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THE EVOLUTION OF LEAD-FREE BRASS ALLOYS

DRINKING WATER DIRECTIVE (DWD)

[1]The **DWD (Drinking Water Directive)** was updated in 2020 and estrablished that the member countries must adopt the new lead transfer limit in drinking water at the sampling point of 5µg/l within 31/12/2036. This limit is the sum of lead transfers deriving from the aqueduct and the domestic drinking water distribution system. To be effective, the Directive will publish the delegated acts that have been published last April (2024) on the EU Official Journal.

As regards copper alloys production the relevant acts are the following:

- **Directive 2024/367** establishes that from 31/12/2026[2] only the materials (alloys) included in the EU Positive List (EUPL) can be used for contact with drinking water. In the chart on the right, all the alloys that are currently okay for the UBA List but that do not comply with the new EUPL are highlighted in red; the only alloys that also comply with the EUPL are highlighted in green.
- The materials that, between 2021 and 2026, have been approved by the competent authority of a member state (e.g. UBA) and that comply with the parameter value of 5µg/l at the water sampling point, can be used in the manufacture of products in contact with drinking water until 31/12/2032. The alloy CW511L Pb max 0.1 in revision 21 of 27th November 2024 of the UBA is included.
- **Regulation 2024/370** establishes that all products compliant with national hygiene requirements (e.g. DWGV, Kiwa, etc.) that in contact with water intended for human consumption and for which the national certificate of conformity is still valid on 31/12/2026, the Regulation itself applies from 31/12/2032.

WHEN DESIGNING A PRODUCT COMPLIANT WITH THE 5µG/L TRANSFER LIMIT, TO BE SOLD FROM 01/01/2027, WHICH MATERIAL CAN BE USED?

For a new product it is possible to use all the alloys in the EUPL and those approved by one of the member states and compliant with the 5µg/l limit (e.g. CW511L Pb max 0.10) until 31/12/2032.

Alloy		Pb content of bulk material in %
Designation	Composition	
CW509L	CuZn40	≤0.2%
CW510L	CuZn42	≤0.2%
CW511L	CuZn38As	≤0.2%
CW612N	CuZn39Pb2	1.6 - 2.5%
CW617N	CuZn40Pb2	1.6 - 2.5%
CW614N	CuZn39Pb3	2.5 - 3.5%
CW625N	CuZn35Pb1.5AlAs	1.2 - 1.6%
CW626N	CuZn33Pb1.5AlAs	1.2 - 1.7%
CW725R	CuZn33Pb1AlSiAs	0.4 - 0.9%
CW724R	CuZn21Si3P	≤0.1%

NOTE

1 The information on this page have been published by Assomet, Kupfer and the International Wrought Copper Council on 21st June 2024.

2 Germany with the "German Drinking Water Ordinance" has introduced the limit of 5µg/l starting from 12th January 2028. From that date, alloys that will no longer comply to the new limit cannot be used in Germany.

ROHS (RESTRICTION OF HAZARDOUS SUBSTANCES) DIRECTIVE 2011/65/EU

NORMATIVE BACKGROUND

RoHS Directive, implemented in the EU, limits the use of specific dangerous substances in electric and electronical devices. Among them, lead is the most subjected to regulations, but exemptions for specific technical applications are foreseen when there are no valid alternatives.

RECENT DEVELOPMENTS

On September 8th 2025 the European Commission published a new delegate directive to update the exemptions for lead as element for steel, aluminium and copper alloys. The goal is to align the RoHS directive (2011/65/UE) to the technological progress, maintaining at the same time a high level of environmental and health safety.

EXEMPTIONS AND DEADLINES

- 6(c): Lead as element in copper alloys up to 4% weight.
- 6(a), 6(a)-I, 6(b), 6(b)-I, 6(b)-II: other exemptions for steel and aluminium.
- 7(a): lead in high-temperature welding.

The deadline for exemption 6(c) has been postponed to June 30th 2027.

POSSIBLE SCENARIOS

The new delegate directive brings more clarity but also more responsibility. The companies that act in advance, not only guarantee the normative compliance, but also obtain a competitive advantage through a more sustainable product design. Should the exemption 6(c) be officially removed starting from June 30th 2027, the maximum limit allowed in copper alloys would lower from 4% to 0.1%.

This limit would mean that standard lead alloys could not be used (e.g. CW617N, CW614N, CW612N, ecc..) as well as low lead content alloys (e.g. CW510L, CW511L, CW509L, ecc..).

Lead-free alloys could be used instead, those with lead content lower than 0.1%. Among them, we can mention as example:

- CW510L Pb max 0.1
- CW511L Pb max 0.1
- CW724R

OTHER UE REGULATIONS AND LIMITS

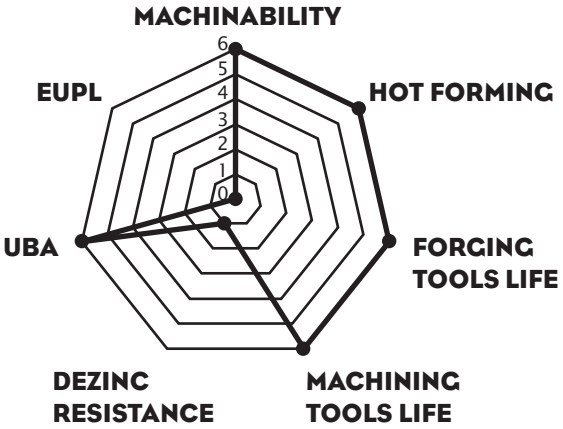
At the moment, the evolution towards **lead-free alloys** is delimited to **materials in contact with drinking water**, but in the next few years it might be applicable also to other working fields.

For example, in 2025 and 2026 ELV lead exemptions will be revised. Exemptions referring to lead might be removed. These restrictions were first applied because the companies stated that it was impossible to work without lead, but thanks to **DWD** (Drinking Water Directive) they will have to be revised.

Product application	Regulations	Max. lead %	Lead exemption in copper alloys	Exemption revision date
Automotive	Directive 2000/53/EC ELV End-of-life vehicle	0,1%	Max. 4% (Annex II: article 4 (2) (a) under exemption 3)	2025

The above information has been collected from the International Wrought Copper Council report

CW617N



Standard Reference	
EN	ASTM
CW617N - CuZn40Pb2	C37700

This is the **standard alloy for hot forging**. It has excellent hot forging characteristic associated with good machinability.

It **complies with the 4MS guidelines** for materials in contact with drinking water, but it's **not compliant to DWD directive** and it's **not included in EUPL**.

It's largely used in **many different applications**: valves, faucets, accessories for plumbing and heating systems, bolts, handles, clamps and components in general, diving accessories, automotive connector harness, automotive valves, battery terminal, etc.

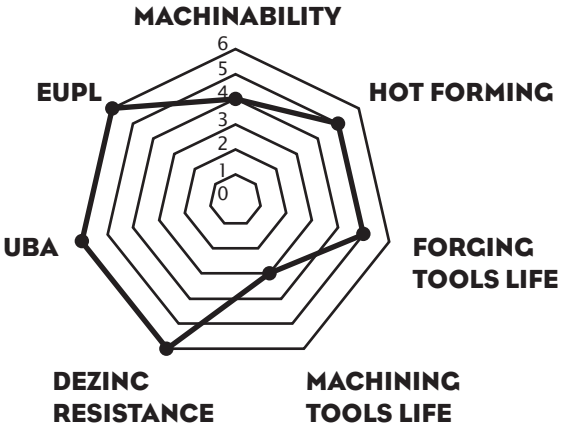
HEAT TREATMENTS
Stress relieving heat treatment enables the **redistribution of stresses** induced by mechanical processing or cold plastic deformation **reducing the risk of stress corrosion cracking.**
The validation of the stress relieving treatment can be performed with the **ISO 6957 test**.

No other heat treatments are required.

CHEMICAL COMPOSITION - EN 12165									
	Cu	Pb *	Sn	Fe	Ni *	Al	Si *	Zn	Other elements
Min. (%)	57,0	1,6	-	-	-	-	-	difference	-
Max. (%)	59,0	2,2	0,3	0,3	0,1	0,05	0,03	difference	0,2

* Limitation according to 4MS. Elements not listed must be ≤0.02 %.
Restriction group of the surface in contact with drinking water according to the "Common composition list": B and D.

CW724R



Standard Reference	
EN	ASTM
CW724R - CuZn21Si3P	C69300

Dezincification resistant alloy with high mechanical properties.
No-lead alloy of new generation, anti-dezincifying, **arsenic-free** with Pb<0,1% and **excellent mechanical properties and excellent chip dimension**.

Good attitude to the hot forging. It is the **ideal material to use for products in contact with drinking water** thanks to the absence of lead.

Due to the high percentage of silicon, this alloy needs a specific waste and shrinkage handling that cannot be mixed with other alloys. The machines must be cleaned before and after the production of parts with this alloy.

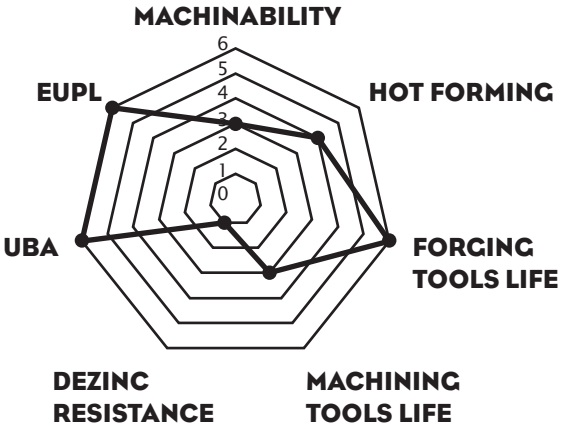
This alloy is **already in the EUPL**.

HEAT TREATMENTS

This alloy exhibits a **good corrosion resistance**. For operations performed over 600 °C a heat treatment is recommended to improve dezincification resistance.

CHEMICAL COMPOSITION - EN 12165											
	Cu	Pb	Sn	Fe	Ni	Al	Si	Mn	P	Zn	Other elements
Min. (%)	75,0	-	-	-	-	-	2,7	-	0,02	difference	-
Max. (%)	77,0	0,1	0,3	0,3	0,2	0,05	3,5	0,05	0,10	difference	0,2

CW510L (PB MAX0,1)



Standard Reference	
EN	ASTM
CW510L - CuZn42	C25800

This is the **standard alloy for no-lead hot forging**. It has good hot deformability characteristics, associated with sufficient machinability by chip removal.

It **complies with the 4MS guidelines** for materials in contact with drinking water and to USA market requirements.

It can be used in **many different applications**: valves, faucets, accessories for plumbing and heating systems, bolts, handles, clamps and components in general.

HEAT TREATMENTS

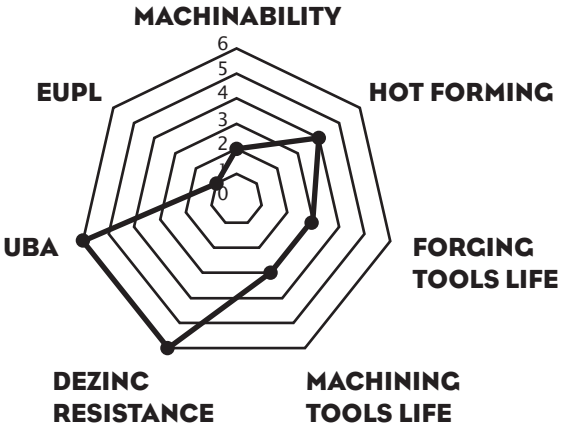
Stress relieving heat treatment enables the **redistribution of stresses** induced by mechanical processing or cold plastic deformation **reducing the risk of stress corrosion cracking**.
The validation of the stress relieving treatment can be performed with the **ISO 6957 test**.

No other heat treatments are required.

CHEMICAL COMPOSITION - EN 12165								
	Cu	Pb	Sn	Fe	Ni *	Al	Zn	Other elements
Min. (%)	57,0	-	-	-	-	-	difference	-
Max. (%)	59,0	0,10	0,3	0,3	0,2	0,05	difference	0,2

* Limitation according to 4MS. Elements not listed must be ≤0.02 %.
Restriction group of the surface in contact with drinking water according to the “Common composition list”: B and D.

CW511L (PB MAX0,1)



Standard Reference	
EN	ASTM
CW511L - CuZn38As	C27493

Dezincification resistant alloy with Pb<0,1%.

Compliant with the requirements of the USA market with limits on lead for materials in contact with water for human consumption.

This alloy is an **excellent material for hot forging** with truly modest dezincification, thanks to the good hot deformability and the high copper content.

HEAT TREATMENTS

Stress relieving heat treatment enables the **redistribution of stresses** induced by mechanical processing or cold plastic deformation **reducing the risk of stress corrosion cracking**.

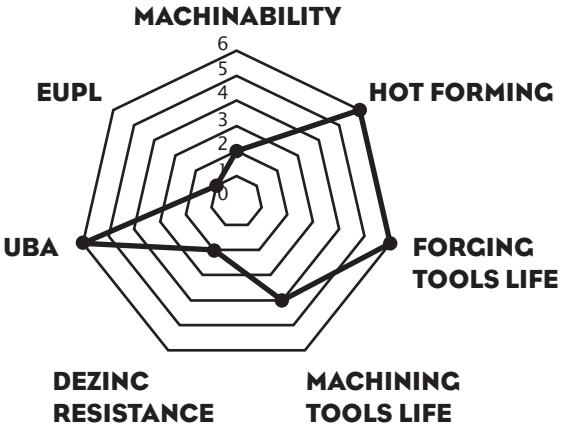
The validation of the stress relieving treatment can be performed with the **ISO 6957 test**.

Heat treatment is required to **improve the corrosion resistance** of the alloy. This treatment after hot stamping **enhances the solubilization of the residual beta phase** to grant material resistant to dezincification. The omission of this treatment impairs the anti-dezincification performance that the material is designed for.

CHEMICAL COMPOSITION - EN 12165										
	Cu	Pb *	Sn	Fe	Ni *	Al	Mn *	As *	Zn	Other elements
Min. (%)	61,5	-	-	-	-	-	-	0,02	difference	-
Max. (%)	63,5	0,1	0,1	0,1	0,3	0,05	0,1	0,15	difference	0,2

* Limitation according to 4MS. Elements not listed must be ≤0.02 %.
Group of restriction of the surface in contact with drinking water: B,D.

EZEE BRASS (DIEHL)



Standard Reference	
EN	**UNS**
CW732R(DW) - CuZn41Mg	C49400

This is a **lead-free alternative to the standard alloy CW617N**.

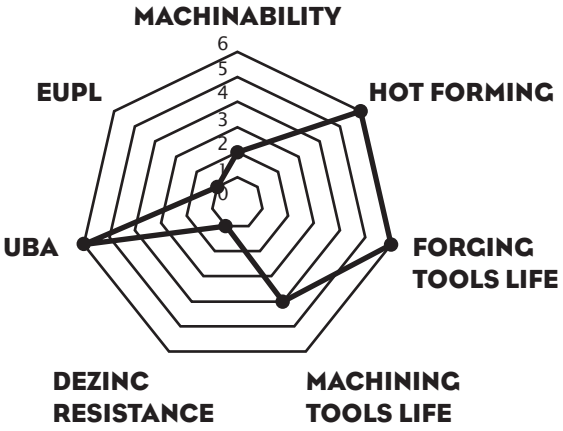
This alloy contains **magnesium**. Although it's in a small amount, it has a great metallurgical impact, achieving the **chip-breaking effect** previously performed by lead in standard brasses.

This is not a dezincification resistant alloy.

CHEMICAL COMPOSITION - Reference values								
	Cu	Pb	Mg	Al	Fe	Ni	Zn	Other elements
Min. (%)	57,0	-	0,1	0	0	0	difference	-
Max. (%)	60,0	0,10	0,5	0,1	0,3	0,2	difference	-

Chemical composition values as per 2.18.3.3 of UBA "EVALUATION CRITERIA DOCUMENT 6th amendment"

ECO SZ3 ® (WIELAND WERKE AG)



Standard Reference	
EN	**UNS**
CW728R(DW) - CuZn40SiP	C68330

This is a **lead-free alternative to the standard alloy CW617N and CW614N**.

Despite being lead-free it has **good machinability**.

This is not a dezincification resistant alloy.

CHEMICAL COMPOSITION - Refrence values									
	Cu	Pb	Si	P	Ni	Fe	Sn	Zn	Other elements
Min. (%)	58,5	-	0,10	0,10	-	0	0	difference	Single
Max. (%)	60,5	0,10	0,3	0,20	0,10	0,2	0,2	difference	≤0,05

Chemical composition values as per 2.18.3.3 of UBA “EVALUATION CRITERIA DOCUMENT 6th amendment”

RECAP

Alloy	Dezinci-fication resistance	Machina-bility	Hot forming	Forging tools Life	Machining tools life	RoHs	UBA LIST	DWD EUPL	AB 1953
CW617N-DW	●○○○○○	●●●●●●	●●●●●●	●●●●●●	●●●●●●	●***	●****	○	○
CW724R	●●●●●●	●●●●○○	●●●●●○	●●●●●○	●●●○○○	●	●	●	●
CW510L Pb max 0,1	●○○○○○	●●●○○○	●●●●○○	●●●●●●	●●●○○○	●	●	●	●
CW511L Pb max 0,1	●●●●●●	●●○○○○	●●●●○○	●●●○○○	●●●○○○	●	●	●**	●
eZee Brass	●●○○○○	●●○○○○	●●●●●●	●●●●●●*	●●●●○○*	●	●	●	●
eco SZ3®	●○○○○○	●●○○○○	●●●●●●	●●●●●●*	●●●●○○*	●	●	●	●

* This is just an estimation due to a limited quantity of test with this recent alloy
** See In-depth study on page 12
*** Compliant with exemption 6(c)
**** UBA valid until January 11th 2028

NOTES

CW724R Due to the high percentage of silicon, this alloy needs a specific waste and shrinkage handling that cannot be mixed with other alloys. The machines must be cleaned before and after the production of parts with this alloy.

CW510L Low lead content. Excellent replacement for CW617N for applications in contact with drinking water. The burrs left by this material are difficult to remove in manual operations.

CW511L High corrosion resistance, low lead content. Excellent replacement for CW602N for applications in contact with drinking water (currently not present in DWD). The burrs left by this material are difficult to remove in manual operations.

W511L (PB MAX0,1) – DRINKING WATER DIRECTIVE

Excerpt from: uba-information_-_hygienic_requirements_for_materials_in_contact_with_drinking_water_transitional_regulations_-_rev01

Lead-containing materials

«(omissis)»

With the 5th amendment to the new version of the evaluation criteria for metallic materials, the UBA* shall identify the materials that may no longer be installed in water supply systems starting from 12th January 2028.

The pictures below are an excerpt of the updated UBA Evaluation Criteria Document.

In conclusion:

- CW511L-DW (ref 2.5.3.1 of UBA Evaluation Criteria Document) can't be used starting from 12th January 2028

but

- CW511L-DW (low lead) (ref 2.5.3.2 of UBA Evaluation Criteria) can still be used until 31st December 2032

In the meantime, the request for the inclusion in the EUPL of CW511L-DW (low lead) will be submitted to ECHA by Almag or industry association starting from 01/01/2026.
The tests made by UBA for these alloys have already confirmed the compliance to the EUPL requirements (5µg/l max reduced to 2.5µg/l).

* UBA: German Umweltbundesamt (Federal Environment Agency)

2.5.3 MATERIALS SUITABLE FOR CONTACT WITH DRINKING WATER

2.5.3.1 CW511L-DW (CUZN38AS) Entry valid until January 11 2028

Notation	Product Group
CW511L-DW* (CuZn38As)	B - D

* Further restrictions on composition (see below) compared to the standardised European composition of CW511L

Constituents (% (m/m))

Cu	Zn	As
61.5% - 63.5%	Remainder	0.02% - 0.15%

Impurities (% (m/m))

Al	Fe	Mn	Ni	Pb	Sn
≤ 0.05%	≤ 0.1%	≤ 0.1%	≤ 0.3%	≤ 0.2%	≤ 0.1%

2.5.3.2 CW511L-DW (CUZN38AS) (LOW LEAD)

Notation	Product Group
CW511L-DW* (low lead)	B - D

* Further restrictions on composition (see below) compared to the standardised European composition of CW511L

Constituents (% (m/m))

Cu	Zn	As*
61.5% - 63.5%	Remainder	0.02% - 0.10%

Impurities (% (m/m))

Al	Fe	Mn	Ni	Pb	Sn
≤ 0.05%	≤ 0.1%	≤ 0.1%	≤ 0.10%	≤ 0.10%	≤ 0.1%

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