Brass for European Potable Water Applications

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 European 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 example, the max limit for lead 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 United Kingdom) 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.[4-6] 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 Common Approach for metals to be mutually recognized throughout the E.U.

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.[3]

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. For reference, a summary table of copper alloys included on the 4MS list as of October 2016 is provided in the table below.

4MS list of approved copper alloy compositions

<0.2% alloyed lead	0.2% to 3% alloyed lead	>3% alloyed lead
CW509L	CW617N	CW614N**
CW510L	CW612N	CW603N**
CuZn42Al	CC757S	
CW511L	CC770S	
CuZn35Al-C	CW626N	
CW724R*	CW625N	
CC768S*	CC772S	
CC771S*	CW725R	
CuZn10Si4MnP*	CC499K	

*"Lead-free" alloys with <0.1% lead
**Limited to moving parts in water meters and parts of pumps/valves

With lead-free brass alloys 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 meet E.U. drinking water requirements, product designers and engineers can specify leaded and lead-free 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 or 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 of the constituent metallic materials comply with the 4MS list of approved compositions (see table). 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 that contain greater than 1% lead by weight must demonstrate that any metallic 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 which 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 different types of leaded and lead-free brass scrap 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.

Ideal materials for drinking water components

Brass alloys are versatile engineering materials used to make safe and durable products that readily meet regulatory requirements for drinking water applications in many European member states. Brass alloys are 100% recyclable and are made almost entirely from recycled content contributing to a more sustainable planet. Compared to other materials, the unparalleled machinability, excellent corrosion resistance and high scrap value of brasses make them preferred materials in potable water systems around the world.

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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 'Procedure for the acceptance of metallic materials for PDW', Part B, '4MS Common Composition List', 4MS Joint Management Committee, 6th Revision, May 27, 2016.
4 '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.
5 '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.
6 '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.
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.