

and water lines, to anti-vibration padding under equipment, and to flexible duct connectors to isolate operating sounds.

AIR DISTRIBUTION METHODS

Where cooling is installed with ducts and air outlets which serve the cooling function only, the practice and experience of comfort air conditioning for offices and commercial buildings apply directly to residential installation. Although cooling and heating by means of the same duct work and air outlets has been common practice in commercial and industrial applications, it must be handled carefully in residential applications. It has been found that low air-flow rates are desirable for warm-air heating systems,⁴ much lower than would be used for cooling systems. It is therefore recommended that, in a residence located in a moderate or cold climate, provision be made for different air-flow rates for summer and winter. In warmer climates, however, where air conditioning is the primary consideration, the summer air-flow rate may be used the year around.

The registers may be placed either in the high sidewall or in the perimeter location. For the high sidewall applications, it is necessary that the deflection of the air be different for summer than it is for winter to prevent the jet from dropping into the living zone (60 in. above the floor and below) where the velocity should be not greater than 35 fpm. For registers located at the perimeter of the residence,⁵ it is not necessary to change the deflection from summer to winter.

The air distribution system should be designed for the largest air-flow rate which is to be used, as outlined in Manual No. 11³ of the *National Warm Air Heating and Air Conditioning Association*. For small-pipe perimeter systems, it is necessary to have more outlets than for the larger duct systems. In some applications, it may be necessary to close off some registers during the winter so that adequate register-air velocities will be obtained. These registers would then be opened during the summer to give a sufficient number of outlets.

Recent investigations have shown⁶ that the use of perimeter duct systems for air conditioning gives excellent results, and that objectionable air motion does not occur within the living zone except in the immediate vicinity of the registers. Care must be taken, however, to use only registers or diffusers that are specifically designed for perimeter application. This is necessary to permit the introduction of the air into the room in a pattern which does not cause drafts. Floor diffusers which distribute the air in a fan-shaped pattern along the wall or low sidewall diffusers which blanket the wall are recommended. For supply-air temperatures not more than 15 deg below room-air temperatures, diffuser face velocities of 500 fpm are recommended.⁷ For supply-air temperatures 20 deg below room-air temperature, the diffuser face velocity should not be less than 700 fpm.

OPERATING COSTS

A sufficient number of residential air conditioning installations have been made in most areas to supply local experience on operating costs. Although this experience generally indicates that the operating costs are not an important factor to the users, they usually are considered on new construction by the financing organizations.

When operating costs are to be estimated, it is well to secure information based on the local experience and to take cognizance of the following factors:

1. There is much variation in the operating practice between users, in that some home owners keep their homes closed and on thermostatic control at all times, whereas others use their cooling equipment only in the extreme of hot weather.
2. The possibility of opening the windows at night to take advantage of night-air cooling should be considered.⁸
3. In some areas, cooling requirements vary considerably from one year to the next so that averages are not representative of any one season's expectancy.
4. Since the cooling load of a residence has only a small component of internal heat, it is much more subject to weather variations than commercial installations which have a much higher component of internally generated heat load.
5. Vacation periods may also offset the operating costs.

EFFECTS ON FUTURE HOUSE DESIGN

Air conditioning, like automatic heating, has brought about improved practice in residential construction, particularly in those regions where cooling is of primary importance. Although it is true that construction practices which reduce the heating load also reduce the cooling load, there are certain considerations which are unique in their effect upon the cooling load. Special attention must be paid to window orientation and means of shading the windows. South windows may be shaded by awnings or roof overhangs, but it is not practicable to shade large window areas having an east or west orientation except by exterior solar screening of some type. The use of insulation in the walls and ceiling of the residence will reduce the cooling load appreciably. In addition, attention should be paid to adequate ventilation of the attic. Double-glazed and weatherstripped windows, heat-absorbing glass, planned shade tree locations, and light colored exterior wall and roof surfaces, also help to reduce the cooling load.

REFERENCES

- ¹ Cooling a Small Residence with a Two-Horsepower Mechanical Condensing Unit, by H. T. Gilkey, D. R. Bahnfleth, and R. W. Roose, (A.S.H.V.E. JOURNAL SECTION of Heating, Piping and Air Conditioning, February 1953).
- ² Application Engineering Standard for Year 'Round Residential Air Conditioning (Air-Conditioning and Refrigeration Institute, 1953).
- ³ Summer Air Conditioning, Manual No. 11 (National Warm Air Heating and Air Conditioning Association, 1953).
- ⁴ Continuous Air Circulation, Manual No. 6 (National Warm Air Heating and Air Conditioning Association, 1947).
- ⁵ Comparative Performances of Two Warm Air Perimeter Systems and Three Convection Systems, by M. E. Childs, R. W. Roose, H. T. Gilkey and S. Konzo, (University of Illinois, Engineering Experiment Station Bulletin 403, 1942).
- ⁶ Cooling a Small Residence Using a Perimeter-Loop Duct System, by D. R. Bahnfleth, C. F. Chen and H. T. Gilkey, (A.S.H.V.E. JOURNAL SECTION, Heating, Piping and Air Conditioning, February, 1954).