

Nederlandse norm

NEN-EN 14898+A1

(en)

Apparatuur voor het conditioneren van
drinkwater binnen gebouwen - Actieve media
filters - Eisen voor functioneren, veiligheid en
beproeving

Water conditioning equipment inside buildings -
Active media filters - Requirements for
performances, safety and testing

Vervangt NEN-EN 14898:2006;
NEN-EN 14898:2006/Ontw. A1:2006

ICS 13.060.20; 91.140.60

juni 2007

Als Nederlandse norm is aanvaard:

- EN 14898:2006+A1:2007,IDT

Normcommissie 349 164 "Drinkwatervoorziening"

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Nederlands voorwoord

Voor de in deze norm vermelde normatieve verwijzingen bestaan in Nederland de volgende equivalenten:

<u>vermelde norm</u>	<u>Nederlandse norm</u>	<u>titel</u>
EN 1717	NEN-EN 1717	Bescherming tegen verontreiniging van drinkwater in waterinstallaties en algemene eisen voor inrichtingen ter voorkoming van verontreiniging door terugstroming (en)
EN 12903	NEN-EN 12903	Materialen voor de behandeling van water bestemd voor menselijke consumptie - Actieve koolstof in poedervorm (en)
EN 12904	NEN-EN 12904	Materialen voor de behandeling van water bestemd voor menselijke consumptie - Silicazand en silicagrind (en)
EN 12905	NEN-EN 12905	Materialen voor de behandeling van water bestemd voor menselijke consumptie - Geëxpandeerd aluminiumsilicaat (en)
EN 12906	NEN-EN 12906	Materialen voor de behandeling van water bestemd voor menselijke consumptie - Puimsteen (en)
EN 12907	NEN-EN 12907	Materialen voor de behandeling van water bestemd voor menselijke consumptie - Thermisch behandelde steenkoolproducten (en)
EN 12909	NEN-EN 12909	Materialen voor de behandeling van water bestemd voor menselijke consumptie - Antraciet (en)
EN 12910	NEN-EN 12910	Materialen voor de behandeling van water bestemd voor menselijke consumptie - Granaatzand (en)
EN 12911	NEN-EN 12911	Materialen voor de behandeling van water bestemd voor menselijke consumptie - Mangaangroenzand (en)
EN 12912	NEN-EN 12912	Materialen voor de behandeling van water bestemd voor menselijke consumptie - Bariet (en)
EN 12913	NEN-EN 12913	Materialen voor de behandeling van water bestemd voor menselijke consumptie - Diatomeeënaarde in poedervorm (en)
EN 12914	NEN-EN 12914	Materialen voor de behandeling van water bestemd voor menselijke consumptie - Perliet in poedervorm (en)
EN 12915-1	NEN-EN 12915-1	Materialen voor de behandeling van water bestemd voor menselijke consumptie - Actieve koolstof in korrelvorm - Deel 1: Onbewerkte actieve koolstof in korrelvorm (en)
EN 13752	NEN-EN 13752	Producten gebruikt voor de behandeling van water bestemd voor menselijke consumptie - Mangaandioxide (en)
EN 13753	NEN-EN 13753	Producten voor de behandeling van water bestemd voor menselijke consumptie - Geactiveerd aluminiumoxide granulaat (en)
EN 13754	NEN-EN 13754	Producten gebruikt voor de behandeling van water bestemd voor menselijke consumptie - Bentoniet (en)
EN 14368	NEN-EN 14368	Producten gebruikt voor de behandeling van water bestemd voor menselijke consumptie - Mangaandioxide gecoat kalksteen (en)
EN 14369	NEN-EN 14369	Producten gebruikt voor de behandeling van water bestemd voor menselijke consumptie - IJzer gecoat geactiveerd aluminaat-granulaat (en)
EN 27888	NEN-ISO 7888	Water - Bepaling van het elektrisch geleidingsvermogen (en)
EN ISO 3696	NEN-EN-ISO 3696	Water voor analytische laboratoriumdoeleinden - Eisen en beproevingsmethoden (en)
EN ISO 7027	NEN-EN-ISO 7027	Water - Bepaling van de troebelheid (en)

EN ISO 7393-1	NEN-EN-ISO 7393-1	Water - Bepaling van het vrije chloorgehalte en het totale chloorgehalte - Deel 1: Titrimetrische methode met gebruik van <i>N,N</i> -diethyl-1,4-phenylenediamine (en)
ISO 10523	-	-

English Version

Water conditioning equipment inside buildings - Active media filters - Requirements for performance, safety and testing

Appareils de traitement d'eau à l'intérieur des bâtiments -
Filtres à substance active - Exigences de performance, de
sécurité et essais

Anlagen zur Behandlung von Trinkwasser innerhalb von
Gebäuden - Filter mit aktiven Substanzen - Anforderungen
an Ausführung, Sicherheit und Prüfung

This European Standard was approved by CEN on 27 April 2006 and includes Amendment 1 approved by CEN on 10 May 2007.

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This European Standard exists 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 CEN Management Centre has the same status as the official versions.

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Foreword

This document (EN 14898:2006+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 14898:2006.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**.

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

- 1) This standard provides no information as to whether the product may be used without restriction in any of the Member States.
- 2) It should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulation concerning the use and/or the characteristics of this product remain in force.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

1 Scope

This European Standard specifies requirements relating to the construction, performance and methods of testing for active media filters for drinking water installations inside buildings, with a maximum working pressure of at least 1 000 kPa and a maximum working temperature of less than 30 °C. It only concerns units, which are permanently connected to the mains supply at the point of entry or point of use.

This standard applies only to filter systems comprising a housing and filter media tested together.

It includes capsule type units where both the element and its outer housing are disposable.

NOTE Products intended for use in water supply systems are to 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 principle 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 Standards on products 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. Until the EAS comes into force, the current national regulations remain applicable.

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

EN 12903, *Products used for treatment of water intended for human consumption — Powdered activated carbon*

EN 12904, *Products used for treatment of water intended for human consumption — Silica sand and silica gravel*

EN 12905, *Products used for treatment of water intended for human consumption — Expanded aluminosilicate*

EN 12906, *Products used for treatment of water intended for human consumption — Pumice*

EN 12907, *Products used for treatment of water intended for human consumption — Pyrolyzed coal material*

EN 12909, *Products used for treatment of water intended for human consumption — Anthracite*

EN 12910, *Products used for treatment of water intended for human consumption — Garnet*

EN 12911, *Products used for treatment of water intended for human consumption — Manganese Greensand*

EN 12912, *Products used for treatment of water intended for human consumption — Barite*

EN 12913, *Products used for treatment of water intended for human consumption — Powdered diatomaceous earth*

EN 12914, *Products used for treatment of water intended for human consumption — Powdered perlite*

EN 12915-1, *Products used for treatment of water intended for human consumption — Granular activated carbon — Part 1: Virgin granular activated carbon*

EN 13752, *Products used for treatment of water intended for human consumption — Manganese dioxide*

EN 13753, *Products used for treatment of water intended for human consumption — Granular activated alumina*

EN 13754, *Products used for treatment of water intended for human consumption — Bentonite*

EN 14368, *Products used for treatment of water intended for human consumption — Manganese dioxide coated limestone*

EN 14369, *Products used for treatment of water intended for human consumption — Iron-coated granular activated alumina*

EN 27888, *Water quality — Determination of electrical conductivity (ISO 7888:1985)*

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

EN ISO 7027, *Water quality — Determination of turbidity (ISO 7027:1999)*

EN ISO 7393-1, *Water quality — Determination of free chlorine and total chlorine — Part 1: Titrimetric method using N,N-diethyl-1,4-phenylenediamine (ISO 7393-1:1985)*

ISO 10523, *Water quality — Determination of pH*

3 Terms and definitions

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

3.1

active media

adsorbent, ion exchange or chemically active material that removes or significantly reduces a component from water by chemical reaction or by virtue of ionic charge or other surface activity

3.2

capsule cartridge

sealed cartridge, designed to be used in a support housing

NOTE For this design, the housing may not be watertight.

3.3

capsule filter

complete filter, for which the filter element and the filter housing are inseparable and the housing is discarded with the spent element

3.4

cartridge

replaceable filter element

NOTE This includes any other components that the manufacturer specifies should be changed when the cartridge exchange is due.

3.5

cartridge exchange indicator

means by which the need to change a cartridge is indicated

NOTE It may work by elapsed time, throughput of water or any other suitable method of indication. This indicator can only be regarded as a guide.

3.6

identification mark

identification on the product and/or packaging that the product conforms to the requirements of this standard, e.g. "This product conforms to prEN 14898"

3.7

filter element

part of the filter that contains the active media

3.8

filter rated capacity

volumetric capacity of the filter claimed by the manufacturer

NOTE If more than one substance-specific reduction claim is made by the manufacturer, the filter rated capacity is the capacity for the substance with the lowest substance-specific rated capacity.

3.9

maximum working pressure

manufacturer's stipulated maximum water supply pressure above which the structural integrity of the system may be compromised

3.10

maximum working temperature

manufacturer's stipulated maximum water supply temperature above which filter performance and/or structural integrity of the system may be compromised

3.11

minimum reduction rate

minimum percentage reduction achieved by a filter with respect to a specified substance, as defined in the performance requirements of this standard

3.12

minimum working pressure

manufacturer's stipulated minimum water supply pressure below which filter performance may be compromised

3.13

minimum working temperature

manufacturer's stipulated minimum water supply temperature below which filter performance and/or structural integrity of the system may be compromised

3.14

substance-specific rated capacity

volume of water, in litres, that the filter is capable of treating to the minimum reduction rate with respect to a specific substance

3.15

unit volume

internal empty vessel volume of the complete system which is in contact with the drinking water

3.16

working flow range

manufacturer's stipulated maximum and minimum flow rates outside of which the performance of the filter may be compromised

4 System design requirements

4.1 Materials of construction

Active media shall conform to the requirements for water extractable substances in EN 12903, EN 12904, EN 12905, EN 12906, EN 12907, EN 12909, EN 12910, EN 12911, EN 12912, EN 12913, EN 12914, EN 12915-1, EN 13752, EN 13753, EN 13754, EN 14368 or EN 14369, if and as appropriate.

4.2 Working conditions

4.2.1 Working temperature

The filter shall be designed to operate to the requirements of this standard at:

- minimum ambient air and water temperatures of not less than 5 °C;
- maximum water temperature of at least 30 °C;
- maximum ambient air temperature of at least 30 °C.

4.2.2 Working flow

Performance tests shall be performed at the maximum of the working flow range stipulated by the manufacturer.

If the filter system is not fitted with a flow regulator, the manufacturer shall provide guidance in the operating instructions for adjusting the flow such that it does not exceed the maximum of the working flow range.

4.3 Filter cartridge replacement

Any tools necessary for routine maintenance shall not come into contact with the water intended for human consumption. Any special tools shall be provided by the equipment supplier.

The system shall be designed, and suitable instructions provided, such that contamination of the treated water supply is avoided during the filter cartridge change procedure.

4.4 End connections

Any fittings supplied with the filter to connect it to existing pipework, shall conform to the requirements of the relevant European Standards, and, for point-of-entry installation, shall be minimum size DN 15.

4.5 Backflow prevention

Backflow prevention shall be provided in accordance with the national implementation of EN 1717.

4.6 Exchange indicator

An active media filter system shall incorporate a cartridge exchange indicator, which gives a guide to the remaining life of the element based on filtration capacity, along with a clear statement of the maximum period of time after which the cartridge has to be changed.

5 Performance requirements

5.1 Pressure strength of the filter housing

When subjected to a hydraulic test as defined in 6.1, there shall be no visible leakage or damage.

5.2 Dynamic pressure test of housing

While subject to a cyclic pressure test as described in 6.2, the filter housing shall show no visible signs of leakage or damage.

In the case of a capsule type filter, this test shall be omitted but the dynamic pressure test as described in 6.3 shall be completed.

5.3 Dynamic pressure test of cartridge

While subject to a cyclic pressure test as described in 6.3, the filter cartridge shall show no visible signs of leakage or damage.

5.4 Pressure drop

When subjected to the maximum of the working flow range as described in 6.4, the filter, with a clean element, shall not develop a pressure drop higher than the manufacturer's declared value.

5.5 Substance reduction performance

5.5.1 Performance claims

Any or all of the performance claims covered by this clause may be made by the filter manufacturer but where more than one substance performance claim is made, the rated capacity shall be that for the lowest substance-specific capacity.

5.5.2 Chlorine reduction

When tested in accordance with 6.5, the reduction in chlorine achieved shall be categorized as follows:

Class 1 : ≥ 90 % reduction

Class 2 : ≥ 75 % to < 90 % reduction

5.5.3 Organic chemical reduction

When tested in accordance with 6.6, the unit shall reduce the specified chemical parameter by at least 90 % from an influent concentration of 10 times the regulated value (see [A1](#) [2] [A1](#)) or the World Health Organisation (WHO) Guidelines value (see [A1](#) [3] [A1](#)). With the exception of trihalogenmethanes (THM) (for which chloroform may be used as a surrogate), tests for reduction of each specific substance, for which the manufacturer makes a claim, shall be carried out: other than for THMs, claims for reduction of generic groups (such as pesticides, polycyclic aromatic hydrocarbons (PAH), etc.) of organic chemicals cannot be claimed under this standard.

NOTE The protocols specified in 6.6 can be adapted to test the reduction of substances not specifically covered by the performance requirements of this standard (see Annex C). Claims for the reduction of such substances are clearly separated from the claims made of conformity to this standard (see 7.1).

5.5.4 Odour and flavour reduction

When tested in accordance with 6.6, the unit shall reduce the level of geosmin from 0,15 µg/l to 0,015 µg/l and, in a separate test, it shall reduce the level of 2,4,6-trichlorophenol from 20 µg/l to 2 µg/l. For compliance with this standard, separate claims for odour or flavour reduction are not permitted.

5.5.5 Inorganic chemical reduction

When tested in accordance with 6.6, the unit shall meet the criteria given in Table 1 for any or all of the substances tested.

Table 1 — Chemical reduction requirements

Determinant	Concentration units	Influent concentration C_i	Effluent percentage reduction
Lead	µg/l Pb	100 ± 10	90
Copper	mg/l Cu	$3 \pm 0,3$	80
Aluminium	µg/l Al	600 ± 60	70
Nitrate	mg/l NO_3	200 ± 20	75 ^a
Carbonate hardness	mg/l CaCO_3	300 ± 30	50
a In the case of nitrate, to check that excessive formation of nitrite is not occurring, filtered water samples shall be analyzed for nitrite as well as nitrate and an additional condition shall be fulfilled: $\frac{\rho(\text{NO}_3)}{50} + \frac{\rho(\text{NO}_2)}{3} \leq \frac{C_i}{200}$.			

NOTE The protocols specified in 6.6 of this standard can be adapted to test the reduction of substances not specifically covered by the performance requirements of this standard (see Annex C). Claims for the reduction of such substances are clearly separated from the claims made of conformity to this standard (see also 7.1).

6 Test methods

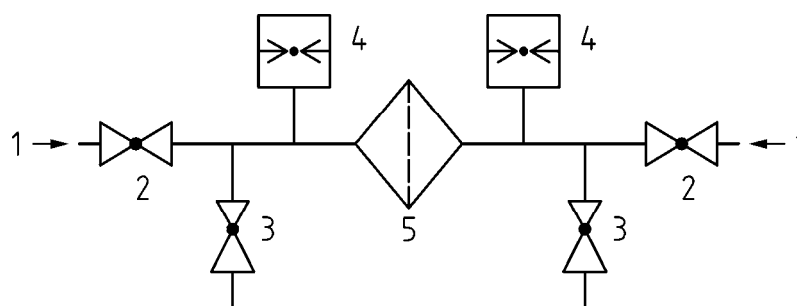
6.1 Static pressure test of filter housing

6.1.1 Principle

The filter is mounted in a test rig and a water pressure 1.5 times the maximum working pressure is applied for 10 min. The filter is examined for visible evidence of leakage or damage.

6.1.2 Procedure

Install the filter in a test rig as shown in Figure 1. The pressure gauge shall be installed at the outlet of the test specimen. It shall be ensured that the pressure at the outlet of the system is at the specified value. Flush with water to purge air from the filter. Increase the water pressure to 1.5 times the maximum working pressure at a minimum rate of 0,1MPa/s. Maintain the pressure for 10^{+2}_0 min. Examine the filter for visible evidence of leakage or damage.

**Key**

- | | | | |
|---|----------------------------|---|----------------|
| 1 | Pressurizing device | 4 | Pressure gauge |
| 2 | Stop valve/ Solenoid valve | 5 | Test specimen |
| 3 | Drain valve | | |

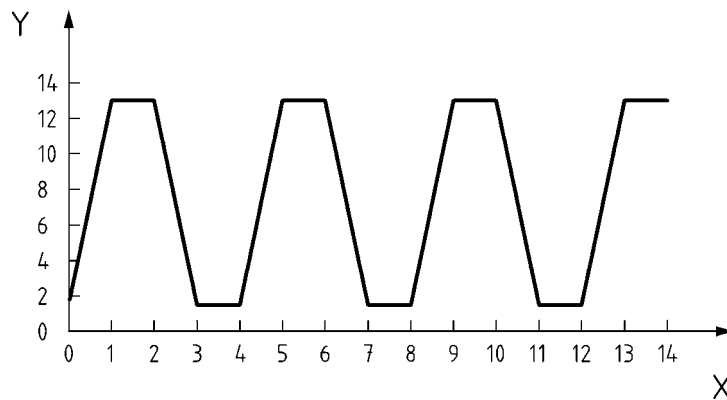
Figure 1 – Pressure strength and tightness test rig**6.2 Dynamic water pressure test of housing****6.2.1 Principle**

The empty filter housing is mounted in a test rig and subjected to 200 000 load cycles with pressure varying from 150 kPa to 1,3 times the maximum working pressure at a frequency of 15 min^{-1} . The filter housing is examined for visible evidence of leakage or damage.

6.2.2 Procedure

Position the filter in a suitable test rig (see Figure 1). Apply 200 000 load cycles with the water pressure cycling between 150 kPa and 1,3 times the maximum working pressure, at a frequency of $(15 \pm 2) \text{ min}^{-1}$ (see Figure 2). The duration of the pressure increase, pressure hold and pressure decrease shall each be $(1 \pm 0,2) \text{ s}$. The pressure shall be measured at the outlet of the filter. Maintain the water temperature of the system at $(20 \pm 3)^\circ\text{C}$. Examine the filter for visible evidence of leakage or damage.

The filter used for the test described in 6.2 shall not be used for subsequent testing.



Key

X Time, in s
Y Pressure, in kPa/100

Figure 2 — Dynamic pressure test of filter housing

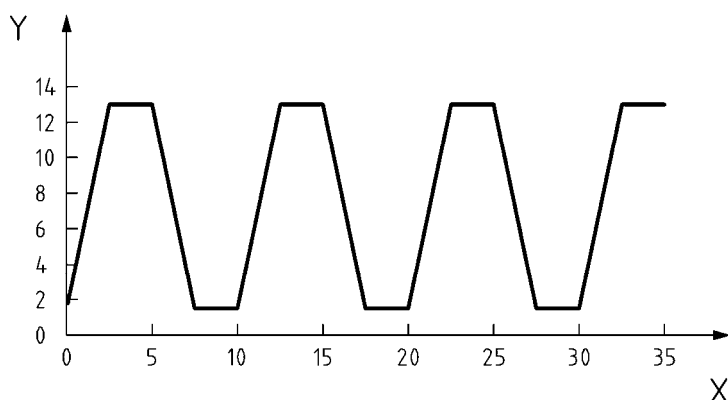
6.3 Dynamic pressure test of cartridge

6.3.1 Principle

The filter complete with cartridge is mounted in a test rig and subject to 20 000 load cycles with the pressure varying from 150 kPa to 1,3 times the maximum working pressure with a frequency of 6 cycles per minute. The filter cartridge is examined for physical evidence of damage to the cartridge and seals.

6.3.2 Procedure

- Position the filter with cartridge installed in a test rig (see Figure 1).
- Apply 20 000 load cycles with the water pressure cycling between 1,3 times the maximum working pressure and 150 kPa. The time for the pressure increase and the pressure hold at 1,3 times maximum working pressure shall each be $(2,5 \pm 0,2)$ s. The time for the pressure decrease from 1,3 times the maximum working pressure to 150 kPa and the hold period at 150 kPa shall together be $(5 \pm 0,2)$ s (see Figure 3).
- Maintain the water temperature of the system at (20 ± 3) °C. After the completion of 20 000 load cycles, remove the cartridge and examine it for visible evidence of leakage or damage.
- The filter used for the test described in 6.3 shall not be used for subsequent testing.



Key

X Time, in s
Y Pressure, in kPa/100

Figure 3 — Dynamic pressure test of filter cartridge

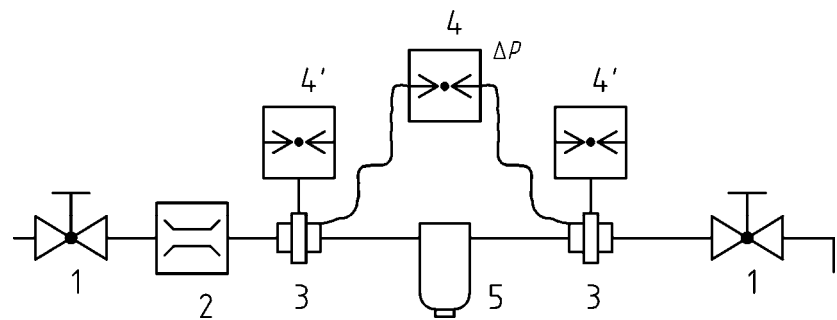
6.4 Pressure drop

6.4.1 Principle

The filter is mounted in a test rig and the differential pressure across the filter is recorded for a number of flow rates in order to generate a pressure drop curve. The test is repeated with the filter cartridge removed. The differential pressure curve across the filter cartridge is calculated by subtracting the curve with the filter removed from that with the cartridge in place. For filters with capsule cartridges, the test with cartridge removed is not applied. For these filters, the pressure drop is provided for the complete system.

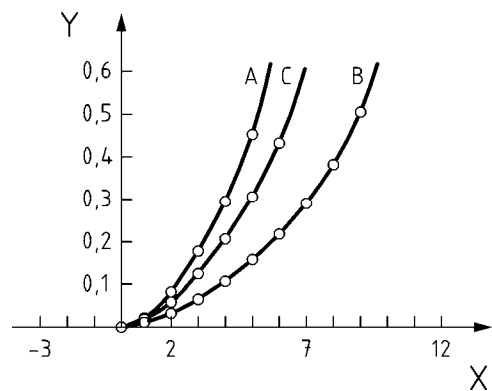
6.4.2 Procedure

- The test rig is shown in Figure 4. Connect the filter in accordance with the manufacturer's instructions supplied with the filter. Install the filter between two sensors for pressure measurement connected to adequately sized manometers (error limit 2 kPa). Alternatively, a differential pressure gauge may be used.
- If the appliance to be tested is fitted with a shut-off valve, open it fully.
- Adjust the flow rate by means of the regulating valve installed downstream of the filter. Maintain the water temperature of the system at $(20 \pm 3) ^\circ\text{C}$.
- Measure the differential pressure at a number (e.g. 10) of flow rates in order to generate a pressure drop curve (curve A in Figure 5).



- Key**
- | | | | |
|---|----------------------------------|----|------------------------------------|
| 1 | Regulating valve | 4 | Differential pressure gauge |
| 2 | Flow meter | 4' | Alternatively: two pressure gauges |
| 3 | Sensors for pressure measurement | 5 | Appliance under test |

Figure 4 — Flow rate/pressure loss test rig



- Key**
- | | | | |
|---|---------------------------------|---|--|
| X | Flow rate, in m ³ /h | A | Differential pressure across the housing and cartridge |
| Y | Pressure drop, in kPa/10 | B | Differential pressure across the empty housing |
| | | C | Differential pressure across the cartridge |

Figure 5 — Pressure drop as function of flow rate

For point of entry units, the nominal flow rates shall not be lower than those specified in Table 2.

Table 2 — Flow rate values (point of entry only)

Nominal size DN	15	20	25	32	40	50	65	80	100
Maximum working flow rate l/s ^a	0,35	0,63	1,0	1,6	2,53	3,89	6,67	10	15,56
^a These flow rates correspond to a superficial linear velocity of approx. 2 m/s.									

For point of use units the pressure drop shall be documented at the maximum working flow rate specified by the manufacturer.

6.5 Chlorine reduction

6.5.1 Test equipment

A test rig capable of providing the maximum of the manufacturer's working flow range and corresponding static pressures shall be used. Two identical units shall be tested in parallel. Annex A gives an example system.

NOTE The raw water supply may be directly from the mains or from a batch tank.

6.5.2 Reagents

6.5.2.1 General

All reagents shall be of a recognised analytical grade and the water used to prepare reagent solutions shall conform to grade 2 in accordance with EN ISO 3696.

6.5.2.2 Sodium hypochlorite

Aqueous solution of sodium hypochlorite (NaClO) containing approximately 12 % by mass of available chlorine.

6.5.2.3 Sodium thiosulfate solution

Dissolve $(3,5 \pm 0,1)$ g sodium thiosulfate pentahydrate ($\text{Na}_2\text{S}_2\text{O}_3 \cdot 5 \text{H}_2\text{O}$) in water and dilute to 1 l in a volumetric flask. Store this solution at $(4 \pm 1)^\circ\text{C}$ in the absence of light.

6.5.3 Analytical methods

Water analyses shall be conducted using the following methods:

- free available chlorine : EN ISO 7393-1
- conductivity : EN 27888
- pH : ISO 10523
- turbidity : EN ISO 7027

6.5.4 Test conditions

6.5.4.1 Test water specification

6.5.4.1.1 General test water

Mains supply water shall be used, adjusted as necessary to the following characteristics:

- pH : $7,5 \pm 0,5$
- temperature : $(20 \pm 5)^\circ\text{C}$
- conductivity : from $300 \mu\text{S}/\text{cm}^2$ to $750 \mu\text{S}/\text{cm}^2$
- turbidity : $< 1 \text{ NTU}$

6.5.4.1.2 Chlorinated test water challenge

Chlorinated test water shall be adjusted to the following characteristic:

- free available chlorine (as Cl_2) : $(1,0 \pm 0,1)$ mg/l

Add sodium hypochlorite solution (6.5.2.2) to achieve the specified free available chlorine concentration.

NOTE For test water from a batch tank, superchlorination and subsequent dechlorination may be required prior to test water preparation in order to assure the specified level of free available chlorine. If a stable free chlorine residual cannot be achieved, the following procedure given should be followed:

Add sodium hypochlorite (6.5.2.2) to the general test water to achieve a total chlorine concentration of at least 5 mg/l. When using storage tanks (with lids) for the test water, allow the water to stand at least 2 h; when using a flow through system, a static mixer and a holding tank with sufficient volume - for a 5 min residence time. After this chlorination and retention, dechlorinate by adding sodium thiosulfate solution (6.5.2.3) addition of 2 ml of this solution will neutralise 1 mg/l of free chlorine in 1 l of water. Confirm that all of the free chlorine has been removed. Chlorinate to the required influent challenge concentration (1,0 mg/l) by adding sodium hypochlorite (6.5.2.2) to the tank or injection (flow).

6.5.4.2 Test water pressure

The water pressure used for the test shall be not less than 410 kPa.

6.5.4.3 Ambient conditions

The ambient air temperature throughout the test shall be (20 ± 5) °C.

6.5.5 Procedure

- Install two identical systems into the test rig referred to in 6.5.1 in accordance with the manufacturer's instructions.
- Condition the systems in accordance with the manufacturer's instructions using the test water defined in 6.5.4.1.1.
- Start the flow of chlorinated challenge water and regulate the flow to the maximum of the working flow range by adjusting the control valve downstream of the filter unit.
- Set the timer on the solenoid valves to operate on a 50 % on 50 % off basis, with a cycle time of 60 min, 16 h/d with an 8 h overnight stagnation.
- Operate the system to the end of the filter rated capacity.

6.5.6 Sampling

- Collect the first influent challenge and product water samples starting during the "on" portion of the cycle after the passage of 10 unit volumes of the influent challenge.
- Sample the influent and effluent from each filter at 10 % increments between 10 % and 100 % of the rated capacity of the filter for chlorine reduction.
- Note the temperature and flow rate of each product sample as it is taken.
- Take samples of influent and product water simultaneously.
- Sample each batch tank of concentrated sodium hypochlorite stock solution, at the beginning and end of use, for free available chlorine.

- Analyse each influent and product sample for free available chlorine within 5 min of taking the sample.
- To verify compliance with the test water requirements (see 6.5.4.1), analyse the first and final influent sample for pH, turbidity and conductivity for each batch tank.

NOTE Laboratories should satisfy themselves that the challenge water meets all of the required concentrations before testing is started. If it does not, then the water composition should be adjusted until the required concentrations are met.

6.5.7 Acceptance criteria

To comply with this standard, the percent reduction efficiency of free available chlorine by each test filter for each sample shall be not less than the claimed efficiency or the minimum specified in 5.5 for the claimed chlorine reduction rating.

6.5.8 Expression of results

For an example test result sheet, see Annex B.

6.6 Chemical and odour/flavour reduction

6.6.1 Test equipment

A test rig capable of providing the specified flow rates and static pressures shall be used. Two identical units shall be tested in parallel. Annex A gives an example system.

6.6.2 Reagents

6.6.2.1 General

All reagents shall be of a recognised analytical grade and the water used to prepare reagent solutions shall conform to grade 2 in accordance with EN ISO 3696.

6.6.2.2 Calcium chloride

Dissolve $(65,6 \pm 0,1)$ g calcium chloride dihydrate ($\text{CaCl}_2 \cdot 2 \text{H}_2\text{O}$) in water and dilute to 1 l in a volumetric flask.

6.6.2.3 Magnesium sulfate

Dissolve $(38,0 \pm 0,1)$ g magnesium sulfate heptahydrate ($\text{MgSO}_4 \cdot 7 \text{H}_2\text{O}$) in water and dilute to 1 l in a volumetric flask.

6.6.2.4 Sodium hydrocarbonate

Dissolve $(67,2 \pm 0,1)$ g sodium hydrocarbonate (NaHCO_3) in water and dilute to 1 l in a volumetric flask.

6.6.2.5 Potassium nitrate

Dissolve $(6,52 \pm 0,01)$ g potassium nitrate (KNO_3) in water and dilute to 1 l in a volumetric flask.

6.6.2.6 Metals

Prepare each of the stock solutions listed in Table 3 separately. Weigh the salt into a 500 ml glass beaker, dissolve in 200 ml of water, acidify with 10 ml of concentrated nitric acid ($\rho(\text{HNO}_3) = 1,42 \text{ g/ml}$). Transfer into a 1 000 ml

volumetric flask, using a further 400 ml water to rinse the glass beaker. Then fill up to the mark with water. The stock solution can be stored for 6 months.

Table 3 — Preparation of metals stock solutions

Metal	Salt	Mass to be dissolved g
Pb	$\text{Pb}(\text{NO}_3)_2$	0,160
Al	$\text{Al}(\text{NO}_3)_3 \cdot 9 \text{H}_2\text{O}$	8,342
Cu	$\text{Cu}(\text{NO}_3)_2 \cdot 3 \text{H}_2\text{O}$	11,430

6.6.2.7 Taste and odour compounds

6.6.2.7.1 2,4,6-trichlorophenol stock solution

Solution containing 100 mg/l 2,4,6-trichlorophenol ($2,4,6\text{-Cl}_3\text{C}_6\text{H}_2\text{OH}$) in water.

6.6.2.7.2 2,4,6-trichlorophenol working solution

Dilute 5 ml of 2,4,6-trichlorophenol stock solution (6.6.2.7.1) to 100 ml with water in a volumetric flask. Prepare this solution immediately before use.

6.6.2.7.3 Geosmin stock solution

Solution containing 1 mg/l geosmin in water.

6.6.2.7.4 Geosmin working solution

Dilute 5 ml of geosmin stock solution (6.6.2.7.3) to 100 ml with water in a volumetric flask. Prepare this solution immediately before use.

6.6.3 Analytical methods

Water analyses shall be conducted using the following methods:

- conductivity : EN 27888
- pH : ISO 10523
- turbidity : EN ISO 7027

Organic chemicals dissolved in water shall be analysed using methods that meet the specification in Annex 3 of 98/83/EC A_1 [2] A_1 .

6.6.4 Test conditions

6.6.4.1 Test water specification

6.6.4.1.1 General test water

Mains supply water shall be used, adjusted as necessary to the following characteristics, except for metals (see 6.6.4.1.3.2):

— pH	:	7,5 ± 0,5
— temperature	:	(20 ± 5)°C
— free available chlorine	:	< 0,02 mg/l
— conductivity	:	from 300 µS/cm ² to 750 µS/cm ²
— turbidity	:	< 1 NTU

6.6.4.1.2 Organic chemical and odour/flavour challenge

- Add the organic chemical to be tested to the general test water (6.6.4.1.1) to achieve a concentration equal to 10 times the regulated value (see [A1](#) [2] [A1](#)).
- If the organic chemical does not have a regulated value, use a concentration 10 times the WHO Guideline value (see [A1](#) [3] [A1](#)).
- For the odour/flavour test, geosmin and 2,4,6-trichlorophenol shall be tested separately. Geosmin shall be spiked at a concentration of 0,15 µg/l and 2,4,6-trichlorophenol at 20 µg/l.

NOTE 1 Annex C gives guidance on selecting spiking concentrations for chemicals that do not have regulated or guideline values.

NOTE 2 The removal of several chemicals may be simultaneously tested using a mixture spiked into the test water, provided that there is no reaction that would invalidate the individual result.

NOTE 3 Presence of TOC in the water supply may adversely affect organic chemical reduction.

6.6.4.1.3 Inorganic chemical challenge

6.6.4.1.3.1 General

Two basic challenge water preparations are specified:

- To test metal reduction. Each metal element shall be tested at two pH levels.
- To test nitrate and carbonate hardness reduction.

For other inorganic chemicals, add the inorganic chemical to be tested to the general test water (6.5.4.1.1) to achieve a concentration equal to 10 times the regulated value (see [A1](#) [2] [A1](#)).

If the inorganic chemical does not have a regulated value, use a concentration 10 times the World Health Organization Guideline value (see [A1](#) [3] [A1](#)).

NOTE 1 Annex C gives guidance on selecting spiking concentrations for chemicals that do not have regulated or guideline values.

NOTE 2 The removal of several chemicals (but not metals) may be simultaneously tested using a mixture spiked into the test water, provided that there is no reaction that would invalidate the individual result.

6.6.4.1.3.2 Challenge water for metal reduction (except for lead pH 8,5)

To avoid interference between different metals in the challenge water, each element shall be tested separately. Mains supply water shall be used, adjusted as necessary to the characteristics given in Table 4:

Table 4 — Characteristics for challenge water for metal reduction

Characteristic	Low pH	High pH (except for lead)
pH	$6,5 \pm 0,25$	$8,5 \pm 0,25$
Hardness	(20 ± 10) mg/l as CaCO_3	(150 ± 50) mg/l as CaCO_3
Alkalinity	(20 ± 10) mg/l as CaCO_3	(175 ± 75) mg/l as CaCO_3
Temperature	(20 ± 3) °C	(20 ± 3) °C
Polyphosphate	< 0,5 mg/l as P	< 0,5 mg/l as P
Turbidity	< 1 NTU	< 1 NTU
Metal element challenge (tested individually)		
Pb	0,1 mg/l	See 6.6.4.1.3.3
Al	0,6 mg/l	0,6 mg/l
Cu	3 mg/l	3 mg/l

Add 1 ml of the respective metal stock solution (6.6.2.6) per litre of challenge water to achieve the specified concentration in the challenge water.

6.6.4.1.3.3 Challenge water for lead pH 8,5 testing

For lead reduction testing, freshly prepared, deionised reverse osmosis water shall be used and the hardness shall be adjusted to (150 ± 10) mg/l as CaCO_3 and the alkalinity to (100 ± 10) mg/l CaCO_3 by adding 2,5 ml of each stock solution (6.6.2.2, 6.6.2.3 and 6.6.2.4) per litre of challenge water. Adjust the pH to $8,5 \pm 0,25$ by adding sodium hydroxide ($c(\text{NaOH}) = 6$ mol/l) or concentrated hydrochloric acid ($\rho(\text{HCl}) = 1,18$ g/ml). Mix for 10 min, then add 1 ml of lead stock solution (6.6.2.6) per litre of challenge water. Stir for 1 h before use. During use, stir for at least 5 min every hour. Prepare fresh test water daily.

6.6.4.1.3.4 Challenge water for carbonate hardness and nitrate reduction

Spike the general test water (6.6.4.1.1) to achieve the following target concentrations:

- hardness : 300 mg/l as CaCO_3 . Add equal volumes of the calcium and magnesium stock solutions (6.6.2.2 and 6.6.2.3). Addition of 1 ml of each solution per litre of challenge water will increase hardness by 60 mg/l CaCO_3 .
- alkalinity : 200 mg/l as CaCO_3 . Addition of 1 ml of stock solution (6.6.2.4) per litre of challenge water will increase alkalinity by 40 mg/l CaCO_3 .
- nitrate : 200 mg/l as NO_3 . Addition of 1 ml of stock solution (6.6.2.5) per litre of challenge water will increase the nitrate concentration by 40 mg/l.

6.6.4.2 Test water pressure

The water pressure used for the test shall be not less than 410 kPa.

6.6.4.3 Ambient conditions

The ambient temperature throughout the test shall be $(20 \pm 5) ^\circ\text{C}$.

6.6.5 Procedure

- Install two identical systems into the test rig referred to in 6.5.1 in accordance with the manufacturer's instructions.
- Condition the systems in accordance with the manufacturer's instructions using the test water defined in 6.6.4.1.1.
- Start the flow of challenge water and regulate the flow to the maximum of working flow range by adjusting the control valve downstream of the filter unit.
- Set the timer on the solenoid valves to operate on a 50 % on 50 % off basis, with a cycle time of 60 min, 16 h/d with an 8 h overnight stagnation.
- Operate the system to the end of the filter rated capacity.

6.6.6 Sampling

- Collect the first influent challenge and product water samples starting during the "on" portion of the cycle after the passage of 10 unit volumes of the influent challenge.
- Sample the influent and effluent from each filter at 10 % increments between 10 % and 100 % of the rated capacity of the filter for the substance-specific organic chemical reduction.
- Note the temperature and flow rate of each product sample as it is taken.
- Take samples of influent and product water simultaneously.
- To verify compliance with the test water requirements (see 6.6.4.1), analyse the first and final influent sample for the specified parameters for each batch tank.

NOTE 1 Adequate precaution should be taken throughout the test to ensure that loss or degradation of the spiked chemical does not affect the result.

NOTE 2 Laboratories should satisfy themselves that the challenge water meets all of the required concentrations before testing is started. If it does not then the water composition should be adjusted until the required concentrations are met.

6.6.7 Acceptance criteria

To comply with this standard, the mean percent reduction efficiency of each substance-specific organic chemical by each test filter shall be not less than the claimed efficiency and shall be not less than the minimum specified in 5.5.3, 5.5.4 or 5.5.5 as appropriate for the claimed reduction rating and, furthermore, no single result shall be less than 90 % of the minimum specified in 5.5.3, 5.5.4 or 5.5.5.

6.6.8 Expression of results

For an example test result sheet, see Annex B.

7 Technical documents, marking, labelling and packaging

7.1 Technical documents

Active media filter units shall be accompanied by a technical product description with comprehensive instructions for installation, operation, maintenance and service.

Instructions for filters with replaceable filter cartridges shall provide the following information:

- complete list of components necessary for correct installation of the filter in accordance with relevant European Standards, clearly stating which components are supplied with and which are not supplied with the product for installation. The component list shall include recommendations for incorporating a pressure reducing valve where the supply pressure exceeds or might exceed the maximum rated pressure (see below). In addition requirements for backflow prevention in the country of sale shall be identified in the instructions (see 4.5);
- recommendations on siting of system for safe and effective operation;
- recommendations for orientation for ease and safety of maintenance;
- commissioning procedure;
- frequency of filter cartridge replacement;
- opening and draining of filter;
- removal and disposal of filter cartridge;
- correct and hygienic insertion of replacement filter cartridge;
- filter element preconditioning procedure;
- troubleshooting guide.

The instruction manual shall include a pressure drop chart up to 100 kPa.

Reference shall be made to possible requirement for installation of a pressure reducing/limiting valve in the event that the supply pressure might exceed the maximum pressure rating of the unit. The manufacturer or supplier shall provide instructions for the correct installation of a pressure reducing valve and shall draw attention to the possible flow reducing effects of such devices.

The instruction manual shall include the statement “The rated capacities quoted are those determined under defined test conditions. The actual in-service capacity may be higher or lower depending on the influent water quality, flow rate, influent water pressure and continuity of flow.”

If the system does not incorporate a flow regulation device, the instruction manual shall provide advice on the control of the flow rate through the filter if the supply pressure should exceed that necessary for the maximum of the manufacturer's specified working flow range.

Claims for filter rated capacity shall be based upon the lowest value determined for substance-specific rated capacity. Claims for the reduction of substances not specifically covered by the performance requirements of this **EN** 14898:2006+A1:2007 shall be clearly separated from claims made of conformity with this **EN** 14898:2006+A1:2007. Any such claims shall be based upon tests conducted according to the guidance in Annex C.

The instruction manual shall recommend that, to ensure adequate continuity of treated water quality, the cartridge shall be replaced after a specified time period from installation of the cartridge, irrespective of whether the volumetric capacity has been reached. This specified time period shall be clearly stated on the cartridge label and/or packaging.

7.2 Marking

The direction of flow of the water through the filter housing shall be permanently and clearly marked on the filter housing. It shall be visible after installation.

7.3 Labelling

7.3.1 Filter housing

A label shall be permanently fixed to the filter housing and be clearly legible in operation after the filter has been installed. It shall include, as a minimum, the following information:

- manufacturer's or supplier's or importer's name and contact details;
- size of connections;
- working flow range, in l/h, for a specified pressure drop, in kPa;
- maximum and minimum working pressures, in kPa;
- maximum and minimum water temperature, in °C;
- identification mark;
- filter type/designation (part number).

7.3.2 Filter cartridge

The filter cartridge packaging shall provide the following information:

- manufacturer's or supplier's name;
- type of cartridge;
- designation (part number);
- maximum differential pressure, in kPa;
- working flow range, in l/h;
- maximum A_1 water A_1 temperature, in °C;
- substance-specific rated capacity;
- filter rated capacity;
- frequency of filter cartridge replacement.

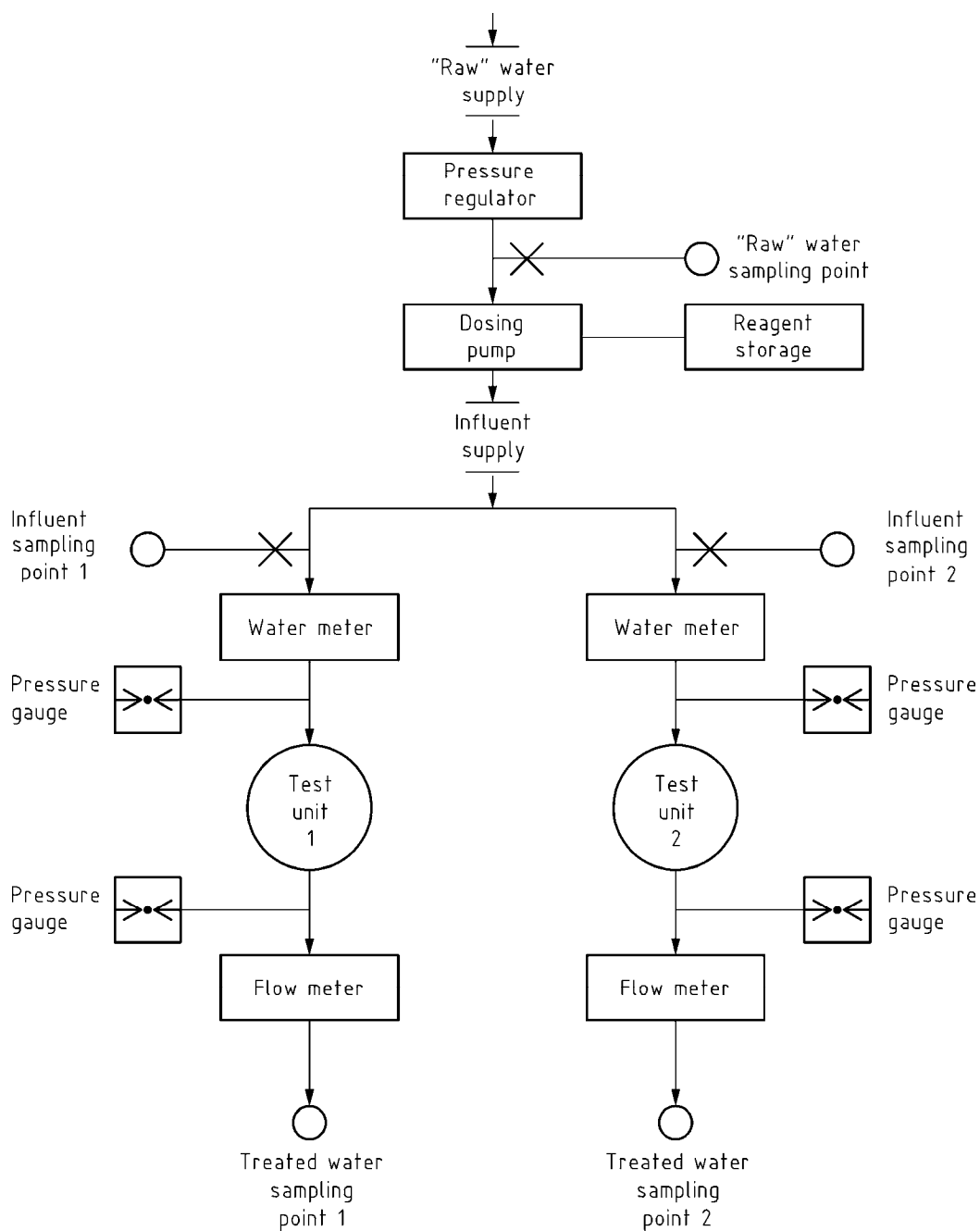
The filter cartridge label shall clearly specify the manufacturer, filter type and designation of the housing(s) for which the filter element meets the requirements of this standard.

7.4 Packaging

Replacement filter cartridges shall be adequately protected from mechanical damage during shipment. They shall also be individually, hygienically sealed to prevent contamination during shipment and storage.

Annex A (informative)

Example of test rig for substance reduction testing



Annex B (informative)

Example test report

Laboratory Name: Address: Technician:	Manufacturer Name: Address: Contact:
Test Type: Date:	Product Brand name: Identification: Serial No:

TEST WATER	Start	Final
pH		
Temperature °C		
Conductivity µS/cm ²		
Turbidity NTU		

Percent of Initial Capacity	Volume (Litres)	Influent Sample Number	Influent Substance Level (mg/l)	Effluent Sample Number	Effluent Substance Level (mg/l)	Effluent Temperature °C	Percent Reduction	Flow rate (l/min)
10								
20								
30								
40								
50								
60								
70								
80								
90								
100								

Concentrate Batch Analysis	Initial (mg/l)	Final (mg/l)
Batch 1		
Batch 2		
Batch 3		

Annex C (informative)

Substance-specific reduction claims

This standard covers the use of active media filters for additional treatment of water supplies that have already been treated to meet the requirements of the European Directive for drinking water quality (see [A1](#) [2] [A1](#)).

However, manufacturers and suppliers of equipment may wish to claim reduction of specific substances in order to enhance certain aesthetic parameters or effect protection against isolated or transient variations in water quality.

The removal of substances is assessed using challenge water spiked to contain 10 times the regulated value [A1](#) [2] [A1](#) or in the absence of a regulated value, the WHO Guideline value [A1](#) [3] [A1](#) (other than specific exceptions detailed in this standard). For a chemical that does not have either a regulated or a Guideline value, a concentration that does not result in any significant risk to the health of the consumer over a lifetime of exposure should be determined from toxicity data using the methods described by WHO for calculation of WHO Guideline values [A1](#) [4] [A1](#). This assessment should be made by a competent institute that is independent of the manufacturer of the filter. Testing should then be conducted using the chemical spiked at 10 times the calculated health-based concentration.

Annex D (normative)

Installation, operation and maintenance

D.1 Introduction

This annex defines essential information and instructions on the installation, operation, maintenance and repair of active media filters. It transposes the general requirements in EN 15161 into specific requirements for active media filters.

Correct operation and maintenance of the device is essential for successful and hygienic performance. Devices in compliance with this European Standard shall be provided with all necessary information and instructions on operation and maintenance appropriate to the device being supplied. The following information is stipulated as a minimum, it is not exhaustive and it is not intended to substitute for the supplier's instructions.

NOTE For the purposes of this European Standard the supplier is the organisation whose name is identified on the product being sold. The supplier may or may not be the manufacturer.

D.2 Installation requirements

D.2.1 Equipment selection

Selection of a device that is appropriate to the performance and operational expectations, and to the intended installation site, is essential. Information outlining the key installation and operation requirements shall be made available at the point of purchase, in the form of either brochures or specification sheets or clearly marked on the external product packaging. This information shall identify limitations on the location for installation in terms of dimensional requirements and environmental conditions (e.g. ambient temperature). The information shall offer guidance on frequency of periodic operation and maintenance along with any associated accessibility required. It shall also identify the water supply requirements (pressure limitations, pipe sizes) along with proximity requirements for other services which may be necessary such as availability of electric power, drainage facilities etc.

D.2.2 Installation

Installation instructions, provided with the device shall include a list of the components provided with the device along with a list clearly identifying any other components deemed necessary to complete a successful installation (e.g. pressure reducing valve). The characteristics of such additional equipment shall be clearly identified.

The instructions shall include a sequenced procedure outlining assembly of the components including connection to the water supply and to any other service(s) required. The instructions shall include definitive guidelines identifying the dimensional and orientational requirements essential to position the device and its ancillaries in order to provide adequate access for operation and maintenance at the chosen installation site.

In addition, the installation instructions shall include a checklist to ensure that the device is located:

- in a suitable location (e.g. clean, well ventilated, adequately illuminated and protected against pests, frost, physical damage, chemical damage) within the domestic water distribution system;
- remote or insulated from sources of heat (e.g. washing machines, dishwashers, boilers, cookers and hot water pipework);

- as close as possible to the existing distribution system and to other necessary services;
- avoiding or minimising dead-legs that can encourage stagnation.

NOTE Drinking water for cleaning purposes and appropriate waste disposal facilities should be available.

D.2.3 Labelling

The device as supplied shall be labelled, with a durable waterproof label mounted on, or close to, the device, with the information required in accordance with 7.3.1.

D.2.4 Commissioning

The instructions shall contain a procedure for putting the device into service including as a minimum:

- initial filling and pressurisation of the system;
- checking for leaks;
- flushing requirements (time and/or volume);
- setting-up , e.g. flow rate adjustment (in the absence of flow regulation);
- performance check (using control kit, if provided).

The instructions shall provide advice on checking performance and, where a control kit is provided, detailed instructions on the use of the kit and interpretation of the results.

D.2.5 Hand over

The instructions shall identify that, where commissioning is carried out by a third party, this third party shall, after checking the performance of the device, hand over to the owner all of the printed instructions on its use (e.g. testing procedure and frequency, actions to be taken dependant upon the testing results), along with the updated logbook and the control kit where provided for monitoring the device performance.

NOTE 1 Depending on the intended application of the active media filters, the control kit could include one or more of the following:

- free and total chlorine measurement;
- specific contaminant determination.

NOTE 2 In its simplest form, the logbook may be a single sheet (which may be adhesive backed to secure to the device) which permits, at the very least, a record of cartridge change dates.

D.3 Operation requirements

The instructions shall include procedures on checks to be made by the user during normal day to day operation for optimum performance of the device. The checklist shall include, as a minimum, instructions:

- to be alert to the treated water quality with respect to the treatment expectations (e.g. taste, odour, visible quality of the treated water);
- to carry out performance checks using the control kit if provided.

D.4 Maintenance requirements

In order to maintain optimum performance of the device, the instructions shall include procedures and checks to be made at specified time intervals, including instructions:

- to carry out the replacement procedure of the active media cartridge in accordance with the instructions (to include dismantling, cartridge disposal, cleaning, reassembly, preconditioning etc., as appropriate);
- to record on the logbook the date of the active media cartridge replacement;
- to inspect the disassembled system for signs of leakage or damage;
- to call for repair in the event that any defect or failure is noticed (e.g. taste, odour, colour in the treated water).

The instructions shall provide guidance on the hygiene precautions necessary for any maintenance operations that require dismantling of the system.

NOTE An example of good practice is as follows:

Hygiene. Maintenance operations that require dismantling the system, such that water contact parts are exposed, should be subject to careful, hygienic control in order to avoid contamination of the system. Preferably, disposable gloves should be used to avoid personal contamination of the system parts; any tools used that may come into contact with the wetted parts should be cleaned and disinfected in accordance with the instructions before use. The spent cartridge should be carefully disposed of and the replacement cartridge should remain sealed in its protective wrapping until the last practical moment.

Routine maintenance and timely replacement of consumable parts are essential to the satisfactory performance of the device. Failure to replace an exhausted or plugged cartridge can result in poor reduction efficiency for the claimed parameters or low flow.

Regular use is also important. Long periods of stagnation can give rise to off-taste in the treated water so, as with any drinking water supply, the system should be flushed before reuse, if it has been out of use for a period of several weeks or more.

D.5 Repair requirements

D.5.1 General

The instructions shall include advice stating that any corrective action carried out on the system that is not regarded as routine and, therefore, not described in the instructions, is to be performed only by a competent repair person. The instructions shall identify either contact details for approved repair engineers or alternatively provide a route (telephone, website) for contacting the supplier to obtain information on such service.

D.5.2 Repair documentation

The instructions shall contain a statement advising that a record of any repair intervention is kept within the logbook.

D.6 Troubleshooting

The instructions shall provide guidance on troubleshooting in the event that problems occur with the device.

An example of a troubleshooting guide is given in Table D.1.

Table D.1 — Troubleshooting guide (example)

Observation	Possible cause	Remedy
Low flow from the device	Plugged cartridge	Clean or replace the cartridge
	Low supply pressure	Check flow from other outlets
Taste or odour from treated water or contaminant test failure	Cartridge exhausted	Replace cartridge
	High influent contamination	Check incoming water supply
	Excessive flow rate through unit	Check flow rate
	Cartridge damaged or incorrectly assembled	Inspect cartridge and assembly for defects
	Excessive period of non use (stagnation)	Flush filter system for several minutes or replace cartridge
Water leakage from system	Housing insufficiently tightened	Tighten in accordance with instructions
	Faulty joint	Check O-rings and gasket for deformation or deterioration



Bibliography

- [1]  EN 15161, *Water conditioning equipment inside buildings — Installation, operation, maintenance and repair* 
- [2] 98/83/EC, Council Directive of 3 November 1998 on the quality of water intended for human consumption.
- [3] Guidelines for drinking-water quality Volume 1. Recommendations. Geneva, World Health Organization, (latest edition).
- [4] Guidelines for drinking-water quality Volume 2. Health criteria and other supporting information. Geneva, World Health Organization, (latest edition).