

AHRI Standard 1291-2017 (R2023) (SI)

**2017 (Reaffirmed 2023) Standard for
Performance Rating
of Zone Dampers**



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ICS Code: 27.200

Note:

This is a new standard.

This standard was reaffirmed October 2023.

For I-P ratings, see AHRI Standard 1290-2017 (R2023) (I-P).

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PERFORMANCE RATING OF ZONE DAMPERS

Section 1. Purpose

1.1 Purpose. The purpose of this standard is to establish for Zone Dampers: definitions; classifications; test requirements for performance ratings; rating requirements; minimum data requirements for Published Ratings; product marking and labeling; and conformance conditions.

1.1.1 Intent. This standard is intended for the guidance of the industry, including manufacturers, designers, 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 Zone Dampers as defined in Section 3. This standard defines the performance of Zone Dampers in the following aspects: Pressure Drop, Airflow Leakage, Airflow Rate, and Operational Torque, which will provide both the specifier and user, the data required to evaluate and compare Zone Dampers.

2.2 Exclusions. This standard does not include or pertain to dampers that are fire and/or smoke rated.

Section 3. Definitions

All terms in this document shall follow the standard industry definitions in *ASHRAE Terminology website* (<https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology>) , *ANSI/AMCA Standard 500-D*, and *AMCA Publication 511*, unless otherwise defined in this section.

These definitions shall be read as an extension of, and not a contradiction to, the definition(s) contained within AMCA Standard 500-D and AMCA Publication 511. Definitions, references, appendices and/or excerpts extracted from AMCA Standard 500-D and AMCA Publication 511, have been re-printed with permission from AMCA International.

3.1 Actuator. The device mounted to the zone control damper that operates the blade(s) device in order to control airflow. The actuation means may be electronic, pneumatic or mechanical.

3.2 Actuator Torque. The force exerted by the Actuator to operate and move the blade(s) device in the Zone Damper, in order to control airflow, expressed in newton-meter (N-m).

3.3 Airflow Leakage (Internal). The amount of air passing through a Zone Damper, expressed as the volumetric rate of air passing through the damper divided by the free area, when it is in the closed position and at a specific Pressure Drop.

3.4 Airflow rate. Volumetric flow through a Zone Damper, expressed in standard cubic meter per second (m³/s of Standard Air).

3.5 Airflow Velocity. Air speed through a Zone Damper, expressed in meter per second (m/s).

3.6 Face Area. The total cross-sectional area of a Zone Damper, expressed in square meters (m²).

3.7 Free Area. The minimum area through which air can pass, in a square, rectangular, round, or oval Zone Damper. It is determined by multiplying the sum of the minimum distances between intermediate blades, top blade and head and bottom blade and sill, by the minimum distance between jambs. Round or oval damper free area is determined by squaring the radius of the damper and multiplying by 3.14, then deduct area obstructions caused by the shaft, blade, and gasket as applicable.

- 3.8** *Insertable Damper.* A Zone Damper which is designed to insert into square, round or oval ducting yet has no integrated shell or frame.
- 3.9** *Operational Torque.* The Torque at varying angles of rotation of the axle which operates the Zone Damper from the full open, to the full closed, and back to the full open position while exposed to specific airflow conditions.
- 3.10** *Pressure Drop.* A measure of the resistance to airflow across a Zone Damper, expressed in Pascals (Pa). It is defined as the pressure differential across a damper for a specific rate of airflow.
- 3.11** *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 the application. These values apply to all units of like nominal size and type (identification) produced by the same manufacturer. The term “Published Rating” includes the rating of all performance characteristics shown on the unit or published in specifications, advertising or other literature controlled by the manufacturer, at stated Rating Conditions.
- 3.11.1** *Application Rating.* A rating based on tests performed at Application Rating Conditions (other than Standard Rating Conditions).
- 3.11.2** *Standard Rating.* A rating based on tests performed at Standard Rating Conditions.
- 3.12** *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.
- 3.12.1** *Standard Rating Conditions.* Rating Conditions used as the basis of comparison for performance characteristics.
- 3.13** *"Shall" or "Should".* "Shall" or "should" shall be interpreted as follows:
- 3.13.1** *Shall.* Where "shall" or "shall not" is used for a provision specified, that provision is mandatory if compliance with the standard is claimed.
- 3.13.2** *Should.* “Should” is used to indicate provisions which are not mandatory but which are desirable as good practice.
- 3.14** *Static Pressure.* That portion of the air pressure inside of the duct which exists by virtue of the degree of compression only, as measured in Pascals (Pa). The pressure may be positive or negative.
- 3.15** *Torque.* The turning force through a radius, expressed in newton meter (N-m), which may or may not vary as the motor Actuator accelerates from zero to maximum speed.
- 3.16** *Total Pressure.* Air pressure which exists by virtue of the degree of compression and the rate of motion. It is the algebraic sum of the Velocity Pressure and the Static Pressure.
- 3.17** *Velocity Pressure.* The portion of the air pressure which exists by virtue of the rate of motion only. It is always positive.
- 3.18** *Zone Damper.* An in-line duct apparatus, typically operated by an electronic or pneumatic Actuator, for the purpose of regulating air-flow, into one or more rooms or zones, served by an HVAC ducted system. The apparatus may be manufactured with or without a frame or shell. May utilize single blade, multi-blade, or hybrid construction, with parallel, opposed or hybrid blade action. Suitable for insertion into rectangular, round or oval duct. The apparatus may be constructed for specific applications and/or mounting orientations.

Section 4. Classifications

- 4.1** A Zone Damper within the scope of this standard shall be classified according to the descriptions provided in Table 1 and Table 2 and as defined in Section 3.

4.2 Zone Damper Classification Based on the Damper Shape.

Table 1. Classification of Zone Dampers	
Dampers	
Rectangle	Round/Oval
1. Framed 1a. Side Mount 1b. Bottom Mount	1. Shell
2. Insertable – no integrated shell or frame	2. Insertable – no integrated shell or frame
3. Single Blade	3. Single Blade
4. Multi-blade 4a. Opposed Blade – blades that move in opposition to each other 4b. Parallel Blade – blades that move in the same direction and overlap each other	4. Butterfly – constructed with two semi-circle blades, pivoting on a central axis, in a wing configuration
	5. Bag/Bladder – pneumatic damper that consists of a bladder that when inflated with air pressure, obstructs the Free Area of the duct
	6. Iris – Multiple blades that pass over each other in a radial movement, to shrink or enlarge the available duct-work face area

4.3 Zone Damper Classification Based on the Actuator Type.

Table 2. Actuator Specifications					
Actuator					
Electronic			Pneumatic		
Power	Control	Torque	Pressure	Control	Torque
Low Voltage 0 - 30 V	Power Open and Power Close	Low Torque 0.011 – 1.11 N-m	Vacuum 29.0– 0.0 mm Hg	Evacuate Open and Pressurize Close	Low Torque 0.011– 1.11 N-m
High Voltage 110 - 240 V	Spring, Ribbon assist to Open or Close	Mid Torque 1.12 – 2.24 N-m	Low Pressure 0.00 – 20.00 kPa	Pressurize Close and Evacuate Open	Mid Torque 1.12– 2.24 N-m
Alternating Current	Modulating Control	High Torque 2.25 – 5.64 N-m	Medium Pressure 20.01– 55.00 kPa	Spring, Ribbon assist to Open or Close	High Torque 2.25 – 5.64 Nm
Direct Current	24 V Floating Point		High Pressure 55.01 kPa and above		
	0 - 10 Vdc				
	4 - 20 mA				

Section 5. Test Requirements for Performance Ratings

5.1 Test Requirements. The conditions and methods for testing Zone Dampers shall be in accordance with AMCA Standard 500-D and AMCA Publication 511, as noted below:

5.1.1 Ambient temperatures. 0 °C – 49 °C.

5.1.2 Dimensional Tolerances.

5.1.2.1 Square and Rectangular. +0.00 mm / -6.00 mm.

5.1.2.2 Oval and Round. +0.00 mm / -3.00 mm.

5.2 The following square and rectangular damper sizes shall be tested per AMCA Publication 511 Section 13 Damper/Air Performance Rating Requirements.

5.2.1 305 mm x 1220 mm

5.2.2 305 mm x 305 mm

5.2.3 610 mm x 610 mm

5.2.4 915 mm x 915 mm

5.2.5 1220 mm x 305 mm

5.2.6 If the maximum single section size is less than shown above, a multi-section Zone Damper shall be tested if offered by the manufacturer. A minimum of one listed size shall be tested.

5.3 The following round and oval damper sizes shall be tested per AMCA Publication 511 Section 13 Damper/Air Performance Rating Requirements.

5.3.1 305 mm

5.3.2 610 mm

5.3.3 915 mm

5.3.4 If the maximum size of the Zone Damper is less than 915 mm in diameter, three dampers shall be tested including the largest, the smallest, plus one size halfway between the two tested sizes. A minimum of one listed size shall be tested.

5.4 *Pressure Drop.* A test for Pressure Drop across a Zone Damper in the full open position shall conform to AMCA Standard 500-D:

5.4.1 *Pressure Drop Test.* The objective of this test is to determine the relationship of Airflow Rate and the Pressure Drop across a Zone Damper.

5.4.2 *Airflow Measurement.* Airflow Velocity at the plane of measurement when determined by using a Pitot-static tube shall not be less than 6.35 m/s. When nozzles are used to determine the Airflow Rate, the minimum Pressure Drop across the nozzle, ΔP_n , shall be 25 Pa at the minimum Airflow Rate of the test.

5.4.3 *Test Damper Setup.* Each Zone Damper shall be tested in a setup which simulate its intended field installation (see AMCA Standard 500-D Section 5.1.1).

5.4.4 *Standard Rating.* The Pressure Drop test is required in order to conform to the AHRI Standard 1291 (SI) standard rating. The test shall be performed to AMCA Standard 500-D per Section 6.1 thru 6.1.4.1.5.

5.5 *Airflow Leakage.* A test for Airflow Leakage through a closed Zone Damper shall conform to AMCA Standard 500-D:

5.5.1 *Airflow Leakage Rate Using Ambient Air.* The purpose of this test is to determine the relationship between one or more sets of Airflow Leakage rate and Static Pressure for a Zone Damper, or other air control damper mounted on a chamber at ambient conditions.

5.5.2 *Airflow Measurement.* When nozzles are used to determine the Airflow Rate, the minimum ΔP_n shall be 25 Pa at the minimum Airflow Rate of test. A direct reading airflow meter may be used if the airflow is below 4.7 L/s.

5.5.3 *Test Damper Setup.* AMCA Standard 500-D Table 3 displays allowable combinations of Airflow Rate measurement and test damper setups.

5.5.4 *Standard Rating.* The Airflow Leakage test is required in order to conform to the AHRI Standard 1291 (SI) Standard Rating. The test shall be performed to AMCA Standard 500-D per Section 6.2 thru 6.2.4.1.5.

5.6 *Operational Torque.* A test to determine Operational Torque on a Zone Damper shall conform to AMCA Standard 500-D:

5.6.1 *Operational Torque.* The purpose of this test is to determine the Torque required to operate a Zone Damper from the open to closed position under airflow, and from the closed to open position against a specified Pressure Drop.

5.6.2 *Airflow Measurement.* Airflow Velocity at the plane of measurement when determined by using a Pitot-static tube shall not be less than 6.35 m/s. When nozzles are used to determine the Airflow Rate, the minimum ΔP_n shall be 25 Pa at the minimum Airflow Rate of the test.

5.6.3 *Test Damper Setup.* Each Zone Damper shall be tested in a setup which simulate its intended field installation (see AMCA Standard 500-D Section 5.1.1).

5.6.4 *Standard Rating.* The Operational Torque test is required in order to conform to the AHRI 1291 (SI) Standard Rating. The test shall be performed to AMCA Standard 500-D per Section 6.6 thru 6.6.4.

5.7 *Test Data to Be Recorded per AMCA Standard 500-D*

5.7.1 *Test damper.* The description of the test damper, including the model, the damper type, (i.e., Single Blade Damper, Multi-blade Damper) size, and Face Area shall be recorded.

5.7.2 *Test setup.* The description of the test setup including specific dimensions shall be recorded. Reference shall be made to the figures in this standard. A drawing or annotated photograph of the setup shall be attached to the data.

5.7.3 *Instruments.* The instruments and apparatus used in the test shall be listed. Names, model numbers, serial numbers, scale ranges, and calibration information shall be recorded.

5.7.4 *Airflow measurement test data.* Test data for each determination shall be recorded. Readings shall be made simultaneously whenever possible. For all types of tests, three readings of ambient dry bulb temperature (t_{db}), ambient wet-bulb temperature (t_{wb}), and ambient barometric pressure (P_b) shall be recorded unless the readings are steady in which case only one need be recorded.

5.7.5 *Presentation of Results.* The test report and presentation of results shall include all the data outlined in Section 8.1.2 of the AMCA Standard 500-D. In addition, the following data shall be recorded as appropriate:

- 5.7.5.1** Damper position, blade orientation, blade action, airflow direction.
- 5.7.5.2** Personnel, date, test ID#, lab Name, lab location.
- 5.7.5.3** Reference to AMCA Standard 500-D and AMCA Publication 511.

Section 6. Rating Requirements

6.1 *Standard Ratings.* Standard Ratings shall be established at the Standard Rating Conditions as defined in Section 5. All Standard Ratings for Air Performance shall be verified by tests, in accordance with AMCA Standard 500-D and AMCA Publication 511. The mandatory rating data that shall be published is shown below:

- 6.1.1** Pressure Drop, Pa.
- 6.1.2** Airflow Leakage, m/s.
- 6.1.3** Airflow Rate, m³/s of Standard Air.
- 6.1.4** Operational Torque, N-m.

6.2 *Standard Rating Conditions.* The conditions of a test for Standard Ratings shall be established at the Standard Rating Conditions as specified in AMCA Standard 500-D, AMCA Publication 511, and Section 5 of this standard.

6.3 *Application Rating Conditions.* Ratings at conditions other than those specified in Section 6.1 may be published as Application Ratings.

6.4 *Published 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.

Section 7. Minimum Data Requirements for Published Ratings

7.1 *Minimum Data Requirements for Published Ratings.* At a minimum, Published Ratings shall include all Standard Ratings. All claims to ratings within the scope of this standard shall include the statement “Rated in accordance with AHRI Standard 1291 (SI)”. All claims to ratings outside the scope of this standard shall include the statement “Outside the scope of AHRI Standard 1291 (SI)”. Wherever Application Ratings are published electronically, written or printed, they shall include a statement of the conditions at which the ratings apply. The following information shall be published for all Standard Ratings:

- 7.1.1** Pressure Drop, Pa.
- 7.1.2** Airflow Leakage, m/s.
- 7.1.3** Airflow Rate, m³/s of Standard Air.
- 7.1.4** Operational Torque, N-m.
- 7.1.5** Mechanical Dimensions, mm.
- 7.1.6** Free Area Dimensions, mm.

7.2 *Installation Instructions.* At a minimum, full installation instructions shall be included in the shipping box and/or made available electronically.

7.3 *Product Data Sheet.* At a minimum, the manufacturer's product data sheet shall be included in the shipping box and/or made available electronically. The product data sheet shall include the standard rating data and product description/classification as per Section 4 of this standard.

Section 8. Product Marking and Labeling

8.1 *Product Label.* At a minimum, the product label shall be prominently displayed and include:

- 8.1.1** Manufacturer’s Name.
- 8.1.2** Model Designation.
- 8.1.3** Damper Classification.
- 8.1.4** Dimensions.
- 8.1.5** Electrical Requirements.
 - 8.1.5.1** Voltage.
 - 8.1.5.2** Volt Ampere, VA.
- 8.1.6** Agency Listings.

Additional product data may be displayed on the product at the discretion of the manufacturer. Labeling shall conform to ANSI/UL Standard 969 for permanence, legibility, and exposure.

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 the standard’s *Purpose* (Section 1) and *Scope* (Section 2) unless such product claims meet all of the requirements of the standard and all of the testing and rating requirements are measured and reported to AHRI in complete compliance with the standard. Any product that has not met all the requirements of the standard shall not reference, state, or acknowledge the standard in any written, oral, or electronic communication.

APPENDIX A. REFERENCES - NORMATIVE

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

A.1.1 AMCA Publication 511-10, *Certified Ratings Program-Product Rating Manual for Air Control Devices*, 2010, Air Movement and Control Association International Inc., 30 West University Drive, Arlington Heights, IL 60004-1893, USA.

A.1.2 ANSI/AMCA Standard 500-D-12, *Laboratory Methods of Testing Dampers for Rating*, 2012, Air Movement and Control Association International Inc., 30 West University Drive, Arlington Heights, IL 60004-1893, USA.

A.1.3 ASHRAE *Terminology* (<https://www.ashrae.org/technical-resources/authoring-tools/terminology>), 2017, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329, USA.

A.1.4 ANSI/UL Standard 969, *Marking and Labeling Systems*. 2017, Underwriters Laboratories. 333 Pfingsten Rd, Northbrook, IL 60062, USA.

APPENDIX B. REFERENCES - INFORMATIVE

B1 Listed here are standards, handbooks, and other publications which may provide useful information and background, but are not considered essential. References in this appendix are not considered part of the standard.

B.1.1 AMCA Publication 11-16, *Certified Ratings Program Operating Manual*, 2016, Air Movement and Control Association International Inc., 30 West University Drive, Arlington Heights, IL 60004-1893, USA.