

# AMCA Publication 511-10 (Rev. 2016)

## Certified Ratings Program Product Rating Manual for Air Control Devices

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## AMCA Publications

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The 2016 revision includes changes to the backdraft damper leakage section will allow manufacturers to show compliance with the new 2015 IECC and ASHRAE 90.1 - 2013 leakage requirements for non-motorized dampers. The proposal increases the number of samples required to be leakage tested from one to three.

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# 1. Purpose

AMCA Publication 511 dictates proper presentation of data and other required technical procedures for certification of air control devices under the AMCA Certified Ratings Program. This manual shall be used in conjunction with the current edition of AMCA Publication 11.

# 2. Scope

The products within the scope of this program are air control devices for use in general ventilation and air conditioning systems.

This program shall apply only to complete cataloged series of sizes. It shall not apply to individual sizes in a series, or part of a series of sizes, or to special units on which catalog ratings are not published.

The AMCA Certified Ratings seal shall be used only in connection with the specifically licensed device. The AMCA Seal shall be used only on complete units. The application of the AMCA seal to individual component parts, such as blades, frames, etc., is not permitted.

# 3. Definitions and Symbols

## 3.1 Definitions

All definitions found in AMCA Publication 11, as well as the definitions in this section, apply to this program.

### 3.1.1 Appurtenance

Appurtenance is any item in the air stream or on the inlet or discharge of the air control device that may affect the performance of the air control device.

An appurtenance shall be considered a part of the air control device if it is in place when the device is tested for performance rating and the effect of the appurtenance is included in the cataloged performance rating.

### 3.1.2 AMCA Certified Ratings Program

The Certified Ratings Program is a program for certifying a product's performance ratings, as defined in this document.

### 3.1.3 Performance rating(s)

Performance ratings are data generated from actual tested products used to derive the certified and published information.

### 3.1.4 Shall and should

The word *shall* indicates a mandatory requirement; the word *should* indicates an advisory statement.

### 3.1.5 Aerodynamically similar

Louver and damper designs are considered to be aerodynamically similar if the profiles of the components in the air stream are geometrically similar. The blades shall be in relative position to the frame and the center-to-center dimensions shall be the same. Frame, blade stops and blade profiles may have slight variances due to manufacturing methods. Blades must have the same streamline shape in that their leading and trailing edges shall be dimensionally equal. The overall angle or curvature of the blade must be the same. Slight deviations in material thickness shall not reduce the overall free area by more than 5% for dampers and 2.5% for louvers. Blade seals shall have the same profile, be of the same durometer and be secured to the blade in the same manner.

In addition to the requirements described above, louver or damper models claiming aerodynamic similarity for the purpose of certifying leakage performance or energy efficiency performance shall meet the following criteria:

The frames and blades shall have a modulus of elasticity (E) greater than or equal to the originally licensed model.

The blade action (i.e., whether the damper is parallel or opposed blade) shall be the same as the originally licensed model.

The method used for interconnecting the damper or louver blades (i.e., the linkage) shall be the same as the originally licensed model.

The jamb seal shall be the same as the originally licensed model.

The blade axle bearing assemblies shall be the same as the originally licensed model.

### 3.1.6 Volume control damper

A volume control damper is a device which, when mounted to a duct or opening, is used to vary the volume of air through the duct or opening. It can be operated manually or mechanically and may have one or more blades.

For the purposes of this document, dampers meeting the definition of a backdraft damper or a UL-classified damper shall not be considered a volume control damper. Ultra-low-leakage dampers and bubble-tight dampers may be tested as volume control dampers.

### 3.1.7 Backdraft damper

A backdraft damper is a damper that, when mounted in a duct or opening, permits airflow in one direction and prevents airflow in the opposite direction.

### 3.1.8 UL-Classified damper

For the purpose of this document, a UL-classified damper is a device which is classified to Underwriters Laboratories category code EMME (Dampers for Fire Barriers and Smoke Applications) as a smoke damper, combination fire and smoke damper, or corridor damper.

### 3.1.9 Ultra-low-leakage damper

This is a device that leaks  $35.2 \text{ L/s/m}^2$  ( $6.93 \text{ cfm/ft}^2$ ) or less at a static pressure differential of 3.0 kPa (12 in. wg). Leakage performance of ultra-low-leakage dampers may be certified at any static pressure differential 3.0 kPa (12 in. wg.) or greater as long as the leakage does not exceed  $2 \times (\Delta P_s)^{0.5}$ .

### 3.1.10 Bubble-tight damper

A bubble-tight damper is a device whose leakage performance at the tested pressure meets the requirements of the bubble test as described in ANSI/AMCA Standard 500-D.

## 3.2 Symbols

| Symbol       | Description                            |
|--------------|----------------------------------------|
| $\Delta P_s$ | Pressure drop or pressure differential |

## 4. Data Submittal Requirements

AMCA staff shall accept test data obtained in only the AMCA laboratory or an AMCA-accredited laboratory. Test data shall conform to the test standard used.

For each air control device and certification type covered by this program, a separate section of testing and rating requirements is included. The specific procedures and test data necessary for preparing performance ratings are defined in Sections 8 through 23.

The following data shall be submitted with all CRP-5 application forms:

Results of the test(s), corrected to standard air density, where applicable  
Photograph of each test setup  
Performance curve(s) of the test results, with test points identified  
Dimensional drawings

For all louvers, one additional drawing as shown in Annex B, along with the methodology that the manufacturer uses to determine the 'A' and 'B' spaces for all louver sizes that are in the product line.

For louvers tested with a drain pan, one additional drawing showing the height and setback dimensions of the drain pan

For gravity ventilators, one additional drawing as shown in Section 20

## 5. Required Catalog Statements

### 5.1 Licensed product statement

The following statement shall be printed prominently and immediately adjacent to the reproduction of the AMCA Certified Ratings seal:

"[Licensee's name] certifies that the [product designation] shown hereon [or herein] is licensed to bear the AMCA seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program."

### 5.2 Licensed performance statement

When performance ratings are licensed to use the AMCA Certified Ratings seal, the following additional statement shall be printed prominently and immediately adjacent to the performance ratings:

"The AMCA Certified Ratings seal applies to [certification type] ratings."

Where [certification type] is one of the following:

- Air Performance
- Water Penetration and Air Performance
- Water Penetration, Wind-Driven Rain, and Air Performance
- Wind-Driven Rain and Air Performance
- Water Penetration, Air Performance, and Sound
- Sound and Air Performance
- Energy Efficiency and Air Performance
- Air Leakage
- Air Leakage and Energy Efficiency
- Air Leakage and Air Performance
- Air Leakage, Air Performance, and Energy Efficiency
- Efficiency

### 5.3 Appurtenances statement

Where published ratings include the effect of an appurtenance, the following statement shall be placed adjacent to the ratings:

"Ratings include the effect of [insert appurtenance here]."

## 6. General Guidelines for Air Control Products

### 6.1 Manufacturer's responsibility

It is incumbent on manufacturers to develop catalog performance ratings of the licensed products so that the product provided to their customers performs within the tolerances allowed by the Certified Ratings Program.

This section provides general guidelines on the process of developing air performance ratings from tests, and Sections 8 through 23 define specific requirements for each type of product.

### 6.2 AMCA staff responsibility

AMCA staff is responsible for the administration of the Certified Ratings Program by verifying that the performance ratings developed by the manufacturer were done in accordance with the requirements of this program.

AMCA staff is also responsible for verifying that the catalog published by the licensee conforms to the requirements of the program.

### 6.3 Rating development

The performance ratings of an air control product or a series of similar products are developed from tests conducted in accordance with ANSI/AMCA 500-D, ANSI/AMCA 500-L, ASTM E90, ANSI/ASHRAE/SMACNA 126, or EN 1751:1998.

### 6.4 Aerodynamically similar products

Products which are aerodynamically similar to a certified product may be certified without additional testing (see Section 3.1.5).

### 6.5 Nameplated products

AMCA Publication 11 allows a company to nameplate another company's product line.

For the purposes of this document, a company may also nameplate a product line of its own (i.e., sell an identical product line under a different name). The nameplated product line must be identical to the original product line.

All the requirements of AMCA 11 for licensing a nameplated product line shall also apply.

## 7. Check Test Tolerances and Required Tests

### 7.1 Licensee's duty

The licensee shall maintain, or cause to be maintained, such manufacturing control of licensed devices manufactured by or for the licensee that, when tested in accordance with the required test standard, the tolerances in Section 7.2 shall be maintained.

The manufacturer of a louver is responsible to maintain the louver's free area within 5% of design free area. Prior to all louver check tests, the free area will be measured and must be within the manufacturing tolerance. If the louver delivered for the check test does not meet this tolerance, it will be returned to the licensee.

### 7.2 Tolerances

#### 7.2.1 Air performance

The airflow at any rated pressure differential shall not be less than 90.0% of the rated airflow.

#### 7.2.2 Wind-driven rain performance

For the cataloged class, the effectiveness shall not be lower than the following:

| Class | Effectiveness |
|-------|---------------|
| A     | 98%           |
| B     | 90%           |
| C     | 75%           |

Discharge loss coefficient shall not be less than 90% of the minimum value in its class.

#### 7.2.3 Water penetration performance

The airflow at the point of the beginning of water penetration shall not be less than 90% of the rated airflow.

#### 7.2.4 Air leakage performance for adjustable louvers

The air leakage at any rated  $\Delta P_s$  shall not be more than 110% of the rated air leakage.

### 7.2.5 Air leakage performance for dampers

The airflow at any  $\Delta P_s$  shall be less than or equal to the corresponding air leakage requirement for the rated class.

### 7.2.6 Air leakage performance for spiral duct

The airflow at the rated pressure shall be less than or equal to the air leakage rating plus one cfm per 100 ft<sup>2</sup> of duct wall surface area.

### 7.2.7 Sound performance

The free field noise reduction ratings of the check test unit shall not exceed the published ratings by more than 3 dB in each octave band.

### 7.2.8 Louver free area

Louver free area shall measure within  $\pm 5\%$  of the published value. The published value shall be no more than the value obtained during the certification test.

### 7.2.9 Thermal efficiency

The cataloged efficiency shall not be less than 90% of the tested efficiency.

### 7.2.10 Wind driven sand performance

For the cataloged class, the effectiveness shall not be lower than the following:

| Class | Effectiveness |
|-------|---------------|
| A     | 90%           |
| B     | 80%           |
| C     | 70%           |

## 7.3 Required tests

### 7.3.1 Damper air performance

One of the originally tested sizes shall be selected and tested in both directions of airflow (front to back and back to front). If the performance is certified in more than one of the allowable test figures, only one figure shall be check tested.

## 8. Louver | Air Performance Rating Requirements

### 8.1 Testing requirements

#### 8.1.1 Air performance test

All louvers tested for air performance determinations shall be tested per ANSI/AMCA Standard 500-L, Figure 5.4 or Figure 5.5.

#### 8.1.2 Test sample

Air performance shall be based on tests conducted on a louver with outside dimensions of 1220 mm x 1220 mm (48 in. x 48 in.) with a tolerance of +0, -6.3 mm (+0, -0.25 in.).

All louvers tested for air performance shall be products as-built, unpainted, cleaned, degreased and without additional factory-applied coating on the product surfaces. All devices tested shall be in the full open position without a screen across the air passages of the louver.

#### 8.1.3 Check test sample

Air performance check test samples shall be 1220 mm x 1220 mm (48 in. x 48 in.); or, for louvers certified for air performance and wind-driven rain, a 1000 mm x 1000 mm (39.375 in. x 39.375 in.) core area louver may be used for an air performance check test.

If the 1000 mm x 1000 mm (39.375 in. x 39.375 in.) louver is not within the check test tolerance, then a 1220 mm x 1220 mm (48 in. x 48 in.) louver may be used for the check test. If the 1220 mm x 1220 mm (48 in. x 48 in.) louver is within the check test tolerance, then the louver is not subjected to the one-year retest.

### 8.2 Calculated performance

### 8.2.1 Proportionality

Air performance of any size louver may be calculated from tests of one size for the same design type using free area velocity versus  $\Delta P_s$  within the limits of extrapolation of test data specified in Section 8.3.3.

### 8.2.2 Blade spacing variations

Where the design blade spacing varies in size, the manufacturer shall submit test data from tests of both the smallest and greatest blade spacing to show that all test data will fall within the specified tolerances.

### 8.2.3 Extrapolation

Extrapolation from test data is permissible.

## 8.3 Published ratings

### 8.3.1 Required data

Published ratings of air performance shall include the following:

- Maximum  $\Delta P_s$  for a specified free area velocity
- Data corrected to standard air density
- AMCA figure or figures to which air performance is tested
- Test sample size

### 8.3.2 Rounding of data

Pressure drop information presented in SI units shall be rounded to the nearest pascal (e.g., 5 Pa, not 5.1 Pa) when testing results in pressure drop values of 1 Pa or greater. Published data may be rounded to one digit after the decimal point (e.g., 0.8 Pa, not 0.83 Pa) when testing results in pressure drop values less than 1 Pa.

Pressure drop information presented in I-P units shall be rounded to a maximum of two digits after the decimal point (e.g., 0.02 in. wg, not 0.025 in. wg) when testing results in pressure drop values of 0.01 in. wg or greater. Published data may be rounded to three digits after the decimal point (e.g., 0.003 in. wg, not 0.0032 in. wg) when testing results in pressure drop values less than 0.01 in. wg, provided that the test equipment is accurate and calibrated to read three decimal places.

### 8.3.3 Extrapolation

The portion of the air performance curve obtained by extrapolation shall be charted with a broken line and must be a smooth continuation of the adjacent portion of the curve.

The air performance shall not be extrapolated more than 50% above the maximum tested static pressure or 50% below the minimum tested static pressure.

### 8.3.4 Mode tested

The published ratings shall indicate the mode tested (intake or exhaust), or test data shall be provided to AMCA that indicates that the data published is worst case.

### 8.3.5 Free area

Published ratings shall include a table of louver free area for the product line. The maximum increment between sizes shall be 305 mm (12 in.).

### 8.3.6 Drain pan statement

If an optional drain pan is used when testing a louver, see Section 5.3.

## 9. Louver | Wind Driven Rain Rating Requirements

### 9.1 Testing requirements

#### 9.1.1 Wind driven rain test

All testing shall be performed in accordance with ANSI/AMCA Standard 500-L, Figure 5.11.

### 9.1.2 Test sample

Wind driven rain performance shall be based on tests conducted on a louver that has one of the following:

A core area of 1000 mm x 1000 mm (39.375 in. x 39.375 in.) with a tolerance of  $\pm 3$  mm ( $\pm 1/8$  in.) with an extended frame

Extended frame outside dimensions of 1213 mm x 1213 mm (47.75 in. x 47.75 in.) with a tolerance of +5, -0 mm (+0.19, -0 in.)

Outside dimensions of 1213 mm x 1213 mm (47.75 in. x 47.75 in.) with a tolerance of +5, -0 mm (+0.19, -0 in.)

## 9.2 Calculated performance

### 9.2.1 Penetration class

The penetration class shall be determined by the effectiveness in accordance with ANSI/AMCA Standard 500-L (see Table 2).

### 9.2.2 Discharge loss coefficient

The discharge loss coefficient, given in Table 1, shall be determined in accordance with ANSI/AMCA Standard 500-L.

## 9.3 Published ratings

### 9.3.1 Wind driven rain performance

Published ratings of wind-driven rain performance of louvers shall be a statement of their ability to reject simulated rain.

Published ratings shall include the following:

Wind velocity

Rainfall rate

Core velocity

Effectiveness

Penetration class (see Table 2)

Discharge loss coefficient class (see Table 1)

### 9.3.2 Free area

Published ratings shall include a table of louver free area for the product line. The maximum increment between sizes shall be 305 mm (12 in.).

### 9.3.3 Drain pan statement

If an optional drain pan is used when testing a louver, see Section 5.3.

**Table 1**

**Discharge Loss Coefficient Class**

| Class | Discharge Loss Coefficient |
|-------|----------------------------|
| 1     | 0.4 and above              |
| 2     | 0.3 to 0.399               |
| 3     | 0.2 to 0.299               |
| 4     | 0.199 and below            |

Note: Table 1 also applies to entry loss coefficient

**Table 2**

**Penetration Class (for Wind-Driven Rain)**

| Class | Effectiveness |
|-------|---------------|
|-------|---------------|

|   |              |
|---|--------------|
| A | 99.9% to 99% |
| B | 98.9% to 95% |
| C | 94.9% to 80% |
| D | Below 80%    |

Note: These classifications apply at various core velocities

## 10. Louver | Wind Driven Sand Rating Requirements

### 10.1 Testing requirements

#### 10.1.1 Wind driven sand test

All wind driven sand testing shall be performed in accordance with ANSI/AMCA Standard 500-L, Figure 5.12. Air performance testing of sand louvers will be performed in accordance with ANSI/AMCA Standard 500-L, Figure 5.13. All air performance and wind driven sand performance testing shall be performed on the same louver and the same test fixture unless the same louver model and design is already certified for air performance.

#### 10.1.2 Test sample

Wind driven sand performance shall be based on tests conducted on a louver with outside dimensions of 1220 mm x 1220 mm (48 in. x 48 in.) with a tolerance of +0, -6.3 mm (+0, -0.25 in.).

All louvers tested for wind driven sand performance shall be products as-built, unpainted, cleaned, degreased and without additional factory-applied coating on the product surfaces. All devices tested shall be in the full open position without a screen across the air passages of the louver.

#### 10.1.3 Air performance requirement

Certified air performance is required prior to certified wind driven sand performance.

### 10.2 Calculated performance

#### 10.2.1 Wind driven sand performance

Sand removal performance data presented shall be a plot of free area velocity m/s (fpm) versus sand rejection effectiveness (%).

#### 10.2.2 Proportionality

Wind driven sand performance of any size louver may be calculated from tests of one size for the same design type using free area velocity versus  $\Delta P_s$  within the limits of extrapolation of test data specified in Section 8.3.3.

#### 10.2.3 Blade spacing variations

Where the design blade spacing varies in size, the manufacturer shall submit test data from tests of both the smallest and greatest blade spacing to show that all test data will fall within the specified tolerances of both air performance and sand performance.

### 10.3 Published ratings

#### 10.3.1 Wind driven sand performance

Published ratings of wind driven sand performance of louvers shall have a statement of their ability to reject airborne dry sand particles.

Published ratings shall include the following:

A graph of the test results of the louver's sand rejection effectiveness at different velocities (1, 2.5, 4, 5.5 and 7 m/s [197, 492, 787, 1083, 1378 fpm]) by plotting the free area velocity  $V_{fa}$  calculated from  $Q/A_{fa}$  against the effectiveness percentage  $E_s$  calculated from  $(m_u/m_i) (100)$

**Penetration class (see Table 3)**

### 10.3.2 Free area

Published ratings shall include a table of louver free area for the product line. The maximum increment between sizes shall be 305 mm (12 in.).

### 10.3.3 Grading of sand

Refer to Table 4.

**Table 3**

**Penetration Class for Wind Driven Sand Test**

| Class | Effectiveness |
|-------|---------------|
| A     | 100% to 90%   |
| B     | 89.9% to 80%  |
| C     | 79.9% to 70%  |
| D     | Below 70%     |

Note: These classifications apply at various free area velocities

**Table 4**

**Requirements for Standard Test Sand**

| Grade ( $\mu\text{m}$ ) | Mass (%) |
|-------------------------|----------|
| >699                    | 0.5      |
| 423-699                 | 3.0      |
| 353-422                 | 12.0     |
| 251-352                 | 30.0     |
| 211-250                 | 20.0     |
| 152-210                 | 27.0     |
| 104-151                 | 6.0      |
| 76-103                  | 1.0      |
| <76                     | 0.5      |

## 11. Louver | Water Penetration Rating Requirements

### 11.1 Testing requirements

#### 11.1.1 Water penetration test

All louvers tested for water penetration performance shall be tested in accordance with ANSI/AMCA Standard 500-L, Figure 5.6.

#### 11.1.2 Test sample

Only 1220 mm x 1220 mm (48 in. x 48 in.) louvers shall be tested. The tolerance is +0, -6.3 mm (+0, -0.25 in.).

All louvers tested for water penetration performance shall be products as-built, unpainted, cleaned, degreased and without additional factory-applied coating on the product surfaces which would enhance water-shedding capability. All devices tested shall be in the full open position without a screen across the air passages of the louver.

The louver sample tested for water penetration performance shall be the same sample tested for air performance.

#### 11.1.3 Air performance requirement

Certified air performance is required prior to water penetration certification.

### 11.2 Calculated performance

#### 11.2.1 Proportionality

Tests may be run on a single size for a given design type. The beginning point of water penetration for all sizes of that design shall be considered to be at the same free area velocity as the tested unit (see Annex C).

### 11.2.2 Linear regression formula

The following formula is used for the simple linear regression:

$$Y = B_0 + B_1 (\ln X)$$

Where:

$Y$  = Free air velocity, m/s (fpm), result for plot of curve

$X$  = Water penetration, mL/m<sup>2</sup> (oz/ft<sup>2</sup>), defined

And:

$$B_0 = \bar{Y}_i - B_1 \bar{X}_i$$

$$B_1 = \frac{S_{xy}}{S_{xx}}$$

$$S_{xy} = \sum_{i=1}^n [(\ln X_i) Y_i] - \frac{\sum_{i=1}^n (Y_i) \sum_{i=1}^n (\ln X_i)}{n}$$

$$S_{xx} = \sum_{i=1}^n [(\ln X_i)^2] - \frac{\left[ \sum_{i=1}^n (\ln X_i) \right]^2}{n}$$

$X_i$  = Water penetration, mL/m<sup>2</sup> (oz./ft<sup>2</sup>), at test point  $i$

$Y_i$  = Free area velocity, m/s (fpm), at test point

$\bar{X}_i$  = Average  $(\ln X_i)$  for  $n$  test points

$\bar{Y}_i$  = Average  $Y_i$  for  $n$  test points

$n$  = Number of points used for regression analysis

### 11.2.3 Beginning point of water penetration

The beginning point of water penetration shall be the free area velocity at the intersection of a simple linear regression of test data and the line of 3 mL (0.01 oz) of water per m<sup>2</sup> (ft<sup>2</sup>) of free area.

## 11.3 Published ratings

### 11.3.1 Water penetration performance

Published ratings of water penetration performance of louvers shall be a statement of the free area velocity at which the beginning of water penetration occurs (see Section 11.2.3).

### 11.3.2 Water penetration curve

Published ratings may be shown as a curve of water penetration, provided that the curve is in accordance with the regression formula shown in Section 11.2.2.

#### 11.3.2.1 Ordinate (y-axis)

The ordinate shall be from 0 to 100 mL (0 to 0.3 oz) of water penetration m<sup>2</sup> (ft<sup>2</sup>) free area.

#### 11.3.2.2 Abscissa (x-axis)

The minimum abscissa velocity shall start on an even 0.5 m/s (100 fpm) more than 0.3 m/s (60 fpm) below the velocity at the beginning of water penetration.

The maximum abscissa velocity shall be up to 0.5 m/s (100 fpm) past the 100 mL (0.3 oz) of water per m<sup>2</sup> (ft<sup>2</sup>) of free area with a maximum velocity of 6.5 m/s (1300 fpm) (see Annex C).

#### **11.3.2.3 Marking the beginning point of water penetration curve**

The starting coordinate of the water penetration curve shall be marked and/or labeled as the beginning point of water penetration.

#### **11.3.3 Louver information**

The louver test size and test duration shall be included on published results of each catalog series.

#### **11.3.4 Mullions**

The following special conditions apply for drainable blade louvers that are separated by an architectural or recessed mullion:

1. If the mullion contains provisions to drain water from the blades and head members away from the airstream, and if louver has been tested for water penetration, the use of the AMCA Certified Rating seal on this design is authorized when louver section falls within the catalog data.
2. If the mullion does not contain provisions to drain water from the blades and head members, the use of AMCA Certified Rating seal is not authorized.

#### **11.3.5 Free area**

Published ratings shall include a table of louver free area for the product line. The maximum increment between sizes shall be 305 mm (12 in).

#### **11.3.6 Drain pan statement**

If an optional drain pan is used when testing a louver, see Section 5.3.

#### **11.3.7 Air performance ratings**

Air performance ratings shall be published in accordance with Section 8.

#### **11.3.8 Mullion exclusion**

The performance of drainable blade louvers supplied with mullions that do not have provisions to drain water from the blades or head shall not be certified.

## **12. Acoustical Louver | Sound Performance Rating Requirements**

### **12.1 Testing requirements**

#### **12.1.1 Sound performance test**

All transmission loss acoustical testing shall be in accordance with ASTM E90.

#### **12.1.2 Test sample**

Test data shall be submitted for a 1220 mm x 1220 mm (48 in. x 48 in.) louver. The tolerance is +0, -6.3 mm (+0, -0.25 in.).

#### **12.1.3 Air performance requirement**

Certified air performance is required prior to sound performance certification.

### **12.2 Calculated performance**

#### **12.2.1 Free Field Noise Reduction**

Free field noise reduction shall be determined by adding 6 dB to the transmission loss (dB).

#### **12.2.2 Proportionality**

Air performance of any size louver may be calculated from tests of one size for the same design type using free area velocity versus  $\Delta P_s$  within the limits of extrapolation of test data specified in Section 8.2.1.

### 12.2.3 Blade spacing variations

Where the design blade spacing varies in size, the manufacturer shall submit test data from tests of both the smallest and greatest blade spacing to show that all test data will fall within the specified tolerances for both air performance and sound performance ratings.

## 12.3 Published ratings

### 12.3.1 Sound performance

Acoustical ratings shall be stated as free field noise reduction (dB) in the 2nd through 7th octave bands.

### 12.3.2 Free area

Published ratings shall include a table of louver free area for the product line. The maximum increment between sizes shall be 305 mm (12 in.).

### 12.3.3 Air performance ratings

Air performance ratings shall be published in accordance with Section 8.

## 13. Adjustable Louver | Air Leakage Rating Requirements

### 13.1 Testing requirements

#### 13.1.1 Air leakage test

All testing for air leakage through closed adjustable louvers shall be per ANSI/AMCA Standard 500-L, Figure 5.4 or Figure 5.5.

#### 13.1.2 Test samples

Test data shall be submitted for the following sizes:

Minimum width x maximum height

Maximum width x minimum height

Maximum width x maximum height

#### 13.1.3 Number of tests

A minimum of two tests shall be conducted on each sample. The adjustable louver shall be cycled to full open and back to full closed between each test.

### 13.2 Calculated performance

#### 13.2.1 Air leakage

Air leakage performance of any size louver shall be calculated from tests of no less than three sizes (single panel design) of the same design.

Data presented shall be a plot of  $L/s/m^2$  (cfm/ft<sup>2</sup>) of face area versus  $\Delta P_s$  that reflects the largest value of  $L/s/m^2$  (cfm/ft<sup>2</sup>) air leakage of the louvers tested at each value of  $\Delta P_s$ .

#### 13.2.2 Blade spacing variations

Where the design blade spacing varies, the manufacturer shall submit data from tests of both the smallest and greatest blade spacing to show that all test data will fall within the specified tolerances.

#### 13.2.3 Extrapolation

Extrapolation above the maximum or below the minimum test  $\Delta P_s$  shall not be permitted.

### 13.3 Published ratings

#### 13.3.1 Air leakage performance

Published ratings of air leakage performance shall be presented in either tabular form, graphical form or both as a statement of the maximum tested air leakage at the following:

A specified differential pressure

Standard air density

AMCA figure or figures to which air leakage performance is tested

### 13.3.2 Torque statement

The following statement shall be included:

“Data are based on the maximum torque of [#]  $\text{N}\cdot\text{m}/\text{m}^2$  (in.-lb/ft<sup>2</sup>) applied to the louver during the test.”

[Any number ending with a decimal greater than 0.02 shall be rounded to the next higher number, e.g.,  $6.12 \text{ N}\cdot\text{m}/\text{m}^2 = 6.1 \text{ N}\cdot\text{m}/\text{m}^2$  and  $6.13 \text{ N}\cdot\text{m}/\text{m}^2 = 6.2 \text{ N}\cdot\text{m}/\text{m}^2$  ( $5.12 \text{ in.-lb/ft}^2 = 5.1 \text{ in.-lb/ft}^2$  and  $5.13 \text{ in. lb/ft}^2 = 5.2 \text{ in.}\cdot\text{lb/ft}^2$ )]

### 13.3.3 Opening torque

A table showing the opening torque may be included on the same page if it is labeled as “opening torque.”

### 13.3.4 Mode tested

The rating shall indicate the mode tested (intake or exhaust) or test data will be provided to AMCA that indicates that the data published is worst case.

### 13.3.5 Operational statement

Published data shall state the following:

“Air leakage is based on operation between 10 °C - 40 °C (50 °F - 104 °F)”

## 14. Damper | Air Performance Rating Requirements

### 14.1 Testing requirements

#### 14.1.1 Pressure drop test

All testing for pressure drop determinations of single-blade, multi-blade or curtain dampers (excluding backdraft dampers) in the full open position shall be per ANSI/AMCA Standard 500-D, per at least one of Figures 5.1, 5.2, 5.3, 5.4, or 5.5. Testing shall be conducted in both directions of airflow (front to back and back to front).

Vertically mounted backdraft dampers shall be mounted per Figure 5.4 or 5.5 so that the airflow assists opening of the dampers. Horizontally mounted backdraft dampers shall be tested per Test Figure 5.7A, 5.7B, 5.7E or 5.7F and such that the airflow assists in opening.

#### 14.1.2 Test samples

##### 14.1.2.1 Rectangular (Excluding backdraft dampers)

Test data shall be submitted for the following sizes:

305 mm x 305 mm (12 in. x 12 in.)

610 mm x 610 mm (24 in. x 24 in.)

914 mm x 914 mm (36 in. x 36 in.)

305 mm x 1220 mm (12 in. x 48 in.)

1220 mm x 305 mm (48 in. x 12 in.)

The tolerance is +0, -6.3 mm (+0, -0.25 in.). If the maximum single section size is less than that shown above, a multi-section damper shall be tested if offered by the manufacturer. If any of the sizes listed above are not offered by the manufacturer, those sizes are not required to be tested or listed. A minimum of one of the sizes listed above must be tested for a product line to be eligible for certification.

##### 14.1.2.2 Round (excluding backdraft dampers)

Test data shall be submitted for the following sizes (diameters):

305 mm (12 in.)

610 mm (24 in.)

914 mm (36 in.)

If the smallest damper is larger than 305 mm (12 in.) or the largest damper is smaller than 914 mm (36 in.), three sizes shall be tested:

Largest

Smallest

Midway between the largest and smallest

#### **14.1.2.3 Rectangular (backdraft dampers only)**

A 610 mm x 610 mm (24 in. x 24 in.) damper shall be tested. If the largest size damper produced is smaller than 610 mm x 610 mm (24 in. x 24 in.), the largest cataloged size shall be tested. The tolerance is +0, -6.3 mm (+0, -0.25 in.).

#### **14.1.2.4 Round (backdraft dampers only)**

A 610 mm (24 in.) diameter damper shall be tested. If the largest size damper produced is smaller than 610 mm (24 in.), the largest cataloged size shall be tested.

### **14.2 Calculated performance**

#### **14.2.1 Extrapolation**

##### **14.2.1.1 Below test pressure**

Extrapolation below the minimum test static pressure drop shall be permitted, excluding backdraft dampers.

##### **14.2.1.2 Above test pressure**

Extrapolation above the maximum test static pressure drop shall not be permitted.

##### **14.2.1.3 Sizes**

Extrapolation outside of test sizes shall not be permitted.

### **14.3 Published ratings**

#### **14.3.1 Air performance**

Published ratings of air performance shall be a statement of the maximum static pressure drop for a specified airflow rate and at standard air density and the AMCA figure or figures tested for all required sizes. Except for backdraft dampers, the published performance for each size shall be from the worse performing of the two airflows.

Ratings shall be published in tabular form, graphical form or both.

#### **14.3.2 Rounding of data**

Pressure drop information presented in SI units shall be rounded to the nearest pascal (e.g., 5 Pa, not 5.1) when testing results in pressure drop values of 1 Pa or greater. Published data may be rounded to one digit after the decimal point (e.g., 0.8 Pa, not 0.83 Pa) when testing results in pressure drop values less than 1 Pa. Pressure drop information presented in I-P units shall be rounded to a maximum of two digits after the decimal point (e.g., 0.02 in. wg, not 0.025 in. wg) when testing results in pressure drop values of 0.01 in. wg or greater. Published data may be rounded to three digits after the decimal point (e.g., 0.003 in. wg, not 0.0032 in. wg) when testing results in pressure drop values less than 0.01 in. wg, provided that the test equipment is accurate and calibrated to read three decimal places.

#### **14.3.3 Extrapolation**

The portion of the air performance curve obtained by extrapolation shall be charted with a broken line and must be a smooth continuation of the adjacent portion of the curve.

The air performance shall not be extrapolated below 50% of the minimum tested static pressure.

## **15. Volume Control Damper | Air Leakage Rating Requirements**