March 2017

Understanding the ANSI/AMCA Standard 500-L Tests

An AMCA International White Paper

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ABSTRACT

This white paper describes the tests outlined in ANSI/AMCA Standard 500-L, helping specifiers understand what testing in accordance with this AMCA standard proves and does not prove about the louver they are considering for a project.

If you review a louver's submittal sheet, you will often see technical information that describes the louver's performance. These submittal sheets help engineers assess if the louver has the right performance attributes for their project's requirements. Louvers are designed to protect air intake and exhaust openings from the infiltration of unwanted water or particles while allowing airflow into the space, and different louver models offer varying levels of performance. Many times, certain louvers are selected because the building needs a specific kind of performance. For instance, the performance of a louver can be especially critical when there is machinery or equipment behind it that must stay dry and free of debris.

Since a louver's performance is so critical, the obvious question is this: when reviewing a louver's submittal sheet, how can we be sure that the performance stated on the sheet is accurate?

The Air Movement and Control Association (AMCA) International acts as the means of providing this assurance. It publishes test standards that are universally accepted in the industry, and it provides third-party testing to confirm the accuracy of manufacturer data. AMCA's members—companies that manufacture air movement and control products—must agree to accurately represent the performance of their products and abide by a stringent code of ethics.

AMCA publishes a standard, ANSI/AMCA Standard 500-L[1], that outlines the testing protocols of louvers. Its goal is not to establish minimum/maximum performance ratings but rather to outline a standardized method for testing louvers for different parameters. Its origins can be traced back to a historical standard, AMCA Standard 500, called "Interim Test Methods for Louvers, Dampers and Shutters." The creation of this standard coincided with AMCA welcoming a number of new member companies that designed and built louvers, dampers and shutters, leading to the adoption of "control" in AMCA's "air movement and control" name in 1971. AMCA Standard 500 went through five revisions before being split off into 500-D for damper testing in 1998 and 500-L for louver testing in 1999.

Since the original publishing of ANSI/AMCA Standard 500-L, there have been many updates, and the most recent version was published in 2015. It is the standard to which all louvers are tested, and its test protocols are what the AMCA Certified Ratings Program (CRP)[2] uses to certify that a louver's reported data is accurate. AMCA then allows the company to place a CRP seal on the certified product (Figure 1).

"When reviewing a louver's submittal sheet, how can we be sure that the performance stated on the sheet is accurate?"

TAKING A CLOSER LOOK AT THE ANSI/AMCA STANDARD 500-L TESTS

There are currently five testing protocols covered in ANSI/AMCA Standard 500-L. These are

- Pressure drop
- Airflow leakage
- Water penetration
- Wind-driven rain
- Wind-driven sand

These testing protocols are all conducted by AMCA at one of their accredited laboratories. Once a CRP participant has its louvers tested at one of AMCA's facilities and has proven the accuracy of its ratings, that manufacturer can display the test results on its louver submittal page, along with an image of the AMCA CRP seal that corresponds to the testing that was done. In some cases, louvers can be certified for multiple performance factors and gain the right to display more than one seal.

PRESSURE DROP TEST

The AMCA Standard 500-L test for pressure drop determines a louver's resistance to airflow.

Since some equipment needs air to operate effectively, airflow is an important factor. If you are considering a louver for a space containing this type of equipment, its pressure drop test results should be one of the first things you look at.

Figure 1. CRP seals for air performance (pressure drop), water penetration/air performance, air leakage.

The test protocol is to take five or more determinations in a desired range of airflow rates, using equal increments. One reading per determination is taken for each of the following:

- Outlet duct static pressure
- Inlet duct static pressure
- Discharge chamber static pressure
- Inlet chamber static pressure

At the AMCA laboratory, ambient temperatures during the test are between 10 degrees Celsius and 40 degrees Celsius (50 degrees Fahrenheit and 104 degrees Fahrenheit). The test requires a complete set of air measurements for one setting of airflow and pressure drop. Most often, the louver is tested with the air flowing in both directions. However, testers make exceptions for louvers that are specified for airflow in one direction only. The test for operable louvers begins with the lowest airflow value. It is left to find its own equilibrium position in the pressure differential.

ANSI/AMCA Standard 500-L specifies that, for pressure drop, a 1219 mm × 1219 mm (48 in. × 48 in.) louver sample must be tested. The information on the louver's submittal page reflects the results of the 1219 mm × 1219 mm (48 in. × 48 in.) sample. This is important to understand because, with a larger section size, a pressure drop test would have reflected a lessened resistance to airflow. Conversely, a smaller section size than the one tested would show an increased resistance.

Figure 2 shows an example of a pressure drop chart that would appear on a manufacturer's submittal sheet.

LOUVER TEST SETUPS		AIR PERFORMANCE PRESSURE DROP MEASUREMENTS SETUPS	
TEST FIGURE	CONNECTION PLANE	TEST FIGURE	CONNECTION PLANE
5.1	Z	6.1	B
		6.2	B
		6.3	A
		6.4	A
5.2	Y	6.1	C
		6.2	C
	X	6.5	B
5.4	Y	6.1	B
		6.2	B
	X	6.3	B
		6.4	B
5.5	X	6.1	C
		6.2	C
	Y	6.5	A
5.12	Z	6.3	A

Figure 2. Example pressure drop chart.

When the final report is presented, it will include the test data along with the following criteria called out on the report:

- Blade orientation
- Blade action
- Blade position (open or closed)
- Airflow direction
- Personnel
- Date that the test was conducted
- Model
- Louver type
- Size
- Free area
- Test figure

AIR LEAKAGE TEST FOR ADJUSTABLE AND COMBINATION LOUVERS

The ANSI/AMCA Standard 500-L test for air leakage determines the relationship between the airflow leakage rate and the static pressure for a louver mounted in a test chamber. This test can aid you in properly selecting a louver for a building's needs after considering airflow, the need for energy savings and the importance of having a sealed building envelope.

As with the standard's pressure drop test, there are five or more determinations that are taken at equal increments of pressure differential that cover a desired range during equilibrium conditions. Testers use precisely measured weights, and they measure distance with devices having divisions of 1.0 millimeters (0.04 inches).

For this test, multiple samples of the louver are required. Testers use the following criteria for samples:

- Minimum width × maximum height
- Maximum width × minimum height
- Maximum width × maximum height

When completed, the finished report and conclusions of the test will include the following:

- Method of closure
- Blade orientation
- Blade action
- Airflow direction
- Personnel
- Date
- Test ID#
- Lab name
- Lab location
- Reference to ANSI/AMCA Standard 500-L
- Test figure

Engineers concerned with the building's envelope should look for louvers that bear the AMCA CRP seal for leakage. In these cases, a damper may not provide adequate leakage protection.

WATER PENETRATION TEST

The water penetration test in ANSI/AMCA Standard 500-L is designed to determine the intake air velocity at which water begins to penetrate the louver. A common misconception is that the test reports how much water penetrates the louver during service conditions (i.e., wind-driven rain). This is not the case. There are conditions in which wind-driven rain will not be a factor during service conditions of the louver, and this test is meant to show how the louver will perform under what are considered typical conditions rather than heavy rains or windy conditions.

For this testing protocol, water droplets are released in front of the louver to mimic a light, vertical rainfall. The simulated rainfall is dropped in front of the louver at a rate of

- 100 mm (4 in.) per hour, minimum
- 3.28 L/m per linear meter (0.25 gpm per linear foot) , which simulates water coming down an exterior wall

The testing sample size for the louver is 1219 mm × 1219 mm (48 in. × 48 in.). At the back of the testing chamber behind the louver, an intake fan is positioned. The intake fan attempts to draw water through the louver during the test. This is known as a still air test.

When testing, the beginning point of water penetration is determined at the free area intake velocity. For the minimum test point, the test is run at conditions in which the water collected on the floor of the testing chamber does not exceed 3 g/m^2 (0.01 oz/ft^2) of free area. The finished results are cataloged on the louver submittal sheet and are represented with a graph similar to the one pictured below.

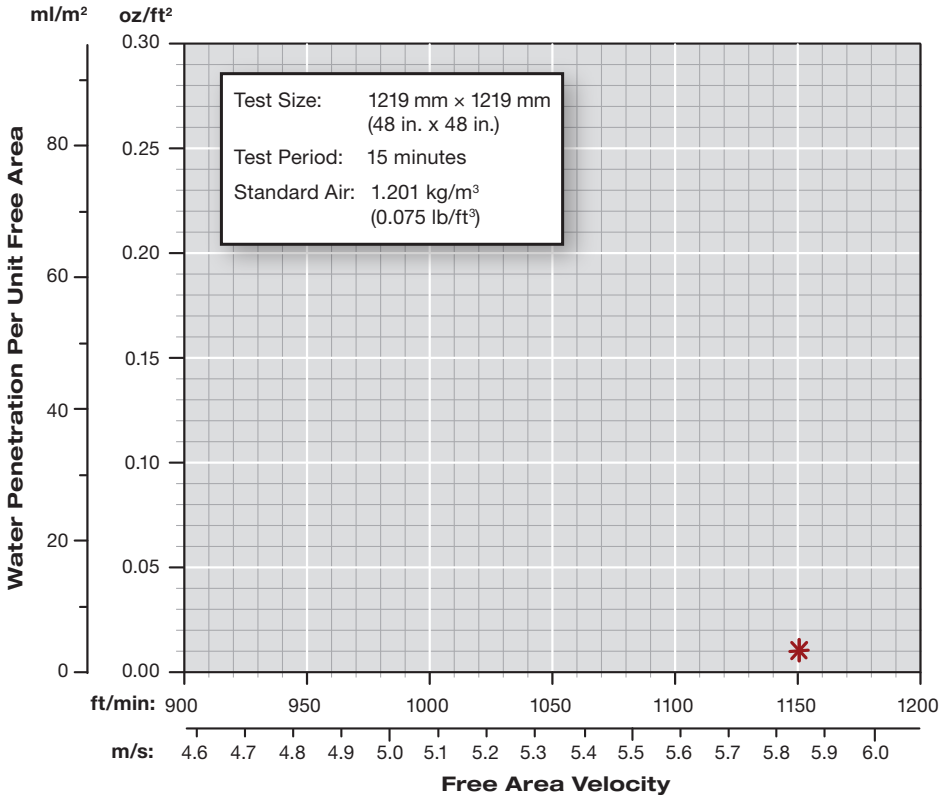

Figure 3. Example water penetration graph.

For the example above, the beginning point of water penetration is 5.09 m/s (1002 fpm) free area velocity.

The maximum intake velocity, 6.35 m/s (1250 fpm) for the louver test and on most submittal sheets, is represented as a single point without the curve.

A test report and results for the ANSI/AMCA Standard 500-L water penetration test includes the following information:

- Personnel
- Date
- Test ID#
- Lab name
- Lab location
- Reference to ANSI/AMCA Standard 500-L
- Test figure
- Model
- Louver type size
- Free area
- Any appurtenances, such as drain pans

The test is important for specifiers because, in many cases, the space behind the louver needs to be kept dry, particularly when adequate drainage does not exist.

WIND-DRIVEN RAIN TEST

It is not uncommon to see a louver submittal sheet display the CRP seal for both water penetration and wind-driven rain. The latter certifies that the louver underwent a test that simulates storm conditions, and the results report its ability to block water from getting into the space behind it.

For this test, a meter by meter core sample is required. Once the louver is set up in the testing chamber, a high-powered fan is set up in front of it to simulate the following conditions:

- 12.96 m/s (29 mph) winds
- 22.35 m/s (50 mph) winds

When the test commences, nozzles will spray water at the louver, simulating an external rainfall of 5.08 cm/hr (3 in./hr) when the fan is running at 12.96 m/s (29 mph) and at 20.32 cm/hr (8 in./hr) when the fan is running at 22.35 m/s (50 mph). The chamber behind the louver is fully pressurized, with an exhaust fan attempting to draw water in through the louver's blades during the test.

The minimum time period for the test is 30 minutes, and test values are noted at standardized intervals and are no more than 10 minutes apart. The wind-driven rain test is complete when four consecutive readings of values within steady state tolerance has been observed.

As the test is conducted, the following values are observed, measured and recorded:

- The water supply rate – q_s
- The water penetration rate – q_d
- Airflow rate through louver (except for no airflow test) – q_v

The performance of the louver is marked by the quantity of water that has penetrated the louver during the testing period.

After the test, a class will be assigned to the louver, indicating its effectiveness at preventing the egress of water. These classes are as follows:

- Class A – 99% to 100% effective

- Class B – 95% to 98.9% effective
- Class C – 80% to 94.9% effective
- Class D – Anything below 80% effective

At the conclusion of the testing protocol, the report will show the following:

- Personnel
- Date
- Test ID#
- Lab name
- Lab location
- Reference to ANSI/AMCA Standard 500-L
- Test figure
- Model
- Any appurtenances, such as drain pans

The wind-driven rain test is valuable because, throughout the United States and other parts of the world, storm conditions can cause water damage to the interiors of buildings. A specifier will often look to a class A louver if the installation site is in an area where storms are likely to occur.

It is rare to see a manufacture display anything other than an A or B rating on their submittal sheet.

WIND-DRIVEN SAND TEST

When air systems that lie behind the louver are exposed to sand particles, it can clog up air filters prematurely. For this reason, the newest addition to the ANSI/AMCA Standard 500-L is a testing protocol for wind-driven sand. Adopted in December of 2015, this test measures a louver's ability to resist intrusive sand.

This test introduces airborne dry sand particles at different airflow rates to the louver under test. The louver is mounted and sealed within the sand injection chamber, so all sand ingress measured has come through the louver's blades only.

The test size for the louver is 1220 mm × 1220 mm (48.03 in. × 48.03 in.). The test is carried out with dry sand that is uniformly distributed through a sand injector blower while the pressure drop is documented.

During the testing, the free area velocity is observed and recorded at twenty second intervals. Once the measured weight of the sand has been entirely injected into the test duct, the exhaust fan and sand injector blower will continue to run for an additional two minutes. The sand that is prevented from egressing past the louver is collected by a vacuum cleaner, and the difference between the sand blown at the louver and the sand that is rejected by the louver is then documented.

Figure 4 shows the requirements for the sand used during the test.

The effectiveness of the louver at keeping sand from egressing into the space behind the louver is represented by classes, in a manner similar to the test for wind-driven rain:

- Class A – 90% to 100% effective
- Class B – 80% to 89.9% effective

GRADE (µM)	MASS (%)
>699	0.5
425–699	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

Figure 4. Table 8 from ANSI/AMCA Standard 500-L.

- Class C – 70% to 79.9% effective
- Class D – Anything below 70% effective

At the conclusion of the testing protocol, the report will show the following:

- Date
- Test ID#
- Lab name
- Lab location
- Reference to ANSI/AMCA Standard 500-L
- Test figure
- Tested louver model name
- Core area
- Actual frame outer size
- Number of front blades
- Number of rear blades
- Louver free area
- Any appurtenances, such as sand collector and weighing device
- Personnel performing the test

CERTIFICATION

Companies with AMCA-certified products have done more than tested their louvers in accordance with ANSI/AMCA Standard 500-L. They have had AMCA or an accredited third party run the tests as well, confirming the data's accuracy. These companies have followed the guidelines in AMCA Publication 511, which specifically outlines the program for certifying louvers after they have been tested.

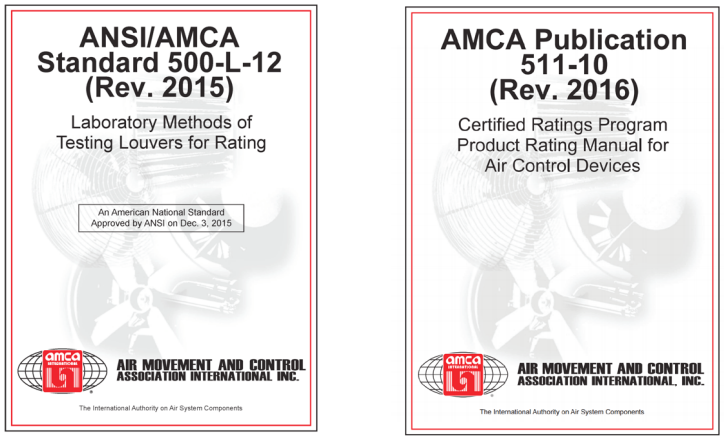

Figure 5. ANSI/AMCA Standard 500-L and AMCA Publication 511.

CONCLUSION

The protocols outlined in ANSI/AMCA Standard 500-L were created to establish uniform laboratory test methods for louvers for all manufacturers, including pressure drop, air leakage, water penetration, wind-driven rain and wind-driven sand. Louvers that are tested to these protocols have undergone the first step in earning the AMCA seal that signifies third-party verification of test data, which specifiers should look for on a louver submittal sheet.

If you find yourself in the position of asking "How can we be sure that the performance stated on the sheet is accurate?" Know the answer starts with ANSI/AMCA Standard 500-L and its test methods.

REFERENCES

1 AMCA Standard 500-L. Laboratory Methods of Testing Louvers for Rating. Arlington Hts., IL: AMCA, 2015. **tinyurl.com/AMCA500-L-15**

2 Brooks, Joe; Michael Ivanovich and Lisa Ullrich. “An Introduction to the Certified Ratings Program.” Arlington Hts., IL: AMCA, 2015. **tinyurl.com/AnIntroductionToTheAMCACRP**

3 AMCA Publication 511. Certified Ratings Program — Product Rating Manual for Air Control Devices. Arlington Hts., IL: AMCA, 2016. **tinyurl.com/AMCA511-16**

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