SLOVENSKI STANDARD
SIST EN 308:1997

01-avgust-1997

Prenosniki toplote - Preskusni postopki za ugotavljanje lastnosti naprav za prenos toplote zrak/zrak in dimni plini/zrak

Heat exchangers - Test procedures for establishing performance of air to air and flue gases heat recovery devices

Wärmeaustauscher - Prüfverfahren zur Bestimmung der Leistungskriterien von Luft/Luft- und Luft/Abgas-Wärmerückgewinnungsanlagen

Echangeurs thermiques - Procédures d'essai pour la détermination de la performance des récupérateurs de chaleur air/air et air/gaz

Ta slovenski standard je istoveten z: **EN 308:1997**

ICS:

27.060.30	Grelniki vode in prenosniki toplote	Boilers and heat exchangers

SIST EN 308:1997 **en**

EUROPEAN STANDARD **EN 308**

NORME EUROPÉENNE

EUROPÄISCHE NORM January 1997

Supersedes ENV 308:1990

ICS 27.060.30

Descriptors: heat transfer, heat exchangers, regenerative heaters, definitions, tests, measurement, thermodynamic properties

English version

Heat exchangers - Test procedures for establishing performance of air to air and flue gases heat recovery devices

Echangeurs thermiques - Procédures d'essai pour la détermination de la performance des récupérateurs de chaleur air/air et air/gaz

Wärmeaustauscher - Prüfverfahren zur Bestimmung der Leistungskriterien von Luft/Luft- und Luft/Abgas-Wärmerückgewinnungsanlagen

This European Standard was approved by CEN on 1996-12-27. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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.

The European Standards exist in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

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

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

Contents **Page**

Contents **Page**

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 110 "Heat exchangers", the secretariat of which is held by BSI.

This European Standard supersedes ENV 308:1990.

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

Introduction

This European Standard is one of a series of European Standards dedicated to heat exchangers.

1 Scope

This European Standard specifies methods to be used for laboratory testing of air-to-air heat recovery devices or those recovering heat from flue gases of heating appliances in buildings (except process-process applications) to obtain rating data. It gives test requirements and procedures for performing such tests and specifies input criteria required for tests to verify performance data given by the manufacturer.

For the purposes of this standard, the term exhaust air may also be taken to mean the products of combustion.

This European Standard is intended to be used as a basis for testing heat recovery devices for HVAC-systems, which as specified in prEN 247 consist of the heat exchanger itself installed in a casing having the necessary air duct connecting elements and in some cases the fans and pumps, but without any additional components of the HVAC-system.

This European Standard is applicable to the following categories of heat exchangers:

Category I	Recuperators
Category II	With intermediary heat transfer medium Category IIa - without phase-change Category IIb - with phase-change (heat pipe,..)
Category III	Regenerators (containing accumulating mass) Category II1a - non hygroscopic Category II1b - hygroscopic

Heat recovery devices with exchangers and intermediary heat transfer medium without phase-change (category IIa) are to be tested as one unit including pump and pipe system between the coils.

This European Standard prescribes test methods for determining:

a) the external leakage;

b) the internal leakage of exhaust air to the supply-air within the device at a given pressure difference between air ducts, for recovery devices of categories I and II;

c) the carry-over of exhaust air to the supply air in recovery devices of category III;

d) the temperature and humidity ratios;

e) the pressure drop of exhaust-air and supply-air sides.

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.

prEN 247	Heat exchangers - Terminology
prEN 305	Heat exchangers - Definitions of performance of heat exchangers and the general test procedure for establishing performance of all heat exchangers
prEN 306	Heat exchangers - Methods of measuring parameters necessary for establishing the performance
prEN 307	Heat exchangers - Guidelines to prepare installation, operating an maintenance instructions required to maintain the performance of each type of heat exchanger

3 Symbols and subscripts

a	concentration in 10^{-6}
n	rotating speed in min^{-1}
x	moisture contents in kg water/kg dry air
d_n	diameter of a circular duct in which the pressure drop is equal to that of the actual duct at the same air velocity in mm
μ	dynamic viscosity in $kg \cdot m^{-1} \cdot s^{-1}$
q_{mn}	nominal air mass flow rate of the recovery device, indicated by the manufacturer
q_{m1}	exhaust-air mass flow rate in $kg \cdot s^{-1}$
q_{m2}	supply-air mass flow rate in $kg \cdot s^{-1}$
q_{men}	external leakage mass flow rates at negative pressures in $kg \cdot s^{-1}$
q_{mep}	external leakage mass flow rates at positive pressures in $kg \cdot s^{-1}$
q_{mco}	carry-over mass flow rate in $kg \cdot s^{-1}$
q_{mil}	internal leakage mass flow rate in $kg \cdot s^{-1}$
Δp_1	pressure drop on exhaust-air side in Pa
Δp_2	pressure drop on supply-air side in Pa
η_t	temperature ratio
η_x	humidity ratio
t_w	wet bulb temperature in °C
21	supply-air inlet (see figure 3)
22	supply-air outlet (see figure 3)
11	exhaust-air inlet (see figure 3)
12	exhaust-air outlet (see figure 3)

Subscripts

n	nominal
en	external air leakage, negative pressure
ep	external air leakage, positive pressure
iI	internal air leakage
co	carry-over air leakage
w	wet bulb
meas	measure

4 Definitions

For the purposes of this European Standard, the definitions of prEN 247 and the following definitions apply:

4.1 heat recovery device: Heat recovery devices are heat exchangers or combinations of these which transfer heat and, in some cases, moisture between exhaust and supply air flows depending on the differential of temperature and humidity levels.

Heat recovery devices are generally installed in casings with suitable air-duct connections.

The heat recovery devices are divided into three categories as defined in clause 1.

4.2 mass flows: The mass-flow rate q_{m22}, supply air outlet, and q_{m11}, exhaust air inlet, are used as reference values.

These are the mass flows that enter or leave on the application side.

4.3 ratios: The temperature and humidity ratios of the device are defined on the supply-air side according to:

$$\eta_t = \frac{t_{22} - t_{21}}{t_{11} - t_{21}}$$

$$\eta_x = \frac{x_{22} - x_{21}}{x_{11} - x_{21}}$$

NOTE: To avoid confusion, no definitions of ratio on the exhaust-air side are included. The ratio defined on the supply-air side has been chosen, because the temperature and humidity of the supply air are the main criteria in sizing recovery devices. If data on the exhaust-air side is required conditions can be calculated by heat and mass balances.

4.4 external leakage: External leakage is the leakage to or from air flowing through the heat recovery device to or from the environment.

4.5 internal leakage: Internal leakage is the air leakage between the primary and secondary air flows in a heat recovery device.

4.6 internal exhaust air leakage: The internal exhaust air leakage is the internal air leakage from the exhaust-air side to the supply-air side of a recovery device

4.7 carry-over air flow: Carry-over air flow is the transfer of exhaust air into the supply air side in a heat recovery device of category III at over pressure on the supply air side.

4.8 reference conditions: The reference condition for air is air with a density of 1,20 $kg.m^{-3}$, a dynamic viscosity of 18,2 10^{-6} $kg.m^{-1}.s^{-1}$ and an absolute pressure of 101,3 kPa (1 013 Bar). Air at 20,0 °C, 50 % relative humidity and 101,3 kPa has approximately these properties.

4.9 pressure: Relative pressures are measured as difference to the atmospheric pressure. Unless otherwise specified the term pressure is used for relative pressure.

NOTE 1: Absolute pressure is used for air and fluids properties calculation.

NOTE 2: Pressure drop is the pressure difference along a circuit.

5 General requirements

The European Standards prEN 305, prEN 306, prEN 307 shall apply where appropriate and not otherwise stated in the following clauses.

5.1 Heat recovery device

The heat recovery device to be tested shall be installed in a test rig in accordance with the manufacturer's published instructions.

5.2 External leakage

The air tightness is established by the external leakage at positive and negative pressures of 400 Pa. The external leakage shall be determined using the test arrangement as described in 6.1, with mean positive and negative pressures of 400 Pa relative to ambient condition on supply and exhaust-air sides respectively. The measured mass flow rates q_{mep} and q_{men}, the external leakage flow rates, shall be recorded in the test report as a percentage of the nominal air flow (q_{me}/ q_{mn}) · 100 %. Air density during measurements shall be between 1,16 $kg \cdot m^{-3}$ and 1,24 $kg \cdot m^{-3}$ outside this range the measurements taken shall be corrected to reference conditions.