

velocity be not in excess of 75 per cent of the maximum permissible outlet velocity.

Outlet Location

The control of the room air motion for the maintenance of comfort conditions depends on the proper selection of the supply outlets. The location of the return or exhaust intakes does not critically affect air motion unless room air velocities in the occupied zone adjacent to the intake exceed comfort limits. The locations of return or exhaust intakes are however important for obtaining the desired room temperature equalization.

Ceiling locations for outlets are recommended for bars, kitchens, lavatories, dining rooms, club rooms, etc., where warm air will rise to the ceiling level. In heating installations, location of the return grilles in the ceiling or high on the wall will result in stratification of the conditioned air and a high percentage of the heated air will be drawn into the return duct before it has served its purpose. (Refer also to considerations outlined previously in section *Outlet Location and Selection* in this Chapter.)

Some circular ceiling outlets combine the supply and return openings in a single unit. The return duct is in the center with the supply pattern on the

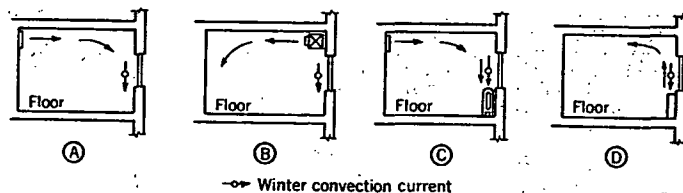


FIG. 9. DISTRIBUTION METHODS FOR SMALL ROOMS

- A. Satisfactory for cooling. Unsatisfactory for heating in severe climates where the outside temperature is consistently below 40 F. and single glass and uninsulated walls are prevalent.
 B. Performance approximately that of A when small diffusers are used in bottom of the duct.
 C. Satisfactory for cooling. Satisfactory for heating if direct radiation is properly controlled.
 D. Satisfactory for both cooling and heating. The air should be discharged slightly away from the wall and for low velocities should be fanned out parallel to the wall.

outside. This method gives best results for cooling applications. The application for heating is more critical and requires consideration of ceiling height, amount of outside wall area, and number of air changes required. In some cases, stratification of warm air may cause short circuiting. Where the wall losses are a small part of the total, little difficulty is encountered with stratification.

Floor locations of outlets are used in heating installations for ceiling or side wall supply. When located so that air is drawn across exposed walls, the performance of the system may be somewhat improved. In general, floor locations tend to collect dirt and refuse.

Wall and door locations of outlets depending on their elevation, have the characteristics of either floor or ceiling returns. In large buildings with many small rooms, the return air may be brought through door grilles or door undercuts into the corridors and then to a common return or exhaust. The pressure drop through door returns should not be excessive; otherwise

the air distribution to the room may be seriously unbalanced with the opening or closing of the doors. Outward leakage through doors or windows cannot be counted upon for dependable results.

SPECIFIC APPLICATIONS

For theaters and auditoriums the air distribution methods used are the downward distribution system with ceiling diffusers and the horizontal distribution system with ejector nozzles or wall diffusers. Fig. 8 shows both methods. Ceiling distribution is accomplished by ceiling outlets under main ceiling and balcony. It is indicated when main ceiling or balcony are cut up by architectural treatment or beams. The only critical points are under the balcony, and (occasionally) above the very rear of the balcony, where ceiling heights are low and where direct impingement of air is sometimes a hazard.

Wall or ejector distribution is particularly applicable for relatively long and narrow theaters. It is essential with this type of distribution that there be no interference with the movement of air throughout its entire path from the high velocity nozzles to the front of the theater. The ceiling should be

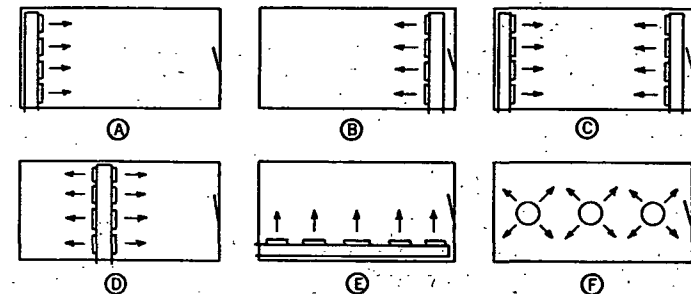


FIG. 10. SMALL STORE COOLING DISTRIBUTION

- A. *Rear Wall.* High outlet velocity, satisfactory if properly designed; possibility of excessive air motion and drafts if used for wrong application.
 B. *Front Wall.* High outlet velocity, results same as A.
 C. *Front and Rear Walls.* Moderate room air motion, outlet blows should not impinge giving rise to down drafts in center.
 D. *Center.* Moderate air motion, no impingement of air streams. Good results.
 E. *One Side.* Moderate room air motion; should blow toward exposed wall. Good results.
 F. *Ceiling.* Low room air motion. Good results. Outlets should be selected of sufficient size to allow for blocking when not located in perfect squares.

smooth without projecting beams or obstructing ornamentation. For large theaters, relatively high velocities can be used. These will work satisfactorily if adjustable outlets are used to avoid areas of local turbulence.

In small or medium size theaters, it is sometimes practicable to use side wall or front wall distribution. For the satisfactory operation of such a system during the winter heating period, the returns should preferably be located at the floor level and near the front of the theater to prevent cold spots which may result from exposed wall convection or infiltration from exists.

For multi-room buildings diagrams shown in Fig. 9 illustrate distribution