

AirWorkx[®] Fabric Ducting & Diffusers

T E C H N I C A L D A T A



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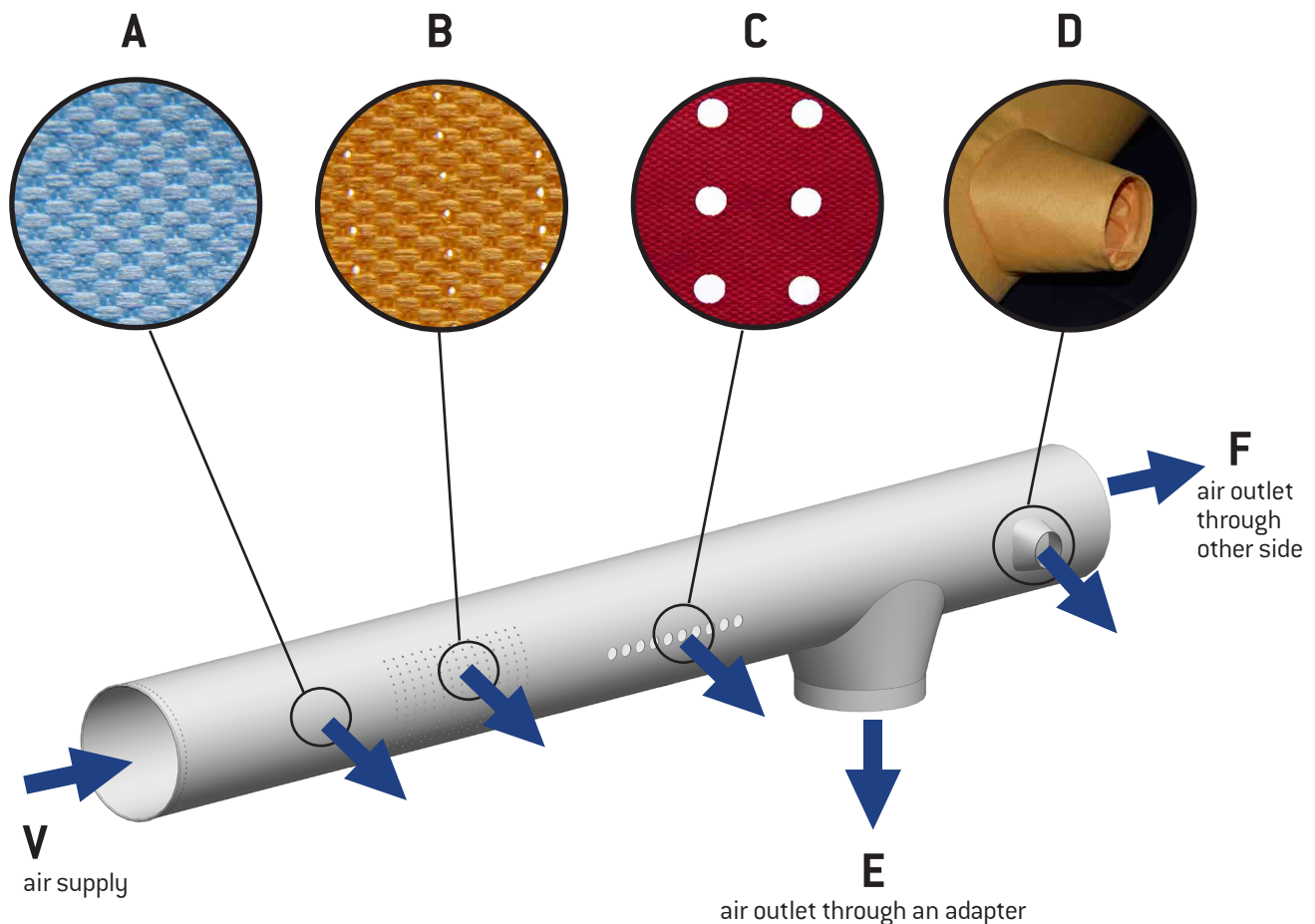
1. Fabric Ducting & Diffusers: Methods of distributing and returning air

AirWorkx products are generally ducting as well as air distribution devices (or return devices) all at the same time. We offer positive pressure air distribution systems (fabric ducting & diffusers) as well as negative pressure ducting for exhaust or returning air to the unit from the space served.

1.1. Air dispersion / distribution options for fabric diffusers

Flow V brought into the diffuser through any of the ends or through the entry adapter may exit in the following manners:

- A - through a permeable fabric
- B - through microperforation – 0.2 – 0.4 mm holes in the fabric
- C - through perforation – holes with a diameter greater than 5/32" (4mm)
- D - through a nozzle – see chapter 5 for more details
- E - through an adapter – air is guided off into another ducting branch (Fabric or metal)
- F - through the second end – air leads to another diffuser or ducting (such as back to metal duct, etc.)



It always holds true that: $V = A + B + C + D + E + F$

[certain values of A, B, C, D, E, F may be zero]

Airflow Models for AirWorkx Fabric Ducting & Diffusers

Air is distributed from fabric diffusers through various sizes, patterns, and types of openings. The combination of size, spacing, and grouping of holes together with various outlet flow models provide an infinite number of combinations and solutions for air distribution requirements for today's project challenges.

Microperforation - Tiny laser cut holes with a diameter of 0.2 – 0.4 mm, intended for low velocity / laminar air dispersion [Very low throw, not recommended for heating unless directional microperforation is used].

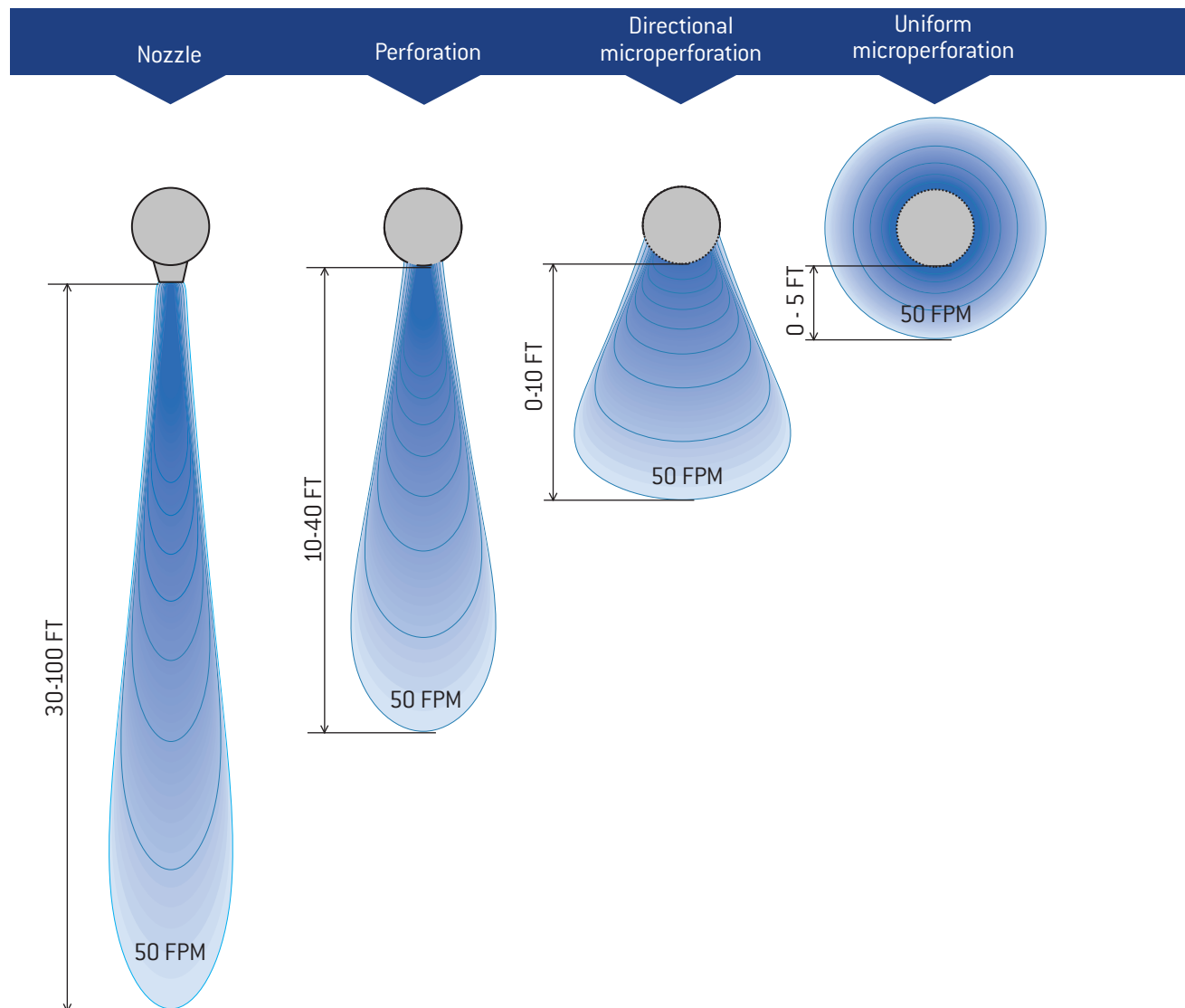
Perforations - A series of 5/32 inch (4mm) or larger holes, provide directed air supply [low to medium throw for heating, cooling, and ventilating].

Nozzles - 3" diameter and up, very long throws or when a high velocity or spot cooling/heating is required.

* When calculating the throw/velocity at different distances from the duct, the temperature difference between the delivered air and the room (Delta T) must be considered along with the air speed from the outlets.

Fabric diffusers are an extremely versatile air distribution device which cover the entire spectrum of applied flow models used today. We achieve the desired throw by selecting the correct air diffuser outlet method, or quite often, a combination of methods.

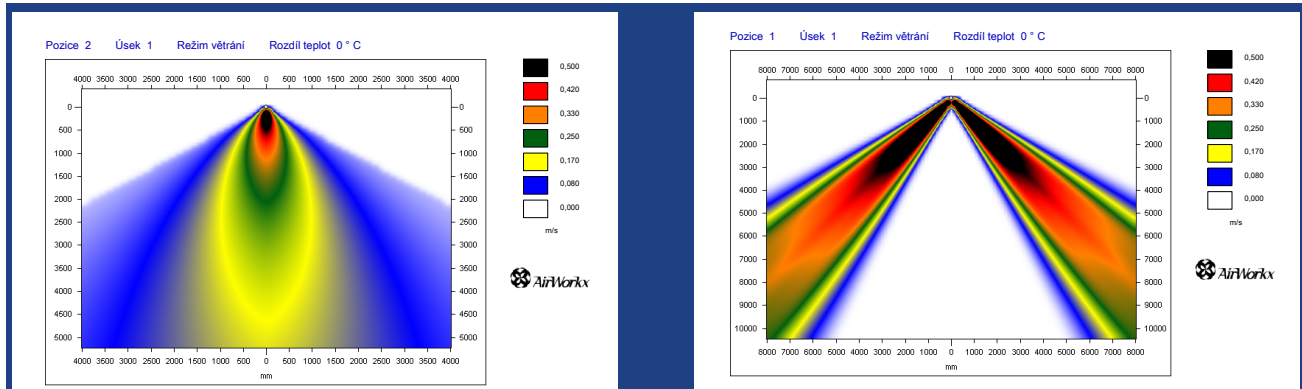
Airflow Models



Note: Throws will vary and depend on static pressure in the diffuser, temperature of air delivered vs room temperature, environment, heat sources, obstacles, etc. Please contact us for design or layout assistance.

We tailor make all of our products to meet the needs of each individual project. Due to every project's specific needs and the numerous combinations of flow models we decided years ago to develop design software to better assist our customers and to insure a proper solution is achieved on every order we deliver.

Our software provides throw velocities at various distances from the diffuser (isothermal or corrected for heating / cooling), pressure loss calculations, and sound generated. Generally the design parameters are static pressure available to the diffuser, volume of air, flow model, fabric type, installation height, throw needed (space dimensions), temperature difference, sound sensitive or not, and mounting method.



Examples of airflow patterns created by AIRWORKX design software and confirmed by Ansys Fluent CFD software

Many years of continuous software updates, lab/field testing, and thousands of installations world wide gives us complete confidence that our products will accomplish the solution your project requires. On very large or critical airflow applications we also offer the use of Computational Fluid Dynamics software from one of the leading CFD software companies, Ansys Fluent (formerly Fluent Airpak).

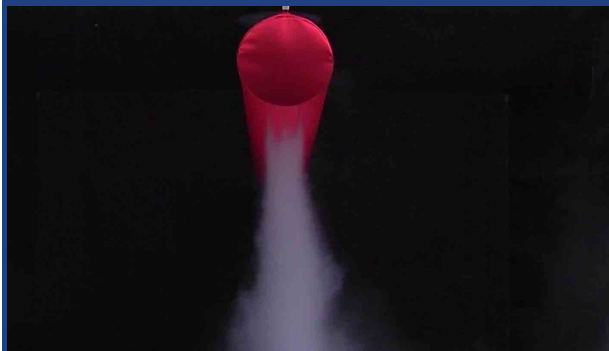
Examples of airflow patterns created through a smoke test in the AIRWORKX testing center



uniform microperforation



directed microperforation



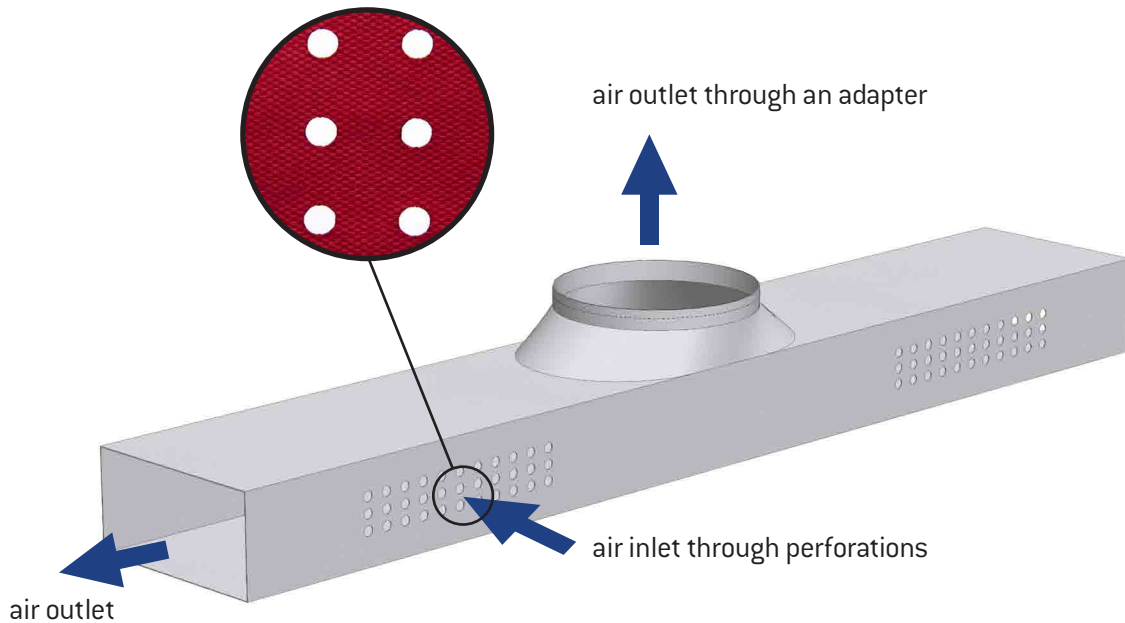
directed perforation



close - up of air outlet from perforation

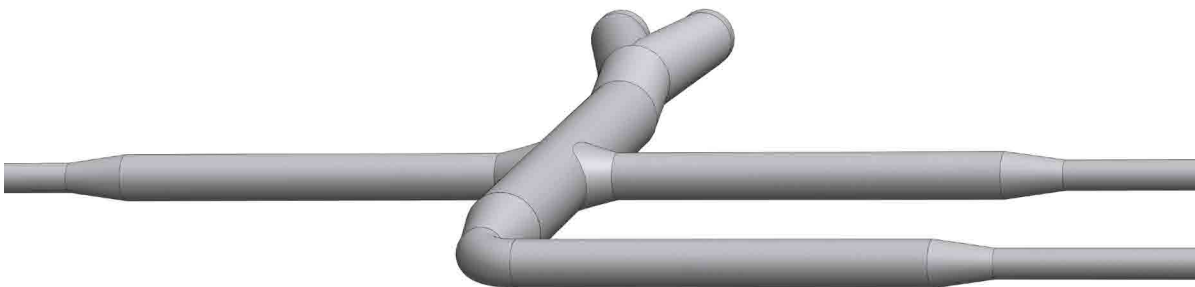
1.2. Air inlets for negative pressure ducting

Perforations are currently the only air inlet option used for negative pressure ducting, see chapter 5.3 for more information.



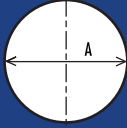
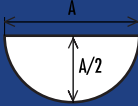
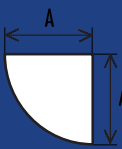
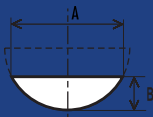
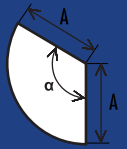
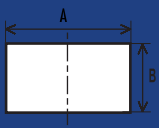
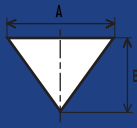
1.3. Transporting air with fabric ducting

Ducting made from impermeable fabric or insulated ducting (see chapter 5.3.) feeds air to the point where it needs to be distributed. We can manufacture nearly any fitting required such as a "T", reducer, radius elbow and many other custom fittings.



2. Basic properties of AirWorkx Fabric Ducts

2.1. Cross section

POSITIVE PRESSURE ONLY	C	CIRCULAR		The basic and most simple version, which is the easiest to install and maintain. Recommended unless your project requires otherwise.
	H	HALF-ROUND		Use where there is not enough space for circular diffuser.
	Q	QUARTER-ROUND		Use where there is not enough space for a circular diffuser, or if the diffuser is to be installed in a corner of a room or space.
	SG	SEGMENT		Use where there is not enough space even for a half-round diffuser or if a low profile look is desired.
	SC	SECTOR		Use where quarter-round shape cannot be used because of an unusually shaped ceiling construction.
POSITIVE AND NEGATIVE PRESSURE	S	SQUARE		The shape is kept by means of a special structure holding all the corners of the diffuser and holding all four sides of fabric in tension.
	T	TRIANGULAR		The diffuser cross section is maintained by stretching with a weighted rod placed into the cross section bottom corner.

Note: We also make transitions to take the duct from one of the shapes above to a different shape. Some shapes deform slightly despite being properly tensioned, this is due to positive or negative pressure and the material flexibility (applies to cross sections S and T).

2.2. Dimension

We manufacture fabric ducting and diffusers ranging from 4" to 80" diameters (custom diameters upon request), depending on the project requirements. The inlet adapter dimensions are always approximately 1/2" larger than the metal connection for ease of installation.

In general, fabric diffusers are designed for similar flow speeds as traditional ducting and the volume of air determines the inlet size. Maximum velocities range from 1400-1800fpm for round ducts and 700-1400fpm for half round ducts (the higher the inlet velocity, the more static pressure required). Factors to consider are potential flow turbulence from fittings, available pressure, and sound generated by fast moving air. Specific conditions of flow, static pressure and weight of the fabric used must be taken into account to avoid vibrations/duct movement. Do not hesitate to contact us for design advice, we would be glad to help.

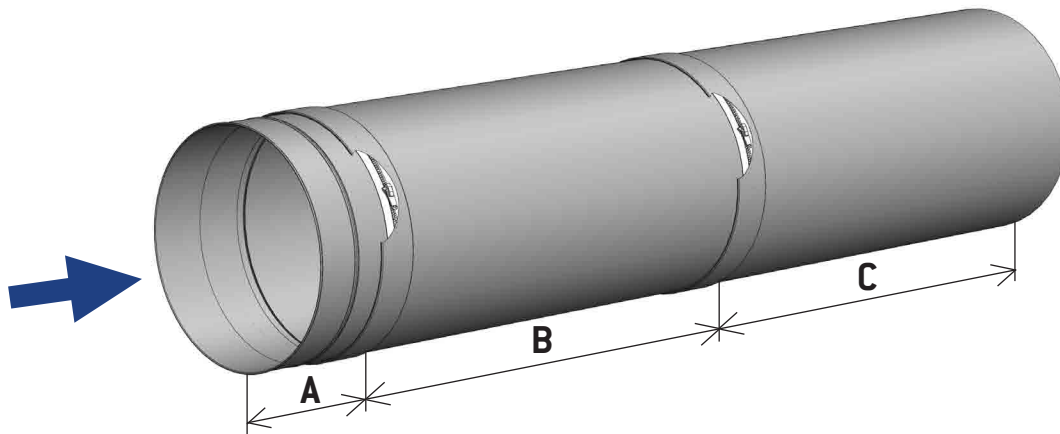
Dimension in individual shapes is understood to mean:

Shape	Dimension (values A,B)
Circular	diameter (A)
half-round	diameter (A)
quarter-round	radius (A)
segment	chord, height (A,B)
sector	radius (A)
square	length of edges (A,B)
triangular	base, height (A,B)

2.3. Length

Determining the length of fabric ducting and diffusers typically depends on the space. Generally the same air flow may be supplied into an area using a 10' - 650' long diffuser depending on the material used, its modification, and the supply fan's delivery pressure. The length of diffuser will usually correspond with the space dimensions depending on throw, velocity and installation height. We can help to determine the length and flow model to specify for the most economical and effective solution.

MOST FREQUENT CASE



A - beginning (Inlet/Collar) – length 4"-8"

B - continuous part (Straight section) – length 16.4'-33', may be repeated several times in sequence

C - end part – length from 3' to 36' (6" Zippered end caps also available upon request, otherwise the endcap is sewn directly to the last section.)

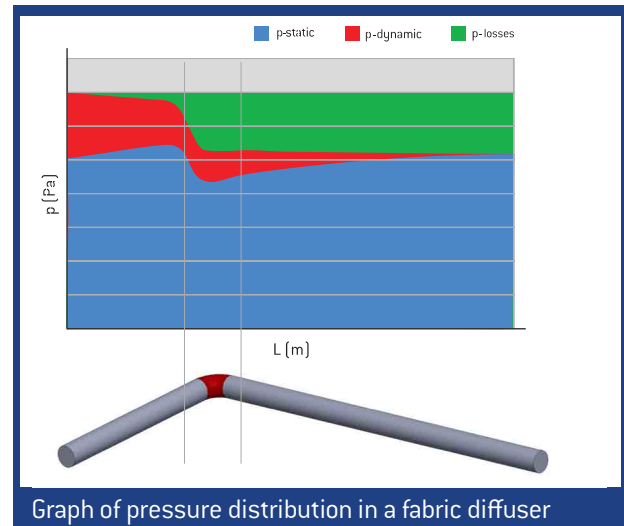
- Individual parts are connected with zippers; the number of zippers may be modified per customer request.
- Only the overall length in feet (thus A + B + C) is provided in the material list; ducting and diffusers are separated into segments during production.

2.4. Pressure

Fabric ducting is typically designed with the static regain method. Pressure losses of fabric diffusers & ducting are very similar to those of traditional metal ducting, but also slightly different. The biggest difference is that for most fabric duct applications the air is continuously distributed along the entire length so the velocity of the air continuously decreases. This equates to a lower velocity or friction pressure loss per running foot for fabric ducting than traditional metal ducting. For very long duct runs, typically over 100', we will also reduce the duct diameter similar to metal ducting to ensure even air delivery from inlet to the endcap.

Minimum static pressure necessary to keep a fabric diffuser or duct fully inflated depends on the weight of the fabric used and if reinforcement options are used. Sufficient pressure for light weight materials is .10 INWG and 0.20 INWG for medium and heavy weight fabrics (if no reinforcement options used).



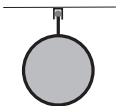
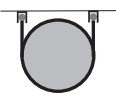
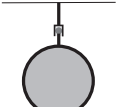
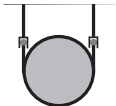

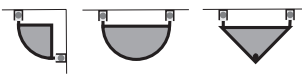
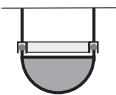
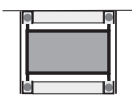
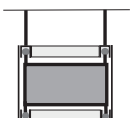
Generally Fabric ducts are designed on average for .50" wg inlet external static pressure loss. Do not hesitate to contact us for design assistance of the distribution system or ducting, as our software can easily provide accurate pressure loss calculations.



2.5. Types of Ending

F BEGINNING (Inlet/Collar) 	H HEMMING (No Zip)
WOUT OUTER WINGS (Outer square flange) 	WIN INNER WINGS (Inner Square flange)
B BLANKING (end cap) 	Z ZIP
S SUTURE (Sewn together sections with no zip) 	

3. Installation

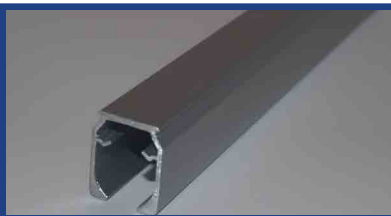
Installation no.	Cross section view	Type of suspension	Additional accessories
0	this type is without mounting material, hooks or enlarged cord. For vertical installations secured and hung by the inlet clamp, horizontal installations only suspended by tensioner ring in endcap (see chapter 5.7), or for under floor ducting which require no suspension		
1		1 wire	D, F, K, M
2		1 wire	D, F, K, M
3		1 profile (track), velcro	A, B, C, G, J, L, H
4		2 profiles (tracks)	B, C, G
5		1 suspended profile (track)	A, B, C, G, I, D, E, F, K, L, M
6		2 suspended profiles (tracks)	A, B, C, G, I, D, E, F, K, L, M
7		tensioner	D, F, H can be added to any other installation
8		profiles (tracks), velcro	A (can be added to any other installation), B, C, G, L, H, J
9		profiles (tracks)	A, D, E, F, K, L, M
10		profiles (tracks)	A, L
11		profiles (tracks)	A, E, K, L, M

Overview of additional accessories

untagged	suspension by hooks and aluminium profile (track) or by wire
A	enlarged strip instead of hooks that fits in profile (track) for continuous support
B	plastic profile (track)
C	aluminium profile (track), with aluminium hangers
D	stainless wire and stainless mounting material
E	threaded rod
F	plastic coated wire and stainless mounting material
G	stainless profile (track)
H	tensioner at endcap
I	reinforced aluminium profile (track)
J	Velcro
K	galvanized chain
L	screw tensioner in the profile (track)
M	Gripple hangers



hooks



aluminium profile (track)



plastic coated wire



enlarged strip (A)



plastic profile (track) (B)



aluminium profile (track) & hangers (C)



wire hangers (D,E)



thread bar (E)



stainless profile (track) (G)



reinforced aluminium profile (track) (I)



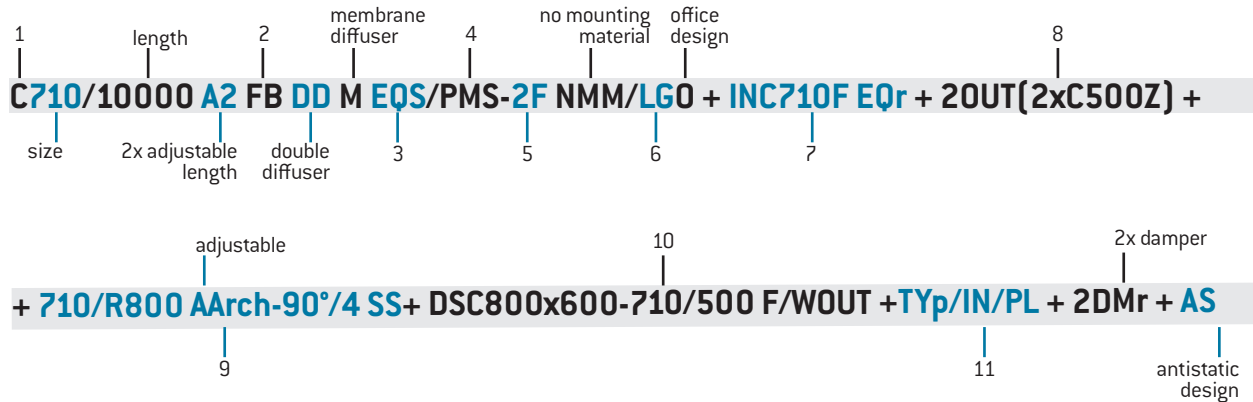
Velcro (J)



Gripple hangers (M)

4. Part Number / Nomenclature

The part number can only completely describe a simple diffuser or duct. It is used for an approximate definition and does not generally suffice for an order. Most cases require a drawing or detailed description. The following items may appear in the material list/packing slip:



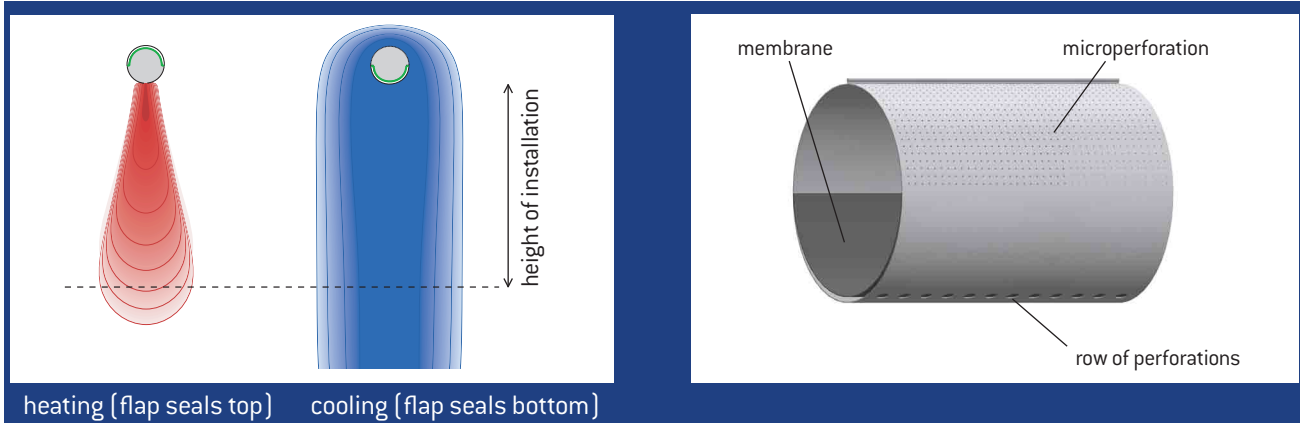
1	Section	C - circular, H - half-round, Q - quarter-round, SG - segment, SC - sector, S - square, T - triangular, see chap. 2.1.
2	Type of ending	F - beginning[inlet piece], Z - zip, H - hemming, S - suture, B - blanking[endcap], WOUT/WIN - outer/inside wings, see chap. 2.5.
3	Equalizer	EQ - cone, EQS - star, EQP - pot, r - removable, see chap. 5.9.
4	Material	Permeability: P - permeable, N - non-permeable Weight: M - medium, H - heavy, L - light Characteristic: S - standard, E - excellent fire resistance, I - increased fire resistance R- Increased strength, F - foil/plastic coated, see chap. 6.
5	Installation type	see chap. 3.
6	Color	WH - white, BL - blue, LB - light blue, LG - light grey, YE - yellow, DG - dark grey, GR - green, RE - red, BC - black, SP - special, GY - grey, see chap. 6.
7	Inlet adapter	C[section]710[size]F[type of ending] EQ[equalizer]
8	Outlet adapter	2[number]C[section]500[size]Z[type of ending]
9	Arch [Elbow]	710[size]/R800[radius]Arch-90°[angle]/4[number of segments] SS[type of ending] without marking - segment, A - adjustable, S - longitudinal strips
10	Reducer	D[reducer]S[section]C[section]800x610[first size]-710[second size]/500[length] F/ WOUT[type of ending]
11	Reinforcing components	TY - tyre (Ring), RA - racks (arcs), p - velcro for tyres only, IN/OUT, PL/ST/AL - plastic/ stainless/ aluminium, see chap. 5.8.

5. Special Design options

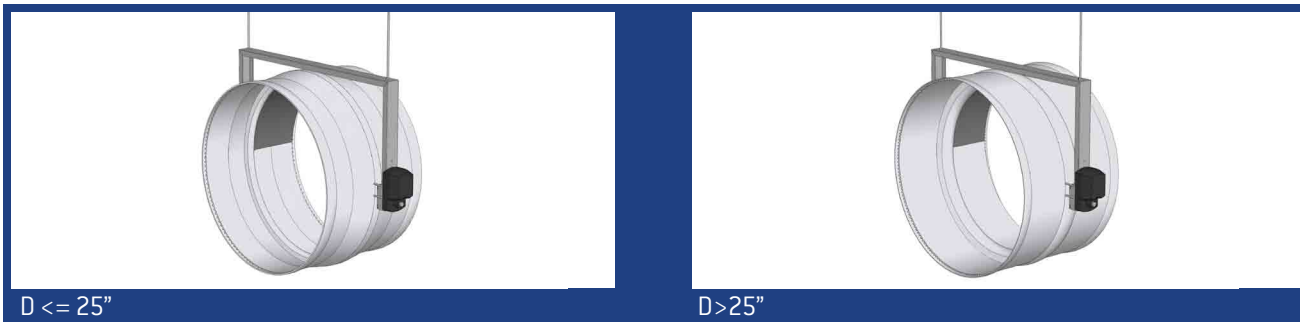
5.1. Membrane diffuser

Diffuser for 2 air outlet modes

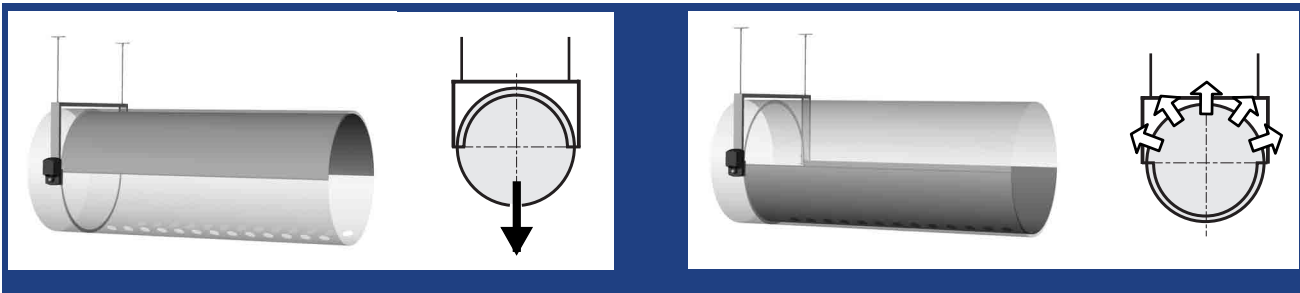
This option combines two types of diffusers into one. The membrane, produced from a light non permeable fabric, is sewn horizontally into the center of the diffuser. It covers either the top or bottom of the inside of the duct in an alternating fashion. The front end of the membrane is fastened to a flap controlled by a servo motor (or manual chain-and gear) which makes it possible to select between two positions, usually cooling or heating. In heating mode the membrane seals the top half of the diffuser and the air exits through a series of perforations downwards. In cooling mode the membrane seals the bottom half and the air exits only out of the top of the fabric or microperforation for a laminar flow / displacement cooling effect.



FLAP: Used for switching between the two modes. It is made from PMS/NMS or PMI/NMI material (according to fire resistance needed); the internal design and external frame are made from galvanized steel. The length is always 16". The flap includes a 220 V or 24 V servo motor, or could be supplied with chain and gear for manual operation.



DIFFUSER: The membrane always covers one half of the diffuser and leaves the other open to supply air.



CONDITIONS OF USE:

- Maximum inlet velocity 1200 FPM (risk of damage to membrane at higher velocities).
- Only for round cross-sections.

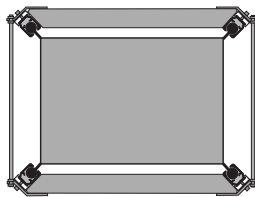
5.2. Negative pressure ducting

Fabric ducting for exhaust or return air applications

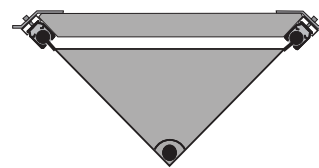
Negative pressure ducting is only supplied in square or triangular cross-sections. To prevent the duct from collapsing due to negative pressure and flexibility of the fabric the duct walls must be stretched and held in tension in the lengthwise and crosswise directions by means of suspension track, threaded rods and tensioning bolts (weighted rods in triangular cross-sections). Air is drawn into the duct through perforations that can be positioned on any side and anywhere along the length of the duct. To ensure equal extract/exhaust rates we can adjust the perforation diameters or span between the perforations progressively along the duct. Designed for use where regular / complete cleaning of ducting is required, negative pressure fabric ducting may be easily pulled out from the suspension structure, the parts are separated using zippers, and everything can be washed. If PMI or NMI material is used, the ducting will have antimicrobial properties as well. This can also be a good option for pools and natatorium return ducts as the material will not rust or corrode.



Square negative pressure fabric ducting with stretching frame



Sectional view of square negative pressure ducting



Sectional view of triangle negative pressure ducting

5.3. Insulated ducting

Thermal insulation and sound attenuation

Used for decreasing heat losses/gains when transporting air through unconditioned spaces from the air handler to the space/area intended to be conditioned. An unwoven 2" polyester layer is used as insulation and is sewn in between the inner wall (light weight material) and the external wall of the duct which is usually a medium weight material; however all of our materials are suitable for use as the external layer. The process of sewing some what decreases the thickness of the insulation by about 0.8"-1.2".

The maximum achieved heat coefficient is 1.8 W/ m²K. We typically provide 7' sections with diameters starting at 10". Each 7' section has at least one reinforcement ring. This insulated hose also has excellent sound attenuation properties as an added benefit.



5.4. Adjustable length

Option of changing length during assembly/install

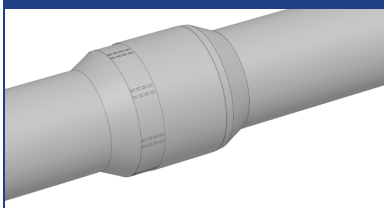
CONDITIONS OF USE:

- Adjustable section has a max length of 4.92' and may be reduced to 1.64'.
- The diameter must be increased by approx. 25% to accommodate for local pressure losses.
- Only for circular sections > 10" dia
- Only for PMI, PMS, NMI, NMS, PLI, PLS, NLI, NLS materials.
- Adjustable parts may not contain enlarged strip for support

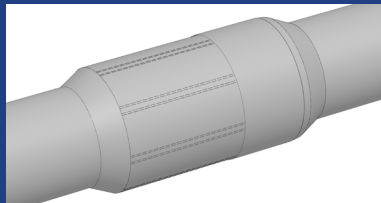
8 lengthwise adjustable tie belts are equally sewn around the circumference of the circular ducting for an adjustable length section. If all are adjusted to the same length, the section's length is decreased. The ducting is thus able to quickly adapt to the situation required on site.



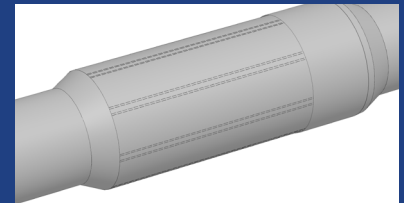
Close-up view of tie belt



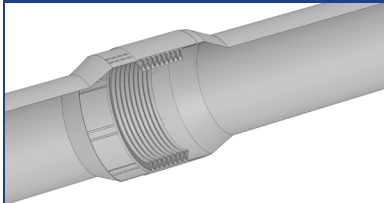
Length 1.64'



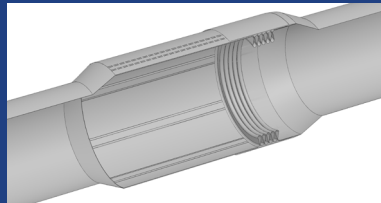
Length 3.29'



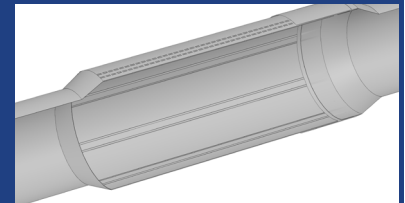
Length 4.92'



Length 1.64' - sectional view



Length 3.29' - sectional view



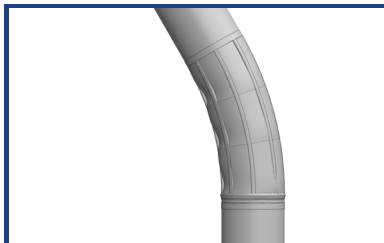
Length 4.92' - sectional view

5.5. Adjustable elbow

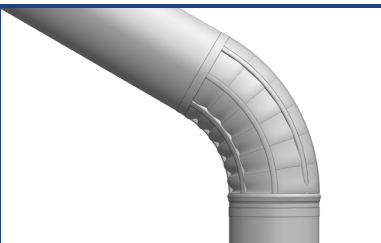
Angle may be adjusted during assembly

8 lengthwise adjustable tie belts (same as adjustable length) are equally sewn around the circumference of the circular ducting.

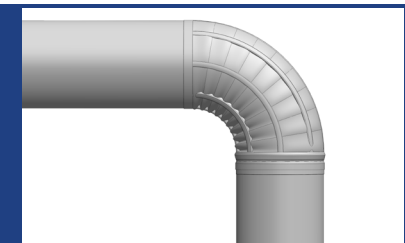
Shortening a particular belt turns the ducting in a certain direction. The bend/angle is changed by adjusting the belt:



30°

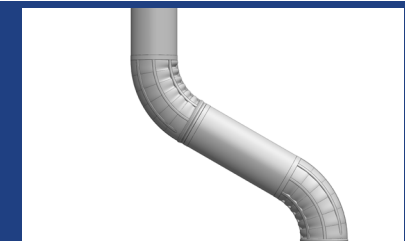
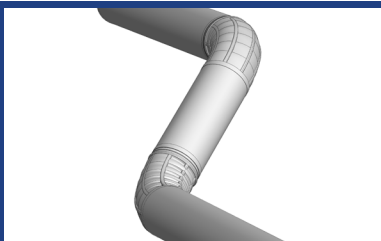
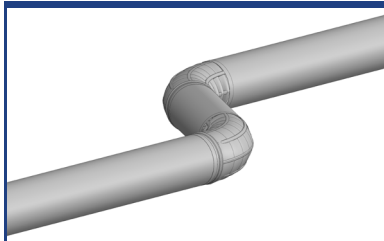


60°



90°

Placing two adjustable elbows in sequence makes it possible to get around any obstacle on site.

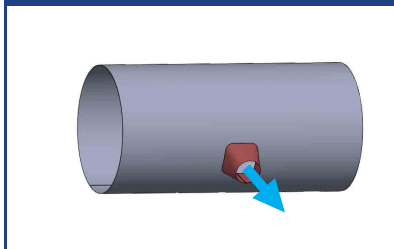


5.6.

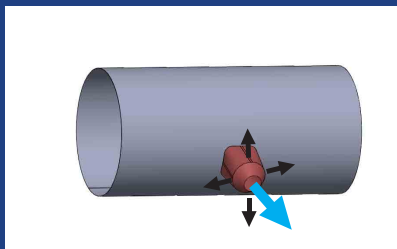
Nozzle

For long throw or spot heating/cooling applications

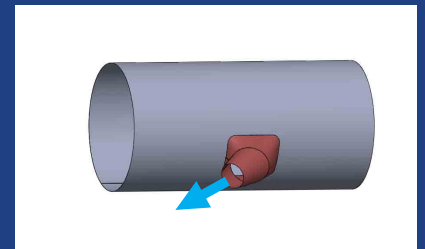
Nozzles make it possible to deliver air at longer distances than simple perforations are capable of. Depending on the volume of air, static pressure and temperature difference throws of more than 70ft can be achieved. Nozzles can be fixed position (centered), directed in a certain angle from the factory or adjustable onsite, but the appearance of each type of nozzle is about the same. The adjustable nozzle may be directed as desired up to $\pm 45^\circ$ using 4 belts. The folds and belts are covered in fabric so they are concealed along with a damper that is sewn internally in the nozzle to adjust the flow of air if needed. Please feel free to contact us with the requirements and details of your long throw/high velocity nozzle design.



Fixed nozzle



Adjustable nozzle



Directed nozzle

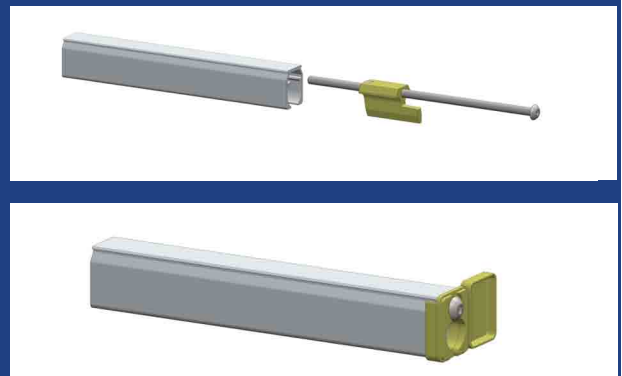
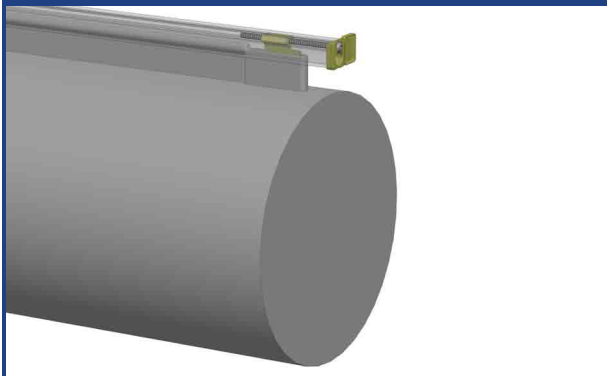
5.7.

Tensioners

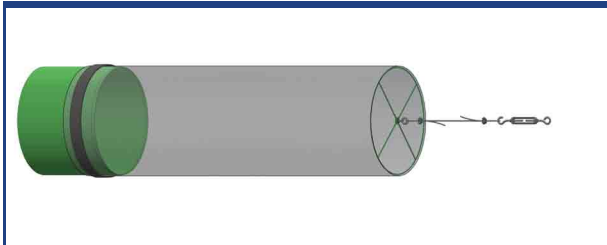
Significantly improve appearance

Screw tensioner in the track profile

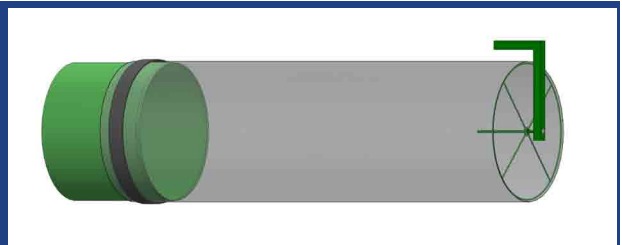
Screw tensioners in the track profile are used to improve the duct appearance by removing creases and rinkles in the fabric that may have been created when the ducts were packed and shipped from the factory. The pliability of the fabric allows stretching by up to 0.5% of the length. Non-stretched diffusers are thus 0.5% shorter than specified in drawings and the proper length is achieved by using tensioners. The installation procedure is specified in the assembly instructions included with all deliveries.



CONDITIONS OF USE: We recommend using whenever possible, i.e. in all aluminium profile (track) installations.

Tensioner in endcap

anchored into the wall in the axis of the diffuser



anchored into the profile (track) on the ceiling (wall)

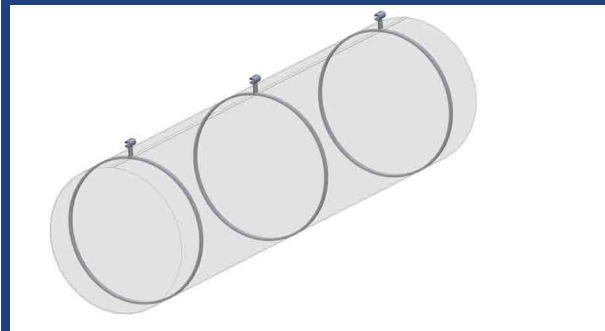
5.8. Reinforcement components

Maintaining the shape of circular ducting

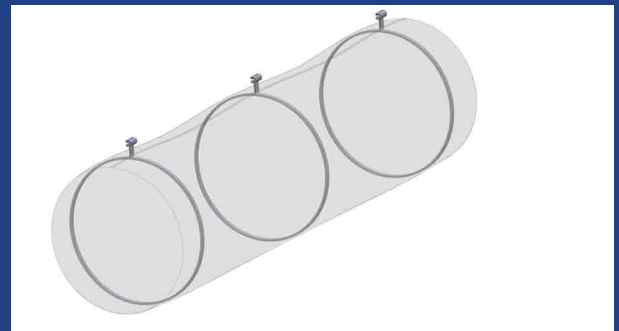
Optional accessories are available to hold round ducts open when the supply fan is off and the ducts are not inflated by static pressure. Variable Frequency Drives or soft starter devices are recommended to prevent rapid inflation of the ducts if the unit does not ramp up slowly to ensure longevity, but holding the duct open is another way to reduce rapid inflation “snapping” or “popping”.

Rings

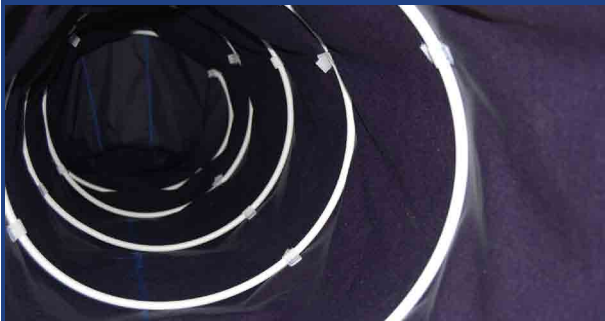
Made from heat resistant plastic (for diameters $\geq 16"$), from stainless steel, or from flat aluminum profiles. Rings can be installed internally or externally with a standard spacing of 39" (custom intervals available). Fastened with Velcro and typically installed from the factory rings eliminate inflation pop, have the best appearance with no air, and make it possible to have a lower minimum airflow on variable air volume systems (VAV's)



Inflated diffuser with rings



Diffuser with rings without air supply



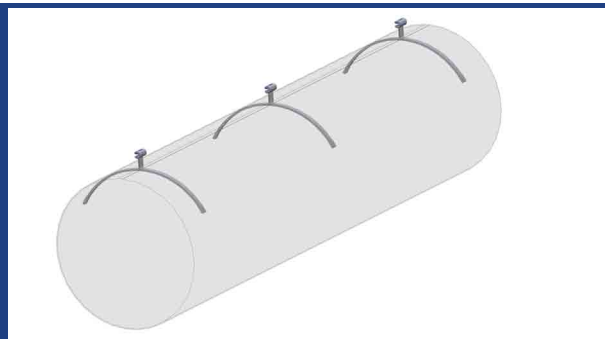
Detailed view of internal plastic ring attachment



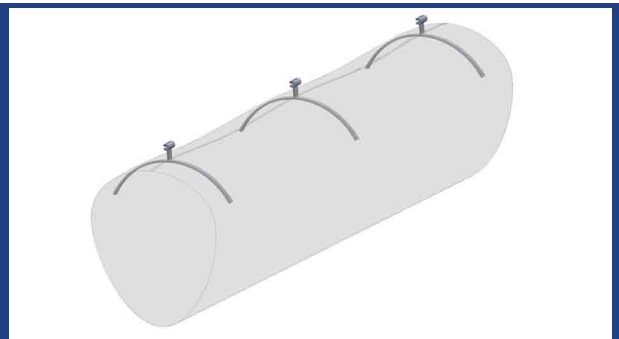
Actual diffuser with rings and no air supply

Internal arcs

Used for improving ducting/diffuser shape when the unit is off and reducing rapid inflation pop/snap if no soft starter device or VFD on fan. Aluminum Arcs are inserted into pockets sewn in the top of the internal ducting wall/roof and fastened in the middle by a Velcro attachment. They are installed from the factory and provide a cheaper alternative to full circumference rings. See chapter 9, FAQ 1 to see the cross section views of the hold open options with no air in the diffuser.



Inflated diffuser with racks (Arcs)







Diffuser with racks (Arcs) without air supply

5.9. Equalizers

Airflow equalizing/Flow correction

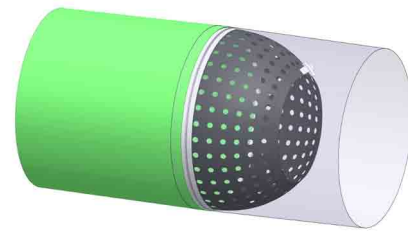
Equalizers are internal devices used for equalizing flows and reducing turbulence downstream of the fan or a fitting. Their use can remove vibrations/ movement in the fabric caused by irregular airflow, however they add a pressure loss which should be considered in the design process. Many of our competitors use similar devices made of a finer mesh material which acts like a filter and clogs with debris over time; our unique design is clog resistant.

			
EQ	EQS (star)	EQP (pot)	EQT (T-shape)
perforated fabric cone	star-shaped fabric sewn into the diffuser	cylinder sewn from a perforated fabric with bottom	equalizer copies inside form of diffuser

5.10. Damper

Similar to an equalizer only it has an adjustable outlet where the diameter may be adjusted using a sewn in belt with stopping clamp. Maximum opening to the diffuser diameter means zero pressure loss, and in contrast, fully closing provides the highest local loss. The setting may be adjusted at any time by opening the zip-fastener. It serves to equalize the static pressure along a diffuser, thereby equalizing the outflow. It can be used for flow regulation into the diffuser or help balance a complex system. Most fabric duct systems do not require balancing if designed properly, but dampers add increased adjustability of the system and are included in all of the large nozzles.

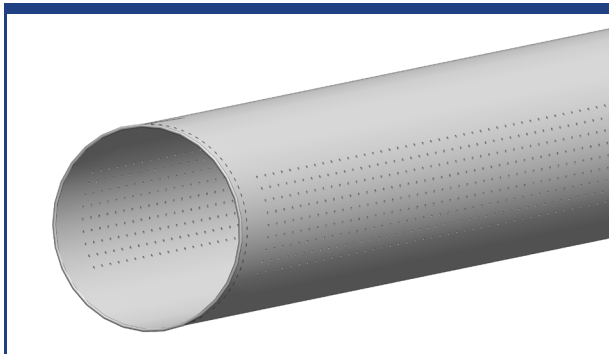
Adjusting flow or Equalizing the static pressure



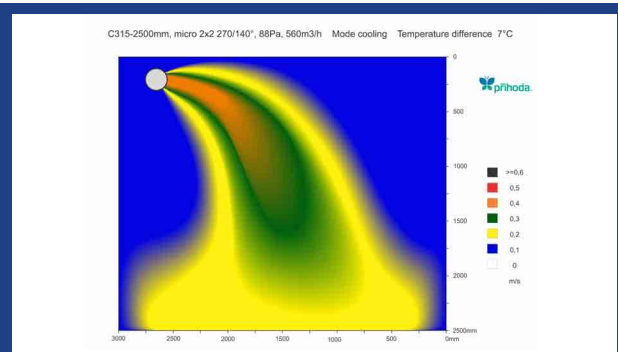
5.11. Diffuser for high load cooling

Cooling with high temperature difference (+6K)

The air will fall directly under the diffuser at a high velocity even when using uniform microperforations due to the density of very cold air. To prevent discomfort or drafts over sensitive equipment we recommend using horizontal air discharge rather than uniform microperforations. By placing the micro-perforations in a row on either side of the duct and ensuring the horizontal airflow pattern achieves a specific speed we can prevent premature downward deflection of the airflow. With sufficient outlet speed (static pressure) it is possible to introduce 1 kW (3412 btus/hr) of cooling capacity per meter of duct (3.3ft), while maintaining a velocity below 50fpm in the occupied zone. See figures below and please contact us for the specific calculations on your project.



Microperforation 90°



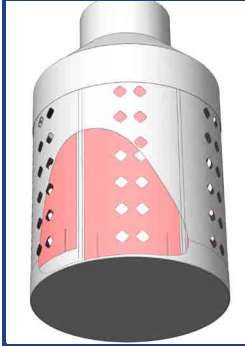
Airflow patterns, Microperforation 90° & .66in wg

5.12. Air diffuser Lantern

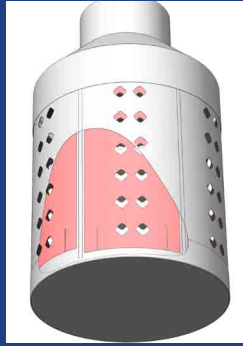
Easy to install, adjust and direct airflow

Our Lantern diffuser is designed to distribute air at high levels, most often from units installed on the roof and is intended to be installed vertically. The Lantern is an adjustable flow diffuser with changeable outlet direction from which air is discharged horizontally from one to six directions. Adjustment is possible with the vertical sliding strips which are used to regulate the flow rate or completely close the vents. Installation is simple, merely connect the inlet with a band clamp to the metal outlet and let the diffuser vertically hang free.

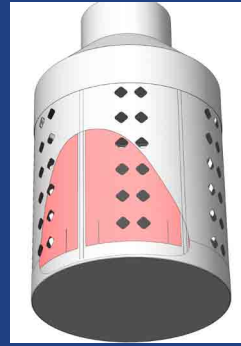
Airflow setting



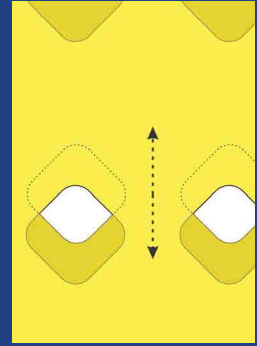
closed



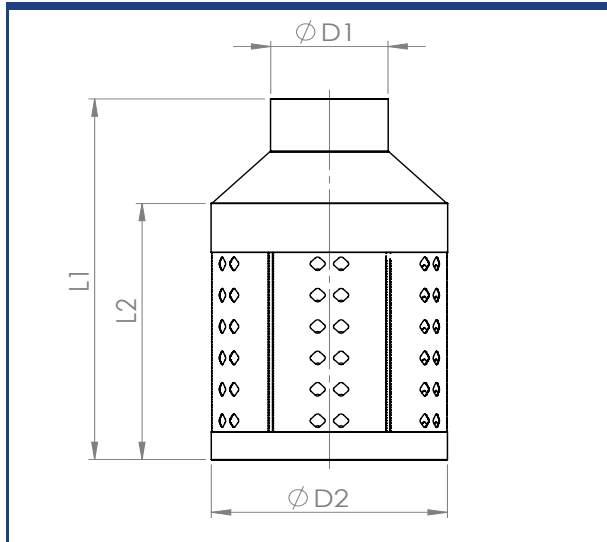
50% open



100% open



Detail of setting



Drawing and photo of lantern

Basic data

Connection	D1	IN	8"	12"	16"	20"	24"	28"	32"
Lantern	D2	IN	16"	24"	32"	40"	50"	56"	64"
Total length	L1	IN	28"	38"	46"	54"	66"	72"	82"
Length	L2	IN	20"	27"	32"	38"	46"	52"	58"
Airflow .32in wg	50% open	V	cfm	294	730	1177	1839	2920	3709
	100% open	V	cfm	589	1460	2353	3679	5840	7417
Weight	M	lbs	2.2	4.63	7.05	10.8	16.54	20.5	25.8

5.13. Defrost damper

Faster and more efficient defrosting of coolers

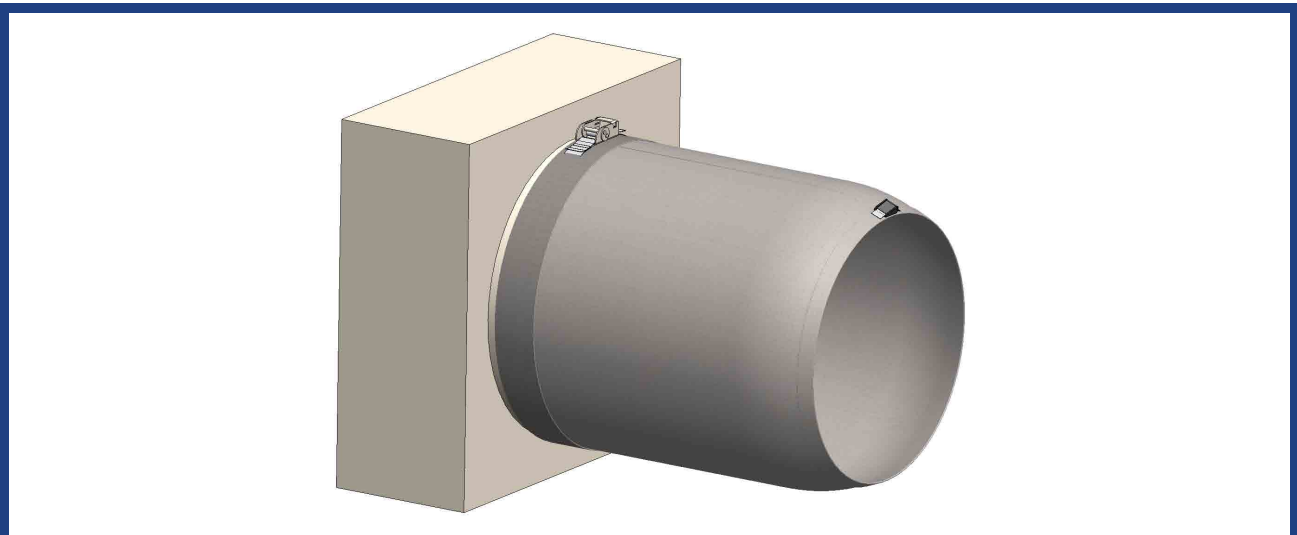
The purpose of the Defrost Damper (DeDa) is simple, it serves to close off the fan/coils of a walkin cooler evaporator to speed up the process of defrosting.

HOW IT WORKS:

- a) While the fan runs the damper is open and supply air is flowing through the damper, (air volume is slightly reduced by the damper). The precise reduction in volume depends upon the airflow curve of the fan and the construction of the damper.
- b) When the fan stops, the damper deflates and drapes over the fan outlet. This prevents the cold air still in the cooler from coming in direct contact with the coils, which creates a faster and more efficient defrost cycle.

CHARACTERISTICS:

- 1) We utilize a special fabric for defrost dampers, designed to provide good coverage of the fan outlet and resistance to ice build up (hydrophobic treatment).
- 2) The Defrost Damper is connected to the cooler by a textile clamp or metal strip. The defrost damper may require a transition or adapter to fit to the cooler fan, these are not included as standard but can be supplied upon request.
- 3) There is an adjustable cord with a buckle at the end of damper, which allows for adjustment of the outlet diameter. During commissioning it is important to adjust the cord to balance the damper so that there is no vibration or movement, while trying to minimize pressure drop.
- 4) The Length of the Defrost Damper will always be: $1,2 \times \text{diameter} + 2 \text{ inches}$.



Defrost damper on the cooler fan outlet while fan is running



Detail of tightening strip

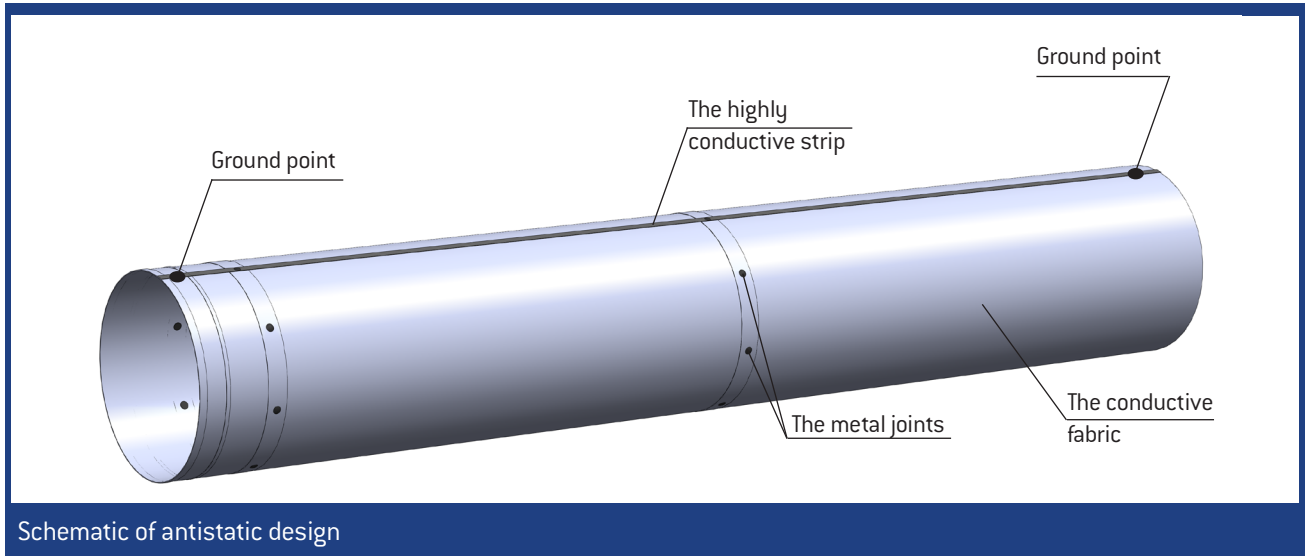
5.14. Antistatic design

Elimination of electrostatic discharge

Antistatic design is intended for rooms where there can be no risk of electrostatic discharge from the diffuser (sensitive electronic equipment, battery manufacturing, server rooms, data storage, etc.)

It consists of 4 components and must be asked for in the design and quote process:

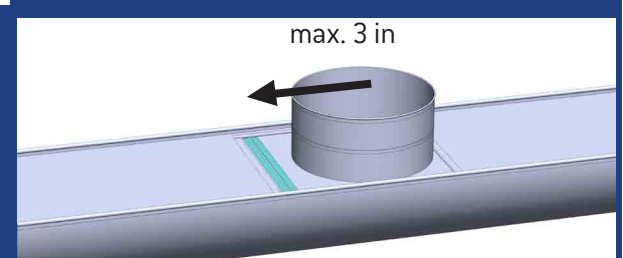
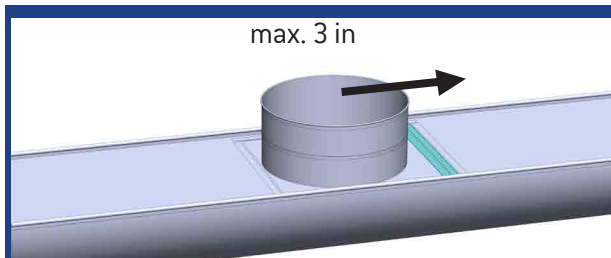
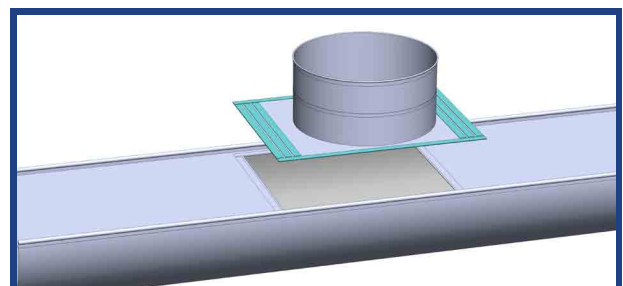
1. A conductive fabric (PMI and NMI have conductive carbon fibers woven into the material)
2. A highly conductive strip sewn in along the length of the diffuser
3. All zippers are equipped with metal joints
4. Grounding points at the ends of the diffuser



5.15. Moveable inlet adapter

Inlet adapters in the roof of a half-round or quarter-round diffuser can be designed in a way so they are laterally movable by up to 3 inches. A moveable inlet adapter can be helpful when onsite conditions differ slightly from the design drawings. "INM" symbolizes the moveable inlet adapter in a specification (short for Inlet-Movable).

Positioning the inlet adapter



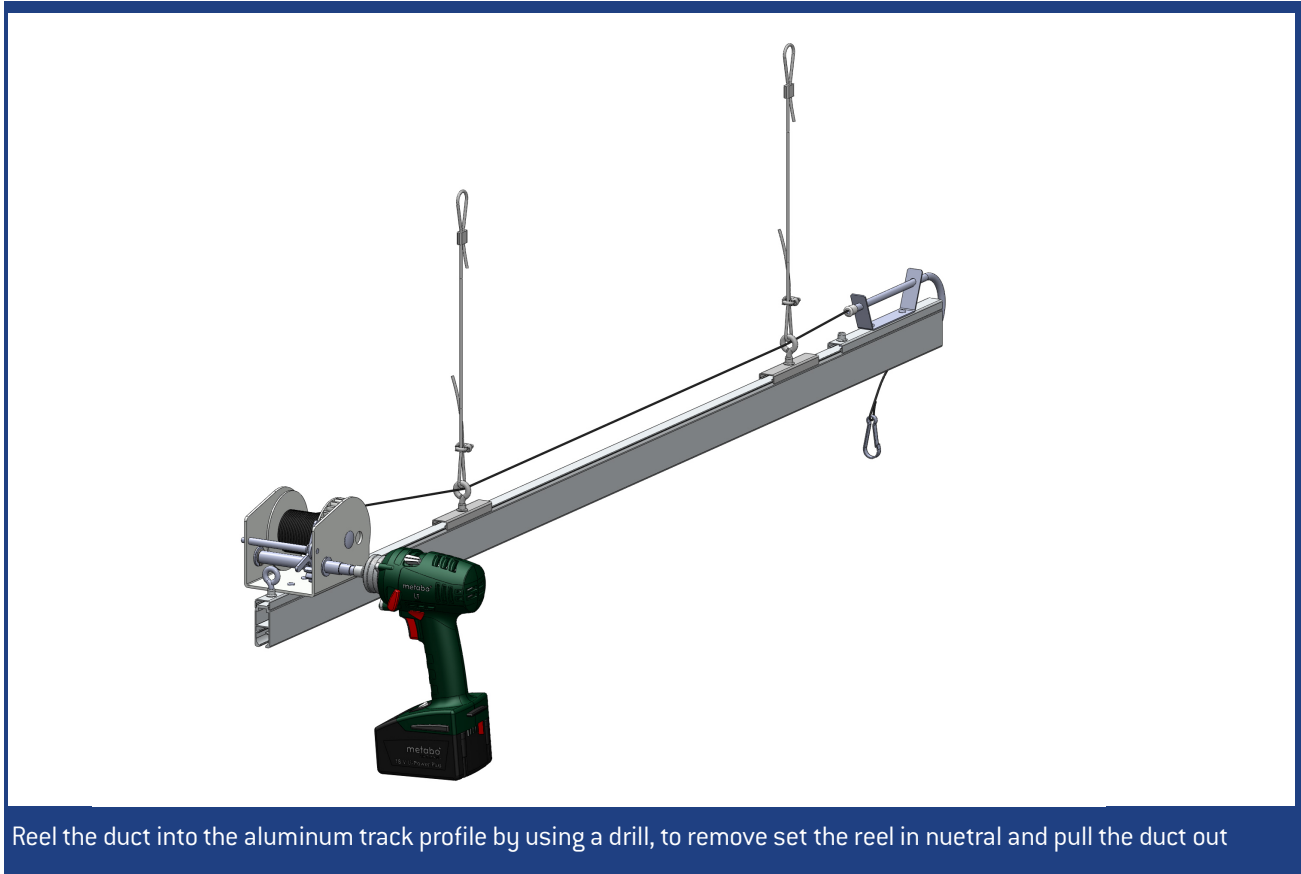
5.16.

Winch

Installing and uninstalling from one end

The entire diffuser can be pulled into the aluminum profile track from one end using a simple winch. This significantly simplifies installing and un-installing the diffuser especially if installed over permanent equipment or pools where the ducts are not easily accessible.

CONDITIONS OF USE: It is only suitable for installation 5, 5D, 5F, 5I, 5DI, 5FI, let us know in the design or quote phase if your project may require this option and we can advise the type of installation method needed.



Reel the duct into the aluminum track profile by using a drill, to remove set the reel in neutral and pull the duct out

5.17.

Other options**Combined half-round section**

This is a combination of several half-round diffusers sewn together side-by-side. It enables higher flows at a relatively small height.

Manometer

The static pressure in the textile diffuser can be detected using a simple manometer. Increased pressure above a specific value due to clogging may serve as an indicator to wash the diffuser [if all the air comes through the surface of the material or microperforations and there is poor filtration].

We manufacture every order to suit your project needs. We will gladly meet your project's requirements if they differ from our standard options. Feel free to contact us with for custom inquiries.

6. Material

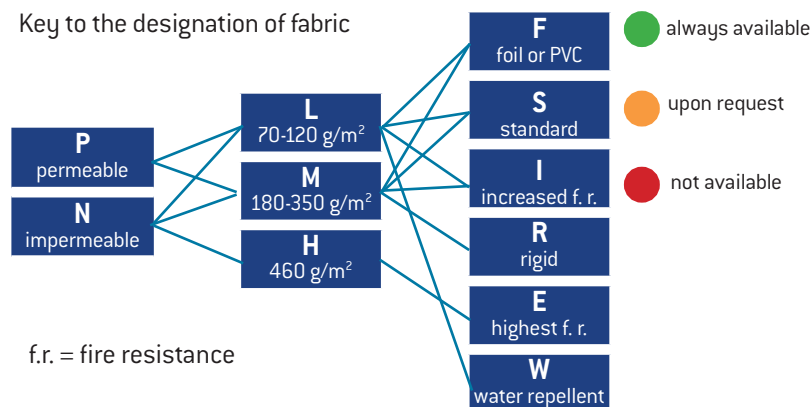
Fabric is the central component of our product, so AirWorkx places great emphasis on ensuring that only the highest quality materials are used. Every material we offer has been through a long development process in order to achieve the highest value for our customers as possible. The PMI/NMI fabrics provide all of the built in benefits listed below at no additional cost.

List of most important benefits of our fabrics

High tear strength	Our basic PMS/NMS/PMI/NMI fabrics offer optimum strength and durability. In the texture it is 1800 N/10mm, and 1000 N/10mm in the weave. Because of these parameters, it is nearly impossible that the material will come apart or fray under normal operating conditions.
High fire resistance	The PMI/NMI fabrics are certified according to EN 13501-1 with an excellent result. They achieve B-s1,d0 classification meaning they meet a specified flame spread / smoke development index, and do not produce burning droplets. NHE fabrics in fact meet class A requirements. PMI/PLI/NLI fabrics meet UL723/NFPA 90A 25/50 index (UL file number R125183).
Very low fiber shedding	Due to the use of endless fibres, ALL of our fabrics can be used in cleanrooms up to ISO Class 4. Independent laboratory tests demonstrate that there is practically no particle shedding from our material during operation.
Antistatic effect	Woven carbon fiber in PMI/NMI materials eliminate electrostatic discharge from the diffuser. (Note: Grounding accessories must be used to fully dissipate electrostatic discharge).
Antimicrobial effect	We utilize a special treatment which kills various types of bacteria and fungi that come in contact with our fabric. Independent testing has proven even after TEN washes there was no reduction in the efficacy of the treatment. This essentially means a permanent effect due to the low maintenance requirements (see the following point).
Easy to maintain	Our fabrics made of endless fibers are not prone to clogging from impurities in the airflow. This air is distributed through the holes, and the textile diffusers remain nearly clean inside (in a normal environment with EU3/G3/MERV 5 filtration) so the diffusers do not require maintenance other than outer dusting. Washing is usually only needed due to sanitary or aesthetic reasons.
Durable Appearance	Thanks to our endless fiber technology, the appearance of the fabric does not change over time, or with multiple washing cycles, unlike materials made of staple fibres. Our PMI/NMI/PMS/NMS materials retain their aesthetics after many maintenance cycles.

Designation	Permeability	Weight	Material	Specification									
PMS/NMS	yes/no	medium	100% polyester	●	●	●	●	●	●	9	●	●	
PMI/NMI	yes/no	medium	100% polyester	●	●	●	●	●	●	9	●	●	
PLS/NLS	yes/no	light	100% polyester	●	●	●	●	●	●	9	●	●	
PLI/NLI	yes/no	light	100% polyester	●	●	●	●	●	●	9	●	●	
NLF	no	light	100% polyethylene	●	●	●	●	●	●	1	●	●	
NMF	no	medium	100% polyester + 2x PVC	●	●	●	●	●	●	4	●	●	
NHE	no	heavy	100% fibre glass+ 2x polyurethane	●	●	●	●	●	●	7	●	●	
NMR	no	medium	100% polyester	●	●	●	●	●	●	1	●	●	
NLW	no	light	85% polyester, 15% nylon	●	●	●	●	●	●	1	●	●	

Key to the designation of fabric



antimicrobial	fire resistant	antistatic	high strength	machine washable	suitable for clean rooms	number of standard colors	special colors	water repellent
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How to Choose a Suitable Fabric?

When selecting a material, please keep the following in mind:

1/ Fire Resistance

Our fabrics show 3 levels of fire resistance.

Peak fire resistance (specified using the letter “E”, as in “Excellent”) means an entirely non combustible material. Within this class, we only use fabrics constructed from fiberglass with a polyurethane coating. These are however are nonpermeable, offered in fewer colors and more fragile than polyester fabrics of medium weight.

Increased fire resistance (specified using the letter “I”, as in “Increased”) means practically non combustible and very low smoke production. These materials meet the requirements for use in majority of spaces/building codes and are by far our most popular fabrics.

Standard polyesters or foils (specified using the letter “S”, as “standard” or “F”, as in “foil”) have a very low fire resistance. They can be used in an environment where no fire resistance is required.

2/ Rigidity and Cleaning Ability

Fabrics are divided into 3 categories by weight.

Light (marked “L”). These fabrics have a mass between 2 and 3.5oz/ yd2. Diffusers made from these materials only require .10 in wg of static pressure to achieve proper inflation. However, they are light weight, have lower durability and increased risk of tearing if improperly used. All our lightweight materials can be machine washed with the exception of NLF.

Medium (marked “M”). These fabrics have a mass between 5 and 10 oz/ yd2. They display the highest rigidity and anti-tear resistance. The minimum static pressure required for inflation is .20 in wg. All of our medium weight materials can be machine washed.

Heavy (marked “H”). These are PVC or polyurethane-coated fabrics and are only available in a non permeable specification. They cannot be machine washed but can be hosed or sprayed down. This makes our heavy materials suitable for the most contaminated environments. The minimum static pressure for inflation is .25 in wg.

3/ Permeability

Permeable material prevents condensation occurring on the duct when cooling below dew point.

4/ Colors

Most of our materials are available in our 9 stock colors detailed below (shades may vary). Custom / special colors are available at an additional cost and longer delivery time.

RAL 9016	PANTONE 135 (RAL 1017)	PANTONE 420 (RAL 7035)	PANTONE 424 (RAL 7037)	PANTONE 341 (RAL 6024)	PANTONE 187 (RAL 3001)	PANTONE 2915 (RAL 5012)	PANTONE 7462 (RAL 5005)	PANTONE 419 (RAL 9017)
								
WH	YE	LG	DG	GR	RE	LB	BL	BC

Please ask for a sample book if you wish to see or match a precise color or shade.

7.

Maintenance and Warranty

All of our diffusers and ducts are made of high-quality, temperature and shrink resistant synthetic materials. The material used is specified when your order is processed and is indicated on documents that accompany the shipment and also indicated on the labels sewn in by the zips (STRICTLY FOLLOW THE MAINTENANCE SYMBOLS ON LABELS).

Ducts and diffusers made of permeable fabric (PMS, PMI, PLS, PLI) can be washed normally in an industrial or commercial washing machine. Impermeable fabrics (NMS, NMI, NLS, NLI) can be machine washed but only on a gentle or "delicate" cycle. NMF, NHE and NLF are to be hand washed only. If the duct or diffuser has hold open accessories such as rings (tyres), arcs (racks), braces or turn-buckles these solid elements must be removed before the washing process. Induction surface dirt on the outside of the duct or diffuser can be vacuumed off and washing may be unnecessary.

Any maintenance must strictly follow the washing label symbols sewn into every section.

1. Wash the diffusers with a regular laundry detergent (follow directions for amount recommended by detergent manufacturer). Since most dirt is collected on the inside of the duct or diffuser its generally best if the diffuser is turned inside out for washing. We advise to repeat the washing up to four times as needed or to use a stronger detergent (acc. to level of contamination). A special detergent (we can recommend one by request according to the particular dirt or application) should be used if the fabric is badly soiled.

2. A disinfectant can be used for added safety (medical or food service applications) but is not generally needed due to the antimicrobial agent already in the material (PMI/NMI). The chemical composition of the disinfectant must not harm the diffuser fabric (see maintenance symbols, no whiteners!). Observe the producer's dosage instructions.

3. Rinse the diffusers in clean water.

4. Spin-dry the diffusers gently, and either drip dry on a line or re-install them and finish drying by the air flow from the ventilator.

pos01-part02-of02
OP123882
1654/2012
PMS 100% polyester



AirWorkx

Air Ducting & Diffusers

Made in EU
in November 2012

washing label

Legend for symbols

	Machine wash at max. temperature of 40°C (104°F), normal mechanical action, normal rinse, normal spin cycle.
	gentle/delicate machine wash only, rinse at falling temperature, light spin, max. temperature 40°C (104°F).
	Hand wash only, do not machine wash, max. temperature 40°C (104°F), handle gently.
	Do not bleach product.
	Product may be dried in rotary drum drier at reduced drying temperature.
	Do not dry the product in a rotary drum dryer.
	Iron at a max. temperature of 110°C (230°F), use caution when steam ironing.
	Do not iron product; steaming and steam processing is prohibited.
	Do not dry clean product, do not remove spots using organic solvents.
	The product is safe to dry clean using perchlorethylene and all solvents specified under the symbol F.

Warranty

Warranty Period

10 year	fabrics PMS/NMS/PMI/NMI/NMR
2 year	membrane diffuser, fabrics NMF/NLF/NHE
2 year(max. 50 washing cycles)	fabrics PLS/NLS/PLI/NLI
12 months	All other items not mentioned above, unwoven accessories (zips, hooks, etc), printing, assembly and accessories

The warranty period is deemed to start on the day of sale. For warranty to be valid all installation and maintenance instructions must be followed, in addition to good practice for the maintenance of the supply air units. Additionally, supply air must be filtered to at least EU3 (MERV5) and the ducts washed or cleaned every 12 months. Chemicals used which may have an adverse affect on the material or ancillaries will invalidate the warranty.

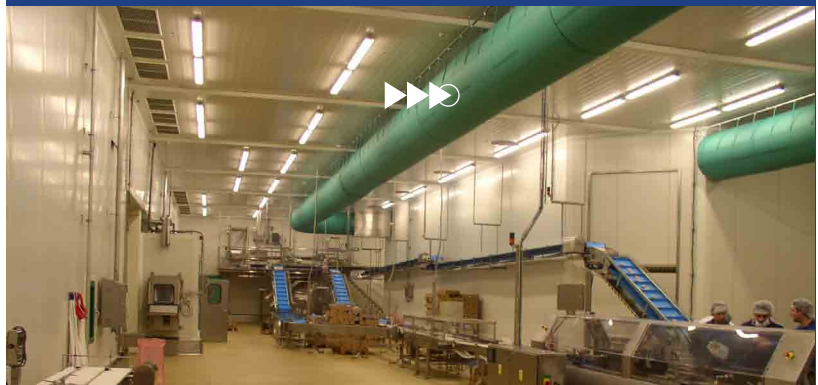
Special conditions for diffusers with silk screening

1. Ambient Temperature within the range +10°C (50°F) to +40°C (104°F).
2. Do not iron.

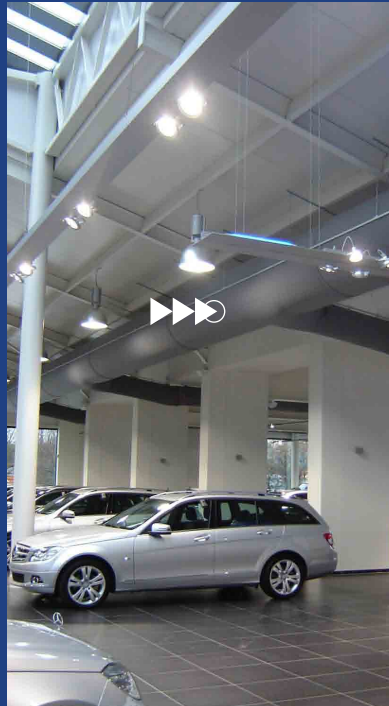
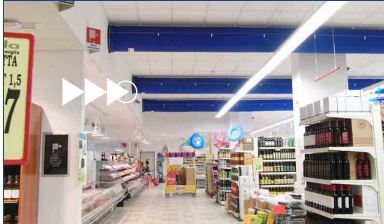
8. Examples of Applications

Food processing industry

The first fabric diffusers were used in the food industry. Sanitary regulations require that all food processing devices should be easily sanitised and cleaned. Out of all the air distribution system options, this condition is only met by Fabric Ducting. Fabric Ducts are perfectly clean after washing and a disinfecting agent can also destroy any pathogens that may resist the antibacterial treatment. Fabrics made of continuous fibres, developed especially for AirWorkx textile diffusers, are very smooth and do not allow the build up of impurities. This unique and special feature distinguishes them from diffusers made of standard fibres that continuously trap dust and can represent a sanitary risk.



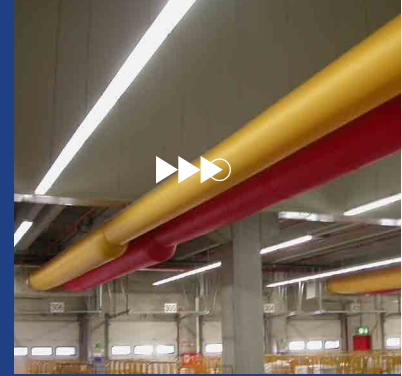
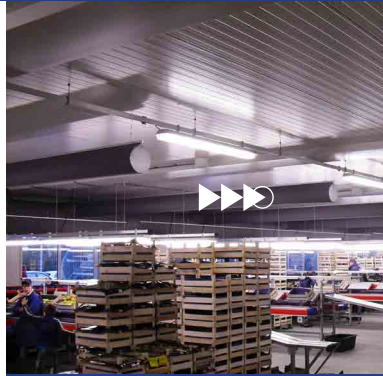
Supermarkets, exhibition and large retail areas



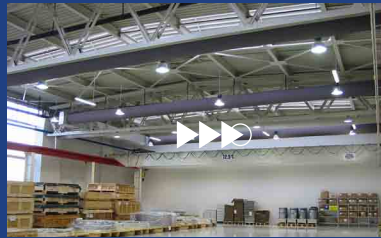
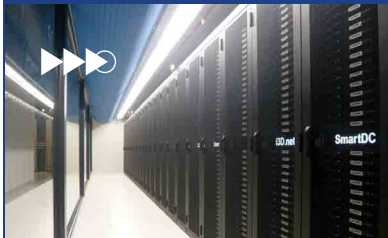
For large retail areas we can provide supply air through laser cut perforations or nozzles, whichever suit the application best. Experience over many years shows that Fabric ducting & diffusers offers a substantially better, more uniform air pattern than can be achieved with traditional systems, while also offering substantial cost savings. The wide range of 9 stock colours allows for many different aesthetic designs while the Fire Resistance of our fabrics meet all world wide standards.

Food Storage, Low Temperature Production Areas

In large cold storage rooms AirWorkx Fabric Ducting distribution systems provide uniform air distribution, ensuring maintenance of stable product temperatures and temperature zones. In production zones with large amounts of people working in low temperatures, high air velocity will be a major cause of discomfort and may cause a higher sickness or absence rate. Fabric ducts and diffusers disperse cold air without causing drafts, and create comfortable, low velocity environments for workers.



Chemical, textile and and electronic industry

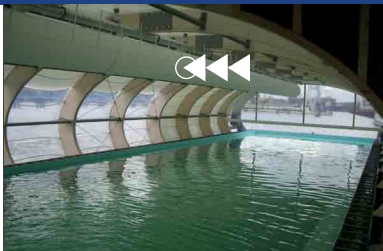


AirWorkx Fabric Ducting air distribution is a perfect solution for any industrial operation. AirWorkx Fabric Ducts provide uniform low velocity air distribution or targeted air patterns, at unbeatably low costs. Over 100 suspension solutions make it possible to choose a convenient installation style for any application, easily accommodating most suspended and formed ceiling types. Contaminated production environments may require the use of fabrics with larger laser cut perforations.



Pools, Sports Halls and Fitness Centers

Large sports facilities are a typical application for AirWorkx Fabric Ducting & Diffusers, we are able to create a large range of diffusion air patterns to suit any project. While our many installations at sports and fitness centers provide comfortable cooling air movement for customers "working out". In these applications low ceiling heights are often encountered, where half round fabric ducts make an aesthetic and functional low cost solution. Swimming Pools are a perfect application for Fabric Ducts, as the fabric material will not rust, corrode or sweat and is a fraction of the cost of double wall treated/SS/ALU metal systems. The bright colors available also revive and enhance many swimming pool interiors.

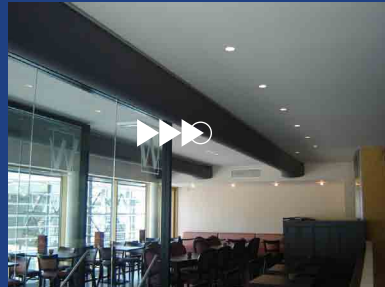


Kitchens

Space in kitchens is usually minimal, and their extreme load with heat and vapors requires intense ventilation. AirWorkx Fabric Ducts disperse high volumes of air uniformly into this environment without creating drafts. The fabric material used is resistant to steam and vapors and maintenance is quick and easy. Compared to a traditional stainless steel installation Fabric Ducting is a much lower purchase, installation and maintenance cost and easily achieves sanitary demands due to the fact the ducts are washable.



Offices, restaurants, cinemas etc.



Higher aesthetic demands can be satisfied by the multiple colors and shapes available with AirWorkx Fabric Ducting air distribution systems. When designed properly and correctly installed fabric diffusers become an elegant part of an interior. Air diffusion through Fabric Ducting provides similar comfort results to chilled beams or perforated ceilings, however at a much lower capital cost. Unlike the traditional diffusers, embedded in soffits, our even and continuous diffused solutions do not cause any local discomfort such as drafts or dead zones. Studies have demonstrated that employees in such evenly distributed and cooled offices are significantly more comfortable, and sick leave can be reduced.



Temporary installations

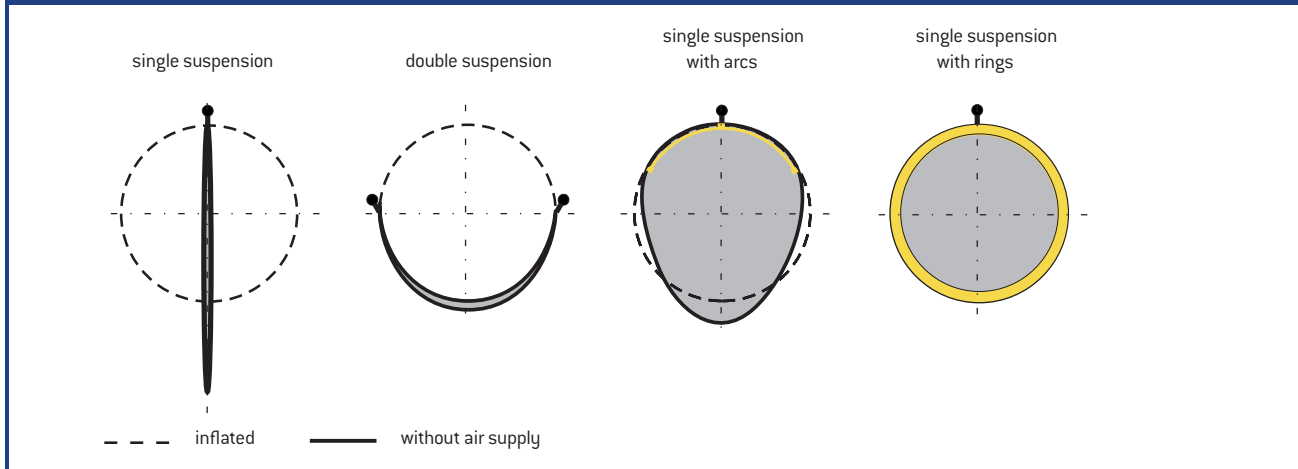


The benefits of using AirWorkx Fabric Ducting and distribution systems for cooling or heating of large scale tents or other temporary structures are quite obvious. Light weight roof structures can easily support fabric ducting and diffusers because they weigh less than a pound per linear foot. Installation is very quick, using the supporting wires and hooks provided as part of the system. Top quality materials allow multiple repeated use so the ducting system can be taken down and reused with the tent. Cooling or heating using a large AHU and Fabric Ducting diffusing all along the structure, is much more economical and comfortable than simply blowing the air into a space. Specifically with heating the warm air rises quickly creating stratified hot air near the ceiling, and thus an enormous heat loss. In cooling, with air diffused through Fabric Ducting intense airflow causes local air currents and drafts; while elsewhere dead zones with insufficient cooling develop. Both cases are successfully resolved by a properly designed Fabric Ducting air distribution system.

9. Frequently asked questions

1/ What does a textile diffuser look like when the fan is switched off?

more in chap. 5.8.



Circular diffuser - comparison of installation

2/ Is it possible to use Fabric Ducting for exhaust or return air?

more in chap. 1.3. , 5.2.

AirWorkx was the first fabric duct manufacturer worldwide to introduce negative pressure ducting into the market. It is made with a square or triangular shape. The principal is based on sufficient stretching of all ducting walls by means of a tensioning system. The construction enables simple disassembly and re-installation. Laser cut perforations are used to draw the air into the duct.

3/ What is the service-life duration of fabric diffusers?

AirWorkx fabric ducts are not a temporary or short term solution. Diffusers made from good quality fabrics will last for 15 years or longer. In fact, some of our first installations from the early 90's are still in use with the original ducts in place, which is a testament to the longevity of our products. The lighter fabrics (PLI/NLI) or polyethylene ducts have limited durability and are used for short term installations when cost has the highest priority.

4/ What is the pressure loss of a fabric diffuser?

more in chap. 2.3.

The external static pressure required at the inlet of our round duct systems range from .20inwg - 1inwg, with the average being about .50in wg ESP. Smaller air handlers may have less static pressure available or some projects may require much higher throws or smaller duct diameters (higher inlet velocities) which increases the static pressure needed. Complex systems with elbows, T's and equalizers present certain pressure losses which needs to be taken into consideration and is easily calculated in our software. Friction loss for fabric ducts is usually lower than traditional metal systems (designed with equal friction) due to the decreasing air speed inside our diffusers (static regain design). Lighter materials or half round ducts require as little as .10 in wg.

5/ What to do with diffusers when they get clogged by contamination?

more in chap. 7.

Diffusers with micro-perforation or larger laser cut holes rarely, if ever, get completely clogged by contamination (if used with minimum pre-filtration EU3/MERV5). Diffusers with laser cut perforations and microperforations are superior to ducts with mesh slots and materials woven to a specific permeability as our diffusers do not act like giant filters. The maintenance (typically washing in a washing machine) is really only necessary for hygienic and aesthetic reasons. Each individual zipped section contains a washing label which provides all washing information. Our experience has proven that our fabrics made of continuous fibers remain practically clean on the inside after many years of operation with proper filtration.

6/ Can fabric diffusers get moldy?

Generally the answer is no for all of our products when installed and air is running through them. Antimicrobial treatments in our PMI/NMI offer added protection from many forms of bacteria, molds, mildew and fungi however, mold can form on any kind of untreated surface if left moist and unventilated and there is an organic food source such as dirt or cardboard. Therefore, never store moist diffusers and do not keep them out of operation for long periods of time. Mold is extremely difficult and often impossible to remove once established. It is usually best to replace the diffusers if they have gotten wet while stored or have been exposed to mold growth.

7/ Is it possible to use rectangular diffusers?

more in chap. 2.1., 5.2.

AirWorkx has developed a special construction which enables use of a rectangular cross-section. The principal is based on stretching the fabric in transverse and longitudinal direction by means of a tensioning system. The construction enables simple disassembly and re-installation. Fabric ducting with rectangular cross-section can be assembled directly on the ceiling or suspended from the structure above.

8/ Does the textile diffuser function as a filter at the same time?

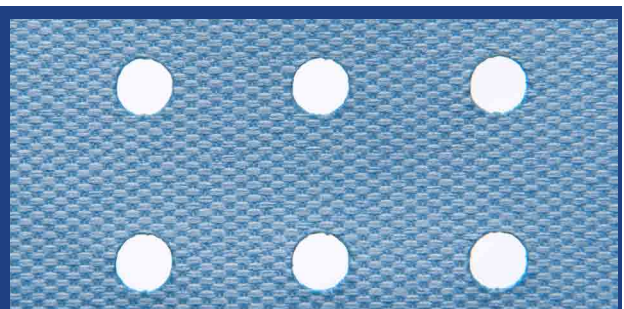
If materials woven to a specific permeability are used, the fabric functions as a filter for the part of the transferred air that goes through the fabric. As the fabric contamination gradually increases, the pressure loss grows and the air flow decreases (or energy costs increase). Therefore, it is necessary to frequently wash those types of fabrics. This is why AirWorkx utilizes microperforated or laser cut perforated fabrics as a better solution because they do not function as filters thus significantly reducing maintenance. Furthermore it is much easier to change a filter before the duct system rather than washing the entire duct system...we are a manufacturer of air distribution ducts and diffusers, we are not in the business of filtering air.

9/ Why doesn't AIRWORKX use small plastic nozzles or mesh slots?

Mesh slots were first used as a method to reduce washing maintenance for fabric ducts with no openings that only distributed air through materials woven to a certain permeability. By placing mesh slots in the duct with horizontal discharge maintenance requirements were reduced as the mesh did not clog as quickly as the material. Mesh slots were never intended to solely distribute the air from the ducts and are an outdated flow model which clogs with dirt, creates higher noise, and does not control the air as well as perforations or nozzles do. Plastic nozzles were used to prevent deflection of the discharged air towards the endcap. We prevent deflection by properly designing our diffusers with the appropriate inlet air speed, pressure and unique microperforation technology. For longer throws we offer large textile nozzles that outperform small plastic nozzles.



Microperforation



Perforation

10/ Why doesn't AIRWORKX use more permeable fabrics?

We use permeable materials to avoid condensation where supply air temperature is below dew point. However, we only have material of a single permeability value. It is very low and serves just to prevent condensation. For air distribution we exclusively use laser cut openings (perforations, microperforation or a combination of both). Our product portfolio also includes non permeable materials, which are often useful in other situations (such as ducts that only serve to transport air to another area, and where there is no risk or consequence of condensation).

5+5+5

5 for fabric ducting & diffusers

1/ Economy & Speed

The cost savings when using AirWorkx Fabric Duct instead of traditional metal can be as much as 70% especially when you consider the cost of conventional diffusers, cost of shipping, much longer installation times, painting, sealing & balancing. Installation and/or removal of fabric ducts take only a fraction of the time needed for metal systems.

2/ Hygiene

Cleaning is simple, the ducts are easy to remove and cleaned in conventional washing machines. Once cleaned and disinfected Fabric Ducts are 100% hygienic, much more than can be guaranteed with traditional rigid systems.

3/ Ecology and Green technology

AirWorkx Fabric Ducts & Diffusers are environmentally-friendly, requiring much less energy than manufacturing, transporting and installing heavy traditional metal systems. AirWorkx Fabric Ducts are also partially manufactured of recycled material, and upon request we can arrange to collect old or unused components for recycling.

4/ Designs that meet any requirement

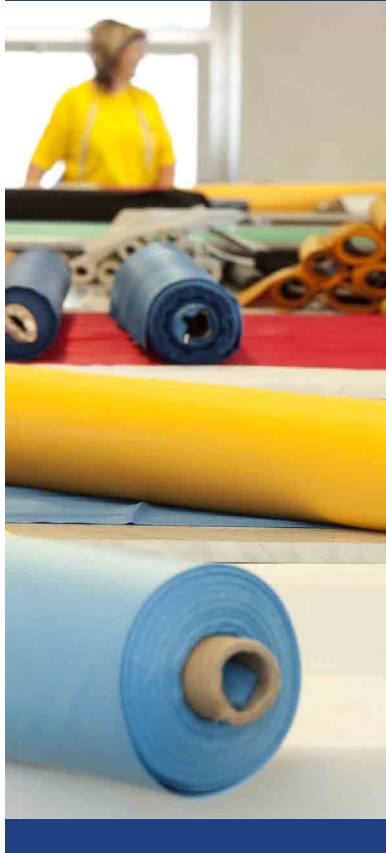
A myriad of air flow models can be achieved from laminar flow, low velocity air distribution for critical environments to high velocity, high throw targeted air patterns.

5/ Aesthetics

Various color and shape combinations exist to satisfy most aesthetic demands. Allowing the product to blend into its environment, or become a tasteful enhancement of the buildings interior.



5 for AIRWORKX`s fabrics

**1/ Optimum Strength**

Through a long development process, we have optimized the weight of our PMI textiles to about 6.5oz/yd2. The textile strength moderately exceeds the strength of the ducts seams, which is ideal. Greater strength or heavier materials do not in any way benefit customers as the strength a fabric duct is limited by the strength of the seams.

2/ Very low particle shedding

Because we use continuous fibers, all of our fabrics can be used in Clean Rooms up to ISO Class 4. Independent laboratory tests have demonstrated almost zero particle emissions from AirWorkx materials in operation. AirWorkx fabrics are very smooth and do not allow settlement of impurities from flowing air. This air is distributed through the laser cut holes, and the textile diffusers remain practically clean inside (in a normal environment with proper filtration). AirWorkx Fabrics do not require any other maintenance than outer dusting. Thanks to continuous fibers, the appearance of the fabric will not change even after multiple washing cycles, unlike materials made from staple fibers.

3/ Antimicrobial Effect

Our special antimicrobial treatment kills various microbes that come in direct contact with the material. Even after ten washing cycles the AirWorkx antimicrobial material still conforms to the requirements of the relevant international standard, which means realistically a lifetime guarantee considering the low frequency of washing required with our fabrics. This applies to PMI/NMI/NMR fabrics.

4/ High Fire Resistance

Our AirWorkx PMI/NMI/NMR fabrics are certified in accordance with EN 13501-1 with excellent results. AirWorkx material achieve classification B-s1,d0. (excellent fire resisting performance B, low smoke emissions S1, zero molten, flaming drips d0) In addition to the PMI/PLI/NLI are UL listed to UL723(NFPA90a). Our range of products also includes class A2 - textiles made from fiber glass which are practically flame proof.

5/ Antistatic Design

Our material includes interwoven carbon fibers which make our AirWorkx PMI, NMI and NMR textiles more electrically conductive. This allows us to easily prepare the ducts to prevent electrostatic discharge when required.

Best Price/Quality Ratio

We offer the best ratio between price and quality however our very reasonable prices do not mean any compromise on quality. We hold ourselves responsible for the products we deliver. Their proper operation and long service life are a priority for us.

Experience, Knowledge & Technical Support

Fabric Ducting is the only product we manufacture and we focus constantly on its improvement. Our engineers carefully verify every technical detail in our specialized R&D test lab. Furthermore, technical engineers review every order to approve the parameters prior to manufacture and delivery.

Innovative

Every year we launch several new ideas on to the market as a natural consequence of the enthusiasm and creativity of our teams. We do not consider anything finished, everything can be improved upon. For example microperforation of fabrics is our unique technology.

10 Year Warranty

Because of the highest quality materials and manufacturing techniques, we are able to provide a ten year warranty.

Speed

Despite manufacturing mostly custom items, we are still able to meet very demanding delivery time schedules, thanks to our excellent work organization. In 2012, we delivered more than 4500 orders into 56 countries across the globe. More than 99% of these deliveries were dispatched within our confirmed delivery time. The production time required never exceeded 3 weeks throughout the year and many orders were produced within 1 week to help our customers with tight deadlines (express/expressed orders).



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