ADDENDA

ANSI/ASHRAE Addenda b and c to
ANSI/ASHRAE Standard 206-2013

Method of Test for Rating of Multipurpose Heat Pumps for Residential Space Conditioning and Water Heating

Approved by the ASHRAE Standards Committee on June 28, 2014; by the ASHRAE Board of Directors on July 2, 2014; and by the American National Standards Institute on July 3, 2014.

These addenda were approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE website (www.ashrae.org) or in paper form from the Manager of Standards.

The latest edition of an ASHRAE Standard may be purchased on the ASHRAE website (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. 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.

 ISSN 1041-2336

Approved American National Standard
ANSI
www.ansi.org

SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus standard developed under the auspices of 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.

(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 addendum adds wording to clarify that the upper-element portion of the water-heater tank is always heated to 57°C (135°F) at the conclusion of a water heating test, and to correct for any net change in average tank temperature.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum b to Standard 206-2013

Add Section 9.3.1.4 and modify Sections 10.6.1.3, 10.7.1.3, 10.7.2.3, 10.8.1.3, 10.8.2.3, and 11.4.1 and Tables 10.8 and 10.9 as follows.

[Note: This addendum modifies sections changed by the erratum dated March 26, 2014, which can be downloaded from http://www.ashrae.org/technology/page/120.]

9.3.1.4 If the average tank temperature at the conclusion of a water heating test is less than the average tank temperature at the initiation of a test, the difference shall be made up from supplemental electric heat and calculated according to the calculation procedure of Section 11.4.1.

[. . .]

10.6.1.3 A water draw is imposed until the appliance initiates water heating, either from a resistive element or refrigerant-to-water heat exchange. A draw of not less than 42 L (41 kg) (11 gal or 90 lb) shall be imposed. Water shall be removed at a rate of 11.4 ± 1.0 L/s (3.0 ± 0.25 gpm) while the make-up water temperature is maintained within 14.4°C ± 1.1°C (58°F ± 2°F). Once water heating is initiated, or 42 L (or 41 kg) (11 gal or 90 lb) has been drawn, the water draw is terminated and the water heater is allowed to fully recover. If the recovery did not include upper element operation, the upper element shall be energized as a last operation until T_{w1} equals 57°C or greater (135°F or greater).

[. . .]

10.7.1.3 A water draw is imposed until the appliance initiates water heating, either from a resistive element or refrigerant-to-water heat exchange. A draw of not less than 42 L (41 kg) (11 gal or 90 lb) shall be imposed. Water shall be removed at a rate of 11.4 ± 1.0 L/s (3.0 ± 0.25 gpm) while the make-up water temperature is maintained within 14.4°C ± 1.1°C (58°F ± 2°F). Once water heating is initiated, or 42 L (or 41 kg) (11 gal or 90 lb) has been drawn, the water draw is terminated and the water heater is allowed to fully recover. If the recovery did not include upper element operation, the upper element shall be energized as a last operation until T_{w1} equals 57°C or greater (135°F or greater).

[. . .]

10.7.2.3 A water draw is imposed until the appliance initiates water heating, either from a resistive element or refrigerant-to-water heat exchange. A draw of not less than 42 L (41 kg) (11 gal or 90 lb) shall be imposed. Water shall be removed at a rate of 11.4 ± 1.0 L/s (3.0 ± 0.25 gpm) while the make-up water temperature is maintained within 14.4°C ± 1.1°C (58°F ± 2°F). Once water heating is initiated, or 42 L (or 41 kg) (11 gal or 90 lb) has been drawn, the water draw is terminated and the water heater is allowed to fully recover. If the recovery did not include upper element operation, the upper element shall be energized as a last operation until T_{w1} equals 57°C or greater (135°F or greater).

[. . .]

10.8.1.3 A water draw is imposed until the appliance initiates water heating, either from a resistive element or refrigerant-to-water heat exchange. A draw of not less than 42 L (41 kg) (11 gal or 90 lb) shall be imposed. Water shall be removed at a rate of 11.4 ± 1.0 L/s (3.0 ± 0.25 gpm) while the make-up water temperature is maintained within 14.4°C ± 1.1°C (58°F ± 2°F). Once water heating is initiated, or 42 L (or 41 kg) (11 gal or 90 lb) has been drawn, the water draw is terminated and the water heater is allowed to fully recover. If the recovery did not include upper element operation, the upper element shall be energized as a last operation until T_{w1} equals 57°C or greater (135°F or greater).

[. . .]

10.8.2.3 A water draw is imposed until the appliance initiates water heating, either from a resistive element or refrigerant-to-water heat exchange. A draw of not less than 42 L (41 kg) (11 gal or 90 lb) shall be imposed. Water shall be removed at a rate of 11.4 ± 1.0 L/s (3.0 ± 0.25 gpm) while the make-up water temperature is maintained within 14.4°C ± 1.1°C (58°F ± 2°F). Once water heating is initiated, or 42 L (or 41 kg) (11 gal or 90 lb) has been drawn, the water draw is terminated and the water heater is allowed to fully recover. If the recovery did not include upper element operation, the upper element shall be energized as a last operation until T_{w1} equals 57°C or greater (135°F or greater).

[. . .]

11.4.1 Potable Water Heating Capacity. The temperatures of the water withdrawn and the make-up water supplied to the water heater during a draw shall be measured as described in Section 8.7.2. The mean for each set of temperatures shall be determined, $\dot{T}_{dr,o}^{z}$ and $\dot{T}_{dr,i}^{z}$, where z designates the hot water draw number. The total mass or volume removed during each draw, m_{dr}^{z} or V_{dr}^{z}, shall also be measured. From these measurements, the energy removed from

TABLE 10.8 Steady-State Combined Operation and Water Draw Schedule

Sequence	
1	Heat pump operating continuously in space conditioning mode, and/or resistive to conclusion of water heating.
2	Condition with minimum 41.6 L (11 gal) draw to initiate water heating.
3	Heat pump and/or resistive operation to conclusion of water heating.
4	Heat pump continues to operate in space conditioning mode for 5 to 15 minutes.
5	t = 0, draw 20.4 L (5.4 gal).
6	Heat pump and resistive operate on internal controls, with a continuous call for space conditioning.
7	t = 68 minutes, draw 60.9 L (16.1 gal).
8	Heat pump and resistive operate on internal controls, with a continuous call for space conditioning.
9	t = 118 minutes, draw 40.5 L (10.7 gal).
10	Heat pump and resistive operate on internal controls to conclusion of water heating, with a continuous call for space conditioning.
11	If T_{w1} is less than 57°C (135°F) following step 10, the upper element shall be energized as a last operation until T_{w1} equals 57°C or greater (135°F or greater).

TABLE 10.9 Dedicated Water-Heating Operation and Water Draw Schedule

Sequence	
1	Heat pump operating continuously in dedicated water-heating mode, and/or resistive to conclusion of water heating.
2	Condition with minimum 41.6 L (11 gal) draw to initiate water heating.
3	Heat pump and/or resistive operation to conclusion of water heating.
4	Compressor off for 10 minutes.
5	t = 0, draw 20.4 L (5.4 gal).
7	Heat pump and resistive operate on internal controls.
8	t = 68 minutes, draw 60.9 L (16.1 gal).
9	Heat pump and resistive operate on internal controls.
10	t = 118 minutes, draw 40.5 L (10.7 gal).
11	Heat pump and resistive operate on internal controls.
1	Heat pump operating continuously in dedicated water-heating mode, and/or resistive to conclusion of water heating.
12	If T_{w1} is less than 57°C (135°F) following step 11, the upper element shall be energized as a last operation until T_{w1} equals 57°C or greater (135°F or greater).

the water heater during each draw, Q_{dr}^{z}, shall be calculated using:

$$Q_{dr}^{z} = m_{dr}^{z}\, C_{pw}(\check{T}_{dr,o}^{z} - \check{T}_{dr,i}^{z})3600, \text{ Wh} \quad \text{(SI)} \quad \text{(11.4.1-1)}$$

$$[= m_{dr}^{z}\, C_{pw}(\check{T}_{dr,o}^{z} - \check{T}_{dr,i}^{z}), \text{ Btu}] \quad \text{(I-P)}$$

or

$$Q_{dr}^{z} = V_{dr}^{z}\, \rho_{w} C_{pw}(\check{T}_{dr,o}^{z} - \check{T}_{dr,i}^{z})3600, \text{ Wh} \quad \text{(SI)} \quad \text{(11.4.1-2)}$$

$$[= V_{dr}^{z}\, \rho_{w} C_{pw}(\check{T}_{dr,o}^{z} - \check{T}_{dr,i}^{z}), \text{ Btu }] \quad \text{(I-P)}$$

where

m_{dr}^{z} = mass of water withdrawn on the z^{th} draw, kg (lb)

V_{dr}^{z} = volume of water withdrawn on the z^{th} draw, L (gal)

ρ_w = water density, 0.985 kg/L (8.22 lb_m/gal) (unless determined based on $\check{T}_{dr,o}^{z}$); and

C_{pw} = specific heat of the water removed, 4.186 J/kg·°C (1.00 Btu/lb_m·°F)

The total energy removed during all three draws of the simulated use test shall be recorded as:

$$\Sigma Q_{dr,s} = Q_{dr}^{1} + Q_{dr}^{2} + Q_{dr}^{3} \quad \text{(11.4.1-3)}$$

The combined appliance average water heating capacity from the test is then calculated from:

$$q'_{w} = (\Sigma Q_{dr,s} + Q_{tk} - E_r)/[(t_f - t_i)/60], \text{ W} \quad \text{(SI)} \quad \text{(11.4.1-4)}$$

$$[= (\Sigma Q_{dr,s} + Q_{tk} - E_r \times 3.413)/[(t_f - t_i)/60], \text{ Btu/h }] \quad \text{(I-P)}$$

where

Q_{tk} = water-heater tank standby loss, W (Btu/h). As presented in Section 11.7.2.1, the hourly tank standby loss is equal to 44.2 W (150.8 Btu/h) for the standard rating 189 L (50 gal) water heater prior to April 15,

2015. After April 15, 2015, the tank standby loss will equal 15.7 W (53.6 Btu/h).

E_r = the net electrical energy consumed by the water heater during a simulated use test, Wh

t_i = time that the compressor or auxiliary water heater elements begin operation following initiation of the first water draw, minutes. For steady-state tests conducted per Sections 10.6.1, 10.7.1, and 10.10, $t_i = t_0$, the time that the first water draw is initiated. For cyclic tests conducted per Sections 10.6.2 and 10.7.2, t_i = the time that the compressor starts, whether due to internal controls or at $t_i = 10$ when the space conditioning thermostat signal is initiated. For demand tests conducted per Sections 10.8.1 and 10.8.2, t_i = the time that the compressor starts.

t_f = time that both the compressor and the auxiliary water heater elements cease operation following termination of the third water draw, minutes. See Section 9.3.1.1.

If both the compressor and the auxiliary water heater elements cease operation between initiation of the first and third water draw because of a fully recovered water heater, the off time shall be deducted from the total elapsed time.

If the average tank temperature at the conclusion of a water heating test is less than the average tank temperature at the initiation of a test, a value Q_{wsup} is added to the heat-pump water-heating capacity, and a value E_{wsup} is added to the heat-pump energy use, where

$$Q_{wsup} = \sum((T_{w1i} + T_{w2i} + T_{w3i} + T_{w4i} + T_{w5i} + T_{w6i} - (T_{w1f} + T_{w2f} + T_{w3f} + T_{w4f} + T_{w5f} + T_{w6f}))/6) \times V_t \times C_{pw} \times \rho_w \times 3600, \text{ Wh} \quad \text{(SI)} \qquad \text{(11.4.1-5)}$$

$$[= \sum((T_{w1i} + T_{w2i} + T_{w3i} + T_{w4i} + T_{w5i} + T_{w6i} - (T_{w1f} + T_{w2f} + T_{w3f} + T_{w4f} + T_{w5f} + T_{w6f}))/6) \times V_t \times C_{pw} \times \rho_w, \text{ Btu}] \quad \text{(I-P)}$$

$$E_{wsup} = \sum((T_{w1i} + T_{w2i} + T_{w3i} + T_{w4i} + T_{w5i} + T_{w6i} - (T_{w1f} + T_{w2f} + T_{w3f} + T_{w4f} + T_{w5f} + T_{w6f}))/6) \times V_t \times C_{pw} \times \rho_w \times 3600, \text{ Wh} \qquad \text{(11.4.1-6)}$$

where

T_{w1i} through T_{w6i} = tank temperatures at the initiation of the test, °C (°F)

T_{w1f} through T_{w6f} = tank temperatures at the conclusion of the test, °C (°F)

(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 addendum corrects editorial errors that have been identified associated with Sections 10.6 and 10.7 related to the combined space/water heating tests, and it eliminates all of Section 10.7.2, which is not used in the approved version of the standard.

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum c to Standard 206-2013

In Table 10.5a, "Single Capacity Air-Source Systems," delete the word "cyclic" from the Mode B tests as follows.

*C*27.8(*C*82.0) ~~cyclic~~

H8.33(*H*47.0) ~~cyclic~~

Modify Sections 10.6.1, 10.7.1, 10.7.1.1, and delete Section 10.7.2 as follows.

10.6.1 ~~High Temperature~~ Steady-State Test.

10.7.1 ~~Low Temperature~~ Steady-State Test.

10.7.1.1 This test ~~only~~ applies to ~~air-source~~ all equipment, with conditions as set forth in Tables 10.5a through 10.7c as applicable.

Delete Section 10.7.2.

~~**10.7.2 Mid Temperature Cyclic Test**~~

~~**10.7.2.1** This test only applies to air-source equipment.~~

~~**10.7.2.2** Source side conditions (heating mode) are held constant and the system operates cyclically by a demand for space cooling.~~

~~**10.7.2.3** A water draw is imposed until the appliance initiates water heating, either from a resistive element or refrigerant-to-water heat exchange. A draw of not less than 42 Liters (or 41 kg) (11 gallons or 90 pounds) shall be imposed. Water shall be removed at a rate of 11.4 ± 1.0L/s (3.0 ± 0.25 gpm) while the make-up water temperature is maintained within 14.4°C ± 1.1°C (58°F ± 2°F). Once water heating is initiated, or 42 Liters (or 41 kg) (11 gallons or 90 pounds) has been drawn, the water draw is terminated, and the water heater is allowed to fully recover.~~

~~**10.7.2.4** Beginning 10 minutes after the water heater is fully recovered, a series of water draws, at a rate of 11.4 ± 1.0L/s (3.0 ± 0.25 gpm) while the make-up water temperature is maintained within 14.4°C ± 1.1°C (58°F ± 2°F), are imposed as outlined in Table 10.9.~~

~~**10.7.2.4.1** The system cyclic schedule is for energizing of the compressor and indoor fan (and/or pump) control terminal. Actual system operation will be controlled by the system internal controls. Depending on internal controls, the compressor and one of the system fans (and/or pumps) may start or continue to run irrespective of the compressor terminal being energized. There shall be no airflow through the coil with the idle fan. When the indoor fan is off, the duct shall be blocked.~~

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the standards and guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive technical committee structure, continue to generate up-to-date standards and guidelines where appropriate and adopt, recommend, and promote those new and revised standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating standards and guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

ASHRAE · 1791 Tullie Circle NE · Atlanta, GA 30329 · www.ashrae.org