AMCA Publication 500-D-18

Laboratory Methods of Testing Dampers for Rating

Air Movement and Control Association International
30 West University Drive
Arlington Heights, Illinois
60004
AMCA Publications

Authority
AMCA Standard 500-D-18 was adopted by the membership of the Air Movement and Control Association International, Inc. on June 1, 2018. It was approved as an American National Standard by the American National Standards Institute (ANSI) and became effective on December 6, 2018.

Copyright
© 2018 by the Air Movement and Control Association International Inc.

All rights reserved. Reproduction or translation of any part of this work beyond that permitted by Sections 107 and 108 of the United States Copyright Act without the permission of the copyright owner is unlawful. Requests for permission or further information should be addressed to the executive director, Air Movement and Control Association International Inc. at 30 West University Drive, Arlington Heights, IL 60004-1893 U.S.

Objections
The Air Movement and Control Association (AMCA) International Inc. will consider and take action upon all written complaints regarding its standards, certification programs or interpretations thereof. For information on procedures for submitting and handling complaints, write to

AMCA International
30 West University Drive
Arlington Heights, IL 60004-1893 U.S.A.

European AMCA
Avenue des Arts, numéro 46
à Bruxelles (1000 Bruxelles)

Asia AMCA Sdn Bhd
No. 7, Jalan SiLC 1/6,
Kawasan Perindustrian SiLC Nusajaya,
Mukim Jelutong, 79200 Nusajaya, Johor
Malaysia

Disclaimer
AMCA uses its best efforts to produce publications for the benefit of the industry and the public in light of available information and accepted industry practices. However, AMCA does not guarantee, certify or assure the safety or performance of any products, components or systems tested, designed, installed or operated in accordance with AMCA publications or that any tests conducted under its publications will be non-hazardous or free from risk.
## Review Committee

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dane Carey (Chair)</td>
<td>TAMCO</td>
</tr>
<tr>
<td>Karina Saenz Acosta</td>
<td>AAON Inc.</td>
</tr>
<tr>
<td>David Hustvedt</td>
<td>AcoustiFlo LLC</td>
</tr>
<tr>
<td>Eric Gohring</td>
<td>Air Balance</td>
</tr>
<tr>
<td>Tim Fleitz</td>
<td>Air Conditioning Products Co.</td>
</tr>
<tr>
<td>Cedric Chu</td>
<td>Aire Technologies, Inc.</td>
</tr>
<tr>
<td>Noman Qamar</td>
<td>Aldes Middle East</td>
</tr>
<tr>
<td>Jacob Carr</td>
<td>American Warming and Ventilating</td>
</tr>
<tr>
<td>John Penka</td>
<td>American Warming and Ventilating</td>
</tr>
<tr>
<td>Alex Talwar</td>
<td>Greenheck Fan Corporation</td>
</tr>
<tr>
<td>Kyle Vach</td>
<td>Greenheck Fan Corporation</td>
</tr>
<tr>
<td>Marty Gissel</td>
<td>Greenheck Fan Corporation</td>
</tr>
<tr>
<td>Mike Astorian</td>
<td>Nailor Industries Inc.</td>
</tr>
<tr>
<td>Eric Stanczyk</td>
<td>Metal Industries</td>
</tr>
<tr>
<td>Matt Remington</td>
<td>Pottorff</td>
</tr>
<tr>
<td>Matthew Joyce</td>
<td>Price Industries, Inc.</td>
</tr>
<tr>
<td>Kamil Mohamed</td>
<td>Prime Air Conditioning Industries, Inc</td>
</tr>
<tr>
<td>Joe Rockhold</td>
<td>Ruskin</td>
</tr>
<tr>
<td>Ganeson Kandasamy</td>
<td>The Trane Co.</td>
</tr>
<tr>
<td>Mike Dean</td>
<td>United Enertech Corp.</td>
</tr>
<tr>
<td>Maribel Saffo</td>
<td>Williams Furnace Co.</td>
</tr>
<tr>
<td>Joe Brooks</td>
<td>AMCA International</td>
</tr>
</tbody>
</table>
1. Purpose .................................................................................................................................................... 6
2. Scope ........................................................................................................................................................ 6
3. Definitions/Units of Measurement/Symbols .......................................................................................... 6
   3.1 Definitions ........................................................................................................................................... 6
   3.2 Units of measure ................................................................................................................................. 9
   3.3 Symbols and Subscripts ...................................................................................................................... 10
4. Instruments and Methods of Measurement ......................................................................................... 13
   4.1 Accuracy [4] .................................................................................................................................... 13
   4.2 Pressure ............................................................................................................................................ 13
   4.3 Airflow rate ..................................................................................................................................... 14
   4.4 Torque ............................................................................................................................................. 16
   4.5 Air density ...................................................................................................................................... 16
   4.6 Voltage .......................................................................................................................................... 17
   4.7 Electrical meters ............................................................................................................................ 17
   4.8 Pneumatic actuator supply air pressure ........................................................................................... 17
   4.9 Pressure gauges ............................................................................................................................. 17
   4.10 Chronometers ............................................................................................................................... 17
   4.11 Velocity meters ............................................................................................................................. 17
5. Equipment and Setups .......................................................................................................................... 17
   5.1 Setups ............................................................................................................................................. 17
   5.2 Ducts .............................................................................................................................................. 18
   5.3 Chambers ..................................................................................................................................... 18
   5.4 Variable supply and exhaust systems ............................................................................................ 19
6. Objective, Observations and Conduct of Test ....................................................................................... 20
   6.1 Air performance — pressure drop test ............................................................................................... 20
   6.2 Airflow leakage rate using ambient air ............................................................................................. 24
   6.3 Airflow leakage rate using ambient or heated air [15] ................................................................. 29
   6.4 Dynamic closure test using ambient air ......................................................................................... 31
   6.5 Operational test using ambient air ................................................................................................. 35
   6.6 Damper dynamic operational torque ............................................................................................... 38
   6.7 Dynamic closure test using heated air ............................................................................................ 41
   6.8 Operational test using heated air .................................................................................................... 44
   6.9 Thermal Efficiency Test .................................................................................................................. 48
7. Calculations .......................................................................................................................................... 51
   7.1 Calibration correction ....................................................................................................................... 51
   7.2 Density and viscosity of air ............................................................................................................. 51
   7.3 Airflow rate at test conditions ......................................................................................................... 52
   7.4 Density correction ......................................................................................................................... 55
7.5 Continuity of mass flow......................................................................................................................55
7.6 Airflow leakage — system leakage correction .................................................................................56
7.7 Pressure drop — duct system correction ..........................................................................................56
7.8 Airflow leakage — system leakage correction for elevated temperature leakage tests..............57
7.9 Thermal efficiency .............................................................................................................................58

8. References .............................................................................................................................................60

Annex A  Presentation of Air Performance Results for Rating Purposes (Informative) .................91
  A.1 Rating air performance — pressure drop .........................................................................................91
  A.2 Rating air leakage .............................................................................................................................91

Annex B  References (Informative, Unless Otherwise Indicated) .........................................................92

Annex C  Additional Damper Information (Informative).........................................................................93
Laboratory Methods of Testing Dampers for Rating

1. Purpose
The purpose of this standard is to establish uniform laboratory test methods for dampers. The characteristics to be determined include, as appropriate, air leakage, pressure drop, dynamic closure and operational torque.

It is not the purpose of this standard to specify the testing procedures to be used for design, production or field testing. Similarly, it is not the purpose of this standard to indicate or establish minimum or maximum performance ratings to be used for specifying these products.

2. Scope
This standard may be used as a basis for testing dampers when air is used as the test gas.

A test conducted in accordance with the requirements of this standard is intended to demonstrate the performance of a damper and is not intended to determine acceptability level for a damper. It is not within the scope of this standard to indicate the actual sequence of testing.

The parties to a test for guarantee purposes may agree to exceptions to this standard in writing prior to the test. However, only a test that does not violate any mandatory requirement of this standard shall be designated as a test conducted in accordance with this standard.

For more information on damper modulating control characteristics, see Annex C.

3. Definitions/Units of Measurement/Symbols

3.1 Definitions

3.1.1 Damper
A device mounted in a duct or opening which is used to vary the volume of air flowing through the duct or opening. It may be operated manually or mechanically and may have one or more blades.

3.1.1.1 Single blade damper
A damper having one blade.

3.1.1.2 Multi-blade damper
A damper having more than one blade. The damper is a parallel blade damper if the blades rotate in the same direction, and it is an opposed blade damper if adjacent blades rotate in opposite directions.

3.1.1.3 Curtain damper
A damper that uses a folded, interlocked series of blades.

3.1.1.4 Backdraft damper (shutter)
A damper that, when mounted in a duct or opening, permits the flow of air in one direction only. It is normally opened by the energy of the airstream, but it may be opened and/or closed by mechanical