STANDARD

ANSI/ASHRAE Standard 103-2017
(Supersedes ANSI/ASHRAE Standard 103-2007)

Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers

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ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

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a. interpretation of the contents of this Standard,
b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard, or
d. permission to reprint portions of the Standard.

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NOTE

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

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

ASHRAE Standard 103 is an industry standard specifying the method of testing for determining the annual fuel utilization efficiency of residential and light commercial furnaces and boilers. Previous significant updates to the standard were published in 1993, when the content of the standard was aligned with the United States Department of Energy test procedures for rating furnaces and boilers, and in 2007. In the 2007 revision, attention was given to modern classes of two-stage and modulating equipment and to equipment whose performance is affected by post purge of the combustion chamber. Also, greater understanding and clarity regarding losses from equipment were incorporated into the standard.

This 2017 revision focuses on improving mandatory language and on incorporating SI units. While the project committee focused mostly on editorial improvements to these areas, they also made quality improvements to the test duct and plenum figure, the system number table, and figures for surface heat transfer coefficient and coefficient of radiation. This revision also adopts the 2013 Department of Energy change to the procedure section allowing for the optional procedures for condensing equipment (Section 9.10) to be extended to two-stage modulating controls.

1. PURPOSE

The purpose of this standard is to provide procedures for determining the annual fuel utilization efficiency of residential central furnaces and boilers.

2. SCOPE

2.1 This standard includes

a. a test method for cyclic and part-load performance,
b. methods for interpolating and extrapolating test data, and
c. calculation procedures for establishing seasonal performance.

2.2 This standard applies to central furnaces with inputs less than 225,000 Btu/h (65.92 kW) and boilers with inputs less than 300,000 Btu/h (87.90 kW), having gas, oil, or electric input, and intended for use in residential applications. This standard also applies to furnaces with inputs less than 225,000 Btu/h (65.92 kW) contained within the same cabinet with central air conditioners that have rated cooling capacities of 65,000 Btu/h (19.04 kW) or less. This standard applies to equipment that utilizes single-phase electric current or low-voltage DC current.

2.3 The procedures are intended to be used to compare energy consumption measures of various furnace and boiler models. They are not intended to provide an absolute measure of performance in any specific installation configuration, as the effects of heating system installation variables are not fully taken into account.

3. DEFINITIONS

air intake terminal: a device that is located on the outside of a building and is connected to a furnace or boiler by a system of conduits through which air for combustion is taken from the outside environment.

air shutter: an adjustable device for varying the amount of primary air entering the burner (atmospheric and power types).

annual fuel utilization efficiency (AFUE): the ratio of annual output energy to annual input energy, which includes any non-heating-season pilot input loss and, for gas- or oil-fired furnaces or boilers, does not include electric energy.

atmospheric burner: a device for the final conveyance of the gas, or a mixture of gas and air at atmospheric pressure, to the combustion zone.

automatic vent damper: an electrically operated or thermally actuated device installed downstream of the draft hood (see *stack damper*).

barometric draft regulator or barometric damper: a device designed to maintain a constant draft in a furnace or boiler.

boiler: a self-contained fuel-burning or electrically heated appliance for supplying low-pressure steam or hot water for space-heating application.

boiler, finned-tube: a boiler whose heat exchanger consists of only finned tubes.

boiler, low-pressure steam or hot water: an electric, gas, or oil-burning boiler designed to supply low-pressure steam or hot water for space-heating applications. A low-pressure steam boiler operates at or below 15 psig (103 kPa) steam pressure; a hot-water boiler operates at or below 160 psig (1.10 MPa) water pressure and 250°F (121°C) water temperature.

boiler outlet: the opening provided in a boiler for the exhaust of the flue gases from the combustion chamber.

condensing furnace or boiler: a unit that will, during the laboratory tests prescribed in this standard, condense part of the water vapor in the flue gases and is equipped with a means of collecting and draining this condensate.

control: a device used to regulate the operation of a piece of equipment; the device regulates the gas, air, water, or electrical supplies.

control, modulating: a manual control, an automatic step modulating control, or a two-stage control.

control, single-stage: a control that cycles a burner between the maximum heat input rate and OFF.

control, step modulating: a modulating control that cycles a burner between the reduced input rate and OFF if the heating load is light. If a higher heating load is encountered that cannot be met with the reduced input rate, the control goes into a modulating mode where it either gradually or incrementally increases the input rate to meet the higher heating load. At