"TEXAS MULTIZONE" ZONES
SUBZONED WITH THERMA-FUSER™ VAV DIFFUSERS

DESCRIPTION OF A "TEXAS MULTIZONE"

A "Texas Multizone" has a cooling coil in the cold deck and no coil in the bypass deck. Each zone has a separate heating coil.

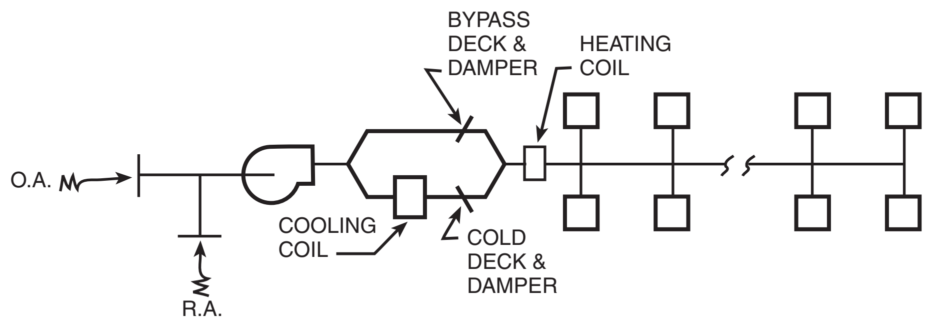
Before upgrade "Texas Multizones", in general, supply a constant volume of air to each zone. Room temperature is controlled at a room thermostat by varying supply air temperature.

At room temperatures above the thermostat set point the cold deck damper is fully open, the bypass damper fully closed and the heating coil off. As the temperature at the room thermostat drops, the cold deck damper is modulated closed as the bypass damper opens. After the cold deck is closed and the bypass fully open, a continued temperature drop activates the heating coil.

In most cases involving hot water or steam heat, activation is by a proportioning valve. Electric heating coils may have proportioning controls, but more often are controlled in an on/off manner or possibly in stages.

GOALS

The objectives of upgrading are: (1) to gain **individual temperature control** at an occupant chosen level between 70°F/21°C and 78°F/26°C, and (2) to **reduce energy** consumption. Conversion from constant volume to variable volume will make possible significant savings in energy if fan speed control is added.



One Zone of a "Texas Multizone" Before Upgrading

If the system utilizes a so called "economizer cycle," conversion to VAV will greatly reduce the energy waste of heating the cold mixture of outdoor and return air. See Reducing Economizer Cycle Energy Waste at the end of this chapter.

METHOD OF UPGRADING

Each zone of the "Texas Multizone" becomes a master zone supplying either heated, cooled or bypassed air to Therma-Fuser™ subzones. Type –HC Therma-Fuser diffusers are used for the subzones. Each controls its diffuser of space by varying the volume of essentially constant temperature air as selected by the master zone thermostat.

The 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.

A typical example is the cooling load caused by the addition of major computer hardware. This may create a new zone needing a dedicated cooling system.

Using the existing room thermostat for changeover should be satisfactory if the zone was well conceived; that is, that heating and cooling loads do not exist within the zone simultaneously to a troublesome degree. Systems with poorly conceived zones will need alteration of zone coverage and ductwork before the basic comfort goals of the retrofit can be achieved.

Discharge thermostats provide for a constant temperature air supply which will be able to satisfy the load in any space regardless of its location in the master zone. This sequence also controls heated air supply to prevent excessive supply air temperature, whether heating is steam, electrical or hot water. It assures that heated supply air temperature is warm enough to change the Therma-Fuser diffuser to the heating mode.

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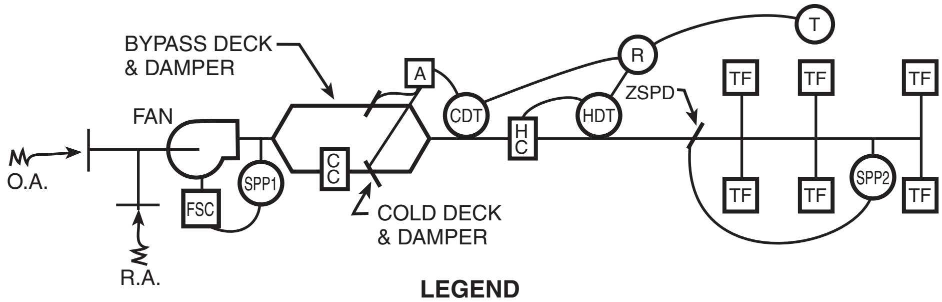

LEGEND

CC: COOLING COIL IN "COLD DECK."
HC: HEATING COIL IN ZONE DUCT.
T: ROOM THERMOSTAT.
A: ZONE ACTUATOR.
R: PNEUMATIC OR ELECTRICAL RELAY(S) TO ACTIVATE CDT OR TO ACTIVATE HDT. MAY NOT BE REQUIRED WITH A TWO CIRCUIT ELECTRIC ROOM THERMOSTAT.
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.
TF: TYPE –HC THERMA-FUSER DIFFUSER.
SPP1: STATIC PRESSURE PROBE TO CONTROL FAN CAPACITY. (SEE FAN CONTROL.)
FSC: FAN SPEED CONTROL. (OPTIONAL—SEE FAN CONTROL.)
SPP2: STATIC PRESSURE PROBE TO CONTROL ZSPD; ONE PER ZONE, (OPTIONAL—SEE STATIC PRESSURE CONTROL.)
ZSPD: ZONE STATIC PRESSURE DAMPER AND CONTROLLER, AS NEAR AS POSSIBLE TO DIFFUSERS. (OPTIONAL—SEE STATIC PRESSURE CONTROL.)

SUPPLY AIR TEMPERATURE CONTROL

The master zone thermostat, T, becomes a changeover device that selects cooling or heating. Between them the cold deck is closed, heating is off and bypass air is supplied. In the cooling mode, discharge thermostat, CDT, controls cooling at a constant air temperature, usually 55°F/13°C. In the heating mode, discharge thermostat, HDT, controls supply air at a heating level.

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 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.

Changeover from cooling to heating and vice versa may utilize the existing zone actuator, existing pneumatic tubing or electrical wiring. In the case of a pneumatic system, the existing zone thermostat may be used. a new relay, pneumatic or electrical, will activate CDT or HDT.

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

ZONES WITHOUT HEATING LOADS

Zones without heating loads, as may be found in interior spaces, do not require heating and may be converted to a cooling only zone by disconnecting or removing the heating coil and sealing the bypass deck. It will be necessary to control supply air temperature such that it is not lower than 50°/10°C which may call for a low limit thermostat.

This master zone can be subzoned with VAV cooling only (Type –C) Therma-Fuser diffusers.

STATIC PRESSURE CONTROL

The static pressure control method shown uses automatic zone dampers (can be Acutherm PIM™). In some cases the existing zone balancing damper may be fitted with a controller and actuator and used for static pressure control.

R-ring bypass will also provide pressure independence at the Therma-Fuser diffusers for plenum return systems and eliminate the need for fan control but less energy will be saved. See Options of Supply Air Static Pressure Control to Provide Pressure Independence at Therma-Fusers.

Zone static pressure control may not be required if there is little variation between the zones in the resistance of duct runs (equal length ducts).

FAN CONTROL

In converting a constant volume system to variable volume, some sort of static pressure control at the fan will almost certainly be required. One exception is use of R-ring ceiling plenum bypass.

Fan control may be as simple as automatic bypass dampers or discharge dampers. It can be as energy efficient and easy to install as fan speed control. See Options of Supply Air Static Pressure Control to Provide Pressure Independence at Therma-Fusers.

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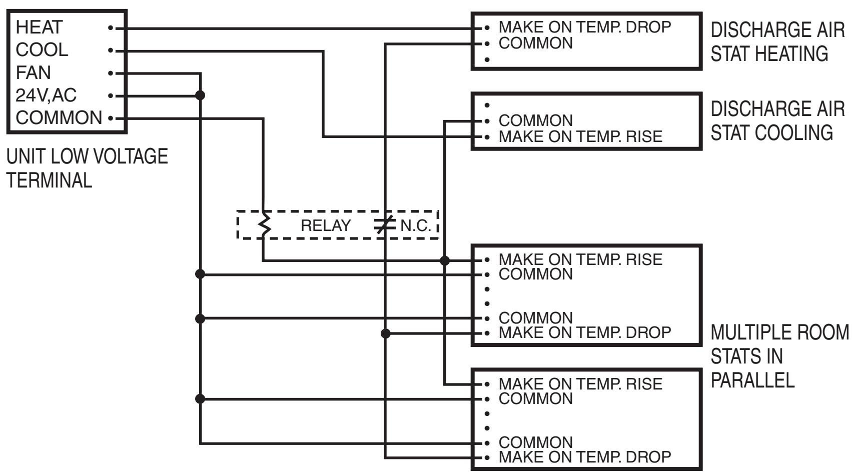
THE THERMA-FUSER DIFFUSER IN THE ROOM WITH THE CHANGEOVER THERMOSTAT

SYSTEMS WITH A BAND OF RECIRCULATED AIR

When the system sequence has a band of recirculated air between heating and cooling, a Therma-Fuser Type –HC diffuser **with minimum flow stops** can be used in the room with the thermostat.

Parallel changeover thermostats may also be used to assure that critical subzones are served. The master zone can only heat or cool at one time so the parallel thermostats must be connected to be cooling dominant or heating dominant. When cooling dominant, heating can only be selected after all the cooling needs are met and vice-versa on heating dominant. It may be desirable to switch from one to the other depending on the season or on outdoor temperature.

Wiring Parallel Changeover Thermostats—Cooling Dominant



SYSTEMS CHANGING DIRECTLY BETWEEN HEATING AND COOLING

When the system modes change directly from cooling to heating or back (no band of recirculated air), **the setpoint of the changeover thermostat should be in a deadband between the setpoints of the Therma-Fuser Type –HC diffuser for that room**. An example of a situation where the system can change directly from cooling to heating is an "economizer cycle" where all of the air handled by the fan is at a cooling level so that the bypass is cooling and not at recirculated air temperature.

The Therma-Fuser diffuser and changeover thermostat should be adjusted such that the Therma-Fuser diffuser in the changeover room is nearly closed when changeover occurs so that capacity to the changeover room does not change from full cooling to full heating causing rapid temperature change leading to rapid cycling. Do this by establishing a deadband in the temperature settings of the TF-HC used in that room and setting the changeover thermostat in the middle of the deadband.

Examples:

TF-HC Settings °F/°C		Changeover
Heating Stat	Cooling Stat	Thermostat °F/°C
70/21	74/23	72/22
72/22	76/24.5	74/23
74/23	78/25.5	76/24.5

This is not as difficult as some situations requiring synchronization of controls, as one can easily see what a Therma-Fuser diffuser is doing simply by looking at the position of the blades.

GENERAL POINTS TO CONSIDER

Stratification sometimes occurs when mixing cold air in "Texas Multizone" units which can result in some rooms cold while others are hot. Therma-Fuser diffusers can help to reduce the effect of stratification by preventing over cooling or overheating.

The self-contained multi zone units of some manufacturers have special controls and sequences not covered in this bulletin. In dealing with these, we recommend review of the Master Zone/Subzone concept, then, examining the details of the multi zone unit to develop an interface procedure. Essentially the same principles will apply with each zone of the unit becoming a master zone, while each Therma-Fuser diffuser is the sub zone. Either cooling or heating will be supplied at one time by a master zone, and static pressure to the Therma-Fuser diffusers will be controlled.

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REDUCING ECONOMIZER CYCLE ENERGY WASTE

All of the air handled by the multizone fan is a mixture of outdoor and return air at the supply air temperature required for cooling, usually around 55°F/13°C.

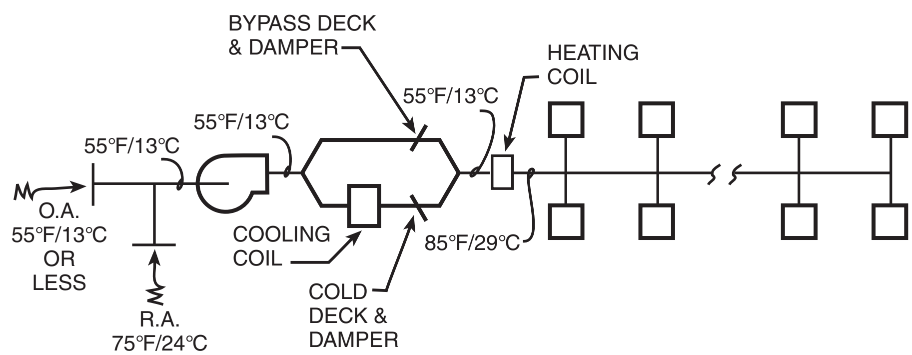
At times one of the zones may require 85°F/29°C air to meet the heating load, or a supply-to-room temperature differential of 10°F/5°C (assuming a 75°F/24°C room). With the economizer control, the air actually must be heated from 55°F/13°C to 85°F/29°C, or a 30°F/17°C rise. In this example, the actual heating energy required is *three times* the heat loss of the zone.

When retrofitted to VAV, the zone will be served by a variable volume of constant temperature air. If the example zone has 4,000 cfm 1889 L/s before retrofit, and a heating load needing 85°F/29°C supply air, then the waste due to the economizer is 4,000 x (75-55) x 1.10 = 88,000 Btu/hr or 1889 x (24-13) x 1.23 = 25,558 W. In a VAV retrofit, the same load could be handled with 2,000 cfm/944 L/s of 95°F/35°C supply air, and the **waste would drop to half that of the constant volume system**, or 2,000 x (75-55) x 1.10 = 44,000 Btu/hr or 944 x (24-13) x 1.23 = 12,722 W.

Sometimes the heating was left out of interior zone ducts to save on first cost. Such spaces have no control when the economizer cycle is activated, receiving constant volume at the mixed air temperature. Retrofit of these to modular VAV will give these zones individual temperature control.

People may try to reset the mixed air temperature to minimize waste, but in likelihood little change can be made where interior loads are present. The interior does not care it if it is 10°F/-12°C or 110°F/43°C outside. If it needs cold supply air in July, it will probably need that condition in January, forcing other zones to heat from that level.

Conversion to modular VAV fine tunes energy usage to a minimum on both the heating and the cooling modes of operation.



One Zone of a "Texas Multizone"

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