



JRC TECHNICAL REPORT

Review of standards related to materials in contact with drinking water

*In view of the implementation
of the Drinking Water
Directive (EU) 2020/2184*

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Abstract

This report presents an inventory of European and international standards related to the hygiene requirements on materials that come into contact with drinking water (DCM). These materials are relevant for Directive (EU) 2020/2184 on the quality of water intended for human consumption. The report is also listing technical committees of CEN and ISO that may deal with standardisation related to materials in contact with drinking water. It provides lists of documentary standards that are directly relevant to the characterisation of those materials, i.e. describing 'analytical methods' or 'migration test methods'. A search was also conducted beyond those applications by looking into product groups of the Construction Products Regulation (CPR) (EU) No 305/2011 and to other standards indirectly relevant to DCM that may contain useful information for the future establishment of the positive lists and accepted methodologies required by Directive (EU) 2020/2184. The inventory will serve as basis for a further gap analysis of analytical and migration methods for drinking water contact materials not yet covered by standards. This shall support in addition the establishment of possible standardisation mandates from the European Commission to CEN, as foreseen in the Directive.

1 Scope

The present document is a JRC deliverable in the frame of the Administrative Arrangement (AA) 35402-2019 between DG ENV and the JRC. The purpose of this AA is to provide scientific and technical support to DG ENV in the evaluation and surveillance of drinking water contact materials (DCMs), as defined in Directive (EU) 2020/2184 on the quality of the water intended for human consumption ('Drinking Water Directive' - DWD) (EU, 2020).

The objective of this document is to provide an inventory, as complete as possible, of existing documentary standards of the European Standardisation Organisation (CEN) and the International Organization for Standardization (ISO) relevant for testing the compliance of DCMs (intended to be) placed on the EU market. Testing the chemical safety of DCMs consists of two methodological parts; i) the migration or release of chemicals from the given material into drinking water and ii) the analysis of the substance(s) in the migration solution. The search was conducted beyond the 'analytical methods' and 'migration test methods' areas directly relevant to DCMs. It looked also into product groups under the Construction Products Regulation (CPR) (EU) No 305/2011 and other standards seemingly unrelated to DCM, but which may contain useful information for the future establishment of positive lists and accepted analytical methods foreseen by the Directive.

This document should serve as a stepping stone for the further gap analysis and the subsequent preparation of standardisation mandates from the European Commission (EC) to CEN.

2 Background

The DWD, first adopted in 1998, has regulated the quality of drinking water delivered across Europe for many years. Due to new developments and initiatives the implementation of the DWD faced challenges. To evaluate these challenges, the European Commission launched in 2015 a REFIT¹ review of the Directive². This was also one of the follow-up actions to the first successful European Citizens' Initiative (ECI) "Right2Water"³.

One of the primary objectives of the review process was to ensure a high level of protection of the environment and of human health from the adverse effects of contaminated drinking water.

The following DWD recast proposal of 2017 aimed to update water quality standards, to introduce a risk-based approach for monitoring, to improve the information on water quality and water services provided to consumers and to improve access to water. In addition, the proposal addressed for the first time the "minimum hygiene requirements" for DCMs in a dedicated article.

The recast DWD was adopted in 2020 as Directive (EU) 2020/2184 (EU, 2020) and entered into force on 12 January 2021. Its Article 4 (General obligations) states that "[...] *water intended for human consumption shall be wholesome and clean if [...] (a) that water is free from any micro-organisms and parasites and from any substances which, in numbers or concentrations, constitute a potential danger to human health; (b) that water meets the minimum requirements set out in Parts A, B and D Annex I; (c) Member States have taken all other measures necessary to comply with Articles 5 to 14,*" including thus the new Article 11 on "*Minimum hygiene requirements for materials that come into contact with water intended for human consumption*".

As specified in Article 11, "[...] Member States shall ensure that materials that are intended to be used in new installations or, in the case of repair works or reconstruction, in existing installations for abstraction, treatment or distribution of water intended for human consumption and that come into contact with such water do not: (a) directly or indirectly compromise human health protection [...]; (b) adversely affect the colour, odour or taste of the water; (c) enhance microbial growth; (d) leach contaminants into drinking water at levels that are higher than necessary in view of the intended purpose of the material".

By early 2025, the Commission shall adopt positive lists of "starting substances, compositions or constituents for each group of materials, namely organic, cementitious, metallic, enamels and ceramic or other inorganic materials, which are authorised for use in the manufacture of materials or products in contact with water intended for human consumption, including, where appropriate, conditions for their use and migration limits, which are to be determined on the basis of the methodologies adopted pursuant to point (a) of this subparagraph, and taking into account paragraphs 3 and 4 [...]" (Art. 11(2)(b)).

Importantly, the list of starting substances for organic materials shall take into account the list established by Regulation (EU) No 10/2011⁴ on plastic materials and articles intended to come into contact with food (EU, 2011a). However, this Regulation includes only substances for the manufacturing of plastics and not for rubber or organic coatings.

Article 11(2)(c) specifies that the implementing acts adopted by the Commission shall establish "by 12 January 2024, procedures and methods for testing and accepting final materials as used in a product made from materials or combinations of starting substances, compositions or constituents on the European positive lists, including: [...] (ii) methods for testing the effects on water quality, having regard to any relevant European standards".

¹ Regulatory Fitness and Performance programme

² Adopted on 1.12.2016 as SWD(2016) 428 final

³ Communication from the Commission on the European Citizens' Initiative "Water and sanitation are a human right! Water is a public good, not a commodity!" COM/2014/0177 final

⁴ Art. 11(3) actually refers to "Article 5 of Regulation (EC) No 1935/2004" (EC, 2004), later complemented by this Regulation

Article 11(4) states "[...] The Commission shall ensure that any relevant acts, or standardisation mandates, which it adopts pursuant to other Union legislation are consistent with this Directive", and, according to Art. 11(10), "[...] The Commission shall request one or several European standardisation organisations to draft a European standard for uniform testing and assessment of products in contact with water intended for human consumption [...]".

Hence, as it can be seen from the extracts above, a review (or 'mapping') of existing applicable European and international standards to DCMs and their constituents is needed and is the subject of this report. For clarity, 'testing' the chemical safety of DCMs consists of two methodological parts; i) the migration or release of chemicals from the given material into drinking water and ii) the analysis of the substance(s) in the migration solution..

3 Available migration test and analytical methods for compliance checking

In order to verify compliance of materials intended to come in contact with drinking water with the Directive, migration test methods and analytical methods need to be available. In the absence of those, existing methods for food contact materials (FCMs), in particular for organic materials, shall be considered (Art. 11.(3)).

The methods need to be *harmonised* where necessary for the comparability of test results across laboratories. A large part of such a harmonisation of methods is taking place in the technical committees (TCs) of CEN and ISO.

As mentioned in the previous section, testing the chemical safety of DCMs consists of two methodological parts; i) the migration or release of chemicals from the given material into drinking water and ii) the analysis of the substance(s) in the migration solution. The first part relies on 'migration test methods' (see par. 3.2) and the second on 'analytical methods' (see par. 3.1). General parameters, such as organoleptic characteristics (odour, taste, colour and turbidity), can also be determined in the migration solution. The safety of DCMs does not only cover the migration or release of chemicals into drinking water, but also issues such as microbial safety in the frame of biofilm formation.

Furthermore, DCMs should be safe with respect to other aspects than health. Harmonised product standards define these non-health related aspects. CEN standards may contain an "Annex Z", which is dedicated to reference to EU legislation. It further specifies the requirements for a DCM to be used as e.g. construction product (see par. 3.6).

As stated in Art. 11(11), products intended to come into contact with drinking water shall be marked conspicuously, clearly legibly and indelibly, following an established harmonised specification, yet to be adopted by the Commission as delegated act.

Finally, the initiative of the 'four Members States' (4MSI)⁵ is mentioned in the following paragraphs to indicate when existing standards have been considered by the collaborative group in its common approach.

3.1 Analytical methods

CEN/TC 230 on water analysis and ISO/TC 147 on water quality standardise terminology, sampling, measurement and reporting, but do not set limits.

Annex 1 of this report shows that all the parameters, e.g. substances, mentioned in Annexes I and II of the recast Directive are covered by a suitable standard, except for acrylamide, total PFAS, i.e. the totality of per- and polyfluoroalkyl substances, and the sum of PFAS, i.e. the sum of per- and polyfluoroalkyl substances considered a concern as regards water intended for human consumption listed in point 3 of Part B of Annex III of the Directive. The standard ISO 21675:2019 on the determination of perfluoroalkyl and polyfluoroalkyl substances (PFAS) in water by a method using solid-phase extraction and liquid chromatography-tandem mass spectrometry (LC-MS/MS) covers 30 specific PFAS and the scope could be extended. This standard does not cover 4 out of the 20 PFAS listed in point 3 of Part B of Annex III of the Directive. In addition it still has to be verified that the PFAS covered by the standard are all relevant for drinking water. According to Article 13(7) of the DWD, technical guidelines for monitoring of PFAS-total and sum of PFAS have to be established by 12 January 2024.

⁵ <https://www.umweltbundesamt.de/en/topics/water/drinking-water/distributing-drinking-water/approval-harmonization-4ms-initiative#undefined>

Table 1 shows the parameters that may originate from migration or release from DCM, their parametric values, i.e. limits, in drinking water, in Annex I of the recast Directive 2020/2184 and their acceptable uncertainty of measurement, expressed as percentage of each parametric value, according to Table 1 of Part B of Annex III.

Table 1 Chemical parameters in Annex I of the DWD relevant for DCM and their parametric values.

| Parameter | Parametric Value | Unit | Uncertainty of measurement (%)[#] |
|-----------------------|-------------------------|-------------|---|
| acrylamide | 0.10 | µg/l | 30 |
| aluminium | 200 | µg/l | 25 |
| antimony | 10 | µg/l | 40 |
| arsenic | 10 | µg/l | 30 |
| benzo(a)pyrene | 0.010 | µg/l | 50 |
| bisphenol A | 2.5 | µg/l | 50 |
| cadmium | 5.0 | µg/l | 25 |
| chromium | 25 (50 [*]) | µg/l | 30 |
| copper | 2.0 | mg/l | 25 |
| epichlorohydrin | 0.10 | µg/l | 30 |
| iron | 200 | µg/l | 30 |
| lead | 5.0 (10 [*]) | µg/l | 30 |
| nickel | 20 | µg/l | 25 |
| manganese | 50 | µg/l | 30 |
| PAH [®] | 0.10 | µg/l | 40 |
| PFAS-Total | 0.50 | µg/l | 50 |
| sum of PFAS | 0.10 | µg/l | 50 |
| selenium | 20 | µg/l | 40 |
| trihalomethanes Total | 100 | µg/l | 40 |
| vinyl chloride | 0.50 | µg/l | 50 |

* until 12/01/2036; [®] sum of concentrations of benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene, and indeno(1,2,3-cd)pyrene; [#] (k=2).

The future gap analysis based on the availability of national DCM positive lists for classes of materials (organic, cementitious, ...) and the composition list for metallic materials should reveal the estimated number of analytical methods needed for the proper compliance checking of the migration or release of specific substances from all those DCMs. Analytical methods developed under the FCM legislation should be evaluated for their applicability for drinking water and should be included in the gap analysis.

There is at least one documentary standard available to determine **organic substances** that may migrate into water (EN 15768:2015 “Influence of materials on water intended for human consumption - GC-MS identification of water leachable organic substances”). The scope of this CEN standard method is detecting and identifying organic chemicals that are suitable for GC-MS analysis using a specified instrumental configuration. The standard provides a method for only semi-quantifying the concentrations of the organic substances detected and is therefore not sufficient to describe the reliable quantification of the selected substances.

The 4MSI approach proposes to analyse also the migration in water of the following parameters:

- Trihalomethanes by

- ISO 17943:2016 (Water quality – determination of volatile organic compounds in water – method using headspace solid-phase microextraction (HS-SPME) followed by gas chromatography-mass spectrometry (GC-MS)): it is a multi-analyte method for drinking, ground, surface and treated waste water. It includes the trihalomethanes and the applicable range is 0.01-100 µg/L.
- EN ISO 10301:1997 (Water Quality – determination of highly volatile halogenated hydrocarbons – gas-chromatographic methods). It standardises two methods. It prescribes how to extract the water with an organic solvent and analyse the extract by gas-chromatography with an electron capture detector and a limit of quantification of 0.2-5 µ/L, depending of the substance. the second method uses static headspace and gas-chromatography with an electron capture detector.
- EN ISO 15680:2003 (Water quality – Gas-chromatographic determination of a number of monocyclic aromatic hydrocarbons, naphthalene and several chlorinated compounds using purge-and-trap and thermal desorption). It uses the purge and trap technique, where the trap can be either a packed adsorbent trap, preferably combined with a cold trap, or only a capillary cold-trap. The analysis is performed by gas chromatography and mass spectrometry.
- Elements by EN ISO 17294-2:2016 (Water quality – application of inductively coupled plasma mass spectrometry (ICP-MS) – part 2: determination of selected elements including uranium isotopes). The limit of quantification is in the range of 0.002-1.0 µg/L.
- Mercury (Hg) by EN ISO 17852:2006 (Water quality – determination of mercury – method using atomic fluorescence spectrometry). EN 1483 and EN 12338 are also mentioned by the 4MSI, but were not found on the CEN or ISO website.
- Total organic carbon (TOC) by standard EN 1484:1997 (Water analysis – guidelines for the determination of total organic carbon (TOC and dissolved organic carbon (DOC)). The scope of this standard does not include drinking water and the working range of this standard is 0.3-1000 mg/L.
- Odour and flavour by EN 1622:2006 (Water quality - Determination of the threshold odour number (TON) and threshold flavour number (TFN)), which specifies quantitative methods for determining the TON and TFN of waters.
- Colour by EN 7887:2011 (Water quality – Examination and determination of colour), which specifies four different methods for the examination of colour.
- Turbidity by EN 7027-1:2016 (Water quality – determination of turbidity – part 1: quantitative methods), which specifies two quantitative methods for the determination of turbidity, using turbidimeters or nephelometers.

The 4MSI put forward the following three methods for the determination of the composition of copper and copper alloys.

EN 15063-2:2006, which specifies a routine method for analysing copper and copper alloys by wavelength dispersive X-ray fluorescence (XRF) spectrometry. The method is applicable to all elements detectable by XRF (impurities, minor and main constituents) and is able to analyse either unwrought, including chill-cast, or wrought products. An appropriately cleaned test specimen is irradiated by an X-ray beam of high energy. The secondary X-rays produced are dispersed by means of crystals and the intensities are measured by detectors, usually counters at selected characteristics wavelengths. The concentration of the elements is determined by relating the measured intensities from the sample to analytical curves prepared from certified reference materials (CRMs) or reference materials (RMs). Fixed channels or a sequential system are used to provide simultaneous or sequential determinations of element concentrations.

EN 15063-1:2014 provides guidance on the concepts and procedures for the calibration and analysis of copper and copper alloys by wavelength dispersive XRF spectrometry.

EN 15079:2015 specifies a routine method for the analysis of copper and copper alloys by spark optical emission spectrometry (S-OES). The method is applicable to all elements, except copper, commonly present in copper and copper alloys as impurities or minor or main constituents, which can be determined by S-OES. It is based on the measurement of the intensity of the radiation of a selected wavelength which is characteristic of each element, generated by a spark resulting from the application of an electrical discharge between the sample, as one electrode, and an inert counter-electrode. Concentrations of elements are determined by relating the measured intensities of test samples to calibration curves prepared from RMs.

EN 15605:2010 specifies six inductively coupled plasma optical emission spectrometry (ICP-OES) methods (A to F) for the determination of alloying elements and impurities in copper and copper alloys in the form of unwrought, wrought and cast products. The precision criteria concerning this method do not reach the suitable level, for all the elements specified, i.e. zinc and phosphorus. These methods are applicable to specified elements and composition ranges. A test portion is dissolved using hydrochloric and nitric acids. After suitable dilution and addition of an internal reference element, the solution is nebulised into an ICP-OES spectrometer and the intensity of the emitted light, including that of the internal reference element, is measured.

3.2 Migration/release test methods

CEN/TC 164 on water supply establishes standards for the installation and performance requirements of systems used in water supply from the production facility to the tap, including the treatment of the water and taps attached or unattached to a sanitary appliance with the view of maintaining the quality of water as stated in the DWD. CEN/TC 164 has also published standardised migration and release tests for DCM. These standards are mentioned in the 4MSI approach.

EN 13052-1:2001 (Influence of materials on water intended for human consumption - **Organic materials** - Determination of **colour** and **turbidity** of water in **pipng systems** - Part 1: Test method) specifies a migration method for determining the colour and turbidity of test waters, after their contact with the organic materials used in pipes, fittings, ancillaries, including their coatings and joints. Following a defined pre-treatment procedure of the product by flushing, stagnation with or without disinfection and prewashing, the surface of the test pieces is brought into contact with test water. The migration test is carried out three times on the same test piece under specified conditions as follows. The test pieces are put in contact with chlorinated or unchlorinated water for 72 h at 23 °C, or are put in contact with unchlorinated water for 24 h at a specified temperature in the range of 60 °C to 85 °C. After this contact, the migration water is assessed for colour and turbidity.

EN 1420:2016 (Influence of **organic materials** on water intended for human consumption - Determination of **odour** and **flavour** assessment of water in **pipng systems**) specifies a test for obtaining a migration water to determine its odour and flavour after being in contact with pipes, fittings, ancillaries and coatings made from organic materials intended to come in contact with drinking water. Following a defined pre-treatment procedure of flushing, stagnation with test water and then prewashing, the surface of the test pieces is brought into contact with the test water. The test pieces are put in contact with chlorinated or unchlorinated test water for 72 h at 23 °C (cold water test), or put in contact with unchlorinated test water for 24 h at a temperature of 60 °C (warm water test) or 85 °C (hot water test). If a warm or hot water test is required, a cold water test shall be performed in addition. After the contact with the test piece, the migration water is assessed by a test panel to determine the parameters odour and flavour.

EN 14395-1:2004 (Influence of **organic materials** on water intended for human consumption - Organoleptic assessment of water in **storage systems** - Part 1: Test method) specifies a migration

test method for determining the organoleptic properties (**odour, flavour, colour and turbidity**) of test water after contact with tanks, reservoirs, ancillaries and their coatings, both for factory-made and site-applied products made from organic materials used in storage systems. Products containing cementitious materials are not covered. Following a defined pre-treatment including flushing, stagnation with or without disinfection and prewashing, the surface of the test pieces is brought into contact with test water. The migration test is carried out three times on the same test piece under specified conditions as follows. Test pieces are put in contact with chlorinated and unchlorinated water for 72 h at 23 °C, or put in contact with unchlorinated water for 24 h at a specified temperature in the range of 60 °C to 85 °C. After this contact, the migration water is assessed for odour, flavour, colour and turbidity.

EN 14718:2014 (Influence of **organic materials** on water intended for human consumption - Determination of the **chlorine demand** - Test method) specifies a test method for determining the chlorine demand of organic materials intended for use in contact with drinking water. This standard is applicable to factory-made and site-applied products used for the distribution, transport and storage of drinking water. It does not cover the application of high levels of chlorine to disinfect products when they are put into service. Initially test pieces are preconditioned by washing and rinsing procedures. Test pieces are then completely filled with or immersed in test water. This filling or immersion procedure is carried out three times on the same test pieces under specified conditions. After each contact period the contact water is immediately analysed to determine the residual content of free chlorine. Blank tests without test pieces are undertaken with the same test water to obtain blank water results. The chlorine demand for disinfecting (i.e. oxidising) the material/water interface during its use is based on the difference between the free chlorine content of the contact water and that of the blank water.

EN 12873-1:2014 (Influence of materials on water intended for human consumption - Influence due to **migration** - Part 1: Test method for **factory-made products** made from or incorporating **organic or glassy** (porcelain/vitreous enamel) **materials**) specifies a test to determine the migration of substances from factory-made or factory-applied products (plastics, rubber and glassy (porcelain/vitreous enamel) materials) for use in contact with drinking water. Each test piece is pre-treated by stagnation contact and prewashing. After that, the surface of the test piece is brought at least three times into contact with test water (chlorinated or chlorine-free). For products intended to come into contact with cold water the test conditions are 72 h at (23 ± 2) °C, whereas for warm water and hot water the test conditions are 24 h at (60 ± 2) °C and (85 ± 2) °C, respectively. The specific migration in the first three migration periods is determined by the analysis of the required substances according to their relevant standards or validated methods.

EN 12873-2:2005 (Influence of materials on water intended for human consumption - Influence due to **migration** - Part 2: Test method for **non-metallic and non-cementitious site-applied materials**) specifies a test method to determine the migration of substances from non-metallic and non-cementitious site-applied materials for use in contact with drinking water. It is applicable to site-applied materials intended to be used under various conditions for the **transport and storage** of drinking water. It covers the extraction of substances by water from these materials after their application on site. The test method is applicable to materials for which the physical or chemical properties are altered during or after on-site application, such as coatings, paints, and adhesives. In addition, some site-applied materials that do not change in such a manner, e.g. greases or lubricants, are also included. Test pieces are taken on site or prepared under specific conditions that are intended to simulate site application, taking into account the manufacturer's written instructions. Each test piece is subjected to pre-treatment by stagnation and prewashing. The surface of the test piece is brought into contact with the test water (chlorinated or chlorine-free) during at least three sequential migration periods. For products intended to come into contact with cold water the test conditions are 72 h at 23 °C for cold water, whereas the test conditions for warm water and hot water are 24 h at (60 ± 2) °C and (85 ± 2) °C, respectively. The specific

migration in the first three migration periods is determined by the analysis of the required substances according to their relevant standards or validated methods.

EN 12873-3:2019 (Influence of materials on water intended for human consumption - Influence due to migration - Part 3: Test method for **ion exchange and adsorbent resins**) specifies a test method to determine the **migration** of substances from ion exchange, adsorbent or hybrid resin materials for use in contact with drinking water. This standard is applicable to resins of the following types:

- ✓ ..Ion exchange resins used to modify the composition of water (e.g. softening by removal of calcium ions). They can be in either an anionic or cationic state;
- ✓ ..Adsorbent resins used to lower the concentration of undesirable substances (usually organic pollutants) from water. They are used in a neutral state;
- ✓ ..Hybrid adsorbents used to lower the concentration of undesirable substances (specific inorganic or organic pollutants) from water. They can be in either an anionic, cationic or neutral state. They are made from organic polymer-based ion exchange resins or adsorbent resins with an incorporated inorganic (e.g. iron hydroxide) or second organic phase.

If relevant, the test sample is subjected to a pre-treatment according to the manufacturer's instructions. The test sample is then brought into contact with the test water during a static/dynamic procedure carried out at (23 ± 2) °C. Test water samples are collected for analysis after the contact with the resin.

EN 12873-4:2006 (Influence of materials on water intended for human consumption - Influence due to **migration** - Part 4: Test method for **water treatment membranes**) describes a test method for the laboratory evaluation of possible adverse effects of water treatment membranes on the drinking water quality. It is applicable to microfiltration, ultrafiltration, nanofiltration, reverse osmosis and electrodialysis modules for use in the treatment of public water supplies and of water inside buildings. An evaluation of the efficiency of the membrane filter in removing contaminants from the treated water is not included. The principle of the method is that water of specified quality is run through a membrane module under specified operating conditions representing as much as possible the actual conditions of use. The method comprises several steps including flushing, operation with and without recycling and cleaning and/or disinfection. The last step depends on the manufacturer's recommendations. The purpose of the recycling phase is to concentrate the potential contaminants migrating from the test sample. Samples of the concentrates and the single-pass extracts are taken for analysis. The operating test temperature is maintained at the highest temperature approved by the manufacturer. In the absence of a recommended temperature it is (25 ± 5) °C.

EN 14944-1:2006 (Influence of **cementitious products** on water intended for human consumption - Test methods - Part 1: Influence of **factory-made** cementitious products on **organoleptic** parameters) specifies a test method to determine the influence of factory-made cementitious products on the odour, flavour, colour and turbidity of test water after its contact with the products. This standard is applicable to factory-made cementitious products, such as cement mortar linings of metallic pipes, tanks, concrete pipes, etc. These are intended to be used for the transport and storage of drinking water. Each test piece is subjected to a preconditioning procedure where the surface is brought into contact with preconditioning water (chlorinated or chlorine-free) during five sequential periods: three periods of 24 h, 1 period of 72 h and a final period of 24 h. The preconditioned test piece is then brought into contact with test water (chlorinated or chlorine-free) during three sequential migration tests. For products intended to come into contact with cold water the test conditions are 72 h at (23 ± 2) °C, whereas they are for warm water 24 h at a specified temperature. After each contact period, each migration water is assessed for odour, flavour, colour and turbidity.

EN 14944-3:2007 (Influence of **cementitious products** on water intended for human consumption - Test methods - Part 3: **Migration** of substances from **factory-made** cementitious products) specifies a test method to determine the migration of substances from factory made cementitious products. This standard is applicable to factory made cementitious products, e.g. cement mortar linings to metallic pipes, tanks, concrete pipes etc., intended to be used for the transport and storage of water intended for human consumption. Each test piece is subjected to a specified preconditioning procedure where the surface is brought into contact with preconditioning water (chlorinated or chlorine-free) during five sequential periods: three periods of 24 h, 1 period of 72 h and a final period of 24 h. The preconditioned test piece is then put in contact with test water, chlorinated or chlorine-free, during three sequential migration periods. For products intended to come into contact with cold water the test conditions are 72 h at (23 ± 2) °C, whereas for warm and hot water they are 24 h at a specified temperature. After each contact period, each migration water is assessed for migration of the selected substances.

EN 15664-1:2008+A1:2013 (Influence of **metallic** materials on water intended for human consumption - Dynamic rig test for assessment of metal **release** - Part 1: **Design and operation**) specifies a test method to determine the release of metals from metallic materials used in construction products intended to come into contact with drinking water. The test can be used for three purposes:

- a) ..To assess a metallic material as reference material for a category of metallic materials, using the results of several investigations in different waters covering a broad range of water compositions;
- b) ..To assess a metallic material for approval by way of comparative testing;
- c)...To obtain data on the interaction of a metallic material with local water.

Test pieces/pipes of a metallic material of defined geometry and given surface characteristics are installed in a test rig which is operated for a period of time under controlled conditions of water quality, temperature and flow regime. Water samples are taken throughout the whole of the test, at specified operation periods and after specified stagnation times and are analysed for the concentrations of relevant metals.

EN 15664-2:2010 (Influence of **metallic** materials on water intended for human consumption - Dynamic rig test for assessment of metal **release** - Part 2: **Test waters**) defines the requirements for test waters used in the dynamic test rig defined in EN 15664-1 above.

EN 16058:2012 (Influence of **metallic** materials on water intended for human consumption - Dynamic rig test for assessment of **surface coatings with nickel layers** - Long-term test method) specifies a procedure to determine the release of nickel from nickel layers or a coating containing nickel on inner surfaces of products. Representative samples of endpoint and inline devices to be tested are installed in a test rig operated for 26 weeks under controlled conditions of water quality, temperature and flow regime. Water samples are taken throughout the period of the test, at specified operation periods and after 4 h stagnation time and are analysed for the nickel concentration. The test items shall be representative of the product. If the same product comes from several manufacturing (plating) operations, then samples of each plant shall be tested.

3.3 Migration modelling

CEN/TC 164 on water supply has also published a technical report on modelling migration from organic materials. This report is mentioned in the 4MSI approach.

CEN/TR 16364:2012 (Influence of materials on water intended for human consumption - Influence due to migration - Prediction of **migration** from **organic materials** using **mathematical modelling**) describes a procedure, based on a diffusion model and partitioning, to estimate the specific migration of substances from organic materials into drinking water. The modelling approach

is applicable to specified organic materials. It is claimed that the diffusion modelling approach could be also applicable to other organic materials. However, polymer-specific characterisation data are still missing. Only organic substances with well-defined molecular weight or mixtures with well-defined ranges of molecular weights are suitable for the diffusion modelling approach. Substances applied externally to a product made of an organic material, e.g. antistatic agents and lubricants, but also electrolytes, salts, oxides and metals are excluded from the diffusion modelling approach.

The diffusion modelling approach could be applicable to organic materials shaped like a pipe or a sheet, where data, such as material thickness, is readily measurable and the surface area can be calculated. More complicated product shapes, such as fittings, require further assumptions to be made. It may not be possible to model the effects of test water which is chemically reactive, like chlorinated test water, because migrating substances may react with substances having different chemical properties. It has to be checked, if this migration model has been validated and whether the concepts of the model are in line with the protection level for DCM as outlined in the DWD.

3.4 Standards for specific materials

CEN/TC 164 on water supply has also published standardised methods for requirements of metallic materials concerning the passive behaviour of stainless steel and residual lead on a metallic surface. These standards are mentioned in the 4MSI approach.

EN 16056:2012 (Influence of metallic materials on water intended for human consumption - Method to evaluate the **passive behaviour of stainless steels**) specifies a procedure to evaluate the passive behaviour of stainless steels used in DCMs. The passive state of stainless steels prevents the release of relevant amounts of metals into drinking water. This test method is used to verify whether a stainless steel is passive under conditions seen in drinking water.

EN 16057:2012 (Influence of metallic materials on water intended for human consumption - Determination of **residual surface lead** (Pb) - Extraction method) describes a test method to determine the amount of lead on the surface of a test specimen made from **lead-containing copper alloys**. The lead film on the surface of a test specimen is dissolved by using a defined test solution. This procedure is repeated and each extract is analysed for lead. The total mass of the surface lead is calculated from the sum of the lead removed. The method is sensitive to the concentration and storage temperature of the acids in the test solution and the degree of shaking during the procedure. The effectiveness of the method is therefore checked using control samples.

3.5 Enhancement of microbial growth

EN 16421:2014 (Influence of materials on water for human consumption - Enhancement of microbial growth (EMG)) specifies **three methods** for determining the ability of **non-metallic materials** to enhance the growth of microorganisms. The standard allows for testing a single material or a product in which only one material is in contact with drinking water. It is unsuitable for assembled products where more than one material is in contact with drinking water. The results of the three methods are not directly comparable, as they are not measuring the same parameter (measurand).

The first test method measures an estimate of the biomass production potential by quantifying adenosine triphosphate (ATP). Representative samples of the material to be tested are incubated in appropriately amended drinking water and inoculated with a mixture of naturally occurring microorganisms derived from a surface source of water. The test pieces are incubated at a surface area to volume ratio of 0.16 cm^{-1} for 16 weeks. This ratio is kept constant adjusting the volume of water in the test containers when a test piece is removed for biomass measurement. The test water is replaced every 7 days. The formation of biomass on the test piece and in the water is determined

by ATP quantification after 56, 84 and 112 days of incubation. The amount of ATP is used as a proxy measure for the amount of active biomass. The biomass associated with a defined surface area of the test piece is calculated from the amounts of attached and suspended biomass. Each test is validated by the satisfactory performance of the positive and negative controls under equivalent conditions.

The second method is the biofilm volume test. Test pieces are cleaned with disinfectant, rinsed with drinking water and exposed to slowly flowing test water in a test container for a defined period of time. Subsequently, test pieces are removed, the biofilm is harvested by scraping and its volume is measured quantitatively after centrifugation. After harvesting, test pieces are washed with test water and are placed once again in the test container for another period.

The third method measures the mean dissolved oxygen depletion. Drinking water in contact with a test item is inoculated with a mixture of naturally occurring aquatic microorganisms. The overall activity of the microbial population is indirectly estimated by the measurement of the mean dissolved oxygen depletion in the test system against a control sample. A validation of the results is achieved by the assessment of reference materials tested in parallel with the test item.

EN 16421:2014 is mentioned in the 4MSI approach.

3.6 Product groups and standards

The establishment of general standards regarding requirements for products used in the water supply system (from the production facility to the domestic tap) is in the scope of CEN/TC 164. However, several products are also covered by other TCs targeting the harmonisation of safety aspects under various EU legislations. A list of products potentially used in drinking water distribution systems and their respective CEN and/or ISO TCs has been composed from the websites of the respective standardisation organisations and is given here:

- Adhesives (CEN/TC 193)
- Aggregates (CEN/TC 154)
- Agglomerated stone (CEN/TC JWG 229/246)
- Aluminium and aluminium alloys (CEN/TC 132)
- Boilers and pressure vessels (ISO/TC 11)
- Building valves (CEN/TC 164)
- Cast iron pipes, fittings and their joints (CEN/TC 203)
- Cast irons and pig irons (ISO/TC 25)
- Cement (CEN/TC 51)
- Cement and lime (ISO/TC 74)
- Products in fibre reinforced cement (ISO/TC 77)
- Concrete (= cement + aggregates) (CEN/TC 51 + TC104)
- Concrete, reinforced concrete and pre-stressed concrete (ISO/TC 71)
- Construction Products - Assessment of release of dangerous substances (CEN/TC 351)
- Copper and copper alloys (CEN/TC 133, ISO/TC 26)
- Corrosion of metals and alloys (ISO/TC 156)
- Devices to prevent pollution by backflow of potable water (CEN/TC 164)

- Domestic appliances used for water treatment not connected to water supply (CEN/TC 426)
- Elastomeric seals for joints in pipework and pipelines (CEN/TC 208)
- Ferroalloys (ISO/TC 132)
- Ferrous metal pipes and metallic fittings (ISO/TC 5)
- Fibre-cement pipelines (CEN/TC 164)
- Fibre-cement products (CEN/TC 164)
- Fine ceramics (ISO/TC 206)
- Flanges and their joints (CEN/TC 74)
- Flexible hose assemblies (CEN/TC 164)
- Gas fired central heating boilers (CEN/TC 109)
- Gas fired domestic appliances producing hot water (CEN/TC 109)
- Gas-fired water heaters (CEN/TC 48)
- GRP tanks and vessels (CEN/TC 210)
- Heating boilers (CEN/TC 57)
- Inlet valves for flushing cisterns with internal overflow (CEN/TC 164)
- Light metals and their alloys (ISO/TC 79)
- Methods of chemical analysis for iron and steel (CEN/TC 459/SC 2)
- Metallic and other inorganic coatings (CEN/TC 262)
- Metal hoses, hose assemblies, bellows and expansion joints (CEN/TC 342)
- Metallic and other inorganic coatings (ISO/TC 107)
- Metallic tanks for the storage of liquids (CEN/TC 265)
- Nanotechnologies (CEN/TC 352, ISO/TC 229)
- Natural stones (CEN/TC 246, ISO/TC 327)
- Nickel and nickel alloys (ISO/TC 155)
- Non controllable backflow preventer with different pressure zones (CEN/TC 164)
- Paints and varnishes (CEN/TC 139, ISO/TC 35)
- Pigments and extenders (CEN/TC 298, ISO/TC 256)
- Plastics (CEN/TC 249, ISO/TC 61)
- Plastics piping systems and ducting systems (CEN/TC 155)
- Plastics pipes, fittings and valves for the transport of fluids (ISO/TC 138)
- Pre-stressed concrete pressure pipes (CEN/TC 164)
- Precast concrete products (CEN/TC 229)
- Pumps (CEN/TC 197, ISO/TC 115)
- Reinforced concrete pressure pipes (CEN/TC 164)
- Rubber and plastics hoses and hose assemblies (CEN/TC 218)

- Rubber and rubber products (ISO/TC 45)
- Sanitary tapware (CEN/TC 164)
- Steel (ISO/TC 17)
- Steel static storage systems (CEN/TC 344)
- Storage of water (CEN/TC 164)
- Surface active agents (CEN/TC 276)
- Thermal spraying and thermally sprayed coatings (CEN/TC 240)
- Unfired pressure vessels (CEN/TC 54)
- Valves (ISO/TC 153)
- Water conditioning equipment inside buildings (CEN/TC 164)
- Water meters (CEN/TC 92)
- Welding and allied processes (CEN/TC 121, ISO/TC 44)
- Zinc and zinc alloys (ISO/TC 18)

It should be verified with experts in the relevant working groups of the Expert Group on the DWD and/or on a case-by-case basis with relevant stakeholders, if products addressed within these groups/TCs are used as DCMs. Although not expected, it should be verified whether their published standards contain relevant health aspects for the implementation of Article 11 of the recast DWD. Annex 2 of this document is listing standards that include an Annex Z, which means that they relate to the EU New Approach Directives, such as the Construction Products Regulation⁶ (CPR) (EU) No 305/2011, and have specific formats.

3.7 Other standardisation information of potential interest

If, in spite of the available standards mentioned in the previous sections, there are still gaps in the availability of standards for migration test or analytical methods, other CEN or ISO TCs may have developed relevant output. Below is a list of potential topics of interest and the corresponding CEN and ISO TCs obtained from the websites of those standardisation organisations:

3.7.1 Other non-food products

- Bamboo and rattan (ISO/TC 296)
- Ceramic ware, glassware and glass ceramic ware in contact with food (ISO/TC 166)
- Clean cook stoves and clean cooking solutions (ISO/TC 285)
- Conveyor belts (CEN/TC 188)
- Cork (ISO/TC 87)
- Cutlery and table and decorative metal hollow-ware (ISO/TC 186)
- Gas cooking appliances (CEN/TC 49, ISO/TC 291)
- Glass containers (ISO/TC 63)
- Jewellery and precious metals (ISO/TC 174)
- Large kitchen appliances using gaseous fuels (CEN/TC 106)

⁶ Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products (EU,2011b)

- Leather (CEN/TC 289, ISO/TC 120)
- Machinery intended for use with foodstuffs and feed (CEN/TC 153, ISO/TC 326)
- Non-destructive testing (CEN/TC 138, ISO/TC 135)
- Packaging (CEN/SS T14, CEN/TC 261, ISO/TC 122)
- Products for household and leisure use (CEN/SS H99)
- Pulp, paper and board (CEN/TC 172, ISO/TC 6)
- Safety of toys (CEN/TC 52, ISO/TC 181)
- Service activities relating to drinking water supply, wastewater and stormwater systems. (ISO/TC 224)
- Textiles and textile products (CEN/TC 248, ISO/TC 38)
- Timber (ISO/TC 218)
- Utensils in contact with food (CEN/TC 194)

3.7.2 Food products

- ...Animal feeding stuffs - Methods of sampling and analysis (CEN/TC 327)
- ...Cereal and cereal products (CEN/TC 338)
- ...Essential oils (ISO/TC 54)
- ...Food analysis (CEN/TC 275)
- ...Food Products (CEN/SS C01, ISO/TC 34)
- ...Microbiology of the food chain (CEN/TC 463)
- ...Milk and milk products (CEN/TC 302)
- ...Oilseeds, vegetable and animal fats and oils and their by-products - Methods of sampling and analysis (CEN/TC 307)
- ...Starch (CEN/SS C10, ISO/TC 93)

4 Conclusions

A first finding of this review is that standardised *analytical methods* are covering the substances mentioned in the Annexes I and II of the recast Directive (EU) 2020/2184 (EU, 2020), except for acrylamide, PFAS-Total and the sum of PFAS (par. 3.1). The limit of quantification or the lower working range is generally well below the parametric value. Measurement uncertainties for the parameters are defined in the Directive. Standardised analytical methods are also available for the detection of microorganisms and indicator parameters listed in Annex I of the Directive.

Standardisation needs for *migration/release test methods* for substances, organoleptic parameters (odour, taste, colour and turbidity) and chlorine demand seem to be well covered by the general standards established by CEN/TC 164 on water supply (par. 3.2). However, a check should be performed whether all potential materials used in DCMs are covered and whether the concepts of the migration tests are in line with the protection level for DCM as outlined in the DWD.

The availability of standardised analytical methods for substances migrating from the wide range of material groups needs to be checked. This work will be based on the information collected by ECHA during the notification stage of positive lists established in the Member States. Another source of information could be analytical methods from the food contact materials area, especially for plastics.

A technical report – not a standard – issued by CEN/TC 164 for *migration modelling* for DCMs is available, albeit for limited cases of some organic materials (par 3.3). It has to be checked, if this migration model has been validated and whether the concepts of the model are in line with the protection level for DCM as outlined in the DWD.

Some standards were found for specific material cases (par. 3.4). The determination of the composition of metals and alloys only covers copper and its alloys.

The standard for the enhancement of microbial growth (EN 16421:2014) covers three methods, which provide non-comparable results and should be harmonised to the extent possible (par. 3.5). It is unsuitable for assembled products where more than one material is in contact with drinking water. The results of the three methods are not directly comparable, as they are not measuring the same parameter (measurand).

A rather long list of standards for product groups that are relevant in the context of the Construction Products Regulation (EU) No 305/2011 has been identified (par. 3.6). All those standards are also potentially relevant to the minimum requirements for DCMs (Article 11 DWD). It should be verified with experts, whether products within those groups are considered to be DCM. Although not expected, it should also be verified whether the standards for these product groups contain relevant health aspects for the implementation of Article 11 of the DWD.

Finally, the findings in par. 3.7 show that a broad range of food/non-food products are covered by standards that may be helpful in ad-hoc considerations about certain DCMs. The lists in paragraphs 3.7.1 and 3.7.2 shall be kept for reference in the upcoming evaluations by the JRC and in the work of expert committees.

Based on these conclusions, the following steps should be carried out.

Since the implementation of the health and safety aspects of DCM is likely to be largely based on the 4MSI proposal, its in-depth analysis is required. This work should lead to a list of requirements for product testing and, subsequently, to a list of necessary migration test methods and analytical methods for substances and organoleptic parameters. This includes the microbial growth enhancement test. The results of the analysis will feed into the development of the relevant implementing and/or delegated acts foreseen by Article 11 of the DWD.

Then, the list of needed methods will be compared with the available documentary standards in CEN and ISO and, in case of absence, with available national standards. This step may lead to the

identification of needs for further standardisation work in the field and the establishment of mandates to CEN.

References

- EC (2004) REGULATION (EC) No 1935/2004 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 October 2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC
- EU (2011a) COMMISSION REGULATION (EU) No 10/2011 of 14 January 2011 on plastic materials and articles intended to come into contact with food
- EU (2011b) REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC
- EU (2020) DIRECTIVE (EU) 2020/2184 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2020 on the quality of water intended for human consumption (recast)

List of abbreviations and definitions

| | |
|---------|--|
| 4MSI | Four Member States Initiative |
| AA | Administrative arrangement |
| ATP | Adenosine triphosphate |
| CE | European Conformity |
| CEN | European Committee for Standardisation |
| CPR | Construction Products Regulation |
| DG | Directorate General of the European Commission |
| DCM | Drinking Water Contact Material |
| DWD | Drinking Water Directive |
| EC | European Commission |
| EMG | Enhancement of microbial growth |
| EN | European Norm |
| ENV | Environment |
| EU | European Union |
| FCM | Food Contact Material |
| GC-MS | Gas Chromatography-Mass Spectrometry |
| ICP-OES | Inductively coupled plasma optical emission spectrometry |
| ISO | International Organization for Standardization |
| JRC | Joint Research Centre |
| MS | Member State |
| S-OES | Spark optical emission spectrometry |
| TC | Technical Committee |
| TOC | Total organic carbon |
| TR | Technical Report |
| TS | Technical Specification |
| XRF | X-ray fluorescence |

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Annexes

Annex 1 - Standards for the analysis of the parameters mentioned in Annex I of the recast DWD

| ANNEX I - PART A | | |
|----------------------------|------------------|--|
| Microbiological parameters | | |
| Parameter | Parametric value | International Standard |
| Escherichia coli | 0/100 ml | EN ISO 9308-1:2014 - Water quality - Enumeration of Escherichia coli and coliform bacteria - Part 1: Membrane filtration method for waters with low bacterial background flora |
| | | EN ISO 9308-2:2014 - Water quality - Enumeration of Escherichia coli and coliform bacteria - Part 2: Most probable number method |
| Intestinal Enterococci | 0/100 ml | EN ISO 7899-2:2000 - Water quality - Detection and enumeration of intestinal enterococci - Part 2: Membrane filtration method |

| ANNEX I - PART B | | | | | |
|---------------------|------------------|------|--|-----|------|
| Chemical parameters | | | | | |
| Parameter | Parametric Value | Unit | International Standard | LOQ | Unit |
| Acrylamide | 0.1 | µg/l | EN 16618:2015 - Food analysis - Determination of acrylamide in food by liquid chromatography tandem mass spectrometry (LC-ESI-MS/MS) | | |
| | | | ISO 18862:2016 - Coffee and coffee products — Determination of acrylamide — Methods using HPLC-MS/MS and GC-MS after derivatization | | |
| Antimony | 10 | µg/l | EN ISO 11885:2009 - Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) | 4 | µg/l |
| | | | EN ISO 15586:2003 - Water quality - Determination of trace elements using atomic absorption spectrometry with graphite furnace | 1 | µg/l |

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|----------------|------|------|--|--------|------|
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 0.2 | µg/l |
| Arsenic | 10 | µg/l | EN ISO 11885:2009 - Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) | 5 | µg/l |
| | | | EN ISO 15586:2003 - Water quality - Determination of trace elements using atomic absorption spectrometry with graphite furnace | 1 | µg/l |
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 0.1 | µg/l |
| Benzene | 1 | µg/l | ISO 17943:2016 - Water quality. Determination of volatile organic compounds in water. Method using headspace solid-phase micro-extraction (HS-SPME) followed by gas chromatography-mass spectrometry (GC-MS) | <1 | µg/l |
| Benzo(a)pyrene | 0.01 | µg/l | EN 16691:2015 - Water quality - Determination of selected polycyclic aromatic hydrocarbons (PAH) in whole water samples - Method using solid phase extraction (SPE) with SPE-disks combined with gas chromatography mass spectrometry (GC-MS) | 0.0003 | µg/l |
| | | | EN ISO 17993:2003 - Water quality - Determination of 15 polycyclic aromatic hydrocarbons (PAH) in water by HPLC with fluorescence detection after liquid-liquid extraction | 0.005 | µg/l |
| Bisphenol A | 2.5 | µg/l | EN ISO 18857-2:2011 - Water quality - Determination of selected alkylphenols - Part 2: Gas chromatographic-mass spectrometric determination of alkylphenols, their ethoxylates and bisphenol A in non-filtered samples following solid-phase extraction and derivatisation | 0.05 | µg/l |
| Boron | 1.5 | mg/l | EN ISO 11885:2009 - Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) | 4 | µg/l |

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|----------|------|------|---|------|------|
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 1 | µg/l |
| Bromate | 10 | µg/l | EN ISO 11206:2013 - Water quality - Determination of dissolved bromate - Method using ion chromatography (IC) and post column reaction (PCR) | 0.5 | µg/l |
| | | | EN ISO 15061:2001 - Water quality - Determination of dissolved bromate - Method by liquid chromatography of ions | 0.5 | µg/l |
| Cadmium | 5 | µg/l | EN ISO 5961:1995 - Water quality - Determination of cadmium by atomic absorption spectrometry (ISO 5961:1994) | 50 | µg/l |
| | | | EN ISO 11885:2009 - Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) | 1 | µg/l |
| | | | EN ISO 15586:2003 - Water quality - Determination of trace elements using atomic absorption spectrometry with graphite furnace | 0.1 | µg/l |
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 0.1 | µg/l |
| Chlorate | 0.25 | mg/l | EN ISO 10304-4:1999 - Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 4: Determination of chlorate, chloride and chlorite in water with low contamination | 0.03 | mg/l |
| Chlorite | 0.25 | mg/l | EN ISO 10304-4:1999 - Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 4: Determination of chlorate, chloride and chlorite in water with low contamination | 0.01 | mg/l |
| Chromium | 25 | µg/l | EN 1233:1996 - Water quality - Determination of chromium - Atomic absorption spectrometric methods | 5 | µg/l |
| | | | EN ISO 11885:2009 - Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) | 1 | µg/l |

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|--------------------|----|------|--|-----|------|
| | | | EN ISO 18412:2006 - Water quality - Determination of chromium(VI) - Photometric method for weakly contaminated water | 2 | µg/l |
| | | | EN ISO 23913:2009 - Water quality - Determination of chromium(VI) - Method using flow analysis (FIA and CFA) and spectrometric detection | 2 | µg/l |
| | | | EN ISO 15586:2003 - Water quality - Determination of trace elements using atomic absorption spectrometry with graphite furnace | 0.5 | µg/l |
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 0.1 | µg/l |
| Copper | 2 | mg/l | EN ISO 11885:2009 - Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) (ISO 11885:2007) | 2 | µg/l |
| | | | EN ISO 15586:2003 - Water quality - Determination of trace elements using atomic absorption spectrometry with graphite furnace | 0.5 | µg/l |
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 0.1 | µg/l |
| Cyanide | 50 | µg/l | EN ISO 14403-1:2012 - Water quality - Determination of total cyanide and free cyanide using flow analysis (FIA and CFA) - Part 1: Method using flow injection analysis (FIA) | 2 | µg/l |
| | | | EN ISO 14403-2:2012 - Water quality - Determination of total cyanide and free cyanide using flow analysis (FIA and CFA) - Part 2: Method using continuous flow analysis (CFA) | 2 | µg/l |
| 1,2-dichloroethane | 3 | µg/l | ISO 17943:2016 - Water quality. Determination of volatile organic compounds in water. Method using headspace solid-phase micro-extraction (HS-SPME) followed by gas chromatography-mass spectrometry (GC-MS) | <3 | µg/l |

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|-------------------------|-----|------|--|------|------|
| Epichlorohydrin | 0.1 | µg/l | EN 14207:2003 - Water quality - Determination of epichlorohydrin | 0.1 | µg/l |
| Fluoride | 1.5 | mg/l | EN ISO 10304-1:2009 - Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate | 0.1 | mg/l |
| Haloacetic acids (HAAs) | 60 | µg/l | EN ISO 23631:2006 - Water quality - Determination of dalapon, trichloroacetic acid and selected haloacetic acids - Method using gas chromatography (GC-ECD and/or GC-MS detection) after liquid-liquid extraction and derivatization | 0.05 | µg/l |
| Lead | 5 | µg/l | EN ISO 11885:2009 - Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) | 5 | µg/l |
| | | | EN ISO 15586:2003 - Water quality - Determination of trace elements using atomic absorption spectrometry with graphite furnace | 1 | µg/l |
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 0.1 | µg/l |
| Mercury | 1 | µg/l | EN ISO 12846:2012 - Water quality - Determination of mercury - Method using atomic absorption spectrometry (AAS) with and without enrichment | 0.01 | µg/l |
| | | | EN ISO 17852:2008 - Water quality - Determination of mercury - Method using atomic fluorescence spectrometry | 0.01 | µg/l |
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes (ISO 17294-2:2016) | 0.05 | µg/l |
| Microcystin-LR | 1 | µg/l | ISO 20179:2005 - Water quality — Determination of microcystins — Method using solid phase extraction (SPE) and high performance liquid chromatography (HPLC) with ultraviolet (UV) detection | 1 | µg/l |

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|------------|-----|------|---|-----------------|------|
| Nickel | 20 | µg/l | EN ISO 11885:2009 - Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) | 2 | µg/l |
| | | | EN ISO 15586:2003 - Water quality - Determination of trace elements using atomic absorption spectrometry with graphite furnace | 1 | µg/l |
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 0.1 | µg/l |
| Nitrate | 50 | mg/l | EN ISO 10304-1:2009 - Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate | 0.1 | mg/l |
| | | | EN ISO 13395:1996 - Water quality - Determination of nitrite nitrogen and nitrate nitrogen and the sum of both by flow analysis (CFA and FIA) and spectrometric detection | 0.2 | mg/l |
| Nitrite | 0.5 | mg/l | EN ISO 13395:1996 - Water quality - Determination of nitrite nitrogen and nitrate nitrogen and the sum of both by flow analysis (CFA and FIA) and spectrometric detection | 0.01 | mg/l |
| | | | EN 26777:1993 - Water quality - Determination of nitrite - Molecular absorption spectrometric method | 0.001 | mg/l |
| | | | EN ISO 10304-1:2009 - Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate | 0.05 | mg/l |
| Pesticides | 0.1 | µg/l | EN 16693:2015 - Water quality - Determination of organochlorine pesticides (OCP) in whole water samples - Method using solid phase extraction (SPE) with SPE-disks combined with gas chromatography mass spectrometry (GC-MS) | 0.00005 to 0.03 | µg/l |

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|--------------------|-----|------|--|-----------------|------|
| | | | EN ISO 6468:1996 - Water quality - Determination of certain organochlorine insecticides, polychlorinated biphenyls and chlorobenzenes - Gas chromatographic method after liquid-liquid extraction | 0.001 to 0.01 | µg/l |
| | | | EN ISO 15913:2003 - Water quality - Determination of selected phenoxyalkanoic herbicides, including bentazones and hydroxybenzotrioles by gas chromatography and mass spectrometry after solid phase extraction and derivatization | 0.05 | µg/l |
| | | | EN 12918:1999 - Water quality - Determination of parathion, parathion-methyl and some other organophosphorus compounds in water by dichloromethane extraction and gas chromatographic analysis | 0.01 | µg/l |
| Pesticides — Total | 0.5 | µg/l | EN 16693:2015 - Water quality - Determination of organochlorine pesticides (OCP) in whole water samples - Method using solid phase extraction (SPE) with SPE-disks combined with gas chromatography mass spectrometry (GC-MS) | 0.00005 to 0.03 | µg/l |
| | | | EN ISO 6468:1996 - Water quality - Determination of certain organochlorine insecticides, polychlorinated biphenyls and chlorobenzenes - Gas chromatographic method after liquid-liquid extraction | 0.001 to 0.01 | µg/l |
| | | | EN ISO 15913:2003 - Water quality - Determination of selected phenoxyalkanoic herbicides, including bentazones and hydroxybenzotrioles by gas chromatography and mass spectrometry after solid phase extraction and derivatization | 0.05 | µg/l |
| | | | EN 12918:1999 - Water quality - Determination of parathion, parathion-methyl and some other organophosphorus compounds in water by dichloromethane extraction and gas chromatographic analysis | 0.01 | µg/l |

| | | | | | |
|--|-----|------|--|-----------------|------|
| PFAS-Total | 0.5 | µg/l | No standard available; Article 13(7) states that “by 12 January 2024, the Commission shall establish technical guidelines regarding methods of analysis for monitoring of per- and polyfluoroalkyl substances under the parameters ‘PFAS Total’ and ‘Sum of PFAS’, including detection limits, parametric values and frequency of sampling” | 0.2 | ng/l |
| Sum of PFAS | 0.1 | µg/l | ISO 21675:2019 - Water quality — Determination of perfluoroalkyl and polyfluoroalkyl substances (PFAS) in water — Method using solid phase extraction and liquid chromatography-tandem mass spectrometry (LC-MS/MS); covering 30 specific PFAS and scope can be extended; PFNS, PFUnS, PFDoS and PFTTrS are missing as listed in Annex III Part B(3) | 0.2 | ng/l |
| Polycyclic aromatic hydrocarbons | 0.1 | µg/l | EN 16691:2015 - Water quality - Determination of selected polycyclic aromatic hydrocarbons (PAH) in whole water samples - Method using solid phase extraction (SPE) with SPE-disks combined with gas chromatography mass spectrometry (GC-MS) | 0.0002 to 0.002 | µg/l |
| | | | EN ISO 17993:2003 - Water quality - Determination of 15 polycyclic aromatic hydrocarbons (PAH) in water by HPLC with fluorescence detection after liquid-liquid extraction | 0.005 | µg/l |
| Selenium | 20 | µg/l | EN ISO 11885:2009 - Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) | 7 | µg/l |
| | | | EN ISO 15586:2003 - Water quality - Determination of trace elements using atomic absorption spectrometry with graphite furnace | 2 | µg/l |
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 1 | µg/l |
| Tetrachloro-ethene and trichloroethene | 10 | µg/l | ISO 17943:2016 - Water quality. Determination of volatile organic compounds in water. Method using headspace solid-phase micro-extraction (HS-SPME) followed by gas | <10 | µg/l |

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|--------------------------|-----|------|--|------|------|
| | | | chromatography-mass spectrometry (GC-MS) | | |
| Trihalo-methanes - Total | 100 | µg/l | ISO 17943:2016 - Water quality. Determination of volatile organic compounds in water. Method using headspace solid-phase micro-extraction (HS-SPME) followed by gas chromatography-mass spectrometry (GC-MS) | <100 | µg/l |
| Uranium | 30 | µg/l | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 0.1 | µg/l |
| Vinyl chloride | 0.5 | µg/l | ISO 17943:2016 - Water quality. Determination of volatile organic compounds in water. Method using headspace solid-phase micro-extraction (HS-SPME) followed by gas chromatography-mass spectrometry (GC-MS) | <0.5 | µg/l |

| ANNEX I - PART C | | | | | |
|----------------------|------------------|------|---|-----|------|
| Indicator parameters | | | | | |
| Parameter | Parametric value | Unit | International Standard | LOQ | Unit |
| Aluminium | 200 | µg/l | EN ISO 11885:2009 - Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) | 1 | µg/l |
| | | | EN ISO 12020:2000 - Water quality - Determination of aluminium - Atomic absorption spectrometric methods | 10 | µg/l |
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 1 | µg/l |
| Ammonium | 0.5 | mg/l | EN ISO 11732:2005 - Water quality - Determination of ammonium nitrogen - Method by flow analysis (CFA and FIA) and spectrometric detection | 0.1 | mg/l |
| | | | EN ISO 14911:1999 - Water quality - Determination of dissolved Li ⁺ , Na ⁺ , NH ₄ ⁺ , K ⁺ , Mn ²⁺ , Ca ²⁺ , Mg ²⁺ , Sr ²⁺ and Ba ²⁺ using ion chromatography - Method | 0.1 | mg/l |

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|--|-----------------|----------------|--|---------|----------|
| | | | for water and waste water | | |
| Chloride | 250 | mg/l | EN ISO 10304-1:2009 - Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate | 0.1 | mg/l |
| | | | EN ISO 10304-4:1999 - Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 4: Determination of chlorate, chloride and chlorite in water with low contamination | 0.1 | mg/l |
| | | | EN ISO 15682:2001 - Water quality - Determination of chloride by flow analysis (CFA and FIA) and photometric or potentiometric detection | 1 | mg/l |
| Clostridium perfringens (including spores) | 0 | Number/ 100 ml | EN ISO 14189:2016 - Water quality - Enumeration of Clostridium perfringens - Method using membrane filtration | | |
| Colour | | | EN ISO 7887:2011 - Water quality - Examination and determination of colour | | |
| Conductivity | 2500 | µS/cm | EN 27888:1993 - Water quality - Determination of electrical conductivity | | |
| Hydrogen ion concentration | ≥ 6.5 and ≤ 9.5 | pH units | EN ISO 9963-1:1995 - Water quality - Determination of alkalinity - Part 1: Determination of total and composite alkalinity | 4 to 10 | pH units |
| | | | EN ISO 10523:2012 - Water quality - Determination of pH | 2 to 12 | pH units |
| Iron | 200 | µg/l | EN ISO 11885:2009 - Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) | 2 | µg/l |
| | | | EN ISO 15586:2003 - Water quality - Determination of trace elements using atomic absorption spectrometry with graphite furnace | 1 | µg/l |
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 5 | µg/l |
| Manganese | 50 | µg/l | EN ISO 11885:2009 - Water quality - Determination of selected elements by | 1 | µg/l |

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|---------------|-----|---------------------|---|-----|------|
| | | | inductively coupled plasma optical emission spectrometry (ICP-OES) | | |
| | | | EN ISO 14911:1999 - Water quality - Determination of dissolved Li ⁺ , Na ⁺ , NH ₄ ⁺ , K ⁺ , Mn ²⁺ , Ca ²⁺ , Mg ²⁺ , Sr ²⁺ and Ba ²⁺ using ion chromatography - Method for water and waste water | 0.5 | mg/l |
| | | | EN ISO 15586:2003 - Water quality - Determination of trace elements using atomic absorption spectrometry with graphite furnace | 0.5 | µg/l |
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 0.1 | µg/l |
| Odour | | | EN 1622:2006 - Water quality - Determination of the threshold odour number (TON) and threshold flavour number (TFN) | | |
| Oxidisability | 5 | mg/l O ₂ | EN ISO 8467:1995 - Water quality - Determination of permanganate index | 0.5 | mg/l |
| Sulfate | 250 | mg/l | EN ISO 10304-1:2009 - Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 1: Determination of bromide, chloride, fluoride, nitrate, nitrite, phosphate and sulfate | 0.1 | mg/l |
| Sodium | 200 | mg/l | EN ISO 11885:2009 - Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) | 20 | µg/l |
| | | | EN ISO 14911:1999 - Water quality - Determination of dissolved Li ⁺ , Na ⁺ , NH ₄ ⁺ , K ⁺ , Mn ²⁺ , Ca ²⁺ , Mg ²⁺ , Sr ²⁺ and Ba ²⁺ using ion chromatography - Method for water and waste water | 0.1 | mg/l |
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 10 | µg/l |
| Taste | | | EN 1622:2006 - Water quality - Determination of the threshold odour number (TON) and threshold flavour number (TFN) | | |

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|----------------------------|---|-------------------|--|--|--|
| Colony count 22 °C | | | EN ISO 6222:1999 - Water quality - Enumeration of culturable micro-organisms - Colony count by inoculation in a nutrient agar culture medium | | |
| Coliform bacteria | 0 | Number/ 100 ml | EN ISO 9308-1:2014 - Water quality - Enumeration of Escherichia coli and coliform bacteria - Part 1: Membrane filtration method for waters with low bacterial background flora | | |
| | | | EN ISO 9308-2:2014 - Water quality - Enumeration of Escherichia coli and coliform bacteria - Part 2: Most probable number method | | |
| Total organic carbon (TOC) | | | EN 1484:1997 - Water analysis - Guidelines for the determination of total organic carbon (TOC) and dissolved organic carbon (DOC) | | |
| Turbidity | | | EN ISO 7027-1:2016 - Water quality - Determination of turbidity - Part 1: Quantitative methods | | |
| | | | EN ISO 7027-2:2019 - Water quality - Determination of turbidity - Part 2: Semi-quantitative methods for the assessment of transparency of waters | | |

| ANNEX I - PART D | | | | | |
|---|------------------|-------|--|-----|-----------|
| Parameters relevant for the domestic distribution risk assessment | | | | | |
| Parameter | Parametric Value | Unit | International Standard | LOQ | Unit |
| Legionella | <1000 | CFU/l | EN ISO 11731:2017 - Water quality - Enumeration of Legionella | 10 | CFU/plate |
| Lead | 10 | µg/l | EN ISO 11885:2009 - Water quality - Determination of selected elements by inductively coupled plasma optical emission spectrometry (ICP-OES) | 5 | µg/l |
| | | | EN ISO 15586:2003 - Water quality - Determination of trace elements using atomic absorption spectrometry with graphite furnace | 1 | µg/l |
| | | | EN ISO 17294-2:2016 - Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS) - Part 2: Determination of selected elements including uranium isotopes | 0.1 | µg/l |

| ANNEX II - PART A | | | | | |
|---|-----------------|----------------|---|-----|------|
| General objectives and monitoring programmes for water intended for human consumption | | | | | |
| Parameter | Reference Value | Unit | International Standard | LOQ | Unit |
| Somatic coliphages | 50 | PFU/ 100 ml | EN ISO 10705-2:2001 - Water quality - Detection and enumeration of bacteriophages - Part 2: Enumeration of somatic coliphages | | |
| | | | ISO 10705-3:2003 - Water quality — Detection and enumeration of bacteriophages — Part 3: Validation of methods for concentration of bacteriophages from water | | |

Annex 2 - EN Standards that have a Z Annex included

| European Standard | Standard Title |
|-------------------|---|
| EN 197-1:2011 | Cement - Part 1: Composition, specifications and conformity criteria for common cements |
| EN 413-1:2011 | Masonry cement - Part 1: Composition, specifications and conformity criteria |
| EN 459-1:2015 | Building lime - Part 1: Definitions, specifications and conformity criteria |
| EN 494:2012 | Fibre-cement profiled sheets and fittings - Product specification and test methods |
| EN 934-2:2009 | Admixtures for concrete, mortar and grout - Part 2: Concrete admixtures - Definitions, requirements, conformity, marking and labelling |
| EN 934-3:2009 | Admixtures for concrete, mortar and grout - Part 3: Admixtures for masonry mortar - Definitions, requirements, conformity and marking and labelling |
| EN 934-4:2009 | Admixtures for concrete, mortar and grout - Part 4: Admixtures for grout for prestressing tendons - Definitions, requirements, conformity, marking and labelling |
| EN 934-5:2007 | Admixtures for concrete, mortar and grout - Part 5: Admixtures for sprayed concrete - Definitions, requirements, conformity, marking and labelling |
| EN 1504-2:2004 | Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 2: Surface protection systems for concrete |
| EN 1504-3:2005 | Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 3: Structural and non-structural repair |
| EN 1504-4:2004 | Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 4: Structural bonding |
| EN 1504-5:2013 | Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 5: Concrete injection |
| EN 1504-6:2006 | Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 6: Anchoring of reinforcing steel bar |
| EN 1504-7:2006 | Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 7: Reinforcement corrosion protection |
| EN 1520:2011 | Prefabricated reinforced components of lightweight aggregate concrete with open structure |
| EN 1916:2002 | Concrete pipes and fittings, unreinforced, steel fibre and reinforced |
| FprEN 10025-1 | Hot rolled products of structural steels - Part 1: General technical delivery conditions |
| EN 10088-4:2009 | Stainless steels - Part 4: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for construction purposes |

| | |
|-----------------|--|
| EN 10088-5:2009 | Stainless steels - Part 5: Technical delivery conditions for bars, rods, wire, sections and bright products of corrosion resisting steels for construction purposes |
| EN 13055:2016 | Lightweight aggregates - Part 1: Lightweight aggregates for concrete, mortar and grout |
| EN 13139:2002 | Aggregates for mortar |
| EN 13263-1:2005 | Silica fume for concrete - Part 1: Definitions, requirements and conformity criteria |
| EN 13279-1:2008 | Gypsum binders and gypsum plasters - Part 1: Definitions and requirements |
| EN 13310:2015 | Kitchen sinks - Functional requirements and test methods |
| EN 13479:2017 | Welding consumables - General product standard for filler metals and fluxes for fusion welding of metallic materials |
| EN 13967:2012 | Flexible sheets for waterproofing - Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet - Definitions and characteristics |
| EN 13969:2004 | Flexible sheets for waterproofing - Bitumen damp proof sheets including bitumen basement tanking sheets - Definitions and characteristics |
| EN 14216:2015 | Cement - Composition, specifications and conformity criteria for very low heat special cements |
| EN 14428:2015 | Shower enclosures - Functional requirements and test methods |
| EN 14647:2005 | Calcium aluminate cement - Composition, specifications and conformity criteria |
| EN 14680:2015 | Adhesives for non-pressure thermoplastic piping systems - Specifications |
| EN 14814:2016 | Adhesives for thermoplastic piping systems for fluids under pressure - Specifications |
| EN 14889-1:2006 | Fibres for concrete - Part 1: Steel fibres - Definitions, specifications and conformity |
| prEN 14889-2 | Fibres for concrete - Part 2: Polymer fibres - Definitions, specifications and conformity |
| EN 15274:2015 | General purpose adhesives for structural assembly - Requirements and test methods |
| EN 15275:2015 | Structural adhesives - Characterisation of anaerobic adhesives for co-axial metallic assembly in building and civil engineering structures |
| EN 15014 | Plastics piping systems - Buried and above ground systems for water and other fluids under pressure - Performance characteristics for pipes, fittings and their joints |
| EN 15015:2007 | Plastics piping systems - Systems for hot and cold water not intended for human consumption - Performance characteristics for pipes, fittings and their joints |
| EN 15389:2008 | Industrial valves - Performance characteristics of thermoplastic valves when used as construction products |
| EN 16622:2015 | Silica-calcium fume for concrete - Definitions, requirements and conformity |

| | criteria |
|----------------------|--|
| EN 10224:2002 | Non-alloy steel tubes and fittings for the conveyance of water and other aqueous liquids - Technical delivery conditions |
| EN 10311:2005 | Joints for the connection of steel tubes and fittings for the conveyance of water and other aqueous liquids |
| EN 10312:2002 | Welded stainless steel tubes for the conveyance of aqueous liquids including water for human consumption - Technical delivery conditions |
| EN 16397-2:2015 | Flexible couplings - Part 2: Characteristics and testing for metal banded flexible couplings, adaptors and bushes |
| EN 13160-2:2016 | Leak detection systems - Part 2: Requirements and test/assessment methods for pressure and vacuum systems |
| EN 13160-3:2016 | Leak detection systems - Part 3: Requirements and test/assessment methods for liquid systems for tanks |
| EN 13160-4:2016 | Leak detection systems - Part 4: Requirements and test/assessment methods for sensor based leak detection systems |
| EN 13160-5:2016 | Leak detection systems - Part 5: Requirements and test/assessment methods for in-tank gauge systems and pressurised pipework systems |
| EN 13160-7:2016 | Leak detection systems - Part 7: Requirements and test/assessment methods for interstitial spaces, leak detection linings and leak detection jackets |
| EN 12897:2016 | Water supply - Specification for indirectly heated unvented (closed) storage water heaters |
| EN 1057:2006+A1:2010 | Copper and copper alloys - Seamless, round copper tubes for water and gas in sanitary and heating applications |

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