



– BRONZ1 TECHNICAL REPORT –

Lead-free brass alloy

NEXTBRASS[®]

Registered into ASTM, UNS No. C89720

(For casting)

Rev. 2013.1.28

New Copper Alloy “NEXT BRASS” Earth Friendly Materials – Lead -Free Brass for Casting

In recent years, lead regulations have become strict gradually to reduce the amount of lead elution from water facilities, and also have been discussed in the United States. President Obama has officially signed the bill for the application of the new standard NSF61 Annex G in January 2011. This has enhanced to ensure that the lead controls of the parts related to water will become more strict from 2014 and will be amended to read that the content of lead for the pipes, fittings and drinking systems shall be “0.25% Max lead content weighted average of the products.” “NEXT BRASS” newly developed by us can satisfy these regulation and can keep you living in safe.

1. INTRODUCTION

NEXT BRASS has been developed with the concept “earth-friendly materials” and developed along the following three themes.

1.1 SAFETY

- **Lead Free**
- **Corrosion Resistance**
- NEXT BRASS is harmless for health because this alloy is lead free and has an excellent corrosion resistance.

1.2 ENVIRONMENT

- **Recycling**
- **Energy Conservation**
- Alloy that can be recycled lead-free alloy.
- Alloy that can contribute to energy conservation.

1.3 QUALITY

- **Cost-Down**
- NEXT BRASS is lower cost materials than bronze.
- And its mechanical properties are the same or superior to bronze.

2. NEXT BRASS SERIES

There are two types of NEXTBRASS. One is for hot working and another one is for casting. This technical report explains the thing for casting.

NEXTBRASS for casting is the alloy which can use it for sand casting and continuous casting, is registered into ASTM in U.S. ,and also finished process of patent application in Japan . It is shown in Table 1.

Table.1 NEXT BRASS

	Overview	Japanese Patent Publication No.	CDA UNS No.
NEXT BRASS –CC	Lead Free Brass for Continuous Casting	2012-207255	C89720
NEXT BRASS -SC(In)	Lead Free Brass for Casting	2012-207255	C89720

3. CHEMICAL COMPOSITION

Chemical composition for NEXTBRASS is shown in Table 2.

Table.2 Chemical Composition (wt%)

	Cu	Sn	Pb	Zn	Al	Si	Sb	Bi	B [ppm]
Max/Min	R	0.6 -1.5	≤ 0.09	26.0 -32.0	0.35 -1.5	0.4 -1.0	0.02 -0.20	0.5 -2.0	5 -100
Casting	R	1.0	≤ 0.09	29.8	0.5	0.5	0.07	0.7	10
Continuous Casting	R	1.0	≤ 0.09	29.0	0.5	0.5	0.07	1.5	10

4. USE CASE

4-1 Plumbing Components

- Faucets • Water meter • Fittings • Valves • Elbows • Tees

4-2 Industrial Machinery Parts

- Various Bush • Shaft • Pump Component
- Alternative for Brass
- Automobile-related Parts • Strainer

5. CORROSION RESISTANCE

5-1 Erosion-Corrosion Resistance

The result of erosion-corrosion resistance test is shown in fig1, fig2. You can see that NEXTBRASS can provide an excellent erosion-corrosion resistance equivalent to the bronze by adding Tin.

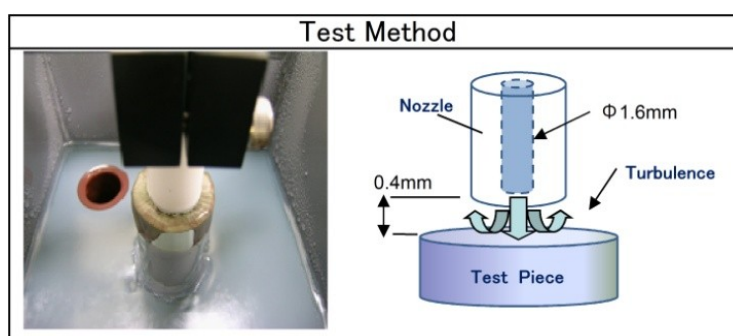
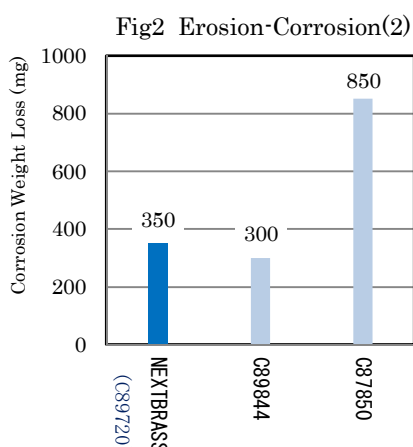
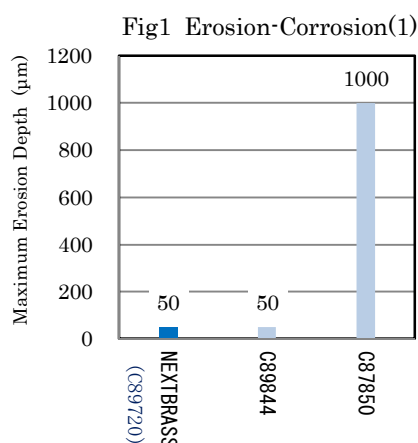


Table.3 Test Condition

Reagent	CuCl ₂ · 2H ₂ O 99%
Concentration	190g reagent in 15L dissolved water (1wt %)
Temperature	40°C±1°C
Flow velocity	3.3m/sec
Flow Rate	400ml/min
Corrosion time	5hours
Air blown	2L/min

* Photo After the Test *



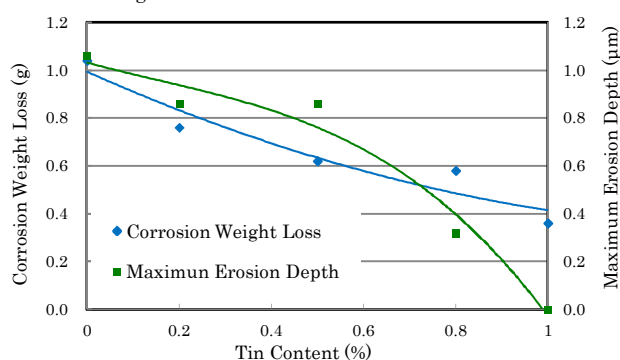
5-2 Tin Content and Erosion-Corrosion

We revealed that erosion-corrosion resistance is good that the tin(Sn) content of 1.0%.

The test result is shown in Fig3,



Fig3 Tin Content and Erosion-Corrosion



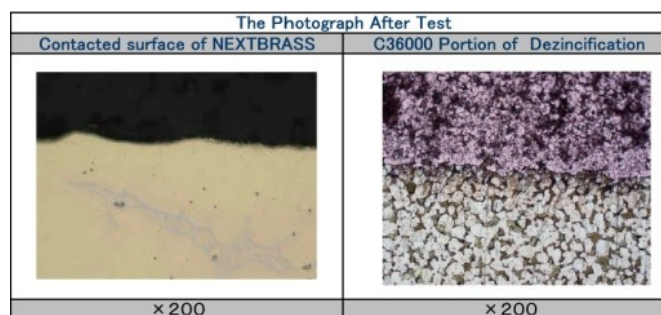
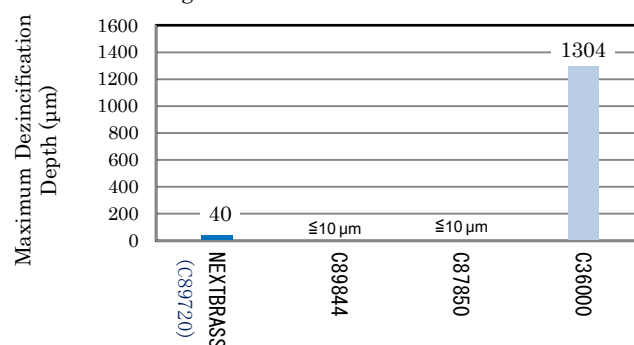
5-3 Dezincification Resistance

Dezincification resistance of NEXTBRASS can provide an excellent dezincification resistance below 100 μm. (Fig4)

*Corresponding to Grade A; standard EN

**Test Method: According to ISO6509-1981

Fig4 Dezincification Resistance



6. STRESS CORROSION CRACK SENSITIVITY

Stress Corrosion Crack Test

The taper screw combination is shown in Table4.

Table.4 Test Condition (Ref. ASTM B858)

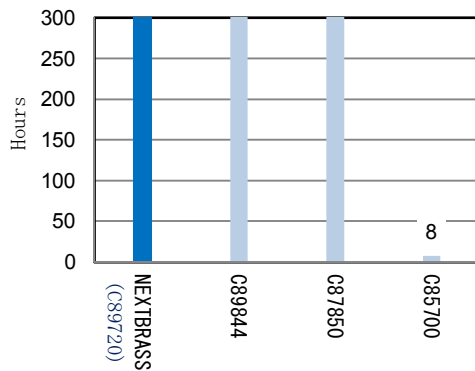
Shape	φ 20.7 × 28mm-Rc3/8
Tightening torque	7.5 N · m
Atmosphere	Ammonia vapor atmosphere at room temperature(12%NH ₃ Solution)
Photograph	
Criterion	The presence or absence of cracks that is observed visually or microscopic

It's tighten constant torque and be exposed ammonia vapor atmosphere.

Then we checked the presence or absence of cracks that is observed visually or microscopic at the specific time.

The test result is shown in Fig5.

Fig5 Test Result



NEXTBRASS compared with C85700 which cracked in 8 hours. There is no crack after 312 hours at the NEXTBRASS.

7. MECHANICAL PROPERTIES

Mechanical properties of NEXT BRASS are equivalent or superior to the lead-free bronze casting's (C89844). Mechanical properties of sand mold castings' are shown in Fig6,7 and 8. And continuous castings' are shown in Fig9,10 and 11. The specimen was collected by sand mold of CO₂, or test mold of type E or B.

7-1 Sand Mold Castings'

Fig6 Tensile Strength

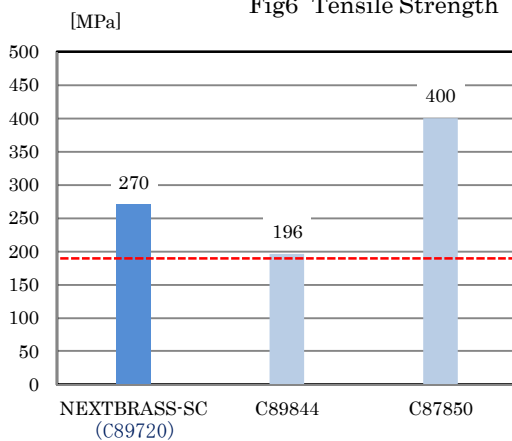


Fig7 Elongation

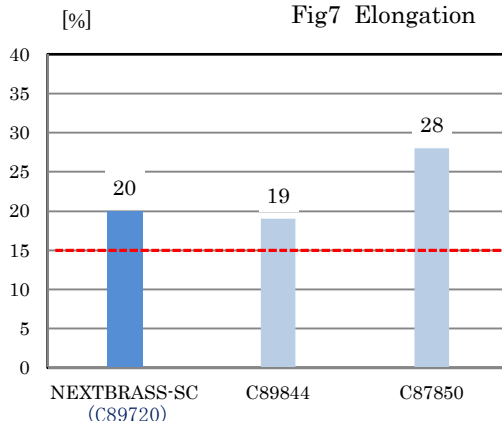
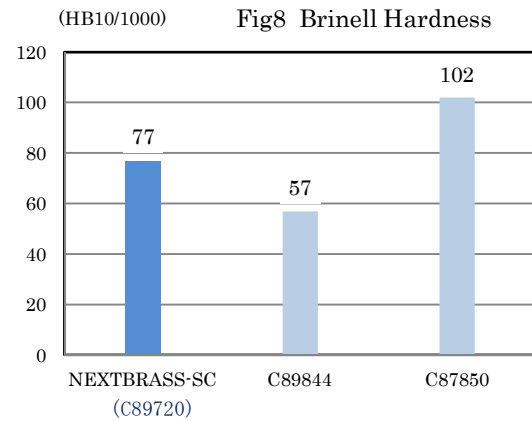


Fig8 Brinell Hardness



7-2 Continuous Castings'

Fig9 Tensile Strength

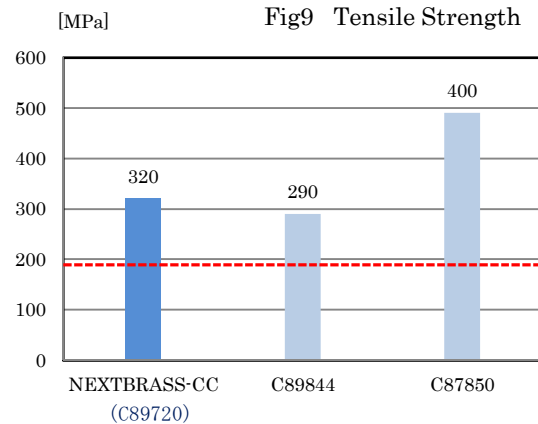


Fig10 Elongation

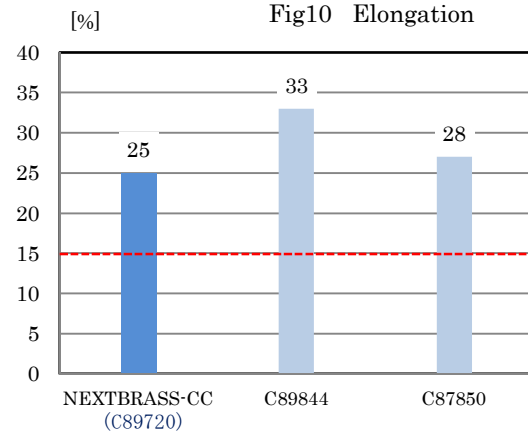
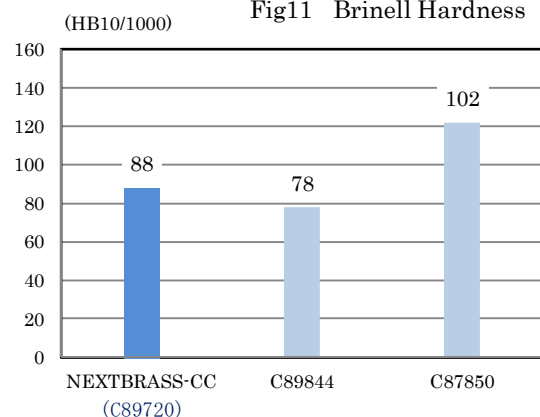


Fig11 Brinell Hardness



8. MACHINABILITY

8-1 Measurement of Cutting Resistance

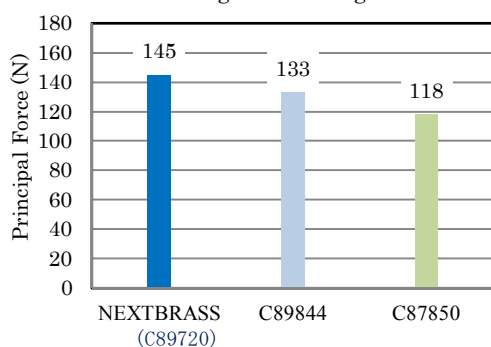
The result of Measurement of cutting resistance of NEXTBRASS is shown in Fig12 and 13.

<Cutting Condition >

Outer Diameter Cutting

- Dry
- Depth of cut ; 1.0mm
- Feed ; 0.1 mm/rev
- Chip ; TNGG160404L-C
- Work material ; ϕ 18 rod

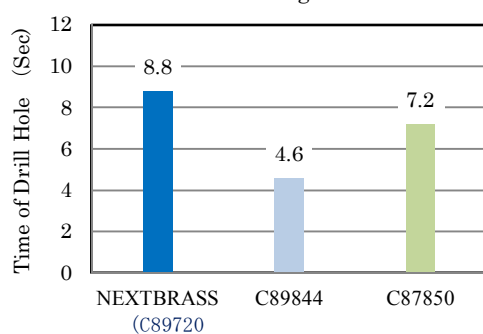
Fig12 Cutting Resistance



Drill Hole

- Load ; 2.5kgf, N=10
- Drill ; ϕ 5
- Depth ; 5mm

Fig13 Drill Test



8-2 The Shape of the Chips

Bismuth grains and κ -phase acts as a chip breaker, and then divide the chips..

* Photo of Chips *



9. METALLOGRAPHIC STRUCTURE

The metallographic structure of NEXTBRASS is shown in Fig14, Fig15. It is mainly composed with α -phase and κ -phase.

Fig14 Sand Castings

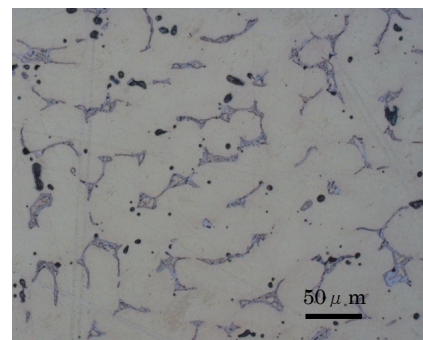
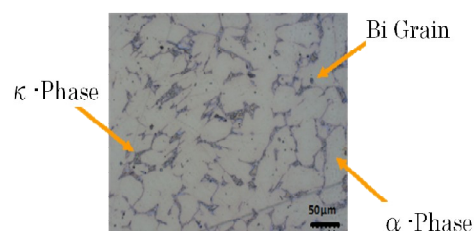
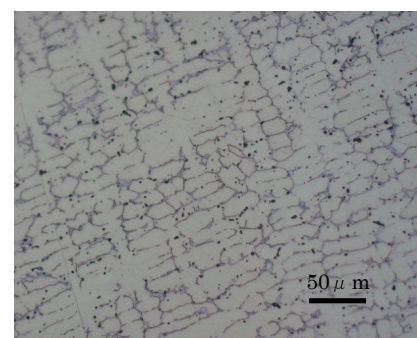


Fig15 Continuous Castings



α -phase ; Whitish part in the photograph
 κ -phase ; Lamellar shaped portion of the blue in the photograph
 Bismuth ; Shaped portion of the black point

10. CASTABILITY

10-1 Solid-Liquid Phase Line Temperature

Solid-liquid phase line temperature of NEXTBRASS is shown in Table5.

The NEXTBRASS properties have become closer to brasses. (Table 5)

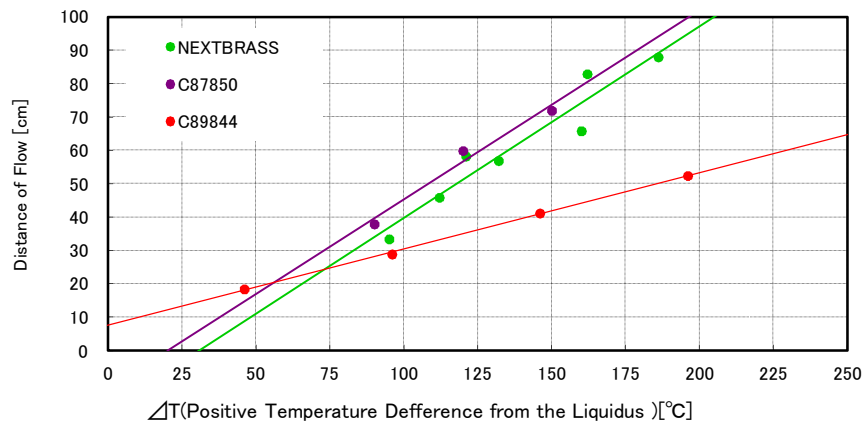
Table 5 Solid-Liquid Phase Line Temperature

Unit : $^{\circ}\text{C}$ (F)	NEXTBRASS	C89844
Liquid Line temperature	918 (1684F)	1010(1850F)
Solid line temperature	873 (1603F)	853(1550F)
Width of the solid-liquid	45 (81F)	167(300F)

10-2 Flow Length Test

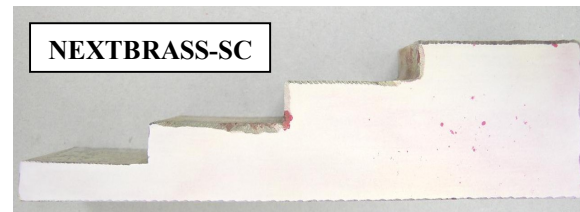
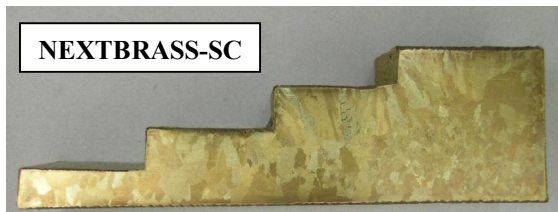
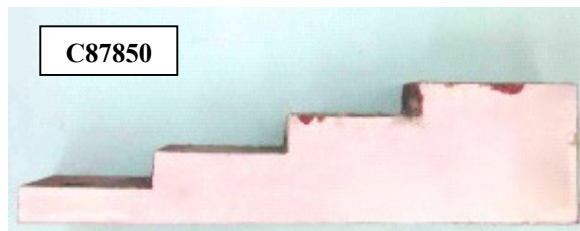
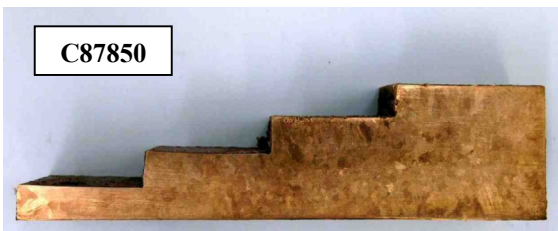
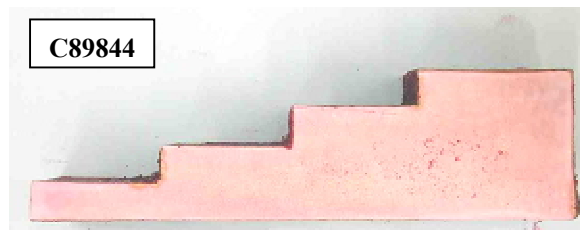
Cast into the spiral molding mold of our CO2 sand mold, and then, we measured the flow length. The measurement result is shown in Fig16.

Fig16 The Result of Flow Length Test



10-3 Stair-Step Test

Flaw detection test results of the stair shaped test specimen, and macro observation.



10-4 Casting Case

• Water Meter



• Strainer



• Water Shutoff Valve

