

Methods of Testing Heavy Duty Dampers for Rating



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Related AMCA Documents

Related Publications	AMCA Publication 502	<i>Damper Application Manual for Heating/ Ventilating, and Air Conditioning</i>
	AMCA Publication 503	<i>Fire, Ceiling (Radiation), Smoke and Fire/Smoke Damper Application Manual</i>
Related Standards	ANSI/AMCA Standard 210	<i>Laboratory Methods of Testing Fans for Certified Aerodynamic Performance</i>
	ANSI/AMCA Standard 500-D	<i>Labortory Methods of Testing Dampers for Rating</i>

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Methods of Testing Heavy Duty Dampers for Rating

1. Purpose and Scope

The purpose of this standard is to establish testing methods to be used in measuring the performance of dampers used in the utility and heavy industry. The scope of the products covered in this standard shall include dampers, which are used to control flow of a gas (be it a specific gas, a mixture of gas and air, or air alone) or to isolate one section of a duct system from another section of the system. The scope narrows to those dampers generally described as “custom design,” “heavy duty,” or “severe service,” because such dampers are normally used in applications where elevated temperature, erosion and/or corrosion conditions exist.

2. Normative References

ANSI/AMCA 210-07 Laboratory Methods of Testing Fans for Aerodynamic Performance Rating, Air Movement and Control Association International, Inc., 30 W. University Drive, Arlington Heights, IL 60004-1893 U.S.A., 2007.

3. Definitions / Units of Measure / Symbols

3.1 Definitions

3.1.1 Heavy duty damper

A device used to control, isolate or divert a gas in a process, industrial or power generation application in accordance with customer requirements.

3.1.2 Performance variables

3.1.2.1 Shop conditions

Ambient temperature and atmospheric pressure in the manufacturing test facility at the time of the damper test.

3.1.2.2 System conditions

The design temperature and pressure conditions under which the damper will operate, as specified by the purchaser.

3.1.2.3 Pressure drop

Pressure drop is a measure of the resistance to airflow across a device. It is expressed as the difference in static pressure across an air control device for a specific rate of airflow.

3.1.2.4 Closure pressure

Pressure drop across a closed damper.

3.1.2.5 Leakage

Leakage is the amount of gas passing through a device when it is in the closed position at a specific pressure differential and density. It is expressed as the volumetric rate or percentage of specified flow.

3.1.2.6 Gland leakage

A gland is a device, such as the outer sleeve of a stuffing box, designed to prevent a fluid from leaking past a moving machine part. In this context, gland leakage refers to leakage through any moving part sealing device intended to prevent or limit the amount of gas from leaking from inside the damper to the atmosphere or vice versa.

3.1.3 Miscellaneous

3.1.3.1 Shall and should

The word *shall* is to be understood as mandatory, the word *should* as advisory.

3.2 Units of Measure

3.2.1 System of units

SI units (The International System of Units, Le Système International d'Unités) [1] are the primary units employed in this standard, with I-P units (Inch-Pound) given as the secondary reference. SI units are based on the fundamental values of the International Bureau of Weights and Measures [1], and I-P values are based on the values of the National Institute of Standards and Technology, which are in turn based on the values of the International Bureau.

3.2.2 Basic units

The unit of length is the meter(m), or the millimeter (mm); I-P units are the foot (ft) or the inch (in). The unit of mass is the kilogram (kg); the I-P unit is the pound mass (lbm). The unit of time is either the minute (min), or the second (s). The unit of temperature is either the degree Celsius (°C), or the degree Kelvin (°K). I-P units are either the degree

Fahrenheit (°F), or the degree Rankine (°R). The unit of force is the newton (N); the I-P unit is the pound force(lbf).

3.2.3 Flow rate and velocity

3.2.3.1 Flow rate

The unit of volumetric flow rate is the cubic meter per second (m³/s); the I-P unit is the cubic foot per minute (cfm).

3.2.3.2 Velocity

The unit of velocity is the meter per second (m/s); the I-P unit is the foot per minute (fpm).



3.2.4 Pressure

The unit of pressure is the pascal (Pa) or the millimeter of mercury (mm Hg); the I-P unit is either the inch water gauge (in. wg), or the inch mercury (in. Hg). Values in mm Hg or in in. Hg shall be used only for barometric pressure measurements.

3.2.5 Torque

The unit of torque is the newton-meter (N-m); the I-P unit is the foot-pound (ft-lbf).

3.2.6 Gas properties

The unit of density is the kilogram per cubic meter (kg/m^3); the I-P unit is the pound mass per cubic foot (lbm/ft^3). The unit of viscosity is the Pascal-second, (Pa-s); the I-P unit is the pound mass per foot-second (lbm/ft-s). The SI unit of gas constant is the joule per kilogram-Kelvin (J/kg-K); the I-P unit is the foot-pound force per pound mass-degree Rankine, ($\text{ft-lbf/lbm-}^\circ\text{R}$).

3.2.7 Dimensionless groups

Various dimensionless quantities appear in the text. Any consistent system of units may be employed to evaluate these quantities unless a numerical factor is included, in which case units must be as specified.

4. Instruments / Methods of Measurements

The requirements of ANSI/AMCA 210, Section 5, shall apply where required.

5. Observations / Conduct of Tests

5.1 Leakage test

5.1.1 Purpose

The purpose of this test is to determine the amount of leakage past the closed damper at a specified operating pressure.

5.1.2 Test setup

A test apparatus is to be used that allows pressure to be applied against the closed damper. The amount of gas that flows past the damper can be determined using a calibrated orifice plate or pitot tube (see Annex A).

The customer is to specify if testing is to be done at system conditions otherwise the testing will be done at shop conditions and adjusting for actual conditions by the ratio of specified and tested gas density.

Dampers shall be oriented in the installed position for testing when specified.

5.1.2.1 Test equipment

- Calibrated orifice plate or pitot tube
- A manometer of the liquid column type using inclined or vertical legs or other instruments which provide a maximum uncertainty of 1% of the maximum observed test reading during the test or 1 Pa (0.005 in. wg) whichever is larger
- A thermometer capable of temperature accuracies within 5°C (9°F) and with a temperature range that covers the specified operating temperature during the test
- Method of determining the applied force or torque required during the test to compare to predicted actuator requirements. This may consist of a pressure gauge, catalog actuator output data, a spring scale and torque arm, or other device

5.1.2.2 Measurements to be taken during the test

- Temperature of air used to pressurize damper
- Pressure applied to damper
- Flow measurements as required for instrument
- Applied torque or force required to maintain the measured leakage

5.1.3 Test methods

5.1.3.1 Leakage testing – shop condition

With the duct pressurized to the specified condition, and maintained for a period of ten minutes, record temperature, pressure at the damper, applied torque (or force), and flow measurement.

5.1.3.2 Leakage testing – system condition

Partially open damper blade(s) allowing enough flow for heating. Heat damper until temperature reaches the test temperature and maintain for ten minutes.

Close the damper blade(s) fully, and adjust upstream pressure to test pressure, record temperature, pressure at the damper, applied torque (or force), and flow measurement data.

5.1.4 Test evaluation

The calculations require having the test data adjusted for temperature, altitude or other operating conditions different from any test conditions.

Pass/fail criteria: If the damper exceeds the manufacturers quoted leakage rate or if the applied torque required to achieve acceptable leakage rates exceeds specifications,