STANDARD

ANSI/ASHRAE Standard 23.1-2019
(Supersedes ANSI/ASHRAE Standard 23.1-2010)

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

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NOTE

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FOREWORD

This 2019 revision of ASHRAE Standard 23.1 meets ASHRAE's mandatory language requirements. The scope of this standard has been expanded to cover (a) multistage compressors in addition to single-stage compressors and (b) intermediate cooling or refrigerant injection in addition to liquid injection. Descriptions, equations, and figures have been revised to clarify steps required to apply this standard.

1. PURPOSE

This standard prescribes methods for performance testing positive displacement refrigerant compressors and condensing units that operate at subcritical pressures of the refrigerant.

2. SCOPE

2.1 This standard applies to methods for performance testing single-stage and multistage positive displacement refrigerant compressors and condensing units that operate at discharge pressures less than the critical pressure of the refrigerant.

2.2 This standard applies to compressors and condensing units that either (a) do not have intermediate cooling or refrigerant injection or (b) do have intermediate cooling or refrigerant injection, and the power required for intermediate cooling or refrigerant injection, if any, is included in the measured total input power to the compressor or condensing unit.

3. DEFINITIONS

The following definitions apply to the terms used in this standard.

accuracy: the degree of conformity of an indicated value to the corresponding true value.

bubble-point temperature: a liquid-vapor equilibrium point for a pure liquid or for a multicomponent mixture of miscible, 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 that is used to determine the mass flow rate of a refrigerant by measuring the heat input/output that will result in a corresponding enthalpy change for the 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 expansion device.

compressor: see *positive displacement refrigerant compressor*.

compressor or condensing unit efficiency (isentropic efficiency): the ratio of the work absorbed for compressing a unit mass of refrigerant entering the stage of the compressor or condensing unit to the work absorbed for compressing the same unit mass of refrigerant by isentropic compression within the stage.

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

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 consists of a condensing heat exchanger and one or more positive displacement compressors and motors with ancillaries.

confirming test: an independent and simultaneous test performed to validate the primary test results (compare to *primary test*). Compressor or condensing unit ratings are determined from the primary test results.

cooling liquid flow rate: the total mass flow rate of liquid required for all cooling purposes in a compressor or condensing unit.

dew-point temperature: a vapor-liquid equilibrium point for a pure liquid or for a multicomponent mixture of miscible, pure components, in the absence of noncondensables, where the temperature of the mixture at a defined pressure is the maximum temperature required for a liquid drop to form in the vapor.

economizer: a heat exchanger or flash tank that is used to subcool liquid refrigerant exiting the condenser for vapor injection.

energy efficiency ratio (EER): a dimensional ratio of the cooling capacity (Btu/h) to the power input (W).

error: the difference between the test result and its corresponding true value.

flowmeter: a device employing a detecting element that determines the mass flow rate of a refrigerant in the gaseous or liquid phase within a closed conduit by measuring the corresponding response of the detecting element.

hermetic compressor: a compressor assembly containing a motor within a gas-tight housing that is permanently sealed by welding or brazing with no access for servicing internal parts in the field.

intermediate cooling: a method of using a heat exchanger to (a) cool the compressor mechanism or lubricant or (b) cool the refrigerant to reduce discharge temperature. The heat-exchanger component of the intermediate cooling means is integral to the compressor. The intermediate cooling thermal load is not taken into account in the calculations of isentropic efficiency, compressor or condensing unit capacity, or volumetric efficiency.

liquid injection: a method of (a) internally cooling the compressor mechanism or lubricant or (b) reducing discharge