



CKsan-etsu Group

# SAN-ETSU

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P R O F I L E



Largest Brass Product Manufacturer in Japan

**SAN-ETSU METALS Co., Ltd.**



# We are the largest manufacturer of brass products in Japan.

## BRASS RODS & BRASS PIPES

Our brass rods have excellent characteristics, such as free-cutting properties, secondary workability and precision machinability. They are available in a variety of shapes. We can meet various customer requirements with reliable quality. Our brass pipes also have smooth surfaces, good free-cutting characteristics, secondary workability and precision machinability. Brass pipes are also available in various shapes, including round and hexagonal.

## PRECISION PARTS

Our precision hot forging machine -- with an accuracy of 20 microns -- and our state-of-the-art cutting equipment achieve a high level of completed front and back machining and mirror-surface machining without any buff polishing required. We combine raw materials produced in-house with these technologies to produce excellent quality precision parts.

## NEW PRODUCTS & SPECIAL ALLOYS

We are very active in pursuing the development of special brass and copper alloys and environmentally friendly products that meet the demands of the present age for high-technology product components. Our efforts are opening up new fields and possibilities all the time.

## BRASS WIRES & PLATED WIRES

The use of our brass wires and special copper alloy wires is expanding in the IT sector, because of their excellent fabrication properties and dimensional accuracy. They are delivered to customers quickly using versatile carriers or bobbins.

## At San-Etsu Metals we meet or exceed customer expectations.

San-Etsu Metals Co., Ltd. is the largest manufacturer of brass rods and wires in Japan. We are a brass products raw materials supplier. On the other hand, we also do forging and cutting of brass materials at our precision plant, which is enjoying a good reputation among our customers as a brass components supplier.

What's more, we are expanding our sales offices in China (Shanghai) and Taiwan (Taichung), cementing our position as the leading brand of Japanese-made brass rods and wires sold overseas. San-Etsu Metals is listed in the First Section of the Tokyo Stock Exchange, and our parent company, CK San-Etsu Co., Ltd., a pure holding company, will celebrate its 100th anniversary in 2020.

Our technological strength is widely recognized. We succeeded in developing a ground-breaking environmentally friendly new alloy (our BZ Series) that is both cadmium- and lead-free. This alloy is used by many companies in the electric/electronic machinery and automobile industries. There is a reason why we are the top manufacturer in the brass industry in Japan. San-Etsu Metals Co., Ltd. was established in December 1937; however we were formerly named Mitsukoshi Metals (the Takaoka Plant now). In 1984, we merged with Hokuriku Kinzoku (the Tonami Plant now), to become San-Etsu Metals. In April 2000, we acquired the brass wire business of Sumitomo Metal Mining Brass & Copper Co., Ltd. And what's more, we also obtained the entire Shin Nitto Kinzoku Co., Ltd. operation in October 2007.

In other words, San-Etsu Metals, the industry's leading company in Japan, was created through the merging of four brass rod and wire industry heavyweights.

We will continue pursuing the merits of scale in the future, leveraging our leading share of the Japanese market. We will work tirelessly to uphold our reputation as a cutting-edge manufacturer that meets and exceeds our customers' expectations.



SAN-ETSU METALS Co., Ltd.  
President  
Hiroyuki Tsuruya

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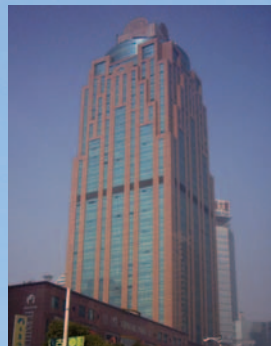


# San-Etsu's Corporate Organization

San-Etsu Metals is responding to expanding customer needs by developing overseas production locations.

## San-Etsu Metals (Shanghai) Co., Ltd.

Room No.1111 New Town Centre 83 Lou  
Shan Guan Road, Shanghai, China



Established in 2004 to enhance sales  
activities in East China and South China

## Taiwan San-Etsu Co., Ltd.

No. 765, Section 2, Taiwan Boulevard,  
Xitun District, Taichung



## Takaoka Plant

(55,468m<sup>2</sup>)

- Brass wire production  
(Top producer of brass wires in Japan)
- Equipped with a 2,500 ton direct extruder

## Headquarters: Tonami Plant (181,030m<sup>2</sup>) \*Including a precision machining factory and an incubation workshop



- Brass rod & brass pipe production (top producer of brass rods in Japan)
- Equipped with a 3,350 ton indirect extruder and a 2,500 ton double-action direct extruder

## Precision Machining Factory & Incubation Workshop



- Precision component production (Our brass camera mounts have a 90% share of the global market.)

## Shin Nitto Plant (69,558m<sup>2</sup>)



- Brass rod production  
(Our brass rods, combined with those produced in the Tonami Plant, have a 40% share in the Japanese market.)
- Equipped with the largest (5,000 ton) direct extruder in Japan.

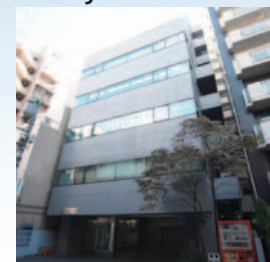
## Osaka Office



## Nagoya Office



## Tokyo Office



Our incessant R&D activities and stringent inspection system mean that we can and do keep on producing highly reliable products.

## Quality Control System

We continue our unceasing efforts to produce high quality brass and brass alloys, all the time. Our strict quality control system, including the in-process analysis of chemical components and fractured surface inspection, and the tensile testing of finished products keep the quality consistently high. In addition, our quality management and environmental management systems are certified respectively by ISO 9001 and ISO 14001.



Chemical Component Analyzer



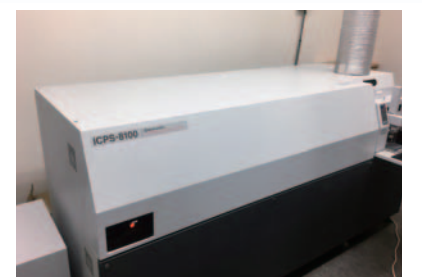
Field emission SEM with EDX and WDX systems

## Field emission scanning electron microscope (SEM) with EDX and WDX systems

The JSM-7001F is a field emission SEM designed for nanoscale research and development activities, ranging from high resolution nanoscale observation to high precision chemical component analysis. It is also equipped with EDS and WDS chemical component analysis systems, making it suitable for submicron analysis.

## ICP emission spectrometer

The ICPS-8100 is a high-performance ICP emission spectrometer equipped with two sequential spectroscopes. It achieves both high resolution and high speed.



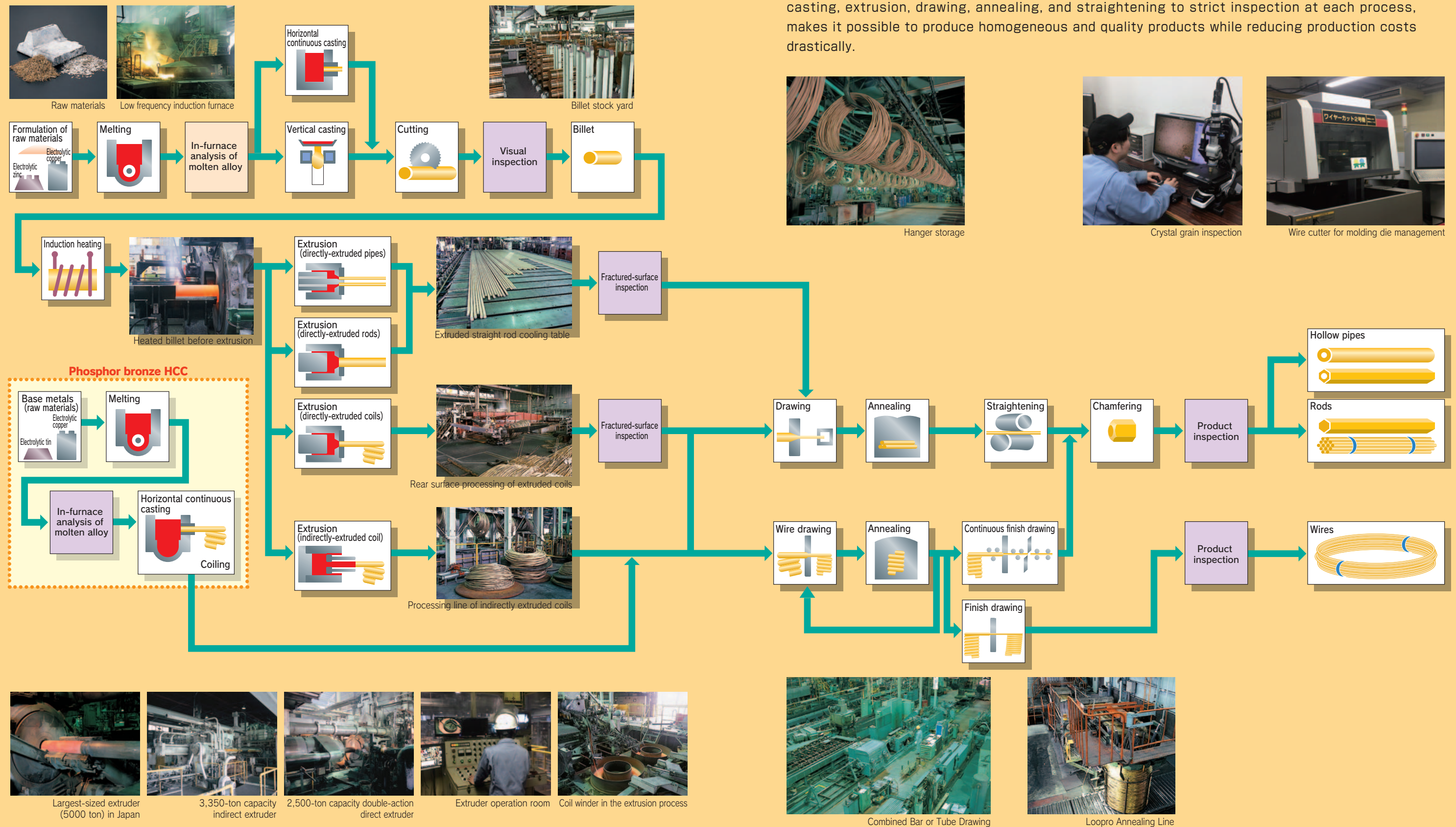
ICP emission spectrometer



## R&D ACTIVITIES AND PRODUCTION SYSTEM

We manufacture homogeneous and quality brass rods and wires in quantity under our integrated production system, careful process management and stringent quality control.

# PRODUCTION SYSTEM





# NEW ALLOYS

San-Etsu Metals is an industry leader in the development of new environmentally friendly alloys.



# LEAD-FREE

LOW-CADMIUM AND LEAD-FREE  
Our low-cadmium, lead-free brass rods fully comply with RoHS & ELV directives.

ELV and RoHS are abbreviations for European Union usage regulations for environmentally hazardous substances. The ELV (End of Life Vehicle) directive is a set of regulations for vehicles, and the RoHS (Restriction of Hazardous Substances) directive is a group of regulations for electric/electronic devices. Cadmium and lead are typical environmentally hazardous substances. The ELV and RoHS directives restrict the amounts of cadmium and lead to 0.01% (100 ppm) and 0.1% (1,000 ppm) respectively. These values are called "thresholds". However, thresholds for lead and cadmium in copper alloys are permitted to be as high as 4%, for the time being. This exemption rule is reviewed at regular intervals and is to be abolished in the future. If this exemption is abolished, the contents of lead and cadmium in copper alloys will have to be reduced to no more than 0.1%.

## 【BZ】SERIES JIS H3250 C6801・C6802

材料試験成績表 INSPECTION CERTIFICATE									
納入先 CUSTOMER	御中	サンエツ金属株式会社 SANTON							
指定問屋 WHOLESALE	御中	磯波工場 1892							
御注文先 AGENT	御中	富山県富山市太田1892 TEL:0763/33-121290							
品名 COMMODITY	鉛レス快削黄銅棒	形状及寸法 SHAPE AND SIZE	丸形						
適用規格 SPECIFICATION	JIS H 3250 C6801B0-F	SIS規格 SIS SPEC	BZ5A	製造番号 MANUFAC. NO.	1053562				
寸法及び外観検査 DIMENSION AND EXTERNAL APPEARANCE									
規格 SPEC	外径 OUTSIDE DIAMETER	長さ LENGTH	曲り CAMBER	外観検査 EXTER APPR					
ロットNo. LOT NO.	5.0 - 0.01 + 0.03	2500	2.0 + 10.0 0.1.4 mm/m						
1053562-01	GOOD	GOOD	GOOD	GOOD					
化学成分 (CHEMICAL COMPOSITION (%))									
成分 ELEMENT	Cu	Bi	Pb	Fe	Sn	As	Cd PPM	Zn	残留部
1053562-01	57.0	0.5	0.01	0.50	2.5	0.2	10	1.4	REM
	64.0	4.0	0.004	0.113	0.25	0.004	1.00		
機械的及び物理的性質 MECHANICAL AND PHYSICAL PROPERTIES									
規格 SPEC	引張強さ TENSILE STRENGTH	伸び ELONGATION	硬さ HARDNESS	時期別 SEASON CRA					
1053562-01	508	11		GOOD					

Inspection certificate

The cadmium content is stated on our mill sheets

### Cadmium-free & Lead-free Free-cutting Brass Products

Type	Standard	Material	Feature/ Use	Lead	Cadmium
Free-cutting brass rods	JIS H3250 C6801	BZ5A	For machining, general caulking	100ppm (0.01%) or lower	10ppm (0.001%) or lower
		BZ5U	For general/ strong caulking	100ppm (0.01%) or lower	10ppm (0.001%) or lower
		BZ5F	For forging (for machining)	100ppm (0.01%) or lower	10ppm (0.001%) or lower
Free-cutting dezincing-resistant brass rods	JIS H3250 C6801 JIS H3250 C6802	BZ3	High-spec item for machining	100ppm (0.01%) or lower	10ppm (0.001%) or lower
		BZ3N	Standard item for machining	1000ppm (0.1%) or lower	10ppm (0.001%) or lower
High-strength brass rods	ASTM C69300	NEO BRASS	High strength, wear resistance	900ppm (0.09%) or lower	10ppm (0.001%) or lower

San-Etsu Metals' BZ Series bismuth-based lead-free brass rods fully comply with ELV and RoHS directives.

In the past, lead was added to improve the machinability of brass rods. However, lead is an environmentally hazardous substance, and thus it is expected that the use of lead-free rods will be promoted in the future. In response to this trend, San-Etsu Metals has developed BZ series low-cadmium, lead-free brass. The BZ series features a high level of strength, machinability and wear resistance, equivalent to those of conventional leaded brass. It is also non-magnetic.



Members of the BZ series are basic lead-free, free-cutting brass rods that have a high level of machinability, well balanced between cutting, forging and caulking.

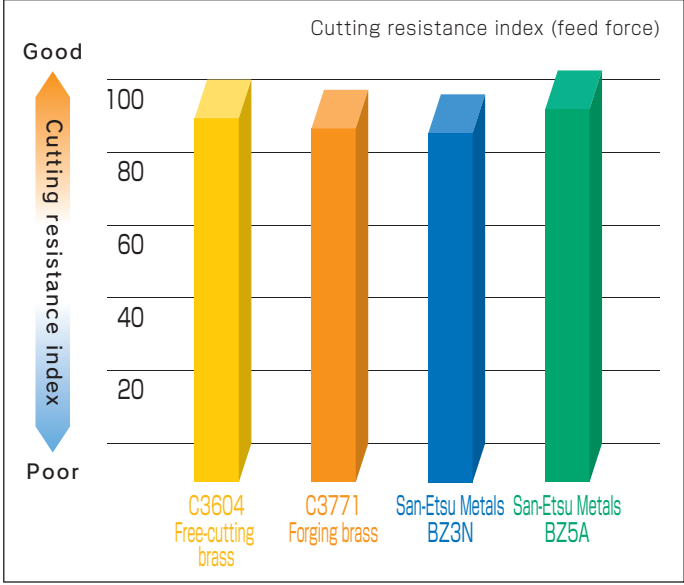
### Excellent forgeability

Forging is possible from high to low temperatures, under the exact same conditions as conventional brass. You won't even realize it's a lead-free material.

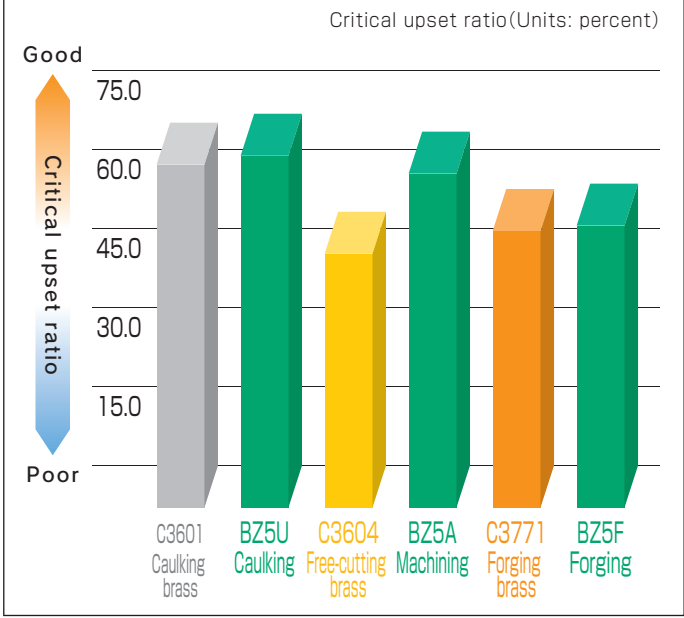
	Upset Ratio							
	50%		60%		70%		80%	
	High	Low	High	Low	High	Low	High	Low
C3771	○	○	○	○	○	○	○	○
BZ5F	○	○	○	○	○	○	○	○
BZ5A (Ref.)	○	○	○	○	○	△	×	×
BZ3N	○	○	○	○	△	×	×	×

High temp range: 780-800°C, Low temp range: 730-750°C

### Cutting resistance index (feed force)



### Critical upset ratio





# BRASS RODS & BRASS PIPES

San-Etsu brass rods boast a top market share in Japan, thanks to our best-in-Japan facilities and development strength. Our brass pipes are suitable for a variety of types of precision machining, thanks to their excellent fabrication properties -- leaders of these current times!

## BRASS RODS

Our brass rods have excellent characteristics, such as free-cutting properties, secondary workability and precision machinability and are available in a variety of shapes. We can meet varied customer requirements with reliable quality.

### Free-cutting brass rods

- Excellent free-cutting helps improve operating efficiency
- A high level of secondary workability (caulking, rolling, bending)
- Precision machinability due to superior dimensional accuracy and straightness
- Available in a variety of shapes, including round, hexagonal and square

### Brass rods for forging

- Versatility due to their wide temperature ranges
- Excellent finishing machinability

Brass rods are made by extrusion or continuous casting. In general, casting rods are inferior to extruded rods in strength, airtightness and dimensional accuracy. However, casting rods possess the following advantages: (1) a very low likelihood of stress corrosion cracking, since their crystals have no directionality; (2) machining costs can be drastically reduced when producing couplings etc., since brass pipes can be manufactured easily; (3) casting ingots can be produced at a low cost.

San-Etsu Metals developed a superior dezincing-resistant brass featuring dezincing-resistance equivalent to that of bronze. We obtained a JIS Standard Number upon the JIS revision in 2016. Previously, we had been manufacturing brass rods by extrusion. However, we recently introduced new production equipment for continuous casting, taking advantage of the standardization of JIS, and commenced production and sales of continuous casting brass rods and casting ingots. We recommend this new alloy with confidence to customers as a substitute for bronze. CAC211 (Material No. ZC00P) can be used as a substitute for leaded CAC406, and CAC231 (Material No. ZC00B) can be used as a substitute for bismuth CAC902.

## BRASS PIPES

San-Etsu brass pipes also feature smooth inner and outer surfaces, free-cutting properties, secondary workability and precision machinability. They are available in various shapes, including round and hexagonal, for many applications.

### Free-cutting brass pipes

- Machining time is reduced, due to excellent free-cutting properties.
- A high level of secondary workability (caulking, rolling, bending).
- Precision machinability due to superior dimensional accuracy and straightness

### Brass pipes for forging

- Versatility, thanks to their wide temperature ranges.
- Excellent finishing machinability.



## Tonami Plant BRASS RODS

### Brass Rod Major Specifications

### Product Types

[Cadmium-free Brass Rods: 60ppm or less guaranteed]

Name	Alloy number	Material (Note)	Component	Feature	Use
Brass	C2600	B42	70Cu-Zn	Cold forging, rolling	Electric parts
	C2700	B62	65Cu-Zn		Automobile parts
	C2800	B72, B82	62Cu-Zn, 60Cu-Zn	Hot working	
Free-cutting brass	C3601	U15P	61Cu-2Pb-Zn	Rolling, caulking	Precision product parts
	C3602	U24P, U25P	60.5Cu-3Pb-Zn	Caulking, versatility	Electric appliance parts
	C3603	A32P	57.5Cu-3.5Pb-Zn	Versatility	Gas fittings
		A35P	58.4Cu-3Pb-Zn		Machine parts
		A36P	59.3Cu-3Pb-Zn		Faucets
	C3604	A44P	58.4Cu-3Pb-Zn		
Forging brass	C3712	F1TP	58.7Cu-0.6Pb-Zn	Stress corrosion cracking resistance	Gas fittings
	C3771	F3P	58.7Cu-2Pb-Zn	Hot forging	Valves
High-strength brass	C6782	H53P	58.5Cu-Fe-Mn-Al-Zn	High-strength, corrosion resistance	Bearings, etc.
Dezincing-resistant brass	C3531	Z34P	61.5Cu-Pb-Sn-P-Zn	Dezincing resistance	Faucets

Note: Only main materials are given due to space limitations. Please consult us for more detailed information.

### [Cadmium-free & Lead-free Brass Rods]

Name	Alloy number	Material (Note)	Component	Feature	Use
Free-cutting brass	C6801	BZ5A	59.5Cu-Bi-Zn (Pb0.01 or lower)	Versatility	Precision product parts
Forging brass	C6801	BZ5F	58.5Cu-Bi-Zn (Pb0.01 or lower)	Hot forging	Machine parts
Dezincing-resistant brass	C6802	BZ3N	61Cu-Bi-Zn (Pb0.1 or lower)	Dezincing resistance	Faucets
High-strength brass rods	ASTM C69300	NEO BRASS	75.5Cu-3Si-Zn (Pb0.09 or lower)	High-strength, wear resistance	Machine parts

Note: Only main materials are given due to space limitations. Please consult us for more detailed information.

### [General Brass Rods]

Name	Alloy number	Material (Note)	Component	Feature	Use
Free-cutting brass	C3601	U15	61Cu-2Pb-Zn	Rolling, caulking	Precision product parts
	C3602	U24, U25	60.5Cu-3Pb-Zn	Caulking, versatility	Electric appliance parts
	C3603	A32	57.5Cu-3.5Pb-Zn	Versatility	Gas fittings
		A35	58.4Cu-3Pb-Zn		Machine parts
		A36	59.3Cu-3Pb-Zn		Faucets
	C3604	A44	58.4Cu-3Pb-Zn		
Forging brass	C3712	F1T	58.7Cu-0.6Pb-Zn	Stress corrosion cracking resistance	Gas fittings
	C3771	F3	58.7Cu-2Pb-Zn	Hot forging	Valves
High-strength brass	C6782	H53	58.5Cu-Fe-Mn-Al-Zn	High-strength, corrosion resistance	Bearings, etc.
Dezincing-resistant brass	C3531	Z34	61.5Cu-Pb-Sn-P-Zn	Dezincing resistance	Faucets

Note: Only main materials are given due to space limitations. Please consult us for more detailed information.

### Dimensional Tolerances [Drawn Rods]

Units:mm

Diameter or Width across flats	Round		Hexagon	Square
	Type: F.O.H	Type: 1/2H		
From 2mm to 3mm	-0.010 -0.025	0 -0.04	0 -0.04	0 -0.04
Over 3mm and 6mm or less	-0.010 -0.030	0 -0.05	0 -0.05	0 -0.05
Over 6mm and 8mm or less	-0.010 -0.030	0 -0.05	0 -0.06	0 -0.06
Over 8mm and 10mm or less	-0.01 -0.04	-0.010 -0.030	0 -0.05	0 -0.06
Over 10mm and 11.5mm or less	-0.01 -0.05	-0.010 -0.030	0 -0.05	0 -0.08
Over 11.5mm and 14.5mm or less	-0.01 -0.05	-0.010 -0.030	0 -0.06	0 -0.08
Over 14.5mm and 14.9mm or less	-0.01 -0.05	-0.010 -0.030	0 -0.08	0 -0.08
Over 14.9mm and 16.5mm or less	-0.01 -0.05		0 -0.08	0 -0.08
Over 16.5mm and 18mm or less	-0.01 -0.05		0 -0.08	0 -0.10
Over 18mm and 20mm or less	-0.01 -0.06		0 -0.08	0 -0.10
Over 20mm and 26mm or less	-0.01 -0.06		0 -0.12	0 -0.15
Over 26mm and 35mm or less	0 -0.08		0 -0.12	0 -0.15
Over 35mm and 50mm or less	0 -0.10		0 -0.20	+0.15 -0.15
Over 50mm	±0.3%		±0.5%	±0.6%

### Tolerances for Diameters or Width Across Flats [Extruded Rods] Units:mm

Shape	Round/ Hexagon/ Square/ Rectangle		
Diameter or width across flats	Alloy number	C2600	C3602 C6782
		C2700	C3604 C6801
		C2800	C3712 C6802
			C3771 C6810
Over 28 and 150 or less	±1.2%		±1.0%

### Brass Rods Production Range

Units:mm

Shape	Type	Diameter or width across flats		Length
		Drawn rods	Extruded rods	
Round		From 2 to 85	From 28 to 150	2,000mm ~ 5,000mm,
Hexagon		From 3 to 75	—	as specified by the customer
Square/ Rectangle		From 3 to 50	—	

Note: Please consult us if you require products outside of the above specifications.

### Product examples



### Applications



- Optical instrument parts
- Gas fittings
- Faucets
- Refrigerator parts
- Computer parts
- Mobile communication device parts
- Air conditioner parts



# BRASS RODS & BRASS PIPES



## Shin Nitto Plant BRASS RODS

### Brass Rod Major Specifications

#### ■Product Types

[Cadmium-free Brass Rods: 60ppm or less guaranteed]

Name	Alloy number	Material	Component	Feature	Use
Free-cutting brass	C3602	NB5H	60.8Cu-3Pb-Zn	Caulking, versatility	Precision product parts
	C3602	NB5N	59.5Cu-3Pb-Zn	Versatility	Electric appliance parts
	C3604	NB5S	58.2Cu-3Pb-Zn		
	C3604	NB5T	57.2Cu-3.5Pb-Zn		
	C3605	NB5L	57.0Cu-3.8Pb-Zn	Rolling, caulking	Machine parts Faucets
	C3602	NB59	60.5Cu-2Pb-Zn		
	Not defined by JIS	NB55	60.5Cu-2.2Pb-Zn		
Free-cutting dezincing-resistant brass	C3531	NB5Z	61.5Cu-3Pb-P-Zn	Dezincing resistance	Faucets
Forging brass	C3771	NB60	59.5Cu-2Pb-Zn	Hot forging	Machine parts Valves
	C3771	NB61	58.5Cu-2.2Pb-Zn		

#### [General Brass Rods]

Name	Alloy number	Material	Component	Feature	Use
Free-cutting brass	C3602	H	60.8Cu-3Pb-Zn	Caulking, versatility	Precision product parts
	C3602	N	59.5Cu-3Pb-Zn	Versatility	Electric appliance parts
	C3604	S	58.2Cu-3Pb-Zn		
	C3604	SS	57.2Cu-3.5Pb-Zn		
	C3605	L	57.0Cu-3.8Pb-Zn	Rolling, caulking	Machine parts Faucets
	C3601	416	62.0Cu-2.8Pb-Zn		
	C3602	419	60.5Cu-2.2Pb-Zn		
	Not defined by JIS	412	62.0Cu-1.7Pb-Zn		
	Not defined by JIS	415	60.5Cu-2.2Pb-Zn		
Free-cutting dezincing-resistant brass	C3531	DR5	61.5Cu-3Pb-P-Zn	Dezincing resistance	Faucets
Forging brass	C3771	B40	59.5Cu-2Pb-Zn	Hot forging	Machine parts Valves
	C3771	B41	58.5Cu-2.2Pb-Zn		
Free-cutting dezincing-resistant forging brass	Not defined by JIS	DR4	61.5Cu-2.2Pb-P-Zn	Dezincing resistance, hot forging	Faucets

#### ■Knurled Product Types

Outer diameter	Straight pattern		Diamond pattern		Tolerance (mm)
	Threads	Pitch (mm)	Threads	Pitch (mm)	
φ 7	32	0.69	23	0.83	0 -0.07
φ 8	32	0.79	26	0.84	
φ 9	36	0.79	30	0.82	
φ 10	40	0.79	32	0.85	
φ 11	44	0.79	36	0.83	
φ 12	44	0.86	39	0.84	
φ 13	40	1.02	42	0.84	
φ 14	52	0.85	46	0.83	
φ 15	56	0.84	48	0.85	

Note: Please consult us if you require products out of the above specifications.

#### ■Dimensional Tolerances [Drawn Rods]

Units:mm

Diameter or Width across flats	Round	Hexagon	Square
From 2mm to 3mm	-0.010 -0.025		
Over 3mm and 6mm or less			0 -0.05
Over 6mm and 8mm or less		0 -0.05	0 -0.06
Over 8mm and 10mm or less	-0.010 -0.030		
Over 10mm and 11.5mm or less			
Over 11.5mm and 12.0mm or less		0 -0.06	0 -0.08
Over 12.0mm and 14.5mm or less	-0.010 -0.035		
Over 14.5mm and 15.0mm or less			
Over 15.0mm and 16.5mm or less	-0.01 -0.05	0 -0.08	
Over 16.5mm and 18mm or less			0 -0.10
Over 18mm and 20mm or less	-0.01 -0.06		
Over 20mm and 26mm or less		0 -0.12	0 -0.15
Over 26mm and 35mm or less	-0 -0.08		
Over 35mm and 50mm or less	-0 -0.10	0 -0.20	+0.15 -0.15
Over 50mm	±0.3%	±0.5%	±0.6%

#### ■Dimensional Tolerances [Extruded Rods]

Units:mm

Shape	Round	
Alloy number	C3602, C3604, C3605, C3771	
Diameter or Width across flats	Tolerance (±)	Tolerance (+)
From 25 to 30	±0.3	+0.6 0
Over 30 and 95 or less	±1.0%	+2.0% 0

#### ■Brass Rods Production Range

Units:mm

Shape	Type	Diameter or Width across flats	Length
		Drawn rods	
Round		From 2 to 75	From 25 to 95
Hexagon		From 4 to 50	—
Square/Rectangle		From 4 to 50	—

Note: Please consult us if you require products outside of the above specifications.



## Tonami Plant BRASS PIPES

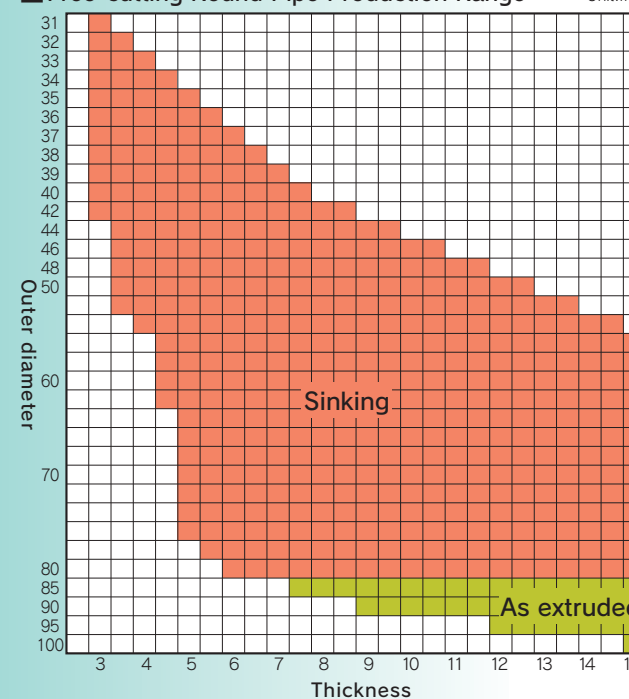
### Brass Pipe Major Specifications

#### ■Chemical Components and Characteristics

Name	Alloy number	Material (Note)	Component	Feature	Use
Free-cutting brass pipes	C3601	U12	59.7Cu-2Pb-Zn	Hot forging	Camera mounts, etc.
	C3604	A45	59.3Cu-3Pb-Zn	Versatility (middle/ thick types)	Machine parts, items produced by machining
Brass pipes for forging	C3771	F3	58.7Cu-2Pb-Zn	Hot forging	Items produced by precision forging or machining

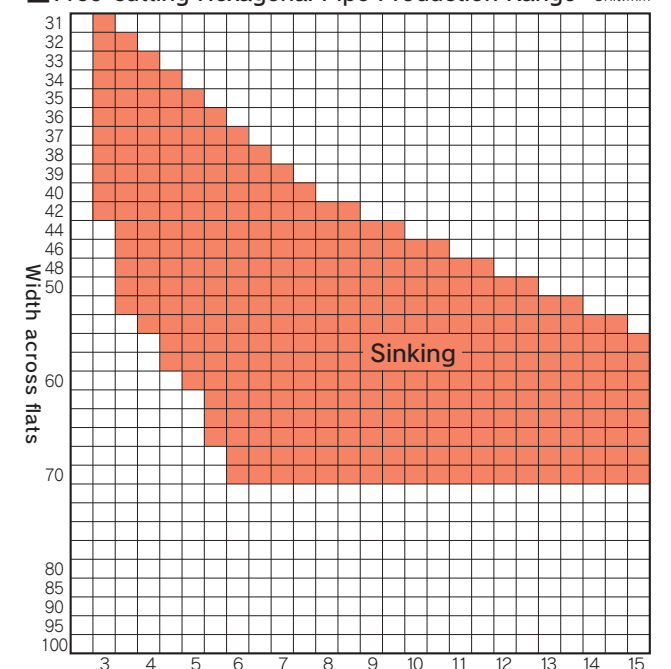
#### ■Free-cutting Round Pipe Production Range

Unit:mm



#### ■Free-cutting Hexagonal Pipe Production Range

Unit:mm



#### ■Brass Pipe Production Range (Shape)

	General pipe
Outer	Round or hexagonal
Inner	Round

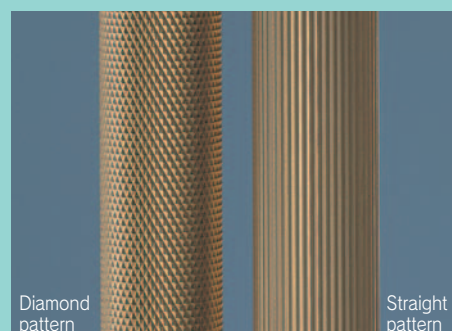
#### ■Dimensional Tolerances for Brass Rods

Unit:mm

Tolerance		Outer	30 or more, and less than 50	50 or more
Thickness	General		±0.15	±0.18
	3 or more, and less than 4		±0.30	—
	4 or more, and less than 5		±0.40	±0.40
	5 or more, and less than 6		±0.45	±0.45
	6 or more, and less than 8		±8%	±8%
	8 or more		—	±9%

#### ■Knurled rods

There are two types of knurled rods: straight pattern and diamond pattern. They are machine-finished to create precise and clear-cut patterns. Knurled rods have excellent slip-resistance and can be attractively surface-treated, such as by plating.



Certificate of trademark registration for β Shrink

#### Product examples



#### Applications



- Optical instrument parts
- Gas fittings
- Faucets
- Refrigerator parts
- Computer parts
- Mobile communication device parts
- Air conditioner parts



# BRASS RODS & BRASS PIPES

Z34, Z00 and DR5 are multi-spec **dezincing-resistant brass rods** that have a high level of corrosion resistance, free-cutting properties and forgeability.

The choice of materials available to customers has been increased because the material has been defined by a JIS standard.

## Z34 Z00 DR5 JIS H3250 C3531

### New alloy Z00 JIS H3250 C3531

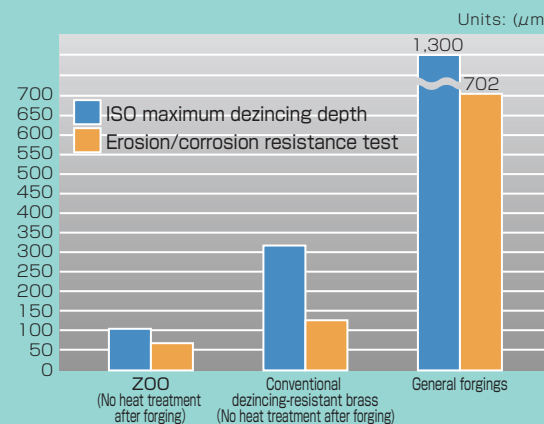
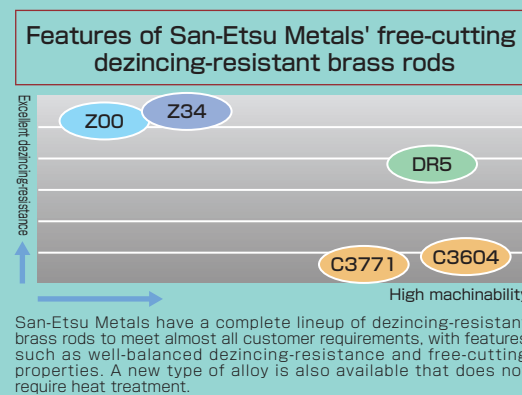
In the past, manufacturing dezincing-resistant brass rods required heat treatment after hot-forging. If the crystal structure of the brass was not properly controlled through heat treatment, satisfactory dezincing-resistance could not be achieved. San-Etsu Metals' Z00 is a revolutionary new alloy that achieves the highest level of dezincing resistance. It is created by taking advantage of our cutting-edge crystal structure control technology, which eliminates the need for heat treatment after hot forging.

**Z00 chemical composition** Units: %

Cu	Pb	Fe	Sn	Other	Zn
62.5	1.5	0.1	2.0	0.15	Remainder

### Z00's Features Increasing productivity and decreasing costs

To heat treat brass alloys after hot forging, it is necessary to have access to the appropriate heat-treatment equipment and technology, and to establish the traceability of raw materials. One must also have the ability to correctly control changes to the structure of the brass alloy which cannot be seen by the naked eye. Z00 exhibits the same level of corrosion resistance as conventional free-cutting dezincing-resistant brass rods, without performing heat treatment after hot forging. This substantially reduces the time and energy costs required for production.



### Continuously cast super dezincing-resistant brass rods and ingots

#### [Continuously Cast Super Dezincing-resistant Brass Rods]

Type	Standard	Material	Feature	Use	Component
Continuously cast dezincing-resistant brass	JIS H5121 CAC211C	ZC00PC	Dezincing resistance and mechanical property equivalent to that of bronze	Water supply parts and piping	67Cu <sub>1.5</sub> Pb <sub>0.25</sub> Sn <sub>0.25</sub> Zn
Continuously cast lead-free dezincing-resistant brass	JIS H5121 CAC231C	ZC00BC	Lead-free, and dezincing resistance and mechanical property equivalent to that of bronze	Water supply parts and piping	67Cu <sub>0.7</sub> Bi <sub>0.25</sub> Sn <sub>0.25</sub> Zn (≤0.25Pb)

#### [Ingots]

Type	Standard	Material	Feature	Use	Component
Continuously cast dezincing-resistant brass	JIS H5120 CAC211	ZC00P	Dezincing resistance and mechanical property equivalent to that of bronze	Water supply parts and piping	67Cu <sub>1.5</sub> Pb <sub>0.25</sub> Sn <sub>0.25</sub> Zn
Continuously cast lead-free dezincing-resistant brass	JIS H5120 CAC231	ZC00B	Lead-free, and dezincing resistance and mechanical property equivalent to that of bronze	Water supply parts and piping	67Cu <sub>0.7</sub> Bi <sub>0.25</sub> Sn <sub>0.25</sub> Zn (≤0.25Pb)

\* Ingots will be supplied considering the amount of zinc which may evaporate during transportation in the chemical composition of the product.

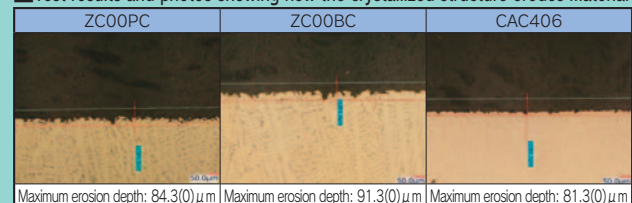
**ZC00 is a new brass alloy that can be used as a substitute for bronze. It delivers almost the same level of resistance to corrosion and stress corrosion cracking as does bronze, at lower costs.**

Bronze CAC406 has been widely used in plumbing, because it excels in dezincing-resistance, erosion/corrosion resistance and stress corrosion cracking resistance, and is also best suited for casting. Now, San-Etsu Metals has launched ZC00 super dezincing-resistant brass, a low-cost substitute for CAC406, without compromising the excellent properties of the bronze material. The low cost of ZC00 has been achieved by reducing the copper content in this new brass alloy. ZC00 is available in two types, lead-based ZC00P and bismuth-based ZC00B. Both alloys are nickel-free. ZC00 is a new type of copper alloy replacing bronze. ZC00 is available in the form of continuously cast rods (for machining) and ingots (for sand-casting).



#### Realization of superior dezincing-resistance

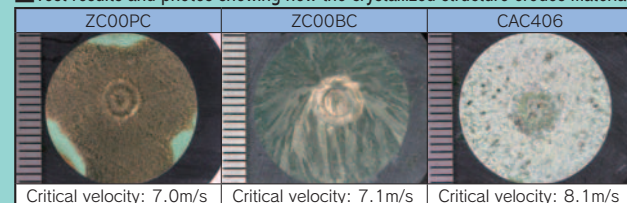
■ Test results and photos showing how the crystallized structure erodes material



※ 1 Results obtained using the JBMA T-303 dezincing test  
※ 2 The dezincing depth is shown in brackets ( ).

#### Excellent erosion/corrosion-resistance

■ Test results and photos showing how the crystallized structure erodes material



※ 1 Results of jet-in-slit test  
The critical velocities obtained in this study may not be representative of those obtained in practical application.

★ Please contact us for detailed information about the test methods used.

## Shin Nitto Plant's $\beta$ -shrink<sup>®</sup> Material<sup>®</sup>:Registered Trademark. Registration No. 5269181

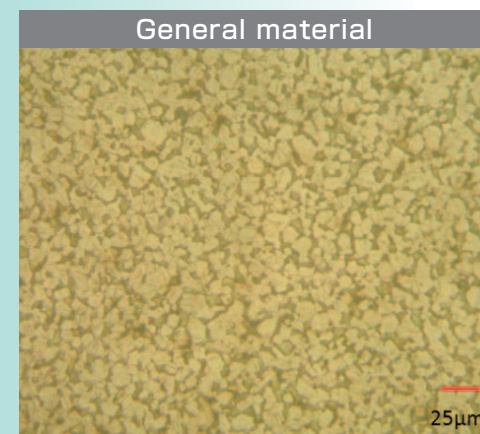
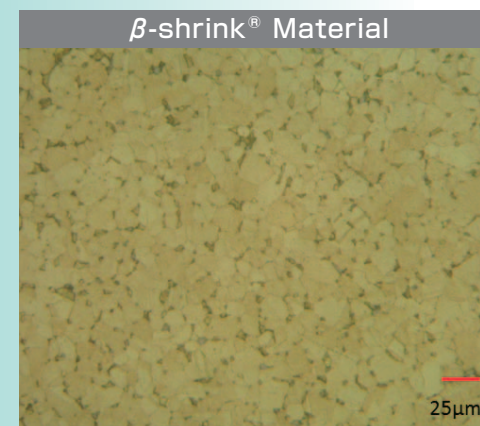
### San-Etsu Metals has succeeded in greatly reducing sensitivity to stress corrosion cracking (SCC), through special processing.

Using machined nuts made from our  $\beta$ -shrink<sup>®</sup> material provides confidence and peace of mind.

Brass is widely used for many applications, due to its strength, load capacity and excellent machinability. However, its one weakness is its high sensitivity to stress corrosion cracking. In particular, the possibility of stress corrosion cracking cannot be ignored for such uses as making nuts or other things where release stress is applied continuously. Until now, hot forging was the only way to produce reliable brass nuts with decreased sensitivity to stress corrosion cracking. However, the hot forging method is expensive, so it results in high production costs for brass nuts. San-Etsu Metals'  $\beta$ -shrink<sup>®</sup> material has solved this problem.

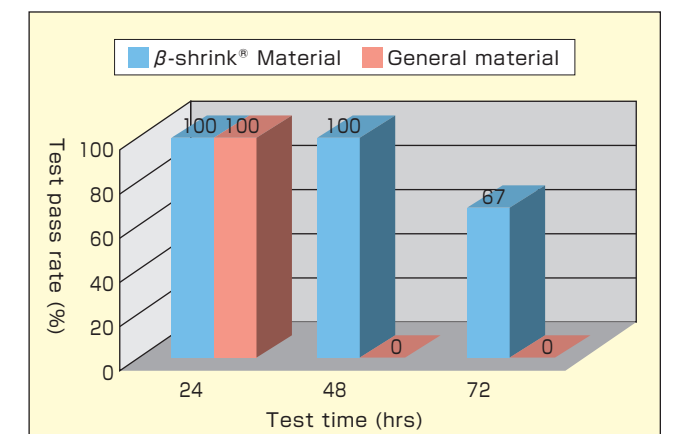
■ San-Etsu Metals'  $\beta$ -shrink<sup>®</sup> material is the best one out there for manufacturing machined brass nuts, because of its dramatically reduced sensitivity to stress corrosion cracking, achieved through our special brass rod heat treatment.

■ San-Etsu Metals'  $\beta$ -shrink<sup>®</sup> material is revolutionary and can be used for the manufacture of reliable, low-cost brass nuts with low sensitivity to stress corrosion cracking.



Data	
<b>Microstructure</b>	
● Grain refinement through our proprietary crystal structure control	Refines the $\beta$ phase, which is highly sensitive to stress corrosion cracking control
● Increased $\alpha$ -phase ratio and reduced residual stress due to our special heat treatment	Improved resistance to stress corrosion cracking
<b>Resistance to stress corrosion cracking</b>	
Sample	Test conditions
Shape: Regular hexagon	Mating material: Cast iron plug (R1/2)
Width across flats: 27mm	Tightening torque: 58.8N·m
Female threads: Rp1/2	Test solution: 14% ammonia in water
n: 6	Atmosphere: Ammonia at room temperature
	Time: 72hr

★ Cracks developed in all the general material samples within 48 hrs. No cracks developed in the  $\beta$ -shrink<sup>®</sup> material samples during the same time period.



#### Product examples (forging)



#### Product examples (machining)



#### Applications

- Gas fittings
- Automobile parts
- Watch cases
- Electric device and telecommunication equipment parts
- Hydraulic device parts
- Air conditioner parts
- Valves and cocks



# BRASS WIRES, COPPER WIRES, SPECIAL COPPER ALLOY WIRES and PLATED WIRES

We produce quality wire products with great efficiency, under a quality management system certified by ISO/TS16949, and have a 70% market share in Japan (80% for plated wires).

## COPPER WIRES

- Oxygen-free copper derived from high-purity ingredients. Tough-pitch copper is suitable for manufacturing connector pins and headers.

## SPECIAL COPPER ALLOY WIRES

- We can deliver various types of copper alloy wires that require special characteristics, including phosphor bronze wires.
  - Outstanding cold-forging properties and stable quality
  - Products are delivered on bobbins and with carriers.
- This helps reduce customers' processing costs.

## BRASS WIRES

- Thick brass wires are also available in long lengths, with assured quality of the welds.

## PLATED WIRES

The San-Etsu Metals Takaoka Plant is the world's only integrated producer of plated wires for terminals and connectors. We manufacture brass alloys by blending copper and zinc, draw square- and rectangular-section wires for terminals and connectors, and plate them in various ways, with the entire process conducted within one specific area of our company. Our integrated production system makes it possible to produce high-quality plated wires within a shorter delivery time.

1. Tin reflow plated wires (controlled whisker growth through reflow processing)
  - (1)Copper base An all-purpose product with strong adhesion and good workability
  - (2)Nickel base Good solderability due to dispersion control
  - (3)Three-layered plating A copper base is applied over a nickel base, to control insertion resistance. Suitable for high-performance connectors

### 2. Silver plated wires

Silver is the best metal for conducting heat and electricity. Silver plated wires are reliable even in a harsh, high-temperature environment.

### 3. Nickel plated wires

Highly resistant to wear and corrosion. Good hardness and adhesion.

### 4. Tin plated wires

Excellent corrosion-resistance and solderability, suitable for automobile, electrical and electronic parts.

## SPECIAL COPPER ALLOY WIRE

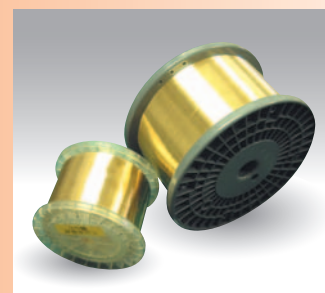
Name	Features & Applications
Phosphor bronze	A Cu-Sn-P-based alloy, with excellent springiness. Suitable for spring-loaded connectors, switches, relays, and electronic/electric device springs; and also for header material, snap buttons, sliding parts, bearings, bushings, etc.
Copper-iron alloy	Cu-Fe-P-based C192 and C194 alloys. Excellent electric and thermal conductivity, strength and heat-resistance. Widely used for the manufacture of automobile diodes and connectors, EV relay terminals and package pins for printing.
Copper-tellurium alloy	A Cu-Te-based C145 alloy. Excellent machinability, electrical conductivity and heat-resistance. Used for the manufacture of electric discharge machining electrodes, automobile connectors, gas welding tips, torch nozzles, heat-sinks, charger plugs, etc.
Copper-lead alloy	A Cu-Pb-P-based C187 alloy. Excellent machinability and electrical conductivity. Suitable for the manufacture of connectors for satellites, aircraft and railway vehicles.
Copper-Corson alloy	An age-hardened C7025 alloy produced by adding Mg to Cu-Ni-Si-based Corson alloy. Excellent electrical conductivity, heat conduction, strength and heat-resistance. Widely adopted for the manufacture of high-performance terminals and connectors.
Silicon bronze	A Cu-Si-Mn-based alloy. Known as MIG wire (Everdur). Used as a brazing filler metal for the joining of sheets (<1mm) in luxury automobiles.



## Product examples



## Applications



- Automobile-related parts
- Faucets
- Sanitary fixture parts
- Gas fittings
- Lighting equipment parts
- Air conditioner parts
- Electric / electronic device parts
- Dry cell collector rods
- Pegs in pachinko machines
- Wire cut electrode wire

ISO/TS16949 certification obtained on November 19, 2013.  
IATF16949 (revised) certification obtained on December 5, 2017.  
IATF certification No. 0280766

SRI (Steel Related Industries Quality System Registrar)  
San-Etsu Metals Co., Ltd. Takaoka Plant  
Manufacture & sales of copper/copper alloy wire

## Major Specifications for Copper Wires, Special Copper Alloy Wires and Brass Wires

### Wire Types

Type	Code	Material	Component	Feature	Use
Oxygen-free copper	C1020W	C20	Cu	Electric and thermal conductivity, malleability and hydrogen-embrittlement-proof	Electric appliance parts, items produced through chemical processing
Tough pitch copper	C1100W	C21	Cu	Electric and thermal conductivity, malleability	Electric appliance parts, items produced through chemical processing, screws, nails
Gunmetal	C2100W	B05	95Cu-5Zn	Malleability, corrosion resistance	Accessories, fasteners, wire nets, thermostats, terminals, connectors
	C2200W	B15	90Cu-10Zn		
	C2300W	B21	85Cu-15Zn		
	C2400W	B22	80Cu-20Zn		
Brass	C2600W	B42	70Cu-30Zn	Malleability, cold forging and rolling	Rivets, screws, pins, hooked nails, springs, wire nets, terminals, connectors, electrode wire for electric discharge machining
	C2700W	B62	65Cu-35Zn		
	C2720W	B74	63Cu-37Zn		
	C2800W	B82	60Cu-40Zn		
	—	B92	57Cu-43Zn	Malleability, electrical discharge machinability	Electrode wire for high-speed electric discharge machining
Brass for nipples	C3501W	F15	62Cu-1.3Pb-Zn	Machinability, cold forging	Nipples, bolts, nuts
Free-cutting brass	C3603W	A35	58.4Cu-3Pb-Zn	Machinability	Precision product parts, electric appliance parts
	C3604W	A45	59.3Cu-3Pb-Zn		
Brass for welding	—	Y10	62Cu-0.25Ni-0.2Si-Zn	Weldability	Welding wire, welding rods
	—	Y47	61Cu-1.5Sn-0.15Si-Zn		
Phosphor bronze	C5071W	C71	Cu-2Sn-Ni-P	Strength, elasticity, fatigue-proof, corrosion resistance, wear resistance	Connectors, switches, relays, electric/ electronic device springs, headers, snap buttons, sliding parts, bearings, bushings
	C5111W	C73	Cu-4Sn-P		
	C5102W	C72	Cu-5Sn-P		
	C5191W	C75	Cu-6Sn-P		
	C5212W	C78	Cu-8Sn-P		
Copper-iron alloy	(C19210)	C92	Cu-0.1Fe-0.03P	Electric and thermal conductivity, strength, heat resistance	Automobile diodes/ connectors, EV relay terminals, package pins
	(C19400)	C86	Cu-2.3Fe-0.1P		
Copper-tellurium alloy	(C14500)	B10	Cu-0.5Te-0.01P	Machinability, electric conductivity, heat resistance	Electrodes for electric discharge machining, connectors, welding tips
Copper-lead alloy	(C18700)	C70	Cu-1.3Pb-0.02P	Machinability, electric conductivity	Connectors for satellites, aircrafts and high-speed trains
Corson-copper alloy	(C70250)	CN3	Cu-3Ni-1Si-0.2Mg	Electric and thermal conductivity, strength	High-performance terminals, connectors
Silicon bronze	—	C65	Cu-2.3Si-1Mn	Weldability, malleability	Brazing fillers, screws, bolts and nuts for high-grade automobile thin plates (1mm or less)
	—	C69	Cu-2.5Si-1Mn-0.07Ce		

### Wire Production Range

#### (1) In Coils

Diameter (mm)	Inner Diameter (mm)	Outer Diameter (mm)	Weight (kg)
0.1 or more, and less than 0.3	110~130	170~190	3~5
From 0.3 to 1.0	160~180	220~240	5~10
	200~250	350~400	20~30
Over 1.0, and 2.0 or less	200~250	350~400	20~30
	450~500	600~650	30~50
Over 2.0, and 6.0 or less	450~500	600~650	30~100
	450~500	600~650	30~100
Over 6.0, and 9.0 or less	550~600	650~700	30~100
	550~600	650~700	30~100
Over 9.0, and 12.0 or less	550~600	650~750	30~100
	650~750	800~1,000	30~100
Over 12.0, and 26.0 or less	750~850	1,000~1,200	30~100

#### (2) Carriers

Diameter (mm)	Inner Diameter (mm)	Outer Diameter (mm)	Weight (kg)
Over 1.0, and 6.0 or less	450~600	600~800	100~500
Over 6.0, and 12.0 or less	450~750	600~1,000	100~600
Over 12.0, and 20.0 or less	750~850	1,000~1,200	100~800

### Tolerances for Diameters or Width Across Flats

Diameter or width across flats (mm)	Round (mm)	Hexagon/ Square/ Rectangle (kg)
From 0.1 to 1.0	+0, -0.01	+0, -0.02
Over 1.0, and 6.0 or less	+0, -0.02	+0, -0.03
Over 6.0, and 26.0 or less	+0, -0.05	+0, -0.05

### Bobbin Types

Diameter (mm)	Inner Diameter (mm)	Outer Diameter (mm)	Width (mm)	Weight (kg)
Over 0.1, and 1.6 or less	15	80	82	1
	15	100	90	2
	20	130	110	3
	20	160	112	5
	30	200	134	10
	52	270/285	52	13~15
	30	300	130	30
	52	400	200	50
	52	440	192	30
	45	800	150/180	50~100
	266	500	250	200

### Plated Wire Production Range

Type	Diameter or width across flats (mm)	Packing Style	Weight (kg)
Reflow Sn	From 0.3 to 1.6	Wound around bobbins	~200
Ag	From 0.5 to 1.6	Wound around bobbins	~400
Ni	From 0.5 to 1.6	Wound around bobbins	~400
Sn	From 0.3 to 1.6	Wound around bobbins	~200

\* Please see the plated wire catalog for more details.



# PRECISION PARTS

We manufacture high-quality precision parts in quantity through our leading-edge technology and facilities.



Precision Machining Plant



- 1 Our integrated production system, from the manufacture of raw materials to forging and machining, makes it possible to achieve a high level of quality that satisfies our customers.**
  - Our quality raw materials and advanced machining technology meet customer expectations.
  - We have a strong track record of delivering precision parts produced by forging and machining our lead-less brass rods.
- 2 We have achieved the outstanding dimensional accuracy of 20 micron in precision forging.**
  - Our camera mount components enjoy a 90% global market share, receiving high praise for their low costs and high quality.
- 3 We offer complex shape forgings produced using hollow forging technology.**
  - It is possible to reduce input weight and machining time.
- 4 When customers request new products, we can deliver them more quickly than others because we design and manufacture dies on our own.**
  - Many customers have expressed intense appreciation of our shorter delivery times for new products.
- 5 We deliver a high level of machining technology in a wide range of variations.**
  - Our superior expertise and cutting-edge technology flexibly meet any machining demand for complicated shapes.
- 6 We produce a constant stream of high quality products using our thoroughly automated production system.**
  - Our thoroughly automated process produces quality products with minimal deviations from specifications.
  - Including a deburring process during production reduces the necessity for rework due to burr formation.

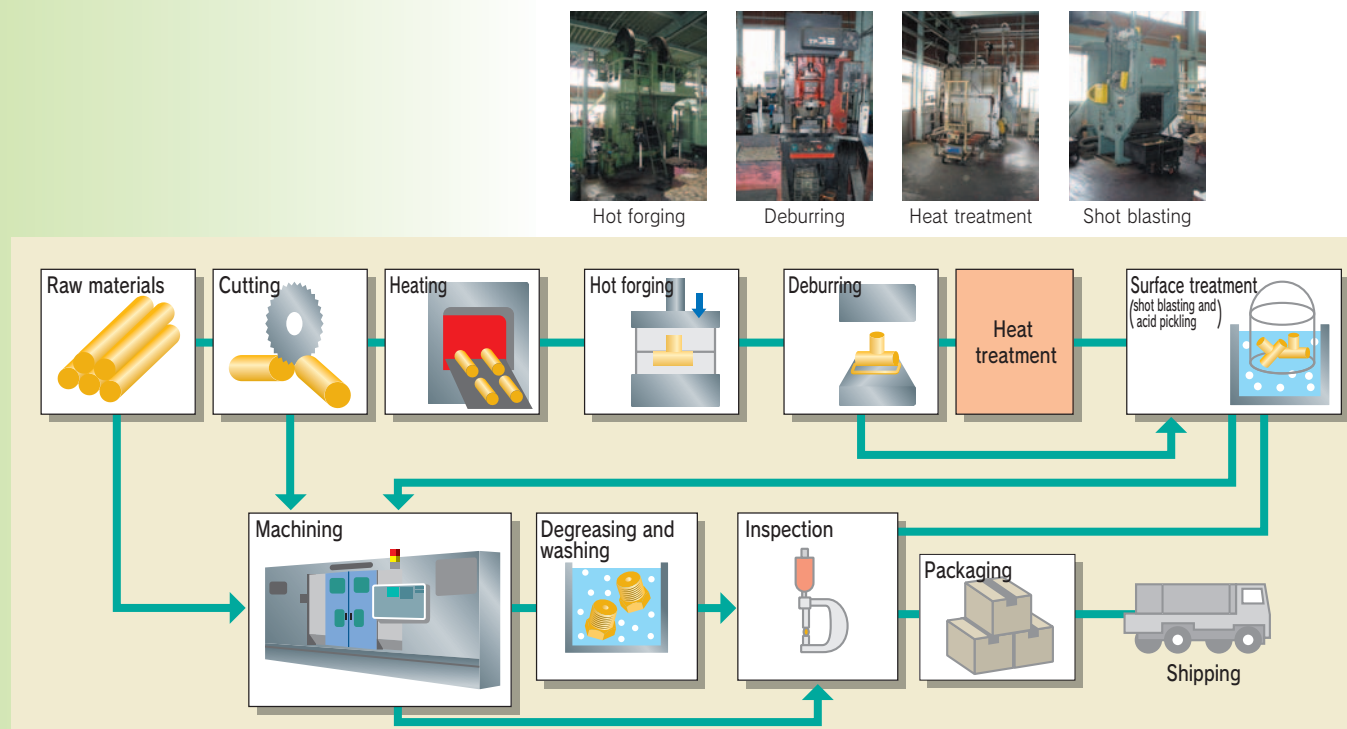
## Quality Management System

We have established a sound management system in compliance with the standards of ISO 9001 (the quality management system) and ISO 14001 (the environment management system). We strive to make sure we always supply homogeneous and high quality products, through our strict quality inspections.

## Measuring Instruments

- CNC three-dimension measuring instrument
- CNC image measuring instrument
- Surface roughness measuring instrument
- Contour measuring instrument

## MANUFACTURING PROCESS



Hot forging



Deburring



Heat treatment



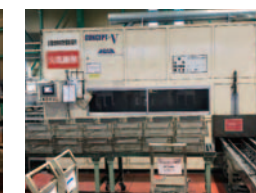
Shot blasting



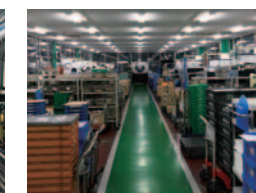
Multi-tasking machine



Machining center

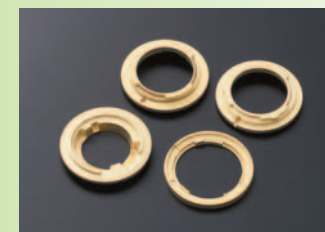


Ultrasonic cleaning

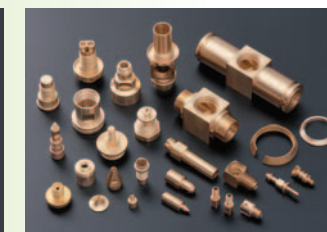


Inspection room

## Product examples



Camera mounts



Electric / electronic device parts



Gas fittings and air conditioner parts



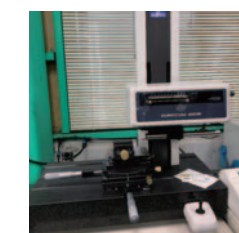
Housing equipment parts



CNC three-dimension measuring instrument



CNC image measuring instrument



Surface roughness measuring instrument



Contour measuring instrument



## OVERSEAS BUSINESS

### San-Etsu Metals (Shanghai) Co., Ltd.

Room No.1111 New Town Centre 83 Lou Shan Guan Road,  
Sanghai 20036, China  
TEL +86-21-6236-8345 FAX +86-21-6236-8353

Based in Shanghai, China, San-Etsu Metals (Shanghai) Co., Ltd. is both a local sales base for San-Etsu Metals Co., Ltd. and San-Etsu Metals' regional headquarters for overseeing all sales outside Japan. Taiwan San-Etsu Co., Ltd. operate under San-Etsu Metals (Shanghai).

San-Etsu Metals (Shanghai) does more than just handle sales operations, as the company manages inventories for the Shanghai Free Trade Zone and the Chengdu Hi-Tech Comprehensive Protective Tariff Zone, Dalian Free Trade Zone, which has earned them great respect from customers because of their smooth deliveries and attention to detail.

They also advise and support customers who are planning to export their products to China, Taiwan and other overseas markets. Feel free to hear what they have to say.



### Taiwan San-Etsu Co., Ltd.

No.765,Section 2,Taiwan Boulevard,Xitun District Taichung  
TEL +886-4-2437-9052 FAX +886-4-2326-2575

Taiwan San-Etsu Co., Ltd. have their office in Taichung City. Their operations cover all of Taiwan, and reach as far overseas as Southeast Asia Area, India, and Europe.

On the map, Taiwan is right at the center of Southeast Asia, which is why they can provide quick support across the region.



## DOMESTIC BUSINESS

### San-Etsu Shoji Co., Ltd.

895-1 Kamimitsumata, Kazo, Saitama, Japan, 347-0006  
TEL +81-480-48-5703 FAX +81-480-48-5704  
Email: sshoji-info@sanetu.co.jp

San-Etsu Shoji Co., Ltd. is a young company, beginning operations in November 2018.

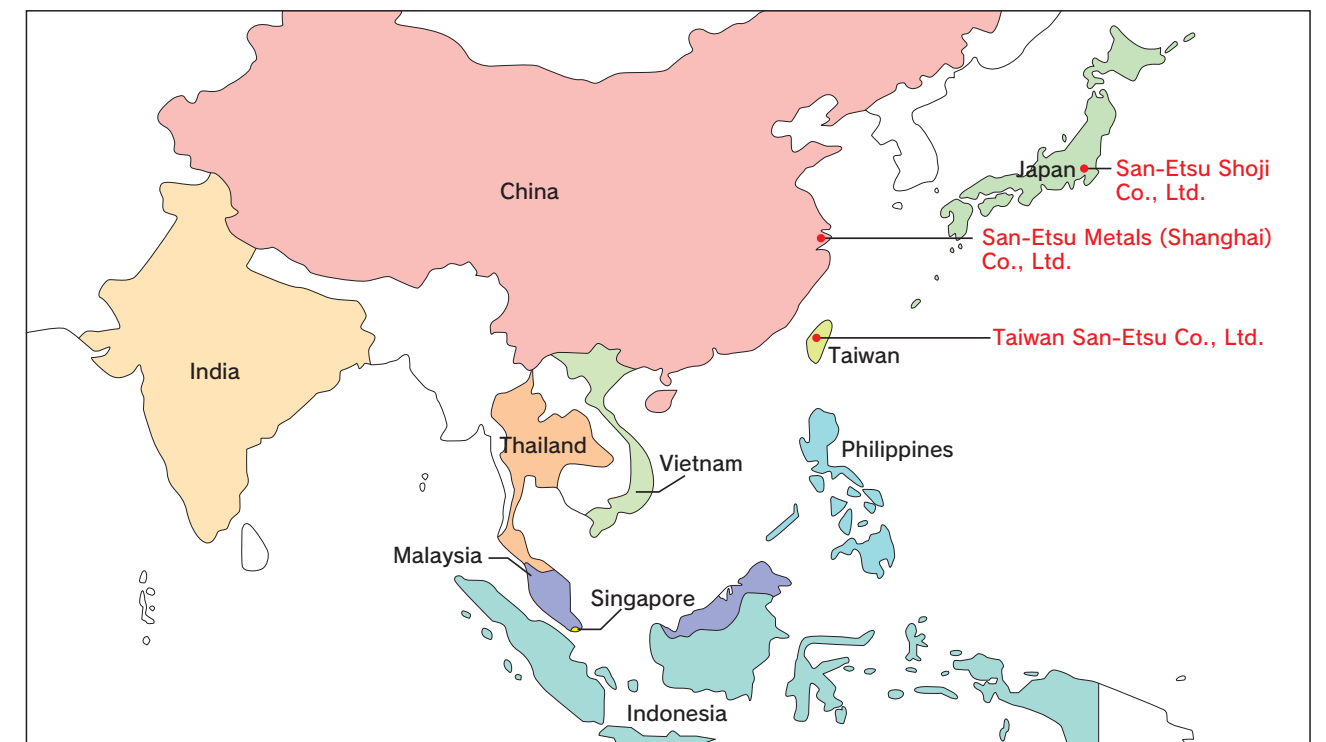
We are a specialized trading company that deals with a wide range of wires, with a focus on brass and stainless steel wires, and also handling various copper alloy wires, aluminum wire, and special wires such as titanium.

We are a subsidiary of San-Etsu Metals Co., Ltd., Japan's largest producer of brass wires. Utilizing our know-how, we respond accurately to customers' material selection inquiries, not only for brass wires but for all nonferrous wires in general.

We have a reserve stockpile, giving us high confidence in our ability to meet delivery times.

We respond to all requests, from large to small, promptly and courteously.

Please feel free to contact us at any time via telephone, email or fax.





## Excellent material properties and wide applications

Brass has many outstanding characteristics and a variety of uses.

### Electrical Conductivity

Brass features a higher electrical conductivity than other alloys and is used in the manufacture of various electrical appliances.



■Product examples  
Connectors  
Electrical plugs  
Fluorescent light pins

### Hot Forging

Brass excels in hot forgeability, and can be used to forge complex shapes easily when it is heated to 600~800°C.



■Product examples  
Burner heads for gas cooking appliances

### Malleability

Brass features great malleability, making it suitable for shaping through pounding and flattening.



■Product examples  
Hooks and fasteners

### Rolling & Caulking Properties

Excellent secondary workability, caulking and rolling properties (suitable for press transfer).



■Product examples  
Screws

### Machinability

Brass containing lead or bismuth has excellent machinability and is used for the manufacture of components requiring high levels of precision machining, such as watch parts and water/gas pipe fittings. Tools used to machine brass last longer than when used to machine other metals.



■Product examples  
Precision machined parts  
Bolts  
Nuts  
Tire tube valves

### Brass is nonmagnetic

Brass does not become magnetized, making it an indispensable material for use in electrical instrument components.



■Product examples  
Electronic devices  
Automobile instruments  
Meter frames

### Thermal conductivity

Brass has excellent thermal conductivity, and is used in heat exchangers, etc.

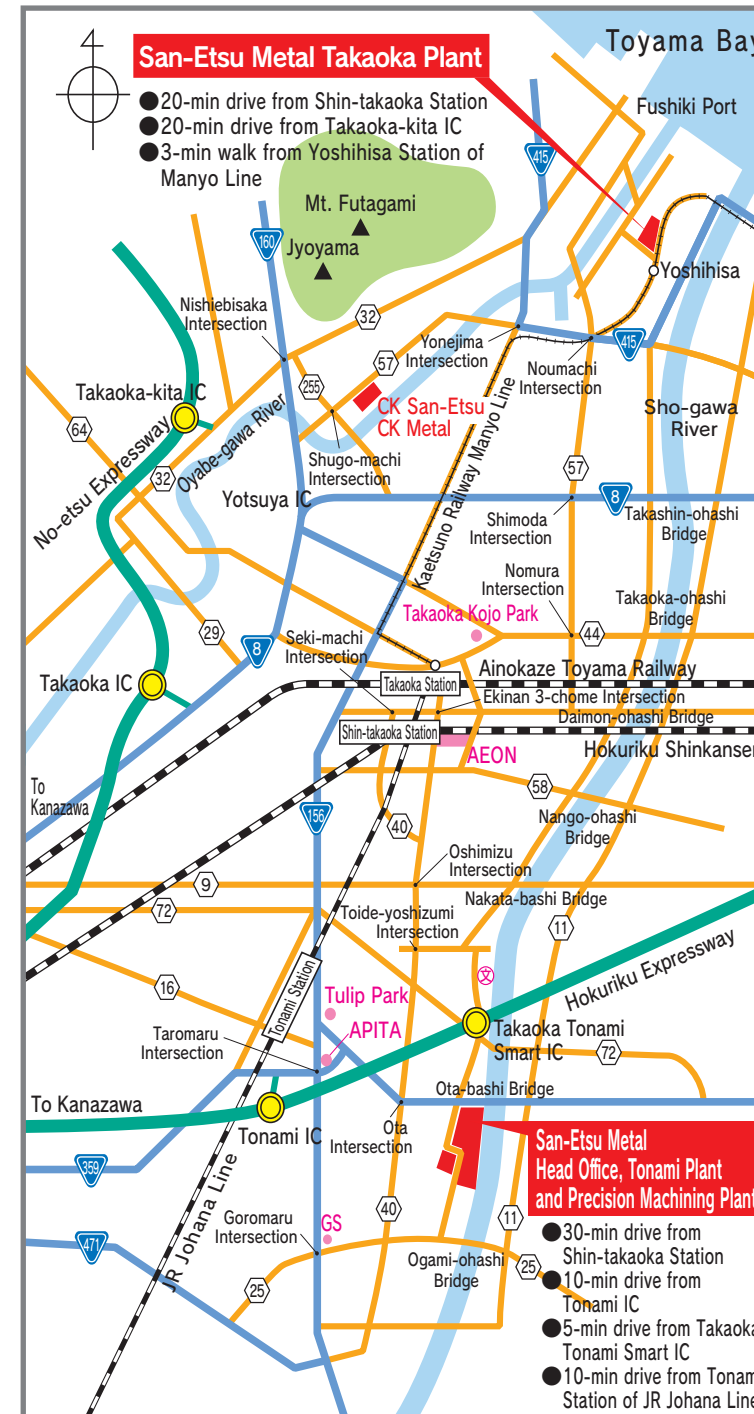


■Product examples  
Water heaters  
Air conditioners  
Automobile radiators

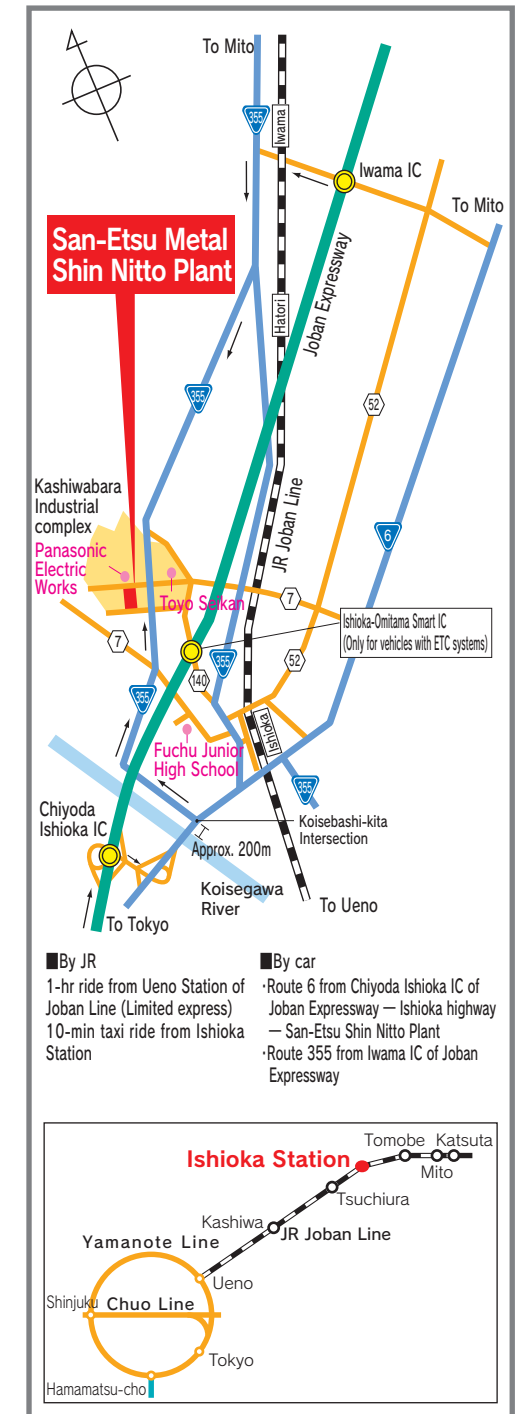
Brass is used everywhere around us. It is an indispensable material for leading-edge industries as well as in our everyday lives.

## Head Office, Plants and Branch Offices

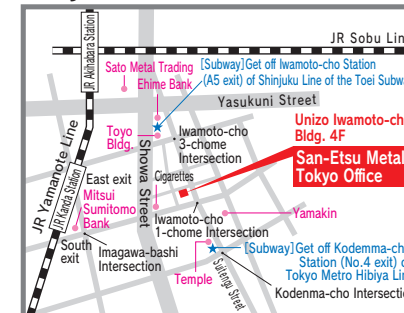
### Head Office and Plants



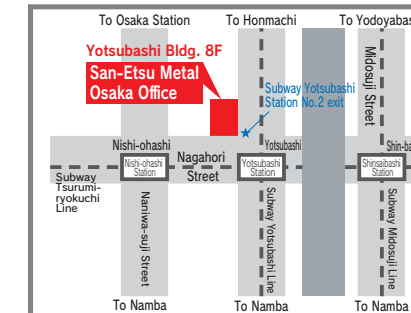
### Shin Nitto Plant



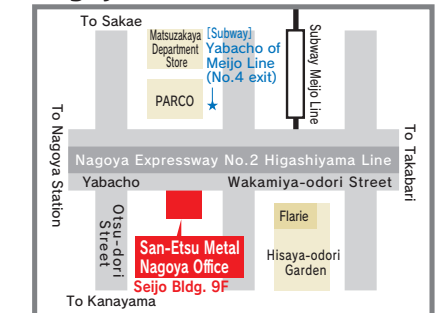
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