



*NSF International Standard /
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NSF/ANSI

Drinking Water System Components -



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American National Standard

Drinking water system components – Lead content

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Foreword²

This Standard, NSF/ANSI 372 *Drinking water system components – Lead Content* is the third in a series of standards developed by the NSF Joint Committees on Drinking Water Additives. The other two Standards for drinking water additives products are NSF/ANSI 60 *Drinking water treatment chemicals — Health effects*, which addresses drinking water treatment chemicals (also known as direct additives) and NSF/ANSI 61 *Drinking water system components — Health effects*, which covers products and materials that contact drinking water (also known as indirect additives).

Prior to being developed as NSF/ANSI 372, part of the content of this Standard was established as NSF/ANSI 61, Annex G – *Weighed average lead content evaluation procedure to a 0.25% lead requirement*. Annex G was developed by the NSF Drinking Water Additives Task Group on Lead and approved by the NSF Joint Committee on Drinking Water Additives – System Components for addition to NSF/ANSI 61 in 2008. The impetus for creating Annex G was the promulgation of individual state regulatory requirements limiting the amount of lead that may be contained in products contacting drinking water. While Annex G was an optional evaluation method within NSF/ANSI 61, it required that products also meet the chemical extraction requirements of NSF/ANSI 61, and it was limited in application to drinking water products that were included within the Scope of ANSI/NSF 61. The NSF Joint Committee on Drinking Water Additives – System Components determined that creation of a separate standard addressing lead content requirements would provide greater flexibility in the application of the lead content requirements to the marketplace and to organizations seeking to reference such requirements.

While NSF/ANSI 61 establishes limits for the amount of lead that may migrate into drinking water from the water contact materials within a drinking water contact product, NSF/ANSI 372 establishes a limit on the amount of lead that may be contained within the water contact materials in a drinking water contact product. This Standard also defines a test methodology for the analytical determination of the lead content of materials in these products.

NSF/ANSI 372 may be used in conjunction with NSF/ANSI 61 for the purpose of minimizing lead from drinking water products. NSF/ANSI 372 may also be used in conjunction with other standards addressing products that are not included in the Scope of NSF/ANSI 61, such as the NSF Drinking Water Treatment Unit Standards. The Standard can also be used to demonstrate compliance with individual jurisdictional or contractual requirements that include lead content restrictions on drinking water contact products.

NSF/ANSI 372 does not include product performance requirements that are currently addressed in other voluntary consensus standards established by such organizations as the American Water Works Association, the American Society for Testing and Materials, and the American Society of Mechanical Engineers. Because this Standard complements the performance standards of these organizations, it is recommended that products also meet the appropriate performance requirements specified in the standards of such organizations.

This Standard and the accompanying text are intended for voluntary use by certifying organizations, utilities, regulatory agencies, and/or manufacturers as a basis of providing assurances that adequate health protection exists for covered products. Product certification issues, including frequency of testing and requirements for follow-up testing, evaluation, enforcement, and other policy issues, are not addressed by this Standard.

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This edition of the Standard contains the following revisions:

Issue 4

This revision updates applicable normative references under section 1.3.

This Standard was developed by the NSF Joint Committee on Drinking Water Additives – System Components using the consensus process described by the American National Standards Institute.

Suggestions for improvement of this Standard are welcome. Comments should be sent to Chair, Joint Committee on Drinking Water Additives – System Components at standards@nsf.org, or c/o NSF International, Standards Department, P.O. Box 130140, Ann Arbor, Michigan 48113-0140, USA.

NSF/ANSI Standard for Drinking Water Additives

Drinking water system components - Lead content

1 Purpose, scope, and normative references

1.1 Purpose

This standard establishes procedures for the determination of lead content based on the wetted surface areas of products.

1.2 Scope

This standard applies to any drinking water system component that conveys or dispenses water for human consumption through drinking or cooking.

1.3 Normative references

The following documents contain requirements that, by reference in this text, constitute requirements of this Standard. At the time this Standard was balloted, the editions listed below were valid. All documents are subject to revision, and parties are encouraged to investigate the possibility of applying the recent editions of the documents indicated below. The most recent published edition of the document shall be used for undated references.

ASTM E29-13. *Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications*³

ASTM E255-07 (2014). *Standard Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition*³

EPA SW 846 *Test Methods for Evaluating Solid Waste, Physical Chemical Methods, Method 3050 B – Acid Digestion of Sediments, Sludges, and Soils*⁴

EPA SW846, *Method 3052 - Microwave Assisted Acid Digestion of Siliceous and Organically Based Matrices*⁴

EPA SW 846, *Method 6010C – Inductively Coupled Plasma-Atomic Emission Spectrometry*⁴

Safe Drinking Water Act⁴

³ ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2859 <www.astm.org>.

⁴ Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268 <www.epa.gov>.

1.4 Significant figures

For determining conformance with the specifications in this standard, the Rounding Method in ASTM E29³ shall be used.

2 Definitions

2.1 coating: A covering or barrier applied to a substrate by electro, chemical deposition or via mechanical adhesion (paint).

2.2 liner: A barrier component which is mechanically attached and sealed to prevent water contact with another component. (Example: a tubular or cast brass spout with a thermoplastic sleeve inserted inside and sealed with an o-ring or other sealing material, such that water does not come into contact with the brass spout material.)

3 General requirements

Solders and fluxes shall have a lead content less than or equal to 0.2%. All other products shall have a weighted average lead content less than or equal to 0.25% based on the average of their wetted surface areas.

3.1 All components $\leq$ 0.25%

If each component of a product has a wetted surface with a lead content of not more than 0.25%, then the product is considered compliant and no further evaluation is required.

3.2 Any components $>$ 0.25%

If any wetted components of a product has a surface area with a lead content of more than 0.25% lead, then the weighted average lead content shall be calculated according to section 4 to determine compliance.

3.3 Restriction on the use of lead containing materials

There shall be no lead added as an intentional ingredient in any product, component, material, or their coatings submitted for evaluation to this standard with the exception of brass or bronze meeting the definition of “lead free” under the specific provisions of the Safe Drinking Water Act⁴ of the United States.

4 Weighted average lead content calculation

The weighted average lead content of the product shall be calculated using the surface area and lead content information established under section 4.1. For internal NPT (pipe) threads, engagement of male components into female threads will assume that 25% of the length of the female thread remains exposed as wetted surface area.

All of the wetted surfaces are to be included in the weighted average lead content calculation, not just those surfaces that contain lead.

The results of the weighted average lead calculation shall be rounded to two decimal places prior to determination of compliance.

4.1 Component surface areas and lead content

The following information shall be established to determine the weighted average lead content:

- a list of all components and materials and their corresponding surface areas that come into direct contact with water;
- the maximum lead content of each material as specified by reference to a national or international standardized material specification (e.g. UNS copper alloy specification). If the material is not formulated to a national or international standardized specification, the manufacturers material specification shall be used.

4.2 Formula for determining weighted average lead content

The following formula shall be used when calculating the weighted average lead content of products:

$$WLC = \sum_{c=1}^n \left(LC_c \times \left[\frac{WSA_c}{WSA_t} \right] \right)$$

where;

WLC	=	weighted average lead content of product
LC _c	=	maximum lead content of the c th component
WSA _c	=	wetted surface area of the c th component
WSA _t	=	total wetted surface area of all components
n	=	number of wetted components in product

NOTE — An example calculation of the weighted average lead content of a product is provided in Annex A.

5 Percentage lead content of water contact surfaces

The maximum lead content of the material specification used to produce wetted components shall be used to determine compliance with this standard. When the actual percent of lead in the chemical composition of individual components is to be determined, the procedures in 7 shall be followed.

5.1 Liners

When lead-bearing surfaces have been excluded from water contact by use of a rigid liner (e.g. plastic sleeve) sealed with a permanent barrier, the lead content of the liner shall be used.

5.2 Coatings

When coatings are used, the lead content of the coated substrate shall be used in the calculation of weighted average lead content.

5.3 Lead removal technologies

For components where the wetted surface areas have been treated with a lead removal technology, the percent lead composition shall be based on the material used to manufacture the component prior to application of the surface treatment.

6 Lead content verification testing

6.1 Lead content testing

Lead content verification testing shall be performed on representative product, materials, or components using the methodologies in 7 and shall at a minimum include screening of the following:

- a) Materials with lead content specifications greater than zero.
- b) Any materials, including coatings and their substrates, with wetted surfaces areas in excess of 10% of the wetted surface area of the product.

NOTE – Although lead content verification testing has not been required on all components, the above criteria has been selected to represent those with the greatest potential for containing lead and those with the greatest potential for significant impact if its material contains lead as an impurity.

The results of testing shall be determined acceptable, if:

- the lead content is found to be less than or equal to the material specification used to determine product compliance with this standard; or
- the weighted average lead content of the product is in compliance with the requirements of this standard when the results of testing are used in lieu of the material specification.

7 Analytical procedures for determining percent lead content of materials

7.1 Lead content screening

Screening may be used to check the lead content in the following cases, but not limited to:

- Screening of components where no lead is expected (e.g. certain plastics, elastomers, coatings);
- Screening of components where lead is expected for comparison to material specification information; and
- Initial screening of components to identify and prioritize items for further testing.

XRF (X-Ray Fluorescence), OES (Optical Emission Spectroscopy) Arc /Spark, SEM (Scanning Electron Microscopy) /EDS (Energy Dispersive Spectrometer) are acceptable methods for screening components, provided the instrument is calibrated to standard reference materials. Other applicable screening methods may be employed, provided that adequate performance can be demonstrated. The following should be taken into consideration with a screening method:

- Surfaces scanned should be clean, dry, and free of coating. Even slight overspray of coatings can significantly reduce lead content readings.
- Part finishes that remove surface lead, such as acid washes, will affect surface lead content readings and may affect the value of the screening analysis.
- Part size, shape, and condition of the surface can impact reading. Area analyzed should be no smaller than the instrument observation window. Shapes, such as curved surfaces, should be minimized.

- Lower lead content parts may require longer read times and the average of several measurements (3 or more) with different orientation to produce accurate results.

When considering the points above the screening method may not be suitable for determining lead content, in which case the lead content shall be determined in accordance with 7.2

7.2 Lead content analysis of materials

7.2.1 Sampling of components

Samples from components can be obtained by various methods, such as drilling, turning, sawing, or milling. Where possible, blend material from a minimum of three areas taken at random locations across the part, so as to obtain a sample that is representative of the properties of the entire component. Care should be taken not to include coating materials in the sampled material. With the exception of very large parts, test pieces should be drilled or sawn completely through in order to avoid over- or under-representation of the center portion.

NOTE – Additional guidance on sampling of copper alloys is provided in ASTM E255: Standard Practice for Sampling Copper and Copper Alloys for the Determination of Chemical Composition³.

7.2.2 Sample preparation

Dissolve a minimum of 1.0 gram of sample in accordance with U. S. EPA SW-846⁴ Method 3050B, Method 3052, or equivalent. Other applicable sample preparation methods may be employed, provided that adequate performance can be demonstrated for the analytes and matrices of interest.

7.2.3 Analysis

Analysis for metals should be performed, except as otherwise provided for herein, in accordance with currently accepted EPA SW-846⁴ Method 6010C, or equivalent. Other applicable chemical analysis methods may be employed, provided that adequate performance can be demonstrated for the analytes and matrices of interest.

7.2.4 Quality control

Sample preparation and analysis procedures shall be validated for the analytes and matrices to be tested. All the quality assurance/quality control protocols and other requirements specified in the method being used shall be followed. If a specified protocol is not followed, a justification for the deviation shall be explicitly addressed.

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Annex A⁵ **(Informational)**

Example weighted average lead content calculation

The following is an example of how this weighted average lead content calculation is conducted on a faucet with 13 wetted components.

1. Identify those components of the faucet that water comes into contact with during the normal operation (wetted components).
2. Use the maximum percentage of lead content within each component (supplied by the component manufacturer or supplier). Table 1, column 4 provides the maximum lead content for each of the wetted components.
3. Determine the percent of wetted surface area represented in each component using the part specifications.
 - a. The *wetted surface area* of each component that comes into direct contact with water is required under 3.1 (to be provided by the manufacturer). Table 1, column 2 shows the *wetted surface area* of the subject faucet.
 - b. Add the areas of the wetted surface for each component together: this is the *total wetted surface area of the faucet*.
 - c. For each component, determine the ratio of its wetted surface area to that of the total wetted surface area of the product.
4. Calculate the weighted average lead content of the faucet by totaling the percent lead contribution for the components that make up the wetted surface of the faucet (Table 1, column 5). For the faucet to be in compliance with requirements, this total must be no more than 0.25%.

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Table 1. Example of weighted average lead content calculations

1 Component No.	2 Wetted surface area ¹ (total = 61.96 in ²)	3 Ratio wetted surface area	4 % lead content	5 % lead Contribution
1	17.31	0.2794	0.05	0.0140
2	1.15	0.0186	2.86	0.0531
3	4.99	0.0805	0.23	0.0185
4	18.25	0.2945	0.05	0.0147
5	11.14	0.1798	0	-
6	4.02	0.0649	0	-
7	1.09	0.0176	1.30	0.0229
8	0.54	0.0087	0	-
9	0.91	0.0147	2.54	0.0373
10	0.76	0.0123	0	-
11	1.019	0.0164	2.54	0.0418
12	0.35	0.0056	2.54	0.0143
13	0.43	0.0069	2.54	0.0176
Total of contributing percent lead =				0.2342%
Weighted average lead content =				0.23% (in compliance)
NOTE – Calculated data for each component in columns 3 and 5 show in this table with four decimal places to increase readability. When the calculation is performed, rounding to two decimals is only performed on the final result.				

Standards⁶

The following standards established and adopted by NSF as minimum voluntary consensus standards are used internationally:

- 2 Food equipment
- 3 Commercial warewashing equipment
- 4 Commercial cooking, rethermalization, and powered hot food holding and transport equipment
- 5 Water heaters, hot water supply boilers, and heat recovery equipment
- 6 Dispensing freezers
- 7 Commercial refrigerators and freezers
- 8 Commercial powered food preparation equipment
- 12 Automatic ice making equipment
- 13 Refuse processors and processing systems
- 14 Plastics piping system components and related materials
- 18 Manual food and beverage dispensing equipment
- 20 Commercial bulk milk dispensing equipment
- 21 Thermoplastic refuse containers
- 24 Plumbing system components for recreational vehicles
- 25 Vending machines for food and beverages
- 29 Detergent and chemical feeders for commercial spray-type dishwashing machines
- 35 High pressure decorative laminates (HPDL) for surfacing food service equipment
- 36 Dinnerware
- 37 Air curtains for entranceways in food and food service establishments
- 40 Residential wastewater treatment systems
- 41 Non-liquid saturated treatment systems
- 42 Drinking water treatment units – Aesthetic effects
- 44 Residential cation exchange water softeners
- 46 Evaluation of components and devices used in wastewater treatment systems
- 49 Biosafety cabinetry: Design, construction, performance, and field certification
- 50 Equipment for swimming pools, spas, hot tubs, and other recreational water facilities
- 51 Food equipment materials
- 52 Supplemental flooring
- 53 Drinking water treatment units – Health effects
- 55 Ultraviolet microbiological water treatment systems
- 58 Reverse osmosis drinking water treatment systems
- 59 Mobile food carts
- 60 Drinking water treatment chemicals – Health effects
- 61 Drinking water system components – Health effects
- 62 Drinking water distillation systems
- 140 Sustainable carpet assessment
- 169 Special purpose food equipment and devices
- 170 Glossary of food equipment terminology
- 173 Dietary supplements
- 177 Shower filtration systems – Aesthetic effects
- 184 Residential dishwashers
- 222 Ozone generators
- 223 Conformity assessment requirements for certification bodies that certify products pursuant to NSF/ANSI 60: Drinking water treatment chemicals – health effects
- 240 Drainfield trench product sizing for gravity dispersal onsite wastewater treatment and dispersal systems
- 245 Wastewater treatment systems - nitrogen reduction
- 305 Personal care products containing organic ingredients
- 321 Goldenseal root (*Hydrastis canadensis*)
- 330 Glossary of drinking water treatment unit terminology
- 332 Sustainability assessment for resilient floor coverings
- 336 Sustainability assessment for commercial furnishings fabric
- 342 Sustainability assessment for wallcovering products
- 347 Sustainability assessment for single ply roofing membranes
- 350 Onsite residential and commercial water reuse treatment systems
- 350-1 Onsite residential and commercial greywater treatment systems for subsurface discharge
- 355 Greener chemicals and processes information
- 358-1 Polyethylene pipe and fittings for water-based ground-source “geothermal” heat pump systems
- 358-2 Polypropylene pipe and fittings for water-based ground-source “geothermal” heat pump systems
- 359 Valves for crosslinked polyethylene (PEX) water distribution tubing systems
- 360 Wastewater treatment systems – Field performance verification
- 363 Good Manufacturing Practices (GMP) for Pharmaceutical Excipients
- 372 Drinking water treatment system components – Lead content
- 401 Drinking water treatment units - Emerging compounds / incidental contaminants
- 416 Sustainability Assessment for Water Treatment Chemical Products
- 418 Residential wastewater effluent filters longevity testing
- 419 Public Drinking Water Equipment Performance – Filtration
- 14159-1 Hygiene requirements for the design of meat and poultry processing equipment
- 14159-2 Hygiene requirements for the design of hand held tools used in meat and poultry processing equipment
- 14159-3 Hygiene requirements for the design of mechanical belt conveyors used in meat and poultry processing equipment

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