

plenum chamber. In many instances, separate, zone heating and zone cooling coils are employed, instead of mixing dampers.

6. The control hook-up for a typical year 'round air conditioning system, including automatic change-over from heating to cooling, is indicated in Fig. 1 and described as follows:

Whenever the fan is started, solenoid air valve or relay E-1, actuated by the fan motor starter, opens minimum outdoor air damper D-1, places hygrostat H in service, and allows duct thermostats T-3 and T-4 to control the maximum outdoor air damper D-2 and the return air damper D-3.

When the fans stop, E-1 is de-energized to close the outdoor air dampers and also to close humidifier valve V-4.

Thermostat T-1 positions steam valve V-3, on the reheater coil, to maintain a constant space temperature. As the space temperature rises, T-1 positions reheater valve V-3 to a closed or to a minimum open position, as determined by low limit

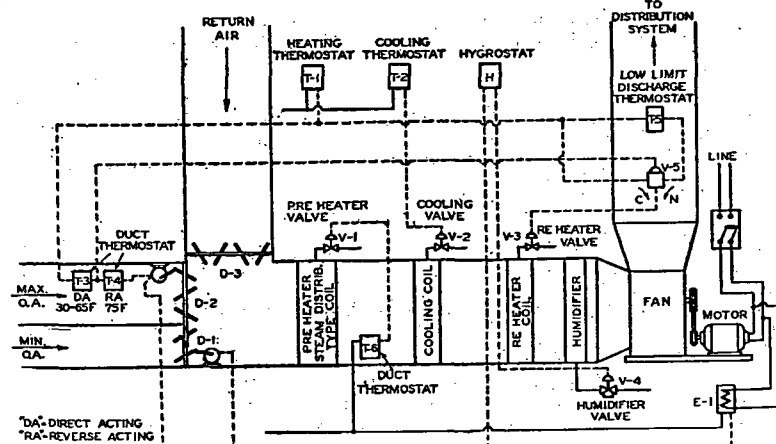


FIG. 1. CONTROL DIAGRAM FOR YEAR 'ROUND AIR CONDITIONING SYSTEM

discharge thermostat T-5. Duct thermostat T-6, in the preheater discharge, positions preheater coil valve V-1 to maintain a constant preheater discharge temperature.

On rising outdoor temperature, between 30 F and 65 F, duct thermostat T-3 located in the outdoor air intake, moves maximum outdoor air damper D-2 toward the open position provided that T-1 is satisfied. At 65 F outdoor, D-2 will be fully open and return air damper D-3 will be fully closed.

As the outdoor air temperature rises above 65 F, duct thermostat T-3 positions V-5 in such a way as to by-pass low limit thermostat T-5, so that reheater coil valve V-3 is operated directly from thermostat T-1. As outdoor air temperature rises from 65 F to 75 F, duct thermostat T-4 gradually closes maximum outdoor air damper D-2 and opens return air damper D-3.

Cooling thermostat T-2 positions cooling coil valve V-2 to admit more chilled water as the space temperature rises.

Hygrostat H positions humidifier valve V-4 to maintain the desired humidity in the conditioned space.

7. The arrangement of automatic control for a constant temperature and constant humidity air conditioning system, using 100 percent outdoor air, is shown in Fig. 2, and the control description follows:

Whenever the fan is running, relay or solenoid air valve E-1, actuated by the fan motor circuit, is energized, opens outdoor air damper D-1, and also permits hygrostat H, in the conditioned space, to control humidifier valve V-2.

When the fan stops, E-1 closes outdoor air damper D-1 and humidifier valve V-2.

Remote bulb thermostat T-2, with bulb located in preheater discharge, operates valve V-3 on the preheater coil to maintain a constant preheater discharge temperature.

On rising temperature, thermostat T-1, in the conditioned space, closes reheater valve V-1 and, through relay C-1, opens face damper D-2 for cooling. On rising humidity in the conditioned space, hygrostat H closes humidifier valve V-2, and likewise, through C-1 may open face damper D-2 for dehumidification.

For closer control, the face and by-pass dampers should be eliminated, and cooling means continuously provided whenever the outdoor dew-point rises above a pre-determined maximum. Reheating and humidifying may be required to provide the desired conditions. However, such a system will be less economical in operation.

PANEL HEATING CONTROL

Panel Heating is sometimes designated as radiant heating because the principal portion of this type of heating is *radiated* to the body or object

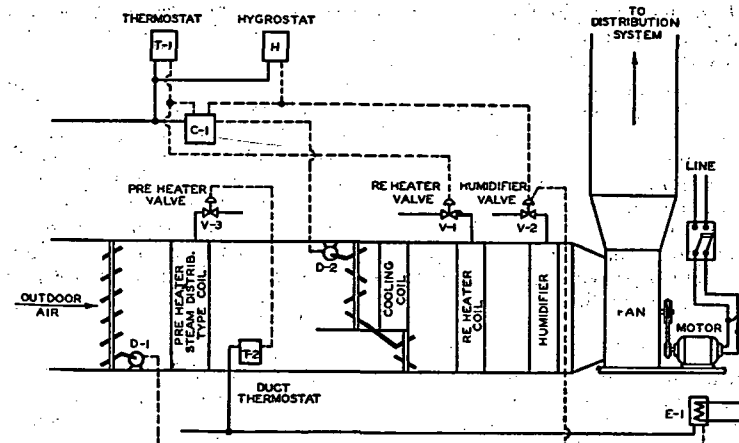


FIG. 2. CONSTANT TEMPERATURE AND HUMIDITY CONTROL FOR YEAR 'ROUND SYSTEM USING 100 PERCENT OUTDOOR AIR

which is being heated. Automatic controls for radiant and convective heating differ somewhat due to the thermal inertia characteristics of the panel heating surface, and the increase in the mean radiant temperature within the space under increasing loads for panel heating.⁵

Effect of Inertia of Panel

If a panel has considerable heat storage capacity (as compared with a convector or conventional radiator) it will continue to emit heat for some time after the room thermostat has become satisfied and has shut off the supply of heating medium. This will cause uncomfortably warm conditions to exist in a space. Also, there will be a considerable delay between the time the thermostat calls for heat and the time heat is actually delivered to the space (because of the large part of the heat that must first be stored in the thermally heavy radiant surface). Whenever inertia exists in the source of heat supply, uncomfortable cycling of space conditions will result unless means of anticipating load changes *before* they occur in the space, or means of setting the basic energy supply rate from load conditions, are provided.

If a thermally heavy radiant surface is used, the primary control should