

AMCA Publication 850-02 (R2011)

Industrial Process/Power Generation: Heavy Duty Dampers for Isolation and Control



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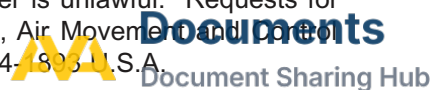
**Industrial Process/Power Generation:
Heavy Duty Dampers for Isolation and Control**



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Authority

AMCA International Publication 850-02 was adopted by the membership of the Air Movement and Control Association International, Inc. on May 16, 2002. It was reaffirmed by the membership of the Air Movement and Control Association International, Inc. on July 28, 2007, and on May 1, 2011.

Foreword

The Air Movement and Control Association International, Inc. (AMCA) is an international trade association representing manufacturers of industrial and commercial fans, airflow control devices such as backdraft dampers, louvers and dampers, airflow measurement stations, and acoustic attenuation devices.

This publication covers dampers such as are used in industrial process systems, and power generation facilities, where flue gas or air is the primary medium. This publication contains base-line information on applications and provides specification guidelines that may be supplemented by designers, specifiers and users to encompass their specific needs.

Disclaimer

This manual has been prepared by the Air Movement and Control Association International, Inc. (AMCA). The information contained in this manual has been derived from many sources and is believed to be accurate. Please note that the recommendations contained herein do not necessarily represent the only methods or procedures appropriate for the situation discussed, but rather are intended to present consensus opinions and practices of the air movement and control industry which may be helpful, or of interest to those who design, test, install, operate or maintain fan-duct systems. Thus, AMCA disclaims any and all warranties, expressed or implied, regarding the accuracy of the information contained in this manual and further disclaims any liability for the use or misuse of this information. AMCA does not guarantee, certify or assure the performance of any fan-duct system designed, tested, installed, operated or maintained on the basis of the information provided in this manual.

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RELATED AMCA STANDARDS

For Air Performance:

ANSI/AMCA Standard 210	<i>Laboratory Method of Testing Fans for Aerodynamic Performance Rating</i>
AMCA Standard 803	<i>Industrial Process/Power Generation Fans: Site Performance Test Standard</i>

For Sound:

AMCA Standard 300	<i>Reverberant Room Method for Sound Testing of Fans</i>
AMCA Standard 301	<i>Methods for Calculating Fan Sound Ratings from Laboratory Test Data</i>

For Balance and Vibration:

ANSI/AMCA Standard 204	<i>Balance Quality and Vibration Levels for Fans</i>
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Industrial Process / Power Generation Series:

AMCA Publication 801	<i>Industrial Process/Power Generation Fans: Specification Guidelines</i>
AMCA Publication 802	<i>Industrial Process/Power Generation Fans: Establishing Performance Using Laboratory Models</i>
AMCA Standard 803	<i>Industrial Process/Power Generation Fans: Site Performance Test Standard</i>

Fan Application Manual:

AMCA Publication 200	<i>Air Systems</i>
AMCA Publication 201	<i>Fans and Systems</i>
AMCA Publication 202	<i>Troubleshooting</i>
AMCA Publication 203	<i>Field Performance Measurement of Fan Systems</i>

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Industrial Process/Power Generation: Heavy Duty Dampers for Isolation and Control

1. Purpose

The purpose of this publication is to provide basic pertinent information in order to simplify communications between damper manufacturers and designers, specifiers and users of such equipment.

2. Scope

The scope of the products covered in this application guide includes dampers that are used to control a flow of 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 that system. The scope narrows to those dampers generally described as "heavy duty" or "severe service", because such dampers are normally used in applications where extreme temperature, erosion and/or corrosion conditions exist.

3. Terms and Definitions

This section defines terms that have special meaning or significance in damper applications and within the damper industry. Most are specific to the dampers under discussion in this publication. For the reader's convenience, terms that are defined in this section are shown in capital letters when used in the definition of a related term.

3.1 Accessory. An accessory is an item purchased by the damper manufacturer and either mounted on the DAMPER at the factory or supplied with the damper for field installation by others. An accessory is generally an item used to enhance or improve the performance of a damper. An accessory may be an ACTUATOR, a SEAL AIR system, a PURGE AIR system, a limit switch, a flow sensor (or system), positioning equipment, or some other item associated with powering, sensing or signaling.

3.2 Actuator. A mechanical accessory item attached to a DAMPER for the purpose of moving the damper BLADES(s) to either the open position, the closed position, or to an intermediate position to achieve low

modulation. An actuator may be manually, electrically, pneumatically or hydraulically powered. The output force of an actuator is delivered in either a linear or a rotary direction.

3.3 Actuator torque. The rated torque capability of an actuator.

3.4 Airfoil (blade). A double-skinned damper BLADE, the blade skins meeting at the leading and trailing edges of the blade with no substantial protrusions external to either blade skin.

3.5 Area of restriction. The total cross-sectional area of DAMPER components that are permanently located within the gross FREE AREA provided for gas flow through the DAMPER frame. The restrictive cross-sectional area of each component is determined by its position when the damper is fully open. Generally, in the full open position, a component will present the smallest frontal area to the direction of the gas flow.

3.6 Blade. In strict terms, the moveable component within the DAMPER frame. The purpose of a blade is to restrict a gas flow for modulation (control), or for closure (isolation).

3.7 Blade entry seal. In a GUILLOTINE DAMPER, the sealing arrangement through which the damper BLADE passes.

3.8 Blade support. A structural member inside the frame of a GUILLOTINE DAMPER. The member supports a portion of the BLADE when the damper BLADE is in the closed position.

3.9 Bonnet, open. The portion of a GUILLOTINE DAMPER frame that supports the BLADE when the damper BLADE is in the open position. An OPEN BONNET does not have an enclosed blade.

3.10 Bonnet, fully enclosed (or sealed). The enclosed portion of a GUILLOTINE DAMPER frame that supports the BLADE when the damper blade is in the fully open position.

3.11 Butterfly damper. A LOUVER DAMPER having a round single BLADE.

3.12 Control damper. A DAMPER which has the purpose of modulating or regulating one or more gas flow parameters such as PRESSURE DROP, rate of gas flow, or airflow distribution.

3.13 Chain drive. An arrangement of chain and sprockets for the purpose of bi-directional transmission of torque to the BLADE(s) of a damper.

3.14 Damper. A self-contained device for the control and/or regulation of gas flow from one portion of a duct system to another portion of that system; consisting of a frame and one or more linked moveable BLADE sections.

3.15 Drive. See ACTUATOR; DRIVE SYSTEM.

3.16 Drive lifting force. Of a GUILLOTINE DAMPER; the tensile force required to move the damper BLADE under specified conditions.

3.17 Drive system. The ACTUATOR and all components through which force is transmitted to the damper BLADE(s) for the purpose of positioning the BLADE(s).

3.18 Flow distribution. The pattern of gas flow variation in a duct, usually expressed in terms of gas velocity across a representative cross-section area of the duct.

3.19 Frame. Of a DAMPER, the external portion of the assembly that supports the BLADE(s), the means of attachment to the duct and provides the means of attaching other specified ACCESSORIES.

3.20 Free area. Of a DAMPER, the internal cross-section area of the DAMPER less the INTERNAL RESTRICTION.

3.21 Goggle damper. A DAMPER having a single sliding BLADE in which there is a cut-out area matching the inside dimensions of the duct. The damper is open when the cut-out area is moved to a position in line with the duct, and closed when the solid portion of the BLADE is positioned in line with the duct. The overall construction is similar to that of the GUILLOTINE DAMPER. (**Note:** The name "goggle" originated with the first application of this type of damper to a round duct.)

3.22 Guillotine damper. A DAMPER, also known as a GATE damper, having a single, solid, sliding BLADE. The DAMPER is closed when the BLADE slides completely into position over the duct cross-section area; it is open when the BLADE slides completely out of the duct area and into the BONNET.

3.23 Guillotine damper, double blade. A GUILLOTINE DAMPER having two parallel blades which operate in tandem, and a separating air space (AIR CHAMBER) which may be pressurized by a

SEAL AIR SYSTEM to prevent LEAKAGE of high pressure upstream system gas when the damper is closed.

3.24 Height. A dimensional reference to DAMPER size. In a GUILLOTINE DAMPER, height is the inside duct dimension parallel to the direction of the BLADE movement (draw). In a LOUVER DAMPER, height is the inside duct dimension perpendicular to the axis of the BLADE(s). See Figures 4 and 2, respectively.

3.25 Isolation. The restriction of system gas flow across the DAMPER. The extent of ISOLATION provided by a damper varies greatly with application requirements and the nature and type of DAMPER. The extent of ISOLATION is usually expressed as LEAKAGE.

3.26 Isolation damper. A DAMPER having the primary function of ISOLATION.

3.27 Leakage. The volume of system gas that can pass through the various flow paths around the components of a closed DAMPER under a given set of conditions. LEAKAGE may be expressed in terms of Actual Cubic Meters per Second (ACMS) (Actual Cubic Feet per Minute (ACFM)), kilograms (of gas) per hour (pounds per hour), Percentage of Normal Airflow rate, or Percentage of Maximum Airflow rate.

3.28 Leakage area. The total area of the various flow paths between the component parts of a fully closed DAMPER.

3.29 Leakage zero. A condition in which no system gas passes from the upstream side of a duct system through a closed DAMPER to the downstream side of the duct system.

3.30 Linkage. Of a DAMPER, includes the blade shaft lever arms and connecting bar assemblies between blades, which accept operating force transmitted from an ACTUATOR.

3.31 Load bar. See BLADE SUPPORT.

3.32 Louver damper. A DAMPER having one or more BLADE(s) permanently in the gas stream; said BLADE(s) may be rotated between the open and closed position or to some intermediate position. See Figures 1 and 2.

3.33 Modulate. In a DAMPER, to vary the gas flow rate or pressure drop, or both, across a DAMPER by changing the restrictive effect of the BLADE(s). This change is brought about by altering the position of the BLADE(s) within the damper frame. Also, the effect of damper closure positioning to vary the

system gas flow rate, flow velocity, or pressure; the action of the damper, damper controls and ACTUATOR to maintain a predetermined set of flow parameters such as pressure or temperature.

3.34 Normal operating conditions. Of a damper installation, the specific (or range of) pressure and temperature at the damper when the system is functioning within the planned productive operating range and conditions.

3.35 Operator. See ACTUATOR.

3.36 Packing. Sealing material used to minimize or eliminate LEAKAGE at a shaft penetration through a damper frame. It is contained in a STUFFING BOX and retained by a packing gland that may be bolted to or threaded into the body of the stuffing box.

3.37 Perimeter air sealed damper. A GUILLOTINE DAMPER having a frame design which includes a chamber around the duct and the BONNET. The chamber must be pressurized by a SEAL AIR SYSTEM.

3.38 Pressure drop. The static pressure loss across a damper due to airflow resistance. Damper pressure drop must be added to other system pressure losses to obtain total pressure drop in the system. For more complete information on pressure drop, see AMCA Publications 200 and 201.

3.39 Purge air. As compared to SEAL AIR that is used for sealing, PURGE AIR is generally used to scavenge or displace gases from enclosed spaces formed within the damper or within isolated spaces in a duct or system.

3.40 Quarter-turn damper. One that moves from fully open to fully closed (or vice versa) with a 90° rotation of the damper shaft.

3.41 Rack and pinion. A damper DRIVE SYSTEM in which rotary effort applied to a toothed wheel causes linear motion of a mating bar having a compatible tooth form. See Figure 5.

3.42 Racking. The twisting of a DAMPER frame out of its intended planar arrangement.

3.43 Screwjack. A GUILLOTINE DAMPER DRIVE SYSTEM that uses the principle of the screw to change rotary motion into linear motion in applying opening/closing force.

3.44 Seals. In a DAMPER; any component located on a DAMPER BLADE or FRAME and having the purpose of limiting the amount of LEAKAGE AREA

between the mating surfaces of a closed damper.

3.45 Seal air. Air introduced into the AIR CHAMBER of a DAMPER at a pressure higher than that of the upstream system gas. SEAL AIR thus provides a barrier to the passage of system gas from upstream of the damper to the downstream side. See Figure 6.

3.46 Shaft. In a LOUVER DAMPER, the supporting structural element of the blade; also the component about which the BLADE rotates and changes the BLADE attitude toward the gas stream. In a GUILLOTINE DAMPER, the round bar or tube through which actuation force is transmitted between components of the DRIVE SYSTEM.

3.47 Shut-off damper. A DAMPER that is not intended/used at any intermediate position between fully open or fully closed; sometimes referred to as "on-off" service. **Note:** Neither the name nor the expression denotes ISOLATION.

3.48 Stub shaft. A short, non-continuous shaft that extends through, as applicable: the LINKAGE, bearing, STUFFING BOX, or DAMPER frame and into the BLADE of a LOUVER or BUTTERFLY DAMPER.

3.49 Stuffing box. A chamber surrounding a shaft penetration through a DAMPER frame and into which PACKING may be installed to provide a leakage-resistant seal around the SHAFT.

3.50 Sprocket. A gear-like disk having teeth shaped to engage a drive chain for the purpose of converting actuator force to tensile force on the drive chain of a GUILLOTINE DAMPER.

3.51 Throat seal. See BLADE ENTRY SEAL.

3.52 Upset conditions. Those recognized potential excursions of pressure or temperature beyond the NORMAL OPERATING CONDITIONS and usually of short duration. A DAMPER subjected to upset conditions is usually required to sustain the upset conditions and perform thereafter without inhibition of normal function, or to specified functions under upset conditions.

3.53 Width. A dimensional reference to DAMPER size; in a GUILLOTINE DAMPER, the duct inside dimension that is perpendicular to the direction of BLADE movement. In a LOUVER DAMPER, it is the duct inside dimension parallel to the SHAFT axis. See Figures 4 and 2, respectively.

3.54 Wire cable. In a GUILLOTINE DAMPER, a tensile force component consisting of woven strands