TF Therma-Fuser™

SquareThermally Powered VAV Diffuser

acutherm by price
Therma-Fuser™ Systems

Models:	**TF-HC**	Separate set points for VAV heating and VAV cooling
	TF-HC-LH	A TF-HC with maximum flow limited in heating only
	TF-CW	One set point for VAV cooling with warm up
	TF-C	One set point for VAV cooling only
	TF-HC-NH	A TF-HC that closes in heating (no heat)
	TF-D	Manually adjustable
	TF-RA	Matching return air

TF: Product Overview
FORM 041.101 REV 1704

BENEFITS AT A GLANCE.

INDIVIDUAL COMFORT SELECTION AND CONTROL

Every Therma-Fuser™ diffuser is a VAV zone of temperature control providing pleasing comfort in both heating and cooling. The built in thermostat senses average room air temperature from a sample of air induced into the unit. It controls air flow to precisely match the comfort requirements of the room or portion of the room served. Occupants breathe easier knowing that their personal temperature choice will not be changed by someone else.

LIMITED HEAT & NO HEAT

The ASHRAE Standard 90.1 requires controls in an HVAC system that limit the reheating of air that was previously cooled. Use the LIMITED HEAT option to meet the ASHRAE standard. The TF-LIMITED HEAT has an adjustable mechanical stop that will limit maximum flow to the required percentage only in the heating mode.

For applications, such as a computer room, where cooling loads always exist but the supply may at times be heated, there is a NO HEAT option. When the supply air is warm, the TF-NO HEAT will close and not open regardless of the room temperature.

ONLY THERMA-FUSER™ VAV OFFERS THESE BENEFITS

- Separate temperature set points for VAV heating and VAV cooling.
- Superior air distribution—longer throws, no dumping, more entrainment, even temperature distribution, higher ADPI* and better room air change 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.

*ADPI (Air Diffusion Performance Index)

TF Therma-Fuser™ Square Thermally Powered VAV Diffuser

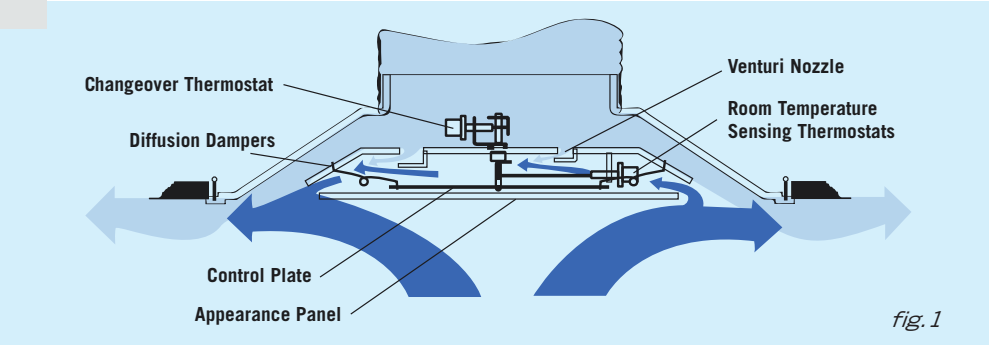


fig. 1

HOW IT WORKS

Model TF Therma-Fuser diffusers are 24" (600mm) square ceiling diffusers with built in temperature controls and VAV damper. Four blade dampers move up to close and down to open, metering air flow (warm or cool) into the room in response to room temperature. The dampers are mechanically positioned by thermostat/actuators which are both a room thermostat and damper motor.

The room thermostat/actuators are a large brass cylinder containing a petroleum based wax. The wax melts and 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 four 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 TF will hold the room average 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 thermostats melts and expands. This pushes the cooling thermostat piston outward against the control plate. The control plate then pivots around the center bearing, opening the dampers allowing more supply air to enter the room. When the room cools, the wax contracts, a spring retracts the cooling thermostat piston and a spring returns the control plate closing the dampers.

CHANGEOVER (TF-HC and TF-CW ONLY)

Changeover between the cooling and heating modes is determined by supply air temperature. A thermostat/actuator located in the inlet of the diffuser senses supply air temperature. Warming the changeover thermostat changes the TF to the heating mode by pivoting the control plate over center. As a result the cooling thermostat is disengaged and the heating thermostat engaged.

Changeover from cooling to heating begins at supply air temperature 76°F/24.5°C and completes at 80°F/26.5°C. Changeover back to cooling begins at 72°F/22°C and completes at 68°F/20°C. During changeover the damper is closed or at minimum flow. The control plate pivots over center, first closing the damper and then opening it.

HEATING MODE (TF-CW ONLY)

In the heating mode, the dampers are fully opened and will remain fully opened until the diffuser changes back from heating to cooling mode.

HEATING MODE (TF-HC ONLY)

In the heating mode, the dampers open on a drop in room temperature. As the room cools, the wax in the room thermostats contracts. A spring retracts the piston in the heating thermostat allowing a spring to pivot the control plate, opening the dampers allowing more supply air into the room.

ADJUSTING SET POINTS

Heating and cooling set points are separately adjusted by turning the heating and cooling thermostats (*fig.2).* Align the white indicator on each thermostat with its respective temperature scale. Each set point can be anywhere between 70°F/21°C and 78°F/25.5°C. Both are factory set at 74°F/23°C. (The model TF-CW and TF-C have only a cooling thermostat).

OPEN FOR BALANCING

To open, unhook the tension spring from the bracket adjacent to the cooling thermostat and turn the control plate slightly to drop the dampers open (*fig.3).*

MINIMUM FLOW

To drive room air sensing, primary air is continuously supplied through the four venture nozzles even when the dampers are closed. The nozzles supply approximately 35cfm/16l/s at 0.15"wg/37Pa (*fig.4).* If required, additional minimum flow is available for both fixed and adjustable flow stops (see Options).

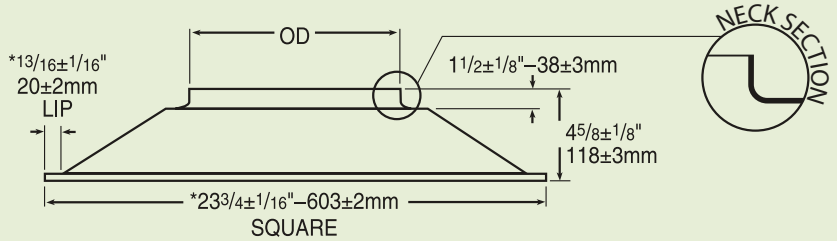
SYSTEM DESIGN

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. Use a room thermostat for changeover between heating and cooling modes. 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 air flow provides good room circulation

DIMENSIONS

Inlet Designation	OD	
	Inches ± 1/16	mm ± 3
6	5 15/16	150
8	7 15/16	200
10	9 15/16	250
12	11 15/16	300



*595±2mm Square with 16±2mm lip available —specify 595mm square.

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 settings where 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 fan speed control and modulating bypass dampers. 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 SP of .15"wg/37Pa and if a maximum SP of .25"wg/62Pa is to be held for quiet operation, size the duct for a maximum pressure drop of .1"wg/25Pa 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. 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.

GUIDE SPECIFICATION

(Suitable for Section 23 36 16 Variable-Air-Volume Units of the CSI MasterFormat). *Material in italics applies only to model TF-HC. Delete the italics for TF-C and TF-CW.*

2.2 Thermally Powered VAV Diffusers

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

B. Thermally powered VAV diffusers shall be a complete VAV terminal and thermostat self-contained in a nominal 24” (600mm) square diffuser. They shall be thermally powered with one cooling thermostat/actuator, *one heating thermostat/actuator and one changeover thermostat/actuator.* External wiring or pneumatics shall not be allowed.

PERFORMANCE GUIDE

Nomimal Inlet Diameter	Inlet Static Pressure In. wg	Maximum Flow cfm	Maximum Flow		25% Maximum Flow	
			Throw - Feet* @ vt=50/100/150FPM	†NC	Throw* - Feet @ vt=50/100/150FPM	†NC
6"	.05	100	6/4/3	<15	3/2/1	<15
	.10	140	8/5/4	20	4/3/2	17
	•.11	147	8/5/4	21	4/3/2	18
	.15	175	9/6/5	26	5/4/3	21
	.20	200	9/7/6	31	6/5/3	24
	.25	220	10/8/7	34	7/6/4	27
8"	.05	160	8/6/4	<15	5/3/2	<15
	.10	225	10/7/5	20	6/4/3	16
	•.13	255	11/8/6	23	7/5/3	19
	.15	275	11/8/6	25	7/5/3	21
	.20	320	12/9/7	30	8/6/4	25
	.25	355	13/10/8	34	9/6/4	28
10"	.05	260	9/7/5	15	7/6/4	<15
	.10	370	11/8/6	23	9/7/5	18
	•.12	402	12/9/7	25	9/7/5	20
	.15	450	13/10/8	27	10/8/6	22
	.20	520	14/11/9	31	11/9/7	26
	.25	580	15/12/10	34	12/10/7	29
12"	.05	350	11/8/6	15	7/6/4	<15
	.10	470	13/10/8	23	9/7/5	19
	.15	560	15/12/10	27	10/8/6	23
	•.16	576	15/12/10	28	10/8/6	24
	.20	640	16/13/11	31	12/10/8	27
	.25	720	17/14/12	34	14/11/9	30

• 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
- Metric performance guide available on request.
- 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 four way blow patterns, reduce the maximum air volume as shown in Acutherm Form 12.2.
- When using Acutherm R-Rings, throws may be as low as 90% and NC 2db higher than those listed in the performance guide.

Adjusting Set Points

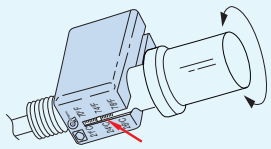


fig.2

Tension Spring for Balancing

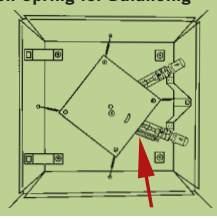


fig.3

Nozzles (blue)

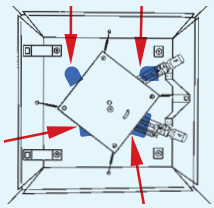


fig.4

C. The VAV diffusers shall have a micrometer type temperature set point adjustment with an indicator and temperature scale to adjust the cooling set point *and a separate micrometer type temperature set point adjustment with an indicator and temperature scale to adjust the heating set point.* The adjustment shall be right above the hinged appearance panel and shall not require tools. Each set point shall be separately adjustable between 70°F/21°C and 78°F/26°C. The initial set point shall be factory set at 74°F/23°C.

D. In the cooling mode the VAV diffusers shall open on a rise in room temperature *and in the heating mode they 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 or, if a minimum flow is set, go to the minimum.* Nothing, *including the changeover mechanism,* shall extend above the inlet of the diffuser.

E. The VAV diffusers shall have four perimeter dampers to provide 66 linear inches of variable discharge area at the perimeter of the diffuser for maximum Coanda effect and to avoid dumping.

F. All VAV diffusers shall have a solid (no holes or slots) hinged appearance panel that can be unlatched and folded down to hang allowing hands to be free for adjusting temperature set points. Instructions for the VAV 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 single spring disconnect which will open the dampers for balancing without tools. VAV diffusers requiring tools, adjustment of set points or adjustment of supply air temperature to open for balancing shall not be allowed.

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

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TF Therma-Fuser™ Square Thermally Powered VAV Diffuser

TEN YEAR WARRANTY

Acutherm warrants that its TF 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 CONSEQUENTIONAL 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.

Protected by U.S. Patents 6,736,326 & 6,857,577. Patents pending in other countries.

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
TF		

Product
1. Model: **TF** – Square Therma-Fuser diffuser
2. Type: **C** VAV cooling only, **CW** VAV cooling with warm up, **HC-NH** VAV cooling with no heat, **HC** VAV heating and cooling, **HC-LH** VAV heating and cooling with limited heat.
3. Size: **6, 8, 10, or 12** inch inlet

Options

(1) Remote Adjust	(2) R-Ring	(3) Insulation	(4) Security Hanger	(5) Minimum Flow

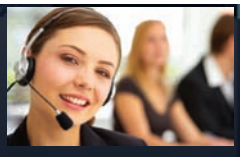
(6) Sheared Housing	(7) Blow Patterns	(8) Silk Screen	(9) Sensor

Options
1. Remote Adjust: **DA1** or **DA1M** for Digital Wall Adjuster
2. R-Ring: **Rx** for bypass relief ring where 'x' is **6**, **8** or **10"** inlet
3. Insulation: **I** for attic side insulation
4. Security Hanger: **H**
5. Minimum Flow: **FR** rubber type, **FS** screw type
6. Sheared Housing: **595** for 600mm metric grid ceilings, **T1** for $23\frac{3}{16}$" and **T2** for $22\frac{3}{4}$"
7. 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.
8. Silk Screen: **S** for appearance panel pattern
9. Sensor: **SMCS** for SMC or **SENSOR** for 3rd party

Accessories

(1) Ceiling Frame

Accessories
1. Ceiling Frame: **TFHD** for hard ceiling, **TF4DB** for 4" drop box, **TF1DB** for $\frac{17}{16}$" drop box, **TFSP** for spline, **TFT1** for tegular $\frac{9}{16}$" T-bar, **TFT2** for tegular 1" T-bar, and **TFAL** for air lifter (no ceiling)



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