SLOVENSKI STANDARD
SIST EN 14652:2006+A1:2007

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Oprema, ki se uporablja za pripravo pitne vode v stavbah - Oprema za membransko filtracijo - Zahteve za delovanje, varnost in preskušanje

Water conditioning equipment inside buildings - Membrane separation devices - Requirements for performance, safety and testing

Anlagen zur Behandlung von Trinkwasser innerhalb von Gebäuden - Membranfilteranlagen - Anforderungen an Funktion, Sicherheit und Prüfung

Appareils de traitement d'eau a l'intérieur des bâtiments - Dispositifs de séparation membranaire - Exigences de performance, de sécurité et essais

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13.060.20	Pitna voda	Drinking water
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Water conditioning equipment inside buildings - Membrane separation devices - Requirements for performance, safety and testing

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This European Standard was approved by CEN on 8 July 2005 and includes Amendment 1 approved by CEN on 10 May 2007.

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Foreword

This European Standard (EN 14652:2005+A1:2007) has been prepared by Technical Committee CEN/TC 164 “Water supply”, the secretariat of which is held by AFNOR.

This document shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2007 and conflicting national standards shall be withdrawn at the latest by December 2007.

This document includes Amendment 1, approved by CEN on 2007-05-10.

This document supersedes EN 14652:2005.

The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1] ⟨A1⟩.

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Introduction

With respect of potential adverse effects on the quality of water intended for human consumption caused by the product covered by this European Standard, the following is pointed out to the user of this European Standard:

1) this European Standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA;

2) it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

1 Scope

This European Standard specifies requirements relating to the construction, performance and methods of testing for membrane separation systems with a particle rating below 1 µm, namely microfiltration (MF), ultrafiltration (UF), nanofiltration (NF) and reverse osmosis (RO) for drinking water installations inside buildings, intended to remove from the drinking water marginal concentrations of suspended and colloidal solids, microorganisms, organic molecules and/or to reduce the dissolved solids concentration and applies to systems with a minimum pressure of PN 10, connections between DN 15 and DN 100 and a maximum working temperature of at least 30 °C.

This European Standard applies to membrane separation systems, whose elements may be partly or entirely cleanable or disposable in accordance with the type of system. It only concerns units which are permanently connected to the mains supply at the point-of-entry or the point-of-use.

A membrane separation system may include, together with the separation device pre- and /or post-treatment devices.

For the scope of this European Standard:

— separation device shall comply with this European Standard, i.e. without pre-and/or post-treatments;

— where pre-and/or post-treatment devices are incorporated in the system, each of them shall conform to the relevant standard. If this is the case, the complete system shall be considered as conforming as a whole.

2 Normative references

The following referenced documents are indispensable for the application 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 1092-1, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 1: Steel flanges*

EN 1092-2, *Flanges and their joints — Circular flanges for pipes, valves, fittings and accessories, PN designated — Part 2: Cast iron flanges*

EN 1254-1, *Copper and copper alloys — Plumbing fittings — Part 1: Fittings with ends for capillary soldering or capillary brazing to copper tubes*

EN 1567, *Building valves — Water pressure reducing valves and combination water pressure reducing valves — Requirements and tests*

EN 1717:2000, *Protection against pollution of potable water in water installations and general requirements of devices to prevent pollution by backflow*

EN ISO 228-1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Dimensions, tolerances and designation (ISO 228-1:2000)*

EN ISO 3696, *Water for analytical laboratory use — Specification and test methods (ISO 3696:1987)*

EN ISO 3822 (all parts), *Acoustics — Laboratory tests on noise emission from appliances and equipment used in water supply installations*

ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

ISO 304, *Surface active agents — Determination of surface tension by drawing up liquid films*

ISO 1219-1, *Fluid power systems and components — Graphic symbols and circuit diagrams — Part 1: Graphic symbols*

ISO 12103-1, *Road vehicles — Test dust for filter evaluation — Part 1: Arizona test dust*

3 Terms and definitions

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

3.1
accessible
fabricated to be exposed for cleaning and inspection using standard available tools if necessary (e.g., screwdriver, pliers, open-end spanner)

3.2
air gap (drain system)
unobstructed vertical distance through the free atmosphere between the outlet of the concentrated discharge pipe and the flood level rim of the receptacle into which it is discharging

3.3
air gap (water distribution system)
unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet to a tank, plumbing fixture or other device, and the flood level rim of the receptacle

3.4
bubble point
minimum pressure required to overcome the surface tension of the water filling the pores of the membrane

3.5
component
separate or distinct part of a drinking water treatment system including, but not limited to, appurtenant accessories such as membranes, filters, housing, tubing, storage tanks, taps, valves, connectors to the feed water supply and connectors to the waste discharge line

3.6
contaminant
any undesirable chemical or microbiological substance or parameter in drinking water

3.7
cross-flow filtration
mode of operation by which part of the water passes through the membrane (product water) and the remaining part is rejected (reject water)

NOTE 1 The reject water, which can be wasted or partly recycled, plays the major role of keeping the membrane surface clean.

NOTE 2 Term "tangential flow" has the same technical meaning.

3.8
daily production
volume of product water produced by the system per day

3.9
dead-end filtration
mode of operation in which all the water feed passes through the membrane (no reject water). Depending on the rate of fouling/clogging of the membrane due to the retained substances, this filtration method is subject to declining rate of flow due to build up of retained matter. The membrane should be cleanable or disposable

3.10
device
complete, assembled, functional system

3.11
disposable component
component that requires periodic replacement

3.12
drinking water
water intended for human consumption as defined in Directive 98/83/EC

3.13
filtrate
water which is obtained by passage through microporous membranes (MF, UF)

3.14
flow controller
device for regulating the flow rate of water

3.15
grade of filtration
minimum membrane particle or dissolved substances rating which expresses the ability of the membrane to retain dissolved or un-dissolved solids of a given size range under normal working conditions irrespective of the nature of the membrane material

3.16
manufacturer
enterprise submitting the membrane module or the device for testing the compliance of that product to this European Standard

3.17
membrane
structure intervening for separating two phases and/or acting as a selective barrier to the transport of matter between the phases adjacent to it

NOTE It is categorised as membrane for MF, UF, NF or for RO in accordance with its construction and performance (see Annex B).

3.18
membrane flux
flow rate characteristics through the membrane that are dependant upon applied pressure and water temperature expressed in volume of product water per surface area unit of membrane and time

3.19
membrane material
material used for manufacturing membranes including organic (polymeric) and inorganic (ceramics, sintered metals or others) materials

3.20
membrane separation system
water treatment system which includes membrane, pressure vessel, fittings, gauges and ancillaries and which may include pre- and post-treatment components

3.21
microfiltration
process which removes particles of a size down to a given rating or a given molecular weight cut-off (MWCO)

NOTE Annex B gives information on each type of membrane.

3.22
module
smallest practical membrane unit which can be directly manifolded to feed streams to separate a feed stream into a reject and a permeate stream once placed in an appropriate housing

3.23
module housing
pressure vessel in which the module is accomodated

NOTE The membrane is usually tested in its final configuration (module) inside its housing specified by the manufacturer.

3.24
nanofiltration
process similar to reverse osmosis where the membrane has a looser structure thus reducing the rejection of monovalent ion

3.25
nominal flow rate
flow rate of water produced, in litres per hour, expressed in relation to the parameters indicated by the manufacturer (namely operating pressure and pressure drop)

NOTE In relation to the cross-flow mode of filtration it is also referred to as product or permeate flow rate.

3.26
operating pressure
pressure specified by the equipment manufacturer to ensure the expected performance

3.27
permeability
for a given fluid at given temperature (viscosity), it represents the flux of the given membrane as a function of the transmembrane driving force

NOTE The permeability coefficient is defined by Darcy's law.

3.28
permeate
water which has passed through the membranes

NOTE The term is currently used in general for membranes operating in the cross-flow mode, sometimes even MF and UF.

3.29
permanent pressure vessel
vessel that contains the cartridge, membrane or media which may be replaced or regenerated at the end of each rated service cycle and has an estimated service life greater than one year

3.30
point-of-entry device
water treatment system installed to treat the drinking water for the majority of the distribution system within the premises

3.31
point-of-use device
water treatment system used to treat the drinking water at a single tap or multiple taps but not for the majority of the facility

3.32
post-membrane treatment
additional treatment of the water subsequent to passage through the membrane(s)

3.33
pre-membrane treatment
any pre-treatment intended to protect the membrane in order to improve its performance and/or to prolong its lifetime

3.34
product water
water that has been treated by the system after blending with untreated water, if applicable

3.35
recovery rate
percentage measure of the amount of influent water which is delivered as permeate with open permeate discharge applicable to cross-flow mode

The recovery rate is calculated by measuring the flow rate of the influent water and the product water (permeate) in accordance with Equation (1):

$$Y = \frac{Q_p}{Q_f} \times 100 \quad (1)$$

where

Y is the recovery rate, in %;

Q_p is the product water flow rate, in m^3/h;

Q_f is the influent water flow rate, in m^3/h.

3.36
rejection rate

mean percentage of the un-dissolved particles and of the ionic and molecular (organic) substances removed by the membrane depending on the operating condition as well as on the type of membrane used

The rejection rate is calculated in accordance with Equation (2):

$$R = \left(1 - \frac{C_p}{C_f}\right) 100 \quad (2)$$

where

R is the rejection rate, in %;

C_f is the feed solution concentration of the considered substance;

C_p is the filtrate/permeate solution concentration of the considered substance.

3.37
reject water
portion of the influent water which is drained to waste

3.38
reference filtration rating
dimension, in micrometers, of particles at which the overall average cumulative filtration efficiency of a membrane module tested in accordance with the procedure described in A.3.1, is greater than or equal to 99,8 %

3.39
reverse osmosis
process that reverses, by the application of pressure, the flow of water in a natural process of osmosis so that water passes from a more concentrated solution to a more diluted solution through a semi-permeable membrane

3.40
service cycle
frequency of servicing (including replacement of disposable components of the system) required to maintain optimum performance

3.41
size range
contaminant rejection range which, dependent upon the intended function of the membrane, may refer to the size of suspended or colloidal particles and/or to the molecular weight of organic dissolved substances or to the ionic species to be removed

3.42
total dissolved solids (TDS)
remaining solids from a filtrate evaporated to dryness and dried to a constant weight at 180 °C after passing through a 0,45 µm filter

3.43
transmembrane differential pressure
pressure expressed as a function of P_i and P_s and calculated by Equation (3):

$$P_{tm} = (P_i + P_0)/2 - P_p \quad (3)$$

where

P_{tm} is the transmembrane differential pressure;

P_i is the pressure at the inlet of the module;

P_o is the pressure at the outlet of the module;

P_p is the pressure of the permeate solution.

3.44
turbidity
condition caused by the presence of suspended matter, or colloidal matter, or both, which results in the scattering and absorption of light rays

3.45
ultra-filtration
process which removes dissolved large organic molecules in the size range of approximately 20 000 g/mol to 200 000 g/mol (1 g/mol = 1 Dalton)

NOTE The nominal efficiency is referred as cut-off range.

3.46
unit void volume
total water holding volume of a treatment system with the replaceable treatment components and disposable components in place

3.47
unit volume
total water holding volume of a treatment system with replaceable treatment components and disposable components removed

3.48
cleanable component
component which can be restored to its original, or close to its original, performance by washing in accordance with the manufacturer's instructions. Recovery may progressively deteriorate after successive washings, requiring ultimate replacement. The manufacturer supplies information on how to check the recovery and on criteria for disposal

4 Classification

The membrane separation devices are classified according to the following criteria:

a) membrane material:

- organic (synthetic polymeric structure);
- inorganic (ceramics, metals and metal alloys).

b) type of membrane.

The membrane device can be intended to exploit the following technologies:

- MF;
- UF;
- NF;
- RO.

The main characteristics and limitations of above technologies are given in the Annex B.

c) membrane configuration:

- plate and frame;
- tubular;
- spiral wound;
- hollow fibres.

d) mode of operation:

- dead-end filtration (washable or disposable membrane element);
- cross-flow filtration.

5 Symbols and abbreviations

The generic symbols are given in Table 1.

Table 1 — Generic symbols

Symbol or abbreviation	Parameter	Unit
C_f	Feed solution concentration of the considered substances	mg/l
C_p	Filtrate/permeate solution concentration of the considered substances	mg/l
C	Solid concentration	% m/m
D	Particle diameter	µm
F	Fluorescence of the suspension	—
c	Beads concentration in the fluorescent latex suspension	—
C_i	Influent water concentration	mg/l
$C_p(i)$	Concentration of the monodimensional particles of "X" diameter in the product water	mg/l
$C_f(i)$	Concentration of the monodimensional particles of "X" diameter in the feed water	mg/l
N	Number of particles/ml	—
i	Monodimensional fraction of solid particles	%
m_1	Volumetric mass of the latex suspension	m/v
m_s	Volumetric mass of the latex particles	m/v
P	Pressure in general (specified in the text with pedice and key)	kPa
P_T	First bubble pressure at T °C	kPa
P_{20}	First bubble pressure at 20 °C	kPa
P_{tm}	Transmembrane differential pressure	kPa
P_i	Pressure at the inlet of the module	kPa
P_o	Pressure at the outlet of the module	kPa
P_p	Pressure of the permeate solution	kPa
Q	Flow rate	m^3/h
γ_T	Surface tension at T °C	N/m
γ_{20}	Surface tension at 20 °C	N/m
ΔP	Differential pressure	kPa
λ	Conductivity	ms/m

The graphic symbols used shall conform to the requirements of ISO 1219-1.

6 Construction requirements

6.1 General

Unless otherwise indicated, the following requirements shall be complied with and tested, if necessary on the complete system (device) as supplied by the manufacturer.

6.2 Materials

The membrane, all other components of the separation device and additives in contact with drinking water shall comply with the relevant European Standards concerned with materials and chemicals in contact with drinking water.

A device exclusively assembled with components complying with above relevant European Standard does not require further testing related to materials in contact with drinking water unless differently stated by national regulations.

On the contrary (one or more components not specifically tested), the complete device will be tested in its final arrangement in accordance with the relevant test method unless differently stated by national regulations.

NOTE Products intended for use in water supply systems should comply, when existing, with national regulations and testing arrangements that ensure fitness for contact with drinking water. The Member states relevant regulators and the EC Commission agreed on the principles of a future unique European Acceptance Scheme (EAS), which would provide a common testing and approval arrangement at European level.

If and when the EAS is adopted, European Product Standards will be amended by the addition of an Annex Z/EAS under Mandate M/136 which will contain formal references to the testing, certification and product marking requirements of the EAS.

6.3 Resistance to temperature

Within the service temperature range indicated by the manufacturer, the device shall not have any operating problems due to temperature exposure.

Independently from above temperature range, the device should withstand a water temperature between 5 °C and 30 °C and between 5 °C and 35 °C for ambient air.

6.4 Resistance to hydrostatic pressure

The device shall resist, without damage and leakage, a hydrostatic pressure equalling 3 times the design nominal pressure, with a minimum of 1 MPa or 1,6 MPa if connected with a pressure regulating valve, when tested as defined in A.2.1.

〈A1〉 NOTE 1 bar = 100 kPa = 0,1 MPa. 〈A1〉

6.5 Resistance to cyclic pressure

The device shall withstand a cyclic pressure fluctuating between 150 kPa and 1,3 times the design nominal pressure, with a minimum of a 1 MPa, when tested as defined in A.2.2.

6.6 Backflow prevention

The device shall include an upstream backflow preventer in accordance with EN 1717.

6.7 Electrical safety

The device shall comply with the relevant safety regulations.