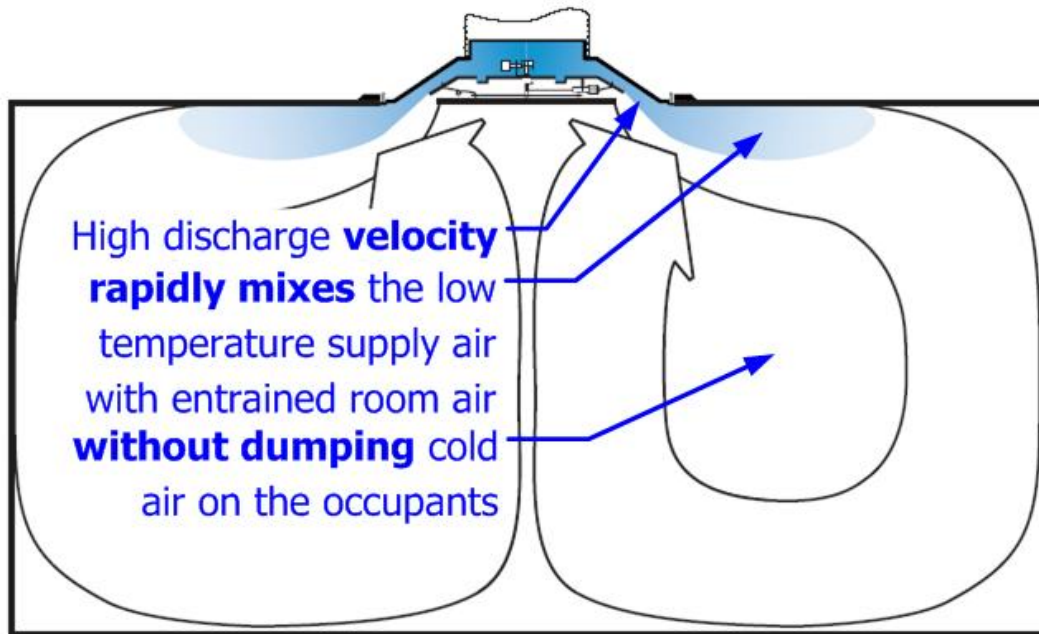


THE LOW TEMPERATURE (40°F/4°C) THERMA-FUSER™



THERMALLY POWERED VAV DIFFUSER

LT-HC VAV Cooling and VAV Heating
 LT-CW VAV Cooling and Constant
 Volume Heating
 LT-C VAV Cooling Only



NO RISK OF LOW TEMPERATURE AIR DUMPING ON OCCUPANT

A high velocity jet of supply air rapidly mixes with room air, quickly warming the low temperature supply air up to room temperatures. The variable discharge opening of the Therma-Fuser™ LT Low Temperature VAV diffuser produces high discharge velocities and rapid mixing, even at turndown. The LT diffuser's high discharge velocity at all flows also produces better Coanda and throw. The superior air distribution produced by the Model LT allows low temperature air to be supplied directly into the space without dumping cold air on the occupants.

BETTER THAN VAV OR FAN POWERED BOXES

Low temperature air must be introduced into the room so that it does not reach the occupied zone. VAV boxes with fixed diffusers dump at low flows. Series fan powered boxes mix the air before introducing it to the room. Therma-Fuser diffusers mix the air in the space without dumping and have many advantages over fan powered boxes.

- Lower Installed cost – install just like a diffuser with no electrical connections
- No maintenance – unheard of with fan powered boxes
- More zones than a typical VAV or fan powered box – each Therma-Fuser diffuser is a VAV zone
- Energy savings – many VAV zones equals no overcooling

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.

*ADPI (Air Diffusion Performance Index) is defined in the ASHRAE Fundamentals Handbook.

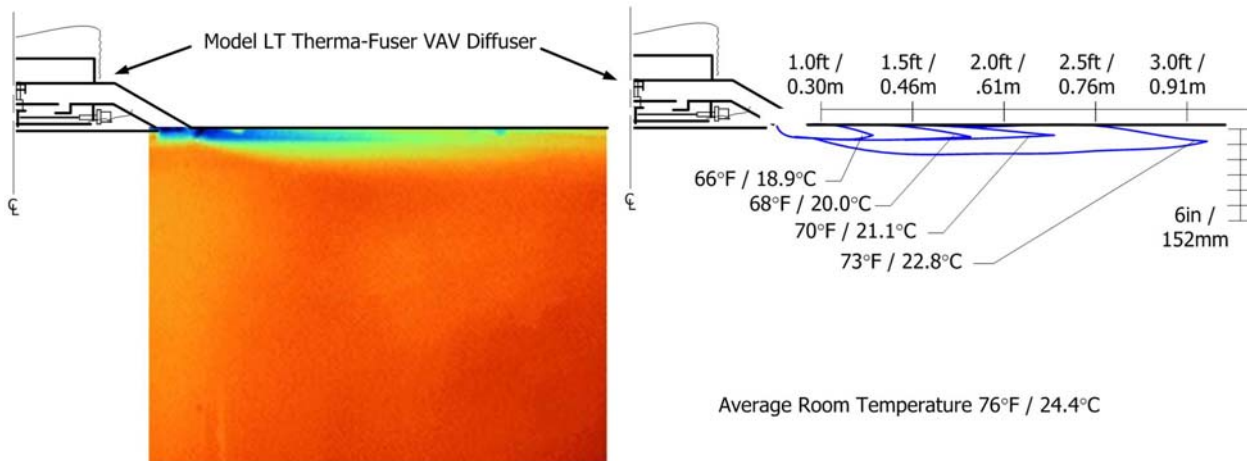
RAPID MIXING OF LOW TEMPERATURE SUPPLY AIR

With low temperature HVAC systems, low temperature (40°-50°F/4°-10°C) air must be introduced into the room so that it does not reach the occupied zone.

Therma-Fuser diffusers help to eliminate the risk of low temperature

supply air reaching the occupied space. By keeping discharge velocity high (approximately 1500 FPM/7.62 m/s), Therma-Fuser diffusers create a high induction of room air into the supply air, rapidly mixing and raising the temperature of the supply air. At both full flow and turn down rapid entrainment of room air into the supply air quickly raises the

temperature. **In a 76°F/24°C room, 40°F/4°C supply air is warmed to 70°F/21°C within 2.5 ft/0.76m horizontally from the center line of the diffuser and with less than 2 in/51 mm of drop.** Supply air is warmed to room temperature within 4 ft/1.2m of the diffuser and within 3 in/76 mm drop.



Infrared photography and temperatures recorded with LT-HC-8 Therma-Fuser diffuser under steady state conditions. Cooling set point 76°F/24°C; Supply air volume 200 cfm/95 l/s; Supply air temperature 40°F/4°C; Average room air temperature 76°F/24°C.

Fig. 1

THERMA-FUSER DIFFUSER BETTER THAN SERIES FAN POWERED BOX

Low temperature air must be introduced into the room so that it does not reach the occupied zone. VAV boxes with fixed diffusers can not always do this because the more dense low temperature air drops or dumps at low flows.

A common answer is to use a series (continuous) fan powered box to mix the cold supply air with air from the return plenum, raising air temperature before introducing it to the room. The risk of low temperature air reaching the occupied zone is reduced by delivering a constant volume of warmer air to the room.

The superior air distribution produced by the Therma-Fuser diffuser allows low temperature air to be introduced directly into the space and there are many advantages over series fan powered boxes. Foremost is **lower installed cost**. Therma-Fuser diffusers install just like a diffuser with

no electrical connections or outside controls which require other skills.

Therma-Fuser diffusers **easily adapt** to office layout changes. No Therma-Fuser zone is split when office walls are put up or moved, a common problem with fan powered boxes.

A **no maintenance** claim is unheard of with VAV or fan powered boxes. Yet customers using Therma-Fuser diffusers for over 20 years testify that no maintenance at all has been required.

Best of all each Therma-Fuser diffuser is a VAV zone. This means more zones than a typical VAV or series box with several diffusers. **More zones** also mean more energy savings because no space is overcooled. There are no electric motors in Therma-Fuser diffusers to use energy.

SYSTEM OPERATION AND CONDENSATION

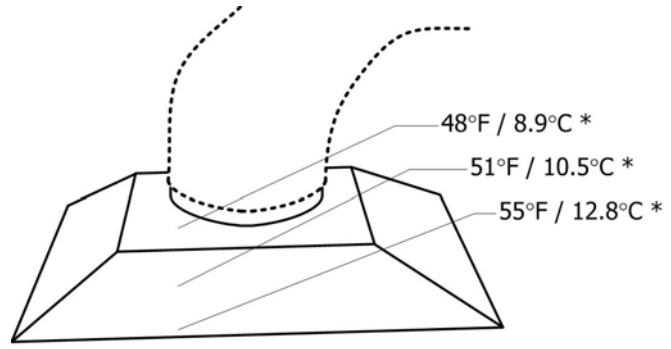
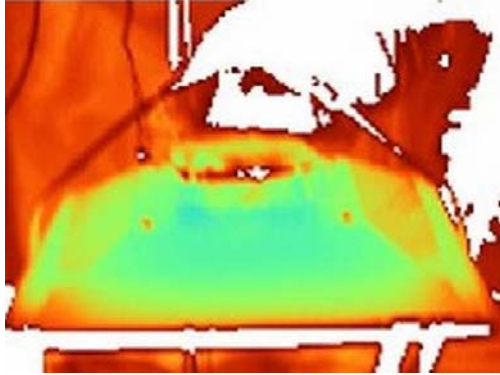
It is the practice in most low temperature supply air systems to decrease building temperature slowly at startup and after weekends or

holidays. This eliminates condensation on metal fixtures and cold water pipes as well as diffusers. As long as this practice is followed condensation is not anticipated on the Model LT Therma-Fuser VAV diffuser.

No condensation was experienced in the testing of the LT-HC diffuser performed in Hayward, California. This does not mean that in a more humid climate condensation due to high humidity should not be a concern.

The lowest surface temperatures recorded are shown on Fig. 2, 3 and 4. Local conditions, especially in areas of high humidity, should be considered when evaluating the chances of condensation on diffusers.

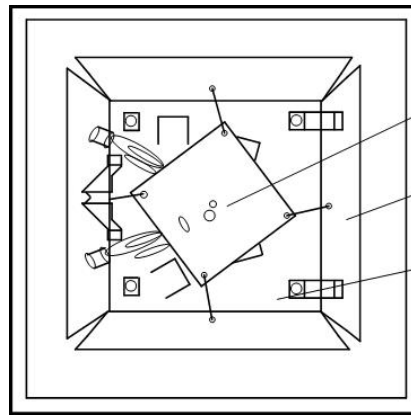
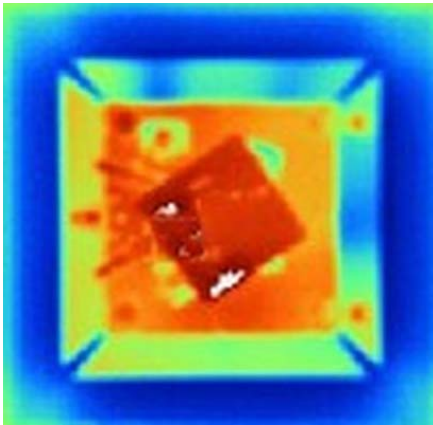
For example, a typical building design might be room temperatures of 74°F/23°C and a relative humidity of 45%. Using the psychrometric chart, the dew point under these conditions is 52°F/11°C. The surface temperatures of an insulated LT diffuser are all above 52°F/11°C.



*Add 20°F/11°C for 1/2"/13mm insulation.

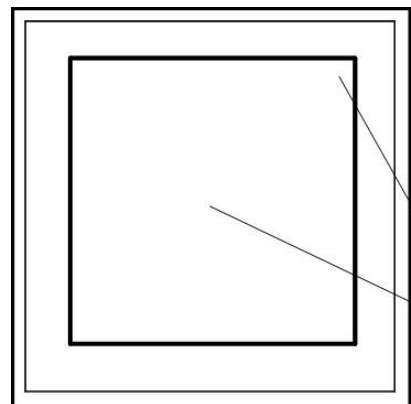
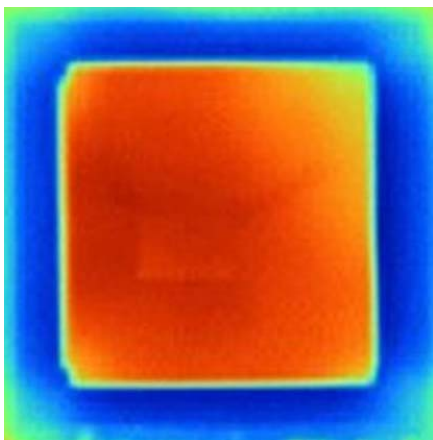
Infrared photography and coldest surface temperatures recorded on un-insulated housing of LT-HC-8 Therma-Fuser diffuser under steady state conditions. Supply air volume 200 cfm/95 l/s; Supply air temperature 40°F/4°C; Average air temperature around housing 76°F/24°C.

Fig. 2



Infrared photography and coldest surface temperatures recorded on exposed face of un-insulated LT-HC-8 Therma-Fuser diffuser under steady state conditions. Supply air volume 200 cfm/95 l/s; Supply air temperature 40°F/4°C; Average air temperature around exposed face of diffuser 76°F/24°C.

Fig. 3



Infrared photography and coldest surface temperatures recorded on exposed face of un-insulated LT-HC-8 Therma-Fuser diffuser under steady state conditions. Supply air volume 200 cfm/95 l/s; Supply air temperature 40°F/4°C; Average room air temperature 76°F/24°C.

Fig. 4

HOW IT WORKS

The Model LT-HC Therma-Fuser diffuser is a nominal 24"x24"/600x600mm ceiling diffuser with built-in temperature controls. The LT-HC has four dampers that open and close to meter air flow (warm and cold) into the room in response to room temperature. The dampers are mechanically actuated by thermal element thermostats.

Each thermostat is a small brass cylinder containing a petroleum-based wax. The wax expands when heated, driving a piston and positioning the dampers in a proportional manner.

Average room temperature is monitored by inducing a sample of air from the room across the thermostats. Because this sample is drawn directly from the air circulation pattern in the room, just before it mixes with supply air flowing into the room, it better represents average

room temperature than does a wall mounted thermostat. A properly applied LT-HC will hold the room within 1.5°F/1°C of the temperature selected.

Room temperature may be set between 70°F/21°C and 78°F/25.5°C by turning the thermostat. Separate room thermostats for heating and cooling may be set at the same or different temperatures. The thermostats are concealed and out of casual reach but are easily accessible by folding down a hinged panel.

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 as it enters from the duct. Changeover from cooling to heating begins at supply air temperature of 76°F/24.5°C and completes around 80°F/26.5°C.

Changeover is achieved by disengaging the cooling thermostat and engaging the heating thermostat. Changeover back to cooling is completed when the supply air temperature reaches 68°F/20°C.

When supply air is warm, the Therma-Fuser diffuser operates in the heating mode – the dampers open on a drop in room temperature. When the supply air is cold, it operates in the cooling mode – the dampers open on a rise in room temperature.

Room temperature set points for heating and cooling are separately adjusted by screwing the heating (red scale) or cooling (blue scale) thermostats in or out – in for cooler and out for warmer. Determine the set point by aligning the white indicator with the °F or °C numbers on the temperature scale.

PERFORMANCE GUIDE

Nominal Inlet Diameter	Inlet Static Pressure In. wg	Maximum Flow cfm	Maximum Flow		25% Maximum Flow	
			Throw – Feet* @v _t =50/100/150FPM	NC	Throw – Feet* @v _t =50/100/150FPM	NC
6"	.10	140	8/5/4	20	4/3/2	17
	•.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"	.10	225	10/7/5	20	6/4/3	16
	•.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

Nominal Inlet Diameter	Inlet Static Pressure Pa.	Max Flow		Maximum Flow		25% Maximum Flow	
		l/s	m ³ /h	Throw – Meters @v _t = 0.25/0.50/0.74m/s	NC	Throw – Meters @v _t = 0.25/0.50/0.74m/s	NC
150mm	•30	75	270	2.5/1.6/1.3	22	1.3/1.0/0.7	19
	40	86	310	2.7/1.8/1.5	27	1.5/1.2/0.9	22
	50	96	345	2.7/2.1/1.8	31	1.8/1.5/1.1	24
	60	106	380	3.0/2.4/2.1	33	2.1/1.8/1.2	26
200mm	•30	118	425	3.2/2.2/1.6	22	1.9/1.3/0.9	18
	40	138	495	3.4/2.4/1.8	26	2.1/1.5/0.9	22
	50	153	550	3.7/2.7/2.1	30	2.4/1.8/1.2	25
	60	168	605	4.0/3.0/2.4	33	2.7/1.8/1.2	27

• Denotes nominal rating.

NC based on L_w(10⁻¹² watts reference) – 10dB

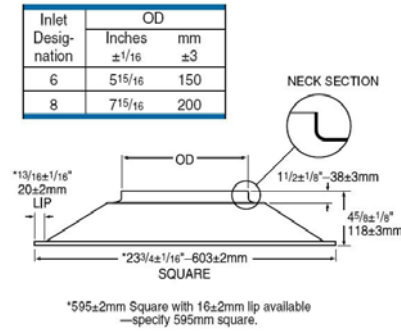
* Throw data is for air 20°F/11°C lower than room temperature. Throws for isothermal air are 40% to 50% greater. Tested in accordance with ANSI/ASHRAE 70-1991, ANSI S12.31, ARI 890-94, ISO 5219 and ISO 3741.

LT-HC LEAKAGE

Static Pressure In. wg	Leakage cfm
0.10	12
0.15	14
0.20	16
0.25	18

Static Pressure Pa	Leakage l/s / m ³ /h
30	6 / 22
40	7 / 25
50	8 / 28
60	9 / 30

DIMENSIONS



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 air flow 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 0.10"wg/25Pa and 0.25"wg/62Pa, at full and partial air flows. Static pressure below 0.10"wg/25Pa will result in low air flow and less induction. Above 0.25"wg/62Pa, Therma-Fuser diffusers operate well but excessive noise may result. Use minimum flow stops 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 bypass, fan control and discharge dampers. 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 0.15"wg/37Pa and if a maximum

static pressure of 0.25"wg/62Pa is to be held for quiet operation, size the duct for a maximum pressure drop of 0.1"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. Avoid this with a three-way blow pattern or relocate either the Therma-Fuser diffuser or the light.

GUIDE SPECIFICATION

Thermally powered variable air volume diffusers shall be Therma-Fuser Model LT-HC – Low Temperature diffusers – manufactured by Acutherm, Hayward, CA. Each module shall be a complete VAV terminal and thermostat, self-contained in a 24"x24"/600x600mm (nominal size) diffuser. External wiring or pneumatics will not be allowed.

The diffusers shall vary the supply air volume to provide both VAV heating and cooling using two room sensing thermostats and one changeover thermostat. The room temperature settings for heating and cooling shall be separately adjustable in the field by separately adjusting each of the two room thermostats.

Units shall operate with cooling supply temperatures between (40°F-50°F/4°C-10°C). One room temperature sensing thermostat shall sense room temperature and vary the supply air when cooling. The other room temperature sensing thermostat shall sense room temperature and vary the supply air when heating and shall be biased to offset room temperature stratification. The cooling thermostat shall have a wax formula designed to work with low temperature air.

Each room sensing thermostat shall have a micrometer type temperature set point adjustment with an indicator that moves along a 70°F/21°C to 78°F/26°C temperature scale. Initial set point shall be factory set at 74°F/23°C.

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 temperature falls below 68°F/20°C. The changeover mechanism shall not extend above the neck of the diffuser.

Each unit 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.

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

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

Units shall have external insulation with vapor barrier to impede condensation.

10 YEAR WARRANTY

Acutherm warrants that its Model LT 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.



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