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CHAPTER 30

AIR-DIFFUSING EQUIPMENT

Supply Air Outlets, Procedure for Outlet Location and Selection, Noise Control, Grille Outlets, Applications, Accessory Devices, Special Construction Features; Slot Diffuser Outlets, Applications, Accessory Devices, Special Construction Features; Ceiling Diffuser Outlets, Applications, Accessory Devices, Special Construction Features; Return and Exhaust Air Intakes, Grilles and Registers, Equipment for All-Air High-Pressure Systems, Types of Equipment, Pressure-Reducing Valves, Single-Duct Terminal Units, Dual-Duct Terminal Units, Constant Volume Control, Static Pressure Control, High-Capacity Dual-Duct Units

THE function of the supply outlets, or the air diffusing equipment, is to introduce the supply air into the conditioned space to obtain the desired indoor atmospheric environment. Return and exhaust air is removed from the space through return and exhaust intakes. Various types of diffusing equipment are available as standard equipment. This chapter describes this equipment and discusses its proper use. Refer to Chapter 29, Space Air Distribution, and Chapter 31, Air Duct Design.

SUPPLY AIR OUTLETS

Supply outlets are important parts of warm air heating, ventilating, and air-conditioning systems. The correct types of outlets, properly sized and properly located, control the air pattern within the space and obtain proper air motion and temperature equalization in the occupied zone. Unsatisfactory conditions result if the air is poorly distributed.

Three basic types of supply outlets are commonly available: (1) grille and register outlets, (2) slot diffuser outlets, and (3) ceiling diffuser outlets. These outlets have different construction features and physical configurations, and differ in their performance characteristics (air pattern).

Accessory devices used in connection with these outlets regulate the volume of the supply air and control its flow pattern. The outlet cannot discharge air properly and uniformly, unless the air is conveyed to it in a uniform flow. Accessory devices are also necessary for proper air distribution in the space, and they must be selected and used in accordance with manufacturers' recommendations. Outlets should be sized to project the air in such manner that its velocity and temperature reach acceptable levels before entering the occupied zone.

The three basic types of outlets vary widely in the manner in which they diffuse or disperse the supply air into the conditioned space, and induce or entrain room air into the primary air stream.

Outlet types which have a high induction rate have short throw and rapid temperature equalization. Ceiling diffusers have a shorter throw and obtain more rapid temperature equalization than slot diffusers. Grilles and registers which have a long throw, have the lowest diffusion and induction rate. Therefore, round or square ceiling diffusers will deliver more air to a given space than other types of equipment in those cases where recommended residual velocities (25 to 35 fpm) are required. In some spaces, higher residual velocities can be tolerated or the ceilings may be high enough to permit a lower diffusion rate.

Outlets with high induction characteristics can also be used to advantage in summer air-conditioning systems with low supply air temperatures and consequent high temperature differential between room air temperature and supply air temperature. Therefore, ceiling diffusers may be used in systems with cooling temperature differentials up to 30 to 35 F deg and still provide satisfactory temperature equalization within the space, if the system is carefully designed. Slot diffusers may be used in systems with cooling temperature differentials as high as 25 F deg under favorable conditions; but in general they should not be used in systems with temperature differentials of more than 20 F deg. Grilles and registers may be used in well designed systems with cooling temperature differentials up to 25 F deg.

The induction or entrainment characteristics of a moving air stream lead to a phenomenon sometimes referred to as *surface effect*. An air stream moving adjacent to or in contact with a wall or ceiling surface creates a low-pressure area immediately adjacent to that surface, and part of its air is diverted into this low-pressure area, remaining in contact with the surface substantially throughout the length of throw. The surface effect counteracts the drop of horizontally projected air streams.

Ceiling diffusers exhibit the surface effect to a very high degree, because the circular air pattern blankets the entire ceiling area surrounding the outlet. Slot diffusers, which discharge the air stream across the ceiling, exhibit surface effect only if they are sufficiently long to blanket a ceiling area large enough to produce the effect. Grilles and registers exhibit varying degrees of surface effect depending upon the spread of the air pattern.

In many installations, the outlets must be mounted on an exposed duct and discharge the air stream into free space.

The general responsibility for this chapter is assigned to TC 6.1, Duct Design and Room Air Distribution.