AHRI Standard 1110-2024 (SI/I-P)

Performance Rating of Vapor Compression Transport Refrigeration Units

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IMPORTANT

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ICS Code: 27.200

Note:

This standard supersedes ANSI/AHRI Standard 1110 (I-P)-2013 and ANSI/AHRI Standard 1111-2013 (SI)

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Intent

This standard is intended for the guidance of the industry, including manufacturers, engineers, installers, contractors, and users.

Review and Amendment

This standard is subject to review and amendment as technology advances.

2024 Edition

AHRI Standard 1110-2024 (SI/I-P), *Performance Rating of Vapor Compression Transport Refrigeration Units*, was prepared by Transportation Refrigeration Standards Technical Committee. The standard was approved by the Refrigeration Standards Subcommittee on 5 March 2024.

Origin and Development of AHRI Standard 1110

The initial publication was ARI 1110 – 1977, *Mechanical Transport Refrigeration Units*. Subsequent revisions include:

ARI 1110-1992, *Mechanical Transport Refrigeration Units*

ARI 1110-2001, *Mechanical Transport Refrigeration Units*

ARI 110-2001 with Addendum 1, *Mechanical Transport Refrigeration Units*

ARI 1110-2006, *Performance Rating of Mechanical Transport Refrigeration Units*

ANSI/AHRI Standard 1110-2013 (I-P), *Performance Rating of Mechanical Transport Refrigeration Units*

ANSI/AHRI Standard 1111-2013 (SI), *Performance Rating of Mechanical Transport Refrigeration Units*

Summary of Changes

AHRI Standard 1110-2024 (SI/I-P) contains the following updates to the previous edition:

- Title change
- Removal of ambient nominal and box nominal conditions
- Removal of split systems
- Removal of operating requirements section
- Changed to optional bulkhead testing equipment
- Consolidated AHRI Standard 1110 (I-P) and AHRI Standard 1111 (SI) into AHRI Standard 1110 (SI/I-P)

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Committee Personnel

Transportation Refrigeration Standards Technical Committee

Company/Organization	Participant	Voting Role
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	Chris Vath	Primary
	David Dykes	Alternate
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Honeywell Performance Materials & Technologies	Kaimi Gao	Nonvoter
	Patrick Birbarah	Nonvoter
Antonio Romeo		AHRI Staff Liaison

Transportation Refrigeration Technical Committee Scope:

The Transportation Refrigeration Standards Technical Committee (STC) is responsible for the development and maintenance of AHRI standards and guidelines pertaining to the performance ratings of Mechanical Transport Refrigeration units.

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Refrigeration Standards Subcommittee

Company/Organization	Participant	Voting Role
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Everidge	Steve Combs	Primary
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Karl Best		AHRI Staff Liaison

Refrigeration Standards Subcommittee Scope:

The scope of the Refrigeration Standards Subcommittee is standards and guidelines related to the end products that are part of the AHRI Refrigeration Industry Sector. The definition of and list of products associated with each sector are found on the AHRI website.

These lists represent the membership at the time the Standards Technical Committee and Standards Subcommittee were balloted on the final text of this edition. Since that time, changes in the membership may have occurred. Membership on these committees shall not in and of itself constitute an endorsement by the committee members or their employers of any document developed by the committee on which the member serves.

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PERFORMANCE RATING OF VAPOR COMPRESSION TRANSPORT REFRIGERATION UNITS

Section 1. Purpose

This standard establishes definitions, test requirements, rating requirements, minimum data requirements for *published ratings*, operating requirements, marking and nameplate data, and conformance conditions for *vapor compression transport refrigeration units*.

Section 2. Scope

This standard applies to encased direct expansion vapor compression type *vapor compression transport refrigeration units* with the following components:

1) Compressor
2) Air-cooled condenser
3) Refrigerant flow control(s)
4) *Forced-circulation air-cooler*
5) Base or frame
6) *Prime mover* as described in the unit manufacturer's literature
7) *Power train* (including coupling, power take-off, transmission, and V-belt drive) connecting the unit to the *prime mover*

Section 3. Definitions

All terms in this document shall follow the standard industry definitions in the *ASHRAE Terminology* website unless otherwise defined in this section. These standard-specific defined terms are italicized throughout the standard.

3.1 Expressions of Provision

Terms that provide clear distinctions between requirements, recommendations, permissions, options, and capabilities.

3.1.1 "Can" or "cannot"

Express an option or capability.

3.1.2 "May"

Signifies a permission expressed by the document.

3.1.3 "Must"

Indication of unavoidable situations and does not mean that an external constraint referred to is a requirement of the document.

3.1.4 "Shall" or "shall not"

Indication of mandatory requirements to strictly conform to the standard and where deviation is not permitted.

3.1.5 "Should" or "should not"

Indication of recommendations rather than requirements. In the negative form, a recommendation is the expression of potential choices or courses of action that is not preferred but not prohibited.

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3.2 Standard-specific Definitions

3.2.1 Ambient Air

Defined based off of the method of test:

1) The air in the test enclosure surrounding the *calibrated-box*, per the *calibrated-box* method of testing.
2) The air surrounding the engine-condenser side of a *vapor compression transport refrigeration unit*, per the *isothermal-box* method of testing.

3.2.2 Calorimeter

A test facility consisting of one or two rooms that can have an annular space(s); each equipped with instrumented reconditioning equipment. The output of this equipment is measured and controlled to counterbalance the *net refrigerating capacity* of the *vapor compression transport refrigeration unit* under test.

3.2.2.1 Calibrated-box

A well-insulated enclosure with a known heat transfer rate determined through calibration, that is used for measuring the heat loss or gain between the enclosure's interior temperature and ambient temperature. The surrounding area of the entire exterior is maintained at the rated *ambient air* temperature.

3.2.2.2 Isothermal-box

A well-insulated enclosure with a known heat transfer rate determined through calibration, that is used for measuring the heat loss or gain between the enclosure's interior temperature and ambient temperature. The surrounding area is divided into a *surround area* and an ambient space. The *surround area* is maintained at the rated return air temperature to the *forced-circulation air-cooler*, while the ambient space is maintained at the rated *ambient air* temperature.

3.2.3 Forced-circulation Air-cooler

A factory-made assembly including means for forcing air circulation and components where heat is transferred from air to refrigerant for the purpose of transferring heat from a refrigerated space, through the medium of air, to the refrigerant.

3.2.4 Net Refrigerating Capacity

The rate of heat transferred from the air in the refrigerated space to the refrigerant circulated through the *forced-circulation air-cooler*, less heat added by the fan and drive, and other sources, in operation under specified conditions. The net refrigerating effect provided for useful cooling.

3.2.5 Observation

A specific instance in time when measurements are recorded.

3.2.6 Power Train

A mechanical device whereby power received from a primary source of power at a given rotating speed is transferred to a driven device at the same or a different rotating speed.

3.2.7 Prime Mover

An engine, motor or same device that drives a refrigeration system.

3.2.8 Published Rating

A statement of the assigned values of those performance characteristics, under stated *rating conditions*, where a unit can be chosen to fit the application. These values apply to all units of the same nominal size and type (identification) produced by the same manufacturer. This includes the rating of all performance characteristics shown on the unit or published in specifications, advertising or other literature controlled by the manufacturer, at stated *rating conditions*.

3.2.8.1 Application Rating

A rating based on tests performed at *rating conditions* other than *standard rating conditions*.

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3.2.8.2 Standard Rating

A rating based on tests performed at *standard rating conditions*.

3.2.8.3 Standby Rating

A *published rating* based on using a standby power source and tests performed under *standard rating conditions* or application *rating conditions*.

3.2.9 Rating Conditions

Any set of operating conditions where a single level of performance results and causes only that level of performance to occur.

3.2.9.1 Standard Rating Conditions

Rating conditions used as the basis of comparison for performance characteristics.

3.2.10 Standby Drive

A device included in a *vapor compression transport refrigeration unit* that receives power from a source external to the vehicle served. The unit can operate to refrigerate the vehicle while stationary.

3.2.11 Surround Area

The enclosure about the *isothermal-box*.

3.2.12 Vapor Compression Transport Refrigeration Unit

A combination of one or more of the following factory-made assemblies:

1) A compressor, drive, and condenser combination
2) A *forced-circulation air-cooler*
3) All necessary refrigerant lines and electrical wiring
4) Means whereby the unit can be mounted and installed on a vehicle the unit is intended to serve

Where such equipment is used in more than one assembly, the individual assemblies are designed to be used together, and the requirements of rating outlined in this standard are based on the use of matched assemblies.

Section 4. Test Requirements

4.1 Test Requirements

Vapor compression transport refrigeration units shall be tested for the rated *net refrigerating capacity* in accordance with one of the two methods set forth in Appendix C and Appendix D.

4.2 All-electric Unit

When the unit being tested includes an engine-generator set in conjunction with an electric drive, the space where the engine-generator set is located shall be maintained at the same ambient condition as the condensing section of the *vapor compression transport refrigeration unit*.

Section 5. Rating Requirements

5.1 Standard Ratings

Standard ratings shall be published for the *standard rating conditions* specified in Table 1. All *standard ratings* shall be verified by tests conducted in accordance with one of the two test methods described in Appendix C and Appendix D.

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