STANDARD

~~ANSI~~BSR/ASHRAE Standard 203-2018 (RA202X)

(Supersedes ANSI/ASHRAE Standard 203-201~~4~~8)

Method of Test for Determining Heat Gain of Office Equipment Used in Buildings

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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

Plug loads are important contributors to a building's total air-conditioning or cooling load and energy consumption. Plug loads over time have evolved to become a larger percentage of a building's overall heat gain. Two factors are responsible for this increased significance. First, over time, computer use has continued to increase, resulting in a much larger number of personal computers in use in buildings; second, advances in building techniques have improved envelopes and reduced that portion of the load/energy use.

Engineers optimize HVAC equipment selections by carefully performing cooling load calculations. Internal heat gains from plug loads (e.g., computers, monitors, printers, projectors, etc.) are a significant portion of the cooling load calculations. Most plug loads operate at a fraction of their nameplate electrical load and, as a result, produce significantly less heat load than engineers may use in their cooling load calculations based on nameplate values.

Manufacturers of plug-load-type equipment report electrical requirements for their equipment, and some include power consumption (heat rejection) information. Some equipment manufacturers include nameplate values showing the total power rating, while others do not. Some manufacturers measure maximum electric power consumption by the equipment and list that as power ratings on the nameplate or in the equipment literature, while some others list the maximum power capacity of the system. Since the manufacturers' power ratings are usually based on instantaneous measurement while equipment is working at maximum capacity, use of equipment nameplate values for cooling load calculation may lead to over sizing of air-conditioning equipment, resulting in extra initial cost for air-conditioning equipment as well as higher operating cost. On the other hand, underestimating of cooling load calculation may result in insufficient cooling capacity.

Since there are no standards for establishing how the power consumption or heat rejection data for various plug loads is determined, it is difficult for engineers to accurately use this data in their cooling load calculations. In the past, ASHRAE has funded research projects (RP-822, RP-1055, RP-1482) to develop a test method and measure plug load type equipment heat rejection. Since plug load type equipment is an ever evolving market, equipment design changes frequently require new testing for power consumption and generation of heat rejection data for cooling load calculation use.

Standard 203 defines a method of test for determining heat gain from plug-load-type electrical office equipment in buildings. The data is to be used to evaluate the range and average operating heat gains for cooling load calculations.

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 interests of obtaining uniform standards throughout the industry.

This 2021~~8~~ ~~revision~~ reaffirmation of the standard ~~converts normative Section 8~~, converts Normative Annex B, "Product Test Report Form," to Normative Annex A and ~~"Normative References," to~~ Informative Annex A~~A~~, "Bibliography" ~~and~~ to Informative Annex B~~converts Normative Annex A, "Product Test Report Form," to Normative Annex B~~.

1. PURPOSE

This standard prescribes methods of test to determine the range and average operating heat gains of electrical equipment for use in cooling load calculations.

2. SCOPE

This standard applies to plug-load-type electrical equipment.

3. DEFINITIONS

HVAC: heating, ventilating, and air-conditioning.

plug load: the heat load (heat rejected) or energy consumed by any electrical device plugged into an electrical wall outlet (socket) or a device wired to electrical power.

power: defined as $P = v \times i$, where i and v are the instantaneous values of the voltage and current. For constant DC circuit, power is simply the product of the voltage and the current. The power in an AC circuit is the product of the voltage, current, and power factor, $P = v \times i \times \varphi$, where φ is the power factor. Power is a measure of the rate at which work is being done. Watt (or power) transducers provide a means of measuring either AC or DC power and provide a signal proportional to the rate at which work is being done. The unit of electric power is the watt.[1]

Informative Note: See Informative Annex B for further information.

total power consumption: under steady state conditions, with no phase change or chemical reactions involved in the equipment, the most accurate method to determine total steady-state heat output is by measuring electric power input to the equipment. Fundamental principles of energy conservation ensure that the total output is equal to the total power input under these conditions.

4. NOMENCLATURE

v	=	voltage, V
i	=	current, amp
P	=	DC power, W (Btu/h); $P = v \times i$ (1 W = 3.41 Btu/h)
P	=	AC power, W (Btu/h); $P = v \times i \times \varphi$ (1 W = 3.41 Btu/h)
φ	=	power factor, dimensionless

5. TEST APPARATUS SPECIFICATIONS

A watt-hour transducer shall be used to measure the total power consumed by the equipment being tested. Most watt transducers measure the instantaneous power averaged over some time interval to obtain average power. The watt-hour

transducers provide a watt-hour output directly proportional to the time integral of power.[1]

Informative Note: See Informative Annex B for further information.

6. TEST PROCEDURES

6.1 A watt-hour transducer of load capacity exceeding the maximum plug load equipment load shall be plugged into an electric power outlet.

6.2 Space ambient test conditions shall be 70°F (21°C) ±10°F (5.6°C).

6.3 The plug load equipment shall be plugged into a watt-hour transducer.

6.4 The plug load equipment item shall be turned on. Allow sufficient warm up time if the watt-hour transducer and the electrical components of the plug load equipment require it.

6.5 Turn on the plug load item and operate continuously at the mode to be tested, and measure average power consumption for a minimum of five minutes. It is imperative to exclude the initial spike in power consumption during the equipment power up or start up since a short initial spike in power consumption of 30 to 60 seconds duration does not contribute to the building heat load significantly.~~[2,3,4]~~ Perform a minimum of three test repetitions for each piece of office equipment tested.

Informative Note: See Informative Annex B for further information.

6.6 Minimum Test Equipment Accuracy

- Watt-hour transducer shall be capable of measuring power consumption with greater than or equal to 97% accuracy at the measured power level.
- Temperature sensor shall be capable of measuring temperature with an accuracy of better than ±°F (1°C) and precision better than 1°F (0.5°C).

7. REPORTING

7.1 Report the test and test results using the form in Normative Annex A.

7.2 The test report shall contain the information in the following subsections.

7.2.1 Date and time of test.

7.2.2 Location of test.

7.2.3 Ambient temperature during testing.

7.2.4 Name of test personnel.

7.2.5 A description of the equipment under test, including manufacturer, make, model number, serial number, and the type of device (e.g., laser printer, laptop computer).

7.3 Test Equipment Information and Calibration

7.4 Test location ambient conditions.

7.4.1 All recorded data at each operating mode.

7.4.2 Nameplate equipment electrical data.

7.4.3 Test method, operating mode description, and results.

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~~INFORMATIVE ANNEX A BIBLIOGRAPHY~~

~~1. Miller, D.W. 1998. *Operation and Calibration Manual—W Series Watt and Watt Hour Transducers*. Freeport, NY: Ohio Semitronics, Inc.~~

~~2. Hosni, M.H., B.W. Jones, J.M. Sipes, and H. Xu. 1996. Test method for measuring the heat gain and radiant/convective split from equipment in buildings. ASHRAE RP-822 Final Report. Atlanta: ASHRAE.~~

~~3. Hosni, M.H., B.W. Jones, and Y. Xu. 1999. Measurement of heat gain and radiant/convective split from equipment in buildings. ASHRAE RP-1055 Final Report. Atlanta: ASHRAE.~~

~~4. Hosni, M. H. and B. T. Beck. 2010. Update to measurements of office equipment heat gain data. ASHRAE RP-1482 Final Report. Atlanta: ASHRAE.~~

(This is a normative annex and is part of this standard.)

NORMATIVE ANNEX AB
PRODUCT TEST REPORT FORM

Instructions to Manufacturer: This form may be adapted to the manufacturer's letterhead and format. Use the exact title block, section headings, and numbering system. Provide requested information under each section heading in a format of your choice.

I. MANUFACTURER'S INFORMATION

Manufacturer: [Name/Address]

Product Tested:

Principal Contact: [Contact Information]

Location of Test:

Date and Time of Test:

II. PRODUCT INFORMATION

Description: [Type of Device (e.g., laser printer, laptop, computer).]

Electric Nameplate Date:

Model Number:

Serial Number:

III. PRODUCT USE NARRATIVE

Describe anticipated on time, cycle time, sleep mode, etc., for insight into end product-use heat rejection.

Example: Printer—Warm-up time, steady state printing energy use, stand-by energy use.

Example: Computer with Screen—Sleep mode energy use, operating energy use with screen on and screen off.

IV. TEST EQUIPMENT

Description, model number, calibration method, and date last calibrated.

V. TEST

Ambient Conditions: Temperature dry bulb, wet bulb, and relative, measured electric service voltage during testing.

Duration of Test Reading:

Number of Tests:

Description of Data Collected: Average readings, number of test runs.

VI. RESULTS

Average steady state power—Watts:

Other Qualified Watt Data (e.g., presented as high-low readings, average readings, etc.)

VII. NARRATIVE

Discuss test results to provide data user with information so that engineering judgment may be applied to the data for the purpose of determining the equipment contribution to building cooling load.

End Report

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INFORMATIVE ANNEX B BIBLIOGRAPHY

1. Miller, D.W. 1998. *Operation and Calibration Manual—W Series Watt and Watt-Hour Transducers*. Freeport, NY: Ohio Semitronics, Inc.
2. Hosni, M.H., B.W. Jones, J.M. Sipes, and H. Xu. 1996. Test method for measuring the heat gain and radiant/convective split from equipment in buildings. ASHRAE RP-822 Final Report. Atlanta: ASHRAE.
3. Hosni, M.H., B.W. Jones, and Y. Xu. 1999. Measurement of heat gain and radiant/convective split from equipment in buildings. ASHRAE RP-1055 Final Report. Atlanta: ASHRAE.
4. Hosni, M. H. and B. T. Beck. 2010. Update to measurements of office equipment heat gain data. ASHRAE RP-1482 Final Report. Atlanta: ASHRAE.

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.

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About ASHRAE

ASHRAE, founded in 1894, is a global society advancing human well-being through sustainable technology for the built environment. The Society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration, and sustainability. Through research, Standards writing, publishing, certification and continuing education, ASHRAE shapes tomorrow's built environment today.

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