KS-21344 AIR DIFFUSER PERFORMANCE DATA AND APPLICATION GUIDELINES

1. GENERAL

1.01 This section provides guidelines for the application of KS-21344 air diffusers to cool equipment frames in which heat dissipation is high. (In this section, dissipation is considered high in individual 2-foot 2-inch frames dissipating more than 600 watts or in equipment areas of several building bays dissipating more than 20 watts per square foot.)

1.02 Whenever this section is reissued, the reason(s) for reissue will be listed in this paragraph.

1.03 The KS-21344 air diffuser (Fig. 1) can be used with conventional cooling systems which have central fan coils and overhead supply ducting. It has been designed for overhead mounting to direct air down the front of equipment frames without interfering with overhead cable racking or aisle lighting. It can be used with new or existing 7-foot, 9-foot, or 11-foot 6-inch equipment frames. The KS-21344 air diffuser can be furnished and/or installed on Bell System hardware by Western Electric. See Fig. 2 for framing and support.

1.04 When it is installed and operating properly, the KS-21344 diffuser produces a flow down the front of the equipment frame that directs cooling air into the maintenance aisle and improves air exchange inside the frame. Without local air movement, the 8-foot column of heated air in the aisles must be displaced by the layer of cold air above the cable racks through gravity alone.

2. PERFORMANCE AND APPLICATION

2.01 The KS-21344 air diffuser can be connected to a branch air supply as illustrated in Fig. 3. Connection can be made by a standard 8-inch diameter flexible duct or by a rigid metallic duct. The elliptical air entrance permits the use of any 8-inch duct. When flexible duct is used, it shall be trimmed and supported to form a minimum number of smooth curves to reduce static pressure loss between the branch duct and the diffuser. It is also convenient to install a stove pipe damper at the connection to the branch duct to facilitate air balancing. Volume control dampers permit application of the diffuser over the range covered by three successive sizes of commercial diffusers with less pressure drop and more uniform air distribution.

2.02 Information for determining the diffuser requirements for a specific application is presented in Fig. 4, 5, 6, and in Table A. Figure 4 shows the static pressure drop in inches of water for various capacities in cubic feet per minute (cfm) standard air densities. Table A shows the capacity in cfm versus the required inlet static pressure (Sp_2), total pressure (TP), and noise compatibility (NC) in decibels (dB). Figure 5 provides capacity versus throw information for terminal velocities of 150, 100, and 50 feet per minute (fpm). For high heat release areas, it is recommended that throws with a terminal velocity of 100 fpm be selected. Figure 6 is a nomograph from which the required number of diffusers per 20-foot by 20-foot building bay can be determined.

2.03 The required number of diffusers can be determined by conventional design procedures or by use of Fig. 6. The example depicted in Fig. 6 is illustrated in Fig. 7. It consists of five telephone equipment frame lines situated in two 20-foot by 20-foot building bays. The total heat release of the equipment to be installed is 61,395 watts. Allowing 1 watt per square foot (w/ft^2) for lighting gives a total heat release of 62,195 watts. Figure 6 can be utilized with either of two quantities: The watts per square foot of heat release for a New Equipment Building Standard (NEBS) application of five equipment frame lineups in a 20-foot by 20-foot building bay, or the average heat release of a 2-foot 2-inch long equipment frame. The watts per square foot of our example is 77.7 w/ft^2. Since a lineup of nine standard 2-foot 2-inch long equipment frames will fit in a 20-foot by 20-foot NEBS building bay, the sample 2-bay example would contain ninety 2-foot 2-inch long equipment frames, and the average heat release per 2-foot 2-inch frame would be 690 watts per frame. Entering the left-hand section of Fig. 6 with either of these values, carrying the line to the "Datum Line" then horizontally to the right three, 3-digit clusters representing three alternative solutions are found. The solutions are five diffusers per maintenance aisle operating at 400 cfm, four per maintenance aisle operating at 500 cfm, or four diffusers in each full maintenance aisle, and three in the half maintenance aisle operating at 600 cfm. Note that each 3-digit cluster on this chart represents a 3-maintenance aisle bay; the top two numbers are the diffuser requirement for the two full maintenance aisles, and the bottom number is the requirement for the half aisle (the aisle next to the column row with a lineup on one side only).

2.04 The location of diffusers should be consistent with the Cable Pathways Plan described in Section 801-801-182, NEBS Cable Distribution and Systems Assembly. This plan coordinates the locations of various elements of the equipment buildings system. Figure 8 illustrates the example solution using five diffusers, each operating at 400 cfm. From Fig. 5, a diffuser operating at 400 cfm has a throw of 7.8 feet at a terminal velocity of 100 fpm. With the diffusers mounted at 10 feet, the terminal velocity point will be 1.8 feet above the floor. This satisfies Section 760-230-101 which recommends a terminal velocity of 100 fpm within 5 feet of the floor. It should be noted that the diffusers in the half-maintenance aisle (the aisle next to the column row) would have the internal damper on the column side closed and each diffuser in this aisle would deliver one-half the listed air quantity at the listed inlet static pressure.

2.05 Figure 9 illustrates the possible locations of diffusers when four frame lineups per building bay are used.

3. OPERATION

3.01 Proper operation of the KS-21344 air diffuser requires the following general procedures:

(a) Where equipment has not yet been installed or powered, shut off the airflow to the diffusers or close the dampers and air deflectors in the diffusers. This action can save energy as well as improve room temperature distribution. Over the half-maintenance aisles, close dampers on the side of the diffuser facing a building column row or any open area that does not contain equipment.

(b) Balance the fan and duct air distribution system to provide the air needed by each branch duct for removal of the equipment heat in the area served. An attempt should be made to minimize pressure drop across dampers. Where only part of the equipment is installed, reduce airflow by reducing fan output or by stopping some of the fans, rather than by using dampers to kill pressure and reduce flow. Static pressure of only 0.1 inch to 0.4 inch at maximum flow is needed at the diffuser depending primarily on the particular air duct distribution system involved. Check to insure that the resultant throw will get the air down into the aisle to a point within 5 feet of the floor.

(c) Sufficient airflow should be provided to the equipment room to maintain a 80°F room return air temperature with a 60°F room air supply temperature (that is, a difference of 20°F). This tends to allow maximum use of economizers while minimizing problems associated with high relative humidity and yet providing effective room cooling.

(d) Airflow from the diffusers should be directed straight down by adjusting the air deflectors perpendicular to the floor. Airflow should ***not*** be directed into the equipment.

(e) If equipment dissipates more or less heat than the anticipated values (for example, due to more or fewer powered shelves in a frame), diffusers can be adjusted to provide more or less air as needed to establish center aisle temperatures.

3.02 In alteration work, the size of existing ductwork may influence the number of diffusers and the airflow through each. For example, the cooling system duct size, capacity in branch ducts, and static pressure available may limit the number of diffusers that can be installed in an area. The required quantity of air, based on the heat release of the equipment, must be provided in the area. It can be supplied in wiring aisles if this facilitates reuse of the existing ductwork. If the required air quantity cannot be supplied in this manner, the duct distribution system must be altered.

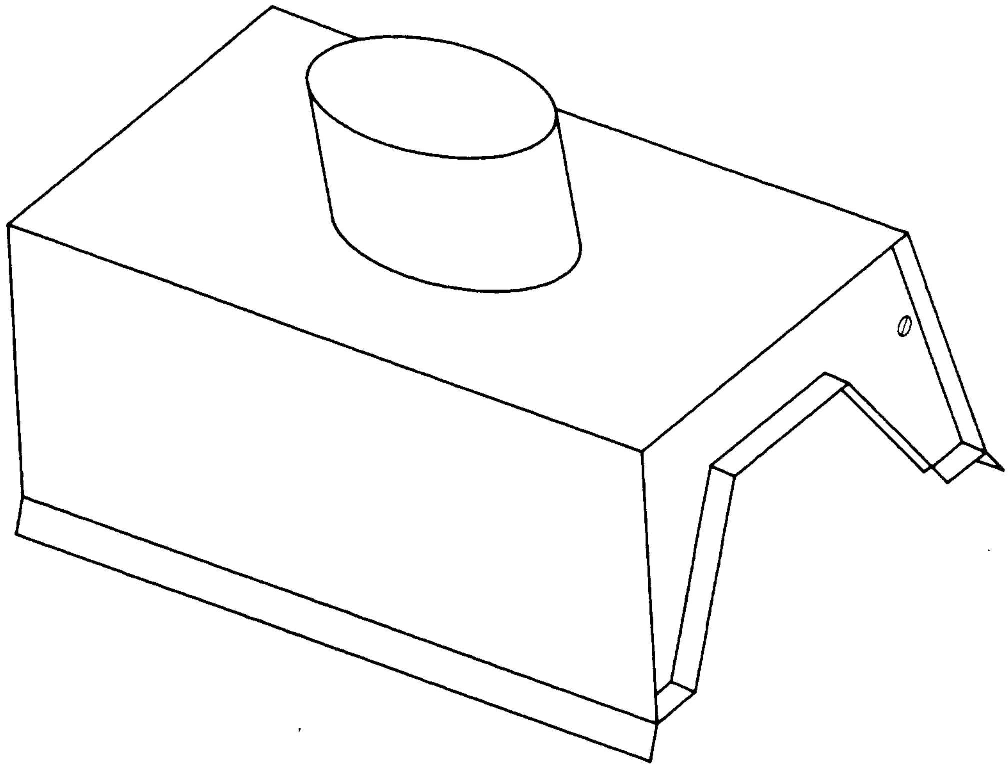


Fig. 1—KS-21344 Air Diffuser

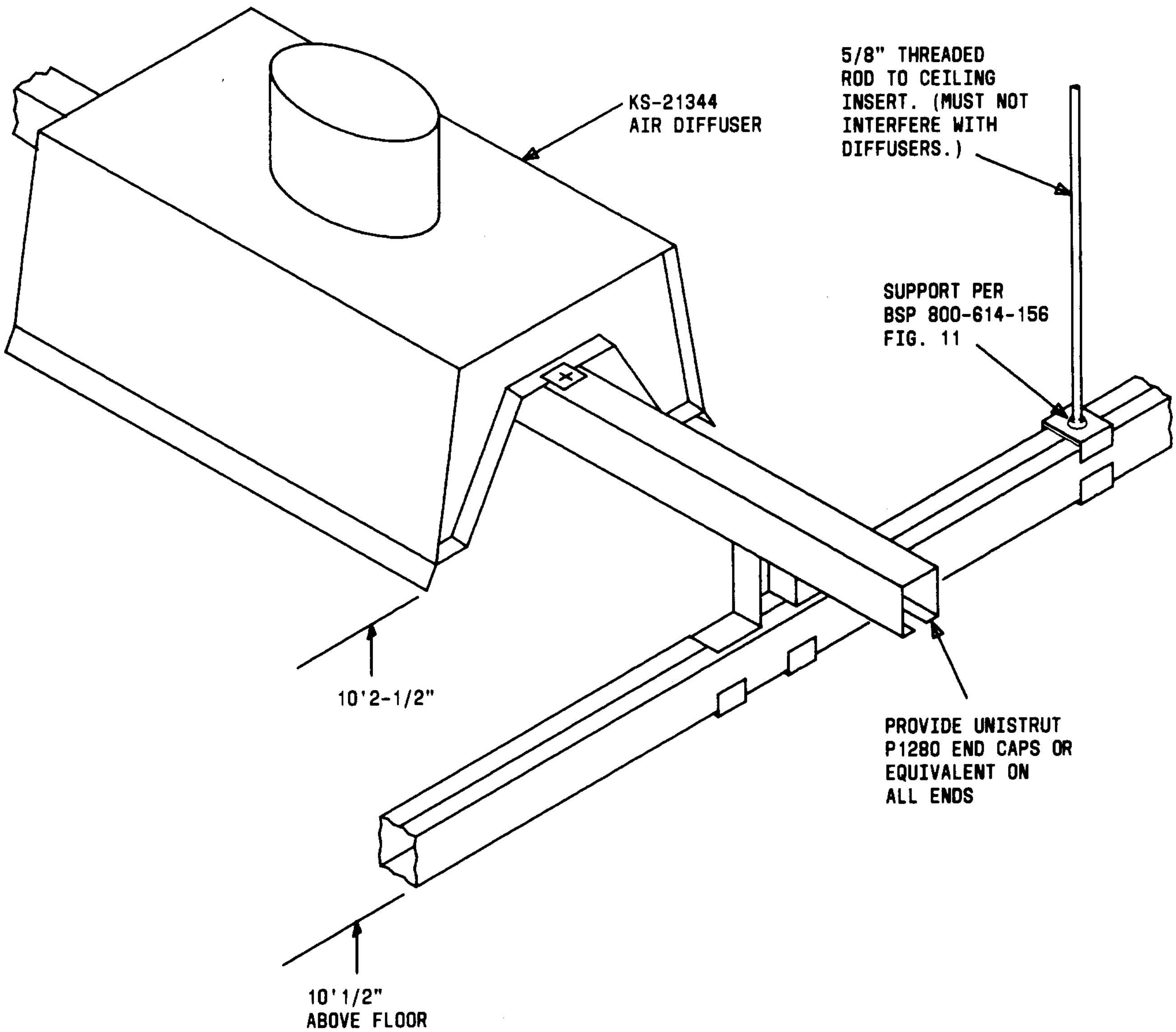


Fig. 2—Framing and Support for KS-21344 Air Diffuser

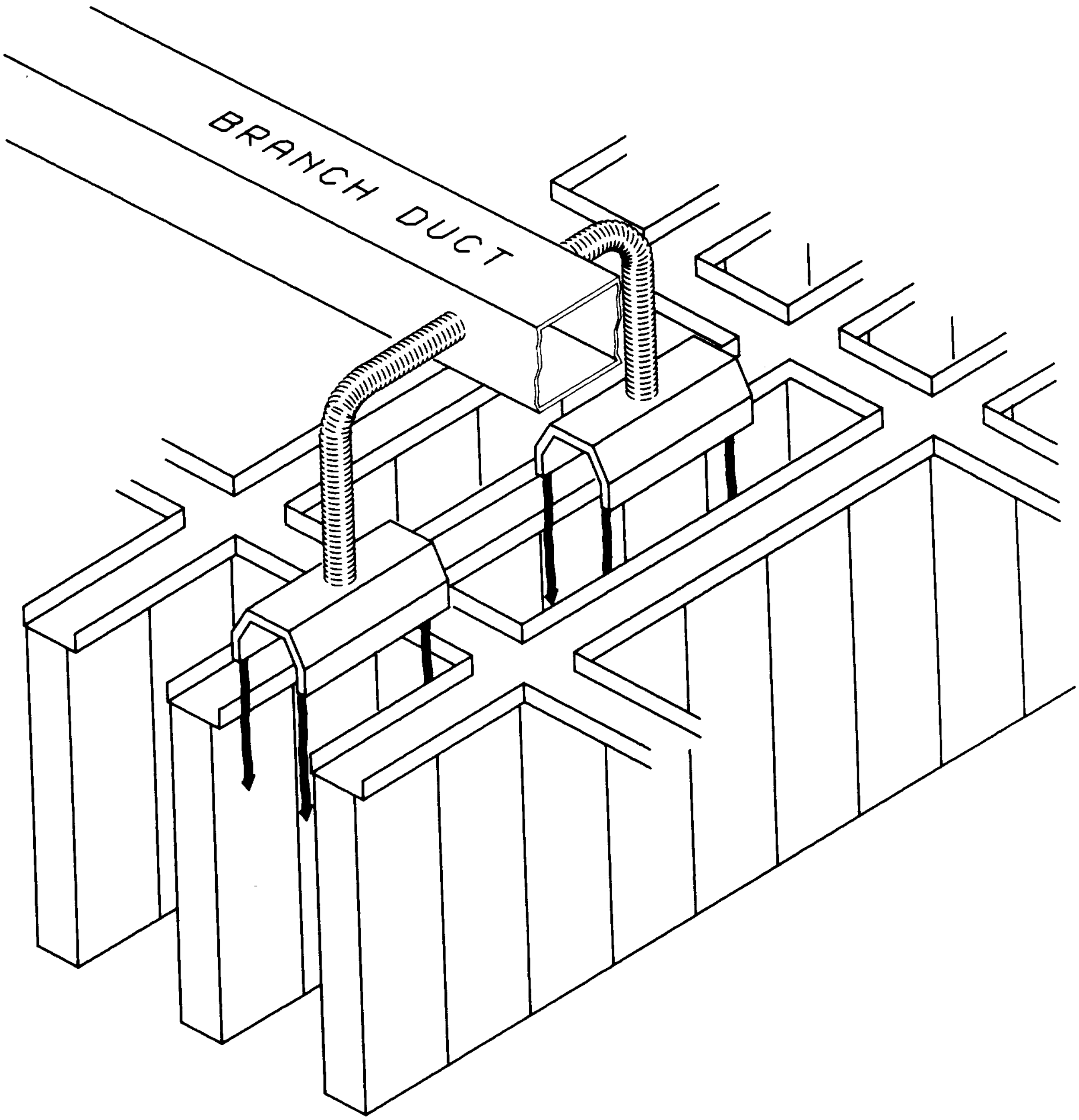


Fig. 3—Conventional Drop Diffuser Air Supply System

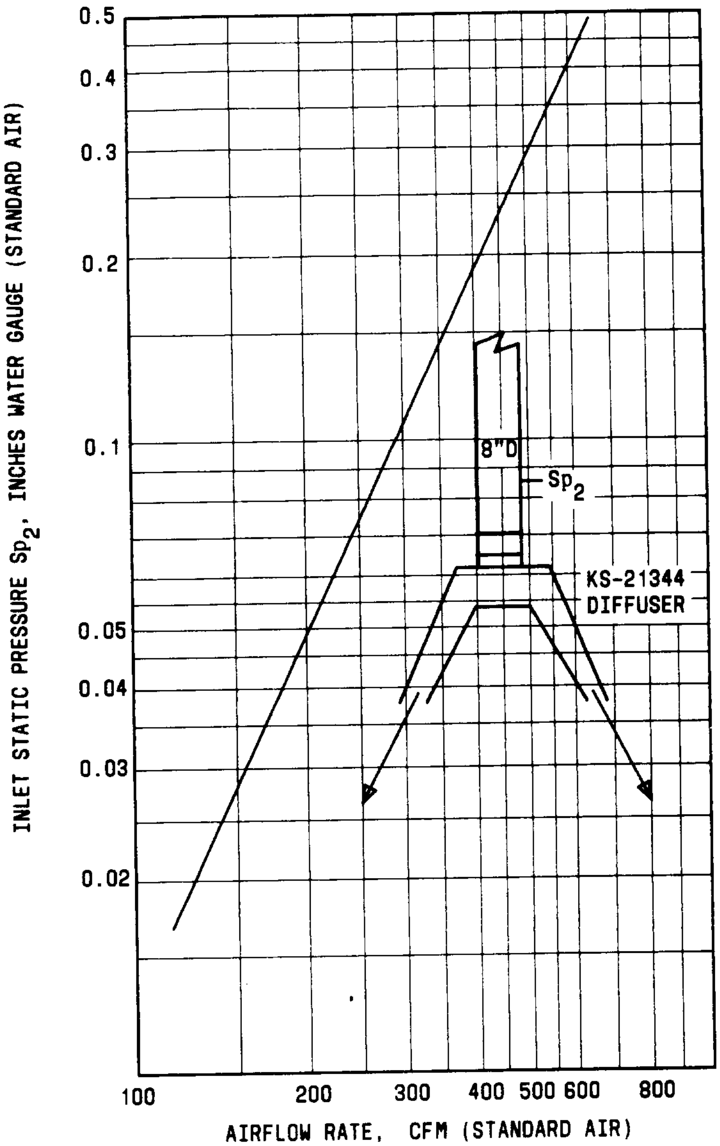


Fig. 4—Pressure Drop Versus cfm Capacity

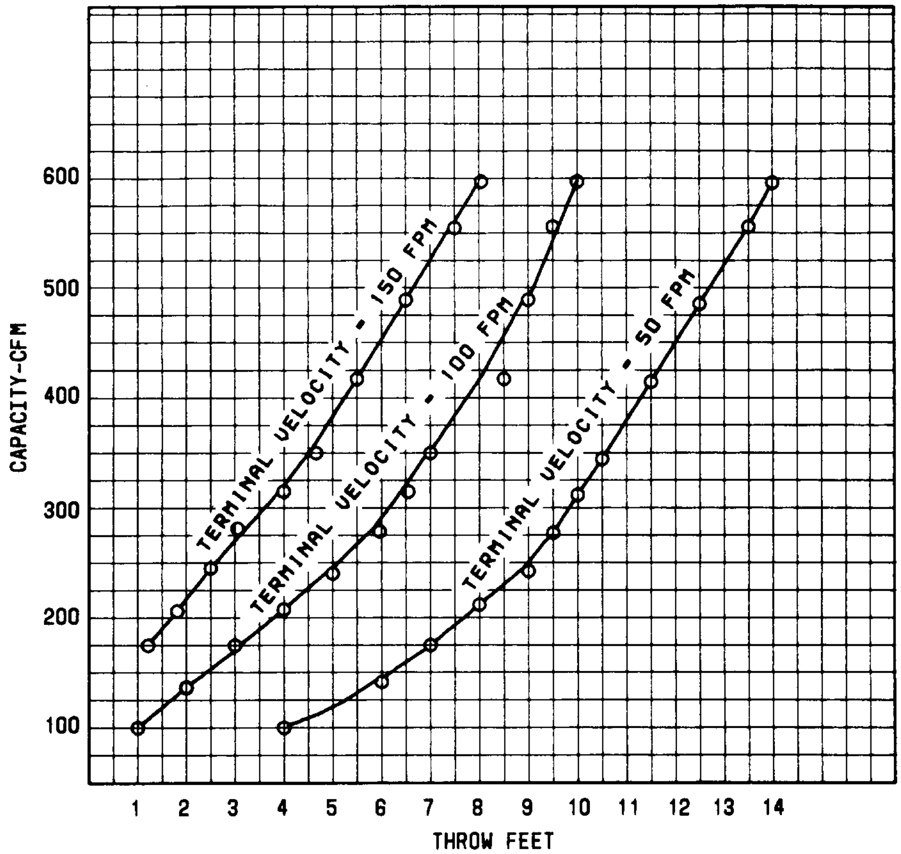
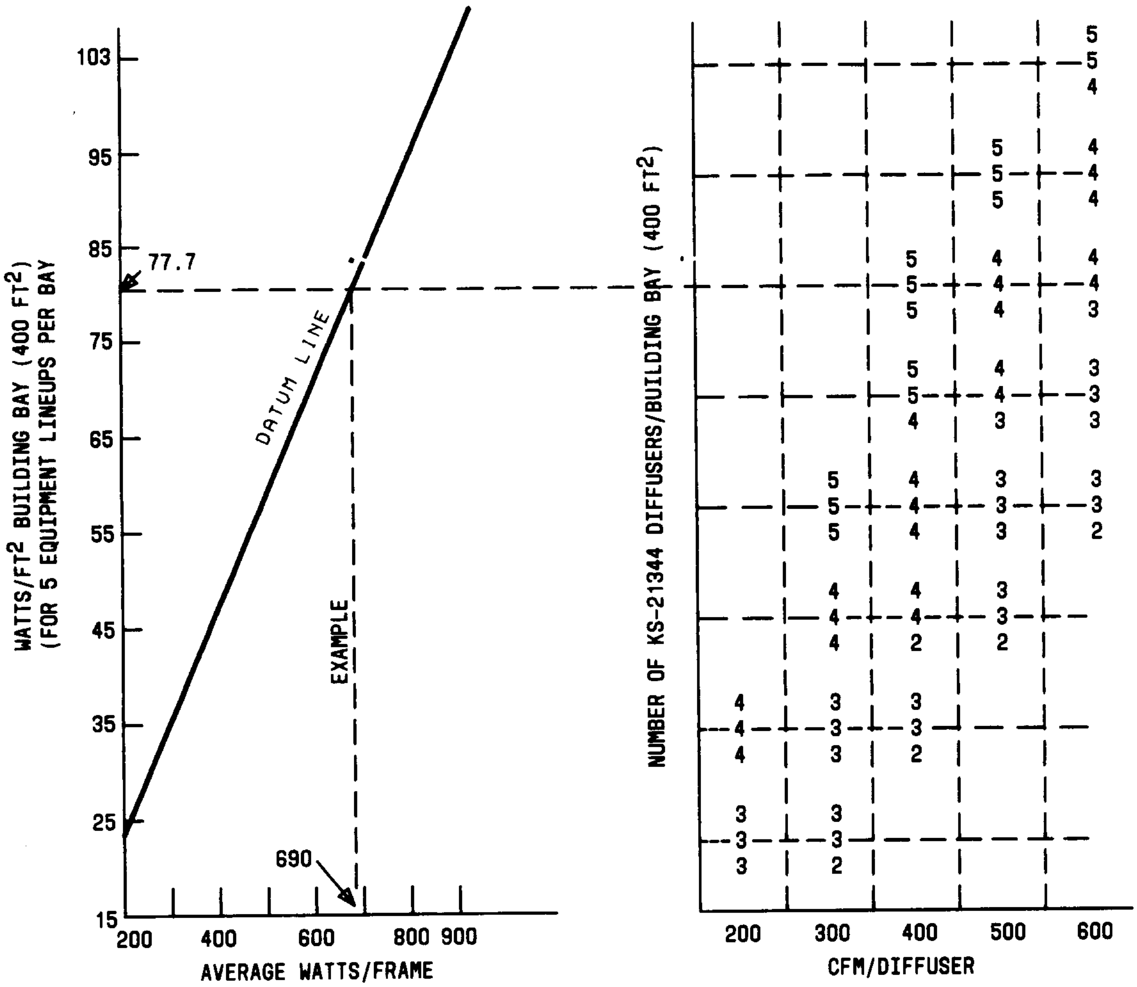


Fig. 5—Cfm Capacity Versus Throw at Terminal Velocities of 150, 100, and 50 fpm



Notes:

1. For use with air conditioning systems which provide supply air 20°F colder than the space design temperature.
2. In 3-digit clusters of numbers, top two digits are requirements for two full-maintenance aisles. Bottom number is requirement for the half aisle.
3. See paragraph 2.03 for description of example.

Fig. 6—Chart Method for Determining the Number of KS-21344 Required per Building Bay (Notes 1 through 3)

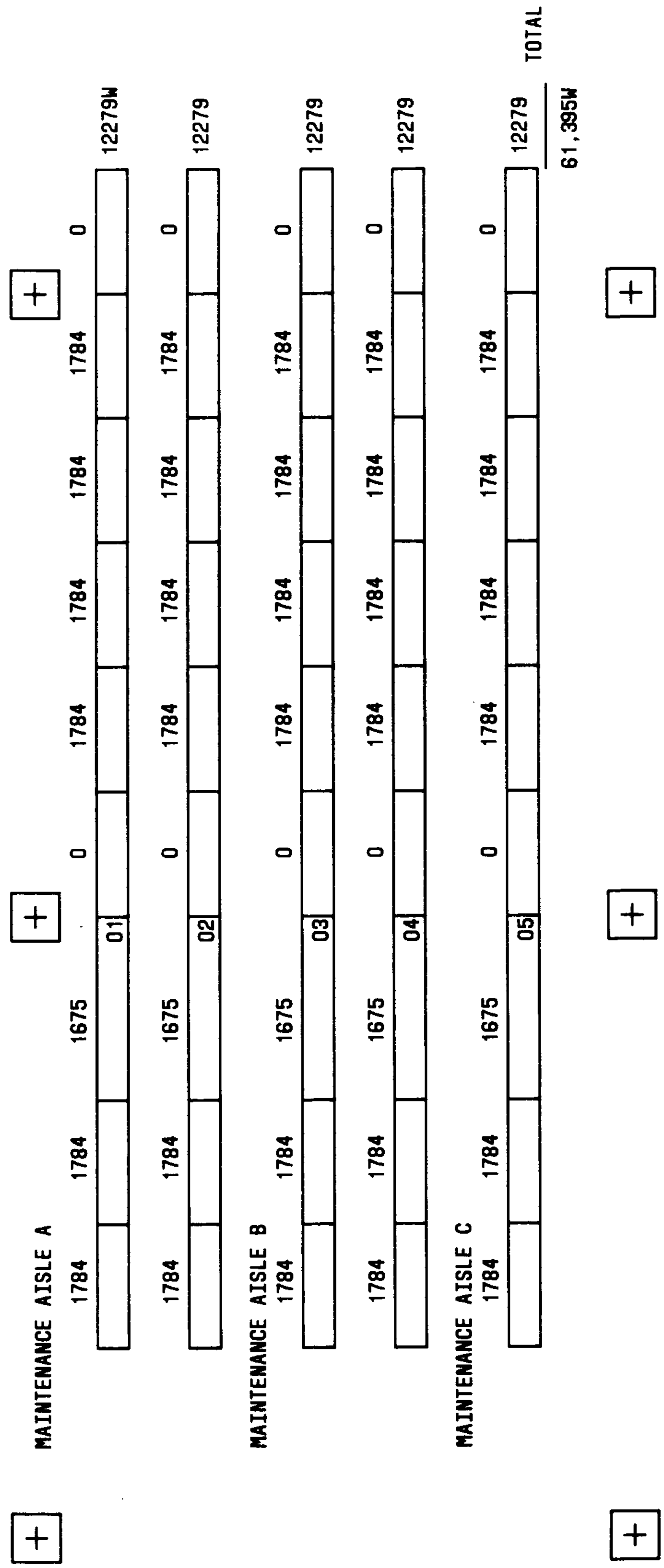


Fig. 7—Equipment Floor Plan

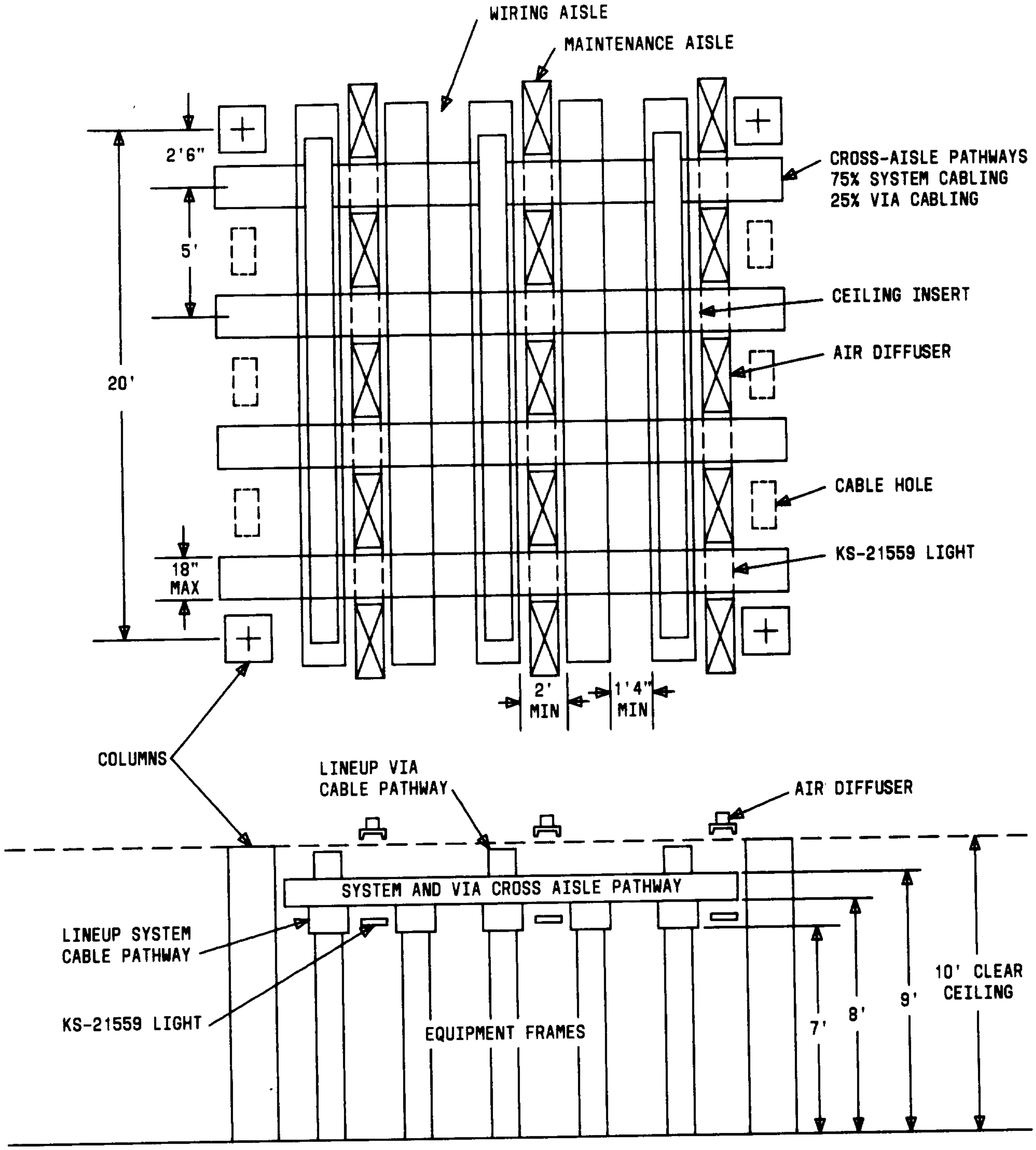


Fig. 8—Cable Pathways Plan for 12-Inch Deep Frame Areas

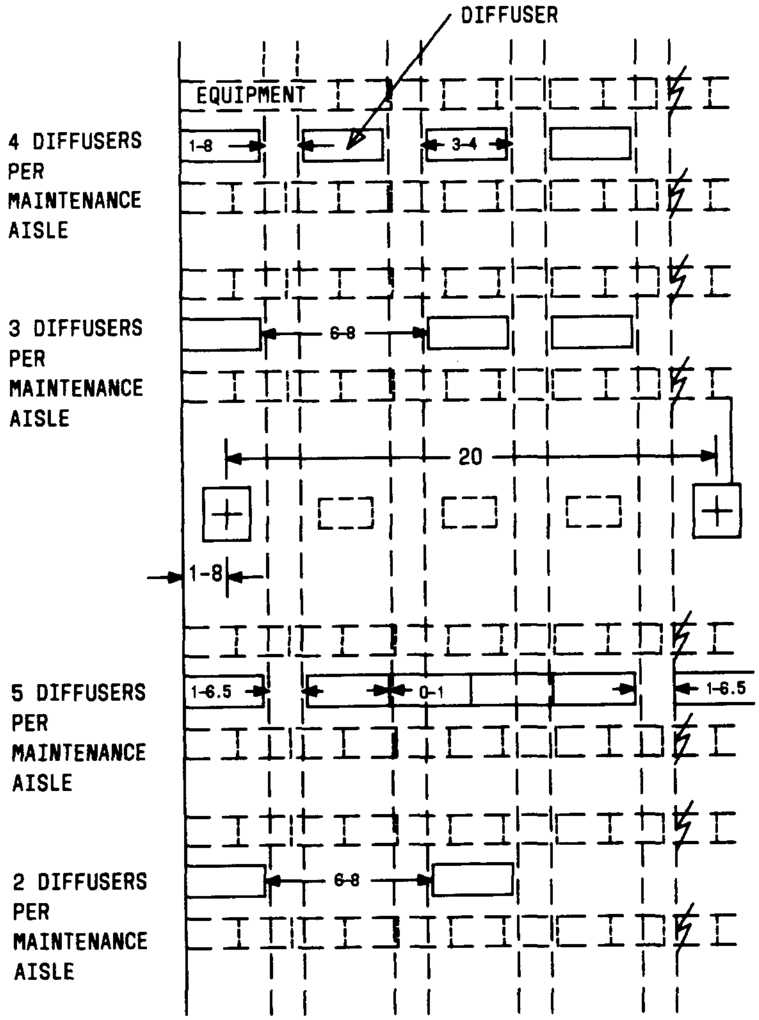


Fig. 9—Various Diffuser Arrangements for Four Cross-Aisle Pathways per Building Bay

TABLE A

PERFORMANCE DATA KS-21344 DIFFUSER (8-INCH OVAL INLET)

CAPABILITY CFM	SP_2 WATER GAUGE INCHES	TP WATER GAUGE INCHES	NC dB (NOTE)
100	—	0.018	—
140	0.024	0.034	13
175	0.037	0.053	18
210	0.053	0.076	22
245	0.072	0.105	26
280	0.096	0.135	29
315	0.120	0.170	32
350	0.150	0.210	35
420	0.215	0.300	39
490	0.290	0.410	43
560	0.380	0.540	46
600	0.430	0.620	48

Note: Noise compatibility based on room absorption of 10 dB re. 10^{-12} watts, refers to the internationally agreed reference base for sound power measurements.