

Refrigerant compressors — Rating conditions, tolerances and presentation of manufacturer's performance data

The European Standard EN 12900:2005 has the status of a
British Standard

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee RHE/4, Testing of refrigerant compressors, which has the responsibility to:

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 10, an inside back cover and a back cover.

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English Version

Refrigerant compressors - Rating conditions, tolerances and presentation of manufacturer's performance data

Compresseurs pour fluides frigorigènes - Conditions de détermination des caractéristiques, tolérances et présentation des performances du fabricant

Kältemittel-Verdichter - Nennbedingungen, Toleranzen und Darstellung von Leistungsdaten des Herstellers

This European Standard was approved by CEN on 26 August 2005.

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Foreword

This European Standard (EN 12900:2005) has been prepared by Technical Committee CEN/TC 113 "Heat pumps and air conditioning units", the secretariat of which is held by AENOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2006, and conflicting national standards shall be withdrawn at the latest by April 2006.

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1 Scope

This European Standard specifies the rating conditions, tolerances and the method of presenting manufacturer's data for positive displacement refrigerant compressors. These include single stage compressors and single and two stage compressors using a means of liquid subcooling. This is required so that a comparison of different refrigerant compressors can be made. The data relate to the refrigerating capacity and power absorbed and include correction factors and part-load performance where applicable.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 378-1:2000, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 1: Basic requirements, definitions, classification and selection criteria*

EN 13771-1, *Compressors and condensing units for refrigeration – Performance testing and test methods – Part 1: Refrigerant compressors*

ISO 817, *Refrigerants — Designation system*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions of EN 378-1:2000 and the following apply.

3.1

positive displacement compressor

compressor in which compression is obtained by changing the internal volume of the compression chamber, see 3.4.6 of EN 378-1:2000

3.2

refrigerating capacity

product of the mass flow of refrigerant through the compressor and the difference between the specific enthalpy of the refrigerant at the compressor inlet and the specific enthalpy of saturated liquid

NOTE The refrigerant at the compressor inlet is superheated above the suction dew point temperature to the stated value (see Table 1). The saturated liquid is at a pressure corresponding to the compressor discharge pressure.

3.3

subcooling

difference between the bubble point temperature of the refrigerant corresponding to the compressor discharge pressure and the temperature of the liquid refrigerant below the bubble point

3.4

superheat

difference between the dew point temperature of the refrigerant corresponding to the compressor suction pressure and the suction vapour temperature of the refrigerant at the compressor inlet

3.5

power absorbed

- for externally driven compressors: the power at the compressor shaft;
- for motor compressors: the electrical power input at the motor terminals

3.6

coefficient of performance, COP,

ratio of refrigerating capacity to the power absorbed, expressed in Watt/Watt

4 Parameters for the presentation of performance data

The parameters as shown in Table 1a – Table 1 d shall be used for the presentation of the performance data.

Table 1 a — Parameters for the presentation of performance data with compressors used in standard applications

Refrigerant	Parameters		
	Suction vapour temperature (°C) or superheat (K) at the compressor inlet	Ambient temperature around the compressor	Compressor application
Halocarbons and hydrocarbons including refrigerant blends	32 °C	32 °C	Household and similar refrigerators/freezers
	20 °C or 10 K		Other applications
R-717	5 K		Any application using ammonia
Other refrigerants	As appropriate, to be clearly speci- fied in performance data		

The refrigerating capacity shall not allow for any subcooling.

Table 1 b — Parameters for the presentation of performance data with compressors using a specific means of factory assembled or factory specified liquid subcooler

Refrigerant	Suction vapour temperature (°C) or superheat (K) at the compressor inlet	Ambient temperature around the compressor	Compressor application
Halocarbons and hydrocarbons including refrigerant blends	20 °C or 10 K	32 °C	Any application with factory assembled or factory specified liquid subcooler
R-717 (NH3)	5 K		
Other refrigerants	As appropriate, to be clearly specified in performance data		
NOTE Liquid entering the subcooler is at saturated (bubble) temperature equivalent to the refrigerant pressure at the compressor outlet.			

The refrigerating capacity includes the subcooling provided by the subcooler.

Table 1 c — Parameters for the presentation of performance data with compressors using an individually selected liquid subcooler

Refrigerant	Suction vapour temperature (°C) or superheat (K) at the compressor inlet	Liquid subcooling (K) or temperature (°C)	Saturated intermediate (dew) temperature (°C) or pressure (bar)	Ambient temperature around the compressor	Compressor application
Halocarbons and hydrocarbons including refrigerant blends	20 °C or 10 K	5 K above saturated intermediate temperature	to be specified with reference to evaporating and condensing temperatures	32 °C	Any application with individually selected liquid subcooler
R-717 (NH3)	5 K				
Other refrigerants	As appropriate, to be clearly specified in performance data				

NOTE Liquid entering the subcooler is at saturated (bubble) temperature equivalent to the refrigerant pressure at the compressor outlet.

The refrigerating capacity includes the subcooling provided by the subcooler.

Table 1 d — Parameters for the presentation of performance data with compressors using an open flash liquid subcooler

Refrigerant	Suction vapour temperature (°C) or superheat (K) at the compressor inlet	Liquid subcooling (K) or temperature (°C)	Saturated intermediate temperature (°C) or pressure (bar)	Ambient temperature around the compressor	Compressor application
Halocarbons and hydrocarbons including refrigerant blends	20 °C or 10 K	equivalent to saturated intermediate temperature	to be specified with reference to evaporating and condensing temperatures	32 °C	Any application with open flash liquid subcooler
R-717 (NH3)	5 K				
Other refrigerants	As appropriate, to be clearly specified in performance data				

NOTE Liquid entering the subcooler is at saturated (bubble) temperature equivalent to the refrigerant pressure at the compressor outlet.

The refrigerating capacity includes the subcooling provided by the subcooler.

5 General requirements

The performance data of a refrigerant compressor shall be presented in either tabular or graphical form as shown in 6.2 and in addition in polynomial form as shown in 6.3. Any operating point published by the manufacturer and falling within the envelope shown in Figure 1 shall comply with the tolerances defined in Table 3.

The performance of the compressor at the standard reference points in table 2 shall also be reported.

To calculate the performance at other suction vapour temperatures or superheat and part-load, correction factors shall be given as shown in clause 9.

Refrigerants shall be designated in accordance with ISO 817. The source from which the thermodynamic properties are taken shall be stated.

NOTE 1 It is recommended that an example illustrating the use of the performance data and the correction factors should be given.

NOTE 2 Other data such as the swept volume, number of cylinders and speed range may also be shown.

6 Performance data

6.1 General

6.1.1 Published performance shall be based on data obtained from tests performed in accordance with EN 13771-1. If an oil separator is required to reach the performance, then this shall be indicated.

6.1.2 The performance data shall be presented for:

- open compressors at the rated speed;
- motor compressors at the rated voltage and frequency.

6.2 Tabular or graphical form

The performance data to be given, in either tabular or graphical form, shall comprise:

- a) refrigerating capacity, in values able to be read to an accuracy of $\pm 2\%$;
- b) absorbed power, in values able to be read to an accuracy of $\pm 2\%$;
- c) evaporating temperatures at suction dew point with intervals not greater than 5 K;
- d) condensing temperatures at discharge dew point with intervals not greater than 10 K;
- e) for compressors using a specific means of liquid subcooling, the temperature of the liquid leaving the sub-cooler must be specified.

6.3 Polynomial form

6.3.1 The polynomial equation shall be a third degree equation utilizing ten coefficients as follows:

$$X = C_1 + C_2 \times (S) + C_3 \times (D) + C_4 \times (S)^2 + C_5 \times (S \times D) + C_6 \times (D^2) + C_7 \times (S^3) + C_8 \times (D \times S^2) + C_9 \times (S \times D^2) + C_{10} \times (D^3) \quad (1)$$

where:

- X is the refrigerating capacity, in Watts, absorbed power, in Watts, or mass flow in kilograms per second;
- S is the evaporating temperature at suction dew point, in degree Celsius;
- D is the condensing temperature at discharge dew point, in degree Celsius;
- C is a coefficient.

6.3.2 The polynomial equation above shall not be used to extrapolate beyond the range of the tabulated data. Interpolation for different superheats is allowed, if the polynoms for different superheat conditions are given.

7 Standard reference points

The standard reference points shall be in accordance with Table 2.

Table 2 — Standard reference points

Reference points	Compressor applications			
	High evaporating temperature	Medium evaporating temperature	Low evaporating temperature	Household and similar refrigerators/freezers
Evaporating temperature (°C) at suction dew point	+ 5	– 10	– 35	– 25
Condensing temperature (°C) at discharge dew point	+ 50	+ 45	+ 40	+ 55
Suction vapour temperature (°C) or superheat (K)	+ 20 10 or 5 ^a	+ 20 10 or 5 ^a	+ 20 10 or 5 ^a	+ 32
Subcooling (K)	0	0	0	0
^a For R-717				

8 Tolerances

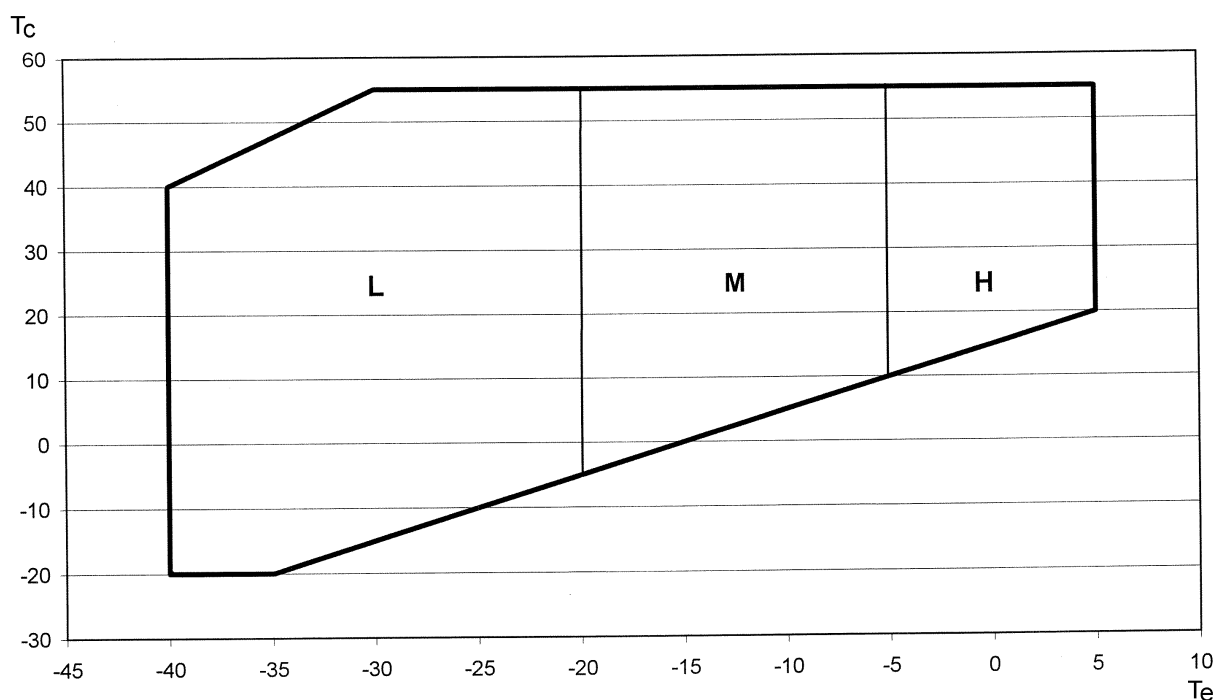
Component differences during production may result in deviations from the manufacturer's stated performance. To comply with this European Standard the performance of tolerances of any individual compressor shall be defined as follows:

Refrigerating capacity or mass flow and COP_r shall not be lower than shown in Table 3. Power absorbed shall not be more than the percentage shown in Table 3.

Table 3 — Actual performance in relation to published data

	Compressor applications			
	High evaporating temperature H	Medium evaporating temperature M	Low evaporating temperature L	Household and similar refrigerators/freezers
Refrigerating capacity or mass flow not less than	95 %	92,5 %	90 %	95 % or – 5W ^a
Power absorbed not more than	105 %	107,5 %	110 %	105 % or + 5W ^a
COP _r not less than	90 %	90 %	90 %	90 %
^a For values less than 100 Watts.				

NOTE The areas of high, medium and low evaporating temperatures are shown in Figure 1.

**Key** T_e Saturated Evaporating Temperature (° C) T_c Saturated Condensing Temperature (° C)**Figure 1 — Application envelope for tolerances****9 Correction factors****9.1 Superheat**

The correction factors applicable to the performance data relating to superheat (see clause 5) shall comprise:

- change in refrigerating capacity (or mass flow) as a function of the superheat;
- change in power absorbed as a function of the superheat.

Correction factors for different values of superheat shall be based on experimental data.

9.2 Compressor speed

The correction factors applicable to the performance data relating to the rated speed (see 6.1.2) shall comprise:

- refrigerating capacity (or mass flow) as a function of varying compressor speeds;
- power absorbed as a function of varying compressor speeds.

These correction factors do not apply to motor compressors.

9.3 Part-load

For compressors supplied with a capacity control mechanism, part-load correction factors shall be given enabling the following to be determined:

- a) refrigerating capacity (or mass flow);
- b) power absorbed.

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