Air Dist **New** Systems

Dimensioning Ducts

March 2005

NEW PRODUCT NAMES

These Dimensioning chapters are using old names for fabrics and flowmodels and are not yet updated to the new names. Dimensioning is still done in the same way, though.

As discribed below you will be able to use the chapters for these product names:

Round FabricAir Ducts

Round FabricAir Ducts:
- FabricAir® Trevira CS using FabFlow™.
- FabricAir® Basic using FabFlow™.

Half Round FabricAir Ducts

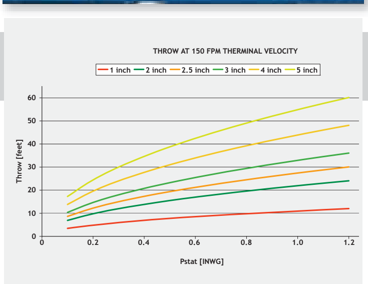
Half Round FabricAir Ducts:
- FabricAir® Trevira CS using FabFlow™.
- FabricAir® Basic using FabFlow™.

FabricAir Ducts w/Slots

FabricAir Ducts w/Slots
- FabricAir® Trevira CS using MeshFlow™.
- FabricAir® Basic using MeshFlow™.

FabricAir PERFO Ducts

FabricAir PERFO Ducts
- FabricAir® PUR100 using PerfoFlow™.
- FabricAir® PUR75 using PerfoFlow™.



Formulae and Throwdata

Throw Data:
- OriFlow™
- NozzFlow™
- MeshFlow™

General Introduction

The various types of products presented in this brochure are specially developed for use in the
air conditioning and ventilation industry. Much emphasis has gone into this development to ensure the products are suitable for use in virtually any given type of space or room that requires the introduction of cooled or heated air as well as spaces or rooms that only require ventilation.

It is our hope that with this brochure, you will be able to select and engineer the right product to suit your air moving needs.

In order to fully meet those needs, we have developed four different types of ducts, each with its own performance characteristics and engineering selection procedure. They are:

- Round FabricAir Ducts
- Half Round FabricAir Ducts
- FabricAir Ducts w/Slots
- FabricAir PERFO Ducts

Schedule for Dimensioning

We have developed a planning schedule for selection of the various products. With this schedule it is our intention to bring all important engineering data for an optimum solution at an early stage in the engineering - planning phase. However, one standard schedule cannot possibly cover all common space categories. The schedule is only to be considered as a guideline and additional drawings etc. for support are very helpfull.
If the planning - engineering is carried without any assistance from us, it may not be necessary to fill in certain sections in the form.
In this section, the schedule is reproduced with explanations.
NOTE: Use one schedule for each room or space.

Schedule for dimensioning

CUSTOMER

Company	________________	Address	________________
		City/State/Zip	________________
Contact person	________________	Phone	________________
		Fax	________________
Title	________________	E - Mail	________________

PRODUCT GROUP SELECTION

Duct Shape
Round Duct ☐ Half Round Duct ☐

Product Type
FabricAir Duct ☐
FabricAir Duct w/ Slots ☐
FabricAir PERFO Duct ☐

OPERATION MODE

Cooling	☐	______	Tons
Heating	☐	______	BTU
Heating and cooling	☐	______	BTU/Tons
Ventilation	☐		

BASIC ENGINEERING DATA

Space dimensions L: __________ ft. W: __________ ft. H: __________ ft.

Total air volume into space ______ CFM

No. of units __________

Space temperature ________ °F

Supply temperature
Summer ________ °F
Winter ________ °F

Nature of human activity in space
Sedentary ☐
Stationary standing ☐
Non - stationary ☐

Desired terminal air velocity ________ ft/min

Duct mounting heigth
☐ clearance
☐ centerline __________ ft.

Total pressure available for *FabricAir* System ________in.WG

Sketch of space

NECESSARY INFORMATION RELATING TO QUOTATION

Required color of duct __________

Do you require plenum duct to be priced YES ☐ ☐ NO

Required length of straps ________ in.

Installation type __________

Do you require mounting material to be priced YES ☐ ☐ NO

The Schedule Point by Point

PRODUCT GROUP SELECTION

Please ✓ your selected duct shape and product type.

OPERATION MODE

Please ✓ your operation mode selection. Indicate the cooling or heating load that is required to satisfy the final room temperature.

BASIC ENGINEERING DATA

Space dimensions
(L x W x H (ft.))
Accurate measurement of the space showing obstructions, are essential for proper plan-ning of duct location. If you need further explanation in order to fully detail the space design, please use the space on the schedule.

Total air volume into space (CFM)
Please indicate the total air volume being introduced into the space via the ***FabricAir System***.

Space temperature (^{0}F)
Please indicate the required space temperature

Supply temperature (^{0}F)
Please indicate the supply air summer and winter temperature.

Nature of human activity in space
Please ✓ the human activity being carried out in the space.

Desired air terminal velocity in the occupied zone (ft/min)
Please indicate the desired terminal air velocity required in the occupied zone. This zone is from floor level to 6 ft. above floor level. The terminal velocity is directly related to the human activity level, and as such you should strike a balance between these two data types.

Duct mounting height (ft.)
Please ✓ your choice and indicate this measurement.

Total pressure available for the FabricAir system (in.WG)
Please indicate the total static pressure (Ps.) available for the inlet to ***FabricAir System***.

Sketch of space
If you feel that the planning - engineering of your project requires further explanation in relation to the above stated data, please use this area to simply sketch additional information such as position of ducts and position of air handling units, or any space obstruction that may be present such as beams, light fittings or building services.

NECESSARY INFORMATION RELATING TO QUOTATION

Required color of duct
Please refer to our color schedule and indicate your choice. If this space is not filled in, **FabricAir** will quote on standard white color.

Do you require plenum ducts to be priced
Please ✓ your choice.

Required length of suspension straps (in.)
Please indicate this measurement.

Installation type
Please refer to our standard installation type chapter and indicate your choice by writing the selected type.

Do you require mounting material to be priced
Please ✓ your choice. If this section is not filled in, **FabricAir** will quote on ducting including mounting material.

Dimensioning

Round FabricAir Ducts

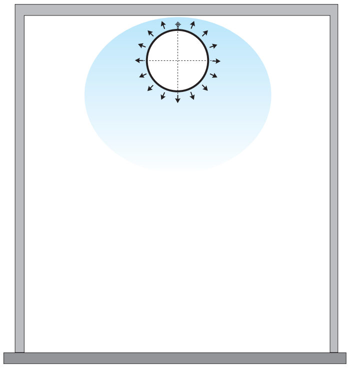


Fig. 1

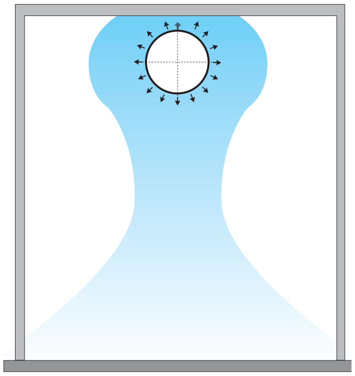


Fig. 2

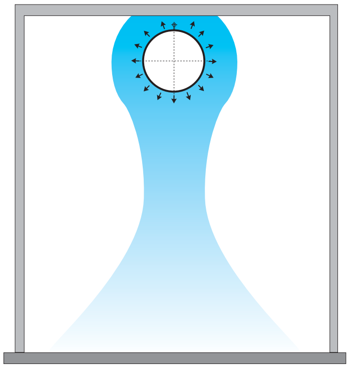


Fig. 3

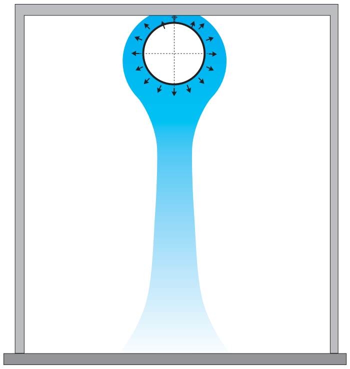


Fig. 4

Introduction

The round fabric duct is made from a 100% permeable material. This means that the air is distributed evenly across the entire surface and thus supplied to the room at the minimum velocity. The fabric duct is used for isothermal supply and for supply of cooled air. Under normal circumstances, this type of duct will not be suitable for supply of heated air.

Supply Principle

The air is supplied to a space by means of the displacement principle. Simplified examples of this can be found in the following figures. The figures show the air distribution at a room temperature of approx. 54ºF and an evenly distributed heat load of approx. 50 BTU/h/ft^2. The figures are only indicative, as different room temperatures or where large local heat sources are present, can create uneven heat loading in the space, resulting in the creation of other air movements than those indicated.

Figure 1 - Isothermal Supply

This figure shows the supply pattern of isothermal supply and an air velocity of less than 20 ft/min. As the isothermally supplied air does not automatically move downwards, the surface exit velocity can successfully be increased to approx. 40 ft/min. However, the velocity should never exceed 60 ft/min.

Figure 2 - Δt: 0-4ºF

In this case the surface exit velocity should not exceed 20 ft/min, as the air will now descend through the space by itself. The air will now largely have the same velocity through its entire fall. The air is distributed across a zone of approx. 4 x the diameter of the fabric duct.

Figure 3 - Δt: 4-9ºF

Here it is important to pay attention to the surface exit velocity which should not exceed 20 ft/min - recommended 16 ft/min. The air velocity will, in this case, increase as the air descends downwards in the space. This picture becomes more distinct at an increased Δt and care must be taken especially in spaces with low working temperatures. Caution must be exercised when placing ducts directly above persons carrying out sedentary or stationary work. The air is distributed across a zone of approx. 2 x the diameter of the fabric duct.

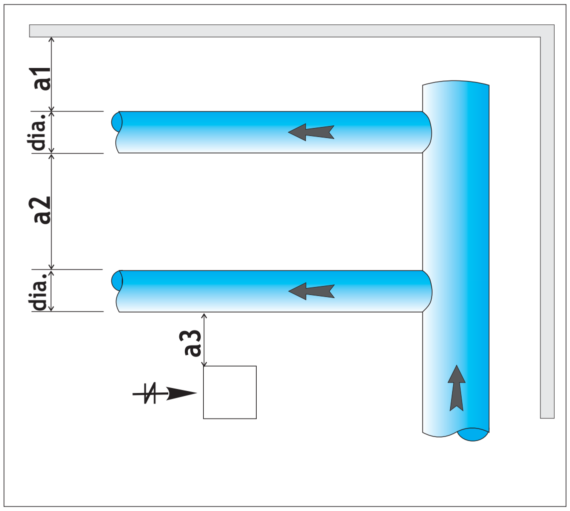
Figure 4 - Δt: > 9ºF

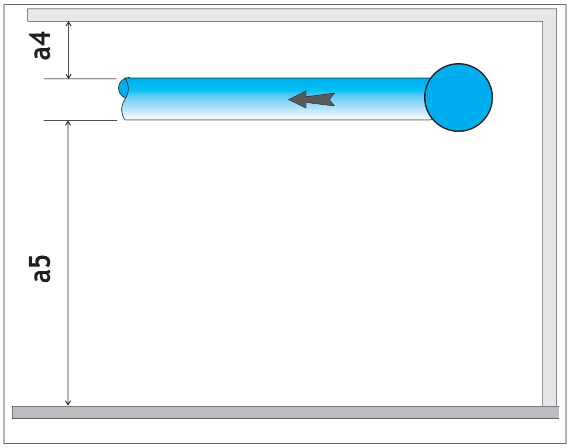
Even though the surface exit velocity is kept below 20 ft/min, the air will accelerate under the duct. This solution should not be used in places where the need for high personal comfort is required. The air is distributed across a zone of approx. 1 x the diameter of the fabric duct.

Positioning of Ducts in Spaces

In order to avoid cooling downfall and other unwarranted conditions that might lead to
undesirable effects in the air supply principle, there are important factors to be considered when planning the final layout of the space.

Recommended minimum distances from walls, ceilings and return/exhaust air grilles for round fabric ducts.





a1

From wall to side of first fabric duct: min. 3 x fabric duct dia. This distance ensures that the air does not fall along the wall surface.

a2

From fabric duct side to fabric duct side:
min. 4 x fabric duct dia. This distance ensures that the air does not "collide" and thus develops a so-called cooling downfall.

a3

From fabric duct side to the return air grill side: min. 1 x fabric duct dia. This distance ensures that a short cycling situation does not occur.

a4

From ceiling to top of fabric duct:
min. ½ x fabric duct dia., minimum 8 in. This distance ensures that the normal return pattern of the fabric ducts is maintained.

a5

From bottom edge of fabric duct to floor:
min. 6 x fabric duct dia. or 7 ft. This distance ensures that the normal return pattern of the fabric ducts is maintained.

Engineering Guidelines

This engineering guideline is based on nominal recommended values for inlet velocity, surface exit velocity and temperature for a duct operating within the specified parameters. Selections deviating from these recommended values and parameters can also be selected and used. In cases where such selections are desired, please refer your requirements to FabricAir, Inc. for correct engineering selection, thus ensuring compliance with our recommended engineering norms.

A number of factors play an important part when dimensioning the fabric ducts. Some act separately, others in conjunction with various factors. Here we will take a look at how the most important parameters are calculated and which limits we recommend are observed:

FabricAir Duct sizes
*Round FabricAir Duct*s are available in sizes from 4 in. diameter through to 80 in. diameter

Total external pressure
In the following, we will look at the applied total external pressure calculations which are fundamental to an optimum dimensioning of fabric ducts. We have, however, simplified these as much as possible, as very specific total external pressure calculations will often give a false feeling of security.

Dynamic total external pressure across the ducts
- Pd. (in.WG)
The dynamic total external pressure increases pro rata with the inlet velocity. Pd. must always be adjusted together with Ps. as a lack of balance between these parameters may give "pulsating" fabric ducts.
FabricAir recommends the following pressure balance: Pd. ≤ 2/5 of Ps.

Static total external pressure across ducts
- Ps. (in.WG)
A margin for system total external pressure should be added together with a margin for a build up of dirt in the fabric ducts. It will there fore be necessary to select a fan with a stable pressure curve, such that the selected air volume is guaranteed at initial start up of the system, as well as when the fabric ducts have absorbed the allowed amount of dust and dirt.
The total external static pressure indicates the external pressure without the pressure caused by velocity. This external pressure is best measured in the end of the fabric ducts, as there is no dynamic pressure at this point. Ps. is also the determining factor for the air flow over the fabric surface.

FabricAir recommends the following values:

Minimum Ps.	*0.25 in.WG*
Nominal Ps.	*0.40 in.WG*
Maximum Ps.	*0.60 in.WG*

Air Velocities
The inlet velocity is very closely related to the total external pressure calculation, as a relative large external pressure can often compensate for a high inlet velocity.

Inlet velocity in duct (ft/min)
This value is closely connected to Pd. as an increased inlet velocity will automatically generate a higher Pd. An excessive inlet velocity in comparison with the static pressure in the system will often result in a "pulsating" system. Therefore, it is especially important that the recommended values of inlet velocities are observed.
FabricAir recommends the following inlet velocities:

Maximum air entering duct at end	*1,600 ft/min*
Air entering duct in mid point	*1,400 ft/min*

Fabric surface exit velocity (ft/min)
The fabric surface exit velocity of the ducts is especially important in relation to the terminal velocity in the occupied zone. As the throw of the air from the ducts is limited as it is, even a marginal increase in the surface exit velocity can have undesired consequences for the terminal velocity in the occupied zone. In the introduction to this section, we presented some air pattern diagrams of different situations. Here it is shown how the air pattern significantly changes at different Δt. A combination of an excessive Δt and an increased fabric surface exit velocity can therefore, create undesired high velocities in the occupied zone.
FabricAir recommends the following surface velocities:
Isothermal supply: max. 60 ft/min
When cooling: max. 20 ft/min

Cooling load per running feet of fabric duct
In order to achieve an acceptable introduction of air into the treated space when supplying cooled air it is important to select the correct length of the duct such that cooling downfall does not occur.
FabricAir recommends the following values:
Recommended cooling load
per foot of duct: 360 BTU/h/L (ft.)
Maximum cooling load per
feet of duct 450 BTU/h/L (ft.)
While these are guidelines for normal applica-tions, higher cooling loads can be selected. Caution should be exercised when applying higher cooling loads in relation to human activity directly below the fabric ducts. Where these are required please refer them to ***FabricAir*** for detailed engineering.

Space air change
In order to avoid draft problems occurring in ventilated spaces *FabricAir* recommends a maximum air change rate per hour of 40. Should you need to design/plan spaces with an air changes rate above the recommended, please refer them to *FabricAir* for detailed engineering.

Mounting heights of fabric ducts
As mentioned before, it is important to avoid cooling downfall from fabric ducts.
There are 2 important factors to look at when evaluating this problem. They are:
- space temperature
- Δt.
In order to determine the correct combination of these factors please refer to the schedule below.

Room temperature °F	Recommended Δt	Maximum Δt
32 to 43	3	5
43 to 54	4	7
54 to 64	5	9
64 to 75	6	9
Above 75	7	9

If maximum Δt is exceeded and/or the room temperature deviates from the above schedule, please refer your requirements to FabricAir, Inc. for the correct engineering selection, thus ensuring compliance with our recommended engineering norms.

Calculation and Recommendations

Basic information:

General :

- Pd. ≤ 2/5 of Ps.
- Ps. must be minimum 0.25 in.WG
- Ps. should not exceed 0.60 in.WG
- The air changes per hour should not exceed 40
- The smallest possible dia.of duct is 4 in.
- The diameter of duct should not exceed 80 in.

For Isothermal supply.

- The surface exit velocity should not exceed 60 ft/min.

For cooling applications:

- The FabricAir duct should not have a cooling load exceeding 450 BTU/h/ft.
- The surface exit velocity should not exceed 20 ft/min.
- Δt. and room temperatures should be within the parameters as recommended in schedule on page 9.

For End Inlet:

- The inlet velocity should not exceed 1,600 ft/min.

For Center Inlet:

- The inlet velocity at the connection must not exceed 1,400 ft/min.
- The inlet velocity in the duct should not exceed 1,400 ft/min.
- Pd. is determined by the inlet velocity in the duct - not the velocity at the connection

Procedure for dimensioning:

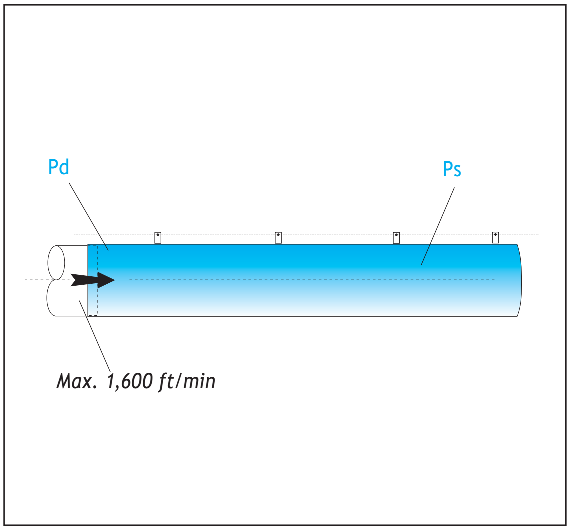
The following procedure is a guideline. Certain points that are calculated here may already be known.
Please refer to fold out section at back of brochure for descriptive explanation of the applied formulae.

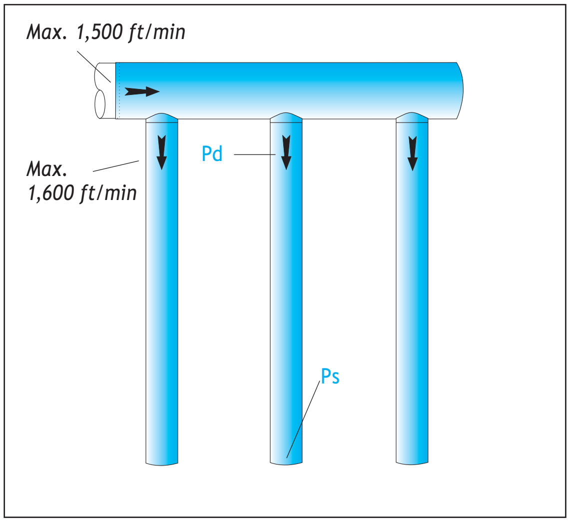
(1) Necessary input parameters:

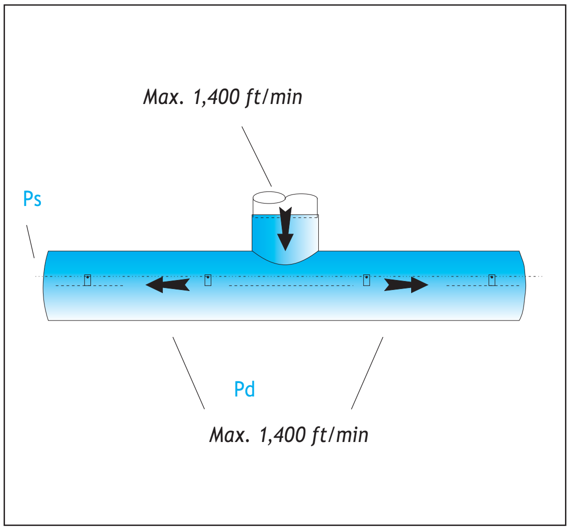
- The dimensions of the room (L x W x H)
- Maximum length of the fabric ducts
- Room temperature
- Total cooling load to be applied
- Number of units
- Space air volume - *if this is not known at this stage, it must be estimated*
- AHU connections - number, location and dimension
- Total external pressure available for the FabricAir system
- Cooling temperature of supply air

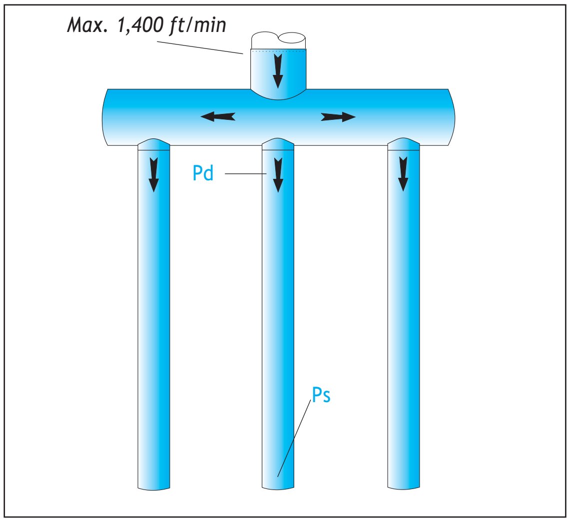
(2) Dimensioning:

(2.1) The minimum L(ft) of duct is calculated taking into consideration the maximum cooling load per L(ft)
(2.2) The minimum L(ft) of duct is calculated taking into consideration the duct surface area of fabric
(2.3) Select the L(ft) that gives the largest value from (2.1) and (2.2)
(2.4) The number of **Round FabricAir** ducts are calculated
(2.5) Calculate duct diameter (in)
(2.6) Calculate duct surface (ft^2)
(2.7) Calculate fabric selection factor
(2.8) Select fabric from schedule using selection factor - note division factor
(2.9) Calculate exact duct static pressure (in.WG)
(2.10) Check calculated static pressure against minimum static pressure









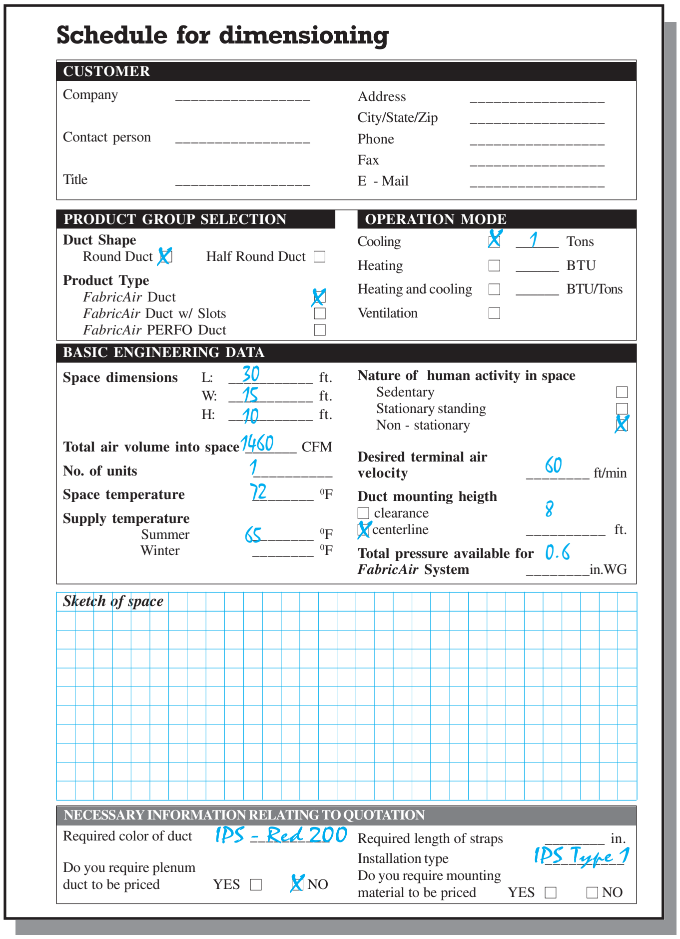
Special considerations in relation to FabricAir Plenum Ducts

In certain cases where the application calls for the use of multiple fabric ducts mounted in parallel, it is often a cost effective solution to use a round plenum duct manufactured from fabric to convey the air to the fabric ducts, rather than fixed sheet metal ducts. Where such fabric plenum ducts are used, the following conditions apply:

- The velocity in the plenum duct immediately prior to any „take off“ to the fabric ducts should be lower than the selected inlet velocity of the fabric duct, in order to facilitate a smooth transfer of air from the plenum duct to the fabric duct.
- Maximum inlet velocity (end of duct) in the plenum duct is 1,500 ft/min.
- Maximum inlet velocity (center of duct) in the plenum duct is 1,400 ft/min.

- The plenum duct is normally selected from Fabric T40, such that the main supply of air to the space is via the fabric ducts.
- In case plenum ducts are desired, please refer your requirements to FabricAir, Inc. for the correct engineering selection, thus ensuring compliance with our recommended engineering norms.

Calculation Example



Schedule for dimensioning

CUSTOMER

Company ________________ Address ________________
City/State/Zip ________________
Contact person ________________ Phone ________________
Fax ________________
Title ________________ E - Mail ________________

PRODUCT GROUP SELECTION

Duct Shape
Round Duct ☒ Half Round Duct ☐

Product Type
FabricAir Duct ☒
FabricAir Duct w/ Slots ☐
FabricAir PERFO Duct ☐

OPERATION MODE

Cooling ☒ 1 Tons
Heating ☐ ______ BTU
Heating and cooling ☐ ______ BTU/Tons
Ventilation ☐

BASIC ENGINEERING DATA

Space dimensions L: 30 ft. W: 15 ft. H: 10 ft.
Total air volume into space 1460 CFM
No. of units 1
Space temperature 72 °F
Supply temperature
Summer 65 °F
Winter ______ °F

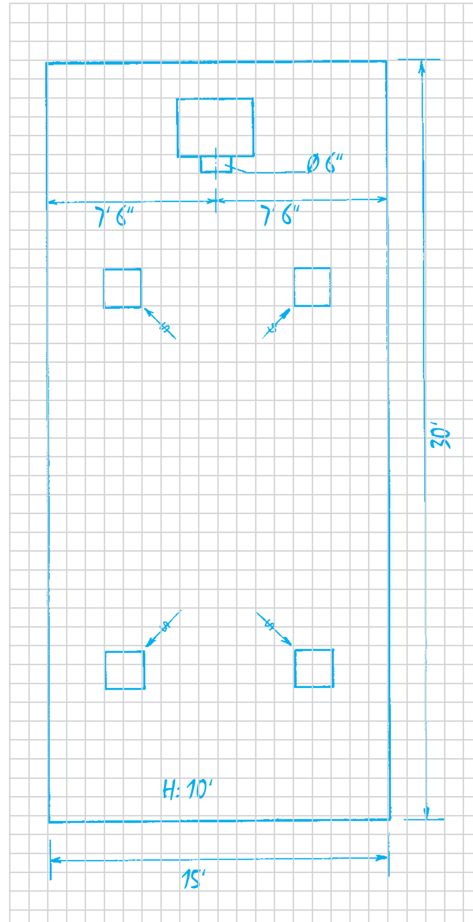
Nature of human activity in space
Sedentary ☐
Stationary standing ☐
Non - stationary ☒

Desired terminal air velocity 60 ft/min
Duct mounting heigth 8 ft.
☐ clearance
☒ centerline
Total pressure available for *FabricAir* System 0.6 in.WG

Sketch of space

NECESSARY INFORMATION RELATING TO QUOTATION

Required color of duct IPS - Red 200
Do you require plenum duct to be priced YES ☐ ☒ NO
Required length of straps ______ in.
Installation type IPS Type 1
Do you require mounting material to be priced YES ☐ ☐ NO



Necessary selection parameters:

Parameter	Definition	Result
Product group	Duct shape	Round
Product group	Product type	FabricAir duct
Operation mode		Cooling
Cooling load	Tons Refrigeration	1.0
Space dimension	L x W x H	30 x 15 x 10
Total air volume into space	CFM	1,460
Number of units	Number	1
Connection location	See sketch	
Size - diameter	in.	6
Nature of human activity in space		Non-stationary
Terminal air velocity	ft/min	60
Clearance height of duct	ft.	8
Total Ps. available	in.WG	0.6
Max. length of duct in space	ft.	27

Procedure for calculation

Position	Procedure	Calculation	Result
(2.1)	Calculate L(ft) of duct	$\frac{1 \times 12{,}000}{450}$	27 ft.
(2.2)	Calculate L(ft) of duct	$\frac{1{,}460}{125.7 \times \sqrt{\frac{1{,}460}{5{,}026}}}$ c	22 ft.
(2.3)	Select L(ft) largest value	from (2.1) and (2.2)	27 ft.
(2.4)	Calculate no. of ducts	$\frac{27}{27}$	1 off
(2.5)	Calculate duct diameter	$\sqrt{\frac{1{,}460}{5{,}026}} \times 24$	13 in.
(2.6)	Calculate duct surface area	$27 \times 1.08 \times \pi$	92 ft^2
(2.7)	Calculate fabric selection factor	$\frac{1{,}460}{92}$	15.9
(2.8)	Select fabric from schedule Division factor	See fold out section	T320 18
(2.9)	Calculate exact static pressure	$\frac{15.9 \times 0.5}{18}$	0.44 in.WG
(2.10)	Check calculated static pressure against minimum static pressure		OK

Engineering Description of the Selected Solution

The air supply must take place through a Round FabricAir Duct system. The system must be engineered in such a way, that draft, noise and condensations is avoided. The FabricAir Duct(s) must be manufactured in zippered sections according to FabricAir's guidelines. The material of construction is fabric, wowen from Polyester/Trevira CS fibers.

The FabricAir system must be classified by Underwriters Laboratory and meet the requirements of NFPA 90A-1993.

USDA accepts approval as established on the specific installation.

All products must undergo quality testing according to ISO 9001.

Supplier: FabricAir, Inc. Phone: (502) 493-2210 Fax: (502) 493-4002			
Air volume per duct	1,460 CFM	Duct fabric quality	T320
Number of ducts	1	Color of duct	IPS - Red 200
Diameter of duct	13 in.	Air inlet	From end of duct
Length of duct	27 ft.	Mounting type	IPS Type 1
Min. static pressure available	0.44 in. WG	Strap lengths	1.2 in.

FabricAir, Inc. shall deliver all installation components except anchoring for walls/ceiling. These components are to be delivered by the refrigeration or ventilation contractor in charge of the installation. FabricAir's installation guidelines must be followed. FabricAir will supply maintenance guidelines for the FabricAir shipment.

FabricAir Systems are warranted to be free of manufacturing defects one year from date of Invoice.

Dimensioning
Half Round FabricAir Ducts

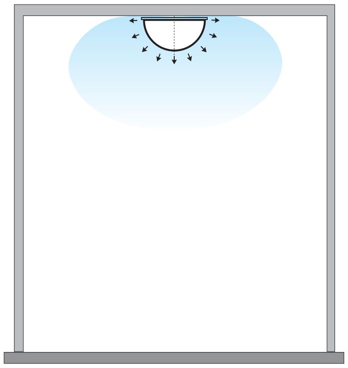


Fig. 1

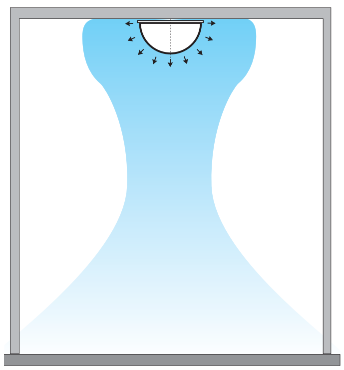


Fig. 2

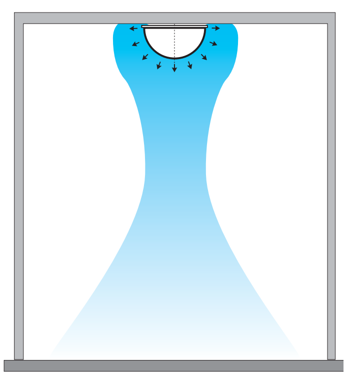


Fig. 3

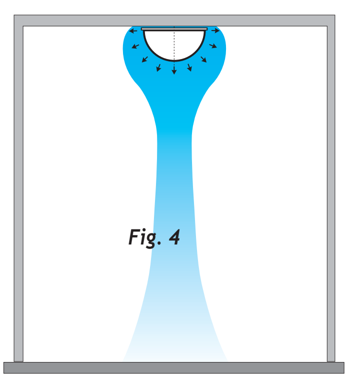


Fig. 4

Introduction

The **Half Round FabricAir Duct** is to a large extend similar to the round FabricAir duct, except for shape and in treatment is produced from similar material. The air is distributed evenly across the entire bottom half surface and thus supplied to the room at the minimum velocity. The FabricAir duct is used for isothermal supply and for supply of cooled air. Under normal circumstances, this type of duct will not be suitable for supply of heated air.

Quarter Round FabricAir Ducts are available within our product range and the constraints as detailed for the Half Round FabricAir ducts apply generally to this product. Should the need arise for this application, we ask you to refer your requirements to FabricAir for detailed engineering.

Supply Principle

The air is supplied to a space by means of the displacement principle. Simplified examples of this can be found in the following figures. The figures show the air distribution at a room temperature of approx. 54°F and an evenly distributed heat load of approx. 50 BTU/h/ft². The figures are only indicative, as different room temperatures or where large local heat sources are present, can create uneven heat loading in the space, resulting in the creation of other air movements than those indicated.

Figure 1 - Isothermal Supply
This figure shows the supply pattern of isothermal supply and an air velocity of less than 20 ft/min. As the isothermally supplied air does not automatically move downwards, the surface exit velocity can successfully be increased to approx. 40 ft/min. However, the velocity should not exceed 60 ft/min.

Figure 2 - Δt: 0-4°F
In this case the surface exit velocity should not exceed 20 ft/min, as the air will now descend through the space by itself. The air will now largely have the same velocity through its entire fall. The air is distributed across a zone of approx. 4 x the diameter of the fabric duct.

Figure 3 - Δt: 4-9°F
Here it is important to pay attention to the surface exit velocity which should not exceed 20 ft/min - recommended 16 ft/min. The air velocity will, in this case, increase as the air descends downwards in the space. This picture becomes more distinct at an increased Dt and care must be taken especially in spaces with low working temperatures. Caution must be exercised when placing ducts directly above persons carrying out sedentary or stationary work. The air is distributed across a zone of approx. 2 x the diameter of the fabric duct.

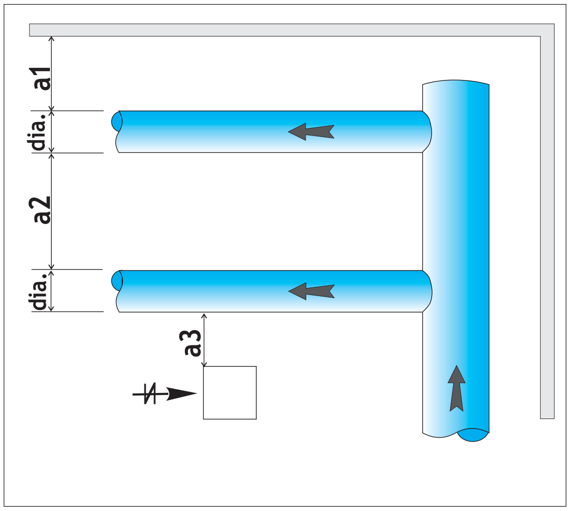
Figure 4 - Δt: > 9°F

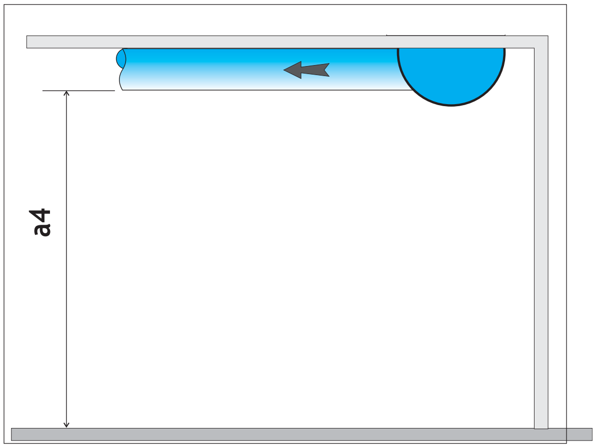
Even though the surface exit velocity is kept below 20 ft/min, the air will accelerate under the duct. This solution should not be used in places where the need for personal comfort is required. The air is distributed across a zone of approx. 1 x the diameter of the fabric duct.

Positioning of Ducts in Spaces

In order to avoid cooling downfall and other unwarranted conditions that might lead to detrimental effects in the desired air supply principle, there are important factors to be considered when planning the final layout of the space.

Recommended minimum distances from walls, ceilings and return/exhaust air grilles for Half Round FabricAir ducts





a1

From wall to side of first fabric duct:
min. 3 x fabric duct dia. This distance ensures that the air does not fall along the wall surface.

a2

From fabric duct side to fabric duct side:
min. 4 x fabric duct dia. This distance ensures that the air does not “collide” and thus develops a so-called cooling downfall.

a3

From fabric duct side to the return air grill side: min. 1 x fabric duct dia. This distance ensures that a short cycling situation does not occur.

a4

From bottom edge of fabric duct to floor:
min. 6 x fabric duct dia. or 7 ft. This distance ensures that the normal return pattern of the fabric ducts is maintained.

Engineering Guidelines

This engineering guideline is based on nominal recommended values for inlet velocity, surface exit velocity and temperature for a duct operating within the specified parameters. Selections deviating from these recommended values and parameters can also be selected and used. In cases where such selections are desired, please refer your requirements to FabricAir, Inc. for correct engineering selection, thus ensuring compliance with our recommended engineering norms.

A number of factors play an important part when dimensioning the Half Round fabricAir ducts. Some act separately, others in conjunction with various factors. Here we will take a look at how the most important parameters are calculated and which limits we recommend are observed:

Half Round FabricAir Duct sizes
Half Round FabricAir Ducts are available in sizes from 8 in. diameter (half round) through to 80 in. diameter (half round)

Total external pressure
In the following, we will look at the applied total external pressure calculations which are fundamental to an optimum dimensioning of FabricAir ducts. We have, however, simplified these as much as possible, as very specific total external pressure calculations will often give a false feeling of security.

Dynamic total external pressure across the ducts - Pd. (in. WG)
The dynamic total external pressure increases pro rata with the inlet velocity. Pd. must always be adjusted together with Ps. as a lack of balance between these parameters may give "pulsating" fabric ducts.
FabricAir recommends the following pressure balance: Pd. ≤ 2/5 of Ps.

Static total external pressure across ducts
- Ps. (in.WG)
A margin for system total external pressure should be added together with a margin for a build up of dirt in the fabric ducts. It will there fore be necessary to select a fan with a stable pressure curve, such that the selected air volume is guaranteed at initial start up of the system, as well as when the fabric ducts have absorbed the allowed amount of dust and dirt.
The total external static pressure indicates the external pressure without the pressure caused by velocity. This external pressure is best measured in the end of the fabric ducts, as there is no dynamic pressure at this point. Ps. is also the determining factor for the air flow over the fabric surface.
FabricAir recommends the following values:

Minimum Ps.	*0.25 in.WG*
Nominal Ps.	*0.40 in.WG*
Maximum Ps.	*0.60 in.WG*

Air Velocities
The inlet velocity is very closely related to the total external pressure calculation, as a relative large total external pressure can often compensate for a high inlet velocity.

Inlet velocity in duct (ft/min)
This value is closely connected to Pd. as an increased inlet velocity will automatically generate a higher Pd. An excessive inlet velocity in comparison with the static pressure in the system will often result in a "pulsating" system. Therefore, it is especially important that the recommended values of inlet velocities are observed.
FabricAir recommends the following inlet velocities:
Maximum air entering duct at end 1,300 ft/min
Air entering duct in center of duct 1,300 ft/min

Fabric surface exit velocity (ft/min)
The fabric surface exit velocity of the ducts is especially important in relation to the terminal velocity in the occupied zone. As the throw of the air from the ducts is limited as it is, even a marginal increase in the surface exit velocity can have undesired consequences for the terminal velocity in the occupied zone. In the introduction to this section, we presented some air pattern diagrams of different situations. Here it is shown how the air pattern significantly changes at different Δt. A combination of an excessive Δt. and an increased fabric surface exit velocity can, therefore, create undesired high velocities in the occupied zone.
FabricAir recommends the following surface velocities:
Isothermal supply: max. 60 ft/min
When cooling: max. 20 ft/min

Cooling load per running feet of fabric duct
In order to achieve an acceptable introduction of air into the treated space when supplying cooled air is important to select the correct length of the duct such that cooling downfall does not occur.
FabricAir recommends the following values:
Recommended cooling load per foot of duct
360 BTU/h/L(ft)
Maximum cooling load per foot of duct
450 BTU/h/L(ft)
While these are guidelines for normal applications, higher cooling loads can be selected. Caution should be exercised when applying higher cooling loads in relation to human activity directly below the fabric ducts. Where these are required please refer them to *FabricAir* for detailed engineering.

Space air change
In order to avoid draft problems occurring in ventilated spaces *FabricAir* recommends a maximum air change rate per hour of 40. Should you need to design/plan spaces with an air changes rate above the recommended, please refer them to *FabricAir* for detailed engineering.

Mounting heights of fabric ducts
As mentioned before, it is important to avoid cooling downfall from fabric ducts.
There are 2 important factors to look at when evaluating this problem. They are:
- space temperature
- Δt.
In order to determine the correct combination of these factors please refer to the schedule below.

Room temperature °F	Recommended Δt	Maximum Δt
32 to 43	3	5
43 to 54	4	7
54 to 64	5	9
64 to 75	6	9
Above 75	7	9

If maximum Δt is exceeded and/or the room temperature deviates from the above schedule, please refer your requirements to FabricAir, Inc. for the correct engineering selection, thus ensuring compliance with our recommended engineering norms.

FabricAir® Chapter 03
4140-121 (2005-01)

Calculation and Recommendations

Basic information:

General :

- Pd. $\leq$ 2/5 of Ps.
- Ps. must be minimum 0.25 in.WG
- Ps. must not exceed 0.60 in.WG
- The air changes per hour should not exceed 40
- The smallest possible dia.of duct is 8 in.
- The diameter of duct must not exceed 80 in.

For Isothermal supply:

- The surface exit velocity should not exceed 60 ft/min.

For cooling applications:

- The FabricAir duct must not have a cooling load exceeding 450 BTU/h/ft.
- The surface exit velocity should not exceed 20 ft/min.
- Δt. and room temperatures should be within the parameters as recommended in schedule on page 17.

For End Inlet:

- The inlet velocity should not exceed 1,300 ft/min.

For Center Inlet:

- The inlet velocity at the connection should not exceed 800 ft/min.
- The inlet velocity in the duct should not exceed 1,300 ft/min.
- Pd. is determined by the inlet velocity in the duct - not the velocity at the connection.

Procedure for dimensioning:

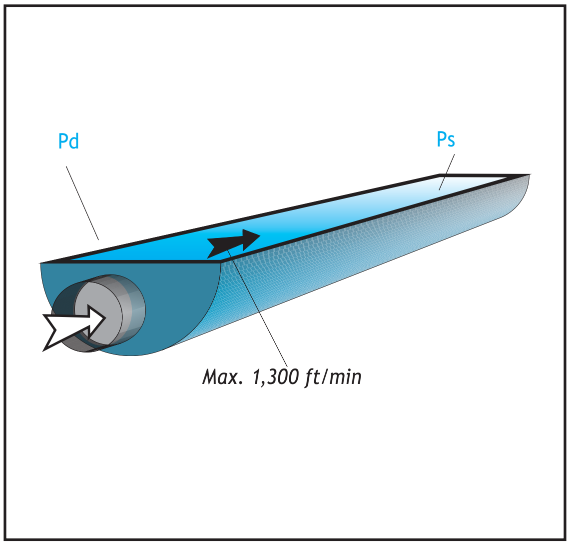
The following procedure is a guideline. Certain points that are calculated here may already be known.
Please refer to fold out section at back of brochure for descriptive explanation of the applied formulae.

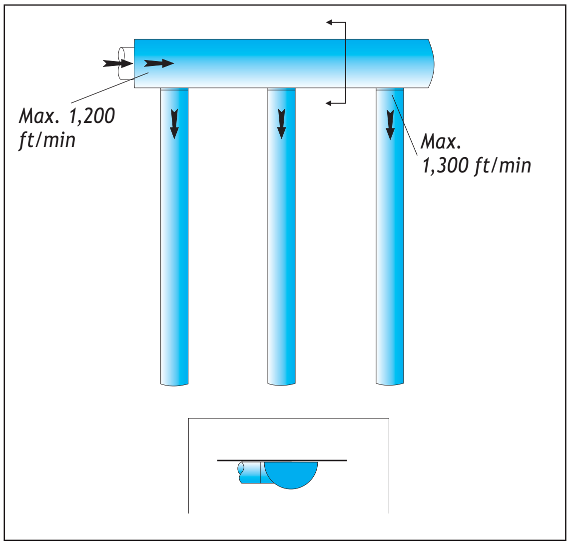
(1) Necessary input parameters:

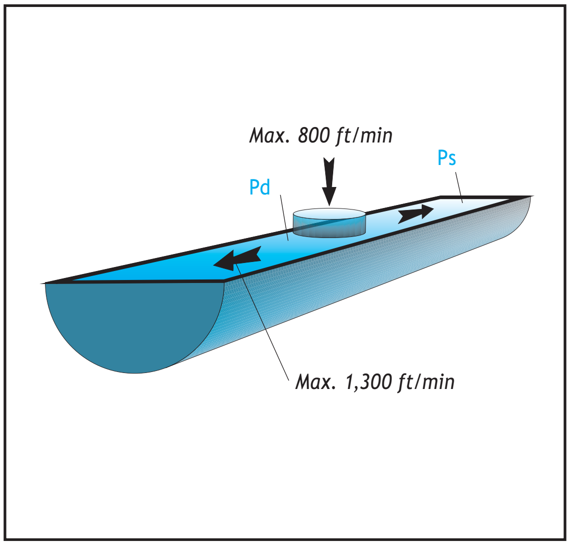
- The dimensions of the room (L x W x H)
- Maximum length of the Half Round FabricAir duct
- Room temperature
- Total cooling load to be applied
- Number of units
- Space air volume - *if this is not known at this stage, it must be estimated*
- AHU connections - number, location and dimension
- Total external pressure available for the FabricAir system
- Cooling temperature of supply air

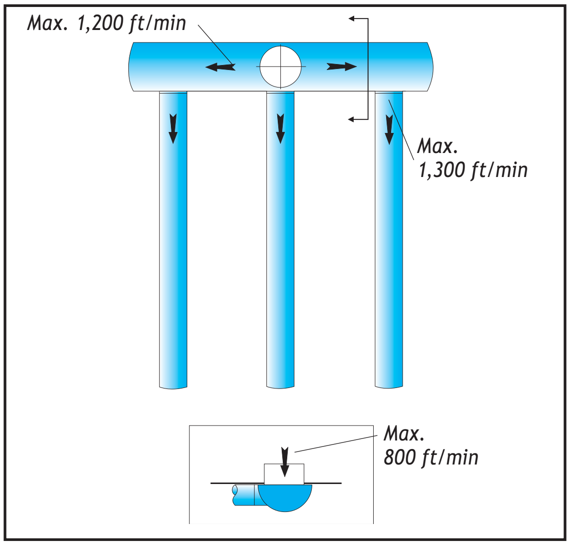
(2) Dimensioning:

(2.1) The minimum L(ft) of duct is calculated taking into consideration the maximum cooling load per L(ft)
(2.2) The minimum L(ft) of duct is calculated taking into consideration the duct surface area of fabric
(2.3) Select the L(ft) that gives the largest value from (2.1) and (2.2)
(2.4) The number of **Half Round FabricAir** ducts are calculated
(2.5) Calculate duct diameter (in.)
(2.6) Calculate duct surface (ft^2)
(2.7) Calculate fabric selection factor
(2.8) Select fabric from schedule using selection factor - note division factor
(2.9) Calculate exact duct static pressure (in.WG)
(2.10) Check calculated static pressure against minimum static pressure









Special considerations in relation to FabricAir Plenum Ducts

In certain cases where the application calls for the use of multiple fabric ducts mounted in parallel, it is often a cost effective solution to use a plenum duct to convey the air to the fabric ducts via a plenum duct manufactured from fabric, rather than fixed sheet metal ducts. Where such fabric plenum ducts are used, the following conditions apply:

- The velocity in the plenum duct immediately prior to any "take off" to the fabric ducts should be lower than the selected inlet velocity of the fabric duct, in order to facilitate a smooth transfer of air from the plenum duct to the fabric duct.
- Maximum inlet velocity (end of duct) in the plenum duct is 1,200 ft/min.
- Maximum inlet velocity (mid point) in the plenum duct is 1,300 ft/min.
- The plenum duct is normally selected from Fabric T40, such that the main supply of air to the space is via the fabric ducts.
- In case plenum ducts are desired, please refer your requirements to FabricAir, Inc. for the correct engineering selection, thus ensuring compliance with our recommended engineering norms.

Calculation Example

Schedule for dimensioning

CUSTOMER

Company ________________ Address ________________
City/State/Zip ________________
Contact person ________________ Phone ________________
Fax ________________
Title ________________ E - Mail ________________

PRODUCT GROUP SELECTION

Duct Shape
Round Duct ☐ Half Round Duct ☒

Product Type
FabricAir Duct ☒
FabricAir Duct w/ Slots ☐
FabricAir PERFO Duct ☐

OPERATION MODE

Cooling ☒ 0.6 Tons
Heating ☐ _____ BTU
Heating and cooling ☐ _____ BTU/Tons
Ventilation ☐

BASIC ENGINEERING DATA

Space dimensions L: 28 ft. W: 15 ft. H: 10 ft.
Total air volume into space 800 CFM
No. of units 1
Space temperature 72 °F
Supply temperature Summer 64 °F; Winter ______ °F

Nature of human activity in space
Sedentary ☒
Stationary standing ☐
Non - stationary ☐

Desired terminal air velocity 40 ft/min

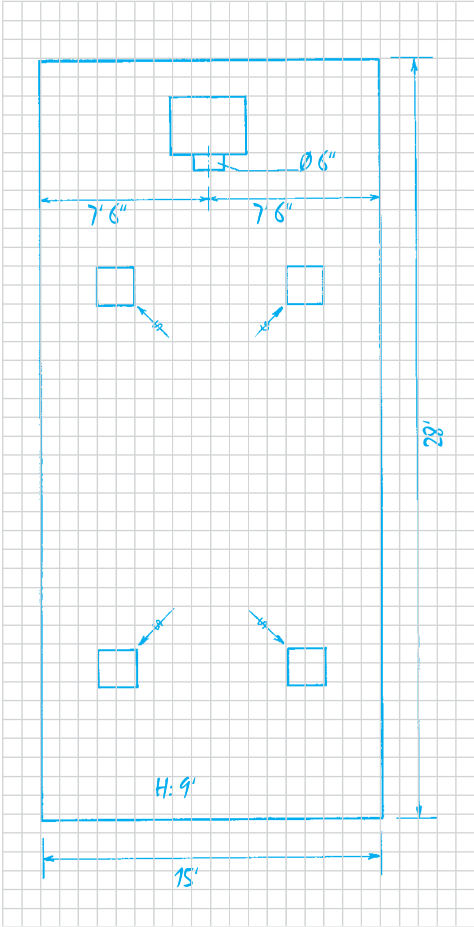
Duct mounting heigth
☒ clearance
☐ centerline
7 ft.

Total pressure available for *FabricAir* System 0.6 in.WG

Sketch of space

NECESSARY INFORMATION RELATING TO QUOTATION

Required color of duct IPS - Blue 202
Do you require plenum duct to be priced YES ☐ NO ☒
Required length of straps ______ in.
Installation type IPS Type 11
Do you require mounting material to be priced YES ☒ NO ☐



Necessary selection parameters:

Parameter Definition	Result	
Product group	Duct shape	Half Round
Product group	Product type	FabricAir duct
Operation mode		Cooling
Cooling load	Tons Refrigeration	0.6
Space dimension	L x W x H	28 x 15 x 9
Total air volume in space	CFM	800
Number of units	Number	1
Connection location		See sketch
Size - diameter	in.	6
Nature of human activity in space		Sedentary
Terminal velocity air velocity	ft/min	40
Clearance height of duct	ft.	7
Total Ps. available	in.WG	0.6
Max. length duct in space	ft.	26

Procedure for calculation

Position	Procedure	Calculation	Result
(2.1)	Calculate L(ft) of duct	$\frac{0.6 \times 12,000}{450}$	16 ft.
(2.2)	Calculate L(ft) of duct	$\frac{800 \times 2}{125.7 \times \sqrt{\frac{800 \times 2}{4,084}}}$ c	20 ft.
(2.3)	Select L(ft) largest value	from (2.1) and (2.2)	20 ft.
(2.4)	Calculate no. of ducts	$\frac{20}{26}$	1 off
(2.5)	Calculate duct diameter	$\sqrt{\frac{800 \times 2}{4,084}} \times 24$	15 in.
(2.6)	Calculate duct surface area	$20 \times 1.25 \times \pi \times 0.5$	39 ft^2
(2.7)	Calculate fabric selection factor	$\frac{800}{39}$	20.5
(2.8)	Select fabric from schedule Division factor	See fold out section	T320 18
(2.9)	Calculate exact static pressure	$\frac{20.5 \times 0.5}{18}$	0.56 in.WG
(2.10)	Check calculated static pressure against minimum static pressure		OK

Engineering Description of the Selected Solution

The air supply must take place through a Half Round FabricAir Duct system. The system must be engineered in such a way, that draft, noise and condensations is avoided. The FabricAir Duct(s) must be manufactured in zippered sections according to FabricAir's guidelines. The material of construction is fabric, wowen from Polyester/Trevira CS fibers.

The FabricAir system must be classified by Underwriters Laboratory and meet the requirements of NFPA 90A-1993.

USDA accepts approval as established on the specific installation.

All products must undergo quality testing according to ISO 9001.

Supplier: FabricAir, Inc. Phone: (502) 493-2210 Fax: (502) 493-4002			
Air volume per duct	800 CFM	Duct fabric quality	T320
Number of ducts	1	Color of duct	IPS - Blue 202
Diameter of duct	15 in.	Air inlet	From end of duct - round dia. 6"
Length of duct	20 feet		
Min. static pressure available	0.56 In. WG	Mounting type	IPS Type 11

FabricAir, Inc. shall deliver all installation components except screws for ceiling. These components are to be delivered by the refrigeration or ventilation contractor in charge of the installation. FabricAir's installation guidelines must be followed. FabricAir will supply maintenance guidelines for the FabricAir shipment.

FabricAir Systems are warranted to be free of manufacturing defects one year from date of Invoice.

Dimensioning FabricAir® Ducts with Slots

Introduction

The **FabricAir Ducts with Slots** are made up from a combination of permeable material equal to the material employed for the FabricAir ducts, in combination with sections of highly permeable material in the form of perforated netting. The air is introduced into the space partly through the surface of the duct and partly through the permeable netting which forms the slots, thus giving a combination of high and low surface velocities. This means that this type of product is suitable for the introduction of both heated and cooled air, as well as air for ventilation. The FabricAir ducts with slots can be supplied with one or two slots running the full length of the duct, all in accordance with the actual space air distribution requirements

Supply Principle

The air is introduced into the treated space largely via the “air mixing” principle and to a lesser degree through the “displacement” principle. As is well known, the air leaves a standard FabricAir duct at approx. 20 ft/min. In the instance of the FabricAir ducts with slots, the air is “ejected” through the slots in varying velocities from 600 ft/min to 1,000 ft/min depending on the static pressure, thus ensuring a thorough mixing of the primary and secondary air streams. The side walls and the ceiling of the treated space act as guides for the air streams so that the required terminal velocity in the occupied zone is obtained. A simplified picture of this principle can be seen in fig.1, 2 and 3. These figures are for general guidance only. As commercial and industrial applications generally are not of such a simple nature as depicted, FabricAir, Inc. is ready to guide you, in engineering and selecting the right application to suit the requirements.

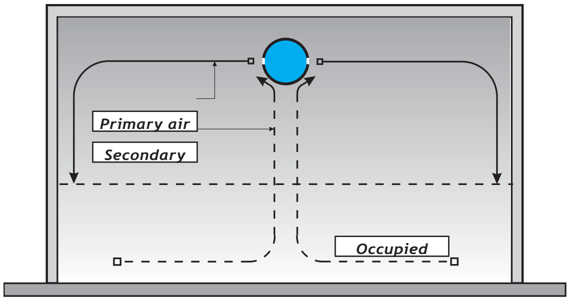


Figure 1 - Isothermal air pattern.

The figure shows the basic air pattern when introducing air into the treated space where the primary air is the same temperature as the secondary air (isothermal) The air is normally distributed horizontally from the duct with slots and flows along the ceiling and side walls down into the occupied zone.

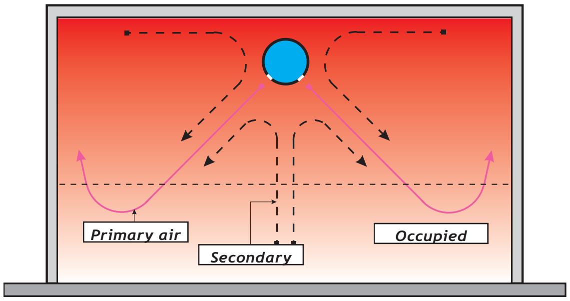


Figure 2 - Heating air pattern.
The figure shows the basic air pattern when introducing air into the treated space where the temperature of the primary air is higher than the secondary air temperature (Heating) The air is normally distributed from the duct with slots at an angle below horizontal, such that the air stream points down towards the occupied zone. In this instance the required air pattern in the occupied zone is brought about by the high velocity air streams leaving the surface of the duct with slots. The secondary air flows upwards from the occupied zone and mixes with the primary air at the same level as the duct with slots thus ensuring a good mix of primary and secondary air.

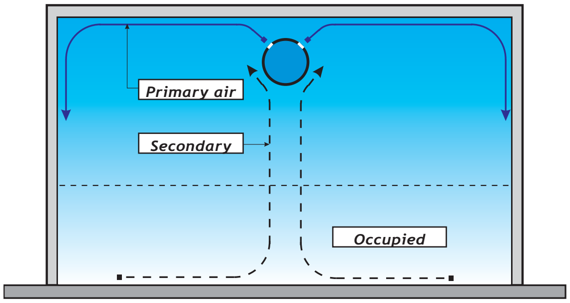
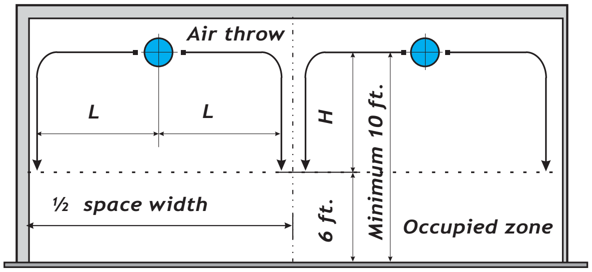


Fig. 3 - Cooling air pattern
The figure shows the basic air pattern when introducing air into the treated space where the temperature of the primary air is lower than the secondary air temperature (cooling) The air is normally distributed from the duct with slots at an angle above horizontal, such that the air flows primarily along the ceiling and thereafter along the side walls down into the occupied zone.

Positioning of Ducts in Spaces

In order to obtain the maximum air distribution benefit from the FabricAir ducts with slots, it is important to place the ducts in the space correctly and at the same time obtain the number of ducts that are required. In order to do this one needs to be aware of the relationship between the distances **(L)** and **(H)**, as well as the duct center line mounting height and the height of the occupied zone.In wide spaces that require multiple mounting of ducts to satisfy the air distribution, they can effectively be arranged in a parallel pattern. In such arrangements the width of the space is divided up into sub division, each sub division is treated as a separate zone. The point where opposing air streams meet is also the division between space sub divisions.



Engineering Guidelines

This engineering guideline is based on nominal recommended values for inlet velocity and temperature for a duct operating within the specified parameters. Selections deviating from these recommended values and parameters can also be selected and used. In cases where such selections are desired, please refer your requirements to FabricAir, Inc. for correct engineering selection, thus ensuring compliance with our recommended engineering norms.

A number of factors play an important part when dimensioning the ducts with slots. Some act separately, others in conjunction with various factors. Here we will take a look at how the most important parameters are calculated and which limits we recommend are observed:

FabricAir ducts with slots sizes
FabricAir ducts with slots are available in sizes from 4 in. diameter through to 80 in. diameter.

Total external pressure
In the following, we will take a look at the applied total external pressure calculations which are fundamental to an optimum dimensioning of ducts with slots. We have, however, simplified these as much as possible, as very specific total external pressure calculations will often give a false feeling of security.

Dynamic total external pressure across the ducts - Pd. (in.WG)
The dynamic total external pressure increases pro rata with the inlet velocity. Pd. must always be adjusted together with Ps. as a lack of balance between these parameters may give "pulsating" fabric ducts.
FabricAir recommends the following pressure balance:
Pd. $\leq$ 2/5 of Ps.

Static total external pressure across ducts
- Ps. (in.WG)
A margin for system total external pressure should be added together with a margin for a build up of dirt in the fabric part of the ducts. It will there fore be necessary to select a fan with a stable pressure curve, such that the selected air volume is guaranteed at initial start up of the system, as well as when the fabric ducts with slots have absorbed the allowed amount of dust and dirt.
The total external static pressure indicates the external pressure without the pressure caused by velocity. This external pressure is best measured in the end of the fabric ducts, as there is no dynamic external pressure at this point. Ps. is also the determining factor for the air flow over the fabric surface.
FabricAir recommends the following values:
Nominal Ps. 0.5 in.WG

Air Velocities
The inlet velocity is very closely related to the total external pressure calculation, as a relative large total external pressure can often compensate for a high inlet velocity.

Inlet velocity in duct (ft/min)
This value is closely connected to Pd. as an increased inlet velocity will automatically generate a higher Pd. An excessive inlet velocity in comparison with the static pressure in the system will often result in a "pulsating" system. Therefore, it is especially important that the recommended values for inlet velocities are observed.
FabricAir recommends the following inlet velocities:

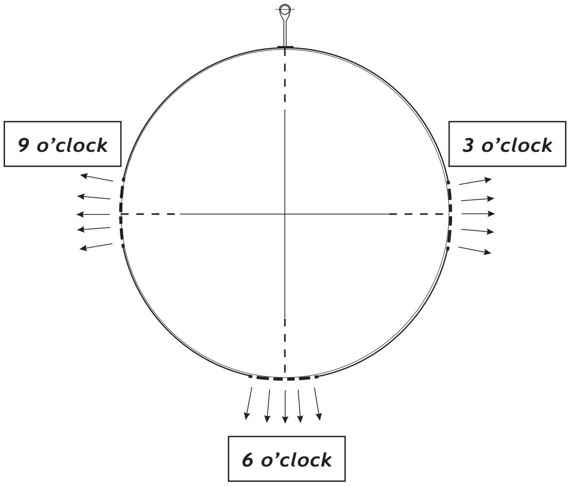
Maximum air entering duct at end	*1,600 ft/min*
Air entering duct in mid point	*1,400 ft/min*

Slot air volumes

It will generally be the intention with this product to supply some of the air volume into the space via the slot part of the duct, such that an acceptable air throw is achieved, whilst the remainder of the air volume will be supplied from the fabric walls of the duct. The relation between the two air volumes is determined on the basis of the space requirements.

No. of slots

The FabricAir ducts with slots can be supplied with either one or two slots running the full length of the duct. The number of slots to be used depends on the space requirements and we therefore recommend that you refer the actual space requirements to *FabricAir* for detailed engineering.



Position of slots

The slots can be positioned on the duct circumference in order to satisfy the space requirements, Such circumferential positioning is determined from the "clock" I.e slots placed at
3 o'clock and 9 o'clock will result in the air being supplied horizontally from the duct. A slot placed at 6 o'clock will result in the air being supplied vertically downwards from the duct. The "clock" position of the slots are always viewed when **looking into the duct with the air from behind.**

Fabric air volumes

The remainder of the required air volume will be supplied via the fabric duct wall. The correct selection of fabric quality will be done by FabricAir, Inc.

Space air change

In order to avoid draft problems occurring in ventilated spaces *FabricAir* recommends a maximum air change rate per hour of 40. Should you need to design/plan spaces with an air changes rate above the recommended, please refer such designs to *FabricAir* for detailed engineering.

Mounting heights of fabric ducts with slots

Due to the relatively high exit velocity from the slots (from 600 ft/min. to 1,000 ft/min) it is necessary to mount the ducts with slots at a given distance (height) from the occupied zone in order to avoid excess velocities occurring in the occupied zone.
FabricAir recommends: Center line mounting height should not be less than 10 ft.

Calculation and Recommendations

Basic information:

General:
- Pd. $\leq$ 2/5 of Ps.
- Ps. should be 0.5 in.WG (standard selection)
- The air changes per hour should not exceed 40
- The smallest possible dia. of duct is 4 in.
- The diameter of duct should not exceed 80 in.

For End Inlet:
- The inlet velocity should not exceed 1,600 ft/min.

For Center Inlet:
- The inlet velocity at the connection must not exceed 1,400 ft/min.
- The inlet velocity in the duct should not exceed 1,400 ft/min.

Procedure for dimensioning:

The following procedure is a guideline. Certain points that are calculated here may already be known. *Please refer to fold out section at back of brochure for descriptive explanation of the applied formulae.*

(1) Necessary input parameters:
- The dimensions of the room (L x W x H)
- Maximum length of the fabric ducts with slots
- Room temperature
- Total cooling/heating load to be applied
- Number of units
- Space air volume - *if this is not known at this stage, it must be estimated*
- Units - number, location and dimension
- Total external pressure available for the FabricAir system
- Supply temperature summer/winter

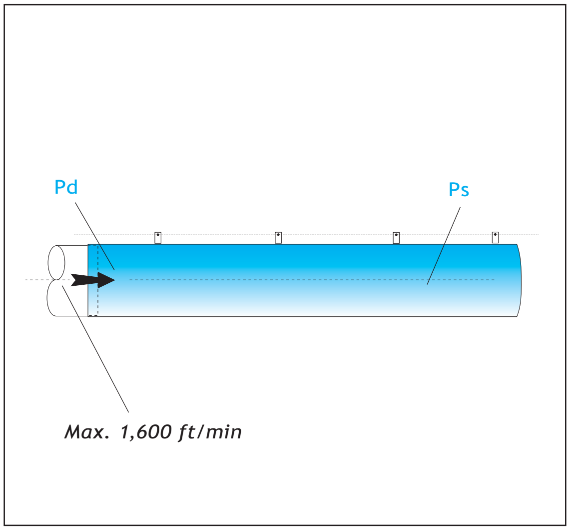
(2) Dimensioning:

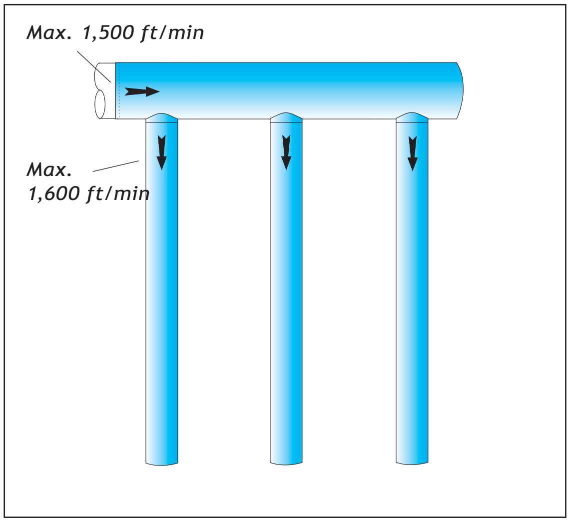
(2.1) Determine length of duct (ft.)

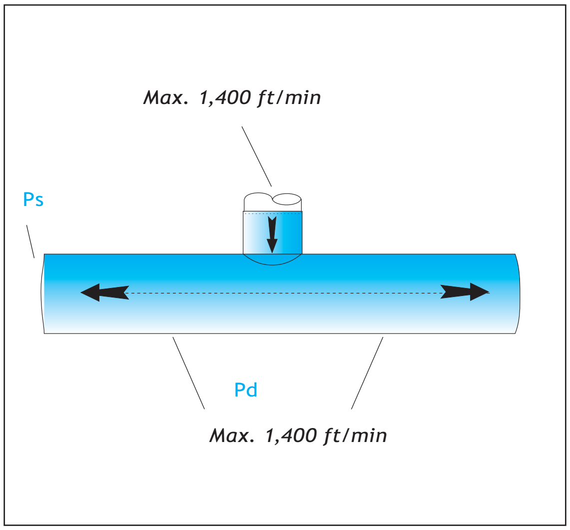
(2.2) Determine no. of slots required

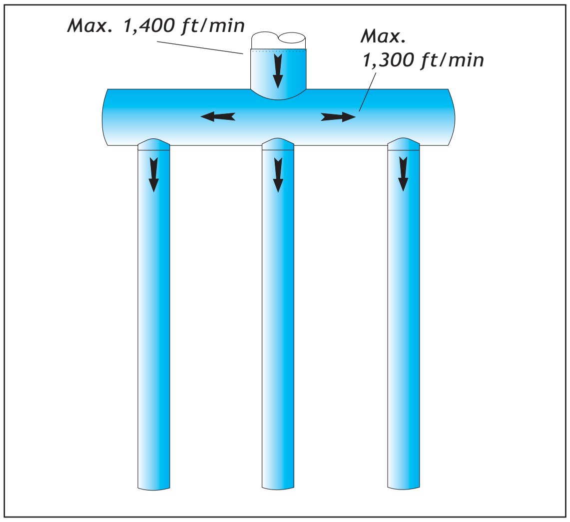
(2.3) Determine position of slots (o'clock)

(2.4) Calculate duct diameter (in.)









Special considerations in relation to FabricAir Plenum Ducts

In certain cases where the application calls for the use of multiple fabric ducts mounted in parallel, it is often a cost effective solution to use a plenum duct to convey the air to the fabric ducts via a plenum duct manufactured from fabric, rather than fixed sheet metal ducts. Where such fabric plenum ducts are used, the following conditions apply:

- The velocity in the plenum duct immediately prior to any "take off" to the fabric ducts should be lower than the selected inlet velocity of the fabric duct, in order to facilitate a smooth transfer of air from the plenum duct to the fabric duct.
- Maximum inlet velocity (end of duct) in the plenum duct is 1,500 ft/min.
- Maximum inlet velocity (mid point) in the plenum duct is 1,300 ft/min.
- The plenum duct is normally selected from Fabric T40, such that the main supply of air to the space is via the fabric ducts. The plenum duct is normally supplied without slots.
- In case plenum ducts are desired, please refer your requirements to FabricAir, Inc. for the correct engineering selection, thus ensuring compliance with our recommended engineering norms.

Calculation Example

Schedule for dimensioning

CUSTOMER

Company ________________ Address ________________
City/State/Zip ________________
Contact person ________________ Phone ________________
Fax ________________
Title ________________ E - Mail ________________

PRODUCT GROUP SELECTION

Duct Shape
Round Duct ☒ Half Round Duct ☐

Product Type
FabricAir Duct ☐
FabricAir Duct w/ Slots ☒
FabricAir PERFO Duct ☐

OPERATION MODE

Cooling ☐ ______ Tons
Heating ☐ ______ BTU
Heating and cooling ☐ ______ BTU/Tons
Ventilation ☒

BASIC ENGINEERING DATA

Space dimensions L: 120 ft. W: 50 ft. H: 20 ft.
Total air volume into space 24,000 CFM
No. of units 1
Space temperature ________ °F
Supply temperature
Summer ________ °F
Winter ________ °F

Nature of human activity in space
Sedentary ☐
Stationary standing ☒
Non - stationary ☐

Desired terminal air velocity ________ ft/min

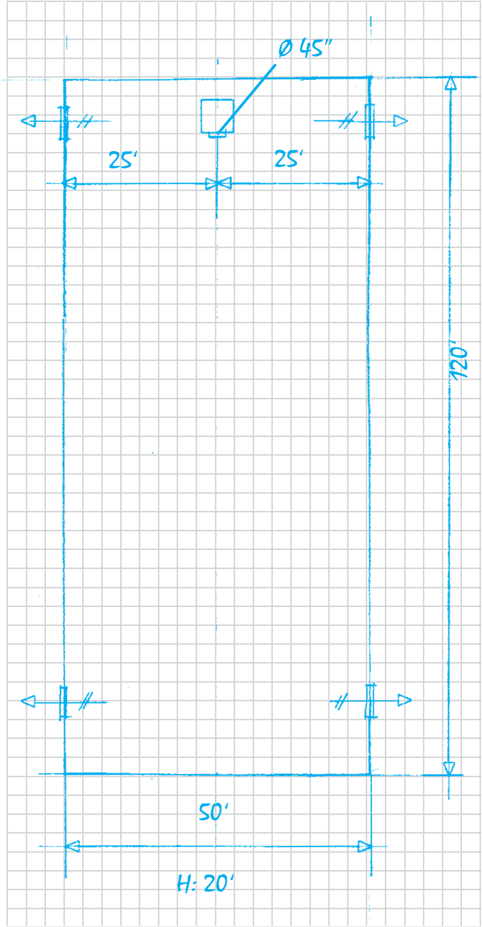
Duct mounting heigth
☐ clearance
☒ centerline 16 ft.

Total pressure available for *FabricAir* System 0.6 in.WG

Sketch of space

NECESSARY INFORMATION RELATING TO QUOTATION

Required color of duct: white
Do you require plenum duct to be priced YES ☐ ☒NO
Required length of straps ________ in.
Installation type: IPS - Type 6
Do you require mounting material to be priced YES ☒ ☐ NO



Necessary selection parameters:

Parameter Definition	Result	
Product group	Duct shape	Round
Product group	Product type	FabricAir duct with slots
Operation mode		Ventilation
Space dimension	L x W x H	120 x 50 x 20
Total air volume into space	CFM	24,000
Number of units	Number	1
Connection location	See sketch	
Size - diameter	in.	45
Nature of human activity in space		Stationary standing
Centerline height of duct	ft.	16
Total Ps. available	in.WG	0.6
Max. length of duct in space	ft.	110

Procedure for calculation

Position	Procedure	Calculation	Result
(2.1)	Determine length of duct	Max. allowable length	110 ft
(2.2)	Determine no. of slots required	Duct mounted in center air throw from 2 sides	2 slots
(2.3)	Determine pos. of slots	Ventilation mode	3 o'clock 9 o'clock
(2.4)	Calculate duct diameter	$\sqrt{\frac{24,000}{5,026}} \times 24$	52 in.

Engineering Description of the Selected Solution

The air supply must take place through a Round FabricAir Duct with slots. The system must be engineered in such a way, that draft, noise and condensations is avoided. The FabricAir Duct(s) must be manufactured in zippered sections according to FabricAir's guidelines. The material of construction is fabric, wowen from Polyester/Trevira CS fibers.

The FabricAir system must be classified by Underwriters Laboratory and meet the requirements of NFPA 90A-1993.

USDA accepts approval as established on the specific installation.

All products must undergo quality testing according to ISO 9001.

Supplier: FabricAir, Inc. Phone: (502) 493-2210 Fax: (502) 493-4002			
Air volume per duct	24,000 CFM	Position of slots	3 and 9 o'clock
Number of ducts	1	Color of duct	IPS - White
Diameter of duct	52 in.	Air inlet	From end of duct - Round dia. 45"
Length of duct	110 ft.		
Min. static pressure available	0.50 in. WG	Mounting type	IPS Type 6
Duct fabric quality	Selected by FabricAir, Inc.	Strap Length	1.2 in.

FabricAir, Inc. shall deliver all installation components. The refrigeration or ventilation contractor will be in charge of the installation. FabricAir's installation guidelines must be followed. FabricAir will supply maintenance guidelines for the FabricAir shipment.

FabricAir Systems are warranted to be free of manufacturing defects one year from date of Invoice.

FabricAir® Chapter 03
4140-121 (2005-01)

Dimensioning PERFO Ducts

Introduction

The FabricAir PERFO ducts are specially developed for use in the commercial and industrial ventilation industry. Much emphasis has gone into our product development to ensure that the FabricAir PERFO ducts are suitable for use in conditioned spaces with high ceilings where cooling and heating is required, as well as isothermal operation.

The FabricAir PERFO ducts are manufactured from light weight non permeable material. The air is distributed to the conditioned space via a special patterns of holes, placed over the whole or part of the duct surface. The desired air pattern and distribution required in the treated space is dependent on the number of holes, the size of the holes, as well as the surface positioning of the actual perforation pattern. The FabricAir PERFO ducts are an economic alternative to the usual means of air distribution which normally includes fixed sheet metal ducting and side wall outlets. Such standard air distribution methods often result in poor performance of the air conditioning or ventilation plants.

Flexibility and the ability to produce “taylor made” solutions are the what the FabricAir PERFO ducts are all about. This flexibility is borne out by the fact that virtually any type of air distribution pattern can be achieved by use of the many different “perforations patterns” that are available within the FabricAir PERFO duct programme. The flexibilty of invidualized air pattern design is not available in other cheaper products on the ligth weight duct market and we would strongly advice that PERFO ducts are not compared in design and function to such other cheaper products.

The selection of these perforation patterns is a result of many hours of development and testing in the laboratory, and is therefore confidential. The guidelines as specified in this brochure is of general interest and is therefore limited to a customer selection of the number of ducts required in a given treated space, as well as the duct diameter selection. Once this information is selected, we invite you to complete the data form and forward it to FabricAir, Inc. for the final engineering work in selecting the correct perforation pattern to suit your needs.

Supply Principle

The air is introduced into the treated space via the “air mixing” principle. As is well known, the air leaves a standard FabricAir duct at approx. 20 ft/min. In the instance of the FabricAir PERFO duct, the air is “ejected” through the holes in varying velocities from 1,400 ft/min to 3,000 ft/min. depending on the static pressure, thus ensuring a thorough mixing of the primary and secondary air streams. The side walls and the ceiling of the treated space act as guides for the air streams so that the required terminal velocity in the occupied zone is obtained. A simplified picture of this principle can be seen in fig.1, 2 and 3. These figures are for general guidance only. As commercial and industrial applications generally are not of such a simple nature as depicted, FabricAir, Inc. is ready to guide you, in engineering and selecting the right application to suit the requirements.

Figure 1 - Isothermal air pattern.
The figure shows the basic air pattern when introducing air into the treated space where the primary air is the same temperature as the secondary air (isothermal) The center line of the duct is < 32 in.from the ceiling. The air is distributed horizontally from the FabricAir PERFO duct and flows along the ceiling and side walls down into the occupied zone. The maximum Δt. with this type of air pattern is 1.0 ^{0}F. Where the center line of the duct is mounted > 32 in. from the ceiling, or where there is no ceiling over the space, as is often the case in industrial applications the air makes use partly of the side walls of the space and partly of the induced secondary air flow, to reach the occupied zone.

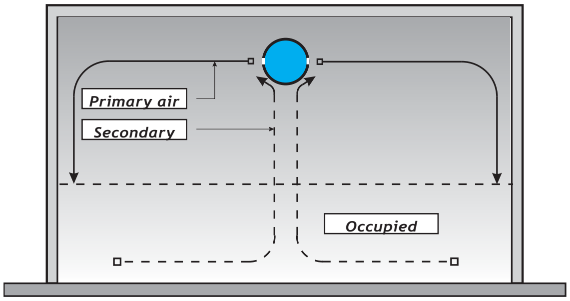
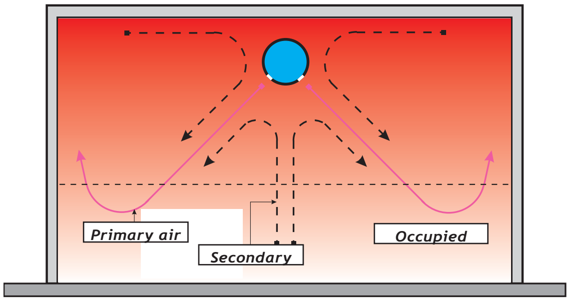


Figure 2 - Heating air pattern.

The figure shows the basic air pattern when introducing air into the treated space where the temperature of the primary air is higher than the secondary air temperature (Heating). In this instance the required air pattern in the occupied zone is brought about by the high velocity air streams leaving the surface of the duct and no consideration is taken to the ducts proximity to ceilings over the space. The secondary air flows upwards from the occupied zone and mixes with the primary air at the same level as the duct thus ensuring a good mix of primary and secondary air. The recommended maximum Δt. with this type of air pattern is 22⁰F.



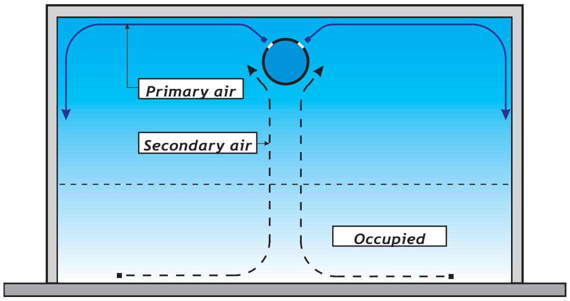
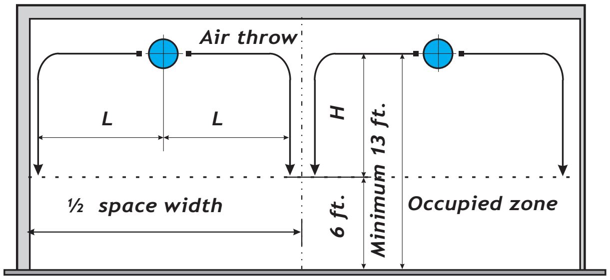


Fig. 3 - Cooling air pattern

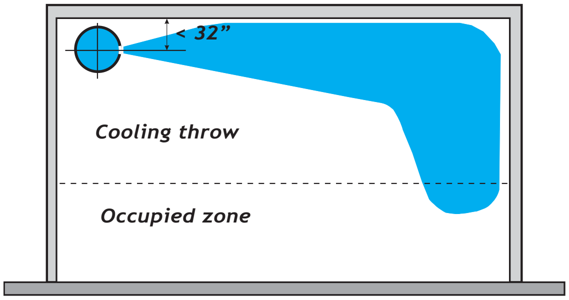
The figure shows the basic air pattern when introducing air into the treated space where the temperature of the primary air is lower than the secondary air temperature (Cooling) The center line of the duct is < 32 in. from the ceiling. The air is distributed horizontally from the FabricAir PERFO duct and flows along the ceiling and side walls down into the occupied zone. Where the center line of the duct is mounted > 32 in.from the ceiling, or where there is no ceiling over the space, as is often the case in industrial applications the air makes use partly of the side walls of the space and partly of the induced secondary air flow, to reach the occupied zone. The recommended maximum Δt. with this type of air pattern is 22⁰F.

Positioning of ducts in spaces

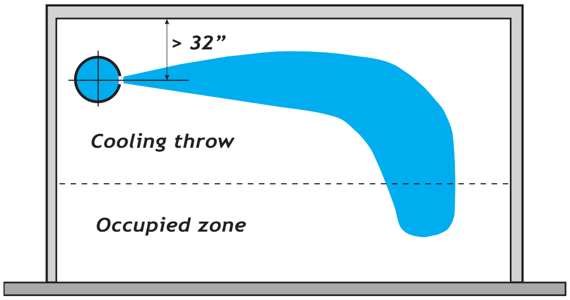
In order to obtain the maximum air distribution benefit from the FabricAir PERFO ducts, it is important to place the ducts in the space correctly and at the same time obtain the number of ducts that are required. In order to do this one needs to be aware of the relationship between the distances **(L)** and **(H)**, as well as the duct center line mounting height and the height of the occupied zone. In wide spaces that require multiple mounting of ducts to satisfy the air distribution, they can effectively be arranged in a parallel pattern. In such arrangements the width of the space is divided up into sub division, each sub division is treated as a separate zone. The point where opposing air streams meet is also the division between space sub divisions.



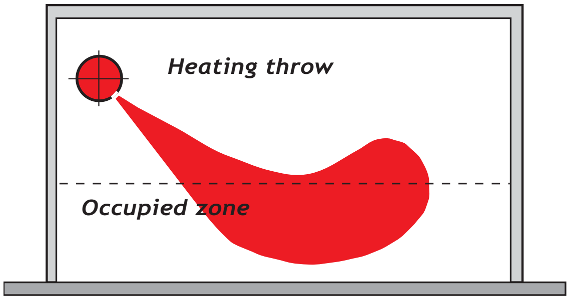
Engineering Guidelines



Basic cooling air pattern (CT)



Basic cooling air pattern (FT)



Basic heating air pattern (HT)

This engineering guideline is based on nominal recommended values for inlet velocity and temperature for a duct operating within the specified parameters. Selections deviating from these recommended values and parameters can also be selected and used. In cases where such selections are desired, please refer your requirements to FabricAir, Inc. for correct engineering selection, thus ensuring compliance with our recommended engineering norms.

A number of factors are important to bear in mind when selecting the FabricAir PERFO ducts, we will therefore focus on these in this chapter and at the same time make recommendations on the important selection data.

FabricAir PERFO duct sizes

FabricAir PERFO ducts are available in sizes from 4 in. diameter through to 80 in. diameter

Dynamic total external pressure across the ducts - Pd. (in.WG)

The dynamic total external pressure increases pro rata with the inlet velocity. Pd. must always be adjusted together with Ps. as a lack of balance between these parameters may give "pulsating" fabric ducts.

FabricAir recommends the following pressure balance: Pd. ≤ 2/5 of Ps.

Static total external pressure across the ducts - Ps. (in.WG)

The static pressure is the total pressure minus the velocity pressure. The static pressure is always measured at the end of the duct and is a good indication of the velocity through the holes in the hole pattern. The terminal velocity in the occupied zone is directly related to the Ps. when employing the FabricAir PERFO duct.

In order to achieve an acceptable terminal velocity it is recommended that Ps. is selected as low as possible.

FabricAir recommends the following static pressures Ps:

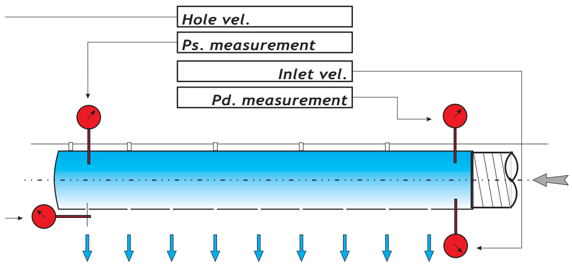
Minimum Ps.	*0.25 in.WG*
Recommended Ps.	*0.25 in.WG to 0.40 in.WG*
Maximum Ps.	*0.80 in.WG.*

Air velocity in the duct - (ft/min)
The initial air velocity (measured approx. 20 in. from the duct inlet) is closely related to the Pd. and as the velocity increases, so will the Pd. increase. A high initial air velocity in the duct will result in the air leaving the holes at an angle less than 90 degrees to the duct direction over the first 40% to 50% of the duct.
FabricAir recommends the following inlet velocities:
Maximum air entering duct at end 1,000 ft/min
The initial air velocity should never exceed 1,300 ft/min

Air velocity in the holes - (ft/min)
The terminal air velocity in the occupied zone is dependent on the velocity of the air leaving the holes which is related to the duct static pressure. As these hole velocities are fairly high, the ducts should not be mounted in spaces with low head room.
FabricAir therefore recommends that the minimum mounting height to the center line of the duct is not less than 13 ft.

Basic air throw type (ATT)
For spaces where the center line of the duct is mounted < 32 in. below the ceiling the **(ATT)** is defined as ceiling throw **(CT)**.
For spaces where the duct is mounted > 32 in. below the ceiling, or where there is no ceiling in the space the **(ATT)** is defined as free throw **(FT)**
For spaces where the heating air pattern is required, the **(ATT)** is defined as a heating throw **(HT).**
Please refer to figures on page 32.

Air throw - (AT) (ft.)
The air throw is defined as the distance of the air stream from when it leaves the duct until it reaches the desired terminal velocity in the occupied zone. The total throw is the sum of the horizontal distance defined as the length **(L)** and the vertical distance defined as



the height **(H)**. In applications where the cooling air pattern is required, the cooled air has a natural tendency to move down towards the occupied zone due to the density difference of the cooled air. In applications where the heating air pattern is required, the warmed air has a natural tendency to move up from the occupied zone due to the density difference of the heated air.
FabricAir recommends the following (AT)
Max. air throw (AT) for ceiling throws (CT) should not exceed 50 ft.
Min. air throw (AT) for ceiling throws (CT) should not be less than 20 ft.
Max. air throw (AT) for free throws (FT) should not exceed 30 ft.
Min. air throws (AT) for free throws (FT) should not be less than 12 ft.

Air terminal velocity in the occupied space - (ft/min)
In order to satisfy the comfort requirements in the occupied zone and taking the human activity level into consideration, the air entering the occupied should enter this zone at a terminal velocity between 40 ft/min and 80 ft/min These requirements will vary depending on federal standards and as such we cannot give any recommendations.

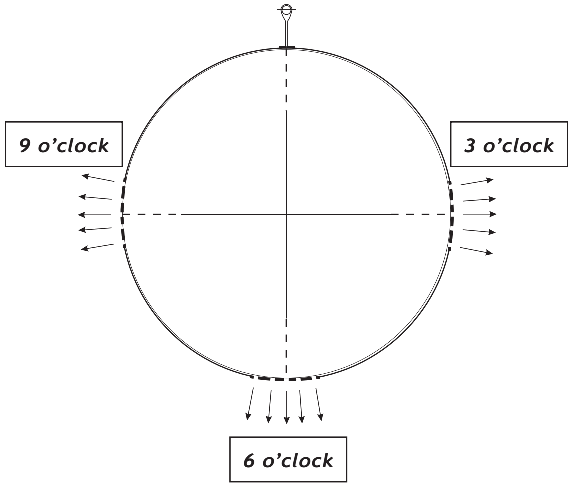
Shell - (no. of)
The FabricAir PERFO duct is provided with shells at various positions on the surface of the duct. The shell is defined as the area surrounding the perforation pattern. The shell is normally equal to the length of the duct.

Air volume per foot of shell - (AVF) (CFM/ft)
This is a simple expression for the amount of air that can be delivered per running foot of the shell. This unit of reference is importance to FabricAir when determining the correct perforation pattern that will satisfy the air distribution pattern. An incorrect selection of the perforation pattern will result in poor air distribution.

FabricAir recommends the following (AVF) (CFM/ft)
In order to achieve the maximum benefit from the distribution capabilities of the FabricAir PERFO ducts whilst avoiding excess air velocity in the occupied zone, it is recommended that the air volume per foot of shell (AVF) be selected as low as possible:
The recommended maximum (AVF) based on Ps. of 0.3 in.WG. is as follows:
Single shell - ceiling throw max. (AVF) 300 CFM
Double shell - ceiling throw max. (AVF) 600 CFM
Single shell - free throw max. (AVF) 200 CFM
Double shell - free throw max. (AVF) 400 CFM

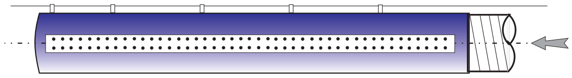
Duct sizes
PERFO duct sizes are generally calculated based on the principle of the maximum allowable inlet velocity (1,000 ft/min) Caution should however be exercised when selecting ducts with high air volumes per foot (AVF) combined with short air throws (AT) as this will result in the selection of a width of shell that cannot be encompassed on the duct circumference. Where such designs are required, please refer designs to FabricAir for detailed engineering

Position of shells on duct
The shells can be positioned on the duct circumference in order to satisfy the space requirements, Such circum-

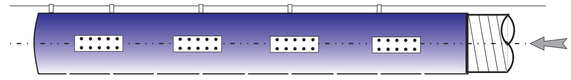


ferential positioning is determined from the "clock" I.e. shells placed at 3 o'clock and 9 o'clock will result in the air being supplied horizontally from the duct. A shell placed at 6 o'clock will result in the air being supplied vertically downwards from the duct. *The "clock" position of the shells are always viewed when* ***looking into the duct with the air from behind*****.**

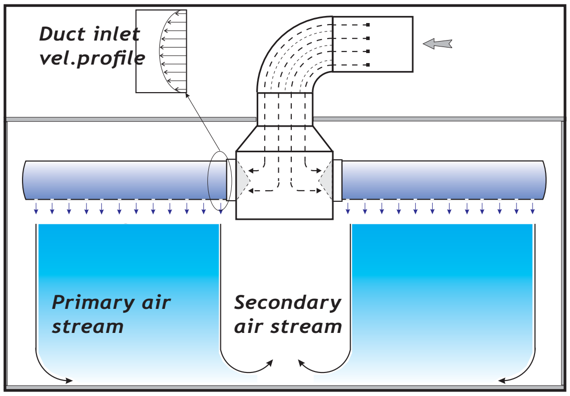
Types of perforations
The FabricAir PERFO ducts are manufactured with two types of perforation patterns depending on the required air throw type **AT**. Where the air throw type is required to be of the **CT** type i.e. ceiling throw the FabricAir PERFO duct will be manufactured with a continuous perforation along the full length of the duct.
Where the air throw type is required to be of the **FT** type or the **HT** type i.e. free throw or heating throw, the FabricAir PERFO duct will be manufactured with perforations arranged in groups. Such perforation groups are normally the same length and is placed along the full length of the duct at equal distances.



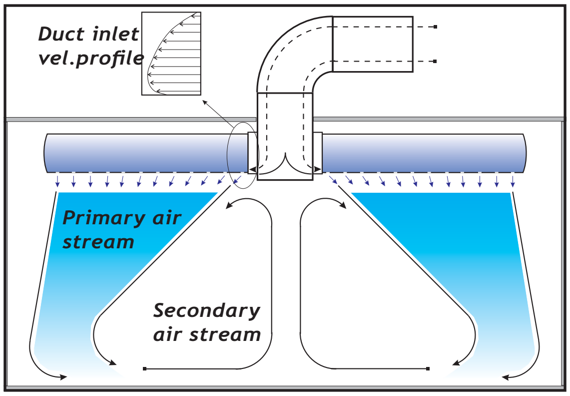
Continuous perforation



Perforation arranged in groups



Correct method of air entry



Incorrect method of air entry

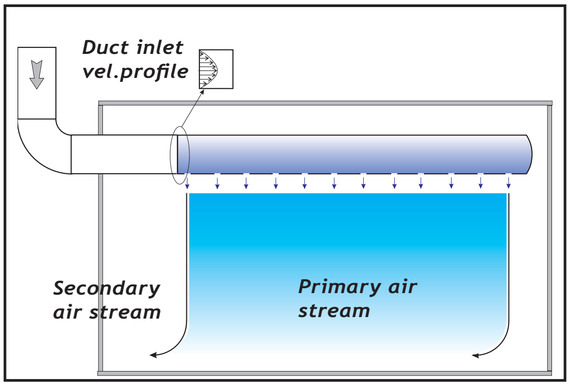
Ceiling projections and air stream obstacles

Beams projecting from ceilings as well as light fittings can often prevent the planned air steam from reaching the occupied zone at the correct terminal velocity and can therefore create unwanted drafts and high velocities in the zone. In order to overcome this, FabricAir recommends that where such projections occur, the FabricAir PERFO duct is mounted at right angles to the projections. If this is not possible due to other restrictions, the ducts can be mounted at a lower level in order to avoid air stream interference.

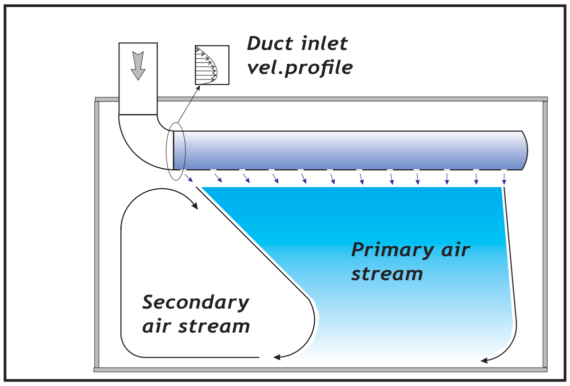
Air entry into PERFO Ducts

It is of vital importance that the air entry into the PERFO ducts is such that a smooth and even air profile is obtained. Recommendations for the right method is given in the following figures.

Correct method of air entry



Incorrect method of air entry



Calculation and Recommendations

Basic information:

General :

- Pd. $\leq$ 2/5 of Ps.
- Ps. must be minimum 0.25 in.WG
- Ps. should not exceed 0.60 in.WG
- The air changes per hour should not exceed 40
- The smallest possible dia. of duct is 4 in.
- The diameter of duct should not exceed 80 in.

For End Inlet:

- The inlet velocity should not exceed 1,000 ft/min.

For Center Inlet:

- The inlet velocity at the connection must not exceed 1,300 ft/min.

The recommended maximum ***(AVF)*** *based on Ps. of 0.3 in.WG. is as follows:*
Single shell - ceiling throw max.(AVF) 300 CFM
Double shell - ceiling throw max. (AVF) 600 CFM
Single shell - free throw max. (AVF) 200 CFM
Double shell - free throw max.(AVF) 400 CFM

Procedure for dimensioning:

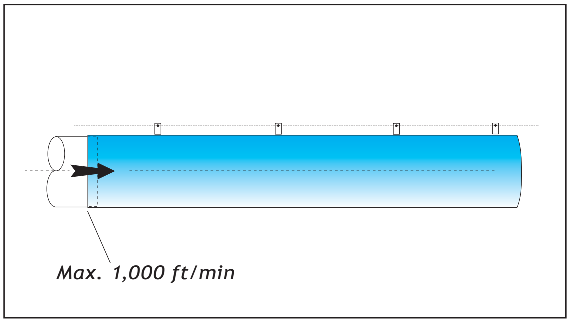
The following procedure is a guideline. Certain points that are calculated here may already be known.
Please refer to fold out section at back of brochure for descriptive explanation of the applied formulae.

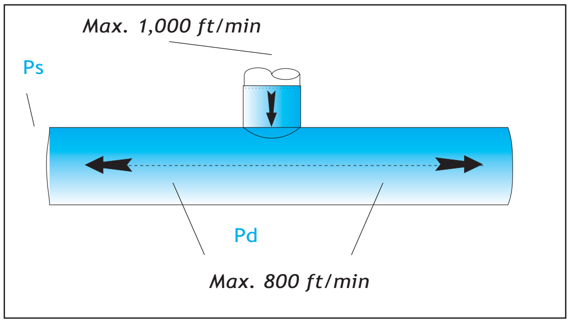
(1) Necessary input parameters:

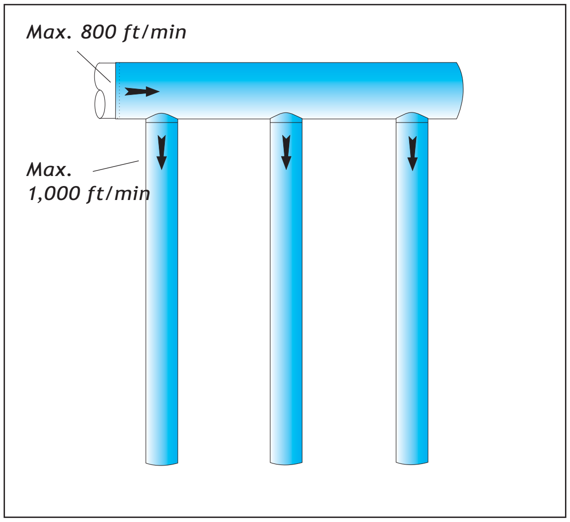
- The dimensions of the room (L x W x H)
- Maximum length of the PERFO ducts
- Number of units
- Space air volume - *if this is not known at this stage, it must be estimated*
- Units - number, location and dimension
- Total external pressure available for the FabricAir system

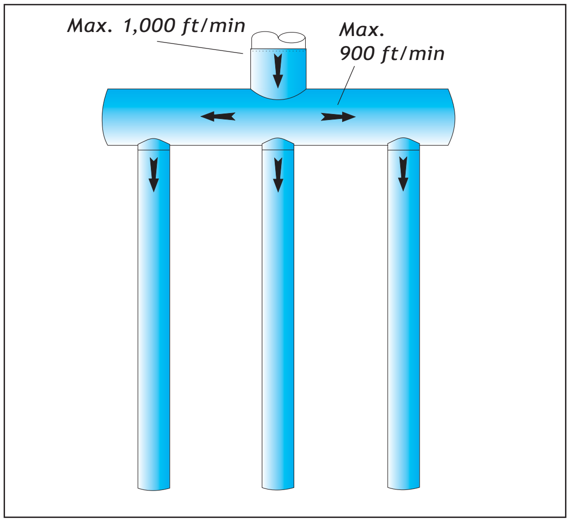
(2) Dimensioning:

(2.1) Determine length of duct (ft.)
(2.2) Determine no. of shells required
(2.3) Determine position of shells (o’clock)
(2.4) Calculate duct diameter (in.)







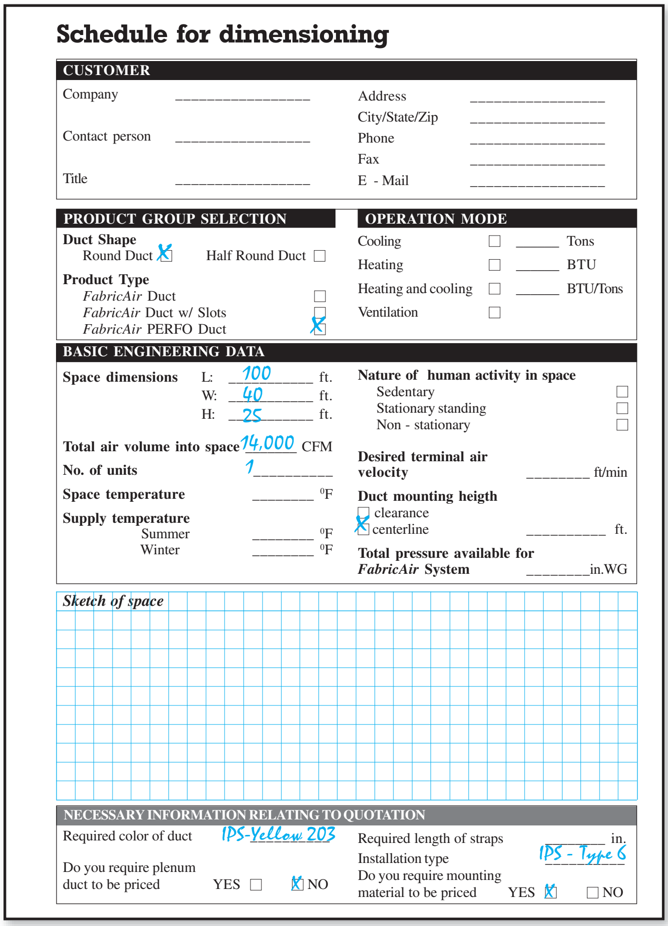


Special considerations in relation to FabricAir Plenum Ducts

In certain cases where the application calls for the use of multiple fabric PERFO ducts mounted in parallel, it is often a cost effective solution to use a round PERFO plenum duct to convey the air to the PERFO ducts via a duct manufactured from PERFO material, rather than fixed sheet metal ducts. Where such PERFO plenum ducts are used, the following conditions apply:

- The velocity in the plenum duct immediately prior to any "take off" to the PERFO ducts should be lower than the selected inlet velocity of the PERFO duct, in order to facilitate a smooth transfer of air from the PERFO plenum duct to the PERFO duct. The PERFO plenum duct is in most cases manufactured without perforations, such that the PERFO plenum duct acts as an "air delivery duct". In cooling applications cases where the space under consideration has a high relative humidity, usually above 75% RH and the air is supplied at low temperature, problems can occur with condensate forming on the surface of the PERFO plenum duct. To overcome this condition, the PERFO plenum duct is supplied with a number of small perforations along its entire length, in order to induce a flow of secondary air over the PERFO plenum duct surface, thus increasing the temperature of the duct surface.
- Where this type of PERFO plenum duct is required, it will be designated as a type "C - PERFO plenum duct"
- Maximum inlet velocity (end of duct) in the plenum duct is 800 ft/min.
- Maximum inlet velocity (center of duct) in the plenum duct is 900 ft/min.
- In case plenum ducts are desired, please refer your requirements to FabricAir, Inc. for the correct engineering solution, thus ensuring compliance with our recommended engineering norms.

Calculation Example



Schedule for dimensioning

CUSTOMER

Company	________________	Address	________________
		City/State/Zip	________________
Contact person	________________	Phone	________________
		Fax	________________
Title	________________	E - Mail	________________

PRODUCT GROUP SELECTION

Duct Shape
Round Duct ☒ Half Round Duct ☐

Product Type
FabricAir Duct ☐
FabricAir Duct w/ Slots ☐
FabricAir PERFO Duct ☒

OPERATION MODE

Cooling ☐ _____ Tons
Heating ☐ _____ BTU
Heating and cooling ☐ _____ BTU/Tons
Ventilation ☐

BASIC ENGINEERING DATA

Space dimensions L: 100 ft. W: 40 ft. H: 25 ft.
Total air volume into space 14,000 CFM
No. of units 1
Space temperature ________ °F
Supply temperature
Summer ________ °F
Winter ________ °F

Nature of human activity in space
Sedentary ☐
Stationary standing ☐
Non - stationary ☐

Desired terminal air velocity ________ ft/min

Duct mounting heigth
☐ clearance
☒ centerline __________ ft.

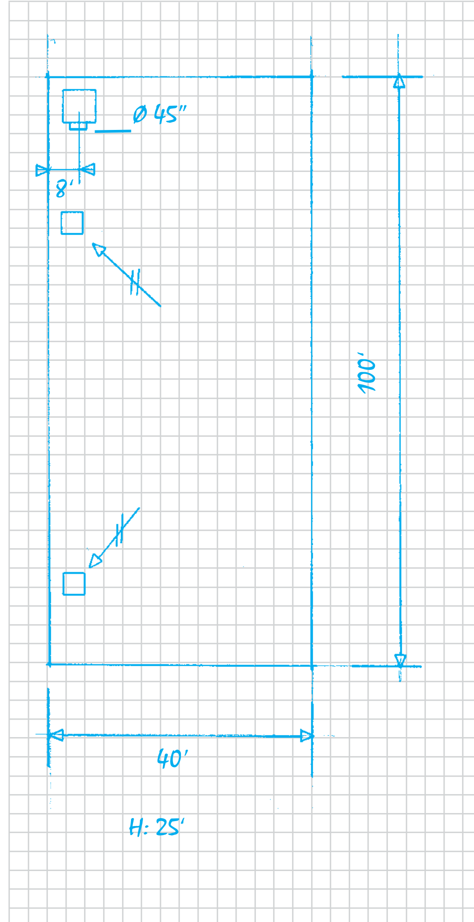
Total pressure available for *FabricAir* System ________in.WG

Sketch of space

NECESSARY INFORMATION RELATING TO QUOTATION

Required color of duct IPS-Yellow 203
Do you require plenum duct to be priced YES ☐ ☒ NO

Required length of straps ________ in.
Installation type IPS - Type 6
Do you require mounting material to be priced YES ☒ ☐ NO



Necessary selection parameters:

Parameter	Definition	Result
Product group	Duct shape	Round
Product group	Product type	FabricAir PERFO ducts
Operation mode		Ventilation
Space dimension	L x W x H	100 x 40 x 25
Total air volume into space	CFM	14,000
Number of units	Number	1
Connection location	See sketch	
Size - diameter	in.	45
Nature of human activity in space		Non - stationary
Centerline height of duct	ft.	16
Total Ps. available	in.WG	0.6
Max. length of duct in space	ft.	80

Procedure for calculation

Position	Procedure	Calculation	Result
(2.1)	Determine length of duct (ft.)	Max. allowable length	80 ft.
(2.2)	Determine no. of shells required	(no. of) duct mounted along one wall, air throw from one side	1 shell
(2.3)	Determine position of shells (o'clock)	Ventilation mode	9 o'clock
(2.4)	Calculate duct diameter (in.)	$\sqrt{\frac{14,000}{3,141}} \times 24$	51 in.

Engineering Description of the Selected Solution

The air supply must take place through a Round FabricAir PERFO Duct. The system must be engineered in such a way, that draft, noise and condensations is avoided. The FabricAir Duct(s) must be manufactured in zippered sections according to FabricAir's guidelines. The material of construction is fabric, wowen from Polyester/Trevira CS fibers and coated with special coating.

The FabricAir system must be classified by Underwriters Laboratory and meet the requirements of NFPA 90A-1993.

USDA accepts approval as established on the specific installation.

All products must undergo quality testing according to ISO 9001.

Supplier: FabricAir, Inc. Phone: (502) 493-2210 Fax: (502) 493-4002			
Air volume per duct	14,000 CFM	Perforation pattern	Selected by FabricAir, Inc.
Number of ducts	1	Color of duct	IPS - Yellow 203
Diameter of duct	51 in.	Air inlet	From end of duct
Length of duct	80 ft.		- round dia. 45"
Min. static pressure available	0.60 in. WG	Mounting type	IPS Type 6
No. of shells	1	Strap Length	1.2 in.
Position of shell	9 o'clock		

Applied Formulae

Round FabricAir Ducts

Pos.	Procedure	Calculation
(2.1)	Calculate L(ft.) (cooling load) of duct	$\frac{\text{Ton} \times 12{,}000}{\text{max.rec.BTU/h/L(ft.)}}$
(2.2)	Calculate L(ft.) (Duct surface) of duct	$\frac{\text{space CFM}}{125.7 \times \sqrt{\frac{\text{space CFM}}{5{,}026}}}$
(2.3)	Select L(ft.) largest value from (2.1) and (2.2)	
(2.4)	Calculate no. of ducts	$\frac{\text{Value from (2.3)}}{\text{Max. lenght of duct in space (ft.)}}$
(2.5)	Calculate duct diameter (in.)	$\sqrt{\frac{\text{space CFM}}{5{,}026}} \times 24$
(2.6)	Calculate duct surface area	Duct lenght(ft.) x diameter(ft.) x π
(2.7)	Calculate fabric selection factor	$\frac{\text{Space CFM}}{\text{Duct surface area (ft}^2\text{)}}$
(2.8)	Select fabric from schedule	

Fabric selection factor	Fabric	Division factor
0 to 2		Reselect duct size
2 to 6	**T40**	2
7 to 14	**T200**	11
15 to 26	**T320**	18
27 to 50	**T650**	36
51 to 82	**T1200**	66
83 to 100	**T1800**	99
100 and above		Reselect duct size

Pos.	Procedure	Calculation
(2.9)	Calculate exact duct static pressure	$\frac{\text{Fabric selection factor} \times 0.5}{\text{Division factor}}$
(2.10)	Check calculated static pressure against minimum static pressure	Minimum static press. 0.4 in.WG If calculated static pressure is < 0.4 in.WG reselect duct size

Half Round FabricAir Ducts

Pos.	Procedure	Calculation
(2.1)	Calculate L(ft.) (cooling load) of duct	$\frac{\text{Ton} \times 12{,}000}{\text{max.rec.BTU/h/L(ft.)}}$
(2.2)	Calculate L(ft.) (Duct surface) of duct	$\frac{\text{space CFM}}{125.7 \times \sqrt{\frac{\text{space CFM} \times 2}{4{,}084}}}$
(2.3)	Select L(ft.) largest value from (2.1) and (2.2)	
(2.4)	Calculate no. of ducts	$\frac{\text{Value from (2.3)}}{\text{Max. lenght of duct in space (ft.)}}$
(2.5)	Calculate duct diameter (in.)	$\sqrt{\frac{\text{space CFM} \times 2}{4{,}084}} \times 24$
(2.6)	Calculate duct surface area	Duct lenght(ft.) x diameter(ft.) x π x 0.5
(2.7)	Calculate fabric selection factor	$\frac{\text{Space CFM}}{\text{Duct surface area (ft}^2\text{)}}$
(2.8)	Select fabric from schedule	

Fabric selection factor	Fabric	Division factor
0 to 2		Reselect duct size
2 to 6	**T40**	2
7 to 14	**T200**	11
15 to 26	**T320**	18
27 to 50	**T650**	36
51 to 82	**T1200**	66
83 to 100	**T1800**	99
100 and above		Reselect duct size

Pos.	Procedure	Calculation
(2.9)	Calculate exact duct static pressure	$\frac{\text{Fabric selection factor} \times 0.5}{\text{Division factor}}$
(2.10)	Check calculated static pressure against minimum static pressure	Minimum static press. 0.3 in.WG If calculated static pressure is < 0.3 in.WG reselect duct size

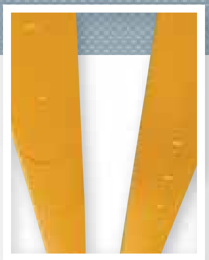
FabricAir Ducts w/Slots

Pos.	Procedure	Calculation
(2.1)	Determine length of duct	Maximum allowable length of duct in space
(2.2)	Determine no. of slots required	No.of slots depends on required air pattern in space
(2.3)	Determine position of slots	Position of slots depends on required air pattern in space
(2.4)	Calculate duct diameter (in.)	$\sqrt{\frac{\text{space CFM}}{5{,}026}} \times 24$

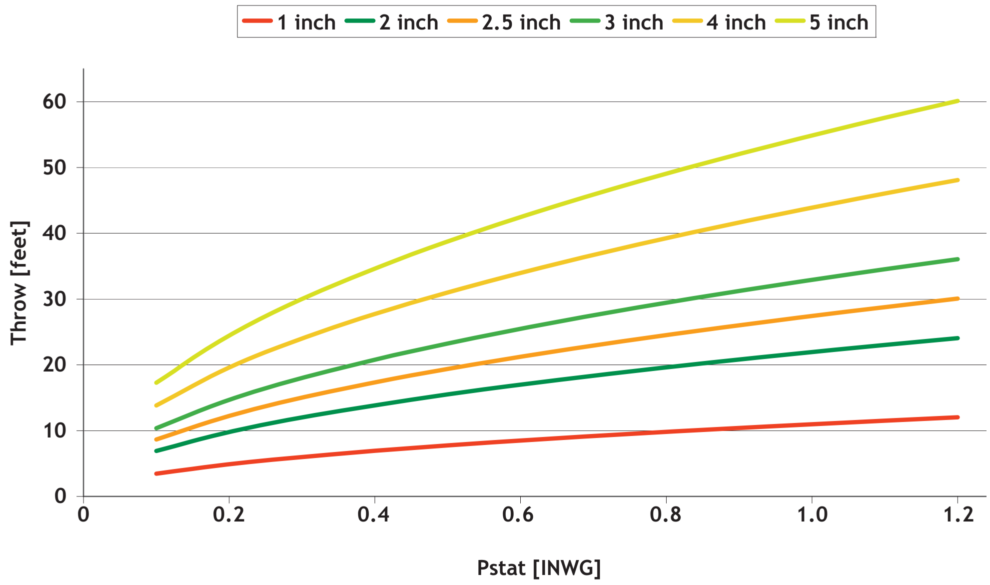
FabricAir PERFO Ducts

Pos.	Procedure	Calculation
(2.1)	Determine length of duct	Maximum allowable length of duct in space
(2.2)	Determine no. of shells required	No.of shells depends on required air pattern in space
(2.3)	Determine position of shells	Position of shells depends on required air pattern in space
(2.4)	Calculate duct diameter (in.)	$\sqrt{\frac{\text{space CFM}}{3{,}141}} \times 24$

Throw data
Orifices



THROW AT 150 FPM THERMINAL VELOCITY



Throw data for non permeable ducts shown at 150 fpm isothermal terminal velocity with various orifice sizes.

THROW AT 150 FPM

Pstat [INWG]	Orifice diameter [inch] 1.0	2.0	2.5	3.0	4.0	5.0
0.1	3	7	9	10	14	17
0.2	5	10	12	15	20	24
0.3	6	12	15	18	24	30
0.4	7	14	17	21	28	35
0.5	8	16	19	23	31	39
0.6	8	17	21	25	34	42
0.7	9	18	23	28	37	46
0.8	10	20	25	29	39	49
0.9	10	21	26	31	42	52
1.0	11	22	27	33	44	55
1.1	12	23	29	35	46	58
1.2	12	24	30	36	48	60

THROW AT 100 FPM

Pstat [INWG]	Orifice diameter [inch] 1.0	2.0	2.5	3.0	4.0	5.0
0.1	8	16	19	23	31	39
0.2	11	22	28	33	44	55
0.3	14	27	34	41	54	68
0.4	16	31	39	47	62	78
0.5	17	35	44	52	70	87
0.6	19	38	48	57	76	96
0.7	21	41	52	62	83	103
0.8	22	44	55	66	88	110
0.9	23	47	59	70	94	117
1.0	25	49	62	74	99	123
1.1	26	52	65	78	104	130
1.2	27	54	68	81	108	135

THROW AT 150 FPM

Pstat [INWG]	Orifice diameter [inch] 0.1	0.2	0.3	0.4	0.5	0.6
0.1	1	1	1	1	2	2
0.2	1	1	2	2	2	3
0.3	1	1	2	2	3	3
0.4	1	2	2	3	3	4
0.5	1	2	2	3	4	4
0.6	1	2	3	3	4	5
0.7	1	2	3	4	4	5
0.8	2	2	3	4	5	5
0.9	2	2	3	4	5	6
1.0	2	3	3	4	5	6
1.1	2	3	4	4	5	6
1.2	2	3	4	5	6	6

THROW AT 100 FPM

Pstat [INWG]	Orifice diameter [inch] 0.1	0.2	0.3	0.4	0.5	0.6
0.1	1	2	2	3	4	4
0.2	2	3	3	4	5	6
0.3	2	3	4	5	6	7
0.4	2	4	5	6	7	8
0.5	3	4	5	7	8	9
0.6	3	4	6	7	9	10
0.7	3	5	6	8	10	11
0.8	3	5	7	8	10	12
0.9	4	5	7	9	11	13
1.0	4	6	8	10	11	13
1.1	4	6	8	10	12	14
1.2	4	6	8	10	13	15

THROW AT 50 FPM

Pstat [INWG]	Orifice diameter [inch] 0.1	0.2	0.3	0.4	0.5	0.6
0.1	5	7	10	12	14	17
0.2	7	10	14	17	20	24
0.3	8	12	17	21	25	29
0.4	10	14	19	24	29	34
0.5	11	16	21	27	32	38
0.6	12	18	24	29	35	41
0.7	13	19	25	32	38	44
0.8	14	20	27	34	41	48
0.9	14	22	29	36	43	50
1.0	15	23	30	38	46	53
1.1	16	24	32	40	48	56
1.2	17	25	33	42	50	58

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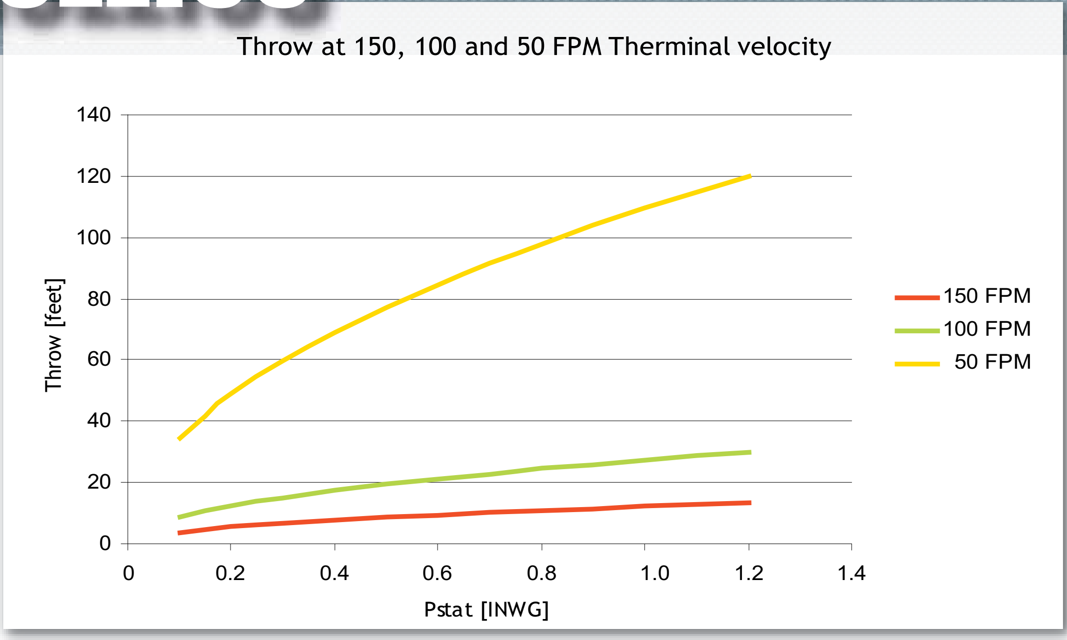
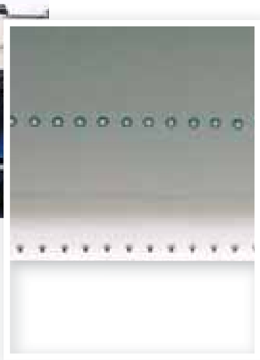
Throw data

Nozzles



Throw data for ducts with nozzles shown at 150, 100 and 50 fpm isothermal terminal velocity.



THROW AT 150 FPM

Pstat [INWG]	Nozzle diameter 0.7 [inch]
0.1	4
0.2	5
0.3	7
0.4	8
0.5	9
0.6	9
0.7	10
0.8	11
0.9	12
1.0	12
1.1	13
1.2	13

THROW AT 100 FPM

Pstat [INWG]	Nozzle diameter 0.7 [inch]
0.1	9
0.2	12
0.3	15
0.4	17
0.5	19
0.6	21
0.7	23
0.8	24
0.9	26
1.0	27
1.1	29
1.2	30

THROW AT 50 FPM

Pstat [INWG]	Nozzle diameter 0.7 [inch]
0.1	34
0.2	49
0.3	60
0.4	69
0.5	77
0.6	85
0.7	91
0.8	98
0.9	104
1.0	109
1.1	115
1.2	120

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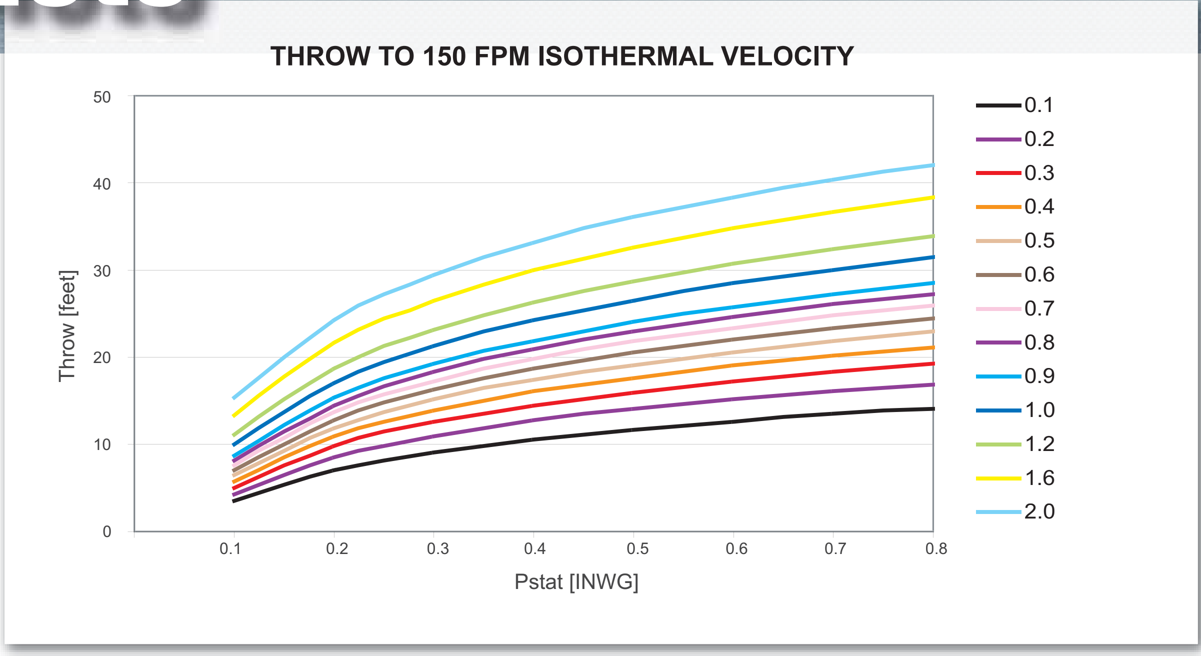
Throw data
Slots

Throw data for non permeable ducts shown at L_{150} fpm isothermal velocity with various slots sizes.



THROW TO 150 FPM

[Feet] Pstat [INWG]	H_{slots} [inch] 0.16	0.24	0.31	0.39	0.47	0.55	0.63	0.71	0.79	0.98	1.18	1.57	1.97
0.1	3.4	4.3	5.1	5.8	6.4	7.0	7.6	8.2	8.7	9.9	11.1	13.3	15.3
0.2	7.0	8.5	9.8	10.9	11.9	12.8	13.7	14.5	15.3	17.1	18.7	21.6	24.2
0.3	9.1	11.0	12.5	13.9	15.1	16.2	17.3	18.3	19.2	21.3	23.2	26.5	29.4
0.4	10.6	12.7	14.5	16.0	17.4	18.7	19.8	20.9	21.9	24.3	26.3	30.0	33.2
0.5	11.7	14.1	16.0	17.7	19.2	20.5	21.8	23.0	24.1	26.6	28.8	32.7	36.0
0.6	12.7	15.2	17.2	19.0	20.6	22.1	23.4	24.6	25.8	28.4	30.8	34.9	38.4
0.7	13.5	16.1	18.3	20.2	21.8	23.4	24.8	26.1	27.3	30.0	32.5	36.7	40.4
0.8	14.2	16.9	19.2	21.1	22.9	24.5	25.9	27.3	28.5	31.4	33.9	38.3	42.1

Throw in feet to L_{150}. H_{slots}=hight of the slot

THROW TO 100 FPM

[Feet] Pstat [INWG]	H_{slots} [inch] 0.16	0.24	0.31	0.39	0.47	0.55	0.63	0.71	0.79	0.98	1.18	1.57	1.97
0.1	9.2	10.1	10.8	11.5	12.2	12.8	13.3	13.9	14.4	15.7	16.9	19.0	21.0
0.2	12.8	14.3	15.5	16.6	17.6	18.6	19.4	20.3	21.0	22.8	24.5	27.4	30.0
0.3	14.8	16.7	18.3	19.6	20.9	22.0	23.0	24.0	24.9	27.0	28.9	32.3	35.2
0.4	16.3	18.5	20.2	21.8	23.1	24.4	25.6	26.6	27.7	30.0	32.1	35.7	38.9
0.5	17.5	19.8	21.7	23.4	24.9	26.3	27.5	28.7	29.8	32.3	34.5	38.4	41.8
0.6	18.4	20.9	23.0	24.8	26.4	27.8	29.1	30.4	31.5	34.2	36.5	40.6	44.1
0.7	19.2	21.8	24.0	25.9	27.6	29.1	30.5	31.8	33.0	35.8	38.2	42.5	46.1
0.8	19.9	22.7	24.9	26.9	28.6	30.2	31.7	33.0	34.3	37.1	39.7	44.1	47.8

Throw in feet to L_{100}. H_{slots}=hight of the slot

THROW TO 50 FPM

[Feet] Pstat [INWG]	H_{slots} [inch] 0.16	0.24	0.31	0.39	0.47	0.55	0.63	0.71	0.79	0.98	1.18	1.57	1.97
0.1	14.9	15.8	16.6	17.2	17.9	18.5	19.1	19.6	20.2	21.4	22.6	24.8	26.8
0.2	18.5	20.0	21.3	22.4	23.4	24.3	25.2	26	26.8	28.6	30.2	33.1	35.7
0.3	20.6	22.5	24.0	25.4	26.6	27.7	28.8	29.7	30.7	32.8	34.7	38.0	40.9
0.4	22.1	24.2	26.0	27.5	28.9	30.1	31.3	32.4	33.4	35.7	37.8	41.5	44.6
0.5	23.2	25.6	27.5	29.2	30.6	32.0	33.3	34.4	35.5	38.0	40.3	44.2	47.5
0.6	24.2	26.7	28.7	30.5	32.1	33.5	34.9	36.1	37.3	39.9	42.3	46.4	49.9
0.7	25.0	27.6	29.8	31.6	33.3	34.8	36.2	37.5	38.8	41.5	44.0	48.2	51.9
0.8	25.6	28.4	30.7	32.6	34.4	36.0	37.4	38.8	40.0	42.9	45.4		

Throw in feet to L_{50}. H_{slots}=hight of the slot

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