

TK Therma-Fuser™

Small Thermally Powered VAV Diffuser



- Models:
- TK-HC** Separate set points for VAV heating and VAV cooling
 - TK-C** One set point for VAV cooling only
 - TK-D** Manually adjustable
 - TK-RA** Matching return air



TK: Product Overview
FORM 051.101 REV 1704

BENEFITS AT A GLANCE.

SPECIFICALLY DESIGNED FOR TASK CONDITIONING

- Provides VAV heating and VAV cooling in a compact size favored by architects.
- Built-in concealed tamper resistant thermostats sensing zone air solve the difficulty of locating individual thermostats in an open office.
- Dial in temperature set points—no turns to count and no tools required.
- Highest ADPI* of any task conditioning system.

SIMPLE LOW COST CEILING AIR DISTRIBUTION

- Uses conventional ceiling duct systems to avoid leaky plenum supply, costly raised floors or special partitions and furniture.
- Standard supply air temperatures provide more energy savings and better humidity control than systems blowing warmer supply air directly on occupants.
- Easily upgrades existing ceiling systems.

ONLY THERMA-FUSER™ VAV OFFERS THESE BENEFITS

- Superior air distribution—longer throws, no dumping, more entrainment, even temperature distribution, higher ADPI* and better ventilation effectiveness.
- Lowest cost per zone of control.
- Lowest energy VAV terminal—green VAV.
- Low to no maintenance—10 year warranty.
- Easily adapts to office changes.
- Only thermally powered terminal offering both VAV heating and cooling.

*ADPI (Air Diffusion Performance Index)

HOW IT WORKS

The model TK Therma-Fuser diffuser is a 12⁵/₁₆ in / 320mm square ceiling diffuser with built-in temperature controls. The TK has four dampers that open and close to meter airflow (warm or cold) into the room in response to room temperature. The dampers are mechanically actuated by thermal actuator/thermostats.

Each thermostat/actuator is a small brass cylinder containing a petroleum-based wax. The wax expands when heated, driving a piston out. A spring retracts the piston when the wax cools and contracts. The movement of the piston positions the dampers in a proportional manner.

ROOM AIR SENSING

As with all diffusers, air circulates around the room in a circular motion. Secondary air rises under the diffuser, passes beneath the appearance panel and entrains with the primary air at the outside edge of the diffuser. (*fig. 1*). This secondary air best represents average room temperature.

To monitor average room temperature, a continuous sample of secondary air is drawn around the appearance panel past the room thermostats. This is accomplished by feeding primary air through venturi nozzles. Primary air blowing through the nozzles creates just enough vacuum to draw some secondary air around the appearance panel, over the thermostats and out the other side. A properly applied TK will hold the room within 1.5°F/0.9°C of the temperature selected.

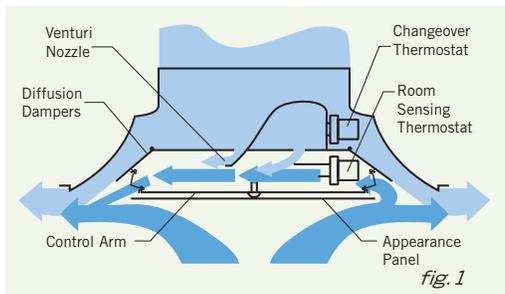
COOLING MODE

In the cooling mode, the dampers open on a rise in room temperature. As the room warms, the wax in the room thermostat melts and expands. This pushes the piston out from the thermostat causing the dampers to open and allow more supply air into the room. When the room cools, the wax contracts, a spring retracts the cooling thermostat piston and the dampers close.

CHANGEOVER (TK-HC ONLY)

Changeover between heating and cooling modes is determined by supply air temperature. A third thermostat located in the inlet of the Therma-Fuser diffuser senses supply air temperature. Warming the changeover thermostat disengages the cooling thermostat and engages the heating thermostat.

Changeover from cooling to heating begins at supply air temperature of 74°F/23°C and completes around



80°F/26.5°C. Changeover back to cooling is completed when the supply air temperature reaches 68°F/20°C.

HEATING MODE (TK-HC ONLY)

In the heating mode, the dampers open on a drop in room temperature. As the room cools, the wax contracts, a spring retracts the heating thermostat piston and the dampers open allowing more supply air into the room.

ADJUSTING SET POINTS

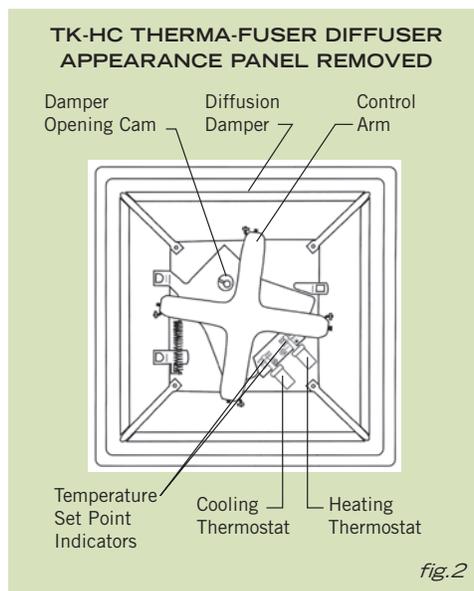
Room temperature set points for heating and cooling are separately adjusted by screwing the heating (red scale) or cooling (blue scale) thermostats—in for cooler and out for warmer. Align the white indicator on each thermostat with the °F or °C numbers on the temperature scale. The cooling room temperature may be set between 70°F/21°C and 78°F/25.5°C and heating between 68°F/20°C and 76°F/24°C. Both are factory set at 74°F/23°C. (The model TK-C has only one thermostat.)

OPEN FOR BALANCING

To open for balancing, adjust the damper opening cam for maximum blade opening. (*fig. 2*).

MINIMUM FLOW

Use the damper opening cam to adjust the minimum damper opening. (*fig. 2*). For an approximate minimum flow of 20%, adjust for a 7/32 in / 5.5mm dimension from blade tip to the housing.



SYSTEM DESIGN

The best control for heating/cooling units supplying air to VAV terminals is a discharge thermostat which maintains a constant supply air temperature. With DX equipment, these are a high and low limit. For hybrid systems (part VAV and part constant volume), control the heating/cooling supply unit with a thermostat in one of the rooms with a constant volume diffuser, preferably the space with the greatest load. For both VAV and hybrid systems, the fan should run continuously.

The constant discharge velocity of Therma-Fuser diffusers at varying airflow provides good room circulation which reduces stratification. Keeping heating supply air temperatures as low as possible will further reduce room air stratification to a negligible level.

Static pressure at the inlet of the Therma-Fuser diffuser should be between .05"wg. / 12Pa and .25"wg. / 62Pa at full and partial air flows. Static pressure below .05"wg. / 12Pa will result in low air flow and less induction. Above .25"wg. / 62Pa, Therma-Fuser diffusers operate well, but excessive noise may result. Use minimum flow adjustment where Therma-Fuser tight shut off is not needed.

If the system turns down more than 30%, static pressure should be controlled. Included in the options for static pressure control are modulating bypass dampers and fan control. Modulating zone dampers are recommended where several zones share a higher pressure duct or riser.

When designing ducts, if Therma-Fuser diffusers are to deliver nominal volume at inlet static pressure of .15"wg. / 37Pa and if a maximum static pressure of .25"wg. / 62Pa is to be held for quiet operation, size the duct for a maximum pressure drop of .1"wg. / 25 Pa between the first and last takeoff.

Manual balancing dampers should be used at the takeoff for each diffuser. Manual balancing dampers may not be required with ducts designed to Acutherm specifications.

Because Therma-Fuser diffusers control room temperature by sensing room air induced up the center of the space, 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 Therma-Fuser diffuser. Avoid this with a three-way blow pattern or relocate either the Therma-Fuser diffuser or the light.

Acutherm has "how to" system design brochures for almost every ducted air system. For specific recommendations, refer to the brochure for your system.

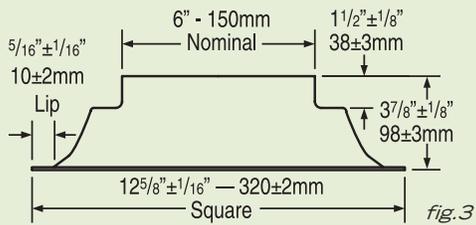
Inlet Designation	Inlet Static Pressure in wg	Maximum Flow cfm	Maximum Flow		25% Maximum Flow	
			Throw - Feet @ $v_t=50/100/150$ FPM	†NC	Throw - Feet @ $v_t=50/100/150$ FPM	†NC
6	.05	115	8/6/4	<15	4/3/2	<15
	•.08	145	9/7/5	19	4/3/2	16
	.10	165	10/7/6	22	5/4/3	16
	.15	205	11/8/7	30	5/4/3	25
	.20	235	12/9/8	34	6/5/4	30
	.25	265	13/10/9	37	7/5/4	34

PERFORMANCE GUIDE in SI (METRIC) UNITS

Inlet Designation	Nominal Inlet Dia. mm	Inlet Static Pressure Pa	Maximum Flow		Maximum Flow Throw (m)*@ $v_t =$				25% Maximum Flow Throw (m)*@ $v_t =$			
			L/s	m³/h	.25 m/s	.50 m/s	.75 m/s	†NC	.25 m/s	.50 m/s	.75 m/s	†NC
6	150	10	50	179	2.3	1.8	1.2	<15	1.0	0.7	0.4	<15
		• 20	69	247	2.8	2.0	1.5	19	1.3	1.0	0.7	16
		30	86	301	3.2	2.3	2.0	25	1.4	1.1	0.8	20
		40	100	359	3.4	2.5	2.2	31	1.6	1.3	1.0	26
		50	111	400	3.7	2.8	2.5	34	1.8	1.4	1.1	30
		60	123	441	3.9	3.0	2.6	36	2.1	1.5	1.2	33

- Denotes 750 fpm / 3.81 m/s inlet velocity.
- * Throw data is for air 20°F/11°C lower than room temperature. Throws for isothermal air are 40 to 50% greater.
- † NC based on $L_w(10^{-12}$ watts reference) -10db
- Tested in accordance with ANSI/ASHRAE 70, ANSI S12.31, ARI 890, ISO 5219 and ISO 3741.
- When using Acutherm directional baffles for other than 4-way blow patterns, reduce the maximum air volume as shown in Acutherm Form 051.201.

DIMENSIONS



a micrometer-type temperature scale located right above the hinge down panel. Heating and cooling temperature setpoints shall be separately adjustable between 70°F/21°C and 78°F/26°C for cooling and between 68°F/20°C and 76°F/24°C for heating. The initial setpoints shall be factory set at 74°F/23°C.

panel that can be unlatched and folded down to hang allowing hands free for adjusting temperature set points. Instructions for the diffuser shall be on the inside of the appearance panel.

G. The VAV diffusers shall have positive induction of secondary room air over the thermostat at all flows from fully closed to fully open.

H. The VAV diffusers shall have a built-in damper opening cam adjustable from a minimum of 0 to 100% airflow. The damper opening cam shall also open the diffuser for balancing. VAV diffusers requiring tools, adjustment of set points or adjustment of supply air temperature to open for balancing shall not be allowed.

I. The manufacturer shall warrant that the diffuser shall be free from defects in materials and workmanship for a period of ten years from date of shipment.

J. Manufacturer's ratings for flow and sound shall be verified by an independent testing laboratory certified for ARI Standard 890 testing.

K. Supply air to the VAV diffuser shall be constant temperature (may be reset to another constant temperature). Supply air shall be limited to no lower than 50°F/10°C on cooling and no higher than 120°F/49°C on heating. The heating high limit shall be as low as possible but no lower than 80°F/27°C.

D. In the cooling mode, the VAV diffusers shall open on a rise in room temperature and, in the heating mode shall close on a rise in room temperature. The changeover thermostat shall be factory installed and adjusted to engage the heating mode when the supply air temperature rises above 80°F/27°C and return to the cooling mode when the supply air temperature falls below 68°F/20°C. During changeover the diffuser shall close. Nothing including the changeover mechanism shall extend above the inlet of the diffuser.

E. The VAV diffusers shall have four perimeter dampers to provide 40 lineal inches / 1015 lineal mm of variable discharge area at the perimeter of the diffuser. The housing shall be square and be aerodynamically contoured for increased capacity and with an offset ridge on each of the four edges to provide better airflow in lay in installations.

F. All VAV diffusers shall have a solid (no holes or slots) hinged square appearance

GUIDE SPECIFICATION

(Suitable for Section 23 36 16 Variable Volume Units of the CSI Master Format.) Material in italics applies only to model TK-HC. Delete the italics for model TK-C.

2.2 Thermally Powered VAV Diffusers

A. Thermally-powered variable air volume diffusers shall be Therma-Fuser model TK manufactured by Acutherm, Hayward, CA.

B. Each thermally-powered variable air volume diffuser shall be a complete VAV terminal and thermostat self-contained in a 12 5/8 in / 320mm square diffuser. It shall be thermally powered with one room thermostat/actuator, one heating thermostat/actuator and one changeover thermostat/actuator. External wiring or pneumatics shall not be allowed.

C. The room thermostat set points shall be adjustable without tools using



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TEN YEAR WARRANTY

Acutherm warrants that its TK diffuser, exclusive of any options and accessories (whether factory or field installed) shall be free from defective 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 and proper usage and all parts and controls remain unaltered. Acutherm 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. ACUTHERM'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 ACUTHERM. IN NO EVENT SHALL ACUTHERM BE LIABLE FOR INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES OR DAMAGES FOR INJURY TO PERSONS OR PROPERTY. Acutherm 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.

ACUTHERM PRODUCT GUIDE



Square VAV Diffusers

Round VAV Diffusers

Linear VAV Diffusers

Accessories

Pressure Control

Temperature control

PRODUCT INFORMATION DESCRIPTION

Use the following model number nomenclature to order Therma-Fuser diffusers, options and accessories.

Product

(1) Model	(2) Type	(3) Size
TK		6

Product

- Model: **TK** – Small square Therma-Fuser diffuser
- Type: **C** VAV cooling only, **HC** VAV heating and cooling, **D** Manually adjustable, **RA** matching return air,
- Size: **6** inch inlet

Options

(1) Remote Adjust	(2) Insulation	(3) Security Hanger	(4) Blow Patterns
(5) Silk Screen	(6) Sensor		

Options

- Remote Adjust: **DA1** or **DA1M** for Digital Wall Adjuster
- Insulation: **I** for attic side insulation
- Security Hanger: **H**
- Blow Patterns: **TFD3** for 3-way blow, **TFD2C** for 2-way blow corner, **TFD2** for 2-way blow opposite, and **TFD1** for 1-way blow.
- Silk Screen: **S** for appearance panel pattern
- Sensor: **SMCS** for SMC or **SENSOR** for 3rd party

Accessories

(1) Ceiling Frame

Accessories

- Ceiling Frame: **AC-TKHD** for hard ceiling, **AC-TK24** for 24"x24" Lay-in, **AC-TK600** for 600mm Lay-in. Contact Acutherm for more options.

AVAILABLE ONLINE

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