VAV REHEAT BOXES SUBZONED WITH THERMA-FUSER[™] VAV DIFFUSERS

GOALS

- 1) Individual temperature control. Each Therma-Fuser[™] VAV diffuser is a zone of temperature control.
- 2) Provide separate heating for separate portions of a system. These may be perimeter areas which require heat when others such as interiors require cooling.
- 3) Vastly improved air distribution is provided by variable aperture Therma-Fuser diffusers as contrasted to VAV supplied through fixed opening diffusers, especially at low air volume. Therma-Fuser diffusers allow modulation down to perhaps 10% maximum flow with air distribution quality that fixed opening diffusers provide at 50% flow.
- 4) Eliminate the problem of keeping air flow balanced to all diffusers at all flow levels inherent to VAV systems which serve multiple outlets from a single terminal box.

5) Additional energy savings

- No overcooling or overheating any of the rooms in the Therma-Fuser subzones.
- Allowing full VAV turndown when cooling avoids using reheat to warm the cooled air to prevent overcooling. The heating coil is used only when the room has a heating load and during that time VAV reduces the volume of air to be heated.
- 6) Reuse existing ductwork. Ductwork does not need to be changed when subzoning existing VAV reheat boxes with Therma-Fuser VAV diffusers.

STATIC PRESSURE CONTROL



Type HC Setting °F/°C T Setting °F/°C Coolina Room Thermostat Heating 70/21 74/23 72/22 76/24.5 72/22 74/23 74/23 78/25.5 76/24.5

Notes

1) All difusers downstream from the VAV box must be type HC Therma-Fuser diffusers. Do not use part fixed diffusers.

electric heat as

may require

at T is above setpoint.

shown on page 4.

Pneumatic controls

pneumatic relay to

when temperature

interupt heating

- 2) Heating coil, HC, can be locked out when central heating is on. Central heating may be used during setback or warm up.
- 3) The Acutherm SMC can be used to control DX package units with VAV reheat boxes. See Acutherm Form 40.4.
- 4) Higher pressure drops over VAV boxes require higher static pressures upstream. Pressure reducing stations (Acutherm PIM's) may be required when using Therma-Fuser diffusers on this higher pressure ductwork.





METHOD OF UPGRADING

Install one or more type HC Therma-Fuser diffusers in each room. The VAV reheat box then becomes the master zone which supplies heated or cool air to the Therma-Fuser subzones. The master zone also controls the static pressure of the supply air to the Therma-Fuser diffusers. For individual temperature control, a return is required in each space with a Therma-Fuser diffuser.

It is assumed that the system has an effective **discharge air temperature control** and some form of **static pressure control** at the fan such as fan speed control, effective variable inlet vanes or discharge dampers.

SUPPLY AIR TEMPERA-TURE CONTROL

Note: BMS controls use sensors instead of thermostats. Control from BMS sensors located where thermostats are shown.

When the room temperature drops below the setpoint, room thermostat, T, signals that heating is needed. This activates control of the heating coil by the discharge thermostat, DT. The discharge thermostat maintains the supply air temperature at a selected level above 80°F/26.5°C and below 120°F/49°C. This sequence prevents excessive supply air temperatures and assures that the temperature is warm enough to complete changeover of the Therma-Fuser diffusers to the heating mode.

Note: in a retrofit, the room thermostat,T, may be the existing thermostat.

HEATING COIL SIZE

New heating coils should be sized to handle the total air volume at a ΔT from the cooling temperature (approx. 55°F/13°C) to the heating temperature (approx. 96°F/35°C).

For heating coils in existing VAV boxes, check if they are sized for design air volume or for a lesser air volume such as a box minimum flow of 50%. If the coils are sized for less than design air volume either:

- Operate as recommended if the temperature to the diffusers at design air volume is more than 80°F/26.5°C and the heating capacity at design air volume is more than required to satisfy the current actual heating load, or
- 2) Increase heating capacity by adding another coil and operate as recommended, or
- Use Model TF-HC diffusers with a heating only maximum flow stop set at the original lesser air volume as a percent of design air flow and operate as recommended.

STATIC PRESSURE CONTROL

Convert the VAV box into a static pressure/pressure independence station by controlling it with a static pressure signal from the duct 2/3 to 3/4 between the takeoff for the first Therma-Fuser diffuser and the takeoff for the last Therma-Fuser diffuser.

- If selecting a **new box**, use a pressure independent box with total and static pressure sensors and a differential controller.
- For existing **pressure independent boxes** with total and static pressure sensors, use the existing controller.
- For other existing pressure independent boxes and **pressure dependent boxes**, add a differential controller such as a pressure independent box controller or add a controller/actuator such as an Acutherm PIM.

Controllers may be DDC, electric analog or pneumatic. Make the same pressure sensing connections for each. Vent the low port to atmosphere and connect the high port to a new static pressure sensor located 2/3 down the duct. Set the high or maximum adjustment on the controller to 0 and adjust the static pressure setpoint with the low or minimum adjustment. With this setup, it makes no difference if the room thermostat is connected or not. It should be connected if it is used to activate discharge thermostat control of the heating coil. The room thermostat must also be connected when the logic is in it instead of the controller.



PROCEDURE FOR CONVERTING A VAV REHEAT BOX TO A STATIC PRESSURE STATION

- 1) Remove the low connection at the inlet pickup and let it hang and sense atmosphere.
- 2) Install Dwyer A-308 static pressure sensing tip or other similar device in the duct at least 2/3 downstream from the box.
- 3) Remove high connection at the inlet pick up, extend the tubing and connect to the static pressure tip installed in step 2.
- 4) Use the low or minimum adjustment on the controller to adjust for the air volume with a velocity pressure equal to the required static pressure set point (usually between .10 and .25 in wg).
- 5) Set the high or maximum adjustment on the controller to 0 unless a thermostat is connected. If a thermostat is connected, then adjust the maximum on the controller to the same air volume used in step 4.



The room thermostat must be connected when it, instead of the controller, contains the logic. It may also be used to activate discharge thermostat control of the heating coil. Otherwise if it controls nothing else, the thermostat may be disconnected. Wire the sensor to the controller so that the space temperature may be monitored over the DDC network. The room sensor can also be used to activate discharge thermostat control of the heating coil. The room thermostat may be used to activate discharge thermostat control of the heating coil. If this is separate from the controller, remove the thermostat line from the port on the controller and vent the port to atmosphere. Cap or plug the line.



ADDITIONAL NOTES FOR ELECTRIC HEAT



- 1) Mount the bulb for the discharge thermostat so that it does not "see" radiant heat from the heaters.
- Mercury contactors are preferred in electric heaters because they can fast cycle without welding, make less noise and are more dependable.
- 3) The air flow switch in most electric heaters measures the pressure differential between the sensor location and the air pressure in the ceiling space immediately surrounding the heater. If this pressure differential becomes too small, usually lower than 0.05"wg/12 Pa, the heating elements are disengaged and no heat is provided. To avoid disengagement of heating elements at low duct pressures it is desirable to set the static pressure control on the VAV box above the level needed to keep the duct heater operational.
- 4) The standard on/off control cycles supply air temperature except when at maximum heat. For a constant supply air temperature modulate electric heat with an SCR and modulating discharge thermostat.
- 5) Control multistage electric heat with a discharge thermostat with multiple set points. Use lower temperature set points for additional heating stages.
- 6) Type HC Therma-Fuser diffusers may have minimum flow stops for minimum flow through the heater. Minimum flow stops also risk overcooling.



Therma-Fuser[™] Systems

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