SLOVENSKI STANDARD
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Rooftop units - Testing and rating at standard rating conditions and part load conditions for calculation of seasonal performance

Dachgeräte - Prüfung und Bewertung unter Standardbedingungen und Teillastbedingungen zur Berechnung der jahreszeitlichen Leistun

Unités de toiture - Essais et détermination des performances nominales et à charge partielle pour le calcul de performances saisonnières

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Rooftop units - Testing and rating at standard rating conditions and part load conditions for calculation of seasonal performance

Unités de toiture - Essais et détermination des performances nominales et à charge partielle pour le calcul de performances saisonnières

Dachgeräte - Prüfung und Bewertung unter Standardbedingungen und Teillastbedingungen zur Berechnung der jahreszeitlichen Leistun

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 17625:2024) has been prepared by Technical Committee CEN/TC 113 “Heat pumps and air conditioning units”, the secretariat of which is held by UNE.

This document is currently submitted to the CEN Enquiry.

1 Scope

This document specifies the terms and definitions, the test conditions, and the test methods for rating the performance of rooftop units with electrically driven compressor(s), which may be equipped with a supplementary heater using electrical resistance or combustion of fossil fuel.

This document covers air-to-air units with integrated indoor and outdoor fans as well as water(brine)-to-air units with integrated indoor fan(s) and integrated or not liquid pump.

This document covers rooftop units with 2, 3 or 4 dampers, including several features as the free cooling, mixing air flows (on both sides) and internal heat recovery. Illustrations of rooftop unit configurations are given in Annex A.

Rooftop units with remote condensers are not in the scope of this document.

This document deals with rooftop units providing space heating and/or cooling for comfort application. Process applications are not covered by this document.

This document provides the part load conditions and the calculation methods taking into account rooftop units features, such as free cooling and air flow mixtures, for the determination of seasonal energy efficiencies *SEER*, $SEER_{on}$ and $SEER_{F}$, seasonal space cooling energy efficiency $\eta_{s,c}$, seasonal coefficients of performance *SCOP*, $SCOP_{on}$ and $SCOP_{net}$, seasonal space heating energy efficiency $\eta_{s,h}$ and the overall annual efficiency. The informative Annex B provides additional definitions for the determination of $SEER_{OA}$ and $SCOP_{OA}$ performance indexes dealing with space cooling/heating while working with a minimum mixture of outdoor air and recycled air.

Such calculation methods may be based on calculated or measured values.

In case of measured values, this document covers the test methods for determination of capacities, *EER* and *COP* values during active mode at part load conditions. It also covers test methods for the determination of power input during thermostat-off mode, standby mode, off-mode and crankcase heater mode.

A rooftop unit that is not using at least the thermodynamic cycle for space heating is considered as a cooling only unit.

For the purpose of this document, rooftop units equipped with additional air heating and/or cooling heat exchangers are rated without operation of these heat exchangers.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 14511-1:2022, *Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 1: Terms and definitions*

EN 14511-3:2022, *Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 3: Test methods*

3 Terms, definitions, symbols, abbreviated terms and units

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp/

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
exhaust air
air from the air conditioned space entering the outdoor heat exchanger

3.1.2
recycled air
air from the air conditioned space entering the indoor heat exchanger

3.1.3
extracted air
air removed from the conditioned space and rejected outdoors without entering the indoor nor the outdoor heat exchanger

Note 1 to entry: The extracted air may be entering a heat recovery device to enhance the efficiency of the unit.

3.1.4
outdoor air
air from the outdoor environment

3.1.5
supply air
air leaving the indoor heat exchanger for entering the space that is to be air conditioned

3.1.6
rooftop
air conditioning unit which main function is space cooling or heating, or both, using a vapour compression cycle driven by electric compressor(s) and in which the evaporator, compressor, condenser and supplementary heaters are integrated into a single package

Note 1 to entry: Rooftop units use recycled air or a mixture of recycled air and outdoor air on the indoor heat exchanger, and outdoor air or a mixture of outdoor air and extracted air on the outdoor heat exchanger, with capability of free cooling and may be equipped with a heat recovery system to benefit from the extracted air.

Note 2 to entry: Air mixtures ratio can vary from 0 % to 100 %.

Note 3 to entry: It can have means for cleaning and/or dehumidifying the air.

3.1.7
single-package rooftop
factory-made assembly constituting a unique functional unit provided by the manufacturer, that can be provided on one or two separate frames

3.1.8
2-damper rooftop
rooftop including indoor fan(s) for air supply, one damper on the recycled air circuit and one damper on the outdoor air circuit that allow to vary the ratio of outdoor air into the indoor heat exchanger from 0 % to 100 %

Note 1 to entry: See Figure A.1.

3.1.9
3-damper rooftop
rooftop including fan(s) for air supply and fan(s) for air extraction, one damper on the recycled air circuit, one damper on the outdoor air circuit and a third damper on the extract air circuit ahead of the air extraction fan, with both fans functioning simultaneously that allow to vary the ratio of outdoor air into the indoor heat exchanger from 0 % to 100 %

Note 1 to entry: The extracted air can be mixed with outdoor air before entering the outdoor heat exchanger.

Note 2 to entry: See Figures A.2 and A.3.

3.1.10
4-damper rooftop
rooftop equipped with four dampers for providing mixtures of outdoor air and exhaust air at the inlet of both outdoor and indoor heat exchangers that allow to vary independently the ratio of outdoor air entering both heat exchangers from 0 % to 100 %

Note 1 to entry: See Figures A.4 and A.5.

3.1.11
space heating mode
operation of the rooftop providing space heating by means of the thermodynamic cycle and supplementary heater, where relevant

3.1.12
space cooling mode
operation of the rooftop providing space cooling by means of the active cooling or free cooling, where relevant

3.1.13
active cooling
operation of the rooftop in which the cooling capacity is only provided by the use of thermodynamic cycle

3.1.14
free cooling
operation mode of the rooftop in which the cooling capacity is partially or totally provided by direct supply of outdoor air or of a mixture of outdoor air/recycled air to air-conditioned space, with or without using the thermodynamic cycle

3.1.15
supplementary heater
any hot water coil, electrical, or fossil fuel heater that is used to provide the missing heating capacity of the thermodynamic cycle and considered in the calculation of seasonal performance regardless whether it is integrated in the rooftop or not

3.1.16
heat recovery device
any device capable to recover an amount of energy from the extracted air for the purpose of improving the overall rooftop efficiency

3.1.17
free cooling temperature
***T*free**
highest outdoor temperature at which the thermodynamic cycle is switched off and the cooling capacity is provided by outdoor air or a mixture of outdoor and recycled air only

Note 1 to entry: For temperatures below or equal than T_{free}, the thermodynamic cycle is switched off .

Note 2 to entry: T_{free}, is declared by the manufacturer of the rooftop.

3.1.18
active mode
mode corresponding to the hours with a space cooling or heating load of the building and whereby the cooling or heating function of the unit is activated

Note 1 to entry: This condition may involve on/off-cycling of the unit in order to reach or maintain a required indoor air temperature.

3.1.19
active mode seasonal coefficient of performance
***SCOP*on**
average coefficient of performance of the unit in active mode for the designated heating season, determined from the part load, supplementary heating capacity (where required) and bin-specific coefficients of performance ($COP_{bin}(T_j)$) and weighted by the bin hours where the bin condition occurs

Note 1 to entry: For calculation of $SCOP_{on}$, the energy consumption during thermostat-off mode, standby mode, off mode and crankcase heater mode is excluded. The energy consumption of a supplementary heater is added for the part load conditions where the declared capacity of the unit is lower than the heating load, regardless whether this supplementary heater is included in the unit or not included in the unit.

Note 2 to entry: Expressed in kWh/kWh.

3.1.20
active mode seasonal energy efficiency ratio
***SEER*on**
average energy efficiency ratio of the unit in active mode for the space cooling function, determined from part load and bin-specific energy efficiency ratios ($EER_{bin}(T_j)$) and weighted by the bin hours where the bin condition occurs

Note 1 to entry: For calculation of $SEER_{on}$, the energy consumption during thermostat-off mode, standby mode, off mode and that of the crankcase heater is excluded.

Note 2 to entry: Expressed in kWh/kWh.

3.1.21
annual energy consumption for space cooling
Q_{CE}
energy consumption required to meet the reference annual space cooling demand and calculated as the reference annual space cooling demand divided by the active mode seasonal energy efficiency ratio ($SEER_{on}$) and the energy consumption of the unit for thermostat-off-, standby-, off- and crankcase heater mode during the cooling season

Note 1 to entry: Expressed in kWh.

3.1.22
annual energy consumption for heating
Q_{HE}
energy consumption required to meet the reference annual heating demand for a designated heating season and calculated as the reference annual heating demand divided by the active mode seasonal coefficient of performance ($SCOP_{on}$) and the energy consumption of the unit for thermostat-off-, standby, off- and crankcase heater mode during the heating season

Note 1 to entry: Expressed in kWh.

3.1.23
average climate conditions
temperature conditions characteristic for the city of Strasbourg for the heating season

3.1.24
bin
j
outdoor temperature interval of 1 K

3.1.25
bin hours

h_j
hours per season for which an outdoor temperature occurs for each bin *j*

3.1.26
bin limit temperature
temperature in the bin for which no more heating or cooling is required

Note 1 to entry: Expressed in °C.

Note 2 to entry: The bin limit temperature equals 16 °C for all climates in space cooling and space heating applications.

3.1.27
conversion coefficient
CC
coefficient for power generation efficiency

Note 1 to entry: The value of *CC* to apply can be found in the relevant regulation, or is 2.5 by default.

3.1.28
bin-specific coefficient of performance
$COP_{bin}(T_j)$
coefficient of performance specific for every bin *j* with outdoor temperature T_j in a season

3.1.29
bin-specific energy efficiency ratio
***EER*$_{bin}$(*T$_j$*)**
energy efficiency ratio specific for every bin *j* with outdoor temperature T_j in a season

3.1.30
bin temperature
***T*$_j$**
outdoor air dry bulb temperature at bin *j*

Note 1 to entry: Expressed in °C.

Note 2 to entry: The relative humidity may be indicated by a corresponding wet bulb temperature.

3.1.31
bivalent temperature
***T*$_{biv}$**
lowest outdoor bin temperature point at which the unit is declared to have a capacity able to meet 100 % of the heating load without supplementary heater, whether it is integrated in the unit or not

Note 1 to entry: Expressed in °C.

Note 2 to entry: Below this temperature, the unit may still provide capacity, but additional supplementary heating is necessary to fulfil the full heating load.

Note 3 to entry: The value of T_{biv} is an integer value.

3.1.32
capacity control
ability of the unit to change its capacity by changing the volumetric flow rate of the refrigerant

Note 1 to entry: Units are indicated as “fixed” if the unit cannot change its volumetric flow rate, “staged” if the volumetric flow rate is changed or varied in series of not more than two steps, or “variable” if the volumetric flow rate is changed or varied in series of three or more steps.

3.1.33
capacity ratio
CR
cooling (or heating) part load or full load divided by the declared cooling (or heating) capacity of the unit at the same temperature conditions

Note 1 to entry: Expressed in kW/kW.

3.1.34
climate conditions
temperature conditions characteristic for a specific location

3.1.35
coefficient of performance at declared capacity
***COP*$_d$**
declared heating capacity of the unit divided by the effective power input of the unit at specific temperature conditions, A, B, C, D, E, F and G, where applicable