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Heat recovery ventilators and energy recovery ventilators — Testing and calculating methods for performance factor

Part 1: Sensible heating recovery seasonal performance factors of heat recovery ventilators (HRVs)

National foreword

This British Standard is the UK implementation of ISO 5222-1:2025. It supersedes BS ISO 5222-1:2023, which is withdrawn.

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A list of organizations represented on this committee can be obtained on request to its committee manager.

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**Heat recovery ventilators and
energy recovery ventilators —
Testing and calculating methods for
performance factor —**

**Part 1:
Sensible heating recovery seasonal
performance factors of heat
recovery ventilators (HRVs)**

*Ventilateurs récupérateurs de chaleur et ventilateurs
récupérateurs d'énergie — Méthodes d'essai et de calcul des
facteurs de performances —*

*Partie 1: Facteurs de performances saisonnières de la
récupération de chaleur sensible des ventilateurs récupérateurs
de chaleur (HRV)*

**Second edition
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 86, *Refrigeration and air-conditioning*, Subcommittee SC 6, *Testing and rating of air-conditioners and heat pumps*.

This second edition cancels and replaces the first edition (ISO 5222-1:2023), which has been technically revised. The main changes are as follows:

- terms and definitions have been revised to align with ISO 5222-2 and ISO 5222-3;
- symbols have been revised in accordance with the ISO/IEC Directives, Part 2;
- names of stages have been revised to align with ISO 5222-2 and ISO 5222-3;
- [6.2](#) sensible heating coefficient of energy and [3.3](#) coefficient of energy have been deleted;
- errors in [6.2.3](#) have been corrected;
- a note has been added to [6.2.5](#) for clarification;
- [Figure A.1](#) has been revised to align with ISO 5222-2 and ISO 5222-3.

A list of all parts in the ISO 5222 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Heat recovery ventilators and energy recovery ventilators — Testing and calculating methods for performance factor —

Part 1: Sensible heating recovery seasonal performance factors of heat recovery ventilators (HRVs)

1 Scope

This document specifies the testing and calculating methods for sensible heating recovery seasonal performance factor of heat recovery ventilators (HRVs) covered by ISO 16494-1.

This document also specifies the test conditions and the corresponding test procedures for determining the sensible heating recovery seasonal performance factor of HRVs. It is intended for use only for marking and comparison purposes.

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.

ISO 16494-1:2022/Amd 1:2023, *Heat recovery ventilators and energy recovery ventilators — Method of test for performance — Part 1: Development of metrics for evaluation of energy related performance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16494-1 and the following 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

heat recovery

<sensible heating> transfer of sensible energy from exhaust air to supply air in heat recovery ventilators while heating

3.2

bypass ventilation function

function for reducing power input of the fans while the heat energy recovered is less than the additional energy input due to overcoming the resistance of recovery heat exchanger during its operation time

Note 1 to entry: The bypass ventilation function makes either the supply air or exhaust air or both airflows go through the bypass passage with energy saving control.

3.3

gross effectiveness

<sensible heating> measured effectiveness, not adjusted for leakage, motor heat gain or heat transfer through the unit casing

Note 1 to entry: The sensible heating gross effectiveness of heat recovery ventilators, at equal airflow, is described in ISO 16494-1:2022, 9.5.

3.4

bypass outdoor temperature

T_b
outdoor temperature in heating conditions, at which the power reduction to heat recovery ventilators (HRVs) by operating in bypass mode is equal to the saving of power input to the heating system due to the heat recovered by HRVs

3.5

seasonal performance factor of sensible heating recovery

F_{sh}
ratio of seasonal amount of sensible heat recovered together with power value of moving air to the whole power input of heat recovery ventilators, under the rating conditions and seasonal outdoor temperature bins selected from this standard

3.6

building heating balance temperature

T_{BHB}
outdoor air temperature at which building internal heat gain, solar radiation, and so on, equals to heat loss through the building envelope

4 Symbols and abbreviated terms

Symbol	Description	Unit
c_p	specific heat of leaving supply air (SA)	kJ/(kg·°C)
E_{sh}	capacity of seasonal sensible heating recovery	Wh
F_{sh}	seasonal performance factor of sensible heating recovery	Wh/Wh
$L_{sh,t,j}$	reference outdoor air sensible heating load at outdoor air bin temperature t_j	W
n	number of temperature bins	–
n_j	bin hours which the outdoor air bin temperature occurs	h
P_{diff}	differential between fan power without bypass and fan power with bypass	kW
$P_{in,by,t,j}$	power input to HRVs at outdoor air bin temperature t_j for bin temperature in H, Stage 1, for HRVs with bypass	W
$P_{in,E}$	power input of seasonal sensible heating recovery	Wh
$P_{in,h,t,j}$	power input to a supplementary preheater at full capacity	W
$P_{in,no,t,j}$	power input to HRVs to operate the fans at outdoor air bin temperature t_j for all stages, for HRVs without bypass	W
$P_{in,t,j}$	power input to ventilator at outdoor air bin temperature t_j	W
$P_{in,v,t,j}$	ventilation power input of HRVs at outdoor air bin temperature	W
$P_{vma,t,j}$	power value of moving air at outdoor air bin temperature t_j	J/s or W
Q_{cn}	heating load from heat inflow of building	kW
Q_{ig}	heating load from internal gain	kW
$Q_{m2, net}$	net supply mass flow rate	kg/s
Q_s	reduced heating load due to heat recovery	kW
Q_t	total heating load of building	kW
Q_v	ventilation air heating load without recovery	kW

Symbol	Description	Unit
Q_{vwr}	ventilation air heating load with recovery	kW
T_b	outdoor air temperature when HRVs operates under air bypass function	°C
T_{BHB}	building heat balance temperature; at this temperature, Q_t will equal zero	°C
T_F	outdoor air bin temperature at which the frost occurs	°C
$T_{F,0}$	temperature at which the test to determine the frost temperature can be started to reduce duration time of the test	°C
$T_{0,h}$	temperature defined in ISO 16494-1:2022, Table 2 as T5/T6/T7; indicates the indoor design temperature of the building	°C
ε_{sh}	gross sensible heating recovery effectiveness of HRVs	%
$\phi_{sh,t,j}$	sensible heat recovery capacity of HRVs at outdoor air bin temperature t_j	W

5 Tests

5.1 General requirements

The test conditions used and the accuracy and uncertainties of the instruments used shall conform with ISO 16494-1 and this document.

5.2 Test conditions

For the purpose of ε_{sh} , E_{sh} and F_{sh} , there are three standard test conditions T5/T6/T7 in accordance with ISO 16494-1:2022, Table 2. HRVs shall be tested at one of the three test conditions. It is recommended to select test conditions that most closely represent the outdoor temperature bin distribution in the region as described in [Annex B](#) and [Annex D](#).

Outdoor temperature bin distribution and bin hours differ from region to region. If bin hours are set to a certain value for a certain region, the integrated value of heating load and energy consumption can be determined.

[Table 1](#) shows the requirement of default values and the reference outdoor temperature bin distribution for test and calculation. In case of setting other outdoor temperature bin distribution, refer to the setting method described in [Annex D](#).

Table 1 — Conditions of performance test (heating)

	Outdoor air temperature (°C)		Indoor air temperature (°C)		Application temperature bin type for calculation
	Dry bulb	Wet bulb	Dry bulb	Wet bulb	
T5	2	1	21	14	In Annex B or D
T6	5	3	20	15	
T7	7	6	20	12	
NOTE The allowable variation of readings is given in ISO 16494-1:2022, Table F.2.					

5.3 Test methods

5.3.1 General

For higher seasonal energy performance, HRVs can be designed with an airflow bypass function that integrates fan speed control or airflow control devices, which can change the fan power input according to different outdoor temperature conditions while maintaining the aerodynamic performance.