AIR HANDLING AND FAN COIL UNITS
SUBZONED WITH THERMA-FUSER™ VAV DIFFUSERS
(See other chapters for subzoning DX Systems and Duct Heat Systems.)

GOALS

The goals of applying Therma-Fuser™ diffusers with an air handling unit or ducted fan coil unit may include:

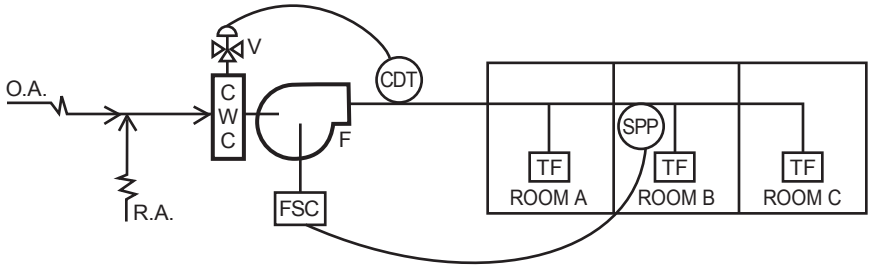
1) **Individual temperature control.** A single zone that serves more than one space may become a master zone which is subzoned with Therma-Fuser diffusers to provide individual temperature control.
2) **Reduce fan energy** consumption. Conversion from constant volume to variable volume will make possible significant savings in energy if fan speed control is added.
3) Additional **refrigeration and heating energy savings** from not overcooling or overheating any of the rooms in the Therma-Fuser subzones.

METHOD OF UPGRADING

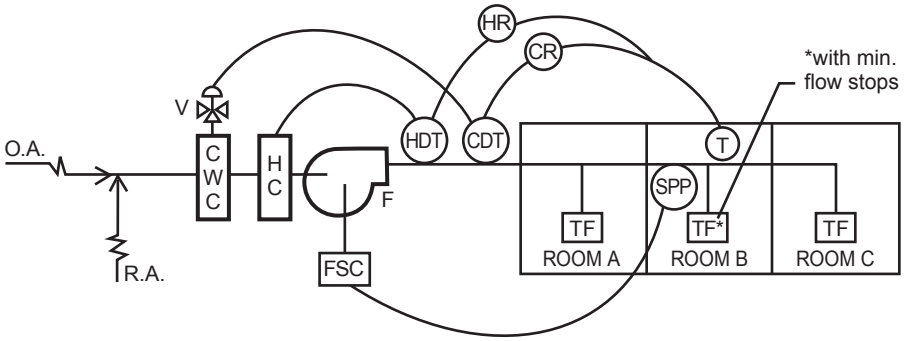
The single zone air handling or fan coil unit becomes the master zone which supplies conditioned air to the Therma-Fuser diffusers subzones. Subzone heating and cooling systems with type –HC Therma-Fuser diffusers. Use Type –C for cooling only systems. For individual temperature control, a return is required for each space with a Therma-Fuser diffuser.

The Therma-Fuser diffuser subzones can only heat *or* cool as the master zone allows. If within the existing master zone there are simultaneous heating and cooling loads, simply varying the volume of the heating *or* cooling may not satisfy all needs. It may be necessary to design the system with separate capabilities of heating and cooling for each of the four exposures and the interior. This can be done with multiple air handling or fan coil units, separate perimeter heat or with duct heat stations. For the latter, see Form 6.6 Controlling Duct Heat.

Cooling Only System *(may have separate perimeter heat)*



Heating and Cooling System *(four pipe, three pipe and electric heat)*



LEGEND

CWC:	**CHILLED WATER COIL.**
V:	**CHILLED WATER VALVE.**
HC:	**HEATING COIL. CONTROL VALVE (HOT WATER OR STEAM) OR ELECTRICAL CONTACTOR(S) ARE NOT SHOWN.**
F:	**FAN. RUNS CONTINUOUSLY.**
T:	**ROOM THERMOSTAT, (IF ELECTRIC; TWO CIRCUIT).**
CDT:	**COOLING DISCHARGE THERMOSTAT. SET FOR 55°F/13°C.**
HDT:	**HEATING DISCHARGE THERMOSTAT. SET NO HIGHER THAN REQUIRED FOR HEATING NEED, BETWEEN 80°F/26.5°C AND 120°F/49°C.**
CR:	**PNEUMATIC RELAY TO STOP COOLING OR PLACE COOLING UNDER CONTROL OF CDT. NOT REQUIRED FOR ELECTRICAL CIRCUITS WHERE T (COOLING) IS IN SERIES WITH CDT.**
HR:	**PNEUMATIC RELAY TO STOP HEATING OR PLACE HEATING UNDER CONTROL OF HDT. NOT REQUIRED FOR ELECTRICAL CIRCUITS WHERE T (HEATING) IS IN SERIES WITH HDT.**
TF:	**THERMA-FUSER DIFFUSER. TYPE –HC FOR HEATING AND COOLING SYSTEMS AND TYPE –C FOR COOLING ONLY SYSTEMS.**
FSC:	**FAN SPEED CONTROL. OPTIONAL—SEE STATIC PRESSURE CONTROL.**
SPP:	**STATIC PRESSURE PROBE. OPTIONAL—SEE STATIC PRESSURE CONTROL.**

SUPPLY AIR TEMPERATURE CONTROL

Discharge air thermostats provide for a constant supply air temperature which will be able to satisfy the load in any space regardless of its location in the master zone.
For heating and cooling systems, discharge air thermostats also control heated air supply, which will serve to prevent excessive supply air temperature, whether heating is steam, electric or hot water. In addition, the discharge thermostats assure that heated supply air temperature is warm enough to change the Therma-Fuser diffusers to the heating mode.

(Continued on back)

acutherm™
The Individual Temperature Control People

SUPPLY AIR TEMPERATURE CONTROL—*Continued*

It is desirable for heated air to be supplied at a temperature (1) no higher than required to meet the heat loss of the space (lower temperatures mean less stratification), (2) high enough to accomplish TF changeover (80°F/26.5°C or above), (3) not high enough to impair TF sensing of room temperature (less than 120°F/49°C). We recommend that HDT be set to accomplish these goals. Reset of HDT as a function of outdoor temperature may be desirable in some installations.

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

HEATING-COOLING CHANGEOVER

The selection of the operational mode (heating or cooling) may be made manually or automatically from a thermostat sensing room temperature, as shown. Locating a thermostat in the room of "greatest need" may be adequate to select the heating or cooling mode, if that room can be determined and if it is always the greatest need room. Otherwise simply use the most important room, maybe the office of the boss!

Use a Therma-Fuser diffuser with minimum flow stops in the room with the thermostat. The room thermostat can be located in the return air opening of the specific room to put it out of reach from continual readjustment.

Multiple room sensors can be used for changeover on systems with BMS controls. Resolve situations with calls for both heating and cooling with either a majority rules or a cooling dominant (heat only when there are no calls for cooling) approach.

Two pipe systems use an aquastat (thermostat located on the supply pipe) instead of a room thermostat to determine the mode of the unit. When subzoned with Therma-Fuser diffusers, the master zone temperature is controlled by supply air thermostats, as shown.

STATIC PRESSURE CONTROL

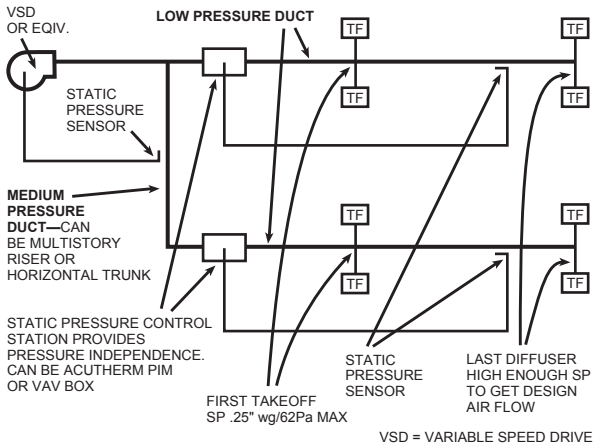
Therma-Fuser diffusers, like most diffusers, get noisy (NC 35) above .25" wg/62Pa static pressure. One of our objectives then is to limit static pressure to .25"/62Pa wg at both full flow and turndown. Another is to maintain a high enough static pressure at the last diffuser for design air flow. A third objective is to design pressure independence into the system.

For fan coil units and smaller air handling units, a low pressure duct back to the fan is preferable for a low fan HP/low energy system. Fan speed control may be the best option for static pressure control and pressure independence. Energy cost savings may not justify fan speed control with smaller fans such as in fan coil units. For plenum return systems, R-ring bypass may be the easiest and least expensive option.

A bypass damper or zone damper can also be used to provide pressure independence. These may be an Acutherm PIM. A zone damper may also be applied at the inlet of fan coil units. See Options of Supply Air Static Pressure Control and Pressure Independence, Form 6.3.

Larger air handling units may use a medium pressure trunk or riser. Static pressure stations, which can be automatic zone dampers or VAV boxes, both reduce static pressure and provide pressure independence. A variable speed drive or equivalent at the fan is also necessary.

Duct design is critical to a low pressure drop, low noise, low energy system. The ducts downstream from the first takeoff must be designed for a pressure drop which is the difference between .25" wg/62Pa static pressure at the first takeoff and the static pressure required for design air volume at the last diffuser. If the last diffuser requires .15" wg/37Pa static pressure, the pressure drop downstream from the first takeoff should be .10"wg/25Pa. If this duct length is 100 equivalent feet/30m, the duct can be sized for .10" wg per 100 ft./8Pa per m. Longer runs may require as low as .04" wg per 100 ft./3Pa per m. to insure a quiet system.



VSD = VARIABLE SPEED DRIVE

CONTROL OF SEPARATE PERIMETER HEAT

Central cooling only systems may be used with separate perimeter heat such as baseboard, radiant panels or separately ducted air. To prevent the energy waste of simultaneous cooling and heating in the same space, establish a deadband between the Therma-Fuser diffuser set point and the heating set point. This is easily done by providing a stop on the heating thermostat to allow a maximum setting of no more than 70°F/21°C. The Therma-Fuser diffusers are then set at 74°/23°C resulting in a 4°F/2°C deadband.

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