STANDARD

ANSI/ASHRAE Standard 194-2012

Method of Test for Direct-Expansion Ground-Source Heat Pumps

Approved by the ASHRAE Standards Committee on October 2, 2012; by the ASHRAE Board of Directors on October 26, 2012; and by the American National Standards Institute on October 27, 2012.

 ISSN 1041-2336

Approved American National Standard
ANSI
www.ansi.org

SPECIAL NOTE

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

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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.

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NOTE

Approved addenda, errata, or interpretations for this standard can be downloaded free of charge from the ASHRAE Web site 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

This standard 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 interest of obtaining uniform standards throughout the industry.

1. PURPOSE

The purpose of this standard is to provide test procedures for rating factory-made residential, commercial, and industrial direct-expansion ground-source heat pumps, as defined in Section 3. In this standard, the terms "heat pumps" or "equipment" may be used to designate direct-expansion ground-source heat pumps.

The heat-pump capacity range covered in this standard is 5.3 to 52.7 kW (18,000 to 180,000 Btu/h) and all standard voltage and frequency ratings.

2. SCOPE

2.1 This standard provides test procedures for determining heating capacity, cooling capacity, coefficients of performance (COPs), and energy efficiency ratio (EER) for systems, as defined in Section 3.

2.2 This standard applies only to electrically driven, mechanical vapor-compression refrigeration systems.

2.3 This standard applies to the testing of heat pumps with an outdoor refrigerant to test liquid heat exchanger used to condition the refrigerant entering the system. This standard does not apply to individual assemblies for separate use.

3. DEFINITIONS AND NOMENCLATURE

3.1 Definitions. All terms in this document shall follow the standard industry definitions in the current edition of *ASHRAE Terminology of Heating, Ventilating, Air Conditioning and Refrigeration* (1911) unless otherwise defined in this section.

coefficient of performance, cooling (COP_c): ratio of net total cooling capacity in watts to effective power input of the equipment in watts at any given set of test conditions.

coefficient of performance, heating (COP_h): ratio of net heating capacity in watts to effective power input of the equipment in watts at any given set of test conditions.

direct-expansion ground-source heat exchanger: continuous sealed-tube heat exchanger with refrigerant supply and refrigerant return. This may be composed of several tubes and may be supplied with each heat pump, and the heat exchanger(s) may be factory or field assembled. For purposes of testing in accordance with this standard, the direct-expansion ground-source heat exchanger (ground loop) is simulated by a refrigerant-to-test liquid heat exchanger (earth loop simulator).

direct-expansion (DX) ground-source heat pump: heat pump consisting of (1) one or more factory-made assemblies that normally include an indoor conditioning coil with air- or water- moving means, (2) compressor(s), and (3) a subsurface refrigerant piping loop system that functions as a heat exchanger, including means to provide a heating function, cooling function, or both. The separate assemblies shall be designed to be used together. In this standard, the terms "equipment" or "heat pumps" may be used to mean DX-to-air heat pumps or DX-to-water heat pumps.

For purposes of testing, the use of an outdoor refrigerant to test liquid heat exchanger shall be utilized with other matched system assemblies. The heat exchanger energy calculations shall be determined by means of the outdoor test liquid-enthalpy method, detailed in Section 6.

Direct-expansion ground-source heat pumps shall provide the function of circulating air or water cooling and/or heating with controlled temperature and may include the functions of potable water heating, air cleaning, dehumidifying, and humidifying.

Models designated as cooling-only units need not include the heating function, and models designated heating-only units need not include the cooling function.

effective power input: average electrical power input, E_e, in watts, to the equipment within a defined interval of time. This is the sum of the following, as appropriate (see Section 6):

- Power input for operation of the compressor, excluding supplemental electric heat, E_c.
- Power input of all control and safety devices of the equipment, E_{cs}.
- Power input to fans, E_f, and power adjustments for fans and pumps, E_{fa} and E_p, respectively, whether provided with the equipment, and as appropriate (see Section 6).

energy efficiency ratio (EER): ratio of net total cooling capacity in Btu/h to effective power input in watts at any given set of rating conditions.

heating capacity: for DX-to-air systems, rate in watts (Btu/h) at which the equipment adds heat to the air passing through the indoor coil under specified conditions of operation. For DX-to-water systems, rate in watts (Btu/h) at which the equipment adds heat to the water passing through the indoor heat exchanger under specified conditions of operation.

I-P (Inch-Pound): U.S. customary system of units.

net heating capacity: for DX-to-air systems, heating capacity in watts (Btu/h) with fan power adjustment. For DX-to-water systems, heating capacity in watts (Btu/h) with indoor-side pump power adjustment.

net total cooling capacity: for DX-to-air systems, total cooling capacity in watts (Btu/h) with fan power adjustment. For DX-to-water systems, total cooling capacity in watts (Btu/h) with indoor-side pump power adjustment.

part-load test: test conducted at part-load test conditions.