum suspension rail, which greatly improves installation, or suspension by a high tension metallic cable.

An adjustable wall mount is also available for a lateral anchor installation.

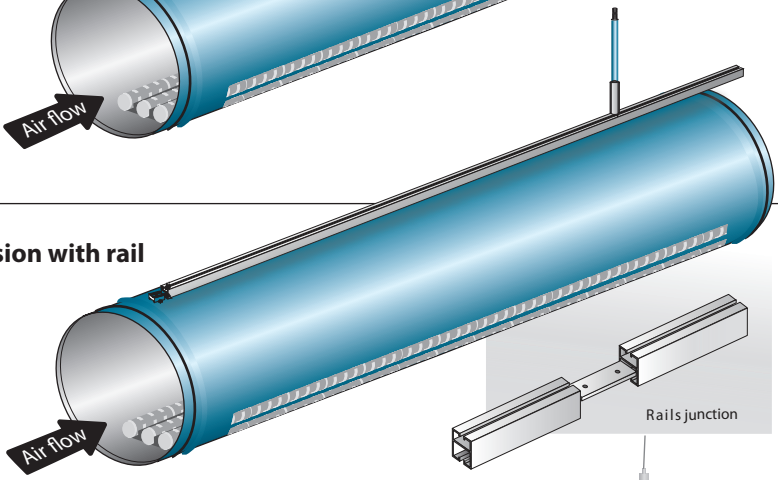


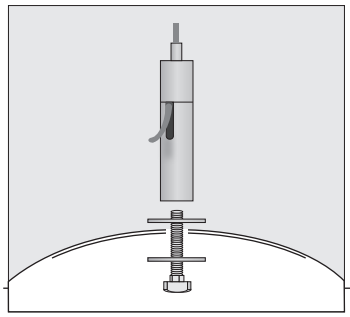
Suspension with threaded rod



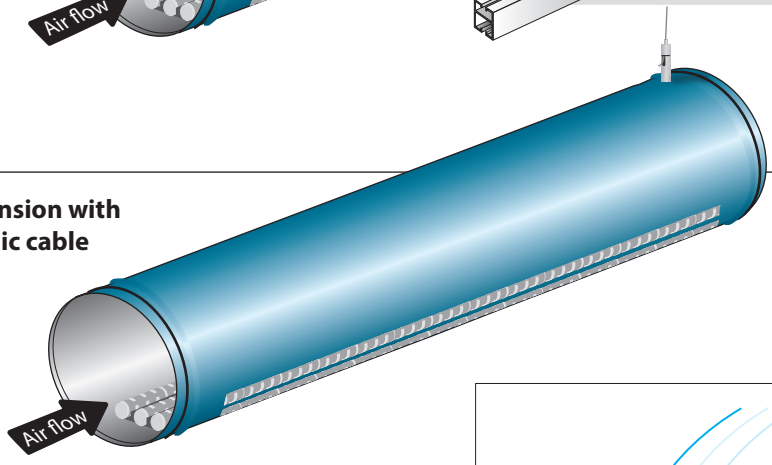


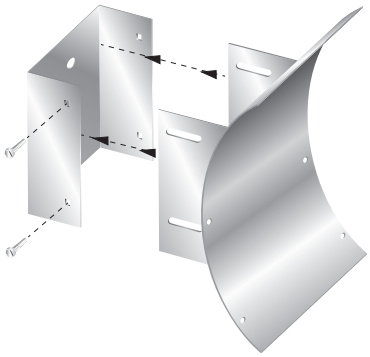
Suspension with rail





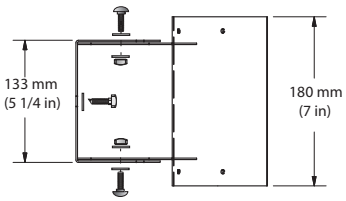
Suspension with metallic cable

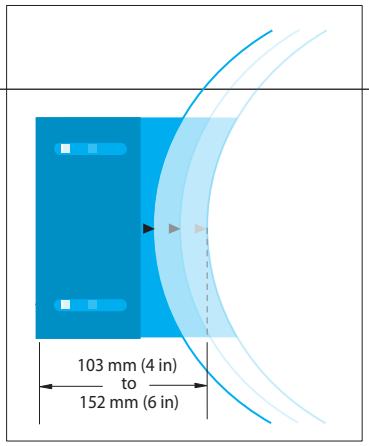




Adjustable wall mount

The two sections of the support allow for a 51 mm (2 in) adjustment.





TVA broadcasting, Montréal, Canada

Thibault-GM Sport center, Sherbrooke, Canada

Specifications

1. Description and physical characteristics

1.1 The high induction duct diffuser shall be made of 22 ga brushed steel for ducts inferior to 457 mm (18 in) in diameter, and 20 ga for diameters superior or equal to 457 mm (18 in).

1.2 The circular duct diffuser shall be available in diameters ranging from 203 mm (8 in) to 1419 mm (56 in). The duct diffuser shall be grooved at each end and fitted with a PVC gasket to insure a tight seal between sections. The sections shall be assembled using union sleeves.

1.3 Steel reininforcements shall be installed inside ducts of more than 433 mm (17 in) in diameter in order to maintain its shape.

1.4 The duct diffuser shall be painted with a TGIC free polyester powder coat. It shall have a smooth surface for easy cleaning. The colour shall be chosen by the architect or the customer. The paint of the diffuser shall be guaranteed against peeling for a minimum period of 5 years when used under normal conditions.

1.5 The duct diffuser shall be supplied with slots containing (black, creme or white) eccentric rollers and / or nozzle rollers. The 100 mm (4 in) long eccentric rollers shall be alphanumerically identified allowing for adjustment of duct's air flow pattern over 180 degrees.

1.6 The union sleeves shall not exceed the dimensions of more than 3 mm (1/8 in), and will be rounded to facilitate cleaning. The duct shall have a as smooth as possible surface to maintain an esthetic appeal.

1.7 A reducer fitting, or perforated balancing damper with a self-locking mechanism, allowing for an output between 25% and 100%, shall be installed after a maximum of 5 consecutive active sections of the same diameter. A slot register shall be integrated to the last active section of the system.

1.8 The duct diffuser can be passive, without slots.

2. Installation and suspension

2.1 The suspension of the duct shall be done with threaded rods 9.5 mm (3/8 in) supplied by the installer.

2.2 The threaded rods shall be covered with rod covers supplied by the manufacturer of the diffuser. The colour of the rod covers shall be chosen by the architect or the customer, according to the RAL colour chart.

2.3 When required, the suspension of the duct diffuser shall be available in three options.

2.3.1 Rail suspension

The duct diffuser shall be slid into a suspended aluminum rail, offering a solution for varied types of ceilings. The rail shall be painted according to the RAL colour chart and chosen by the architect or customer.

2.3.2 Suspension by metallic cable

The duct diffuser shall be suspended by metallic cable (aviation style) 7 x 7 or 7 x 9, made of galvanized or stainless steel (304 or 316), of medium or high traction resistance.

2.3.3 Wall suspension

The duct diffuser shall be anchored laterally with an adjustable wall support in the same colour as the duct diffuser. This wall mount shall be supplied by the manufacturer of the diffuser.

2.4 When the duct diffuser goes through a wall, a collar adapted to the duct diffuser shall be supplied by the manufacturer.

2.5 The standard accessories shall have the same finish as the duct diffuser (elbows, sleeves, reducers, branches, etc.).

2.6 Each duct diffuser shall be identified with a label. This label shall contain the section number, direction of the air flow, number of slots and positioning of the eccentric rollers.

3. Performances

The manufacturer shall supply for approval the following:

3.1 A diagram of the air flow, illustrating the trajectory of the air jets, the pressure loss and the accoustic power produced by the diffuser.

3.2 A simulation of the air flow distance, installation considering conditions for comfort in the occupied zone, for cooling, isothermal and heating ventilation mode.

4. Adjustment

4.1 Adjustment of the eccentric rollers shall be done by the manufacturer according to the required output.

4.2 Adjustment of the eccentric rollers shall be possible even after the installation of the diffuser, in order to meet new output requirements.

5. Balancing

5.1 Balancing of the diffusers shall be done by a ventilation balancing technician, accredited as a qualified professionnal.

5.2 When required, the technician shall refer to the eccentric roller adjustment mode, available in the manufacturers' reference manual.

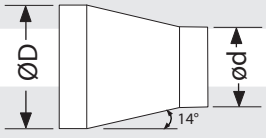
6. Required quality : NAD Klima, model RRA

Codification

RRA	**Product**
1000, 1500, 1800	**Length of duct L_R**
0800, 1300, 1600 ____ = Special length, write the length in mm XXXX = Non applicable (passive duct)	**Length of slots L_S**
200, 251, 302, 353, 403, 454, 505, 556, 607, 657, 708, 759, 810, 861, 911, 962, 1013, 1064, 1115, 1165, 1216, 1267, 1318, 1369, 1419	**Ø Duct diameter**
X = Passive 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15,	**Quantity of slots**
XXX = Passive duct 006 = Slots at 0° (6h) 003 = Slots at +90°(3h) 009 = Slots at -90° (9h) 012 = Slots at 180° (12h) 039 = Slots at +90° (3h) and at -90° (9h) 369 = Slots at +90° (3h), 0° (6h) and at -90° (9h) 612 = Slots at 0° (6h) and at 180° (12h) AAA = Other (specify in annotation)	**Slots position**
XXX = Passive DFS = Diffuse standard 21/ 65 DFR = Diffuse window DE / 21 DFL = Diffuse window BC / 65 DFF = Diffuse height AB / EF DFT = Diffuse CD / EF - slots at 3 o'clock DFN = Diffuse CD / AB - slots at 9 o'clock DFH = Diffuse height BC / DE DFA = Diffuse AB / DE DVB = Divergent 21 DVD = Divergent 65 DVV = Divergent vertical CD DRB = Divergent with roller nozzle	**Air flow**
W = White roller or white roller nozzle (RAL 9003) C = Cream roller (RAL 9010) B = Black roller or black roller nozzle X = Without roller	**Color of eccentric rollers and roller nozzles**
9003 = White 9010 = Cream 00SB = Solar Black (Standard matte black) 00SM = Silver Matte (Standard metallic grey) ____ = RAL color* (write the color number of RAL)	**Diffuser color**
A = With closed-cell acoustic insulation X = Without insulation	**Acoustic insulation**
D = With damper X = Without damper	**Balancing damper**
R = With register (perforated plate) X = Without register	**Register**
RRA - 1500 - 1300 - 200 - 1 - 006 - DFS - W - 9003 - X - X Annotation	**Example**

Codification for reducers

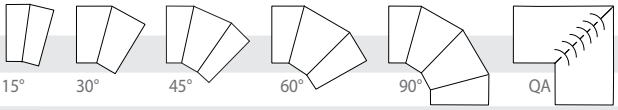
RRA RED = Reducer	**Product**
254, 305, 356, 406, 457, 508, 559, 610, 660, 711, 762, 813, 864, 914, 965, 1016, 1067, 1118, 1168, 1219, 1270, 1321, 1372, 1422	**Ø D - Inlet diameter**
203, 254, 305, 356, 406, 457, 508, 559, 610, 660, 711, 762, 813, 864, 914, 965, 1016, 1067, 1118, 1168, 1219, 1270, 1321, 1372	**Ø d - Outlet diameter**
T = Flat on Top (standard) C = Center B = Flat on Bottom	**Configuration**
S = Standard α = 14° A = Other (specify in annotation)	**Length**
9003 = White, 9010 = Cream 00SB = Solar Black (Standard matte black) 00SM = Silver Matte (Standard metallic grey) ____ = RAL color * (write the color number of RAL)	**Color**
A = With closed-cell acoustic insulation X = Without insulation	**Acoustic insulation**
RRA - RED - 305 - 203 - T - S - 9003 - X Annotation	**Example**



Blue: Standard

Codification

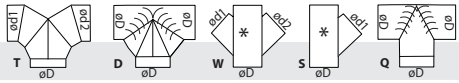
Codification for elbows



RRA	ELB = Elbows	**Product**
	15, 30, 45, 60, 90, QA	**Angle**
	203, 254, 305, 356, 406, 457, 508, 559, 610, 660, 711, 762, 813, 864, 914, 965, 1016, 1067, 1118, 1168, 1219, 1270, 1321, 1372, 1422	**Ø Diameter**
	S = Standard (based on : r = 1.5 D) A = Other (specify in annotation)	**Radius**
	9003 = White 9010 = Cream 00SB = Standard Matte Black 00SM = Standard Metallic Grey ____ = RAL colors * (write the color number of RAL)	**Color**
	A = With closed-cell insulation X = Without insulation	**Insulation**
RRA - ELB - 15 - 203 - S - 9003 - X		**Example**

Codification for the branches

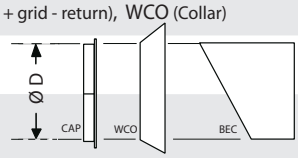
RRA	BRA = Branches	**Product**
	203, 254, 305, 356, 406, 457, 508, 559, 610, 660, 711, 762, 813, 864, 914, 965, 1016, 1067, 1118, 1168, 1219, 1270, 1321, 1372, 1422 (Note : For Q and D, inlet and outlet diameters are the same)	**ØD - Inlet diameter**
	203, 254, 305, 356, 406, 457, 508, 559, 610, 660, 711, 762, 813, 864, 914, 965, 1016, 1067, 1118, 1168, 1219, 1270, 1321, 1372, 1422 (Note : For Q and D, inlet and outlet diameters are the same)	**Ød1 - Outlet diameter** (for T , W and S only)
	203, 254, 305, 356, 406, 457, 508, 559, 610, 660, 711, 762, 813, 864, 914, 965, 1016, 1067, 1118, 1168, 1219, 1270, 1321, 1372, 1422	**Ød2 - Outlet diameter** (for T and W only)
	T, D, W, S, Q	**Configuration**
	9003 = White 9010 = Cream 00SB = Standard Matte Black 00SM = Standard Metallic Grey ____ = RAL colors * (write the color number of RAL)	**Color**
	A = With closed-cell insulation X = Without insulation	**Insulation**
RRA - BRA - 305 - 305 - 203 - T - 9003 - X		**Example**



* for S and W, add an elbow to degree and diameter choosed to completed the fitting

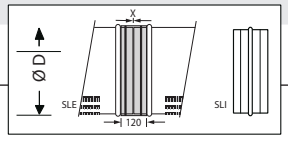
Codification for endcap and collar

RRA	CAP (End cap), BEC (Bevelled endcap), BES (Bevelled endcap + slots - return), BEG (Bevelled endcap + grid - return), WCO (Collar)	**Product**
	203, 254, 305, 356, 406, 457, 508, 559, 610, 660, 711, 762, 813, 864, 914, 965, 1016, 1067, 1118, 1168, 1219, 1270, 1321, 1372, 1422	**Ø Diameter**
	9003 = White 9010 = Cream 00SB = Standard Matte Black 00SM = Standard Metallic Grey ____ = RAL colors (write the color number of RAL)	**Color**
	A = With closed-cell insulation X = Without insulation	**Insulation**
RRA - CAP - 203 - 9003 - X		**Example**



Codification for sleeves

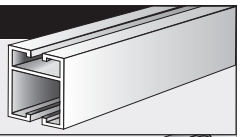
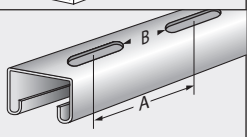
RRA	SLE (Sleeve) , SLI (Inner sleeve) (no length available)	**Product**
	203, 254, 305, 356, 406, 457, 508, 559, 610, 660, 711, 762, 813, 864, 914, 965, 1016, 1067, 1118, 1168, 1219, 1270, 1321, 1372, 1422	**Ø Diameter of SLE**
	200, 251, 302, 353, 403, 454, 505, 556, 607, 657, 708, 759, 810, 861, 911, 962, 1013, 1064, 1115, 1165, 1216, 1267, 1318, 1369, 1419	**Ø Diameter of SLI**
	XXXX = Non applicable (SLI) 0000 = Standard (The distance between RRA is 0 mm) ____ = Special - write the «x» value (distance between RRA) - from 0001 mm to 1380 mm maximum	**Length of the SLE**
	9003 = White, 9010 = Cream, 00SB = Standard Matte Black, 00SM = Standard Metallic Grey , ____ = RAL colors (write the color number of RAL)	**Color**
	A = With closed-cell insulation X = Without insulation	**Insulation**
RRA - SLE - 203 - 0000 - 9003 - X		**Example**

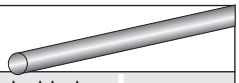


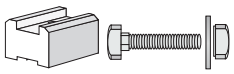
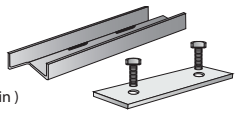
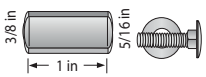
Blue: Standard

Codification

Suspension with rail

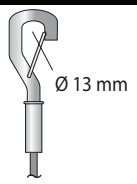
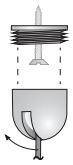
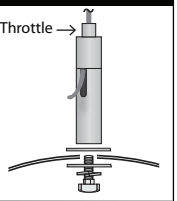
	Description	
RAI	ALU Aluminum rail 1 1/4 in x 1 3/4 in x 10 ft	
	S33 Steel rail 1 5/8 in x 7/8 in x 10 ft A: 2 in B: 7/8 in	
	9003 = White 00SB = Solar Black 9010 = Cream 00SM = Silver Matte ____ = Color RAL * (write the #) XXXX = Unpainted	**Color**
RAI - ALU - 9003		**Example**

RCT	Rod-cover for threaded rod 16 mm x 3.05 m (5/8 in x 10 ft)	
	9003 = White 00SB = Solar black 9010 = Cream 00SM = Silver Mat ____ = Color RAL * (write the #) XXXX = Unpainted	**Color**
RCT - 9003		**Example**

	Accessories supplied for aluminum rail (ALU)	
RKG	Nylon guides assembly	
RKJ	Junction bar plate 200 x 28 x 12 mm (7 13/16 x 1/2 x 1 1/16 in) Plate : 60 mm X 16 mm (2 3/8 in X 5/8 in)	
RKC	Coupling assembly with bolt and washer for installation with aluminum rail (ALU)	
	Accessories supplied for steel rail (S33)	
RKS	Slider, bolt, standard washer and lock washer assembly	
RKG		**Example**

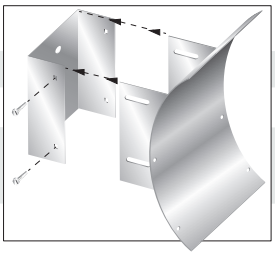
	Touch-up spray paint	
CAN 9003	Paint can (RAL 9003)	
CAN _____	Paint can (other colour RAL) (write the number of the colour)	
CAN - 9003		**Example**

Suspension with cable

	Description of anchors for the ceiling	
CPA	Anchor with hook nickel plated Ø 13 mm x 70 mm x 14.3 mm (Ø 1/2 in x 2 3/4 in x 9/16 in)	
CCP	Swiveling anchor nickel plated Not adjustable Ø 25 x 28 1/2 mm (Ø 1 in x 1 1/8 in) (screw not supplied)	
	Description of anchor for the diffuser	
CCA	Anchor for duct Adjustment throttle nickel plated Ø 19 X 50 mm (Ø 3/4 in x 2 in)	
	XXXX = Without cable 3048 mm - standard (10 ft)	**Cable length**
	A = Nickel plated steel (standard) S = Stainless Steel (optional)	
CPA - 3048 - A		**Example**

Adjustable wall mount

RRA	**AWM**	**Product**
	203, 254, 305, 356, 406, 457, 508, 559, 610, 660, 711, 762, 813, 864, 914, 965,	**Ø Diameter / diffuser**
	9003 = White, 9010 = Cream, 00SB = Solar Black (Standard black matte), 00SM = Standard Metallic Grey ____ = Colour RAL (write the number of colour)	**Colour**
RRA - AWM - 203 - 9003		**Example**



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