Floor Diffusers

in fire rated plastic construction

Model FBK200 for use in underfloor air distribution applications with raised access floors

TROX® TECHNIK

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Contents • General Information

Product Features 3
Principles of Underfloor Air 4
Outlet Selection 5
Performance Data 6
Dimensional Data 8
Installation 9
Specifications 10

Recent advances in communications technology have had a marked effect on almost every facet of the corporate world. Businesses focus on short term plans as the pace of development and competition grows ever faster. Companies must employ these latest technologies in order to stay competitive in their field of endeavor.

Consequently, the office space these companies occupy must also adapt to new technologies and the resultant workplace changes. Owners and developers realize that their buildings must remain as flexible as possible in order to adapt to the changing needs of the tenants they serve.

Raised access floors simplify modification to space layout and service delivery. Power, voice and data cables are located within the floor cavity and can be easily accessed.

The same cavity can be utilized as a plenum to supply conditioned air to the space.

Underfloor air distribution has been widely used in Europe for over twenty years. It is beginning to be employed by major developers and facility owners in North America as well. In addition to adding flexibility to the space, underfloor air systems offer benefits in air quality and comfort to the space occupants.

For over twenty years, TROX has provided engineered solutions for many of the world's most prestigious buildings. We offer the widest variety of floor outlets and underfloor terminal units available. As well, TROX offers a number of publications and services to engineers and architects involved in underfloor system design.

Product Features

- FBK 200 diffusers are constructed of NFPA 90A compliant plastic. Aluminum (FBA) models are also available (see separate catalog PI/1/8.1/US4).
- Space occupants can adjust their own airflow in accordance to their personal preference by simply turning the diffuser face. In addition, damper indicator marks and a damper position index arrow allows visual indication of the damper position.
- Allows imposition of a maximum airflow limit while still affording occupant full control of space airflow (up to preset maximum limit). .
- High induction swirl design assures rapid mixing of supply and room air, enabling location of the diffuser within inches of space occupants.
- Integral catch basin is capable of catching and retaining up to 20 ounces of liquid, the maximum capacity of most vending machine beverage containers.
- Unique spring mounting affords easy installation and removal of the diffuser after the raised floor and carpet tiles are permantely in place. (see page 9 for installation details)

Principles of Underfloor Air Distribution

Underfloor air systems (see figure 2) supply conditioned air to the space using high induction floor diffusers. These outlets are typically tapped directly into the pressurized raised floor plenum, but may be ducted as well. Outlet airflows are generally limited to about 100 cfm and supply temperatures maintained between 60 and 63˚F as the discharge is very near the occupants.

The high induction diffusers discharge air vertically in a spiraling pattern. As the air rises, it entrains ambient air, mixing it to reduce the temperature and velocity differences between supply and room air. At the point where its velocity has been reduced to about 50 fpm, the air stream can no longer support mixing, its energy depleted. A boundary layer forms at this elevation, the area below which is referred to as the *Mixing Zone*, characterized by well mixed supply and room air.

Ambient air above the boundary layer remains thermally stratified with the warmer air resident at the higher elevations of the space. In the absence of convective heat sources, this air would remain stratified, as there is no force present to disturb this equilibrium. However, introduction of people and equipment creates natural convection currents that rise along the surface of the heat source. When these sources are introduced at or below the boundary layer, their ascent induces conditioned air across the boundary layer, and this air rises to cool and ventilate the source.

Air movement through the upper level of the space is unidirectional, driven only by buoyancy forces. The level above the boundary layer is referred to as the *Stratified Zone*. Convective gains that originate above the boundary rise naturally and can be neglected in space airflow calculations, but are reflected in the refrigeration equipment sizing.

Maintenance of mixing zone depths to no more than four feet isolates respiration and the contaminants that accompany it within the stratified zone. As such, cross respiration between occupants is minimized and these contaminants are conveyed directly to the overhead return. Minimizing mixing zone depths also maximizes isolation of convective heat gains, many of which occur at desktop level.

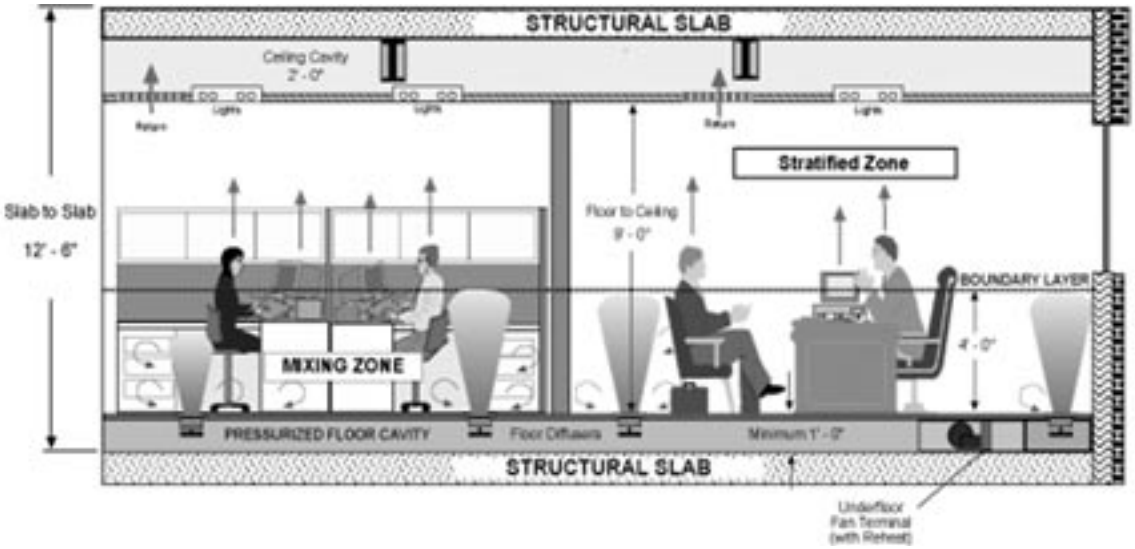


Figure 1: TROX Underfloor Air Distribution System

Outlet Selection and Location Procedures

As underfloor systems discharge into the occupied area of the space, it is important that supply outlets are sufficiently separated from the occupants. The area directly adjacent to these outlets, in which uncomfortable conditions are likely to exist, is referred to as their “clear zone”. The “clear zone” may be quantified as the radial (horizontal) distance that must be maintained between the center of the outlet and the nearest stationary occupant in order to assure that supply air velocities and temperatures are sufficiently dissipated that they will not cause discomfort to the occupant upon contact. Figure 3 may be used to predict statistical levels of occupant discomfort for various combinations of air velocities and draft temperatures. Clear zones that establish a minimum of 90% satisfaction should be observed where stationary occupants reside.

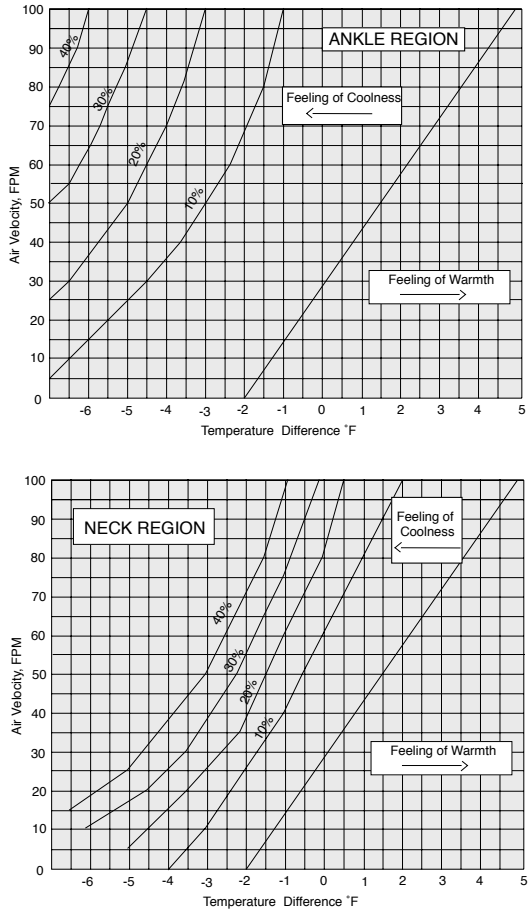


Figure 3: Percentage of Occupants Objecting to Drafts.

Reference: ASHRAE Handbook (Fundamentals) 1997 American Society of Heating, Refrigeration, and Air Conditioning Engineers

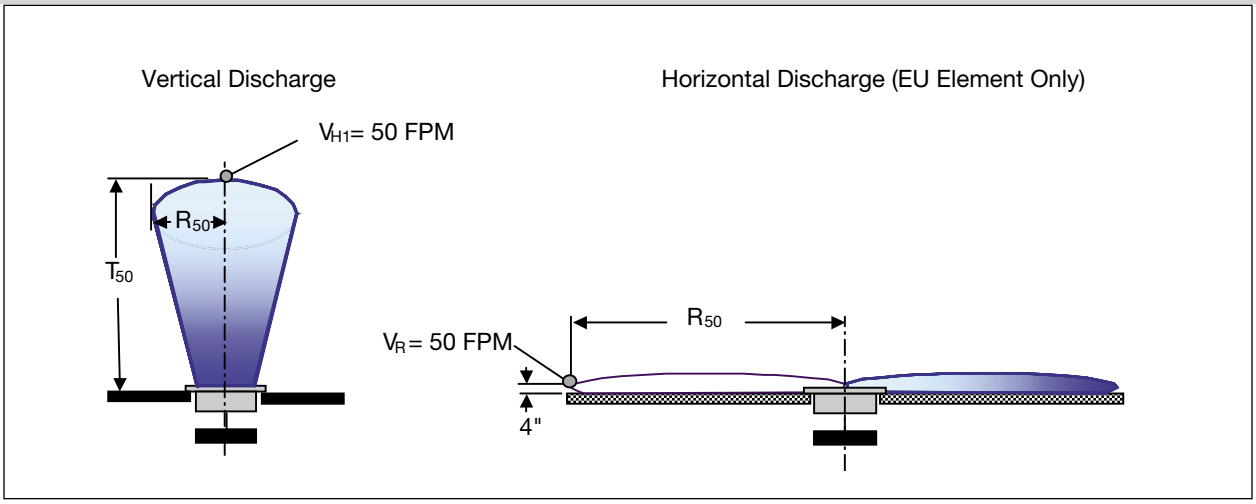
As the Mixing Zone depth affects the degree of isolation of space heat sources, it follows that maintaining a minimal, yet comfortable, depth optimizes the system design. This depth should be less than four feet so the boundary level lies just below the respiration level of seated occupants. This can be accomplished by sizing and selecting diffusers such that their vertical projection (to a terminal velocity of about 50 fpm) is limited to about four feet. Employment and/or selection of outlets with vertical projection in excess of this elevation negates the air quality advantages of the system. Reduced isolation of overhead heat sources will also likely necessitate a requirement for increased space airflow delivery.

Several factors should be considered when determining the static pressure for plenum applications. Although some leakage occurs around the floor tiles, this amount is minor and any leakage escapes to the space to be conditioned. As such, leakage itself is not a major consideration, however, the pressure should be limited so noise associated with the leakage is not excessive. Another concern involves friction losses that occur due to airflow through the plenum. Static pressures should be maintained sufficiently high that these losses remain a small part of the total pressure loss from the inlet to the farthest supplied diffuser. For a plenum with a depth of 10 to 12 inches (and a reasonable distance from its inlet to the farthest outlet) a pressure of 0.10 to 0.15 is usually sufficient.

Although the maximum flow of the diffuser is determined by the available plenum pressure, its operational airflow should be based upon 1) satisfaction of the load of the space it serves and 2) limitation of its vertical projection to an elevation no greater than the respiration level within the space. In cases where space acoustical levels are critical, the outlet regenerated noise levels may also be determinants of the outlet’s maximum airflow.

Performance Data

Standard VF (Fixed Vertical Discharge)



Performance Data for VF Element (Fixed Vertical Discharge)

Airflow Rate	**Pressure Loss**	**Outlet NC ***	**T_{50}**	**R_{50}**	**Local Temperature Differential (°F) at T_{50} and R_{50}**						
					T_{ROOM} - T_{SUPPLY} (°F)						
(CFM)	(in.w.g.)		(in.)	(in.)	8	9	10	11	12	13	14
20	0.003	<10	10	7	-1.77	-1.99	-2.21	-2.44	-2.66	-2.88	-3.10
30	0.007	<10	14	9	-1.18	-1.33	-1.48	-1.62	-1.77	-1.92	-2.07
40	0.013	<10	19	10	-0.89	-1.00	-1.11	-1.22	-1.33	-1.44	-1.55
50	0.020	<10	24	11	-0.71	-0.80	-0.89	-0.97	-1.06	-1.15	-1.24
60	0.029	<10	29	12	-0.59	-0.66	-0.74	-0.81	-0.89	-0.96	-1.03
70	0.040	<10	33	13	-0.51	-0.57	-0.63	-0.70	-0.76	-0.82	-0.89
80	0.052	12	38	14	-0.44	-0.50	-0.55	-0.61	-0.66	-0.72	-0.78
90	0.066	15	43	15	-0.39	-0.44	-0.49	-0.54	-0.59	-0.64	-0.69
100	0.082	18	48	16	-0.35	-0.40	-0.44	-0.49	-0.53	-0.58	-0.62
110	0.099	21	52	17	-0.32	-0.36	-0.40	-0.44	-0.48	-0.52	-0.56
120	0.118	24	55	19	-0.30	-0.33	-0.37	-0.41	-0.44	-0.48	-0.52
130	0.138	27	58	21	-0.27	-0.31	-0.34	-0.37	-0.41	-0.44	-0.48
140	0.160	30	60	23	-0.25	-0.28	-0.32	-0.35	-0.38	-0.41	-0.44
150	0.184	33	62	24	-0.24	-0.27	-0.30	-0.32	-0.35	-0.38	-0.41

PERFORMANCE NOTES:

1. Pressure loss and noise data is for basic assembly with carpet flange, dirt basket, and airflow control damper in wide open position.
2. NC levels shown assume 10 dB room absorption.
3. Local temperature differentials shown are those predicted at a height coincident with T_{50} and a horizontal distance R_{50} from the diffuser centerline (see diagram above). For example, temperature differentials exceeding -0.66°F(shown above for an airflow rate of 80 CFM and T_{room} - T_{supply} of 12°F) and velocities greater than 50 FPM should be confined to the area within 42 inches of the floor and 16 inches (measured horizontally) from the centerline of the diffuser.
4. Value shown in shaded cells represent airflow rates which can generally be achieved only when the diffusers are ducted and/or directly connected to fan powered terminal units and are not recommended for pressurized floor plenum applications.

Performance Data
Adjustable EU Element

Performance Data for EURO (EU) Element, Set for Vertical Discharge Position

Airflow Rate	Pressure Loss	Outlet NC *	T_{50}	R_{50}	Local Temperature Differential (°F) at T_{50} and R_{50}						
					T_{ROOM} - T_{SUPPLY} (°F)						
(CFM)	(in.w.g.)		(in.)	(in.)	8	9	10	11	12	13	14
20	0.004	<10	11	8	-1.77	-1.99	-2.21	-2.44	-2.66	-2.88	-3.10
30	0.008	<10	16	10	-1.18	-1.33	-1.48	-1.62	-1.77	-1.92	-2.07
40	0.014	<10	21	11	-0.89	-1.00	-1.11	-1.22	-1.33	-1.44	-1.55
50	0.022	<10	26	12	-0.71	-0.80	-0.89	-0.97	-1.06	-1.15	-1.24
60	0.032	<10	32	14	-0.59	-0.66	-0.74	-0.81	-0.89	-0.96	-1.03
70	0.044	<10	37	15	-0.51	-0.57	-0.63	-0.70	-0.76	-0.82	-0.89
80	0.057	<10	42	16	-0.44	-0.50	-0.55	-0.61	-0.66	-0.72	-0.78
90	0.072	<10	47	17	-0.39	-0.44	-0.49	-0.54	-0.59	-0.64	-0.69
100	0.089	<10	53	18	-0.35	-0.40	-0.44	-0.49	-0.53	-0.58	-0.62
110	0.108	<10	58	19	-0.32	-0.36	-0.40	-0.44	-0.48	-0.52	-0.56
120	0.128	10	63	20	-0.30	-0.33	-0.37	-0.41	-0.44	-0.48	-0.52
130	0.151	12	66	21	-0.27	-0.31	-0.34	-0.37	-0.41	-0.44	-0.48
140	0.175	14	69	22	-0.25	-0.28	-0.32	-0.35	-0.38	-0.41	-0.44
150	0.200	16	72	23	-0.24	-0.27	-0.30	-0.32	-0.35	-0.38	-0.41

PERFORMANCE NOTES:

1. Pressure loss and noise data is for basic assembly with carpet flange, dirt basket, and airflow control damper in wide open position.
2. NC levels shown assume 10 dB room absorption.
3. Local temperature differentials shown are those predicted at a height coincident with T_{50} and a horizontal distance R_{50} from the diffuser centerline (see diagram on page 6). For example, temperature differentials exceeding -89°F(shown above for an airflow rate of 60 CFM and T_{room} - T_{supply} of 12°F) and velocities greater than 50 FPM should be confined to the area within 32 inches from the floor and 14 inches (measured horizontally) from the centerline of the diffuser.
4. Value shown in shaded cells represent airflow rates which can generally be achieved only when the diffusers are ducted and/or directly connected to fan powered terminal units and are not recommended for pressurized floor plenum applications.

Performance Data for EURO (EU) Element Set in Horizontal Discharge Position

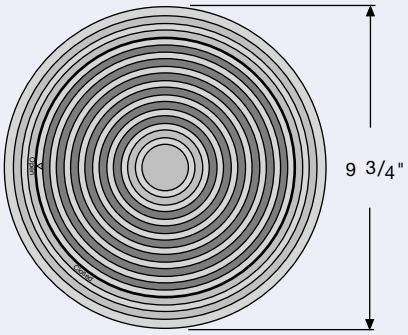
Airflow Rate	Pressure Loss	Outlet NC *	R_{50}	Local Temperature Differential (°F) at R_{50} (4" above floor)						
				T_{ROOM} - T_{SUPPLY} (°F)						
(CFM)	(in.w.g.)		(in.)	8	9	10	11	12	13	14
20	0.011	<10	<12	N/A	N/A	N/A	N/A	N/A	N/A	N/A
30	0.025	<10	<12	N/A	N/A	N/A	N/A	N/A	N/A	N/A
40	0.044	<10	<12	N/A	N/A	N/A	N/A	N/A	N/A	N/A
50	0.069	<10	14	-2.66	-2.99	-2.99	-2.99	-2.99	-2.99	-2.99
60	0.100	17	20	-2.22	-2.49	-2.49	-2.49	-2.49	-2.49	-2.49
70	0.136	22	27	-1.90	-2.14	-2.14	-2.14	-2.14	-2.14	-2.14
80	0.177	28	35	-1.66	-1.87	-1.87	-1.87	-1.87	-1.87	-1.87
90	0.224	33	44	-1.48	-1.66	-1.66	-1.66	-1.66	-1.66	-1.66

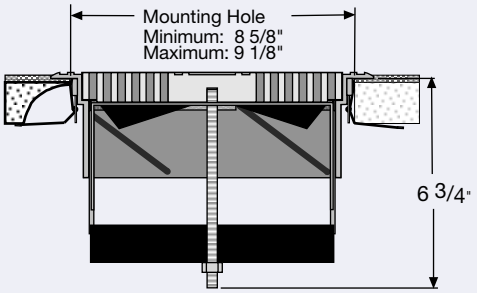
PERFORMANCE NOTES:

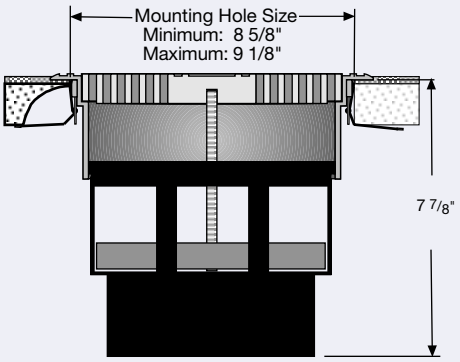
1. Pressure loss and noise data is for basic assembly with carpet flange, dirt basket, and airflow control damper in wide open position.
2. NC levels shown assume 10 dB room absorption.
3. Local temperature differentials shown are those predicted at a height coincident with 4” and a horizontal distance R_{50} from the diffuser centerline (see diagram on page 6). For example, temperature differentials exceeding -2.49°F(shown above for an airflow rate of 60 CFM and T_{room} - T_{supply} of 12°F) and velocities greater than 50 FPM should be confined to the area within 20 inches (measured horizontally) from the centerline of the diffuser.
4. Value shown in shaded cells represent airflow rates which can generally be achieved only when the diffusers are ducted and/or directly connected to fan powered terminal units and are not recommended for pressurized floor plenum applications.

Dimensional Information

FBK/200 with Carpet Flange

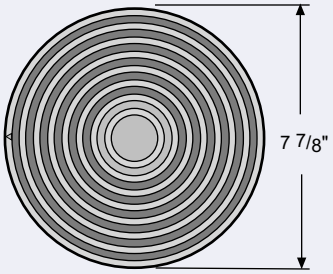


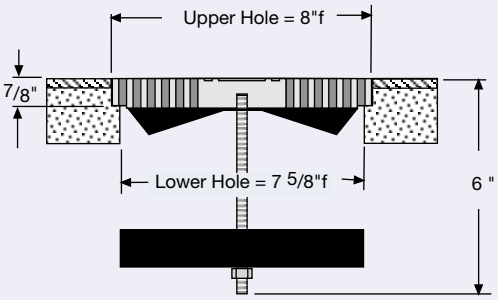




FBK-VAV/200
(with Carpet Flange)

FBK/200 without Carpet Flange

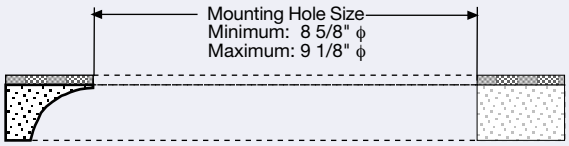




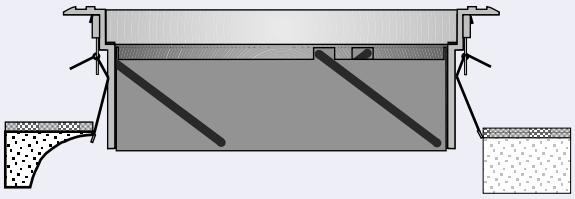
Variable volume model not available without carpet flange

Installation Procedures

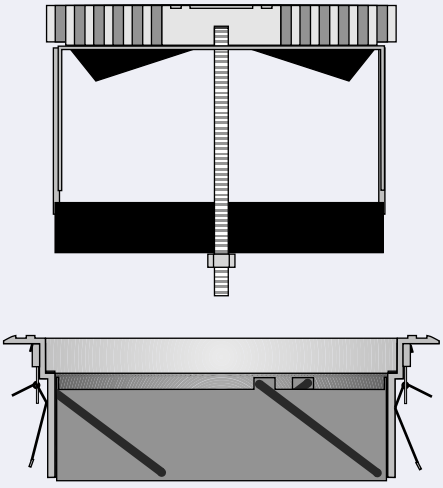
Installation in a Raised Floor Tile with Carpet Flange



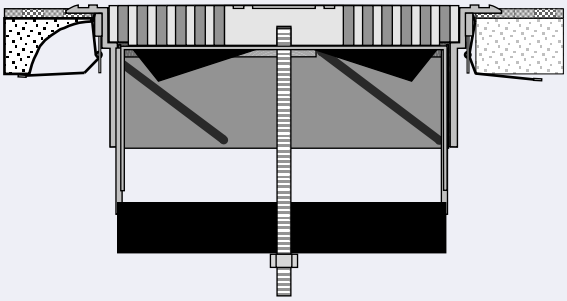
STEP 1: Locate and install the access floor panel and carpet tiles. Assure that the opening in the floor tile is within the dimensional tolerance shown above.



STEP 3: Align the springs such that the long ends (with metal caps) are inserted within the hole in the raised access floor tile.



STEP 2: Remove the core assembly (and VAV chassis where applicable) from the carpet flange. Arrange the springs such that the long end (with the metal cap) faces downward.



STEP 4: Push firmly (applying equal pressure to each side of the carpet flange) until the carpet flange snaps in to the floor tile. Install the core assembly (and VAV chassis, where applicable) into the carpet flange making sure the damper movement arms are placed into the notched openings of the damper sleeve and the core rotation stop is within the milled slot on the bottom of the core.

Specifications

A. General

Contractor shall furnish and install TROX Series FBK/200 floor diffusers as indicated on plans and schedules. Diffusers shall incorporate a removable core section consisting of a series of concentric rings supported by inclined air deflection vanes to distribute air in a cyclonic “swirl” discharge pattern.

B. Materials/Finish

All plastic parts shall comply with NFPA Standard 90A. Exposed surfaces shall be (gray, black or color as specified by architect).

C. Diffuser Features

1. Occupant Airflow Adjustment: Assembly shall provide for occupant adjustment of the outlet airflow rate without removal of the diffuser face or other components. Adjustment shall be accomplished by rotation of the diffuser face. Adjustment through the full airflow range shall require no less than a 30 degree rotation. and be accomplished by hand without use of tools or other mechanical devices. A damper position indicator shall be inscribed on the diffuser face.

2. Balancing Provisions

The outlet shall allow field adjustment of a maximum airflow setting. Adjustment of such shall not affect the ability of the occupant to adjust the outlet airflow, except to limit its maximum airflow availability.

3. Liquid and Solid Debris Retention

A dirt and liquid catch basin shall be furnished to facilitate removal of dust, spills, or other objects that penetrate the outlet face. This basin must be capable of capturing and retaining at least 20 fluid ounces of liquid spillage.

4. Core Removal Provisions

Diffuser shall include a detent mechanism which (when activated) requires the use of a special tool to remove the diffuser core. The activation of this security feature shall not affect the ability of the occupant to manually adjust the outlet airflow delivery.

D. Air Diffusion Performance

Outlet airflow rates shall be limited to that which results in a terminal velocity no greater than 50 fpm when measured four (4) feet directly above the diffuser face (with a temperature differential of 12°F between room and supply air).

E. Installation

Installation requires that a mounting hole (8.75 diameter) in the access floor tile be provided by others. The carpet ring shall support the diffuser core while preventing fraying of the carpet edges, providing a minimum ½” overlap of the carpet surface adjacent to the opening. The carpet ring shall be rigidly mounted to the access flooring system by snap fasteners that contact the lower surface of the access floor tile at a minimum of four points. Diffuser mounting shall be performed upon completed installation of the raised floor and carpet tiles and its removal shall not necessitate the removal of any carpet or floor tiles.

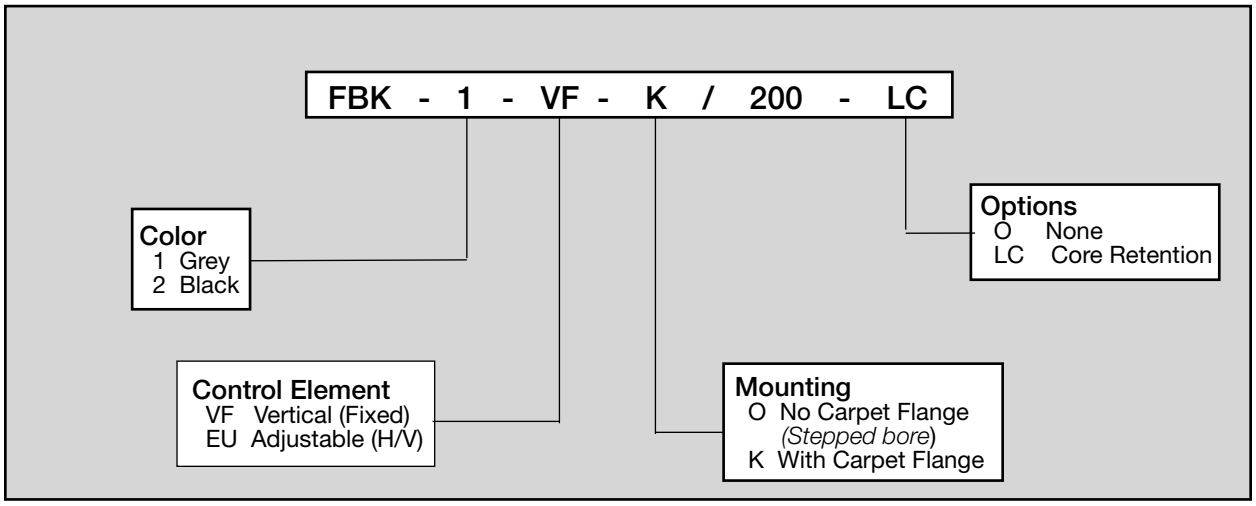
F. Structural Capacity

The diffusers shall be capable of supporting a load of 1,350 pounds applied evenly across a 1 square inch area located at the center of the diffuser face.

G. Compliance with Specification

The diffuser specifications and requirements contained herein supercede and transcend any other mention or description of floor supply diffusers offered in other sections of the building plans and/or specification.

Ordering • Other TROX UFAD Products



OTHER UNDERFLOOR PRODUCTS FROM TROX USA

FBA & FBM/200 series diffusers

- Constructed of heavy duty aluminum
- Nominal 8” diameter diffuser, delivers up to 100 CFM in plenum applications, 150 CFM when ducted or supplied by a fan terminal.
- Easy (manual) adjustment of outlet airflow rate by occupant
- FBA-VAV/200 variant provides automatic reset of airflow rate upon a signal from the space thermostat or BAS (by others).
- See publication PI/1/8.1/US/4 for further information.

FBA & FBK/150 series diffusers

- Available in heavy duty aluminum or plastic construction
- Nominal 6” diameter diffuser, delivers up to 50 CFM in plenum applications, 75 CFM when ducted or supplied by a fan terminal.
- Manual adjustment of outlet airflow rate by occupant.
- See publication PI/1/9/US/4 for further information.

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Accessory Plenum Boxes for FBK, FBA and FBM floor diffusers

- Designed for connection to flexible or rigid duct.
- Available with thermostatically controlled actuators for VAV applications.
- Contact TROX USA for further information.

Fan terminals for UFAD systems

- Seven different models for almost any UFAD application.
- Four sizes provide capacities up to 1800 CFM each.
- All models and sizes are specifically designed to fit within the structure of a low height raised access flooring system.
- See publication TB111203 for further information on these terminals.

TROX FB series floor diffusers can also be used in under seat applications such as those found in theatres and performing arts facilities. Contact TROX USA for information regarding these applications.

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Trox France Sarl
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FSL FassadenSystemLuftung
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Italy
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Trox (Malaysia) Sdn. Bhd.
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Auranor Group AS
Poland
Trox Austria GmbH
South Africa
Trox (South Africa) (Pty) Ltd.
Spain
Trox Española, S.A.
Switzerland
Trox Hesco (Schweiz) AG
Yugoslavia
Trox Austria GmbH

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