

AHRI Standard 751 (SI)

**2016 Standard for
Performance Rating of
Thermostatic Refrigerant
Expansion Valves**



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IMPORTANT

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AHRI uses its best efforts to develop standards/guidelines employing state-of-the-art and accepted industry practices. AHRI does not certify or guarantee that any test conducted under its standards/guidelines will be non-hazardous or free from risk.

Note:

This standard supersedes AHRI Standard 750-2007.

For I-P ratings, see AHRI Standard 750 (I-P)-2016.

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PERFORMANCE RATING OF THERMOSTATIC REFRIGERANT EXPANSION VALVES

Section 1. Purpose

1.1 *Purpose.* The purpose of this standard is to establish for Thermostatic Refrigerant Expansion Valves: definitions; test requirements; rating requirements; minimum data requirements for Published Ratings; marking and nameplate data; conformance conditions.

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

1.1.2 *Review and Amendment.* This standard is subject to review and amendment as technology advances.

Section 2. Scope

2.1 *Scope.* This standard applies to Thermostatic Refrigerant Expansion Valves for use with refrigerants listed in Section 2.1.1 at evaporator temperatures between 10°C and -40°C.

2.1.1 *Refrigerants.* The type of refrigerants applicable to this standard are: hydrofluoroolefins (HFOs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), and hydrocarbons (HCs).

Section 3. Definitions

All terms in this document shall follow the standard industry definitions in the ASHRAE Terminology website (<https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology>), unless otherwise defined in this section.

3.1 *Capacity of Thermostatic Refrigerant Expansion Valves.* The refrigerating effect produced by the evaporation of refrigerant which will pass through the valve under the following specified conditions:

3.1.1 Liquid refrigerant temperature at the valve inlet, °C

3.1.2 Saturated evaporator temperature °C

3.1.3 Pressure difference across the valve, kPa

3.1.4 Static superheat set point, °C

3.1.5 Superheat change from the set point, °C

3.2 *Maximum Operating Pressure (MOP).* The value at which the valve limits evaporator pressure in kPa. Table C1 defines the recommended nominal values for MOP.

3.5 *Published Rating.* A statement of the assigned values of those performance characteristics, under stated Rating Conditions, by which a unit may be chosen to fit its application. These values apply to all units of like nominal size and type (identification) produced by the same manufacturer. The term Published Rating 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.

3.5.1 *Application Rating.* A rating based on tests performed at application Rating Conditions (other than Standard Rating Conditions).

3.5.2 *Standard Rating.* A rating based on tests performed at Standard Rating Conditions.

3.6 *Rating Conditions.* Any set of operating conditions under which a single level of performance results and which causes only that level of performance to occur.

3.6.1 *Standard Rating Conditions.* Rating conditions used as the basis of comparison for performance characteristics.

3.7 *"Shall" or "Should".* "Shall" or "should" shall be interpreted as follows:

3.7.1 *Shall.* Where "shall" or "shall not" is used for a provision specified, that provision is mandatory if compliance with the standard is claimed.

3.7.2 *Should.* "Should" is used to indicate provisions which are not mandatory but which are desirable as good practice.

3.8 *Thermostatic Refrigerant Expansion Valve.* A controlling device which regulates the flow of volatile refrigerant into an evaporator of a refrigeration system and which is actuated by changes in evaporator pressure and superheat of the refrigerant gas leaving the evaporator.

3.9 *Thermostatic Refrigerant Expansion Valve Pressure Drop.* The pressure drop across the valve, which is the net pressure difference between the valve inlet and outlet.

3.10 *Thermostatic Refrigerant Expansion Valve Superheat.* The difference between the temperature of the thermal bulb and the dew point temperature corresponding to the refrigerant pressure at the valve outlet, or at the equalizer connection, when provided.

3.10.1 *Static Superheat.* The superheat at which the manufacturer calibrates or "sets" the thermostatic expansion valve.

3.11 *Vapor-free (Subcooled) Liquid Refrigerant.* Refrigerant which has been cooled below the bubble point temperature for a given pressure.

Section 4. Test Requirements

4.1 *Testing for Capacity.* Thermostatic refrigerant expansion valve ratings shall be based on tests conducted in accordance with the test procedure identified in ANSI/ASHRAE Standard 17.

4.1.1 Alternative flow test methods may be used provided the results obtained can be confirmed by the test method specified in Section 4.1 within the tolerance specified in Section 5.5 of this Standard.

Section 5. Rating Requirements

5.1 *Published Capacity Ratings.* Published capacity ratings shall consist of Standard Ratings and may include Application Ratings. Such ratings shall be based on tests of valves made for use with the refrigerant specified in the ratings. All Published Ratings shall be based on Vapor-free (Subcooled) Liquid Refrigerant entering the Thermostatic Refrigerant Expansion Valve. The tests shall be made in accordance with the test procedure outlined in Section 4 of this standard.

5.1.1 *Standard Ratings.* Standard Ratings of capacity shall be published for all Standard Rating Conditions, shown in Table 1, falling within the intended range of application of the valve.

5.1.2 *Nominal Rating.* The nominal rating is the equivalent capacity rating of the valve at the 4°C evaporator Standard Rating Condition (See Standard Rating Condition A in Table 1).

5.1.3 *Application Ratings.* Application Ratings provide capacities under operating conditions which differ from those in Table 1. Wherever Application Ratings are published or printed, they shall include a statement of conditions at which the ratings apply.

5.2 *Interpolation and Extrapolation of Air Test Data.* Published capacity ratings shall be based on air-fixture tests made at two or more evaporator dew point temperatures. Air-fixture test data may be extrapolated or interpolated no more than 8°C

from test points and only when the same thermostatic charge is used. In the case of R-134a, data may be extrapolated a maximum of 14°C below the lowest test point in order to obtain a rating at -40°C evaporator dew point temperature.

5.3 Superheat Change. Every published capacity rating shall be based on the capacity resulting from a superheat change above the Static Superheat. This superheat change shall not exceed 4°C for any Published Rating unless clearly designated.

5.4 Static Superheat. For purposes of rating, the Static Superheat shall be no less than 1°C.

5.5 Maximum Operating Pressure (MOP). The valve cannot be rated above its MOP.

5.6 Tolerance. To comply with this standard, published capacity ratings shall be based on data obtained in accordance with the provisions of this section, and shall be such that any production Thermostatic Refrigerant Expansion Valve selected at random and tested shall produce not less than 95% of its published rated capacity.

Table 1. Standard Rating Conditions^{1,2,3}			
Standard Rating Condition	Liquid Temperature (at expansion valve inlet), °C	Saturated Condensing Temperature (at expansion valve inlet), °C	Saturated Evaporating Temperature (at expansion valve outlet), °C
A ⁴	38	43	4
B	38	43	-7
C	38	43	-23
D	38	43	-40
Notes:			
1. For recommended MOP for pressure-limiting type thermostatic refrigerant expansion, refer to Appendix C of this Standard.			
2. For recommended standard connection sizes, refer to Appendix D of this Standard.			
3. For superheat conditions, refer to Section 5.3 and Section 5.4.			
4. This is the nominal rating condition.			

Section 6. Minimum Data Requirements for Published Ratings

6.1 Minimum Data Requirements for Published Ratings. As a minimum, Published Ratings shall include all Standard Ratings. All claims to ratings within the scope of this standard shall include the statement “Rated in accordance with AHRI Standard 751 (SI)”. All claims to ratings outside the scope of this standard shall include the statement “Outside the scope of AHRI Standard 751 (SI)”. Wherever Application Ratings are published or printed, they shall include a statement of the conditions at which the ratings apply.

6.2 Published Capacity Ratings. Capacity ratings for net refrigerant capacity, W or kW of refrigeration, shall be published along with at least the following pertinent operating conditions:

6.2.1 Refrigerant designation(s) per ANSI/ASHRAE Standard 34

6.2.2 Evaporator dew point temperature, °C

6.2.3 Pressure drop across the valve, kPa

6.2.4 Maximum superheat change from set point at which ratings apply, °C

6.2.5 Capacity correction factors for liquid temperatures at the valve inlet which differ from the standard value of 37.0°C. These correction factors will be calculated based on values from NIST REFPROP (Database 23) refrigerant properties.

Note: These include corrections for liquid density and refrigerating effect and are based on an average evaporator temperature of -18.0°C.

Section 7. Marking and Nameplate Data

7.1 *Nameplate Data.* Each Thermostatic Refrigerant Expansion Valve shall display the manufacturer's name or trade name, model number, and refrigerant designation(s).

7.1.1 *Refrigerant Designation.* If colors are used to augment refrigerant designation, the colors defined in AHRI Guideline N shall be used.

Section 8. Conformance Conditions

8.1 *Conformance.* While conformance with this standard is voluntary, conformance shall not be claimed or implied for products or equipment within the standard's *Purpose* (Section 1) and *Scope* (Section 2) unless such product claims meet all of the requirements of the standard and all of the testing and rating requirements are measured and reported in complete compliance with the standard. Any product that has not met all the requirements of the standard shall not reference, state, or acknowledge the standard in any written, oral, or electronic communication.

APPENDIX A. REFERENCES - NORMATIVE

A1 Listed here are all standards, handbooks and other publications essential to the formation and implementation of the standard. All references in this appendix are considered as part of the standard.

A1.1 AHRI Guideline N-2016, *Assignment of Refrigerant Container Colors*, 2016, Air-Conditioning, Heating and Refrigeration Institute, 2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, U.S.A.

A1.2 ANSI/ASHRAE Standard 17-2008, *Methods of Testing Capacity of Thermostatic Expansion Valves*, 2008, American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036, U.S.A./1791 Tullie Circle N.E., Atlanta, GA 30329, U.S.A.

A1.3 ANSI/ASHRAE Standard 34-2013, *Designation and Safety Classification of Refrigerants*, 2013, American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036, U.S.A./1791 Tullie Circle N.E., Atlanta, GA 30329, U.S.A.

A1.4 ASHRAE Terminology, <https://www.ashrae.org/resources--publications/free-resources/ashrae-terminology>, 2014, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329, U.S.A.

A1.5 REFPROP Reference Fluid Thermodynamic and Transport Properties NIST Standard Reference Database 23 Version 9.1, 2013, U.S. Department of Commerce, Technology Administration, National Institute of Standards and Technology, Standard Reference Data Program, Gaithersburg, Maryland 20899, U.S.A.

APPENDIX B. REFERENCES - INFORMATIVE

B1 Listed here are standards, handbooks and other publications which may provide useful information and background but are not considered essential. References in this appendix are not considered part of the standard.

None.

APPENDIX C. RECOMMENDED MOP FOR PRESSURE-LIMITING TYPE THERMOSTATIC REFRIGERANT EXPANSION VALVES - INFORMATIVE

Table C1. Recommended MOP for Pressure-Limiting Type Thermostatic Refrigerant Expansion Valves, kPa (gage)¹			
Refrigerant	Air-conditioning	Commercial Refrigeration Medium Temperature	Commercial Refrigeration Low Temperature
R-22	690	450	170
R-134a	380	240	70
R-290	690	450	170
R-404A	830	550	210
R-407A	690	450	170
R-407C	690	450	170
R-410A	1170	790	340
R-507A	830	550	210
R-600a	380	240	70

Note:

1. These are approximate system values. They are subject to a recommended tolerance of ± 35 kPa.

APPENDIX D. RECOMMENDED STANDARD CONNECTION SIZES - INFORMATIVE

Table D1. Recommended Standard Connection Sizes¹			
Capacity, kW		Nominal Connection Size, mm (ODF) ²	
R-134a, R-407A, R-404A, R-507A & R-600a	R-22, R-290, R- 407C, R-410A	Inlet	Outlet
1.8	3.5	6	12
7.0	11	10	12
11	18	12	16
26	35	16	22
35	56	22	28
70	70	22	28
110	110	28	35
180	180	28	35
250	250	28	35
280	280	28	35
350	350	28	35

Notes:

1. For capacities which fall between those listed, the larger connection size is the recommended standard.
2. ODF is Outside Diameter Female.