



Sarbak, press release, June 1, 2023

www.sarbak.com.tr

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Sarbak Signs a Sublicense Agreement for GloBrass® with Luvata

Sarbak Metal Tic. Ve San. A.Ş (“Sarbak”) has signed a sublicense agreement with Luvata Oy (“Luvata”) to use GloBrass® patent and trademark rights in Europe. GloBrass® is lead-free, free-cutting brass developed by Luvata’s parent company Mitsubishi Materials Corporation (“MMC”).

Luvata has been granted an exclusive license, in Europe and North America, for the patent and trademark rights of GloBrass®. Luvata has now granted a non-exclusive sublicense to Sarbak for the use of GloBrass® patent and trademark rights in Europe. GloBrass® is a lead-free (*1), free-cutting brass, with enhanced hot workability and an improved electrical conductivity. It is a great option to customers looking for a more environmentally friendly brass or developing new products that will benefit from its excellent cost effectiveness, electrical conductivity, and hot workability. GloBrass® is expected to be used in a wide range of automotive, electronic, lock and plumbing components. It complies with RoHS (*1) and ELV (*2) directives, and EN (*3) standards.

As a lead-free brass, GloBrass® is very promising for faucet applications, for example. Currently, Luvata and MMC are in the process of registering GloBrass® as compliant with the EU drinking water regulation.

To make GloBrass® known as the number one environmentally friendly lead-free brass, Luvata, together with MMC and Sarbak, will accelerate strategic initiatives, including application development and marketing, in the European market.

*1. RoHS Directive

RoHS (Restriction of the use of certain Hazardous Substances in electrical equipment) Directive is an EU directive on the restriction of the use of certain substances in electrical and electronic equipment.

*2. ELV Directive

ELV (End-of-Life Vehicles) Directive is an EU directive to reduce the environmental impact of end-of-life vehicles.

*3. EN

EN is an abbreviation for the “European Norm”, which refers to technical standards used in the European Union (EU). EN standards are intended to promote technical uniformity and establish common standards among EU member states.

GloBrass®

Lead-free brass with excellent machinability

GloBrass

ECO BRASS

Applicable to RoHS directive, ELV directive and Tap water quality standards

Standard No. ECO BRASS

JIS: C6931, C6932, CAC804 CDA: C69300, C69310, C87850, C87870

EN: CW724R, CB768S, CC768S

GloBrass

CDA: C68370

EN: CW726R



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sarbak vakfı
Sarbak Kayra ve Eğitim Vakfı

EKO-SARI



GloBrass and ECO BRASS are environmentally friendly materials, complying with RoHS directive, ELV directive and Tap water quality standards.

GloBrass is the new material whose copper content is close to general brass, the machinability and the strength are well balanced, it is possible to supply thinner bars, so it is recommended to mass-market segment which lead-containing brass are applied.

ECO BRASS is suitable substitutes for lead-containing brass as well as Austenitic stainless steel (SUS304-EN1.4301-AISI304), since ECO BRASS has a similar strength to stainless steel in addition

to characteristics like superior machinability and hydrogen embrittlement resistance.

RoHS directive, ELV directive, Tap water quality standards (Drinking water quality standards)

GloBrass and ECO BRASS contain lead less than 0.09%, complying with RoHS directive, ELV directive and Tap water quality standards, especially NSF61 (Lead elution amount : 5ppb) of Tap water quality standard in the U.S.

Material properties of GloBrass and ECO BRASS are improved by containing Si which does not affect to health while Lead does harm to.

Enforcement	Area	Name of Regulation	Field	Outline of the Regulation
April 2003	JP	Ministry of Health, Labor and Welfare Ordinance No. 43 of 2002	tap water	Allowable lead content in tap water was reduced from 0.05mg/L to 0.01mg/L (about 10 ppb).
April 2011	US	NSF14	tap water	This regulation is related to dezincification corrosion resistance and stress corrosion cracking resistance.
July 2012	US	NSF61	tap water	Allowable amount of lead dissolved into water was reduced from 15 ppb to 5 ppb.
Jan. 2014	US	S3874	tap water	The amount of lead contained in plumbing fittings is restricted (weighted average: 0.25%).
Dec. 2017	EU	ELV Directive	automobile	Lead may be contained at 0.1% or less (extension of the exemption allowing inclusion of up to 4.0% lead in a copper alloy has been approved).
May 2018	EU	RoHS Directive	electronics	Lead may be contained at 0.1% or less (extension of the exemption allowing inclusion of up to 4.0% lead in a copper alloy has been approved).
Jan. 2021	EU	Drinking Water Directive	tap water	Allowable amount of lead dissolved into tap water was reduced from 10 ppb to 5 ppb.
Sep. 2022	AU	NSF372	tap water	The amount of lead contained in plumbing fittings is restricted (weighted average: 0.25%). - - - Transitional period: 3 years
Feb. 2023	US	AB100 (a Californian bill a.k.a. Chan Bill)	tap water	Allowable amount of lead dissolved into tap water was reduced from 5 ppb to 1ppb. - - - Provisional
Jan. 2024	US	NSF61	tap water	Allowable amount of lead dissolved into tap water was reduced from 5 ppb to 1ppb. - - - Provisional03

Trend in Environmental Regulations

Use of a material containing a harmful substance such as lead, mercury, cadmium, or hexavalent chromium for an electrical or electronic component or an automotive component is prohibited by RoHS Directive and ELV Directive.

However, due to an exemption temporarily applied, copper alloys are still allowed to contain up to 4% Pb.

The Consultants of these Directives proposed extension of the exemptions until 2024 in November 2021 with respect to the ELV Directive, and until July 2026 in December 2021 with respect to the RoHS Directive respectively.

The Consultants also indicated that the subjects to which the exemptions are applicable should be more specific and limited in the next review.

Note: The latest information is available on OEKO's website. Carl-Otto Gensch. Öko-Institut e.V. : "RoHS Evaluations" (<https://rohs.exemptions.oeko.info/>).

Global Material

ECO BRASS® is the world best-selling lead-free, free-cutting brass.

The alloy's accumulated global sales volume reached 300,000 tons in 2019.

Application, Positioning

GloBrass is the new material whose copper content is close to general brass, the machinability and the strength are well balanced, it is possible to supply thinner bars, so it is recommended to mass-market segment which lead-containing brass are applied.

ECO BRASS is superior for erosion resistance^{*1}, ECO BRASS is outstanding for corrosion resistance^{*2}. Each brass is applied to Automotive parts, Electrical parts and Faucet parts etc.

● Proposal for application

Faucet parts etc. : Water meter case, Faucet fittings, Sprinkler head

Automotive parts : Solenoid valves, Turbocharger bearings, Brake parts, Relief valve, Temperature sensor, Insert nuts, Tire valves

Electrical parts : 2-3 way valves / Flare nuts / Terminals for Air conditioners

Watch parts : Watch crowns, Case

Type	Corrosion resistance	Erosion resistance	Application		
			Faucet parts	Automotive parts	Electrical parts
GloBrass	Average	Average	Average	Good	Good
ECO BRASS	Good	Good	Good	Good	Good
Lead-containing brass, C3604(CW612N)	Average	Average	Average	Good	Good

*1 Erosion resistance : Resistance to erosion due to physical action of high-speed fluid

*2 Corrosion resistance : Resistance to chemical corrosion

Features

Each Characteristic of GloBrass and ECO BRASS is as follows. Various Characteristics of GloBrass are superior to Lead-containing brass, the electrical conductivity of GloBrass is higher than Phosphor bronze, it is applicable for terminals which transfer electric signals.

ECO BRASS has well balanced performance and similar strength to Austenitic stainless steel (SUS304 SUS304-EN1.4301-AISI304).

Type	Tensile strength	Wear resistance	Corrosion resistance	Machinability	Forgeability	Castability	Electrical conductivity (%IACS)
GloBrass	Good	Good	Average	Good	Excellent	Good	16
ECO BRASS	Good	Good	Good	Good	Good	Good	8
Lead-containing brass, C3604(CW612N)	Average	Average	Average	Good	-	-	26
Lead-containing brass, C3771(CW608N)	Average	Average	Average	Good	Good	-	27
Austenitic stainless steel (SUS304 SUS304-EN1.4301-AISI304)	Good	Excellent	Good	Average	Average	-	2

Chemical composition, Standard number of ECO BRASS

Chemical compositions and Registered Standard number are as follows.

(Weight%)

Type	Shape	Standard number			Cu	Si	P	Sn	Pb ^{*1}	Cd ^{*1}	Zn
		CDA	JIS	EN							
ECO BRASS	Bar	C69300	C6932	CW724R	75.5	3.0	0.08	<0.1	<0.09	<0.01	Rem.* ²
	Casting	C87850	CAC804	CB768S	76.0	3.0	0.08	<0.1	<0.09	<0.01	Rem.* ²
GloBrass	Bar	C68370	-	-	62.5	1.0	0.07	<0.2	<0.1	<0.01	Rem.* ²

*1 RoHS - ELV directive value Pb < 0.1 Cd < 0.01

*2 Including inevitable impurities and trace additive elements

Shape

GloBrass and ECO BRASS are supplied as following shapes.

	 Bar, Rod	 Ingot for casting
GloBrass	Available	Available
ECO BRASS	Available	Available

Physical properties

Physical properties are as follows.

Typical value

Property	GloBrass	ECO BRASS	Lead-containing brass C3604(CW612N)	Bronze-casting CAC406 (EN-CC491K)
Specific Gravity g/cm ³	8.3	8.3	8.5	8.8
Thermal Conductivity W/m·K	73	35	114	70
Electrical Conductivity %IACS	16	8	26	15
Coefficient of Thermal Expansion X10 ⁻⁶ /°C	19	20	21	18
Liquidus Temperature °C	880	890	900	1010
Solidus Temperature °C	865	855	885	860

Mechanical properties (Sampling direction : L.D.)

Mechanical properties are as follows.

● **Bar, Rod**

Typical value for Φ20mm

Property	GloBrass	ECO BRASS	Lead-containing brass C3604(CW612N)	Stainless steel SUS304 (EN-CC491K)
Tensile Strength MPa	625	650	435	660
0.2%Yield Strength MPa	470	420	295	310
Elongation %	20	20	25	55
Hardness HV	(185)	(200)	(140)	(160)

● **Casting**

Representative values

Property	ECO BRASS	Bronze-casting CAC406 (EN-CC491K)
Tensile Strength MPa	400	220
0.2%Yield Strength MPa	170	-
Elongation %	20	15

Machinability of GloBrass, ECO BRASS

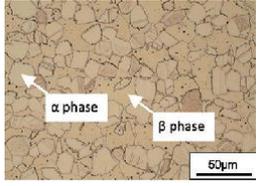
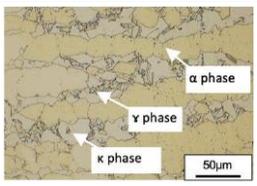
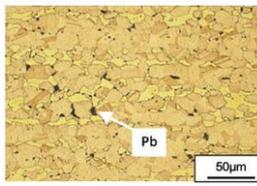
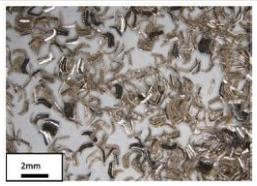
The chips of C3604(CW612N) are cut off because of stress concentration on Pb particles which are soft and low melting temperature.

On the other hand, the chips of GloBrass are cut off due to stress concentration on β phase. The chips of ECO BRASS are cut off because of stress concentration on β - γ phases which are hard.

GloBrass and ECO BRASS are applicable for dry cutting, because it's Lead-free. If the chips are not cut off under the same cutting conditions of C3604(CW612N), we suggest that higher feed rate and lower cutting speed could be effective.

Furthermore, if breakage of cutting edge occurs, cutting edge with honing (small radius) could be one of the solution, such as recommended tools for stainless steel.

Mechanism of the machinability

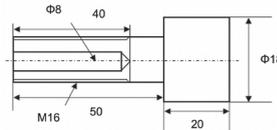
	GloBrass	ECO BRASS	Lead-containing brass C3604(CW612N)
Metal structure			
Chips			

Cutting conditions : Dry cutting, Cutting speed 40m/min, Depth of cut 1.0mm, Feed rate 0.1mm/rev, Corner radius 0.4mm

Example of Turning, Drilling, Tapping, Threading and Cutting-off

One of the test results is as follows, it was possible to machine GloBrass, ECO BRASS under the same cutting conditions as Lead-containing brass C3604(CW612N).

The cycle time of GloBrass and ECO BRASS was shorter than that of Austenitic stainless steel (SUS304-AISI304-EN1.4301) because of the higher cutting speed and feed rate. The video is as follows. (<https://youtu.be/X2Ie3rsLKu0>)



Part after machining Φ 20mm Bar (GloBrass)

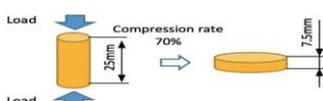
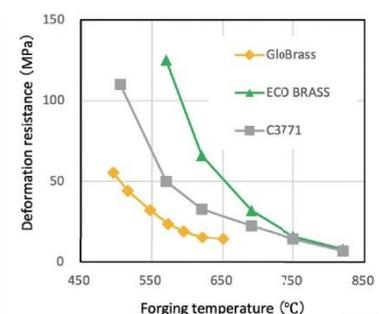
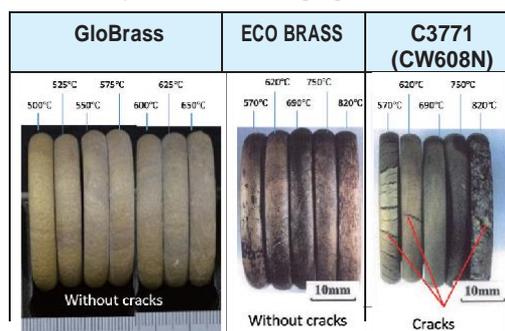
Cutting conditions

Process	Cutting tools*		GloBrass, ECO BRASS, C3604(CW612N) (Dry cutting)			Austenitic stainless steel SUS304 (Wet cutting) (EN1.4301-AISI304)		
	Holder	Insert	Rev. (min ⁻¹)	Cutting speed (m/min)	Feed rate (mm/rev)	Rev. (min ⁻¹)	Cutting speed (m/min)	Feed rate (mm/rev)
1 Facing	SDJCR1212M11	DCMT11T304-LM (VP15TF)	2122	120	0.1	1768	100	0.1
2 Leading-drill	DLE1000S100P090	-	2785	70	0.07	1194	30	0.05
3 Drilling	MVS0800X05S080	-	3183	80	0.1	2387	60	0.1
4 Turning	SDJCR1212M11	DCMT11T304-LM (VP15TF)	1989	100	0.1	1592	80	0.1
5 Threading	MMTER1212H16-C	MMT16ERG60-S (VP15TF)	700	-	2	700	-	2
6 Turning	SDJCR1212M11	DCMT11T304-LM (VP15TF)	1768	100	0.1	1415	80	0.1
7 Cutting-off	GYSR1212JX00-D13	GY2M0200D020N-GS (VP20RT)	2000	-	0.1	2000	-	0.1

Hot Forging of GloBrass, ECO BRASS

The deformation resistance of GloBrass is lower than Lead-containing brass C3771(CW608N), so any cracks did not occurred. GloBrass has well forgeability, the proper temperature is 580 ~650°C. However, C3771(CW608N) cracked below 620°C and at 820°C. On the other hand, suitable temperature of ECO BRASS is 700~760°C, in which the deformation resistance is low.

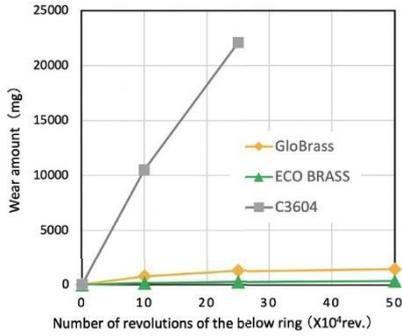
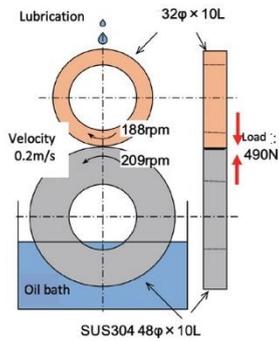
The samples after hot forging



Wear resistance of GloBrass, ECO BRASS

Wear amount of GloBrass and ECO BRASS is smaller than C3604(CW612N) during the Amsler wear test with the lubrication.

Amsler wear test

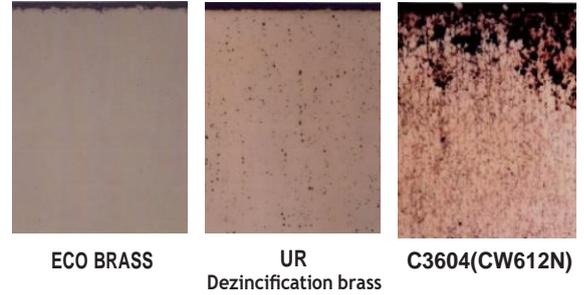


Lubrication conditions :
Silicon oil,
Dripping and oil bath

Dezincification corrosion resistance of ECO BRASS

ECO BRASS shows excellence in Dezincification corrosion resistance, because ECO BRASS contains little Zn, and no low β phase in terms of electrochemical in the matrix.

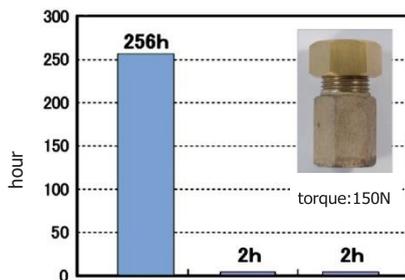
ISO6509 : Dezincification corrosion test



Stress corrosion cracking resistance of ECO BRASS

ECO BRASS has superiority in stress cracking resistance, since its composition of low Zn and 3% Si improves effectively for the performance.

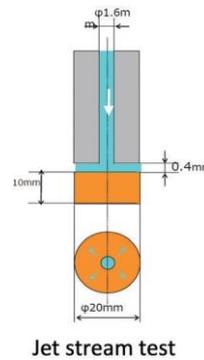
Stress corrosion cracking resistance



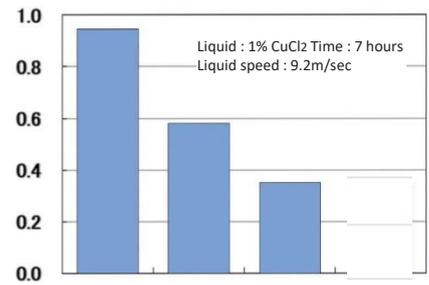
ECO BRASS C3604(CW612N) C3771(CW608N)

Erosion Corrosion resistance of ECO BRASS

The wear amount of ECO BRASS is lower than C3604 (CW612N), and greater than CAC406 (EN-CC491K).



Jet stream test

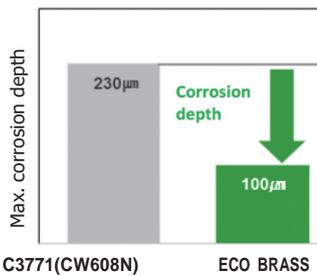


C3604(CW612N) ECO BRASS CAC406

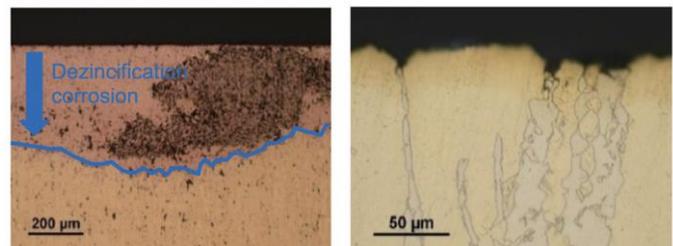
Corrosion resistance of ECO BRASS

Best corrosion resistance in ECO BRASS is recommended for localized corrosion of normal ECO BRASS.

EN15664: Max. corrosion depth after 1 year flow test



ISO6509 : Dezincification corrosion test



C3604(CW612N)

ECO BRASS