



# Casting C87850

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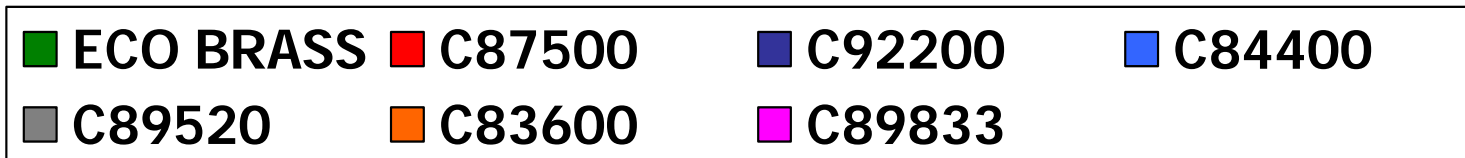
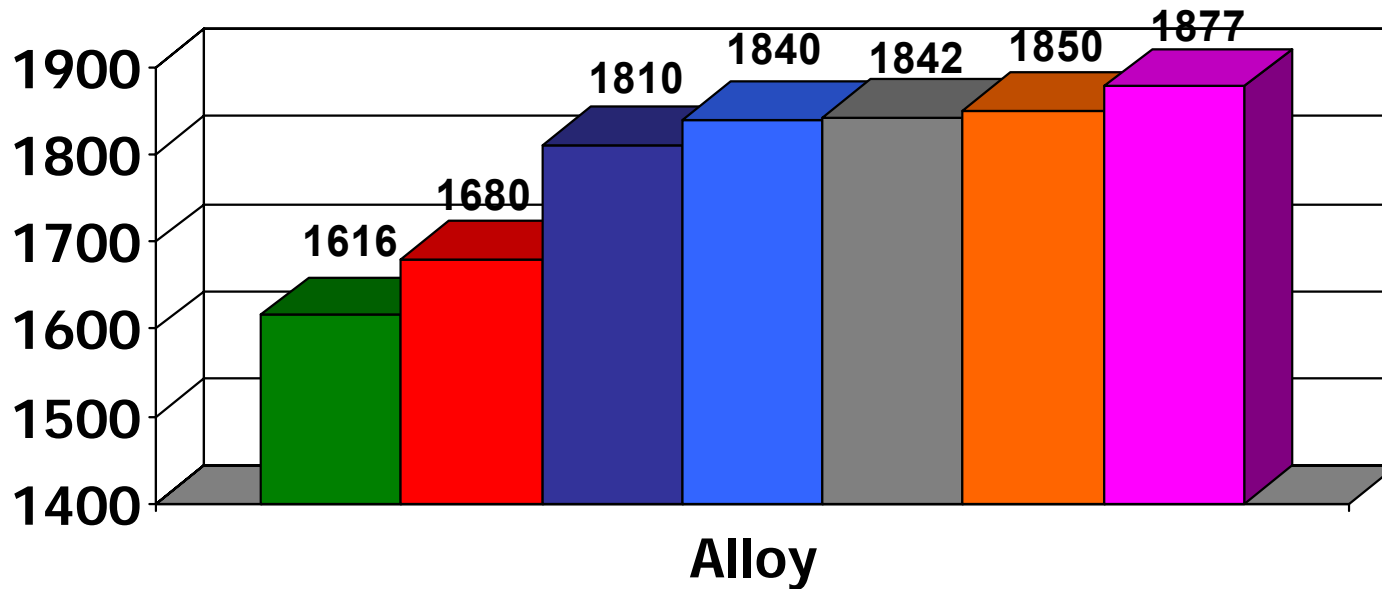
**C87850 Water Meter Bodies**

# C87850 Chemical Requirements

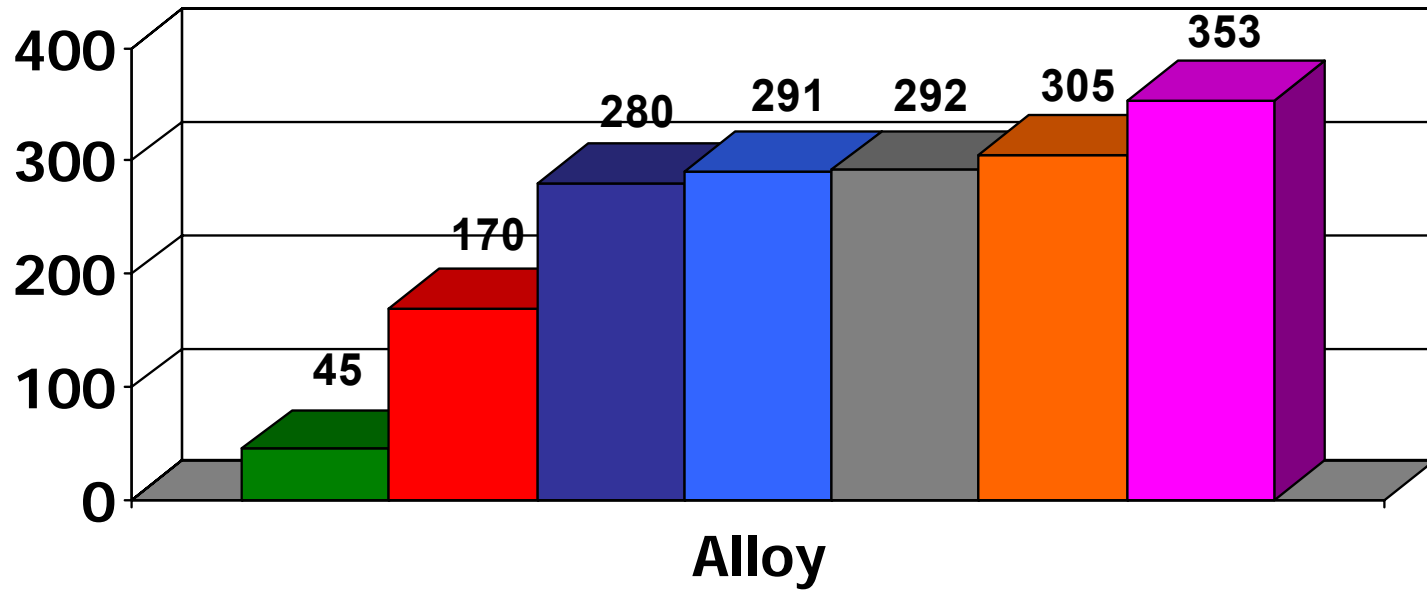
Major Elements	Cu (%)	Si (%)	P (%)	Zn (%)
	74.0 – 78.0	2.7 – 3.4	0.05 – 0.20	Rem.


Residual Elements	Pb (%)	Sn (%)	Fe (%)	Ni (%)	Mn (%)	Sb (%)	TOE
	0.09	0.30	0.10	0.20	0.10	0.10	0.50

## Liquidus Temperatures (F)



## Freezing Ranges (F)



 ECO BRASS	 C87500	 C83600	 C84400
 C92200	 C89833	 C89520	



# Sand Cast Water Meter Bodies



- **Foundry:** Tohoku, Fukushima Japan
- **Original alloy:** C83600
- **Current alloy:** C87850



## **Background**

- **Reason for alloy change:** **Pb leachate reduction from 5 ppm ► 1ppm**
- **Year alloy changed:** **2000**
- **Current total production:** **Over 9 million**

## **Melting**

- **Charge materials:** Run-around scrap, ingot, turnings
- **Melting furnace:** High frequency crucible
- **Dross generation:** Less than C83600
- **Fume generation:** Less than yellow brass





## *Pattern Design*

- **Pattern shrinkage:** **1.2% to 1.7%**
- **Pattern draft:** **0.5°**



## *Gating & Riser*

- **Gating ratio:** 1: 2-3: 3-6
- **Sprue diameter:** 0.6” – 1.2”
- **Casting weight:** 13mm - 1.47 lb  
20mm – 2.74 lb



## **Molding Sand**

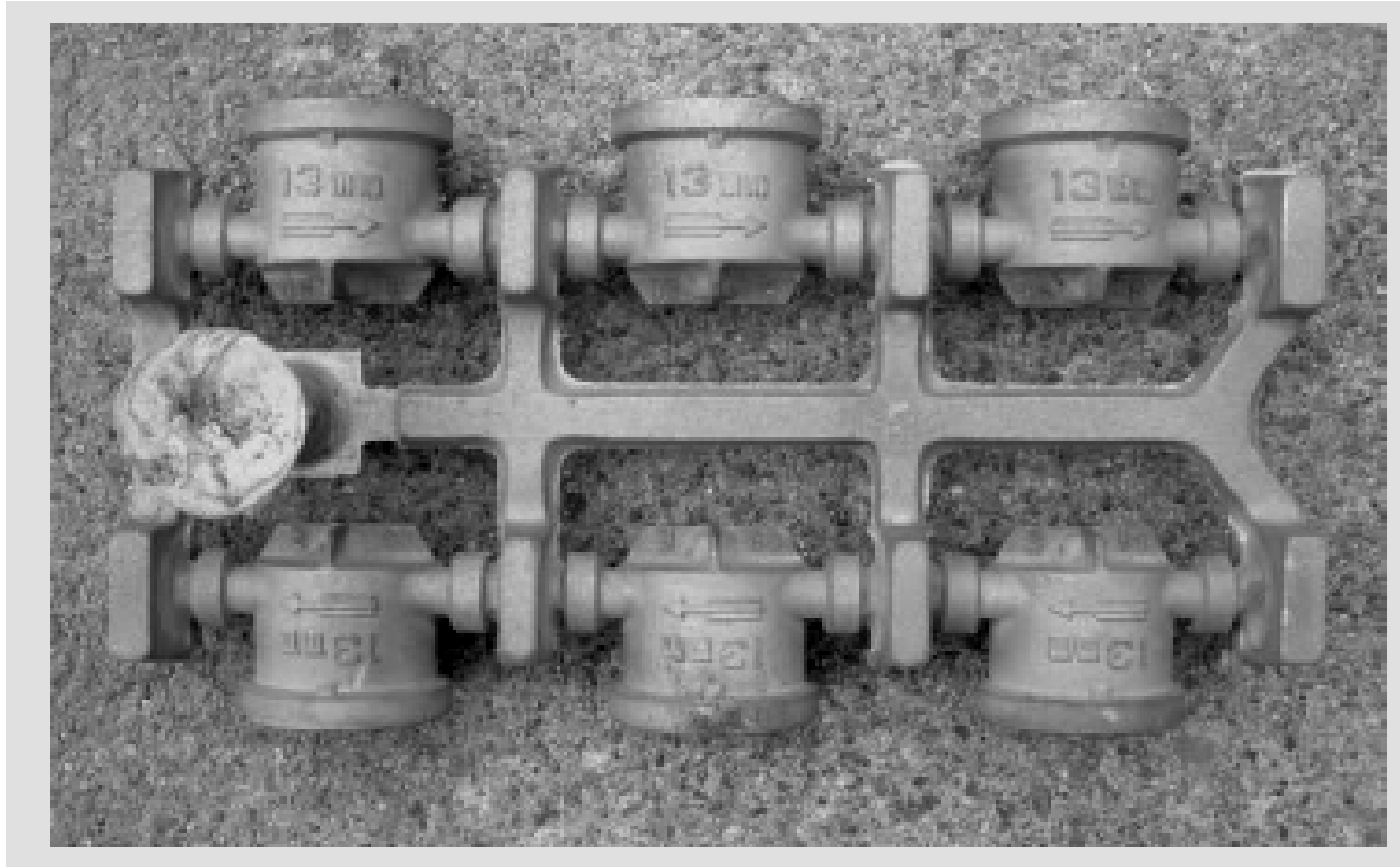
- **Sand type:** No. 90-100 AFS Olivene
- **Binder type:** No-bake, 8.4%



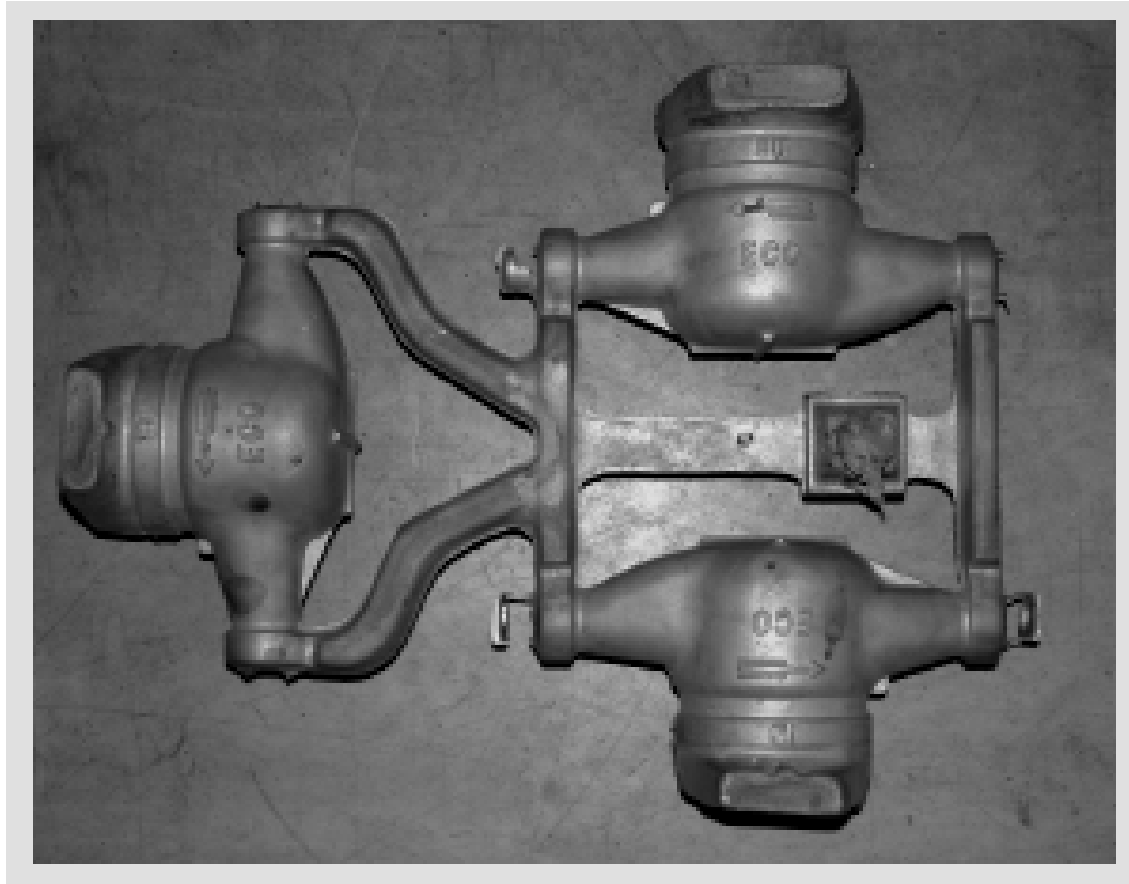
## *Casting Parameters*

- **Liquidus temperature: 1616° F**
- **Melt temperature: 2100° F**
- **Pour start temp.: 1830 - 1960° F**

## *Gating & Riser*



## *Gating & Riser*





## **Shakeout Parameters**

- **Critical temperature:**                      **Controlled for C836**
- **Shakeout precautions:**                      **None**
- **Gate & riser removal:**                      **Cut-off**

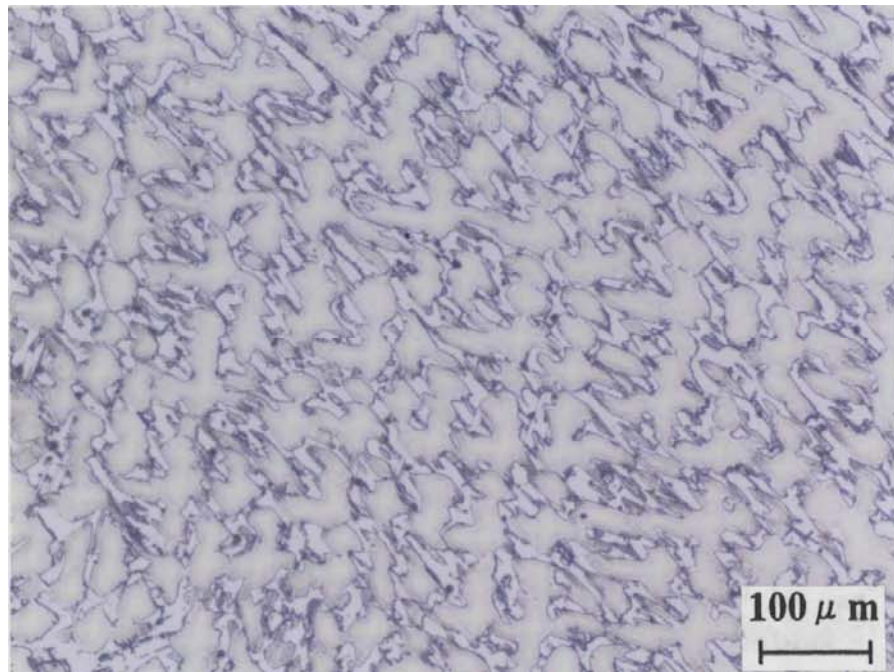


## **Machining**

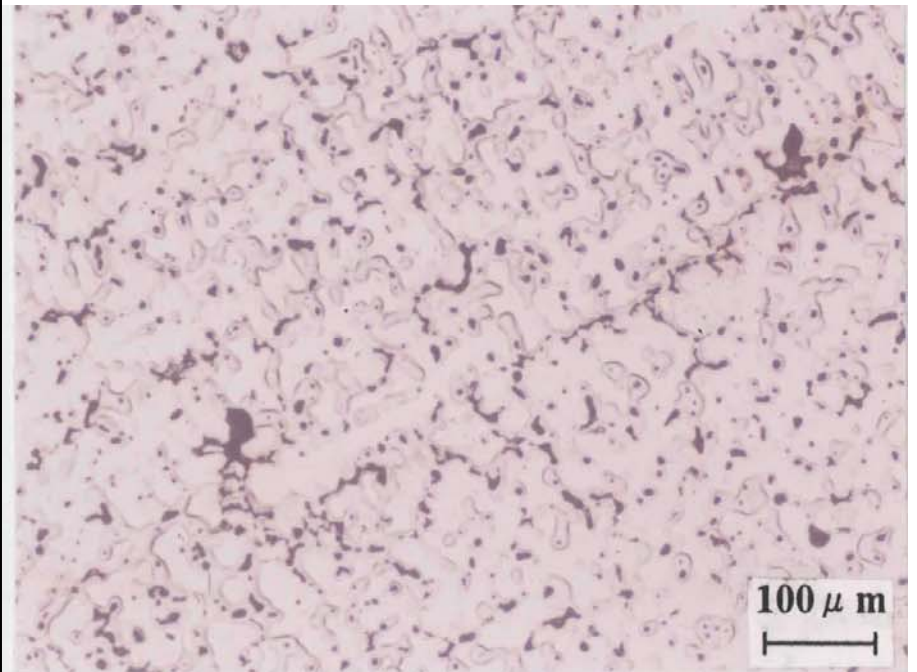
- **% Machinability:** **90%-105% of C836**
- **Coolant:** **Machined dry**
- **Tooling type:** **Cutting – carbide**  
**Drilling – carbide, HSS**
- **Tool life:** **70%**



## **Microstructure**



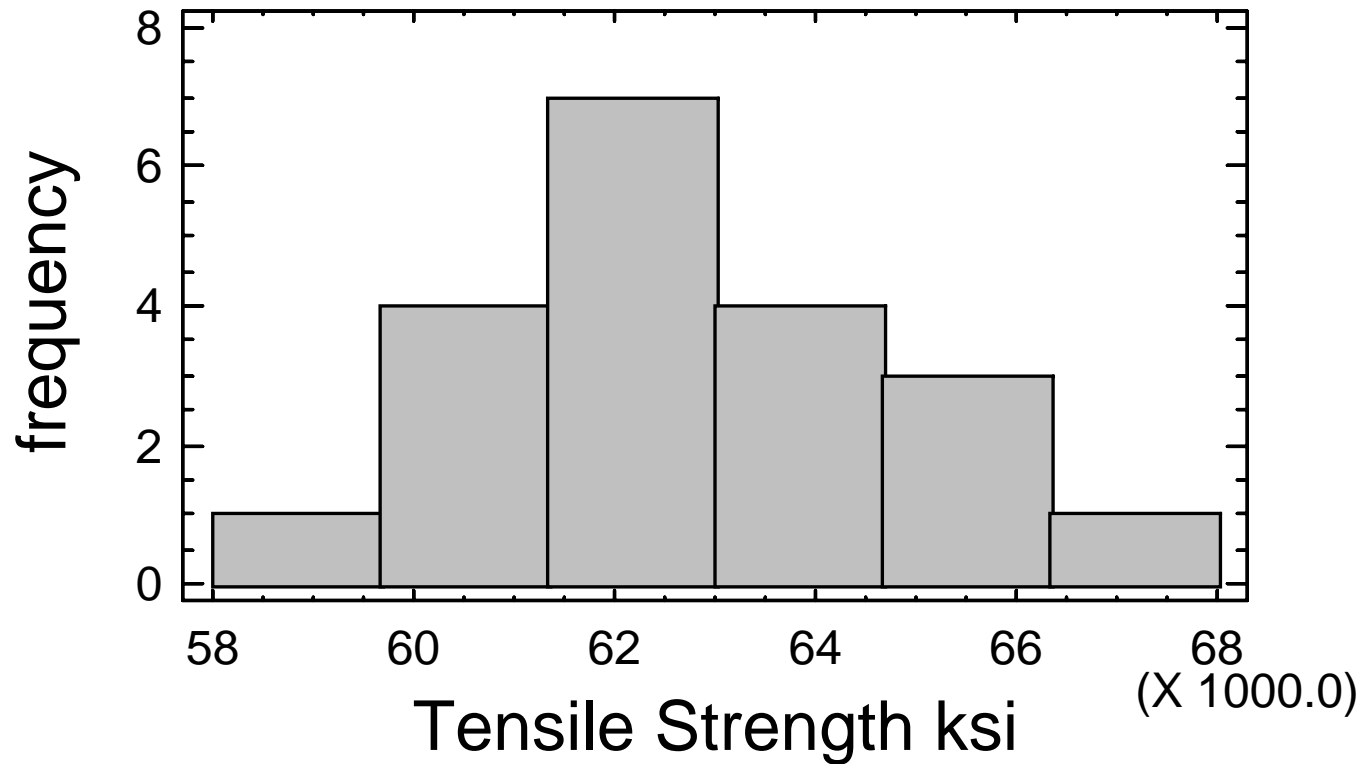
**C87850**



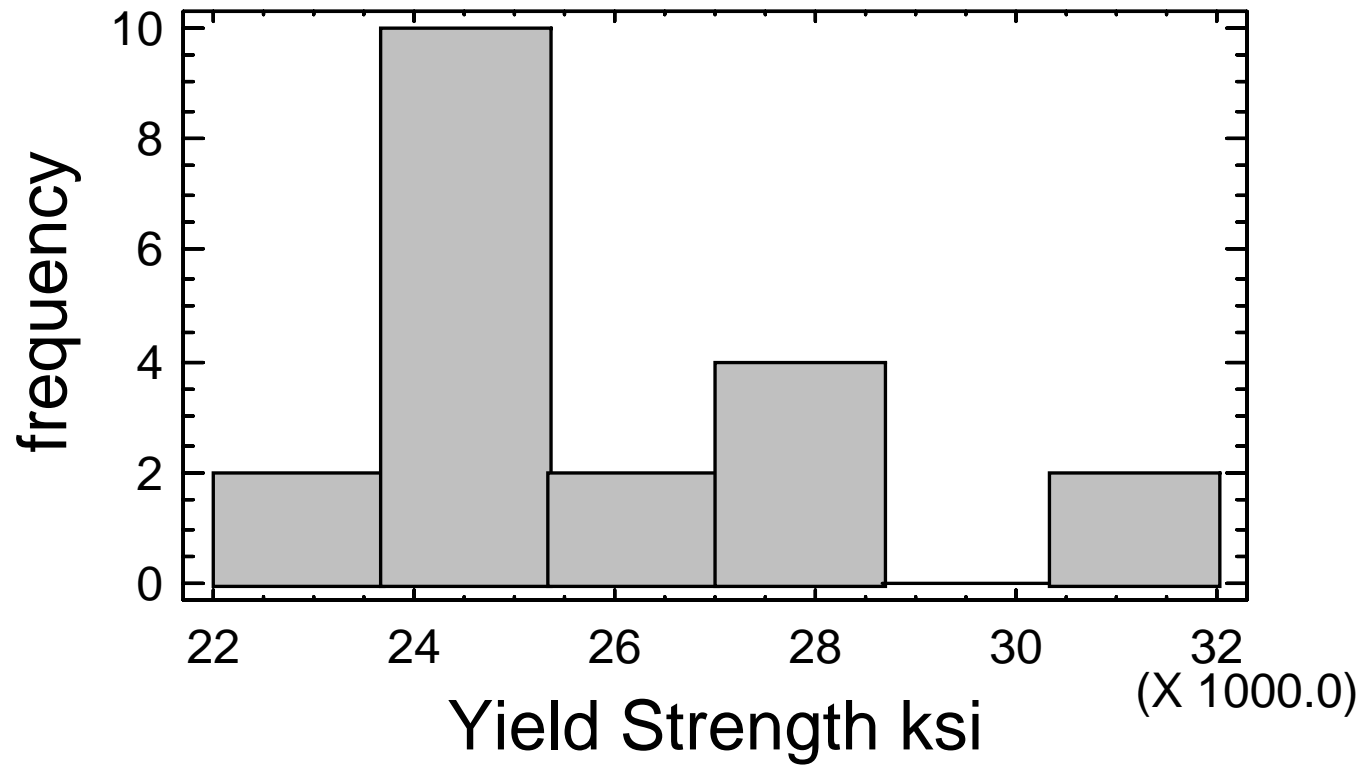
**C83600**



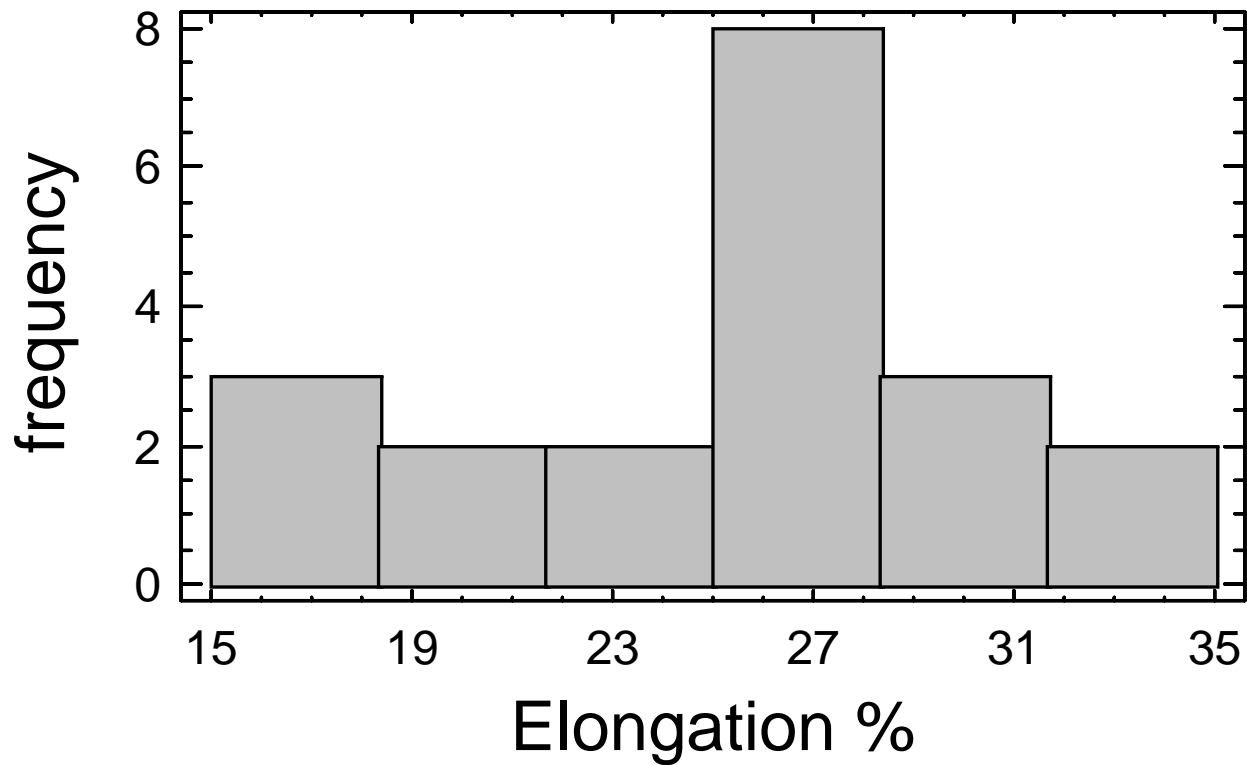
## C87850 ASTM B208 Tensile Strength Results



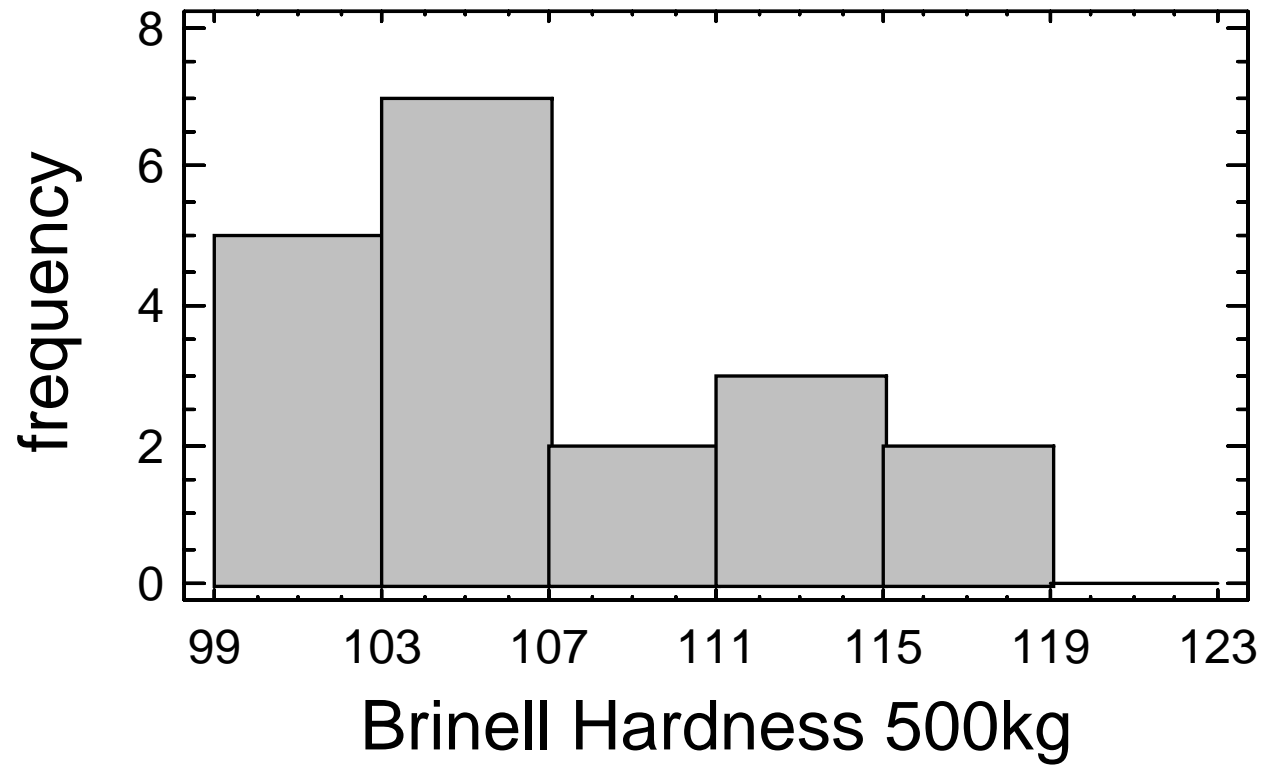
## C87850 ASTM B208 Yield Strength Results



## C87850 ASTM B208 Elongation Results



## C87850 ASTM B208 Brinell Hardness Results



## **Summary of Sand Casting Parameters for C87850**

- **Gating system:** Non-pressurized or pressurized; suggest gating like silicon bronze  
Tapered sprue or reverse taper + choke  
Spread ingates out to prevent hot spots
- **Pouring temperature:** Keep it low (melting T = 1615F; suggest 1950F maximum)
- **Risers:** Use sufficient riser necks if risers are necessary at all



# Corrosion Resistance

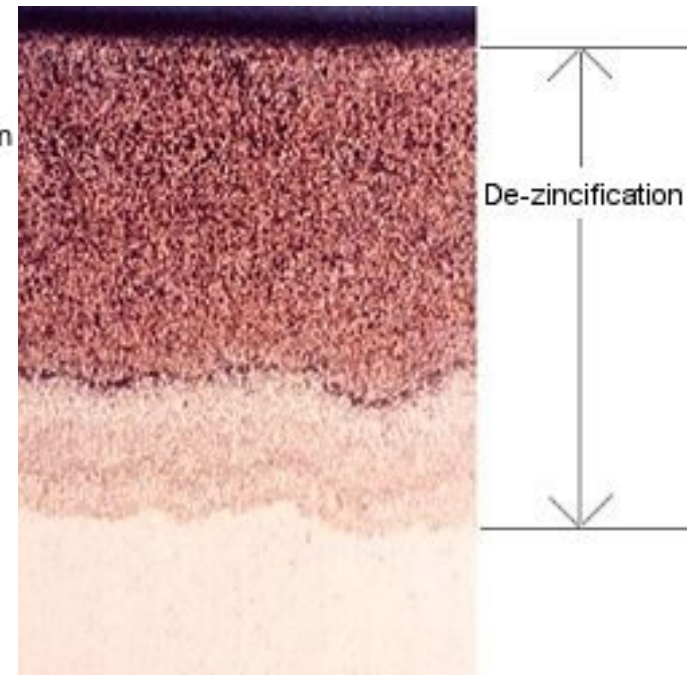


Phosphorus and lower zinc levels in ECO BRASS give it superior dezincification resistance.

Corrosion depth after  
ISO6509  
dezincification test  
(12.7 g/l  $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$  for  
24 hrs. at 167F).



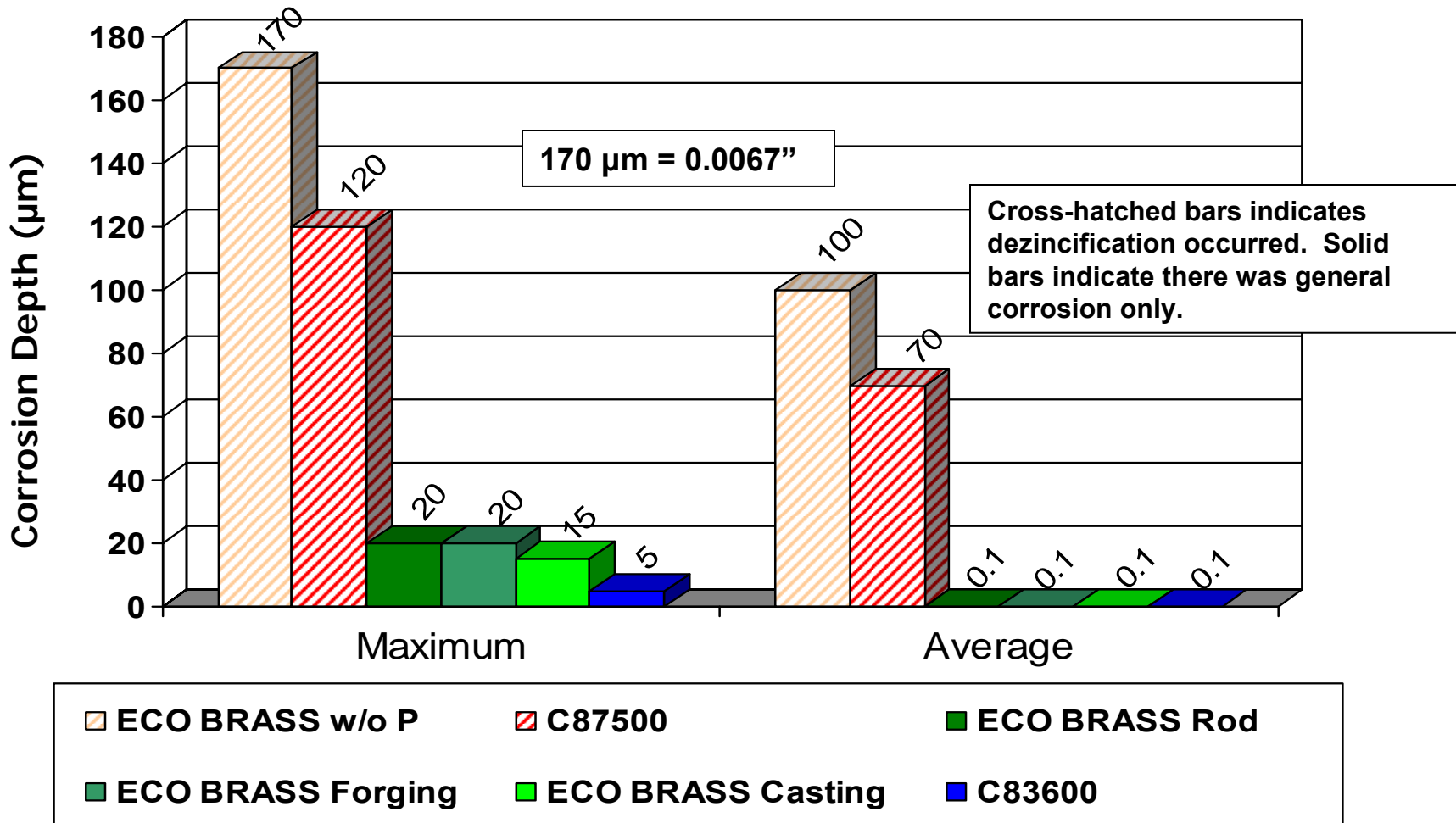
ECO BRASS



C36000


Maximum corrosion depth of C360 and C377 = 0.04" (1.0mm) while ECO BRASS is almost zero.

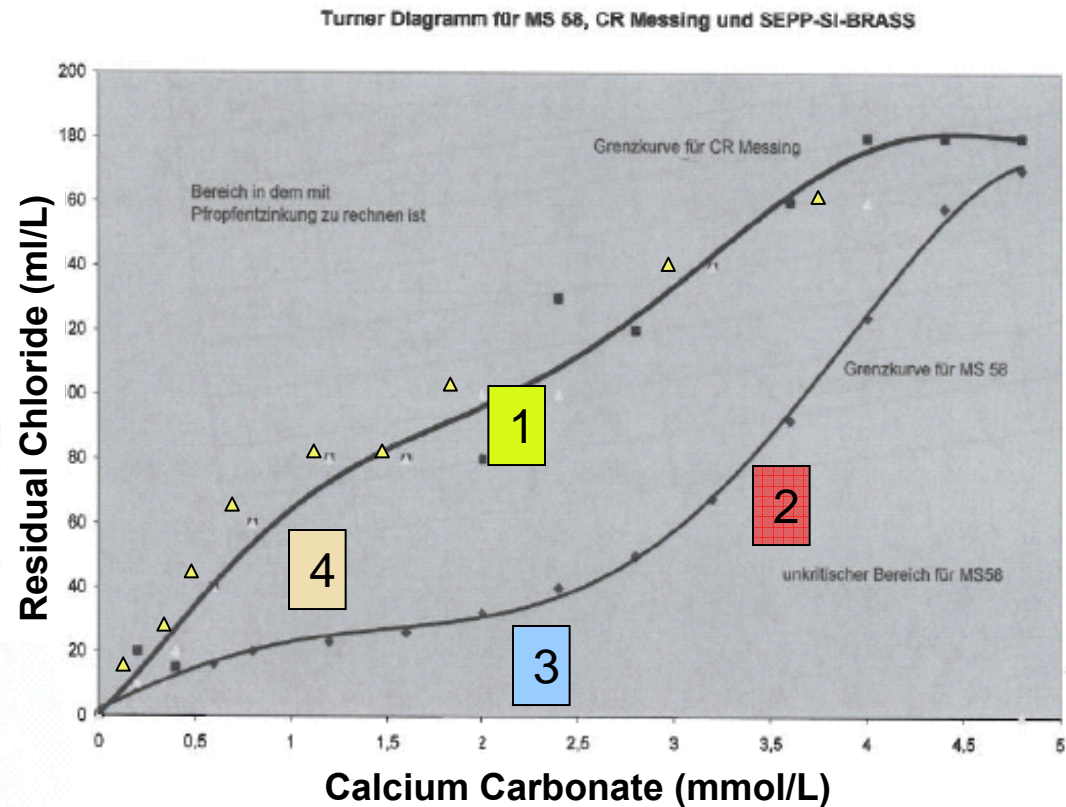
Comparison of ISO 6509 test results shows ECO BRASS excellent dezincification resistance.



## ECO BRASS dezincification resistance data shown in the Turner Diagram

### Key to the Graph

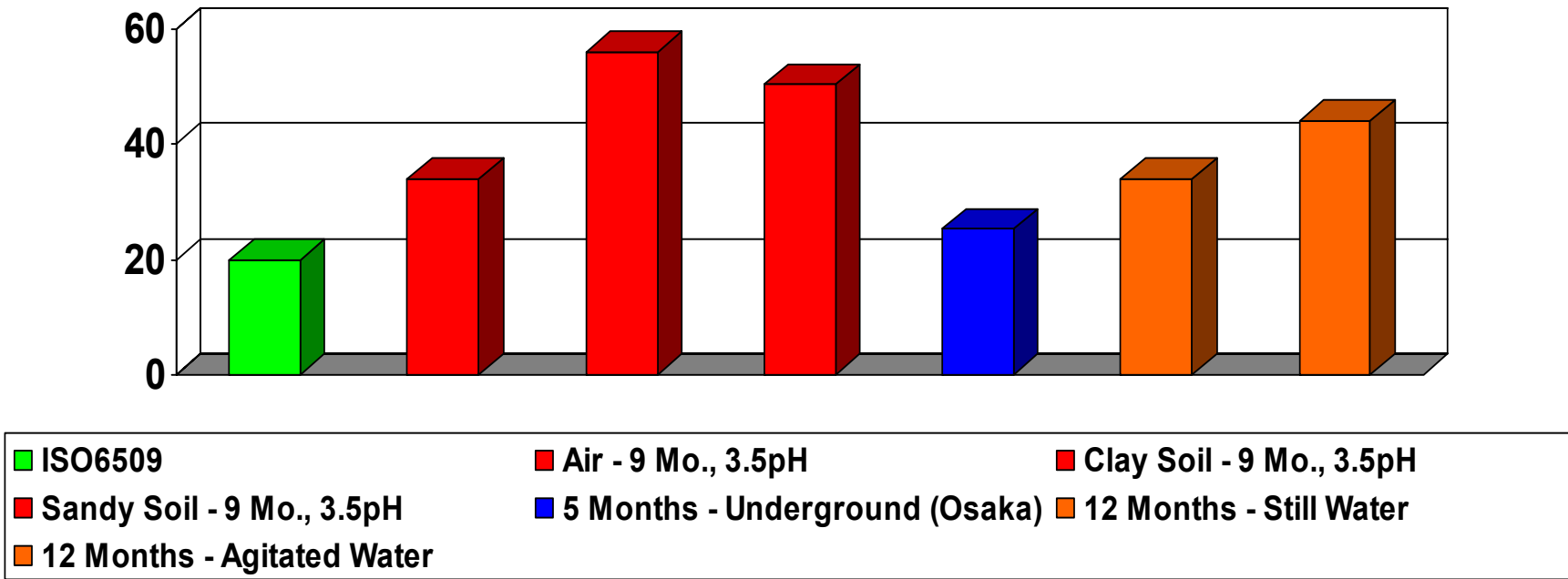
<b>1</b>	Plug-type dezincification
<b>2</b>	Layer-type dezincification
<b>3</b>	Transition boundary for C385
<b>4</b>	Transition boundary for C35330
	Results for ECO BRASS



Dierschke

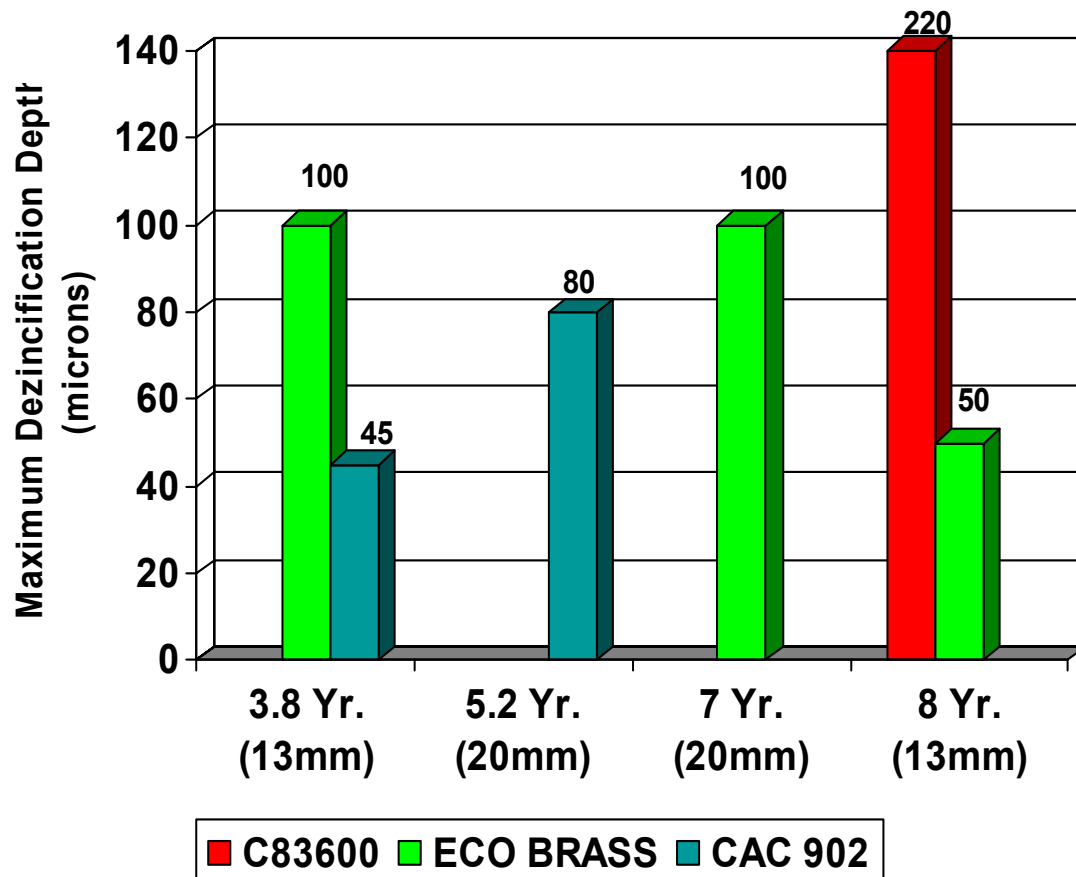
Maximum corrosion depth of ECO BRASS<sup>®</sup> in various above and below ground environments.

### Maximum Dezincification Depths (microns)





Water meter body performance in Japan shows comparable behavior with C836 and bismuth brass. 13mm and 20mm refer to water meter orifice size.

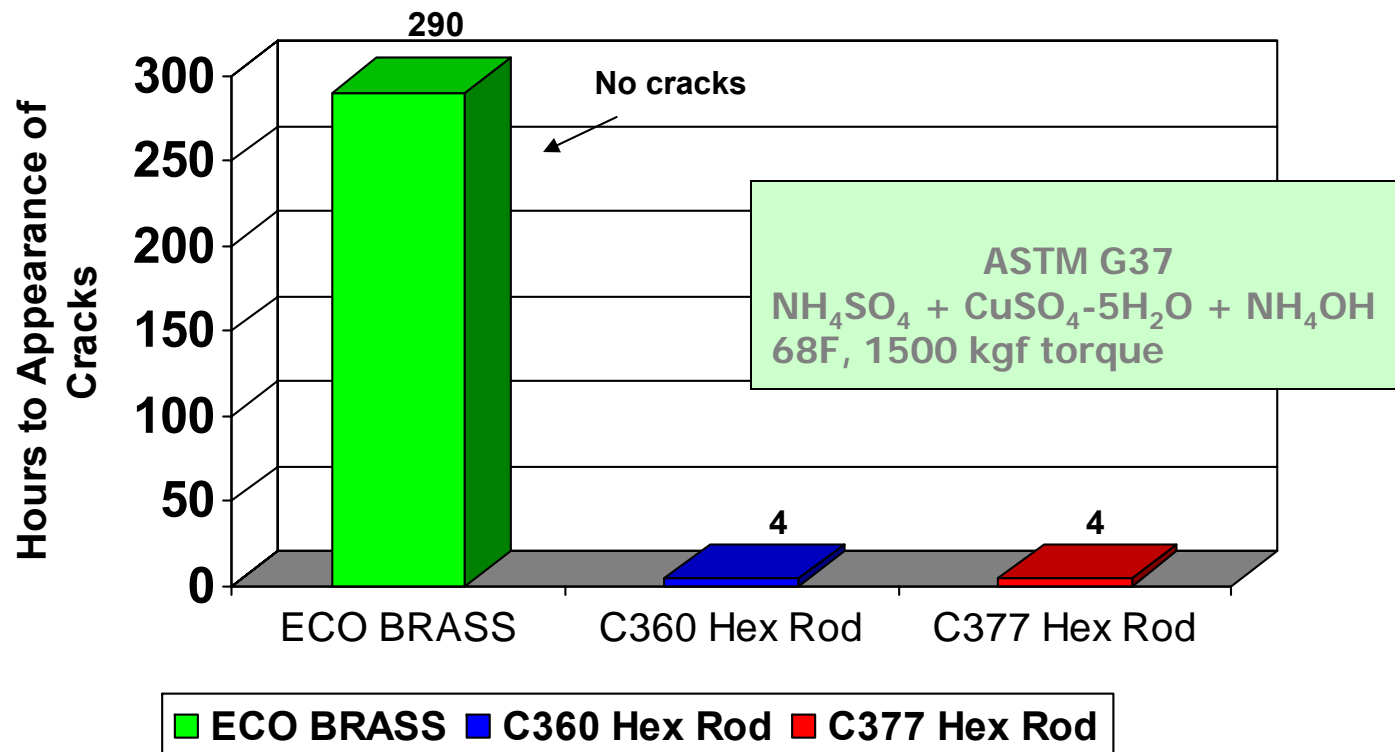


	C83600	ECO BRASS	CAC902
Copper	84.0-86.0	74.0-78.0	84.5-90.0
Lead	4.0-5.7	0.09 max	0.25 max
Bismuth	-	-	1.0-2.5
Silicon	-	2.7-3.4	-
Phos.	-	0.05-0.20	-
Tin	4.3-6.0	0.30 max	4.0-6.0
Zinc	4.3-6.0	Rem.	4.0-8.0

# Measured	C83600	ECO BRASS	CAC902
13mm	3	4	4
20mm	0	8	4

Silicon, low zinc, high strength levels give ECO BRASS high stress corrosion cracking resistance.

### Results of Stress Corrosion Cracking Tests





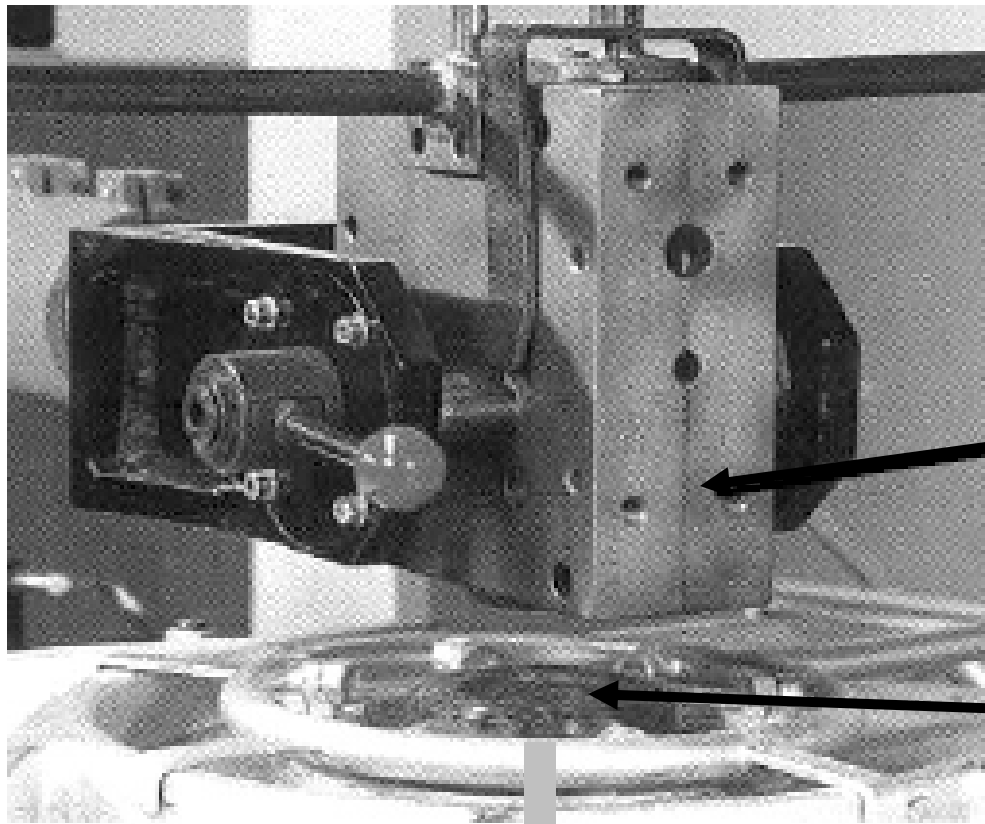
## Permanent Mold Cast Water Meters



- **13mm:** **High Pressure Die Cast**
- **13mm production:** **500,000**
- **20mm:** **Low Pressure Permanent Mold**
- **20mm production:** **50,000**



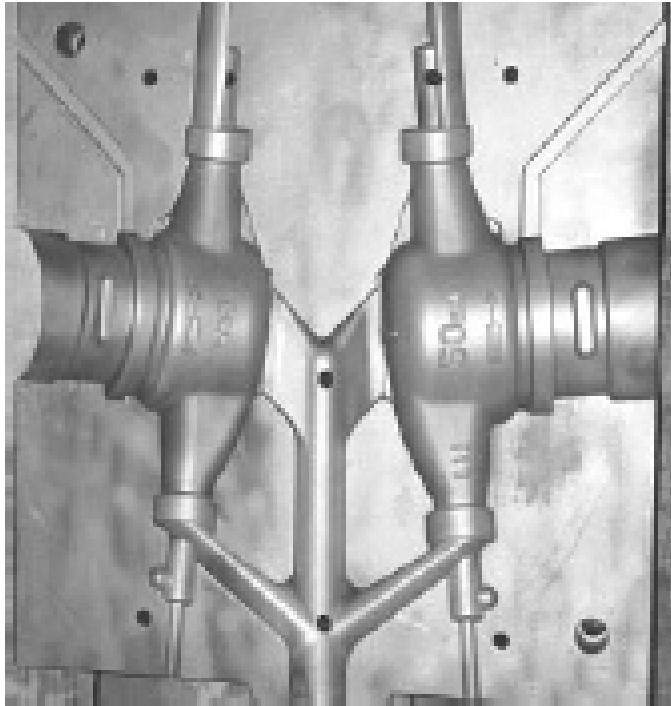
**Equipment**



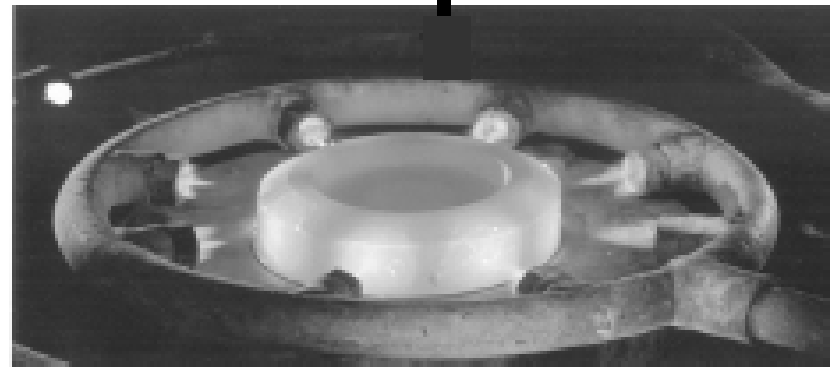
**Mold**

**Spout**

**Equipment**



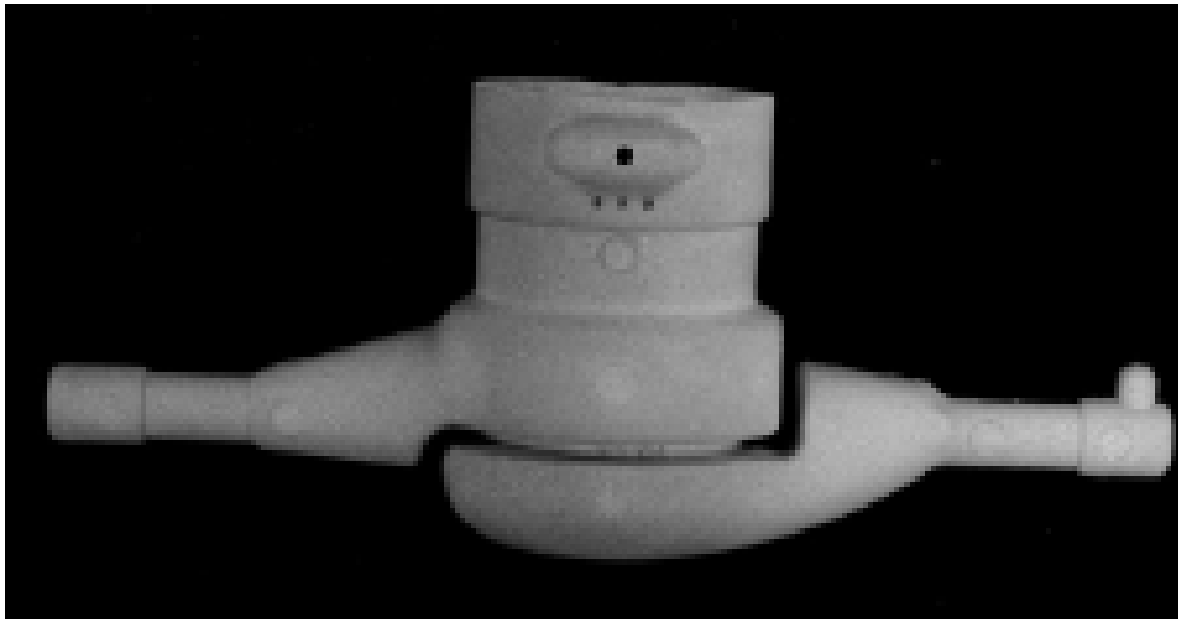
**C17510 Mold Interior**



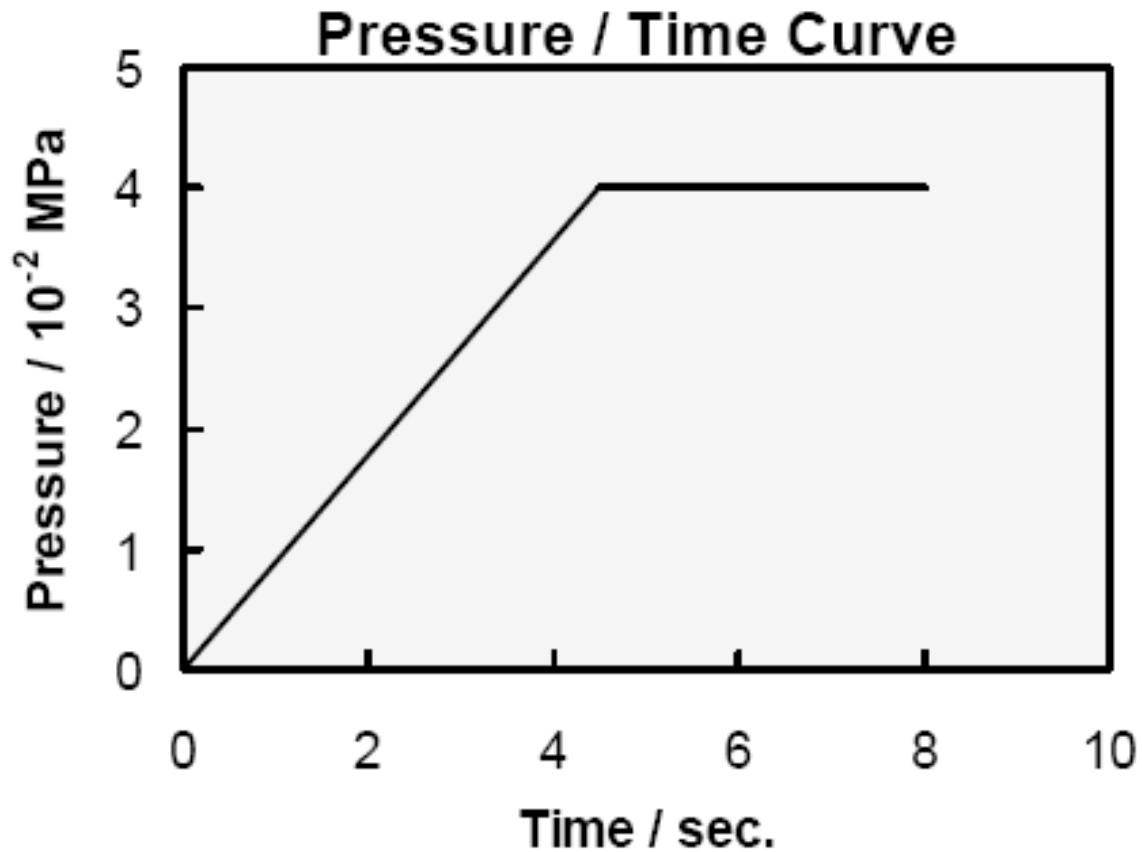
**Pour Spout**

## **Sand Core**

- **Silica sand with phenolic resin binder**



## Casting Parameters



Temperatures (F)	
Liquidus	1616
Solidus	1571
Casting	1830
Mold	250