

are of different orientation, it is much more desirable to install a separate mixing valve with an outdoor control for each orientation and a separate circulator for each zone which has a variable internal heat gain. Each circulator is then started and stopped as required by the thermostat.

In large multiple-zone installations a single circulating pump is often used, usually with a stand-by pump, having a three-way valve and outside control for each orientation and a three-way by-pass valve for each zone. This by-pass valve diverts the water around the coil and effects the same result as though the circulator were stopped.

On a single zone installation as shown in Fig. 4, with continuous circulator operation, the space control can be arranged to modify the setting of the delivered water temperature control in accordance with the space requirements. This arrangement is equally adaptable to a multiple zone installation where a separate circulator or three-way valve is used for each zone.

In Figs. 3 and 4 the heating equipment controls and safety devices, which are always essential, are not shown. These devices are described in the previous section Residential Control Systems. Important considerations in panel heating controls are means of preventing the introduction of excessively hot water in the event of control failure, which might damage the panels, and a manual boiler by-pass or other means of reducing the water temperature to prevent too rapid drying out of new panels. (See Chapter 24, Panel Heating.)

The control arrangement for electronic systems are similar to Fig. 4 but all controls act on the electronic relay which coordinates the signals from the room thermostat, the outdoor element, and the return water control bulb to vary the flow of water in proportion to heating demand.

INDIVIDUAL ROOM CONTROL

The ideal temperature regulating system for any building is one that promotes maintenance of a desired temperature in every room at any time, regardless of location and occupancy.

Individual room temperature control is recognized as the answer to proper thermal environment in schools, hospitals and offices. Demand for it is increasing, to meet individual requirements in apartment homes, hotels and separate residences.

Control of the temperature in each room or possibly of adjacent rooms having the same orientation (as in an apartment home) overcomes many of the problems encountered when attempting to regulate the temperature of a building as a whole, or of large areas or zones. Each individual thermostat regulates the heat input for its particular space regardless of exposure to sun and wind and occupancy. The end result of individual room control is fuel economy and comfort of the occupants. Each room should have a thermostat that controls valves or dampers on all the controllable sources of heat or cooling effect. One uncontrolled source of heat in a room in which a thermostat controls other sources of heat, or cooling, will lead to eventual unpopularity of the thermostat or control system.

ZONE CONTROL

Zone control for any heating, ventilating, or air conditioning system is employed where it is desired to control the heating or cooling effect in a number of rooms or areas, which have similar orientation and occupancy, through one set of controls. Under certain conditions, particularly in

buildings of limited size, it is possible to consider the entire building as a single zone. In such cases, as in small residences, a single thermostat is used to control directly the automatic firing equipment, main heating valve, or the cooling equipment. In large buildings the demand for satisfactory temperature control makes it necessary to sub-divide the building into suitable zones separately controlled.

There are a number of factors to be considered in zoning, in order that heating requirements in a single zone will be approximately consistent throughout its extent.

1. Exposure may be a factor to be considered, with particular reference to prevailing winds, sun effect, and the shelter afforded by surrounding structures and topographical features.
2. Occupancy may be a determining factor, in that the indoor temperature requirements for the activities carried on in various portions of the building may vary, and the hours of occupancy likewise may differ.
3. The physical characteristics of the building will enter into the subdividing of the heating system into zones by reason of the fact that satisfactory temperature conditions throughout a single zone of given extent may not be enjoyed equally in buildings of dissimilar types of construction. Also, the height of the building and its horizontal extent and form are considerations which must be borne in mind.
4. The cost of the zone control equipment for such additional zones as might seem otherwise desirable, often will influence the decision as to the final number of zones to be employed. In buildings of considerable size, accepted practice dictates that there shall be at least one zone for each exposure, although each exposure very possibly should be sub-divided vertically into two or more zones, for the higher structures. Also, the presence of two or more wings, having the same general exposure, may suggest the desirability of more restrictive zoning. When the street floor, or any other portion of the building is used for public occupancy or activities which differ from those carried on in the remainder of the building, it is desirable to provide separate thermostats and controls for each individual area.

For zones which have outside exposures, the control for the zone must, in some manner, respond to the effect of the outdoor temperature, the sun exposure, and the variations of the wind as they effect the temperature and conditions in the zone.

Additional Features

Provisions may also be made to maintain a predetermined low economy temperature in each zone during periods of non-occupancy; to facilitate quick warming-up following such periods; and to follow those portions of the daily cycle of control with normal heating effect during the occupancy period.

A control panel, at a central location, may be arranged so that manual-reset switches for each zone may raise or lower the operating temperature. Time switches, if desired, may be provided for obtaining, automatically, any day-night or other predetermined control program which the operators of the building may desire. The characteristics of the regulators which are operated by the zone controllers depend upon which of the basic systems of zone control is employed in a given installation. Shut-off, mixing or throttling valves, and various forms of devices to reset or pilot the action of reducing valves and to control firing means, are some of the more common regulators which are used to control the flow of steam or hot water, under the command of zone controllers. The characteristics of these regulators usually are determined by the manufacturer of the type of controller which is selected.

DESIGN COORDINATION

A heating or cooling plant designed to meet maximum conditions without regard to controllability, may be unduly costly to operate and difficult