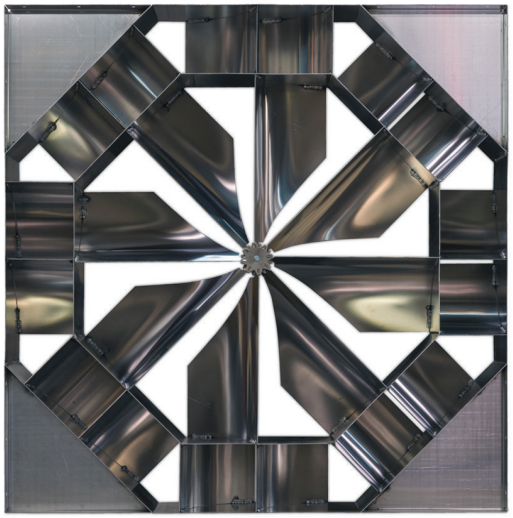
Blender Products INC.



Air Blender®

Mix Stratified Air Streams

REV 02

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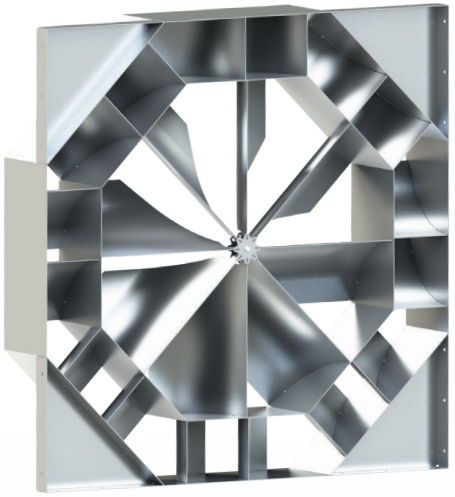
Blender INC. Products

About Air Blender®

Performance Advantages

- Reduce operating costs by extending economizer durations (free cooling)
- Enhance ventilation reliability
- Improve indoor air quality (IAQ)
- Provides freeze stat alarm protection
- Protection against frozen coils
- Minimize sensor errors and improve accuracy for temperature control



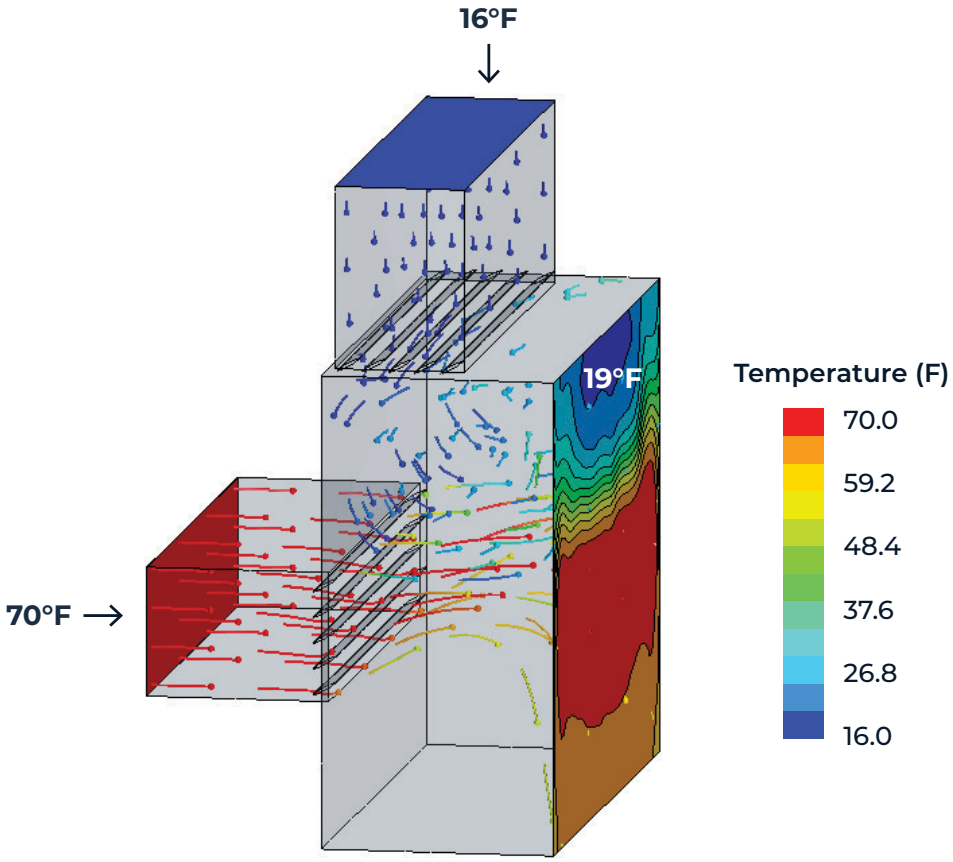
Only proper mixing of return air and outdoor air can directly address the root cause of air stratification inside an air handling unit (AHU). Though there have been attempts to combat this issue such as changing inlet orientations and using additional heating coils, no solution has effectively addressed this problem. The Air Blender is a viable solution to air stratification as it provides building operators the ability to maintain healthy ventilation rates with little to no maintenance.

The Air Blender was originally engineered in 1962 and refined over the years as a static mixing device to mitigate freeze stat trips, protect coils, and to provide a uniform air flow to the other sections of the AHU.

Air Stratification

Maintaining proper ventilation rates provides a myriad of benefits including reducing the risk from infectious aerosols. If the outdoor airstream is not well-mixed, significant air stratification inside an AHU can lead to increased operating costs and poor indoor air quality.

- No orientation of the outside air (OA) & return air (RA) dampers can effectively address air stratification.
- Complete mixing of return and outdoor air is essential to proper coil operation (ASHRAE, HVAC Systems and Equipment).
- Traditional mixing boxes fail to provide effective mixing.



Temperature Stratification Inside Mixing Box of AHU

The Need for Mixing

Stratification in an air handling unit is the result of the momentum inherent in a stream of moving air. The stratification is apparent when two air streams of different temperatures are introduced into the same duct or plenum and the temperature across the duct or plenum varies. This situation occurs many times in the typical HVAC air handling system. The common places where this occurs is in the air handling unit mixing box and after face and bypass coil units.

Temperature

As temperatures start to drop below freezing, stratification becomes a problem that results in a variety of problems including damaged components and freeze stat trips resulting in downtime. In many cases, air handling units are unable to operate when the outside air temperatures fall below 25˚F - 30˚F. Possible solutions to combat this have been presented but have shown little to no performance with an additional increase in energy use.

Indoor Air Quality

The importance of stratification has increased as a result of concerns over indoor air quality. IAQ standards such as ASHRAE Standard 62 requires more outside air than previously required in systems. As the amount of outside air is increased, the amount of mixing which must take place between the two air streams increases. In systems where inadequate mixing occurs, systems may be unable to operate during cold temperature conditions due to the possibility of freeze stat trips.

Comparisons

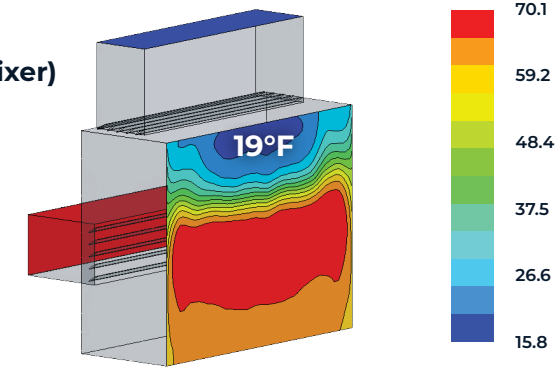
Without Air Blender®

- Dampers positioned in attempt to induce turbulent airflow
- Poor control due to large mixed air temperature error
- Excessive energy required to heat mixed air stream to protect cooling coil
- Cooling coil freezes and repeated freeze-stat trips
- Maldistribution of OA within supply ducts

AHU-1: Supply Flow 44,000 CFM
OA Flow 11,000 CFM @ 16°F

AHU-1 (No Mixer)

- T_{mix}=55°F
- T_{min}=19°F



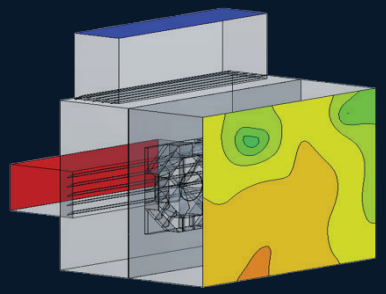
With Air Blender®

- Dampers positioned for proper air volume control
- Improved mixed air temperature sensor accuracy
- Reduced/Eliminated heat required to protect cooling coils
- Protected cooling coils from damage and eliminated freeze-stat trips
- Uniform distribution of OA within supply duct

AHU-1: Supply Flow 44,000 CFM
OA Flow 11,000 CFM @ 16°F

AHU-1 w/Mixer)

- QTY. (2) ABS56 installed at 43" additional AHU length
- T_{mix}=55°F
- T_{min}=40°F
- △ P increase: 0.18"wc



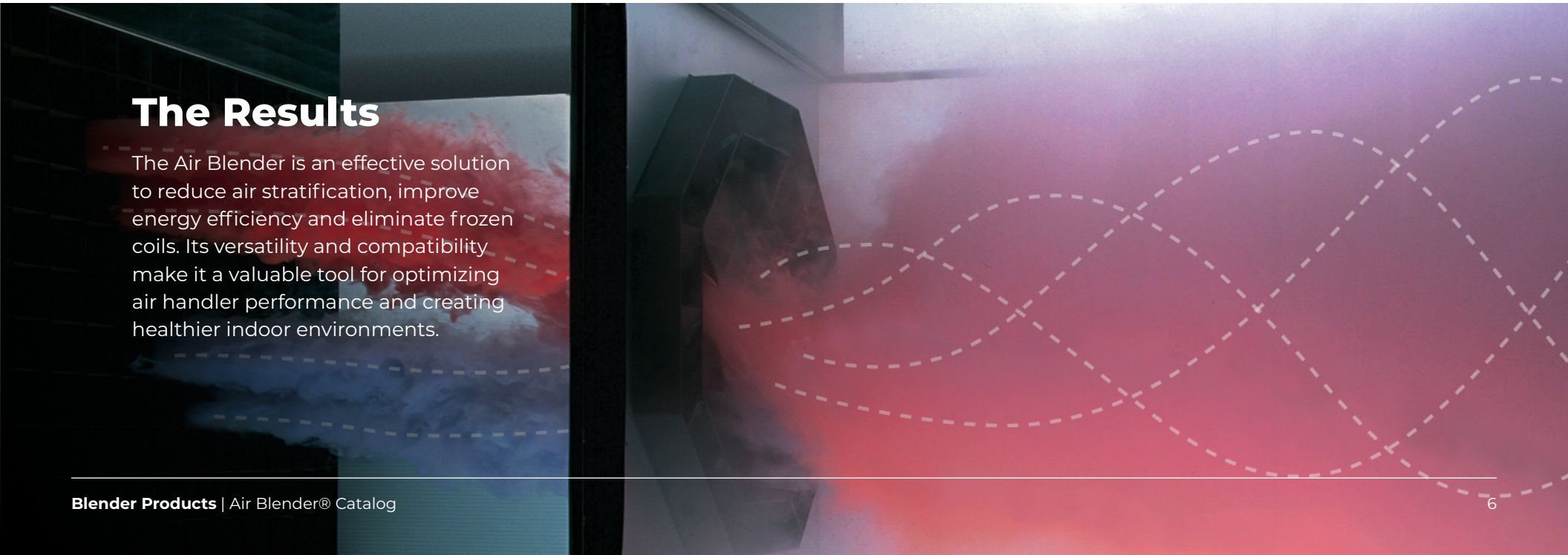
How it Works

Airflow Mixing

Stratified air (e.g. cold OA and warm RA) enters the Air Blender(s) which creates turbulence with its counter-rotational blade design. The turbulence continues downstream of the Air Blender and enables the stratified air streams to have closer proximity across the cross-section of the plenum or duct thereby enhancing the heat transfer between the two air streams and creating a more uniform profile.

Scalability

The Air Blender is designed to be geometrically scalable, making the pressure drop and mixing distance predictable and consistent across the full range of sizes.



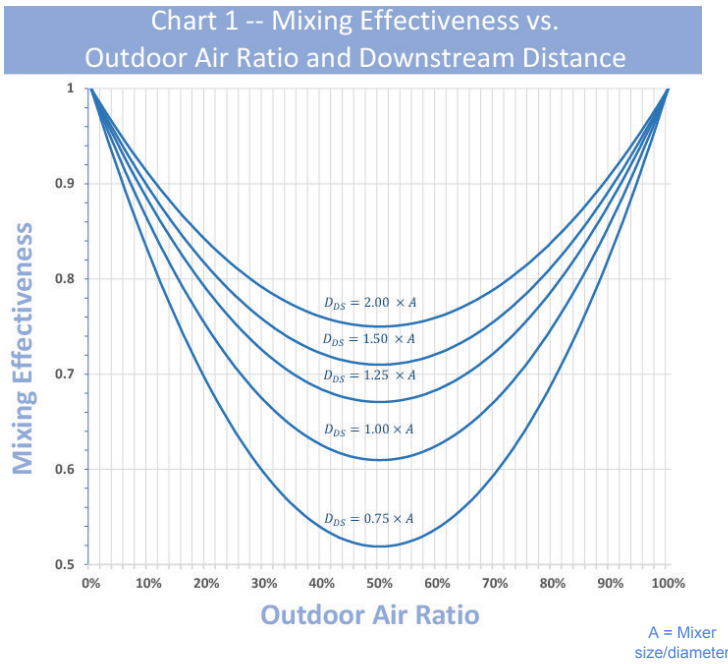
The Results

The Air Blender is an effective solution to reduce air stratification, improve energy efficiency and eliminate frozen coils. Its versatility and compatibility make it a valuable tool for optimizing air handler performance and creating healthier indoor environments.

Distance Required

The mixing provided by a static mixer is largely determined by the amount of distance downstream (D_{DS}) of the static mixer and the amount of outside air being introduced into the system. By changing the distance between the static mixer and the nearest downstream component, the amount of mixing can be altered to fit the mixing requirements of any system. Chart 1 shows the mixing effectiveness for several different downstream distances.

Reference Blender Products' booklet Mixing Effectiveness Design Guide, downloadable from here for further details on mixing performance for various applications.



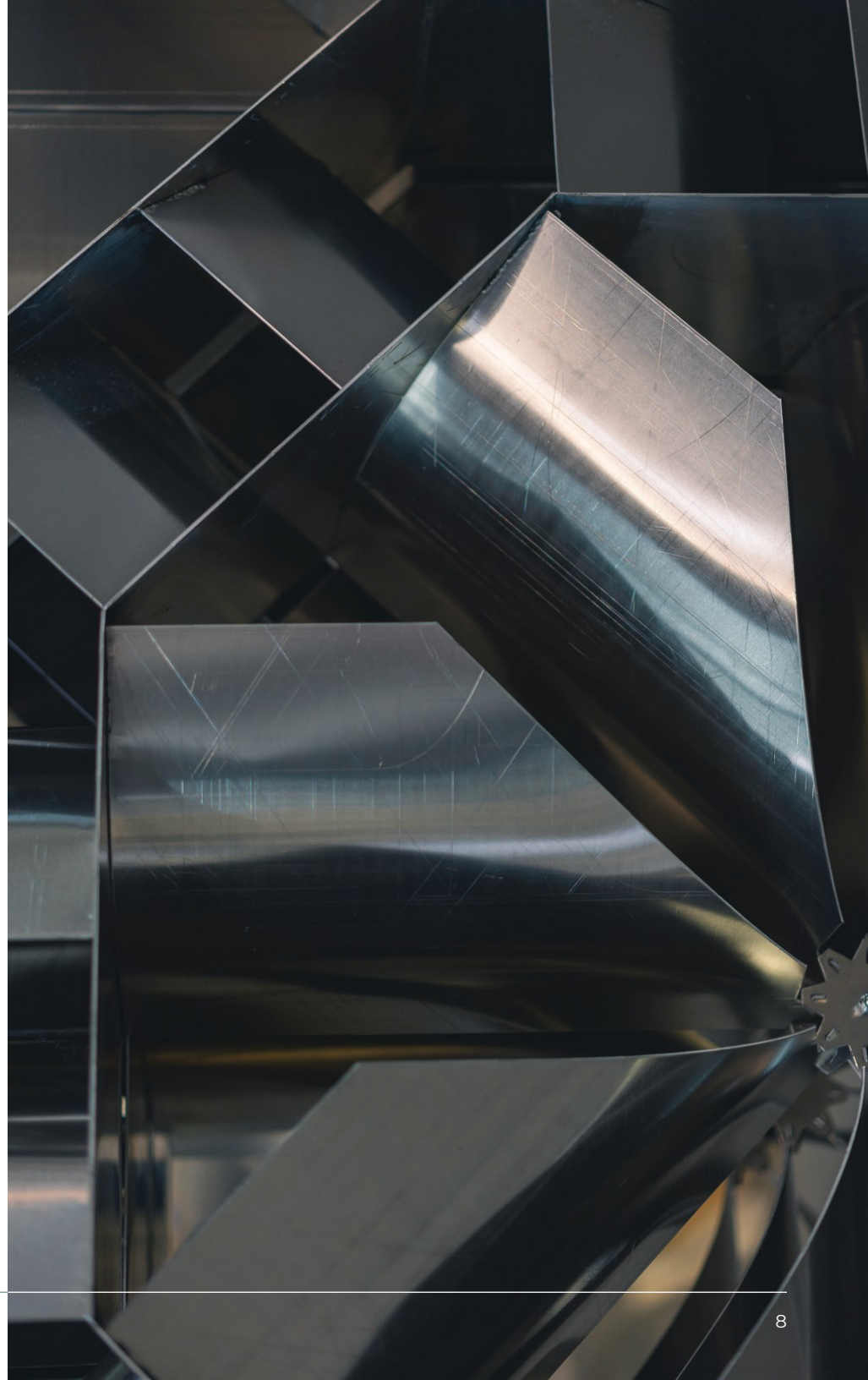
Mixing Effectiveness

The mixing effectiveness of a mixing box and static mixer can be determined using the following equation:

$$\textbf{Mixing Effectiveness} = 1 - \left(\frac{T_{out,\,Max} - T_{out,\,Min}}{T_{RA} - T_{OA}} \right)$$

Construction

- Completely fixed device with no moving parts. Welded and mechanically fastened construction
- 0.080” or 0.125” thick aluminum construction produces a lightweight corrosion-resistant component
- Two counter-rotational sets of fixed blades to induce turbulence and mixing
- Three mounting configurations that can be implemented in a variety of mixing boxes: (See next page for more info)
  - **Standard Mount:** Consists of corners that can be fastened to blank-off panels or walls
  - **Flange Mount:** Consists of flat flanges that can be fastened to a blank-off panel with an octagonal cut-out
  - **Panel Mount:** Consists of the standard mount Air Blender with the blank-off panels around the Air Blender provided by Blender Products

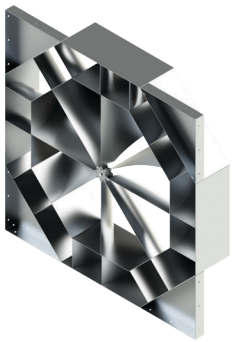


Air Blender® Model Number

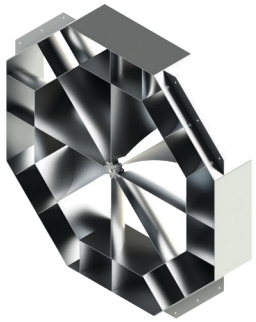
ABS	44

Description	Code
Standard	ABS
Flange	ABF
Panel	ABP

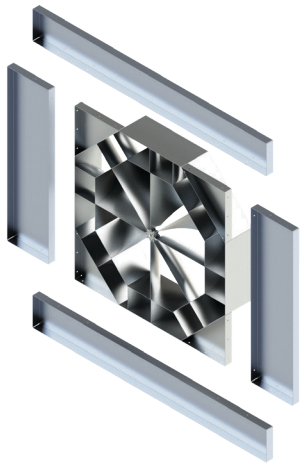
Code	Description
XXX	Size of Air Blender



Standard Mount



Flange Mount



Panel Mount

AVAILABLE SIZES*																					
ABS8	ABS9	ABS10	ABS11	ABS12	ABS13	ABS14	ABS15	ABS16	ABS18	ABS20	ABS22	ABS24	ABS26	ABS28	ABS30	ABS32	ABS34	ABS36	ABS38	ABS40	ABS42
ABS44	ABS46	ABS48	ABS52	ABS56	ABS60	ABS64	ABS68	ABS72	ABS78	ABS84	ABS90	ABS96	ABS102	ABS108	ABS114	ABS120	ABS132	ABS144	ABS156	ABS168	

*Contact Blender Products for custom sizing

Product Selection

The Air Blender is designed to fit into a variety of mixing box arrangements. To properly make an Air Blender selection, the following information is needed:

- Supply Air (CFM)
- Minimum OA Flow (CFM)
- Minimum OA temperature (winter design condition)
- Inside Plenum dimensions (H x W)
- OA and RA inlet orientations into the air handling unit

The Air Blender can be configured for most AHU applications with an online selection tool that can be found at BlenderProducts.com.

Please visit one of our local manufacturing representatives if you have questions or need additional information. A list of Blender Products representatives can be found at BlenderProducts.com.

Application Notes

To properly apply an Air Blender in an air handling unit, there are several factors that need to be considered:

1. Quantity of Air Blenders

The quantity of mixers depends on the OA and RA inlet orientations. To use multiple mixers each mixer needs proportional amounts of OA and RA flow to allow consistent mixing. If each mixer will not see proportional amounts of OA and RA, a single mixer must be used. See next page for additional details.

2. Size of Air Blenders

The size of the mixer depends on the quantity of mixers to be used and the size of the AHU's plenum or the duct where the mixer(s) will be mounted.

3. Pressure Drop

The pressure drop through the Air Blender(s) depends on the plenum dimensions, aspect ratio, and the size and quantity of Air Blenders. At a given flow rate the pressure drop will increase with smaller Air Blenders and will decrease with larger Air Blenders.

4. Blender Section Length

Upstream Distance: The distance required upstream of the mixer depends upon the mixer(s) selected and the size of the plenum in which the mixer is mounted. The distance required upstream of a mixer is based on the laminar flow of the two air streams entering the mixer. (See Application Detail 1 for more information).

Downstream Distance: The downstream distance required is based on the amount of mixing required. If thorough mixing is needed, the downstream distance will increase. If necessary, the upstream distance may be shortened to create more downstream distance. Please note, the pressure drop will increase relative to the lack of upstream distance.

5. Minimum Velocity

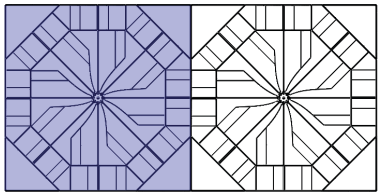
The velocity through the open area of the Air Blender should be maintained above 400 fpm to provide adequate turbulence for mixing to occur. The open area of Air Blender is calculated as an octagon = H x W x 0.82.

The optimal Air Blender selection balances the section length required for adequate mixing and the pressure drop limitations of the system. The smaller the Air Blender(s), the shorter the downstream distance needed for mixing, but the higher the pressure drop.

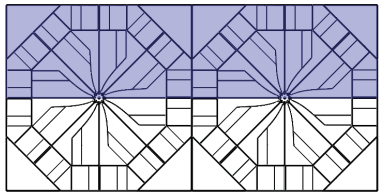
Quantity of Air Blenders®

The quantity and layout of mixers being utilized is solely based on the inlet orientations of the two streams. For multiple mixers to be used, it is vital that proportional amounts of both return air and outside air streams pass through each mixer. Having disproportional amounts of air through each mixer will result in different mixed air temperatures downstream of each mixer. This will inevitably result in a higher level of air stratification. Damper size and position should reflect design to ensure proportional amounts of air are directed to each mixer.

Incorrect:



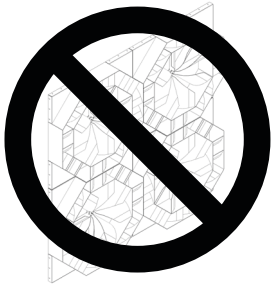
Correct:

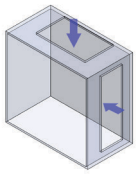


The pattern of stratification is largely dependent upon the inlet arrangement of the air streams.

If viability of using multiple mixers is under question, please contact Blender Products or your local sales representative for more information.

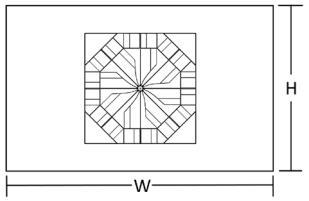
The desire to save space may lead to the decision to use an array of mixers rather than a single line. This practice is rarely acceptable. Consult Blender Products for case-by-case applications.

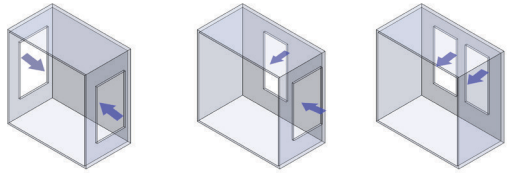




Single Mixer

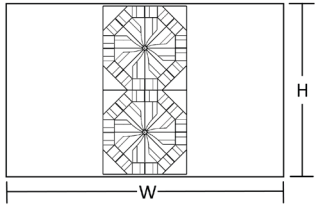
Only a single mixer may be used.

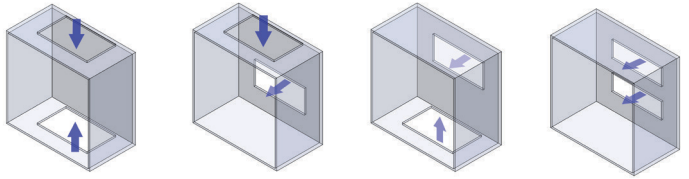




Vertical Line

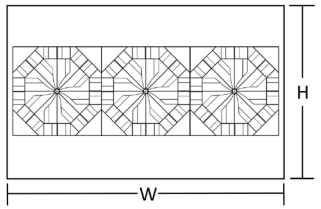
Single or multiple mixers may be used. Multiple mixers must be in a vertical line.





Horizontal Line

Single or multiple mixers may be used. Mixers must be in a horizontal line.

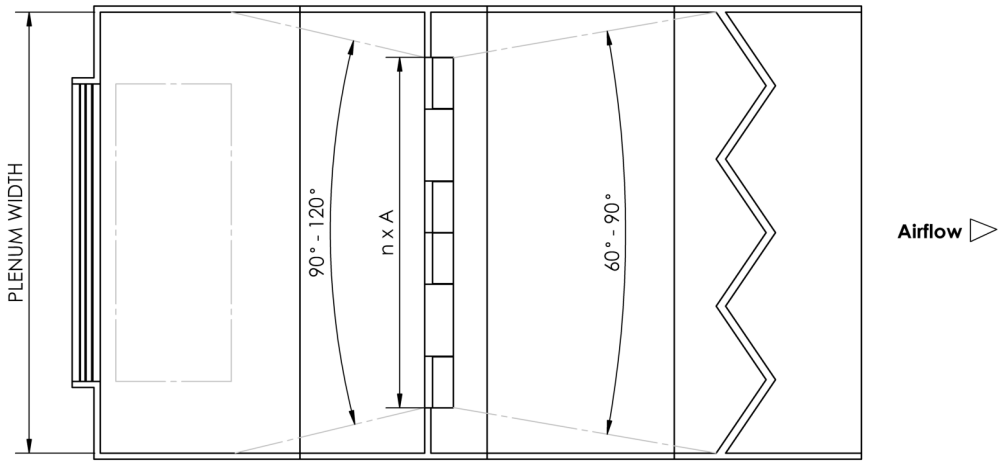


Upstream and Downstream Distances

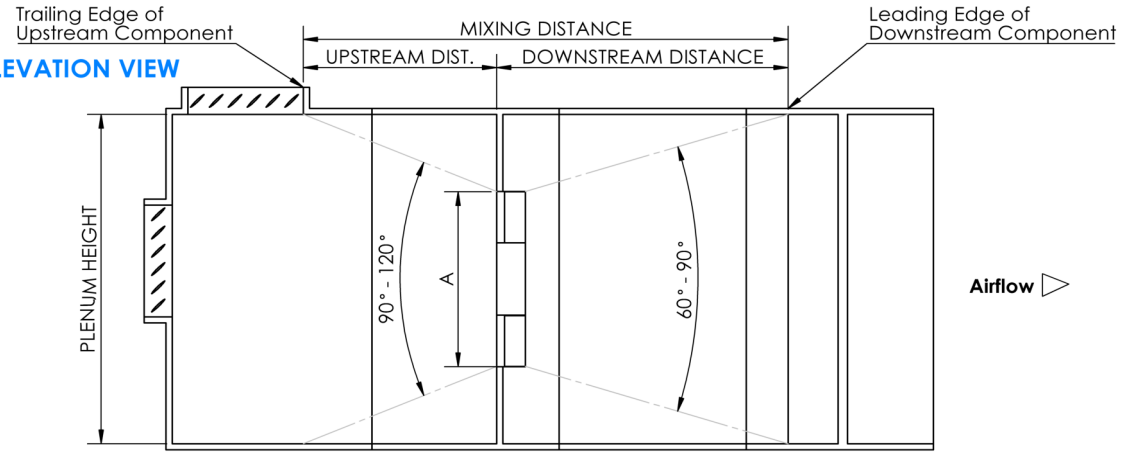
The distance upstream of a static mixer should be large enough that the angle at which the air stream contracts is between 90˚- 120˚. If the contraction angle is greater than 120˚, the pressure drop of the mixer will become greater than predicted.

The downstream distance of a mixer is governed by the required mixing. However, the downstream distance should be large enough so that the discharge angle is between 60˚- 90˚. If the discharge angle is more than 90˚, the velocity profile across the component located immediately downstream of the mixer will be affected. This will decrease the performance and increase the pressure drop for the component downstream of the mixer.

PLAN VIEW



ELEVATION VIEW



Product Installation

The Air Blender is designed to be installed between the mixing box inlets and the front of the filter wall, at distances specified by the selection tool or the manufacturers recommendation.

The Air Blender should be placed in the center of the plenum, surrounded with blank-offs forcing all the air through the mixer.

For additional information, please reference our installation guide available on our website, or contact your local Blender Products representative.

Alternative Applications

The Series IV Air Blender can be used in many industries for a wide variety of mixing applications, extending beyond traditional AHU mixing boxes. These industries include, but are not limited to, data centers, educational campuses, and healthcare facilities.

Airflow Uniformity

Flow homogenization downstream of the AHU. Typically downstream of humidification grids, heat wheels, staged evaporative cooling, etc.

Airflow Diffusion

Distribute airflow across a plenum area.

Duct Mixing

Mix a single airflow with heating or cooling elements upstream.

Stainless Construction*

Alternative construction material for applications where needed.

Please contact Blender Products if you have questions or need additional information.

*Add -SS suffix to part number to order

Blender Products INC.®

About Blender Products

Blender Products, Inc. was founded in 1962 with a unique focus on air and gas mixing through the application of static mixing technology. Blender Products offers multiple product lines in our HVAC Business Segment. We strive to apply best engineering practices to our HVAC solutions to accurately predict and measure performance of our products.

Blender Products is a privately owned business and 100% of our manufacturing is completed in the U.S.A. We are an engineering-driven organization, and we exist to serve our customer by providing value-add products and solutions to our clients.

Contact:

blenderproducts.com/air-blender/

info@blenderproducts.com

16600 E. 33rd Drive, Suite 30 Aurora, CO 80011

800.523.5705

303.295.6111