



ASHRAE STANDARD

Methods of Testing for Rating the Performance of Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant

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 January 28, 2010.

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ISSN 1041-2336



**American Society of Heating, Refrigerating
and Air-Conditioning Engineers, Inc.**
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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>.

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FOREWORD

Despite the change in its title and designation, this “new” standard is actually a revision of ASHRAE Standard 23-2005, *Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units*. Standard 23 has been revised, renumbered, and given a new scope because ASHRAE is in the process of developing a companion standard, Standard 23.2, that will address the testing of positive displacement compressors and condensers using refrigerants like CO₂ that operate at supercritical temperatures. Accordingly, the title and scope of Standard 23 has been revised in this standard to clarify the fact that it is restricted to the testing of such equipment using refrigerants that operate at subcritical temperatures. Standard 23.1 also clarifies some of the procedures of Standard 23-2005 and updates its references.

Standard 23.1 retains all of the improvements that were made when the 2005 edition of Standard 23 was published. In addition to the azeotropic refrigerants that were the focus of the 1993 edition, it covers zeotropic alternative refrigerants as well. It provides the choice of six different test methods for determining refrigerant mass flow rates, and it allows the same test to be used for the primary and confirming tests—provided that the primary and confirming tests are simultaneous and completely independent. It includes test methods that properly account for the effects of liquid refrigerant injection within the scope of the standard, and it includes computations of compressor efficiencies that harmonize the standard with relevant standards promulgated by ARI, ISO, and other entities.

It is intended that, after Standards 23.1 and 23.2 have been published, ASHRAE Standard 23-2005 will be withdrawn.

1. PURPOSE

The purpose of this standard is to provide methods of testing for rating the thermodynamic performance of positive displacement refrigerant compressors and condensing units that operate at subcritical temperatures of the refrigerant.

2. SCOPE

2.1 This standard applies to the methods of testing for rating the thermodynamic performance of single-stage positive-displacement refrigerant compressors and condensing units that operate at subcritical temperatures of the refrigerant which either (a) do not have liquid injection or (b) incorporate liquid injection that is achieved by compressor motor power.

2.2 This standard applies to all of the refrigerants listed in ASHRAE Standard 34,¹ *Designation and Safety Classification of Refrigerants*, that fall within the scope defined in Section 2.1.

3. DEFINITIONS

The following definitions apply to the terms used in this standard. Additional definitions that might be helpful are given in *ASHRAE Terminology of Heating, Ventilation, Air Conditioning, & Refrigeration*.²

azeotropic refrigerant: a blend that contains two or more refrigerants whose equilibrium vapor-phase and liquid-phase compositions are the same at a given pressure. The temperature of an azeotropic refrigerant remains constant as it evaporates or condenses at constant pressure (compare to *zeotropic refrigerant*).

bubble-point temperature: a liquid-vapor equilibrium point for a volatile pure liquid or for a multi-component mixture of miscible, volatile pure component liquids, in the absence of noncondensables, where the temperature of the mixture at a defined pressure is the minimum temperature required for a vapor bubble to form in the liquid.

calorimeter: a thermally insulated apparatus containing a heat exchanger in which the mass flow rate of a volatile refrigerant is determined by measuring the heat input/output that will result in a corresponding enthalpy change for the volatile refrigerant.

capacity: the rate of heat removal by the refrigerant used in the compressor or condensing unit in a refrigerating system. This rate equals the product of the refrigerant mass flow rate and the difference in the specific enthalpies of the refrigerant vapor at its thermodynamic state entering the compressor or condensing unit and refrigerant liquid at the thermodynamic state entering the mass flow control device.

compressor or condensing unit efficiency (isentropic efficiency): the ratio of the work absorbed for compressing a unit mass of refrigerant in a compressor or condensing unit to the work absorbed for compressing the same unit mass of refrigerant in an isentropic compressor or condensing unit.

condensing unit: a machine designed to condense refrigerant vapor to a liquid by compressing the vapor in a positive displacement compressor and rejecting heat to a cooling medium. A condensing unit usually consists of one or more positive displacement compressors and motors, condensing coils, liquid receivers, and other devices mounted on a common base.

condenser liquid flow rate: the mass flow rate of liquid through the condensing unit under the conditions specified.

confirming test: a completely independent and simultaneous test conducted to verify the accuracy of the primary test (compare to *primary test*). Compressor or condensing unit ratings are determined from the primary test results.