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ASHRAE Guideline 16-2025
Selecting Outdoor, Return, and Relief Dampers for Air-Side Economizer Systems

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NOTE

Approved addenda, errata, or interpretations for this guideline can be downloaded free of charge from the ASHRAE website at www.ashrae.org/technology.

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(This foreword is not part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

FOREWORD

Control damper selection and sizing are a critical first step in the design of a control system. The system designer should take care to make the correct damper selections. Improper selection and sizing may cause hunting; improper temperature, flow, and pressure control; and other operational difficulties.

The objective of this guideline is to address the application and sizing of outdoor, return, and relief dampers used to control

- *Outdoor-air intake for economizer (free) cooling,*
- *Minimum-ventilation outdoor airflow for indoor air quality, and*
- *Building pressure.*

This guideline focuses on the three most common damper configurations for systems employing an air-side economizer:

a. Supply and return fan
b. Supply and relief fan
c. Supply fan with gravity (nonpowered) relief

These configurations have outdoor, return, and relief dampers. For other damper configurations, such as multiple return dampers within a system, the general information in this guideline is still beneficial.

The methods of control described in this guideline are not intended to indicate a control preference but to show how dampers typically operate in heating, ventilating, and air-conditioning systems that include an air-side economizer.

The 2025 edition of Guideline 16 updates normative references. This guideline was prepared under the auspices of ASHRAE. It may be used, in whole or in part, by an association or government agency with due credit to ASHRAE. Adherence is strictly on a voluntary basis and merely in the interests of obtaining uniform guidelines throughout the industry.

1. PURPOSE

This guideline provides the basis for selecting and sizing control dampers (outdoor, return, and relief) commonly found in constant-air-volume (CAV) and variable-air-volume (VAV) air-handling units (AHU) and systems with air-side economizers.

2. SCOPE

2.1 This guideline covers the application of mixed-air control dampers in AHUs and systems that incorporate air-side economizer systems for cooling.

2.2 This guideline addresses the selection of control dampers based on damper characteristics and damper pressure drop.

2.3 This guideline is not intended to cover dampers used elsewhere in heating, ventilating, and air-conditioning (HVAC) systems.

2.4 This guideline does not cover air mixing.

3. DEFINITIONS

3.1 Definitions of most terms used in this guideline can be found in *ASHRAE Terminology of Heating, Ventilation, Air Conditioning, & Refrigeration*.[1]

3.2 Terms used in this guideline that are not found in *ASHRAE Terminology of Heating, Ventilation, Air Conditioning, & Refrigeration* or that are used differently are defined in this section.

maximum outdoor-air damper: a modulating damper or set of dampers used to control the outdoor airflow to the system in excess of minimum ventilation outdoor air for free cooling (air-side economizer). Also called economizer outdoor-air damper. May also serve to provide the minimum outdoor airflow control.

minimum outdoor-air damper: a two-position damper in parallel with the maximum outdoor-air damper to provide the minimum outdoor air required for ventilation.

path pressure drop: the pressure drop in the air path that is affected by the control damper.

relief air: building return air discharged by the AHU equipment to control building pressure when an HVAC system is operating in the economizer cycle.