

ANSI/ASHRAE Standard 116-2010
(Supersedes ANSI/ASHRAE Standard 116-1995 [RA 2005])



ASHRAE STANDARD

Methods of Testing for Rating Seasonal Efficiency of Unitary Air Conditioners and Heat Pumps

Approved by the ASHRAE Standards Committee on January 23, 2010; by the ASHRAE Board of Directors on January 27, 2010; and by the American National Standards Institute on February 24, 2010.

ASHRAE Standards are scheduled to be updated on a five-year cycle; the date following the standard number is the year of ASHRAE Board of Directors approval. The latest edition of an ASHRAE Standard may be purchased on the ASHRAE Web site (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide) or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

© Copyright 2010 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

ISSN 1041-2336



**American Society of Heating, Refrigerating
and Air-Conditioning Engineers, Inc.**
1791 Tullie Circle NE, Atlanta, GA 30329
www.ashrae.org

ASHRAE Standard Project Committee 116
Cognizant TC: TC 8.11, Unitary and Room Air Conditioners and Heat Pumps
SPLS Liaison: Allan Fraser

John M. Talbott, *Chair (2007–2010)**
David R. Tree, *Chair (2004–2006)**
Eric Berg*
Brian P. Dougherty*

Byron F. Horak*
Sarah A. Medepalli
Michael E. Shows*
Michael W. Woodford*

*Denotes members of voting status when the document was approved for publication

ASHRAE STANDARDS COMMITTEE 2009–2010

Steven T. Bushby, *Chair*
H. Michael Newman, *Vice-Chair*
Robert G. Baker
Michael F. Beda
Hoy R. Bohanon, Jr.
Kenneth W. Cooper
K. William Dean
Martin Dieryckx
Allan B. Fraser
Katherine G. Hammack
Nadar R. Jayaraman
Byron W. Jones
Jay A. Kohler
Carol E. Marriott

Merle F. McBride
Frank Myers
Janice C. Peterson
Douglas T. Reindl
Lawrence J. Schoen
Boggarm S. Setty
Bodh R. Subherwal
James R. Tauby
James K. Vallort
William F. Walter
Michael W. Woodford
Craig P. Wray
Wayne R. Reedy, *BOD ExO*
Thomas E. Watson, *CO*

Stephanie Reiniche, *Manager of Standards*

SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus standard developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). *Consensus* is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this standard as an ANS, as “substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution.” Compliance with this standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

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

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Manager of Standards of ASHRAE should be contacted for:

- 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.

DISCLAIMER

ASHRAE uses its best efforts to promulgate Standards and Guidelines for the benefit of the public in light of available information and accepted industry practices. However, ASHRAE does not guarantee, certify, or assure the safety or performance of any products, components, or systems tested, installed, or operated in accordance with ASHRAE's Standards or Guidelines or that any tests conducted under its Standards or Guidelines will be nonhazardous or free from risk.

ASHRAE INDUSTRIAL ADVERTISING POLICY ON STANDARDS

ASHRAE Standards and Guidelines are established to assist industry and the public by offering a uniform method of testing for rating purposes, by suggesting safe practices in designing and installing equipment, by providing proper definitions of this equipment, and by providing other information that may serve to guide the industry. The creation of ASHRAE Standards and Guidelines is determined by the need for them, and conformance to them is completely voluntary.

In referring to this Standard or Guideline and in marking of equipment and in advertising, no claim shall be made, either stated or implied, that the product has been approved by ASHRAE.

CONTENTS

ANSI/ASHRAE Standard 116-2010 Methods of Testing for Rating Seasonal Efficiency of Unitary Air Conditioners and Heat Pumps

SECTION	PAGE
Foreword.....	2
1 Purpose	2
2 Scope	2
3 Definitions and Nomenclature	2
4 Classifications.....	3
5 Instruments and Data Acquisition Systems	3
6 Apparatus	10
7 Methods of Test	11
8 Test Procedure	15
9 Data Analysis.....	18
10 Calculation for Seasonal Efficiency Ratios	21
11 References	35
Appendix A: Example Bin Calculations.....	36
Appendix B: Bibliography.....	46

NOTE

When addenda, interpretations, or errata to this standard have been approved, they can be downloaded free of charge from the ASHRAE Web site at <http://www.ashrae.org>.

© Copyright 2010 American Society of Heating,
Refrigerating and Air-Conditioning Engineers, Inc.
1791 Tullie Circle NE
Atlanta, GA 30329
www.ashrae.org

All rights reserved.

(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 116 was developed to provide uniform methods of testing for rating the seasonal efficiency of unitary air conditioners and heat pumps used in residential applications. It was first published in 1983, revised in 1995, and reaffirmed in 2005. This revision of the standard improves the alignment with related ASHRAE and ARI standards, especially ASHRAE Standard 37; Sections 6.6 through 6.13 from Standard 116-1995 (RA 2005) have been deleted and replaced by sections that refer the user to corresponding sections in Standard 37-2005. In addition, the revised Standard 116 incorporates mandatory language throughout, adds the ASHRAE map of climate zones for US locations, updates references, and makes various editorial improvements.

1. PURPOSE

This standard provides test methods and calculational procedures for determining the capacities and cooling seasonal efficiency ratios for unitary air-conditioning and heat pump equipment and heating seasonal performance factors for heat pump equipment.

2. SCOPE

2.1 This standard covers electrically driven, air-cooled air conditioners and heat pumps used in residential applications with cooling capacity of 65,000 Btu/h and less or, in the case of heating-only heat pumps, heating capacity of 65,000 Btu/h and less.

2.2 The methods of test in this standard are broadly applicable, but this standard provides cooling and heating hours in temperature bins for only the contiguous states of the continental USA.

2.3 This standard includes test methods for steady-state, cyclic, and part-load performance and methods for establishing seasonal performance. Equipment with single-speed, multiple-speed, variable-speed, unloading, or multiple compressors for ducted and ductless systems is included.

2.4 This standard does not apply to room air conditioners. See ASHRAE Standards 16 and 58 in Appendix B, Bibliography.

3. DEFINITIONS AND NOMENCLATURE

air-conditioning systems:

cooling (heating) air-conditioning system: specific air-treating combination that may consist of means for venti-

lation, air circulation, humidity control, air cleaning, and heat transfer, with controlled means for cooling (heating).

single package air-conditioning system: air-conditioning system consisting of equipment provided entirely in one assembly or enclosure.

split air-conditioning system: air-conditioning system consisting of equipment provided in more than one assembly or enclosure, usually with supply air distribution equipment housed separately from refrigerant condensing equipment.

air, standard (I-P): dry air having a mass density of 0.075 lb_m/ft³.

ARI: Air-Conditioning and Refrigeration Institute.

bin: in the bin method, a statistical class (sometimes, a class interval) for outdoor air temperature, with the class limits expressed in a temperature unit.

bin method: energy calculation method, usually used in prediction, in which the annual (or monthly) energy use of a building is calculated as the sum of the energy used for all of the outdoor temperature bins. The bin method allows heat pump (or other heater or cooler) performance, which is different for each bin, to be accounted for.

capacity, air conditioner, latent (dehumidifying): available steady-state refrigerating capacity of an air conditioner for removing latent heat from the space to be conditioned (Btu/h).

capacity, air conditioner, sensible: available steady-state refrigerating capacity of an air conditioner for removing sensible heat from the space to be conditioned (Btu/h).

capacity, air conditioner, total: available capacity of an air conditioner for removing sensible and latent heat from the space to be conditioned (Btu/h).

capacity, heating: the rate at which the equipment adds heat to the air passing through it under specified conditions of operation (Btu/h).

coefficient of performance, heating (COP): ratio of the rate of heat delivered to the conditioned space to the rate of energy input, in consistent units, for a complete operating heat pump system or some specific portion of that system under designated operating conditions. Derived by the equations in 9.2.3 and 9.2.4.

coil, indoor: the heat exchanger that removes heat from or adds heat to the conditioned space.

coil, outdoor: the heat exchanger that rejects heat to or absorbs heat from a source external to the conditioned space.

cooling load factor (CLF): ratio of the cooling building load to the steady-state cooling capacity (derived by the equation in 9.2.2).