WHITE PAPER | TAMCO'S AMCA CERTIFIED LABORATORY

Air Leakage and Pressure Drop Testing

TAMCO

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EXPERIENCE TRUE EXCELLENCE IN SERVICE, QUALITY,
AND MAINTENANCE-FREE PERFORMANCE.

"What does it take get a pressure drop and leakage test laboratory certified by AMCA?"

The Questions

TAMCO's R&D Laboratory, consisting of a pressure drop chamber and an air leakage chamber, have been certified by AMCA (Air Movement and Control Association International, Inc.) since 2015. What does it mean to have an in-house AMCA Certified Laboratory? This white paper will explore and explain the following:

- What components make up air leakage and pressure drop test chambers?
- What did it take to get TAMCO's laboratory accredited by AMCA?
- What are the AMCA Test Figures referred to on TAMCO's damper performance data pages?
- What are the benefits of an in-house AMCA certified test facility to TAMCO's manufacturer's representatives and to the end users of TAMCO products?

Background

TAMCO began the process of developing an in-house test facility in Canada in 2008. An engineering consultant was hired to design a pressure drop test system. Working closely with AMCA, the pressure drop test apparatus was designed and built.

In 2011, TAMCO hired me to commission the laboratory and obtain AMCA certification. We moved the pressure drop chamber from Canada to Tennessee. In the move, some of test chamber seals were damaged and had to be repaired to reestablish an airtight seal that would meet certification tolerances. All of the nozzles were adjusted to ensure that they were perfectly round. The fan and VFD were connected to the building's electrical system. The manometers, pressure taps and associated piping base were installed, and all of the measurement instrumentation was calibrated and certified to NIST standards. Finally, five different sizes and lengths of ductwork were acquired to complete the pressure drop testing system.

TAMCO's AMCA Certified Laboratory also includes a leakage test chamber. The leakage chamber was designed and built to meet AMCA's exacting tolerances for air leakage, nozzle diameters, fan requirements for low airflows and high static pressures, and for temperature and pressure sensor specifications. The leakage test chamber enables us to test for both AMCA Test Figure 5.4 (intake) and Figure 5.5 (exhaust).

What components make up pressure drop and air leakage test chambers?

Let's begin by defining what damper pressure drop and air leakage are.

Pressure drop is the energy lost as air flows across a normally open damper. Dampers have components (blades, blade stops, frames, actuators, etc) which introduce obstructions in the airstream. These obstructions change airflow direction, thereby producing turbulent air. The production of turbulent air in laminar airflow results in energy loss.

Air leakage rates provide a measurement of how well a damper resists airflow through closed blades at given static pressures and seating torques.

In order to test products for pressure loss and air leakage accurately, the following test equipment and their components are required:

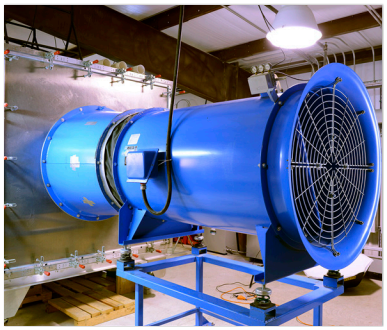
- a fan capable of producing variable flows and pressures,
- a means to measure the air being exhausted from or supplied to the fan,
- a sealed system that prevents air from escaping,
- a method of measuring air as it flows through a controlled environment,
- a settling means to disperse the air uniformly as it travels through the system,
- a means to measure pressure at several locations along the test system,
- a means to measure temperature in several locations in the test environment,
- a prescribed assortment of sizes and lengths of ductwork.

The minimum fan capacity requirement for an AMCA certified damper pressure drop test facility is approximately 20,000 cfm. The fan must also be able to produce high volumes of air at medium pressure levels.

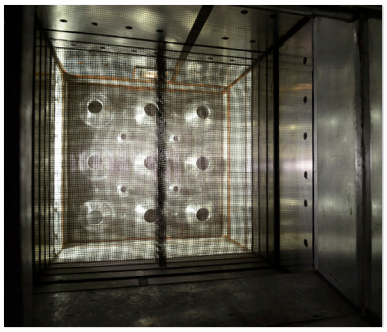
To test a damper's air leakage, AMCA's certified test set up requires a variable speed fan that can produce a high pressure at lower airflows. At a minimum, the fan must be able to maintain a pressure of 4" wg at different airflows for a variety of test damper sizes. AMCA also specifies that the test system's leakage rate can be no greater than 2% of the measured airflow.

Both of TAMCO's chambers consist of a variable speed fan, 4 layers of settling screens, a nozzle wall, and a second set of 4 layers of settling means, all of which are sealed up in an airtight chamber. The chamber is then attached to ductwork or a plenum, where the test damper can be installed.

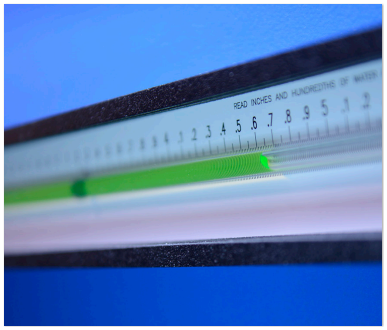
Ductwork



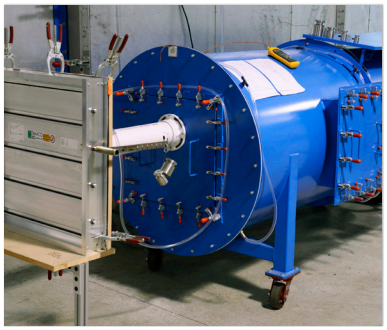
Fan connected to airtight test chamber



Nozzles and screens / air settling means



Manometer



Leakage test chamber

What did it take to get TAMCO's laboratory accredited by AMCA?

In order to obtain AMCA laboratory accreditation, applicant companies must meet stringent equipment, design, calibration, maintenance, and installation requirements. These requirements are defined in AMCA's document entitled "AMCA Publication 111, Laboratory Accreditation Program".

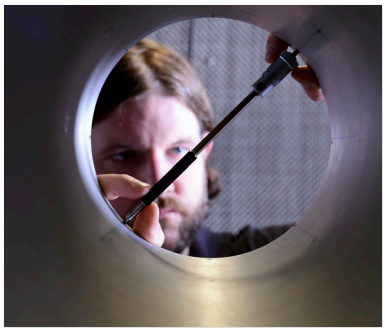
The first step was to design and build the test equipment, adhering to AMCA's specifications. Then, all the requisite paperwork, photos, and drawings had to be submitted to AMCA for review and approval. Following construction, acceptance, and approval, AMCA sent a representative to our facility to conduct an audit to verify that TAMCO's laboratory was built according to the drawings and plans we submitted to AMCA.

The inspector carried out a visual inspection of the laboratory and its envelope. Then, he witnessed actual damper testing, performed in accordance with the various AMCA test figures for which we sought approval. Following the AMCA's representative's verification of the finalized test reports (to ensure that all the required information had been provided), the reports were sent to AMCA's home office.

As soon as AMCA's representative determined that every aspect of our laboratory's design, procedure, setup, testing, and final reports were in compliance with AMCA's specifications, the samples that were used for witness testing were shipped to AMCA's laboratory in Chicago. There, the sample dampers were re-tested, using the same AMCA test figures, and the two sets of test results were compared. In order to pass certification, the test results obtained in TAMCO's laboratory had to fall within a 3% tolerance range of the results obtained in AMCA's laboratory. This is an extremely small window of tolerance!

Once TAMCO's laboratory was deemed to have met all of AMCA's certification requirements, the laboratory was accredited for a period of three years. In order to maintain our accreditation, we must have our equipment calibrated by a third party on a yearly basis. At the end of the three-year term, the entire certification process must be repeated to renew the accreditation. In addition, to ensure that our AMCA accredited laboratory is properly maintained, whenever we test a product for certification under AMCA's CRP, one of the test units must be sent to the AMCA's laboratory in Chicago for a check test.

AMCA Accredited Laboratory Certificate



Measuring nozzles for perfect roundness.

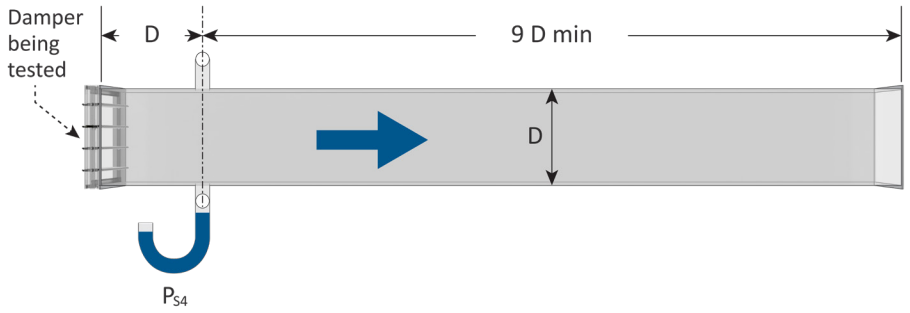
Verifying manometer calibration, function, and accuracy.

What are the AMCA Test Figures referred to on TAMCO's damper performance data pages?

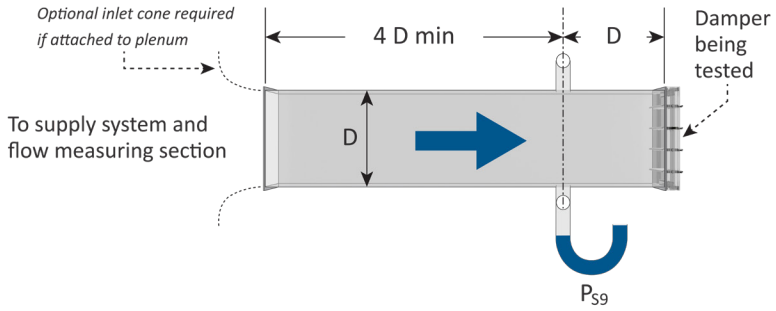
We are often asked, "What is the pressure drop for your model XXXX damper?" Many who ask this question are not aware that how the damper is installed determines the actual pressure drop. The same damper will have very different pressure drops, depending on where it is installed within a system. A constant and repeatable pressure drop value can only be obtained when a damper is installed in laminar flow conditions. If the air approaching a damper is turbulent (such as on the exhaust side of a fan), then the pressure drop will be neither constant nor repeatable.

In order to standardize pressure drop testing for air control dampers within a laminar flow, in a variety of applications and possible damper installations, AMCA has devised five different test figures under Standard 500-D. These AMCA test figures are described below.

AMCA FIG. 5.1 - DUCTED ENTRANCE



AMCA FIG. 5.2 - DUCTED EXIT



AMCA FIG. 5.3 - IN DUCT

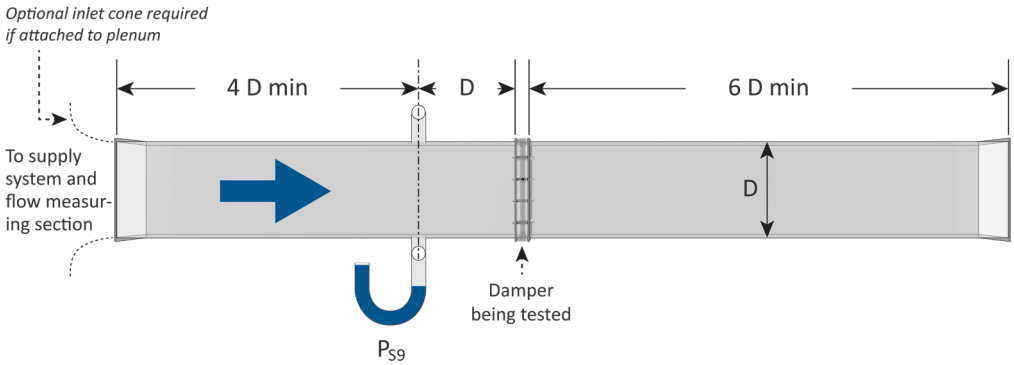


Fig. 5.2

Fig. 5.1

Air is drawn through the damper into ten diameters of ductwork. Pressure drop for Fig. 5.1 and Fig. 5.2 are very similar. Pressure drop for Fig. 5.1 is normally higher than Fig. 5.3, but lower than Fig. 5.4.

Fig. 5.2

Air is pushed through five diameters of ductwork, before it enters the damper. Pressure drop for Fig. 5.2 will normally be higher than Fig. 5.3, but lower than Fig. 5.5.

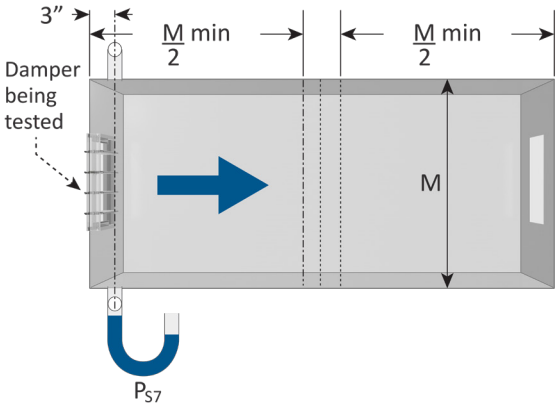
Fig. 5.3

Air is pushed through five diameters of ductwork, before it enters the damper. There are six more diameters of ductwork downstream of the damper. Pressure drop for Fig. 5.3 is normally the lowest of all the test figures. Longer runs of ductwork help to smooth airflow to a more laminar flow, which regains the energy lost as a result of turbulent airflow. Figure 5.3 is the only test setup where the system effect is removed from the reported data leaving the damper only.

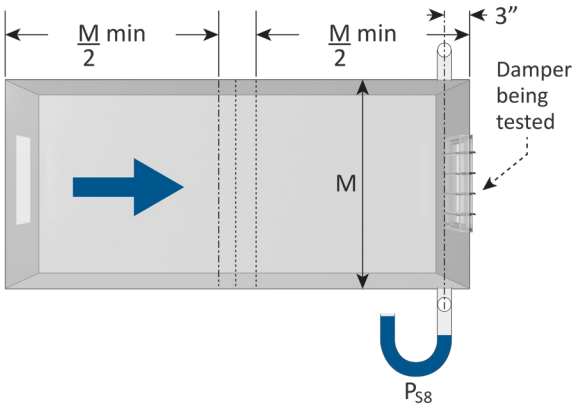
Fig. 5.4 and Fig. 5.5

Air is either drawn through the damper when it is installed at the entrance of a plenum wall (Fig. 5.4), or pushed through the damper when it is installed at the plenum exit (Fig. 5.5). There is no ductwork attached at either side. Pressure drop values for Fig. 5.4 and Fig. 5.5 are normally the highest of any of all the test figures. High pressure loss is attributable to the lack of ductwork that helps to regain the lost energy. Higher pressure drop rates are also caused by the knife edge effect of the opening itself (no damper installed). If the damper is removed, the opening alone will demonstrate a high pressure loss. The damper contributes only a small percentage of the overall pressure loss. In some instances the damper may not contribute any pressure loss at all. Pressure drop rates for a damper tested according to Fig. 5.4 and Fig. 5.5 are very similar.

AMCA FIG. 5.4 - PLENUM ENTRANCE

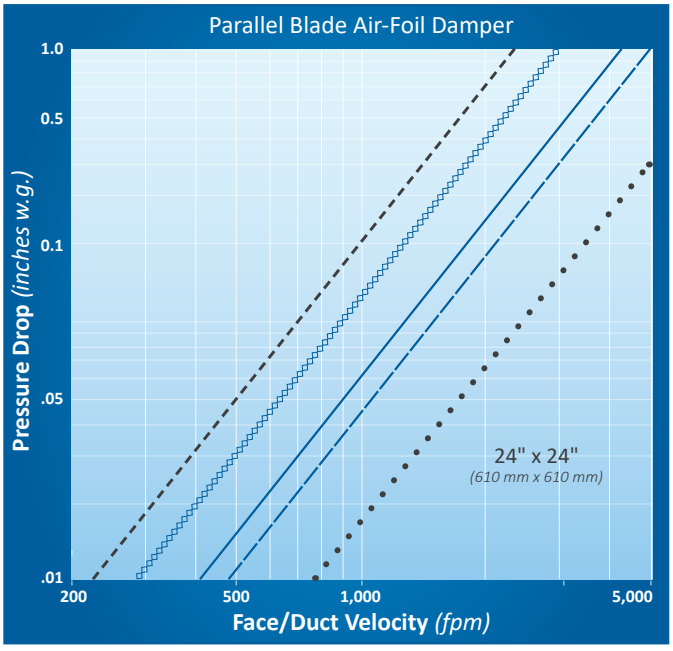


AMCA FIG. 5.5 - PLENUM EXIT



Pressure drop results were plotted on the graph to the right for a 24” x 24” TAMCO Series 1000 Air-Foil Control Damper. The graph clearly shows that the same damper’s pressure drop varies significantly at the same airflow, depending on which AMCA test figure is used. This is why it is so important to identify how a damper is installed, before determining which AMCA test figure and resulting pressure drop values best apply to your application.

VELOCITY VS. PRESSURE DROP



LEGEND:

Fig. 5.1 ——— Fig. 5.3 • • • • • Fig. 5.5 ◇◇◇◇◇◇◇ *Opening Only*

Fig. 5.2 — — — Fig. 5.5 - - - - -

Conclusion

The benefits of having our own in-house, AMCA accredited test facility:

There are a number of distinct advantages to TAMCO's Representatives and to the end users of TAMCO products.

1. *Enhances new product development and supports continuous product improvement*

An in-house, AMCA accredited test laboratory is a boon to any company's R&D department. TAMCO's laboratory has made it possible for us to develop new products more effectively and to make improvements to existing products. While having innovative ideas and thinking outside the box are wonderful, we don't want to waste precious time and resources by repeatedly sending products to an external laboratory for proof of concept testing, especially if the concept does not pan out as we expected. With our own in-house laboratory, we can conduct repeated tests much more quickly and economically. This makes it easier to determine whether or not an idea is worth pursuing. It gives us the ability to accurately measure how improvements affect product performance. It also helps to identify unforeseen issues that may arise, in the safety of a laboratory setting, before these issues could cause problems in an actual installation. As an added bonus, many great ideas are born of accidental discoveries made in the course of experimental testing, or while making adjustments to equipment and test set-ups. TAMCO has introduced more than one product innovation that resulted from just such a discovery!

2. *Enables the development of test-result-based tools to provide more accurate leakage and pressure drop values*

With the increased capacity to test in an AMCA accredited environment, TAMCO is able to generate a larger collection of reliable and repeatable product data, by testing more damper models, a wider variety of damper sizes, and within a broader range of static pressures and velocities. The resulting product data can then be provided to designers, engineers, and customers on an ad hoc basis, or by using custom designed tools such as the TAMCO Pressure Drop Calculator.

AMCA CERTIFIED LABORATORY

3. *Facilitates the certification of more products under the AMCA Certified Ratings Program*

Because we can test in-house, we have been able to justify AMCA certification for some of our lower volume products in addition to our heavy-hitters. This definitely sets TAMCO dampers apart from the competition who may not have certified their equivalent products. Furthermore, it affords our customers the advantage and confidence of selecting a product with AMCA Certified performance.

4. *Provides a training and product education facility for TAMCO Representatives, engineers, end users, and TAMCO employees.*

Our AMCA accredited laboratory is also used as a training center for our Representatives, contractors, facility crews, engineers, and our own employees. We use our facility to demonstrate how our products are installed, used, and the effect our dampers have on an HVAC system. We invite end users to visit our laboratory and factory to learn what goes into building a TAMCO damper and to see the Quality Control process every damper must undergo. Visitors to our laboratory also witness leakage and pressure drop tests conducted on the very damper they followed through the production process. What better way can there be of showing our customers the quality and engineering that goes into making TAMCO dampers, and how that translates into superior performance for their applications.

MORE AMCA CERTIFIED PRODUCTS

PRODUCT TRAINING

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