



MANUAL – INSTALLATION + OPERATIONS

Small Square VAV Diffuser with Blade Damper

VKD - Varitherm Series

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PRICE | VAV
DIFFUSERS

VARITHERM SMALL SQUARE VAV DIFFUSER

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VARITHERM SMALL SQUARE VAV DIFFUSER

INSTALLATION INSTRUCTIONS

Damaged Freight Claim Procedure

When the diffusers are received, inspect for damage which may have occurred during shipment. If damage is evident, it should be noted on the carrier's freight bill. A written request for inspection by the carrier's agent should be made at once.

Storage

Cartons should always be stacked on end. Do not stack cartons flat on their sides. Excessive weight may cause damage to the diffusers. Do not store at temperatures exceeding 130°F/56°C.

Identification

The model designation is on the diffuser and on the carton.

Installation Precautions

When installing diffusers, make sure construction debris does not enter the diffuser or duct system. Because the model VKD-HC controls room temperature by sensing the room air induced up the center of the room, care should be taken not to disturb room air induction and entrainment. For example, location next to walls or dropped lights results in the reflection of primary air back at the Varitherm Small Square VAV diffuser and should be avoided. A three-way blow Varitherm Small Square VAV diffuser should be used in this instance if either the light or the Varitherm Small Square VAV diffuser cannot be relocated.

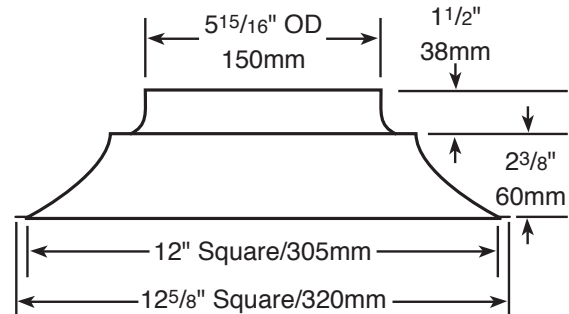
Installation Instructions

1. Inspect the carton for damage before opening. Notify carrier if external damage exists. Submit all claims for shipping damage to the carrier.
2. Move diffusers (in cartons) to installation area. Note unit identification.
3. Remove cardboard box and other packaging. Discard packing material.
4. If other than 4 way blow pattern is factory installed, note the "AIRFLOW" markings on the top of the diffuser and locate those sides in the proper direction.
5. Install in ceiling grid. Install T-bar support wire close to each corner of diffuser. Make sure that only wire suspended T-bars are used to support diffuser weight. (Adaptor frames are available for other ceilings.)
6. Connect and secure the supply duct to the collar. Flexible duct should NOT be formed in a centerline radius of less than 1½ times the duct diameter (9in/230mm radius).
7. Do NOT reset the temperature set point on the VKD-HC model until the space is occupied. It is factory preset for average conditions (74°F/23°C).
8. Balance the system. See **System Balancing**.
9. After the air conditioning system is started and after the space is occupied, where necessary adjust the temperature set point on VKD-HC models to suit the occupant. See **Adjusting Temperature**.

Operating Instructions

Operating instructions for model VKD-HC are located on the back of the appearance panel.

FIG. 1 DIMENSIONS ▼



VARITHERM SMALL SQUARE VAV DIFFUSER

INSTALLATION INSTRUCTIONS

Opening the Appearance Panel

The appearance panel is attached with a latch clip on one side and hinges on the opposite side.

To open the appearance panel (on a Varitherm Small Square VAV diffuser installed in the ceiling):

1. Locate the side of the Varitherm Small Square VAV diffuser to the right (clockwise) from the thermostats.
2. Using two hands, one on each side of the latch clip bracket, place your fingers above the appearance panel and firmly pull down to disengage the clip. The appearance panel will rotate and hang down vertically on the hinges.

To close the appearance panel:

1. Rotate the panel upward.
2. Latch the panel by pushing the clip into the small square hole in the bracket.

To remove the appearance panel:

1. Open appearance panel as described above.
2. Rotate the appearance panel away from the latch clipbracket to force the hinge hooks open on the panel.
3. Slightly lift the panel to remove from the hinges.

To reattach the appearance panel:

1. Hang the appearance panel on the hinges.
2. Press the hinge hooks against the panel to close around the hinge brackets.
3. Close panel as described above.

VARITHERM SMALL SQUARE VAV DIFFUSER

SYSTEM BALANCING (VKD-HC, VKD-C)

VAV systems are balanced for design air volume at maximum air flow and systems using Varitherm Small Square VAV diffusers are no exception. When all the Varitherm Small Square VAV diffusers are set for maximum air flow by fully opening them, the system is really a constant air volume system and is balanced as a constant volume system. Balancing dampers are best located at the takeoff before the runout to the Varitherm Small Square VAV diffuser.

1. Prepare the system for balancing. (Make necessary checks for diversity, fan capacities, fan rotation, minimum outside air requirements, duct leaks and static pressure controller design settings. Set outside air control damper for minimum air and return air control damper for maximum air.)
2. Open Varitherm Small Square VAV diffusers.
 - a. Open appearance panel.
 - b. Using a flat blade screwdriver or coin, turn the damper opening cam clockwise until the damper blades are fully open and the blade tips touch each other. See **Fig. 3**.
 - c. Close appearance panel.
3. Start fans, adjust system for 100% air flow and make system checks. (Measure static pressure across filters and coils and at sensor for static pressure controller. Measure supply, return and branch duct air flow.)
4. Place a direct reading diffuser balancing hood over the face of each Varitherm Small Square VAV diffuser and adjust damper at duct takeoff to obtain maximum design air volume. If a velocity meter is used, measure discharge velocity at the housing (See **Fig. 3**). Multiply the velocity in fpm times A_k of .12 ft² to get air flow in cfm.
5. Return Varitherm Small Square VAV diffusers to operating condition.
 - a. Open appearance panel.
 - b. Turn damper opening cam to allow damper blades to close.
 - c. Close appearance panel.

Balancing (VKD-D)

1. The damper blade opening is factory set at 3/4 inch/19mm (See **Fig. 4**). Readjust where necessary by turning the damper opening cam (See **Fig. 2**).
2. Place a direct reading diffuser balancing hood over the face of each VKD-D diffuser and adjust damper at duct takeoff to obtain design air volume. If a velocity meter is used, measure discharge velocity at the housing (See **Fig. 3**). Multiply the velocity in fpm times A_k of .12 ft² to get air flow in cfm.

FIG. 2 TURN DAMPER OPENING CAM TO OPEN FOR BALANCING ▼

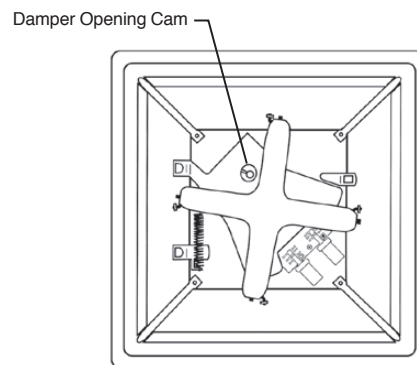


FIG. 3 MEASURING DISCHARGE VELOCITY ▼

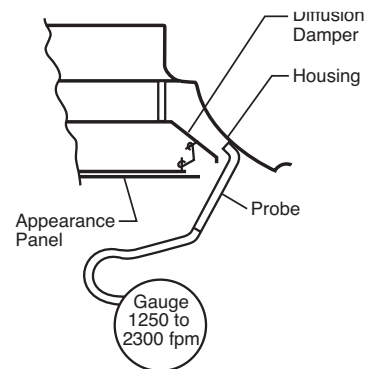
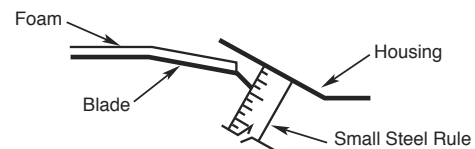


FIG. 4 MEASURING DAMPER BLADE OPENING ▼



VARITHERM SMALL SQUARE VAV DIFFUSER

ADJUSTING MIMINUM FLOW & TEMPERATURE SETPOINTS

FIG. 5 PERCENT MINIMUM FLOW VS. BLADE OPENING ▼

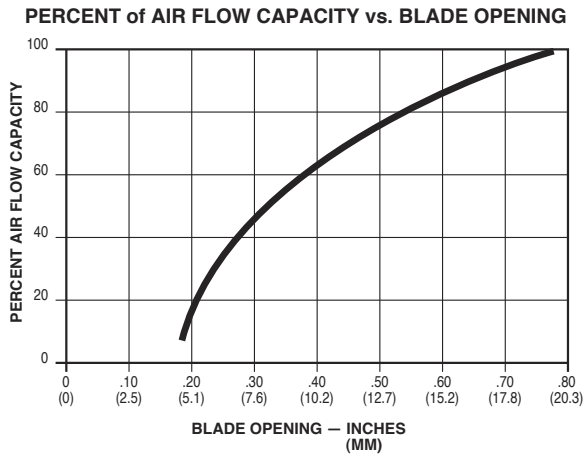
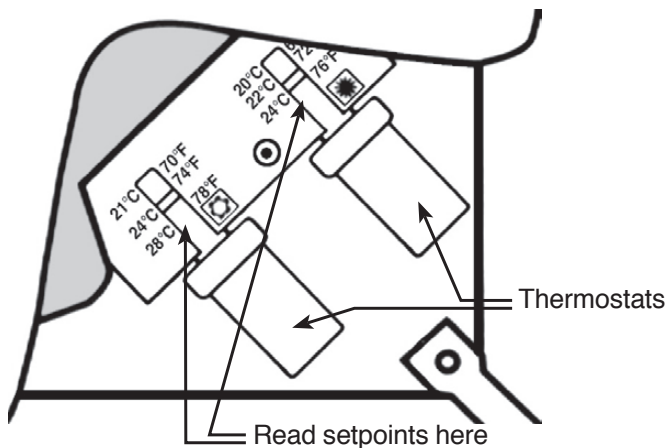


FIG. 6 ROOM TEMPERATURE SET POINT ADJUSTMENT ▼



Adjusting Minimum Flow (VKD-HC, VKD-C)

Minimum flow is adjusted by turning the damper opening cam until the damper blades are open the correct amount. Determine the correct blade opening for the required percent minimum flow from the graph in **Fig. 5**. Measure the blade opening as shown in **Fig. 3** and adjust the damper opening cam.

Adjusting Temperature Setpoints

The VKD-HC Varitherm Small Square VAV diffuser is factory set for 74° F/28°C for both heating and cooling. Because heat loads in various rooms differ and individual occupants prefer different temperatures, it is recommended that the thermostats should not be adjusted until after a few days of operation.

Room temperature set points are adjusted by screwing the thermostats in or out – in for cooler or out for warmer. Determine the set point by aligning the white indicator with the °F or °C numbers on the temperature scale (See **Fig. 6**).

The thermostats may be slightly harder to screw in or out when warm because the shaft is extended, putting more pressure on the thermostat. If you are unable to turn the thermostat in this situation, cool the thermostat by holding an ice cube to the large end. The shaft will then contract and the thermostat will turn easily for adjustment.

VARITHERM SMALL SQUARE VAV DIFFUSER

ADJUSTING MIMINUM FLOW & TEMPERATURE SETPOINTS

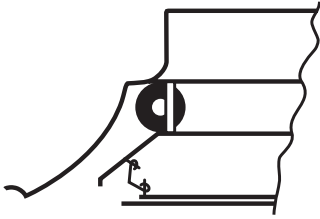
Recommended Adjustments for Various Conditions

	Room Temp.	Blade Position	Recommended Action
Cooling Mode VKD-HC	Too Cold	open	Adjust cooling for higher room temperature set point. (Screw cooling thermostat out.)
		closed	Varitherm Small Square VAV diffuser is correct. Check if cooling is still required, and if not, turn cooling unit off.
	Too Warm	open	Varitherm Small Square VAV diffuser is correct. Check for lack of air or for too warm air temperature.
		closed	Adjust cooling thermostat for lower room temperature setpoint. (Screw cooling thermostat in.)
Heating Mode VKD-HC	Too Cold	open	Varitherm Small Square VAV diffuser is correct. Check for lack of air or too low air temperature.
		closed	Adjust heating thermostat for higher room temperature setpoint. (Screw heating thermostat out.)
	Too Warm	open	Adjust heating thermostat for lower room temperature setpoint. (Screw heating thermostat in.)
		closed	Varitherm Small Square VAV diffuser is correct. Check if heating is still required, and if not, turn it off.
Too Noisy VKD-HC VKD-D	Any	Any	Reduce static pressure. Recommended static pressure is .05 to .25 wg / 10 to 60 Pa at the inlet of the diffuser. If lower noise level does not result from lower static pressure, check for and correct noise generating restrictions in the duct upstream such as large pressure drops over dampers, heaters, etc.

VARITHERM SMALL SQUARE VAV DIFFUSER

BLOW PATTERNS (VKD-HC, VKD-C, VKD-D)

FIG. 7 FIELD INSTALLED FOAM BAFFLE ▼



A major selling feature of the VKD-HC diffusers is the ability to easily add or remove blow patterns in the field. This is done by blocking the air off behind the blades on the appropriate sides.

DO NOT:

- Disconnect the spokes.
- Tape, screw or otherwise lock the blade closed. This unbalances the loads on the center bearings.
- Block the venturi nozzle.

DO block air flow behind the blades or between the standoffs. (Standoffs are the supports between the housing and the diffusion plate.) Ways to do this are:

1. Factory installed directional baffles. These are strips of metal wrapped around the standoffs to block one, two or three sides. These can be removed in the field after first removing the diffusion plate assembly.
2. Field installed directional baffles. These are made of 1-¹/₈" / 28.575mm diameter x 5-⁵/₈" / 143mm long insulation (Armaflex) for ³/₈" / 9.525mm refrigeration lines. Insert between the housing and the diffusion plate/blade assembly and wedge between the standoffs (See **Fig. 7**). Take care to clear the damper hinges so that the damper operates freely.

The rule for blocking the appropriate side is: Always block the thermostat side. (See **Fig. 7** for examples.)

NOTE: Some earlier VBD-C and VBD-CW models have one induction slot by the thermostat instead of four venturi nozzles. The rule for blocking the appropriate side for this version is: Never block the thermostat side.

When blocking for direction, the air volume for a given static pressure is reduced from max. air volume listed in the performance guide by:

Blow Patterns	Blade Opening
3 way (D3)	0.80
2 way opposite (D2)	0.64
2 way corner (D2C)	0.59
1 way (D1)	0.45

VARITHERM SMALL SQUARE VAV DIFFUSER

MAINTENANCE & CONTROLLING THE SYSTEM

Maintenance

The moving parts of the VKD Varitherm Small Square VAV diffuser have no maintenance or lubrication requirements. We are often asked to recommend periodic maintenance procedures and a spare parts stock. Recommended maintenance is to clean the outer surfaces of the Varitherm Small Square VAV diffuser—nothing else. We do not recommend stocking any spare parts. Our customers also confirm that stocking is unnecessary.

Controlling the System

References:

- System Design, p 3, VKD brochure, Form 051.101.
- Chapters 2.2, 3.1 and 3.2, pp 6, 7 and 8, Designing Modular VAV Systems, Form 5.2.
- Air Handling and Fan Coil Units Subzoned with Varitherm Small Square VAV VAV modules, Form 6.7.
- DX Equipment Zoned with Varitherm Small Square VAV VAV Modules, Form 6.5.

Supply Air Temperature

The sources of cooling and heating are controlled from supply air temperature. As with all VAV systems, the goals are to achieve a constant supply air temperature (may be reset to another constant supply air temperature) and to limit the supply air temperature. Limits for supply air temperature should be between 50°F/10°C and 68°F/20°C when cooling and between 80°F/26.5°C and 120°F/49°C when heating. The heating temperature limit should be as low as possible. These objectives are best achieved by modulating chilled water valves, hot water valves and other variable equipment from supply air temperature. On/off equipment such as DX compressors and electric heat are cycled from supply air temperature. Use a discharge air sensor for the supply air temperature signal.

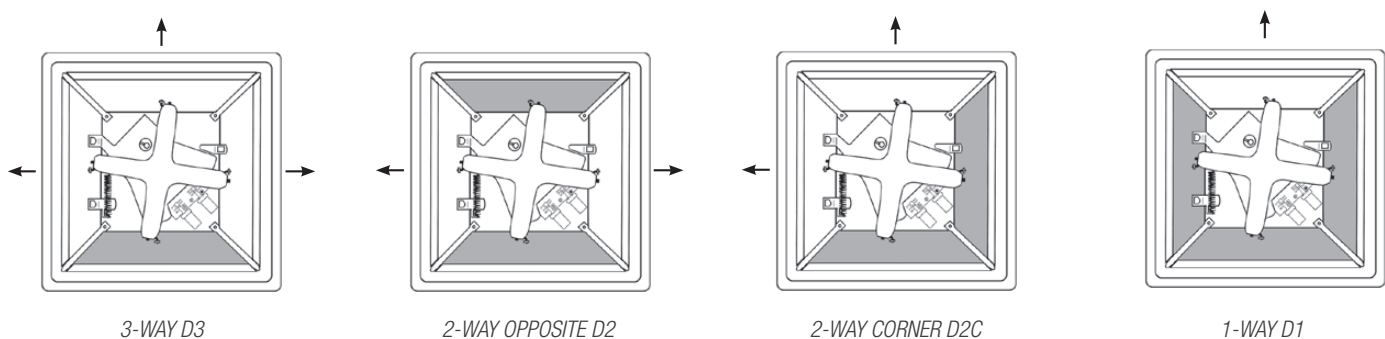
Mode change between heating, recirculation and cooling is controlled from room temperature. Signals from one or more room temperature sensors may be used for mode change. When using more than one sensor, either a “majority rules” or a “cooling dominant” approach is recommended.

Static Air Pressure

As with all VAV systems, the fan must run continuously during occupied times. Goals of static pressure control are to provide enough static pressure to obtain the required air volume especially at the diffuser farthest from the fan, to avoid diffuser noise by limiting static pressure at both full flow and turndown and to provide pressure independence or consistent operation as the system flow changes.

These objectives can be achieved with the usual methods of automatic static pressure control: bypass dampers, discharge dampers, zone dampers, and fan control (variable speed drives, inlet dampers, etc.). Locate the static pressure sensor as far down the duct as possible—at least 2/3 down the duct from the first takeoff.

FIG. 8 BLOW PATTERNS ▼



VARITHERM SMALL SQUARE VAV DIFFUSER

TROUBLE SHOOTING (VKD-HC, VKD-C)

Trouble shooting Varitherm Small Square VAV diffusers requires looking at the system as a whole. Before examining the Varitherm Small Square VAV diffuser for failure it is worth the time to be sure the system is functioning properly and that something has not been overlooked.

System Check List

The system should be:

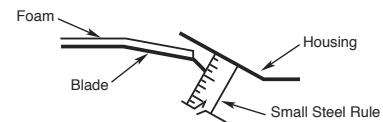
1. Delivering 50° - 68°F/10° - 20°C supply air when in the cooling mode.
2. Delivering 80° - 120°F/26.5° - 49°C supply air when in the heating mode.
3. Maintaining static pressure at the inlet to each Varitherm Small Square VAV diffuser between .05" and .25"wg/12 Pa and 62 Pa.
4. Maintaining continuous fan operation during occupied hours.

Varitherm Small Square VAV Diffuser Check List

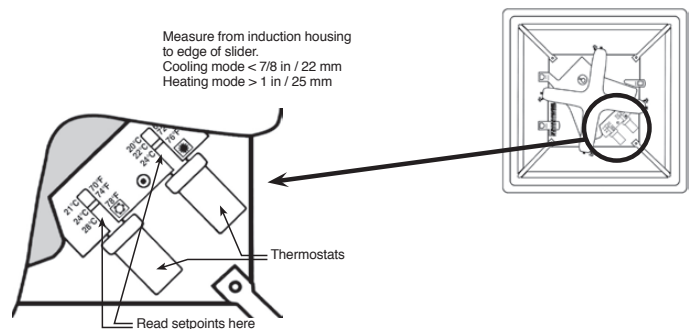
Once the above checks have been completed, examine and record the following (temperature may vary over time; several measurements at different times may be required):

1. Room temperature 4 feet above the floor directly under the Varitherm Small Square VAV diffuser.
2. Supply air temperature at the Varitherm Small Square VAV diffuser.
3. Static pressure at the inlet of the Varitherm Small Square VAV diffuser.
4. Blade opening from the edge of the blade, measured perpendicular to the housing.
5. Thermostat slider position.
6. Cooling and heating setpoints.
7. Damper opening cam—positioned for blades fully closed, partially open or fully open.
8. Is the Varitherm Small Square VAV diffuser located within 2ft/600mm of a vertical protrusion such as a wall or dropped beam which could disturb induction airflow?
9. Is the Varitherm Small Square VAV diffuser located within 2ft / 600mm of a vertical protrusion such as a wall or dropped beam which could disturb induction air flow?

POINT 4 ▼



POINT 5 ▼



VKD-HC DIFFUSER APPEARANCE PANEL REMOVED

VARITHERM SMALL SQUARE VAV DIFFUSER

TROUBLE SHOOTING (VKD-HC, VKD-C)

Trouble Shooting Data Log

Location	Date	Time	Room Temp	S.A. Temp	Duct S.P.

Blade Opening	T-stat Slider	Set Points		Room Thermostat Position
		Cooling	Heating	

VARITHERM SMALL SQUARE VAV DIFFUSER

TEN YEAR WARRANTY

Price Industries warrants that its Varitherm Small Square VAV diffusers, exclusive of any options and accessories (whether factory or field installed) shall be free from defects in material or workmanship for a period of ten (10) years from the date of shipment and agrees to repair or replace, at its option, any parts that fail during said ten (10) year period due to any such defects which would not have occurred had reasonable care been taken, provided that such parts have been inspected by Price and found defective and provided the diffusers have been given normal and proper usage and all parts and controls remain unaltered. Price makes **NO WARRANTY OF MERCHANTABILITY OF PRODUCTS OR OF THEIR FITNESS FOR ANY PURPOSE OR ANY OTHER EXPRESS OR IMPLIED WARRANTY WHICH EXTENDS BEYOND THE LIMITED WARRANTY ABOVE. PRICE'S LIABILITY FOR ANY AND ALL LOSSES AND DAMAGES RESULTING FROM DEFECTS SHALL IN NO EVENT EXCEED THE COST OF REPAIR OR REPLACEMENT OF PARTS FOUND DEFECTIVE UPON EXAMINATION BY PRICE. IN NO EVENT SHALL PRICE BE LIABLE FOR INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES OR DAMAGES FOR INJURY TO PERSONS OR PROPERTY.** Price shall not be responsible for freight to or from its plant in connection with the inspection, repair or replacement of parts under the terms of this limited warranty nor for cost of removal or installation.



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