SLOVENSKI STANDARD
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Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors - Heating mode - Part 3: Testing and requirements for marking for sanitary hot water units

Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors - Heating mode - Part 3: Testing and requirements for marking for sanitary hot water units

Luftkonditionierer, Flüssigkeitskühlsätze und Wärmepumpen mit elektrisch angetriebenen Verdichtern - Heizen - Teil 3: Prüfungen und Anforderungen an die Kennzeichnung von Geräten zum Erwärmen von Brauchwasser

Climatiseurs, groupes refroidisseurs de liquide et pompes a chaleur avec compresseur entraîné par moteur électrique - Mode chauffage - Partie 3: Essais et exigences de marquage pour les appareils pour eau chaude sanitaire

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English version

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart,36 B-1050 Brussels

Contents

Foreword

This European Standard has been prepared by Technical Committee by CEN/TC 113 "Heat pumps and air conditioners", the secretariat of which is held by AENOR.

This standard consists of the following parts:

EN 255-1 Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors - Heating mode - Part 1: Terms, definitions and designations

EN 255-2 Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors - Heating mode - Part 2: Testing and requirements for marking for space heating units

EN 255-3 Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors - Heating mode - Part 3: Testing and requirements for marking for sanitary hot water units

EN 255-4 Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors - Heating mode - Part 4: Requirements for space heating and sanitary hot water units

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 August 1997, and conflicting national standards shall be withdrawn at the latest by August 1997.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This part of EN 255 specifies methods for testing and reporting of the rating and it specifies requirements for marking of air/water and water/water heat pumps with electrically driven compressors when used for sanitary hot water. When these units are used for space heating, then EN 255-2 applies.

This standard aplies to factory-made units which can be ducted.

In the case of units consisting of several parts, the standard applies only to those designed and supplied as a complete package.

This standard does not include any requirement about the quality of water.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 255-1 Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors - Heating mode - Part 1: Terms, definitions and designations

EN 255-2 Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors - Heating mode - Part 2: Testing and requirements for marking for space heating units

3 Definitions and symbols

3.1 Definitions

For the purposes of this part of this European Standard the definitions given in EN 255-1 apply together with the additional terms defined below.

3.1.1 heat pump for heating sanitary water: Heat pump as defined in EN 255-1 connected to a sanitary hot water storage tank.

NOTE: The water can be heated directly by the condenser or indirectly through an intermediate medium (see annex A).

3.1.2 sanitary hot water: Water heated for household or similar purposes.

3.1.3 nominal volume (V_n): Volume of water that is assigned to the storage tank by the manufacturer and marked on it.

3.1.4 equivalent volume of hot water at 40 °C: Total of a volume of hot water with a temperature not less than 40 °C together with the volume of cold water at 15 °C needed to produce an overall temperature of 40 °C.

3.1.5 maximum volume of usable hot water (V_{max}): Equivalent volume of hot water at 40 °C calculated from the maximum draw-off test.

3.1.6 indoor ambient air: In this standard, indoor ambient air is indicated as the heat source for a heat pump which absorbs heat by an outdoor heat exchanger in direct contact with the air inside a building without any duct.

3.1.7 outside air: Air from the free atmosphere.

3.1.8 coefficient of performance for tapping sanitary hot water (COP_t): Coefficient of performance determined from one single tapping of half the nominal volume of the storage tank. This value excludes any heat losses from the storage tank.

3.1.9 reference hot water temperature (θ_{wr}): Temperature determined as the mean value of the average temperatures during two tappings which end when the hot water temperature is below 40 °C, one tapping starting when the thermostat in the tank switches on and the other starting when the thermostat in the tank switches off.

3.2 Symbols

For general symbols not listed below reference is made to EN 255-1.

Coefficient of performance for tapping sanitary hot water, COP_t

Number of operating cycles in the standby measurement period, n_s

Effective power input during the standby period, P_{es}

Energy content of maximum tapped sanitary hot water, Q_{max}

Energy content of tapped sanitary hot water, Q_t

Flowrate of outgoing sanitary hot water, q_{wh}

Heating up time, t_h

Measuring time for standby power input, t_s

Duration of tapping and reheating time for the second draw off, t_t

Maximum quantity of usable hot water in a single tapping, V_{max}

Nominal volume of water storage tank, V_n

Tapped hot water volume, V_t

Effective energy input during the heating up period, W_{eh}

Effective energy input during the standby period, W_{es}

Effective energy input during the tapping period, W_{et}

Temperature of incoming sanitary cold water, θ_{wc}

Temperature of outgoing sanitary hot water, θ_{wh}

Reference hot water temperature, θ_{wr}

4 Performance test

4.1 General

The method of test described in this clause is designed to evaluate the performance of heat pumps for heating sanitary water. It can be applied to heat pumps designed for the sole purpose of heating sanitary water as well as to heat pumps designed for combined space and sanitary water heating.

4.2 Basic principles

4.2.1 Test overview

The performance test consists of the following 5 principal stages (see 4.6, figure 1)

- A heating up period (see 4.2.2)
- A determination of the coefficient of performance for heating sanitary water (see 4.2.3)
- A determination of a reference hot water temperature (see 4.2.4)
- A determination of standby power input (see 4.2.5)
- A determination of the maximum quantity of usable hot water in a single tapping (see 4.2.6)

All tests are performed with power supplied at the rated voltage and frequency as recommended by the manufacturer.

After the initial start of the heat pump the power supply is left on for the duration of the test.

Any supplementary heat supply which can be manually switched by the user shall be switched off during the entire test.

If the water heater is equipped with a mixing valve for the hot water this valve shall be set at the manufacturer's recommended setting throughout the test.

The thermostat of the water heater shall be installed according to the manufacturer's recommendation and shall remain in the same position for the duration of the test. At least one thermostat shall sense the temperature of the sanitary hot water in the tank to make the described test procedure valid.

All measured parameters, with the exception of time, volume, energy and number of cycles, are understood to be average values calculated over the duration of the test period.

4.2.2 Heating up period

Measurements are made of the time necessary to heat the stored quantity of water from an initial state of uniform low temperature until the first time the compressor is switched off by the thermostat sensing the water temperature in the tank. The corresponding input of electrical energy is measured.

4.2.3 Coefficient of performance

Hot water draw-offs are initiated directly after the heating up period. The energy content of the tapped hot water is calculated from measurements of flowrate and temperature difference. The electrical energy input and time duration between the start of the second draw-off and the first time, after this, that the compressor is switched off by the thermostat sensing the water temperature in the tank are also measured.

4.2.4 Reference hot water temperature

A reference value for the hot water temperature inside the tank is determined by measuring the average outlet water temperature.

This is first done for a maximum volume draw-off which is started when the thermostat of the storage tank starts the compressor after the test in 4.2.3. It is then repeated for the maximum volume draw-off in 4.2.6 which is started when the compressor switches off. The reference hot water temperature is the mean value of these two average temperatures.

4.2.5 Standby power input

The standby power input is determined by measuring the electrical power input over an integral number of on-off cycles of the heat pump, initiated by the thermostat situated in the tank, when no hot water is drawn off.

4.2.6 Maximum quantity of usable hot water

The maximum amount of usable hot water which can be tapped in one single draw-off is determined. This is done by measuring the hot water energy during a continuous draw-off terminated when the hot water temperature is considered as being too low (see 4.6).

4.2.7 Power input of fans for heat pumps without duct connection

In the case of heat pumps which are not designed for duct connection, i.e. which do not permit any external pressure differences, and which are equipped with an integral fan, the power absorbed by the fan shall be included in the effective power absorbed by the heat pump.

4.2.8 Power input of fans for heat pumps with duct connection

4.2.8.1 In the case of heat pumps which allow an external static pressure difference, only a fraction of the input to the fan motor shall be included in the effective power absorbed by the heat pump.

4.2.8.2 If no fan is provided with the heat pump, the proportional power input which is to be included in the effective power absorbed by the heat pump, shall be calculated using the following formula:

$$\frac{q \quad \Delta p_i}{\eta} \quad \text{in watts}$$

where:

η is 0,3 by convention;
Δp_i is the measured internal static pressure difference, in pascals;
q is the nominal air flow rate, in cubic meters per second.

4.2.8.3 If a fan is an integral part of the heat pump, only a fraction of the input to the fan motor shall be included in the effective power absorbed by the heat pump.

The fraction which is to be excluded from the total power absorbed by the heat pump shall be calculated using the following formula:

$$\frac{q \quad \Delta p_e}{\eta} \quad \text{in watts}$$

where:

η is 0,3 by convention;
Δp_e is the available external static pressure difference, in pascals;
q is the nominal air flow rate, in cubic meters per second.

4.2.9 Power input of liquid pumps

4.2.9.1 The power input of pumps in any intermediate circuit or for circulation of water through the heat pump shall be fully included in the effective power absorbed by the heat pump.

4.2.9.2 At the outdoor heat exchanger, the fraction of the power absorbed by a pump which is required to overcome the internal static pressure difference of the heat pump, shall be calculated from the measured volume flow of the heat transfer medium, and the measured internal static pressure difference of the heat pump assuming an overall efficiency of 0,3 for the pumps, including their driving motors. If no pump is provided with the heat pump the proportional power input which is to be included in the effective power absorbed by the heat pump, shall be calculated using the following formula:

$$\frac{q \quad \Delta p_i}{\eta} \quad \text{in watts}$$

where:

η is 0,3 by convention;
Δp_i is the measured internal static pressure difference, in pascals;
q is the nominal air flow rate, in cubic meters per second.

4.2.9.3 If a pump is an integral part of the heat pump only a fraction of the input to the pump motor shall be included in the effective power absorbed by the heat pump. The fraction which is to be excluded from the total power absorbed by the heat pump shall be calculated using the following formula:

$$\frac{q \quad \Delta p_e}{\eta} \quad \text{in watts}$$

where:

η is 0,3 by convention;
Δp_e is the available external static pressure difference, in pascals;
q is the nominal water flow rate, in cubic meters per second.

4.3 Test apparatus

4.3.1 Arrangement of the test apparatus

4.3.1.1 General requirements

The test apparatus shall be designed in such a way that all requirements for adjustment of set values, stability criteria and accuracy of measurement according to this European Standard can be fulfilled.

Water systems or other heat transfer liquid systems shall be sufficiently free of entrained gas as to ensure that the measured results are not significantly influenced.