Brass for European Potable Water Applications

(updated November 2020)

Ensuring the safety of drinking water is a global priority, particularly with respect to controlling the presence of lead which is known to cause adverse health effects. Professional care has been deployed throughout the brass value chain to ensure that brass materials and components are in compliance with drinking water requirements. This piece summarizes the European Union (E.U.) regulatory landscape and reviews how different segments of the brass value chain are affected.

Summary of E.U. drinking water regulations

In the E.U., drinking water quality is principally governed by the E.U. Drinking Water Directive (DWD) which took effect in December 2003[1]. The DWD set maximum acceptable limits for many known contaminants including microorganisms, chemicals and metallic elements. For lead, the max limit is 10 µg/L of which no more than 5 µg/L is permissible in water supplied to buildings.

Following the DWD, work began to establish a single European Acceptance Scheme for the hygienic assessment of materials in contact with drinking water. However, the scheme lost support from the European Commission in 2006 and the effort was subsequently taken up by a dedicated group of four member states (France, Germany, the Netherlands and the U.K.) known as the 4MS. Due to the vast amount of materials used in drinking water systems, each member of the 4MS was assigned responsibility for a subgroup of materials with Germany assuming responsibility for metallic materials. For metals, the 4MS developed a 'Common Approach' that established a procedure for acceptance.[2]

To determine the suitability of metallic materials, the results of a long-term 'rig-test' outlined in European standard EN 15664 Parts 1 and 2 are evaluated and assessed in accordance with a separate standard, DIN 50930 Part 6, developed by the German standardization body.[3-5] Part 1 of the EN standard describes test procedures which simulate the consumption behavior of a four-person household. Part 2 defines three different natural water qualities used in the test to represent the broad range of waters distributed in E.U. countries.

The final step is to interpret the data produced by EN 15664 using the DIN standard as a basis for assessment. The DIN standard is used to determine if leached levels of lead and other elements meet the 4MS acceptance criteria adapted from the DWD. Eventually, the intent is for the 4MS scheme for metals to be mutually recognized throughout the E.U. (see next page on DWD revisions).

Approved brass alloys are referenced in the '4MS Common Composition List' (also referred to as the 'Hygienic List' or 'Positive List') with some alloys limited to certain product categories to account for restrictions with respect to wetted surface area.[6]

Raw material suppliers

With an approval process in place, many brasses, even those containing up to 3.5% alloyed lead, readily passed the rig-test and were added to the 4MS list. The list is dynamic, and new alloys can be added at any time after satisfying the testing and assessment requirements. The last revision was published on August 21, 2020, and the current 4MS list as of November 2020 is provided below.

4MS list of approved copper alloys as of Nov. 2020

For current list, visit: https://bit.ly/3pkXtI2

CW509L* (CuZn40)	CuZn35Al-C	CW725R*(CuZn33Pb1AlSiAs)
CW510L* (CuZn42)	CC771S (CuZn38AsSb)	CC499K* (CuSn5Zn5Pb2-C)
CW501L-DW* (CuZn10)	CW617N* (CuZn40Pb2)	CuSn4Zn2PS
CW506L-DW* (CuZn33)	CW612N* (CuZn39Pb2)	CW724R (CuZn21Si3P)
CW507L-DW* (CuZn36)	CW614N* (CuZn39Pb3)	CC768S (CuZn21Si3P)
CW508L-DW* (CuZn37)	CW603N* (CuZn36Pb3)	CC245E (CuSi4Zn4MnP-C)
CuZn42Al	CC757S*(CuZn39Pb1Al-C)	CC246E (CuSi4Zn9MnP-C)
CuZn35Al1.5Sn	CC770S (CuZn36Pb-C)	CuSi4Zn4MnP
CuZn35AlSiFe	CW626N (CuZn33Pb1.5AlAs)	CuSi4Zn9MnP
CW511L (CuZn38As)	CW625N (CuZn35Pb1.5AlAs)	CW453K (CuSn8)
CW707R (CuZn30As)	CC772S (CuZn36Pb1.5AsSbAl)	CuSn10-C*

*Contents of certain elements (e.g., lead, nickel) are further restricted

With lead-free brasses containing different alloying elements now present in the recycling stream, raw material suppliers must carefully scrutinize incoming scrap. This applies to primary scrap returns from industrial manufacturing as well as secondary scrap purchased from dealers. Certain elements present in the scrap stream can act as deleterious impurities depending on the scenario. Scrap from certain types lead-free alloys must be strictly segregated to avoid issues.

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Product designers and engineers

To comply with E.U. drinking water requirements, product designers and engineers can specify brass alloys included on the 4MS list of approved compositions in approved application categories. This flexibility allows product designers and engineers to take full advantage of multiple brass alloy solutions that each offer an attractive combination of properties.

Potable water component manufacturers

Plumbing components can be made from one or more different metallic materials and may also contain subcomponents or residues made from organic materials (e.g., plastics, greases, lubricants). Demonstrating compliance with the DWD in member states which recognize the 4MS scheme is a two step process.

First, a compositional analysis of the product must be conducted in accordance with relevant E.U. standards to demonstrate that all constituent metallic materials comply with the 4MS list of approved compositions. Second, products may be required to demonstrate compliance with surface testing standards in the following scenarios:

1) Products that do not include a processing step to remove organics deposited during manufacturing (e.g., greases or lubricants) must conduct testing to relevant standards to identify the residue composition (e.g. EN 723).[7] Organic materials may be subject to additional compliance requirements.
2) Products with metallic materials containing >1%lead by weight must demonstrate that any lead surface residue falls below set levels. Testing to EN 16057 may be required, but this has not been decided yet.[8]
3) Products with nickel or nickel-chrome coatings must demonstrate that any metallic nickel residue falls below set levels. The EN 16058 test is recommended for the evaluation of nickel release from chrome-plated components.[9]

Thus, a product is accepted for use in member states that recognize the 4MS scheme if all constituent metallic materials comply with the approved composition list and if the product passes any applicable surface testing requirements. Manufacturers may also need to adjust machining parameters to accommodate the different manufacturing properties of lead-free alloys and segregate scrap from different alloys (e.g., bismuth, silicon-containing) to avoid upstream recycling issues.

Labeling and identification for end-users

There are no mandatory or universally accepted product labeling/identification requirements to demonstrate compliance with the DWD. Manufacturers typically use several methods to demonstrate product compliance including third-party certification listings, product and packaging markings, specification sheets and manufacturer declarations.

DWD revisions and impact on leaded brass

Long-term DWD revisions were approved in February 2020 which includes lowering the maximum limit for lead at the tap from 10 to 5 µg/l from 2035 onwards. Per the 4MS scheme, metals are accepted based on a 50% contribution to the tap limit for lead. In other words, the current 5 µg/l lead limit for brasses assessed through the testing and approval process described above will be reduced by 50% to 2.5 µg/l starting in 2035.

The expected impact is that some leaded brasses currently on the 4MS list may not be permitted for use in certain applications including fittings and ancillaries in buildings (e.g., valve bodies, water meters). However, the alloys may still be compliant for other applications (e.g., pump spindles, moving parts in water meters).

Furthermore, the EU Chemicals Agency is expected to propose "Positive Lists" in 2024/2025, meaning that the 4MS scheme will likely be adopted across all of Europe and become legally binding after publication by the EU Commission and a pre-determined transition period.

Who can I contact for more information?

Adam Estelle, Copper Development Association, Inc.
adam.estelle@copperalliance.us; +1 212 251 7232

Cu Copper Development Association Inc.
Copper Alliance

1 'Council directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption', Official Journal of the European Communities, L 330, May 12, 1998.
2 'Procedure for the acceptance of metallic materials for PDW', Part A, 'Procedure for the acceptance', 4MS Joint Management Committee, 6th Revision, May 27, 2016
3 'Influence of metallic materials on water intended for human consumption – dynamic rig test for assessment of metal release', Part 1, 'Design and operation', EN 15664-1:2008.
4 'Influence of metallic materials on water intended for human consumption – dynamic rig test for assessment of metal release', Part 2, 'Test waters', EN 15664-2:2008.
5 'Corrosion of metals – corrosion of metallic materials under corrosion load by water inside of pipes, tanks and apparatus', Part 6, 'Evaluation process and requirements regarding the hygienic suitability in contact with drinking water', DIN 50930-6:2013.
6 'Procedure for the acceptance of metallic materials for PDW', Part B, '4MS Common Composition List', 4MS Joint Management Committee, 6th Revision, May 27, 2016.
7 'Copper and copper alloys. Combustion method for determination of the carbon content on the inner surface of copper tubes or fittings', BS EN 723:2009.
8 'Influence of metallic materials on water intended for human consumption - Determination of residual surface lead (Pb) - Extraction method', EN 16057:2012.
9 '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', BS EN 16058:2012.

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