

2001
STANDARD for

AIR DIFFUSERS
AND AIR
DIFFUSER
ASSEMBLIES

FORMALISED BY ISHRAE IN 2008



AIR-CONDITIONING &
REFRIGERATION
INSTITUTE

Standard 890

IMPORTANT

SAFETY RECOMMENDATIONS

It is strongly recommended that the product be designed, constructed, assembled and installed in accordance with nationally recognized safety requirements appropriate for products covered by this standard.

ARI, as a manufacturers' trade association, uses its best efforts to develop standards employing state-of-the-art and accepted industry practices. However, ARI does not certify or guarantee safety of any products, components or systems designed, tested, rated, installed or operated in accordance with these standards or that any tests conducted under its standards will be non-hazardous or free from risk.

Note:

This standard supersedes ARI Standard 890-94.

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AIR DIFFUSERS AND AIR DIFFUSER ASSEMBLIES

Section 1. Purpose

1.1 Purpose. The purpose of this standard is to establish for Air Diffusers and Air Diffuser Assemblies used in air distribution systems: definitions; classifications; test requirements; rating requirements minimum data requirements for Published Ratings; marking and nameplate data; and conformance conditions.

1.1.1 Intent. This standard is intended for the guidance of the industry, including manufacturers, engineers, installers, contractors and users.

1.1.2 Review and Amendment. This standard is subject to review and amendment as technology advances.

Section 2. Scope

2.1 Scope. This standard applies to Diffusers and Diffuser Assemblies used in air distribution systems which are duct connected to a remote forced air source, as defined in Section 3.

2.2 Exclusions. This standard does not apply to Grilles, Registers, and troffer diffusers. Sound and pressure performance of Diffuser Assemblies providing for automatic volume control shall be rated in accordance with ARI Standard 880.

Section 3. Definitions

All terms in this document shall follow the standard industry definitions in the current edition of *ASHRAE Terminology of Heating, Ventilation, Air Conditioning and Refrigeration* unless otherwise defined in this section.

3.1 Air Inlet. A device through which air is removed or returned from a conditioned space. (Grilles, Registers, Diffusers, and Slots may be used as Air Inlets.)

3.2 Air Outlet. A device or opening through which air is discharged into a conditioned space. It is intended for the purpose of this standard that all accessories, connecting duct adapters, or other mounting airways may be considered part of the outlet device being tested and shall be, in such cases, reported as a unit or assembly. Some specific outlet designations are defined below.

3.2.1 Diffuser. An Air Outlet comprised of deflecting members generally located in the ceiling

and designed to distribute air in varying directions and planes.

3.2.2 Diffuser Assembly. A terminal assembly consisting of a specifically recommended or fabricated duct, box, or plenum with an integral or attached air outlet or diffuser, such as a slot-plenum, or slot-duct assembly.

3.2.3 Grille. A louvered or perforated face over an opening which is generally located in the sidewall, sill, or floor.

3.2.4 Register. A combination Grille and damper assembly.

3.2.5 Slot Diffuser or Slot. A long narrow air outlet (aspect ratio generally greater than 10:1).

3.3 Air Stream Patterns. These are characterized by the following terms (see Figure 1):

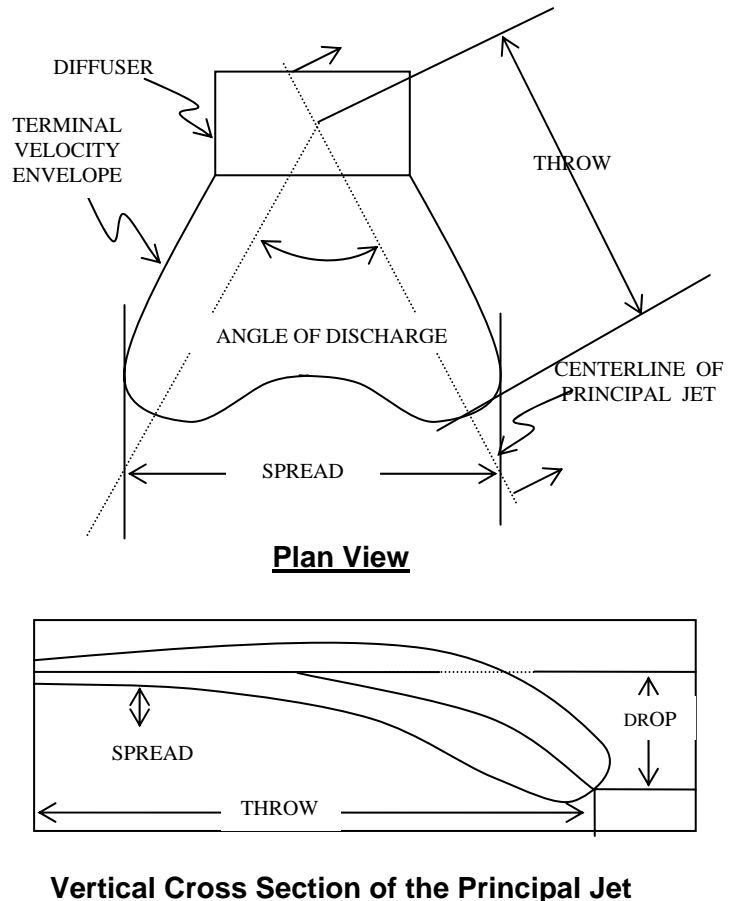


Figure 1. Air Stream Patterns

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3.3.1 *Angle of Discharge.* The largest included angle between centerlines of principal jets of the primary air stream.

3.3.2 *Drop.* The vertical distance that the lower edge of a horizontally projected air stream drops between the outlet and the end of its throw.

3.3.3 *Envelope (ISOVEL).* The boundary surface of points of equal velocity which describe the air distribution profile (see Figure 1).

3.3.4 *Spread.* The maximum distance, in ft [m], measured parallel to the plane of the outlet between the extremes of the Terminal Velocity Envelope (see Figure 1).

3.3.5 *Terminal Velocity (V_t).* The highest sustained velocity in the air stream from an outlet, fpm [m/s], which is arbitrarily specified and used to determine throw (T).

3.3.6 *Throw (T).* The distance, ft [m], from the center of the outlet to a point in the air stream where the highest sustained velocity of the air stream has been reduced to a specified Terminal Velocity (see Figure 1).

3.4 *Area Factor (A_k).* An empirical factor of an outlet or inlet, ft² [m²], determined from the discharge or intake velocity (V_k) and the volume flow rate, Q , cfm [m³/s].

$$A_k = \frac{Q}{V_k} \quad \left[A_k = \frac{L/s}{V_k} \right]$$

3.5 *Aspect Ratio.* Ratio of the length/width of a rectangular air outlet.

3.6 *Discharge or Intake Velocity (V_k).* The average of the velocities of the air stream, fpm [m/s], of an outlet or inlet, measured at specified locations relative to the face of the outlet or inlet with a specified instrument.

3.7 *Flow Rate.* The volume of standard air per unit of time, cfm [m³/s], which moves past a given plane.

3.8 *Hertz (Hz).* A unit of frequency equal to one cycle per second.

3.9 *Neck Velocity (V_n).* This is measured in fpm [m/s] and is calculated as follows:

$$V_n = \frac{Q}{A_n} \quad \left[V_n = \frac{L/s}{A_n} \right]$$

where A_n is the nominal area, ft² [m²], of the duct connection to the Diffuser or Diffuser Assembly.

3.10 *Octave Band.* A frequency band of sound covering a range of frequencies such that the highest frequency is twice the lowest. The Octave Bands used in this standard are defined in ANSI Standard S1.11.

3.11 *Pressure.* The force per unit area, in H₂O [kPa], exerted by a homogeneous liquid or gas.

3.11.1 *Static Pressure (SP).* The pressure that would be exerted by a moving fluid on a body immersed in it if the body were carried along with the fluid. Practically, it is the normal force per unit area at a small hole in a wall of the duct through which the fluid flows.

3.11.2 *Total Pressure (TP).* The sum of the Static and Velocity Pressures, in H₂O [kPa].

3.11.3 *Velocity Pressure (VP).* The pressure in a moving fluid, in H₂O [kPa], capable of accelerating the same fluid from rest to the velocity of the fluid with complete conversion of pressure into kinetic energy. In this standard, Velocity Pressure is a Pressure calculated from duct area and flow rate, at the point of Static Pressure measurement.

3.12 *Published Rating.* A statement of the assigned values of those performance characteristics, under stated Rating Conditions, by which a unit may be chosen to fit its application. These values apply to all units of like nominal size and type (identification) produced by the same manufacturer. As used herein, the term Published Rating includes the rating of all performance characteristics shown on the heat pump or published in specifications, advertising or other literature controlled by the manufacturer, at stated Rating Conditions.

3.12.1 *Application Rating.* A rating based on tests performed at Application Rating Conditions (other than Standard Rating Conditions).

3.12.2 *Standard Rating.* A rating based on tests performed at Standard Rating Conditions.

3.13 *Rating Conditions.* Any set of operating conditions under which a single level of performance results and which causes only that level of performance to occur.

3.13.1 *Standard Rating Conditions.* Rating Conditions used as the basis of comparison of performance characteristics.

3.14 *"Shall" or "Should".* "Shall" or "should" shall be interpreted as follows:

3.14.1 *Shall.* Where "shall" or "shall not" is used for a provision specified, that provision is mandatory if compliance with the standard is claimed.

3.14.2 *Should.* "Should" is used to indicate provisions which are not mandatory but which are desirable as good practice.

3.15 *Sound Power Level, L_w .* This is ten times the logarithm to the base ten of the ratio of the sound power radiated by the source to a reference sound power, expressed in decibels (dB). The reference sound power used in this standard is 1 picowatt (pW).

3.16 *Standard Air.* Air weighing 0.075 lb/ft³ [1.2 kg/m³] which approximates dry air at 70°F [21°C] and at a barometric pressure of 29.92 in Hg [101.3 kPa].

Section 4. Classifications

4.1 *Classifications.* Normally, Diffusers and Diffuser Assemblies falling within the scope of this standard shall be classified as one or more of the following types:

- a. Plenum Slot Diffusers (with integral factory-mounted plenum)
 - 1. Fixed
 - 2. Adjustable
 - 3. Fire Rated
- b. Round Diffusers
 - 1. Round Inlet/Round Face
- c. Perforated Diffusers (perforated panel face)
 - 1. Face-Mounted
 - 2. Neck-Mounted
- d. Louvered Face Diffusers (horizontal pattern)
 - 1. Fixed Blades Non-Adjustable
 - 2. Fixed Blades Adjustable Pattern
 - 3. Adjustable Blades
- e. Square Diffusers
 - 1. Fixed Multiple Cone
 - 2. Fixed Panel or Single Cone
 - 3. Adjustable Multiple Cone
 - 4. Adjustable Panel or Single Cone
- f. Linear Diffusers (with factory provided plenum)

- 1. Fixed
- 2. Adjustable

Section 5. Test Requirements

5.1 *Test Requirements.* Diffusers and Diffuser Assemblies shall be verified by tests conducted in accordance with the provisions set forth in ASHRAE Standard 70. One exception is that the single stationary microphone provision, as defined in 5.2 of ASHRAE Standard 70, shall be disallowed and the room qualification shall be in accordance with ANSI Standard 12.31.

For the purposes of this standard, the highest sustained velocity shall be the average velocity determined for a period of not less than 30 seconds.

5.2 The procedures of Section 6 shall be used where calculation procedures are required to develop the Standard Rating.

Section 6. Rating Requirements

6.1 *Standard Ratings.* Standard Ratings shall be established at the Standard Rating Conditions specified in 6.3.

6.2. All Standard Ratings shall be verified by tests in accordance with Section 5.

6.2.1 *Values of Standard Ratings.* Standard Ratings relating to air flow rates shall be expressed in cfm [m³/s] of Standard Air and stated as follows:

Range, cfm [m ³ /s]	Rate to Nearest, cfm [m ³ /s]
0 to 49 [0 to 24]	1 [0.5]
50 to 199 [25 to 99]	5 [2]
200 to 999 [100 to 499]	10 [5]
1000 and over [500 and over]	25 [10]

Isothermal Throw shall be expressed to the nearest 1 ft [0.3 m].

Static Pressure shall be expressed to the nearest 0.01 in H₂O [2.5 Pa].

Discharge Sound Power Level shall be expressed to the nearest 1.0 decibels.

6.3 *Standard Rating Conditions.* The conditions of test for Standard Ratings shall be as follows:

Inlet Neck Velocity.....750 fpm [3.8 m/s]

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Exception: Where this velocity is outside the manufacturer's recommended velocity, the unit shall be tested at the manufacturer's rated point.

Terminal Velocity.....150 fpm [0.76 m/s]

6.3.1 Air flow rate shall be determined at the Standard Rating Conditions.

6.3.2 Static Pressure shall be measured at the Standard Rating Conditions.

6.3.3 Discharge Sound Power Level (in dB reference to 10^{-12} watts) shall be determined at the Standard Rating Conditions, when installed in accordance with Figure 7 or 8 of ASHRAE Standard 70.

6.3.4 Isothermal Throw shall be measured at the Standard Rating Conditions.

6.4 *Application Ratings.* Ratings at conditions other than those specified in 6.3 may be published as Application Ratings, and shall be based upon data determined by the method of testing described in Section 5.

6.5 *Publication of Ratings.* Wherever Application Ratings are published or printed, they shall include or be accompanied by the Standard Rating, clearly designated as such, including a statement of the conditions at which the ratings apply.

6.6 *Tolerances.* To comply with this standard, Published Ratings shall be based on data obtained in accordance with the provisions of Sections 5 and 6 of this standard, and shall be such that any production unit, when tested, will meet these ratings within the following tolerances:

6.6.1 The isothermal throw to 150 fpm [0.76 m/s] (Terminal Velocity), determined from tests per ASHRAE Standard 70, Section 6.4.4, shall be within $\pm 20\%$ or 1 ft [0.3 m] whichever is greater, of the published value.

6.6.2 Static Pressure shall not be more than 110% of the Published Rating.

6.6.3 Discharge Sound Power Level shall not exceed the published values in each Octave Band by more than the rating tolerance shown:

Octave Band Center Frequencies, Hz	Rating Tolerance, dB
125	6
250	4
500	3
1000	3
2000	3
4000	3

Section 7. Minimum Data Requirements for Published Ratings

7.1 *Minimum Data Requirements for Published Ratings.* As a minimum, Published Ratings shall include Standard Ratings and Part-Load Ratings (where applicable). All claims to ratings within the scope of this standard shall include the statement "Rated in accordance with ARI Standard 890". All claims to ratings outside the scope of this standard shall include the statement "Outside the scope of ARI Standard 890". Wherever Application Ratings are published or printed, they shall include a statement of the conditions at which the ratings apply.

Published Ratings shall include Standard Ratings and may also include Application Ratings. As a minimum, the following information shall be published:

- a. Air flow rate, cfm [m^3/s]
- b. Static Pressure, in H_2O [kPa]
- c. Discharge Sound Power Level, dB (second through seventh Octave Band)
- d. Isothermal Throw, ft [m]

Section 8. Marking and Nameplate Data

8.1 *Marking and Nameplate Data.* As a minimum, the packaging of each Air Diffuser and Air Diffuser Assembly shall display the manufacturer's name and unit model designation.

Section 9. Conformance Conditions

9.1 *Conformance.* While conformance with this standard is voluntary, conformance shall not be claimed or implied for products or equipment within its *Purpose* (Section 1) and *Scope* (Section 2) unless such claims meet all of the requirements of the standard.

APPENDIX A. REFERENCES - NORMATIVE

A1 Listed here are all standards, handbooks and other publications essential to the formation and implementation of the standards. All references in this appendix are considered as part of the standard.

A1.1 ANSI Standard S1.11-1986 (R1993), *Octave- Band and Fractional Octave-Band Analog and Digital Filters*, 1993, American National Standards Institute, 25 West 43rd Street, 4th Fl., New York, NY 10036, U.S.A.

A1.2 ANSI Standard S12.31-1990 (R1996), *Precision Methods for the Determination of Sound Power Levels of Broad-Band Noise Sources in Reverberation Rooms*, 1996, American National Standards Institute, 25 West 43rd Street, 4th Fl., New York, NY 10036, U.S.A.

A1.3 ARI Standard 880-1998, *Air Terminals*, 1998, Air-Conditioning and Refrigeration Institute, 4301 North Fairfax Drive, Suite 425, Arlington, VA 22203, U.S.A.

A1.4 ASHRAE Standard 70-1991, *Method of Testing for Rating the Performance of Air Outlets and Inlets*, 1991, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329, U.S.A.

A1.5 *ASHRAE Terminology of Heating, Ventilation, Air Conditioning and Refrigeration*, Second Edition, 1991, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329, U.S.A.

APPENDIX B. REFERENCES – INFORMATIVE

The following Recommendations have been made by the ASHRAE Standard Committee to be incorporated in the Standard:-

1. Minimum Material specifications for Construction of Diffusers and Dampers – to be included in the Standard.
2. Noise level in the room for Diffusers with Damper (at 25%, 50%, 75% and 100% open) and without Damper – to be included in the Standard.
3. ANSI/ASHRAE 70-1991 to be a part of the Standard.
4. The Standard ARI 890-2001 does not cover Grilles and Registers. Propose to have one Standard which covers Diffusers, Dampers, Grilles and Registers.
5. Room attenuation to achieve the specified noise levels as per the application / usage of space should be a part of this Standard.

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