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Klimatske strešne enote

Roof-top units

Dachgeräte

Unités de toiture

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EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

Page

European foreword 5
1 Scope 6
2 Normative references 6
3 Terms, definitions, symbols and units 7
3.1 Terms and definitions 7
3.2 Symbols, abbreviated terms and units 20
4 Test conditions 22
4.1 Standard rating conditions 22
4.2 Part load conditions 23
4.2.1 Cooling mode 23
4.2.2 Heating mode 25
5 Test apparatus 26
5.1 General requirements 26
5.2 Test room 26
5.3 Appliances with duct connection 26
5.4 Installation and connection of the test object 26
5.4.1 General 26
5.4.2 Measuring points 26
5.5 Uncertainties of measurement 27
6 Settings 29
6.1 Settings of supply air 29
6.2 Setting on the outdoor heat exchanger side 30
6.2.1 Non ducted units 30
6.2.2 Ducted units 30
6.2.3 Water-source units 31
6.2.4 Units with integrated liquid pumps 31
7 Capacity and power input calculations 31
7.1 Basic principles for the determination of capacities 31
7.2 Effective power input correction 31
7.2.1 General 31
7.2.2 Power input correction of fans for units without duct connection 32
8 Capacity test method 33
8.1 Permissible deviations 33
8.1.1 Output measurement for water-sourced units 34
8.1.2 Output measurement for cooling capacity of air-sourced units 35
8.1.3 Output measurement for heating capacity of air-sourced units 35
8.2 Test results 40
8.2.1 Data to be recorded 40
8.2.2 Cooling capacity and heat recovery capacity calculation 42
8.2.3 Heating capacity calculation 43
8.2.4 Effective power input calculation 43

9 Auxiliary modes 43
9.1 Uncertainties of measurement 43
9.2 Measurement of electric power input during thermostat-off mode 44
9.3 Measurement of the electric power input during standby mode 44
9.4 Measurement of the electric power input during crankcase heater mode 44
9.5 Measurement of the electric power input during off mode 45
10 Seasonal performance 45
10.1 Calculation of *SEER* and $SEER_{on}$ 45
10.1.1 General formula for calculation of *SEER* 45
10.1.2 Calculation of the reference annual cooling demand Q_C 45
10.1.3 Calculation of the reference annual energy consumption for cooling Q_{CE} 45
10.1.4 Calculation of $SEER_{on}$ 46
10.1.5 Calculation procedure for determination of EER_{bin} values at part load conditions 47
10.2 Calculation of *SCOP*, $SCOP_{on}$ and $SCOP_{net}$ 48
10.2.1 General formula for calculation of *SCOP* 48
10.2.2 Calculation of the reference annual heating demand Q_H 48
10.2.3 Calculation of the annual energy consumption for heating Q_{HE} 48
10.2.4 Calculation of $SCOP_{on}$ and $SCOP_{net}$ 49
10.2.5 Calculation procedure for determination of COP_{bin} values at part load conditions 51
10.3 Determination of the degradation coefficient *Cd* 52
10.3.1 General 52
10.3.2 Air-to-air units – Cooling mode 53
10.3.3 Air-to-air units – Heating mode 53
10.3.4 Water(brine)-to-air units – Cooling mode 53
10.3.5 Water(brine)-to-air units – Heating mode 53
11 Test methods for electric power input during thermostat-off mode, standby mode and crankcase heater mode and off mode 54
11.1 Measurement of the electric power input during crankcase heater mode 54
12 Test report 54
12.1 General information 54
12.2 Additional information 55
12.3 Rating test results 55
12.3.1 General 55
12.3.2 Seasonal test results 55
12.4 Specific information of the unit 55
13 Marking 56
Annex A (informative) Illustration of rooftop unit configurations 57
A.1 General 57
A.2 2-damper rooftop unit 57
A.3 3-damper rooftop unit 58
A.4 4-damper rooftop unit 60
Annex B (normative) Indoor air enthalpy test method 62
B.1 General 62
B.2 Determination of the air flow rate 62
B.3 Calculations-cooling capacities 62
B.4 Calculations-heating capacities 63

Annex C (informative) Symbols used in Annexes 64
Annex D (normative) Determination of the liquid pump efficiency 66
D.1 General 66
D.2 Hydraulic power of the liquid pump 66
D.2.1 The liquid pump is an integral part of the unit 66
D.2.2 The liquid pump is not an integral part of the unit 66
D.3 Efficiency of integrated pumps 67
D.3.1 Glandless circulators 67
D.3.2 Dry motor pumps 67
D.4 Efficiency of non-integrated pumps 69
Annex E (normative) Air flow rate measurement 70
E.1 General 70
E.2 Test installation 70
E.3 Test conditions 70
E.4 Air flow measurement 70
Annex F (informative) Climate bins and hours 71
F.1 Bin limit temperature 71
F.2 Cooling 71
F.3 Heating 72
F.4 Hours for active, thermostat-off, standby and off modes 73
F.4.1 Cooling 73
F.4.2 Heating 74
F.5 Hours used for crankcase heater mode 74
F.5.1 Cooling 74
F.5.2 Heating 74
Bibliography 75

European foreword

This document (prEN 17625:2020) 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 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 heat recovery.

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 for the determination of seasonal energy efficiency *SEER* and $SEER_{on}$, seasonal space cooling energy efficiency $\eta_{s,c}$, seasonal coefficient of performance *SCOP*, $SCOP_{on}$ and $SCOP_{net}$, seasonal space heating energy efficiency $\eta_{s,h}$ and the overall annual efficiency.

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 14511-1:2018, *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 14511-2:2018, *Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors - Part 2: Test conditions*

EN 14511-3:2018, *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 and units

3.1 Terms and definitions

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

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

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

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

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 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
unit capable of space cooling or heating, or both, using a vapour compression cycle driven by electric compressor(s), a mixture of outdoor air and recycled air on the indoor heat exchanger, and/or a mixture of outdoor air and exhaust air on the outdoor heat exchanger, that may be equipped with a heat recovery device and supplementary heaters

Note 1 to entry: Air mixtures ratio can vary from 0 to 100 %.

Note 2 to entry: It can have means for cleaning and 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 allows to vary the ratio of outdoor air into the indoor heat exchanger from 0 to 100%

Note 1 to entry: See Figures 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 allows 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 heat exchanger and indoor heat exchanger that allows 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/or supplementary heater, where relevant

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

3.1.13
active cooling mode
operation mode of the rooftop in which the cooling capacity, partially or totally, is only provided by the use of thermodynamic cycle

3.1.14
free cooling mode
operating mode of the rooftop in which cooling is provided by direct supply of outdoor air or of a mixture of outdoor air/recycled air to air conditioned space without using the thermodynamic cycle

Note 1 to entry: If free cooling cannot provide the total cooling capacity, the active cooling mode can be activated to compensate for the missing cooling capacity.

3.1.15
free space cooling mode
operation of the rooftop when the outdoor air or a mixture of outdoor air/recycled air is directly entering the space to be air conditioned, without any thermodynamic cycle in use

3.1.16
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

3.1.17
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

3.1.18
free cooling temperature
T_{free}

highest outdoor temperature that allows to switch the thermodynamic cycle to fulfil the room temperature requirements

3.1.19
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.

3.1.20
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.

3.1.21
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 $SEER_{on}$, 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.

3.1.22
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.

3.1.23
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.

3.1.24
average climate conditions
temperature conditions characteristic for the city of Strasbourg for the heating season

3.1.25
bin
outdoor temperature interval of 1 K

3.1.26
bin hours
***h*$_j$**
hours per season for which an outdoor temperature occurs for each bin *j*

3.1.27
bin limit temperature
temperature in the bin for which no more heating or cooling is required

Note 1 to entry: The bin limit temperature equals 16 °C for all climates in space cooling and space heating applications.

3.1.28
conversion coefficient
CC
coefficient for electricity generation efficiency

Note 1 to entry: The CC value of 2,5 is reflecting the estimated 40 % average EU power generation efficiency referred to in Directive 2012/27/EU of the European Parliament and of the Council.

3.1.29
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

3.1.30
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

3.1.31
bin temperature
***T*$_j$**
outdoor air dry bulb temperature

Note 1 to entry: Expressed in °C.

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

3.1.32
bivalent temperature
***T*$_{biv}$**

lowest outdoor 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: Below this point, the unit may still provide capacity, but additional supplementary heating is necessary to fulfil the full heating load.

3.1.33
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.

3.1.34
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

3.1.35
climate conditions
temperature conditions (dry bulb) characteristic for a specific location

3.1.36
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

Note 1 to entry: Expressed in kW/kW.

3.1.37
coefficient of performance at part load
***COP*$_{bin}$**
coefficient of performance at the declared capacity, corrected with the degradation coefficient, where applicable

Note 1 to entry: When the declared capacity of the unit is higher than the heating load, the COP_{bin} includes degradation losses. When the declared capacity of the unit is lower than the heating load (i.e. below the bivalent temperature condition), the COP_{bin} is equal to the COP of the declared capacity.

Note 2 to entry: Expressed in kW/kW.

3.1.38
colder climate conditions
temperature conditions characteristic for the city of Helsinki for the heating season

3.1.39
compressor-off state
compressor is not running while the unit is operating in active mode

Note 1 to entry: This is the “off” phase in on/off cycling.

3.1.40
crankcase heater mode operating hours
***H*$_{CK}$**
annual number of hours the unit is considered to be in crankcase heater mode, the value of which depends on the designated season and type of unit and operating mode(s)

Note 1 to entry: Expressed in h.

3.1.41
crankcase heater mode power input
***P*$_{CK}$**
power input of the unit due to crankcase heater operation mode

Note 1 to entry: Expressed in W.

3.1.42
crankcase heater (operation) mode
condition where the unit has activated a heating device to avoid the refrigerant migrating to the compressor in order to limit the refrigerant concentration in oil at compressor start

3.1.43
cycling interval capacity for cooling
P_{cycc}
(time-weighted) average cooling capacity output over the cycling interval test

Note 1 to entry: Expressed in kW.

3.1.44
cycling interval capacity for heating
P_{cych}
(time-weighted) average heating capacity output over the cycling interval test

Note 1 to entry: Expressed in kW.

3.1.45
cycling interval efficiency for cooling
EER_{cyc}
average energy efficiency ratio over the cycling interval test (compressor switching on and off)

Note 1 to entry: The cycling interval efficiency for cooling is calculated as the integrated cooling capacity over the interval divided by the integrated power input over that same interval.

Note 2 to entry: Expressed in kWh/kWh.

3.1.46
cycling interval efficiency for heating
COP_{cyc}
average coefficient of performance over the cycling interval test (compressor switching on and off)

Note 1 to entry: The cycling interval efficiency for heating calculated as the integrated heating capacity over the interval divided by the integrated power input over that same interval.

Note 2 to entry: Expressed in kWh/kWh.

3.1.47
declared capacity
cooling (*Pdc*) or heating (*Pdh*) capacity a unit can provide at any temperature condition A, B, C, C', D, E1, E2, E, F or G, as declared by the manufacturer

Note 1 to entry: This is the capacity provided by the refrigerant cycle and the necessary circulation means (e.g. fans) of the unit without supplementary heaters, even if those are integrated in the unit.