

SENJU METAL INDUSTRY CO., LTD.

■ SENJU METAL INDUSTRY CO., LTD.

HEADQUARTERS

Senju Hashido-cho 23. Adachi-ku,
Tokyo 120-8555 Tel.(81)3-3888-5151
Plants
Tochigi, Saitama, Tokyo and Hyogo
Laboratories
Tochigi and Tokyo

Branch

•**Taiwan Branch**
Kaohsiung, Taiwan, R.O.C Tel.(886)7-3985-201
•**Kaohsiung Branch**
Kaohsiung, Taiwan, R.O.C Tel.(886)7-8152-878
•**Korea Branch**
Gyeonggi-do, Korea Tel.(82)31-8005-5557

Asia

■ SENJU (MALAYSIA) SDN. BHD.

Selangor, Malaysia Tel.(60)3-5191-2227

■ SENJU TRADING (M) SDN. BHD.

Selangor, Malaysia Tel.(60)3-5191-6670

•ST AUTOMATIC MACHINERY SDN. BHD.

Selangor, Malaysia Tel.(60)3-8066-3673

■ SENJU SOLDER (PHILS.) INC.

Cavite, Philippines Tel.(63)46-437-2720

■ SENJU (THAILAND) CO., LTD.

Bangkok, Thailand Tel.(66)2633-8585

■ SENJU METAL (HONG KONG) LIMITED

Kowloon, Hong Kong Tel.(852)2376-3319

■ SENJU ELECTRONIC MATERIAL (HONG KONG) LIMITED

N.T. Hong Kong Tel.(852)2682-2235

Europe

■ Senju Metal Europe GmbH

•Headquarters

Frankfurt, Germany Tel.(49)69-29 80 15-0

•Schwabach Branch

Schwabach, Germany Tel.(49) 9122 88751-0

•Prague Branch

Prague, Czech Republic Tel.(420)257-289-500

■ SENJU MANUFACTURING (EUROPE) LTD.

Bucks, England Tel.(44)1494-526000

■ SENJU METAL ITALIA S.R.L.

Vicenza, Italy Tel.(39)0444-380789

North & South America

■ SENJU AMERICA INC.

Chicago, IL, U.S.A Tel.(1)847-549-5696

■ SENJU COMTEK CORP.

•Headquarters

Campbell, CA, U.S.A Tel.(1)408-963-5300

•San Jose Plant

San Jose California U.S.A Tel.(1)408-792-3831

•Chicago Office & Plant

Chicago, IL U.S.A Tel.(1)847-549-5690

•San Diego Office

San Diego, CA USA Tel.(1)858-268-2436

•Mexico Office

Guadalajara, Mexico Tel.(52)33-3770-2314

■ Senju Comtek do Brazil Ltda.

Campinas, SP, Brazil Tel.(55)19-3254-2572

■ SENJU METAL (SHANGHAI) CO., LTD.

•Headquarters

Shanghai, P.R. China Tel.(86)21-6235-0178

•Shanghai Plant

Shanghai, P.R. China Tel.(86)21-2868-2228

•Suzhou Office

Suzhou, P.R. China Tel.(86)21-6235-0178

■ Senju Metal (Tianjin) Co., Ltd.

Tianjin, P.R. China Tel.(86)22-8396-3569

■ Senju Metal Korea Co., Ltd.

Kyunggi-do, Korea Tel.(82)31-323-4347

■ PT.SENJU TRADING INDONESIA

Jakarta, Indonesia Tel.(62)21-573-2530



SMIC PLAIN BEARING CATALOG

Handling Precautions and Export Conditions

■ For the sale and use of any and all products in this catalog:

- Read and understand the instructions in the operating manual
- Fully observe all cautions and warnings when handling and operating the product

■ Products in this catalog may be subject to export control restrictions under the Foreign Exchange and Foreign Trade Control Law.

When considering the export or transfer of a product overseas, first contact us for confirmation on the controlled status of the product in question as an export license from the Japanese Government is required.

■ Without exception, we or our sales agent must be notified before the resale or transfer of ownership of any product in this catalog.

Beware of counterfeit products.
Counterfeit flux cored and other inauthentic Senju solder products have been circulating abroad. Always purchase genuine Senju products from Senju subsidiaries or authorized distributors.



Aesthetics of High Technology

SMIC's Plain Bearings Pursuing the Highest Quality

SMIC's plain bearings are developed with an excellent powder sintering, high-precision processing, and unique bonding technology. We test their qualities using instruments such as a friction tester, hydraulic bench tester, and friction/abrasion tester in order for you to use our products with assurance.

Features

- Our plain bearings have achieved the highest quality based on unique alloying, pressure welding, sintering and processing technologies.
- In order to contribute to the global environment, we have developed eco-friendly "lead-free bearings" following our lead-free solder products.
- With a strong capability in developing resin products, we have developed "Clean Metal" bearings, which have a low friction coefficient.

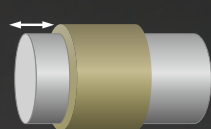
Advantages of SMIC's Plain Bearings

Movement of the shaft is applied to the "points" of the bearing



"Rolling bearing"

Movement of the shaft is applied to the surface of the bearing



"Plain bearing"

Advantages of "Plain Bearings"

- Suited for heavy and impact load because the face supports the shaft
- Lengthened product life
- Dry lubricated bearings, which do not require a lubricant, are also available
- Simple design allows for ease of downsizing which, in turn, leads to weight and cost reduction

Our plain bearings with excellent shock absorption are the best option for sliding sections with large load changes. They are also cost effective due to their light weight and compact size. SMIC specializes in plain bearings with our advanced technology that allows for us to manufacture with microscopic accuracy and ultra-precision machining with composite material. We have developed, manufactured and sold plain bearings that are better suited compared to competitive rolling bearings; and have been recognized as one of the best in the world.

1 Layer Plain Bearings

Heat treated as well as iron and copper surface finish

P3

● Iron Washers for Thrust Control

Best for sliding sections of automobiles and construction equipment due to their high degree of hardness

● Copper Washers for Gaskets

Prevents oil leaks from brake controllers of automobiles



2 Layer Plain Bearings

Bimetallic bearings made by sintering copper powder on iron bases

P4

● Bushing

Suitable for heavy load, impact load, and sliding; as well as a long product life

● Plate

Thin plate materials achieve downsizing and weight reduction



3 Layer Plain Bearings

Produced by sintering copper powder on an iron base then impregnating the base with resin

P5~8

● CBE Series

Best for sliding sections of automobiles and construction equipment due to their excellent resistance to abrasion

● CBR Series

Unique 3 layer bearings constructed for stronger tolerance to pressure



Clean Metal

Design and development processes that ensures high quality

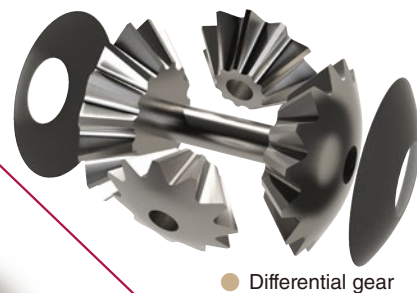
P9~10

1 Layer Plain Bearings

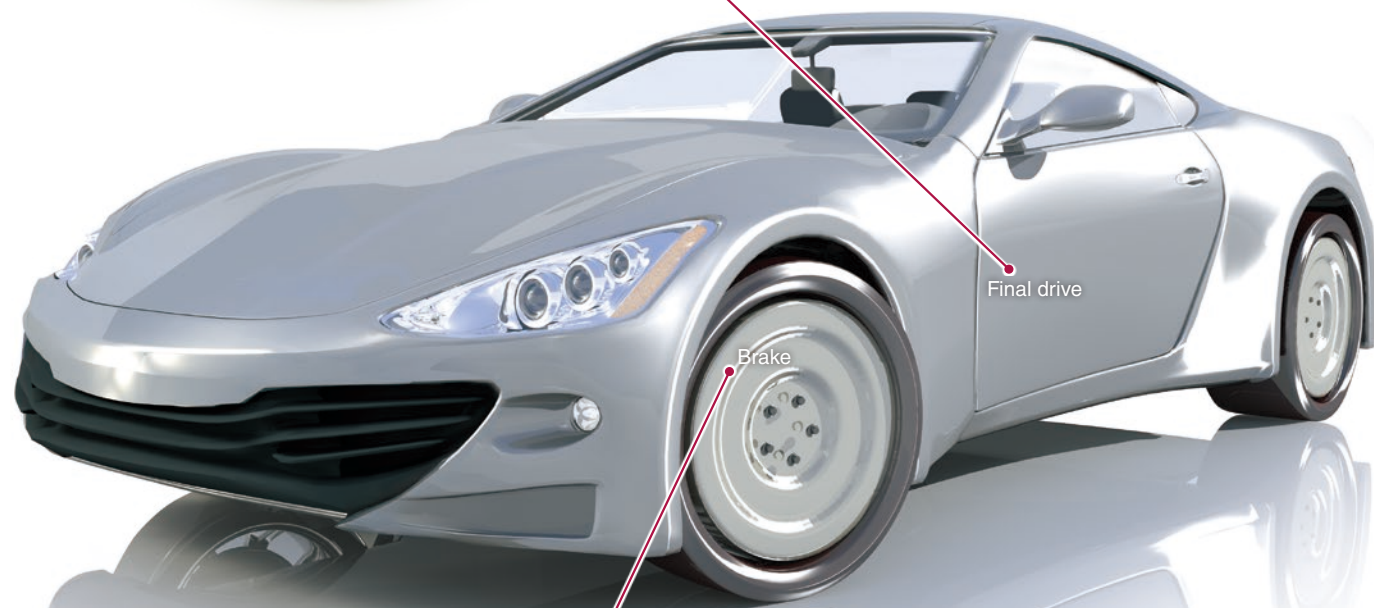
We offer two types of 1 layer bearings: the copper washer, which works as oil seals; and the iron washers with improved resistance to abrasions and sliding property. Our copper washers are most suited to prevent bolts from loosening and most commonly used as gasket washers for brake hoses. Our iron washers, on the other hand, are used as parts for final drive assemblies due to their layer produced with a carbon steel finish for a high degree of hardness.

Improved resistance to abrasions and sliding property

For Thrust Control Iron Washer



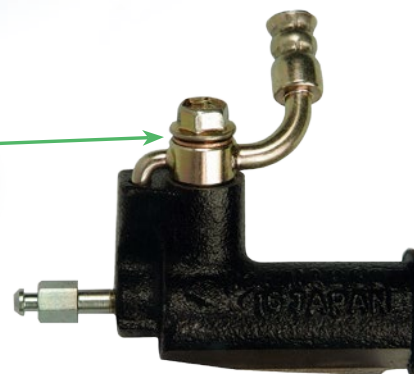
● Differential gear



Works as oil seals

For Gaskets Copper Washer

Copper Washer



● Gasket

2 Layer Plain Bearings

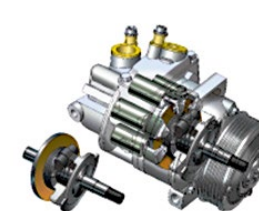
Our 2 layer bearings are made with bimetal structure that consists of sintering a metal base with copper powder. We also utilize a technique to reduce the amount of CO2 emissions by lining the copper powder to the base used instead of the whole base. In doing so, we have succeeded in reducing the cost of materials and, in turn, reducing the overall price of the product. The bearings are used as plates for hydraulic pumps, and as bushings for undercarriages of construction equipment. Furthermore, we have developed and now produce, a lead-free line of products that is in compliance with the ELV and RoHS guidelines.

Partially sintered in an automated line

For Compressors Swash Plate



Compressor



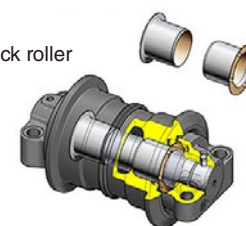
● Air conditioners and compressors
Sintered copper powder on both sides



Achieved high rigidity and long product life

For Undercarriages of Construction Equipment SF Bushing

● Track roller



Realized weight reduction with its compact design

Hydraulic Pumps and Motors Side Plate/Valve Plate

Side Plate/
Valve Plate



● Hydraulic pump

Piston pump

Turning motor

Traveling motor

Track roller



3Layer Plain Bearings, the "Clean Metal" series

Our "Clean Metal" bearings are made with a 3 layer structure that consists of sintering bronze powder on a porous metal base then impregnating it with our very own specialized mixture of fluororesin. This resin works as a dry lubricant, allowing for use without any liquid lubrication. Though it is unnecessary, additional lubrication can extend the product life. Our 3 layer plain bearings are most commonly used for shock absorbers in automobiles due to their compact size and reduced weight. We also offer a wide variation of products from those suited for low friction to those suited for heavy load and high-speed rotation. "Clean Metal" bearings are also eco-friendly and lead-free.

To adjust tension belts

For Auto Tensioners

CBE1

To facilitate the switching of gears

For CVTs and Solenoid Valves

CBR2

For smooth acceleration and braking

For Pedals

CBE1



For a smooth and automatic seat recline

For Moving Power Seats

CBE2

For quiet and smooth operating doors

For Door Hinges

CBE1



Gives a superb ride

For Shock Absorbers of Cars



(For the specifications, please contact us.)

CBE2 CB90

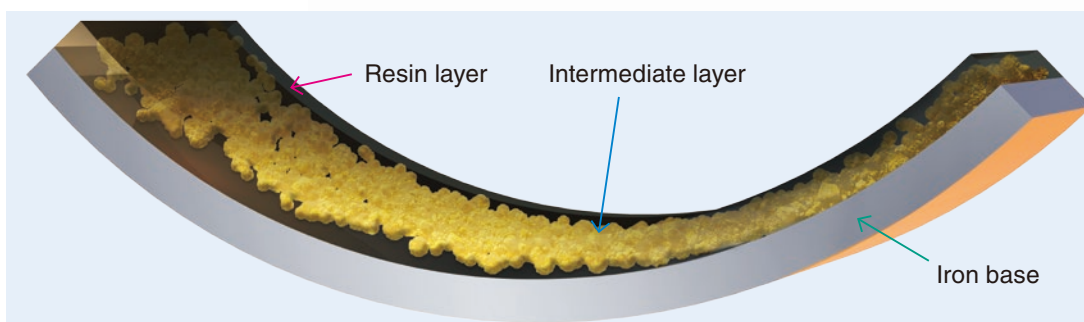
Reduces impact from roads

Shock Absorbers of Motorcycles



CBE5 CB90

Structure and Features of Clean Metal



Clean Metal bearings, with its compact design and light weight, uses dry lubricants instead of oil and therefore can be used without any additional lubrications because of its low coefficient of friction. These Clean Metal bearings can prevent the occurrence of vibrations and abnormal noise even while under heavy load, impact load, continuous rotation or oscillatory movements.

3Layer Plain Bearings: "Clean Metal" Overview

Features

- High-quality products supported by a leading edge evaluation technology using one of the best instruments in the industry
- Lead-free products with excellent resistance to abrasion which can withstand heavy load without lubrication
- Ability to select desired material of resin layer most suited for the intended use
- Thin plate materials allow weight reduction and downsizing to realize high performance
- Functional in a wide temperature range from -200 °C to +280 °C
- Ability to select product types, shapes and sizes according to specifications of usage and characteristics

Criteria of Selecting Products

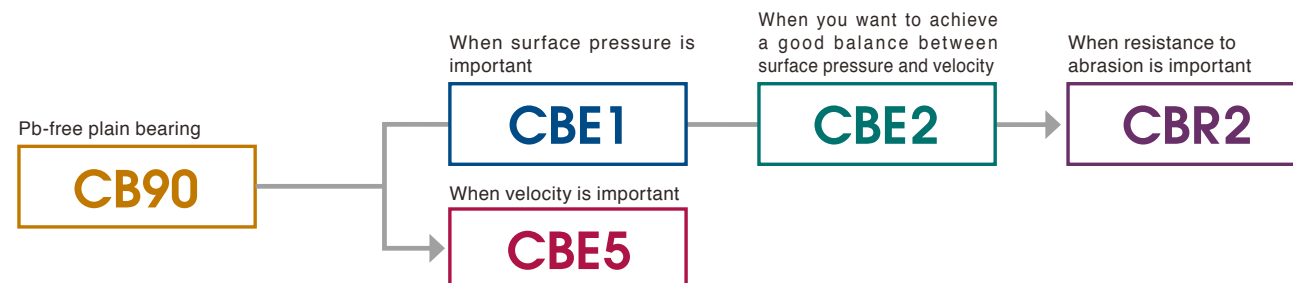
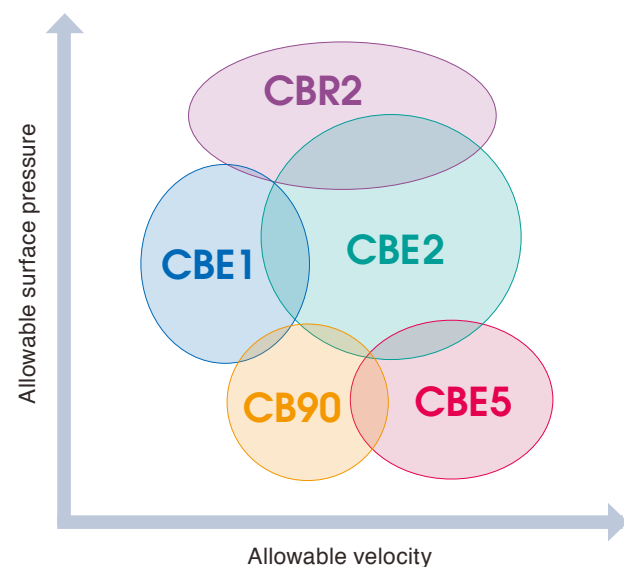
- "CB90" is a series of general-purpose plain bearings that is lead-free.
- Select "CBE1" for a moving part where surface pressure is important.
- Select "CBR2" for a moving part where resistance to abrasion is important.
- Select "CBE5" for a moving part where velocity is important.
- Select "CBE2" for a moving part where a good balance between both of the properties is important.



The capability of plain bearings are measured by their PV values, in which P expresses pressure or the load placed on the projected area of the bearing; and V expresses the velocity or the surface speed at which an object, such as a shaft, moves. This is calculated by finding the product of maximum pressure and maximum velocity.

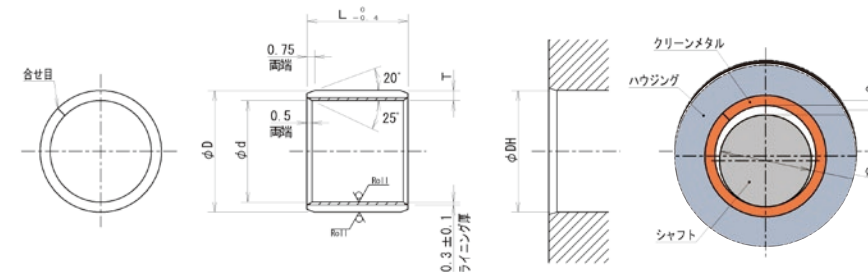
Maximum pressure = Maximum load ÷ Projected area of the bearing

Maximum velocity = Relative velocity between the bearing and the moving object

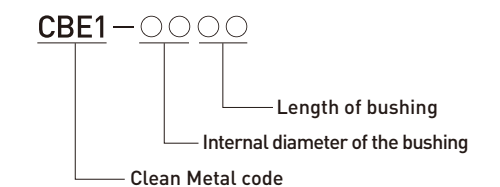


Dimension table

Diagram of a standard Clean Metal bearing



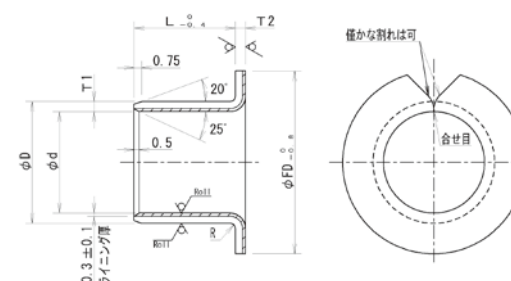
Part number codes



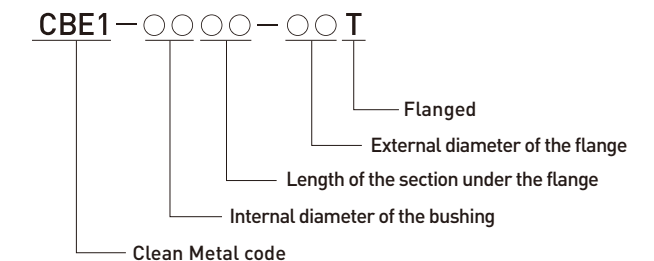
Internal diameter	External diameter	External diameter of the shaft	Internal diameter of the housing	Length of bushing L																Clearance	Plate thickness
φd	φD	φDs	φDH	4	5	6	7	8	10	12	15	20	25	30	35	40	50	(C)*1	T		
4	6 ^{+0.053 -0.023}	4 ^{-0.025 -0.037}	6 ^{+0.015 0}	●	●	●		●										0.025 ~ 0.102	1.0 ^{0 -0.025}		
5	7 ^{+0.053 -0.023}	5 ^{-0.025 -0.037}	7 ^{+0.015 0}	●	●	●		●													
6	8 ^{+0.053 -0.023}	6 ^{-0.025 -0.037}	8 ^{+0.015 0}		●	●	●	●	●												
7	9 ^{+0.055 -0.025}	7 ^{-0.025 -0.040}	9 ^{+0.015 0}		●	●	●											0.025 ~ 0.108			
8	10 ^{+0.055 -0.025}	8 ^{-0.025 -0.040}	10 ^{+0.015 0}		●	●	●	●	●	●											
9	11 ^{+0.060 -0.030}	9 ^{-0.025 -0.040}	11 ^{+0.018 0}				●		●												
10	12 ^{+0.060 -0.030}	10 ^{-0.025 -0.040}	12 ^{+0.018 0}			●	●	●	●	●	●	●						0.025 ~ 0.111			
12	14 ^{+0.060 -0.030}	12 ^{-0.025 -0.043}	14 ^{+0.018 0}			●		●	●	●	●	●									
12.5	14.5 ^{+0.060 -0.030}	12.5 ^{-0.025 -0.043}	14.5 ^{+0.018 0}					●													
13	15 ^{+0.060 -0.030}	13 ^{-0.025 -0.043}	15 ^{+0.018 0}					●	●		●							0.025 ~ 0.114			
14	16 ^{+0.063 -0.033}	14 ^{-0.025 -0.043}	16 ^{+0.018 0}						●	●	●	●	●								
15	17 ^{+0.073 -0.038}	15 ^{-0.025 -0.043}	17 ^{+0.018 0}					●	●	●	●	●	●	●							
16	18 ^{+0.073 -0.038}	16 ^{-0.025 -0.043}	18 ^{+0.018 0}						●	●	●	●	●	●							
17	19 ^{+0.073 -0.038}	17 ^{-0.025 -0.043}	19 ^{+0.018 0}								●	●	●					0.025 ~ 0.124			
18	20 ^{+0.081 -0.046}	18 ^{-0.025 -0.043}	20 ^{+0.021 0}						●	●	●	●	●								
19	22 ^{+0.081 -0.046}	19 ^{-0.025 -0.043}	22 ^{+0.021 0}									●						1.5 ^{0 -0.03}			
20	23 ^{+0.081 -0.046}	20 ^{-0.025 -0.046}	23 ^{+0.021 0}						●	●	●	●	●	●	●						
22	25 ^{+0.086 -0.051}	22 ^{-0.025 -0.046}	25 ^{+0.021 0}							●	●	●	●	●	●						
24	27 ^{+0.086 -0.051}	24 ^{-0.025 -0.046}	27 ^{+0.021 0}								●	●	●	●							
25	28 ^{+0.093 -0.056}	25 ^{-0.025 -0.046}	28 ^{+0.021 0}						●	●	●	●	●	●	●	●		0.025 ~ 0.131			
28	32 ^{+0.115 -0.075}	28 ^{-0.025 -0.046}	32 ^{+0.025 0}							●	●	●	●	●	●						
30	34 ^{+0.115 -0.075}	30 ^{-0.025 -0.046}	34 ^{+0.025 0}								●	●	●	●	●	●	●				
31	35 ^{+0.115 -0.075}	31 ^{-0.025 -0.046}	35 ^{+0.025 0}									●									
32	36 ^{+0.115 -0.075}	32 ^{-0.025 -0.050}	36 ^{+0.025 0}									●	●	●	●		●	0.025 ~ 0.135			
35	39 ^{+0.115 -0.075}	35 ^{-0.025 -0.050}	39 ^{+0.025 0}								●	●	●	●	●	●	●				
												●	●	●	●	●	●				

* 1: Clearance is the calculated value of the difference between the shaft and the inner diameter of the Clean Metal bearing press-fitted into a housing with high rigidity.

Diagram of a standard flanged Clean Metal bearing



Part number codes



Internal diameter	External diameter	Flange diameter	External diameter of the shaft	Internal diameter of the housing	Length of the bushing under the flange									Clearance	Thickness of the bushing	Thickness of the flange
φd	φD	φFD	φDs	φDH	5	6	8	10	12	15	20	25	30	(C)*1	T1	T2
6	8 ^{+0.053 +0.023}	12	6 ^{-0.025 -0.037}	8 ^{+0.015 0}	●	●	●	●						0.025 ~ 0.102	1.0 ^{0 -0.025}	1.0 ^{0 -0.2}
8	10 ^{+0.055 +0.025}	15	8 ^{-0.025 -0.040}	10 ^{+0.015 0}		●	●	●	●					0.025 ~ 0.108		
10	12 ^{+0.060 +0.030}	18	10 ^{-0.025 -0.040}	12 ^{+0.018 0}		●	●	●		●				0.025 ~ 0.111		
12	14 ^{+0.060 +0.030}	20	12 ^{-0.025 -0.043}	14 ^{+0.018 0}		●	●	●	●							
14	16 ^{+0.063 +0.033}	22	14 ^{-0.025 -0.043}	16 ^{+0.018 0}			●	●		●	●					
15	17 ^{+0.073 +0.038}	23	15 ^{-0.025 -0.043}	17 ^{+0.018 0}				●		●	●			0.025 ~ 0.114		
16	18 ^{+0.073 +0.038}	24	16 ^{-0.025 -0.043}	18 ^{+0.018 0}			●	●		●	●					
18	20 ^{+0.081 +0.046}	26	18 ^{-0.025 -0.043}	20 ^{+0.021 0}				●	●	●	●	●		0.025 ~ 0.127		
20	23 ^{+0.081 +0.046}	31	20 ^{-0.025 -0.046}	23 ^{+0.021 0}				●	●		●	●	●			
22	25 ^{+0.086 +0.051}	33	22 ^{-0.025 -0.046}	25 ^{+0.021 0}				●	●	●	●	●	●			
25	28 ^{+0.093 +0.056}	36	25 ^{-0.025 -0.046}	28 ^{+0.021 0}				●	●	●	●	●	●			

* 1: Clearance is the calculated value of the difference between the shaft and the inner diameter of the Clean Metal bearing press-fitted into a housing with high rigidity.

The Design and Development Process that Ensures High Quality

Unique Technologies to Achieve Maximum Strength and Reliability

It is necessary for bearings to have maximum strength and reliability in order to safely and comfortably function throughout their product life. We use atomic level technology for sintering, metalworking and pressure welding, and other unique technologies to establish strong and reliable bearings. We are also ISO/TS 16949 certified to attest to our high quality.

◎ Spraying



Produces high-precision plain bearings with less variations using a unique spraying technology

◎ Powder Sintering



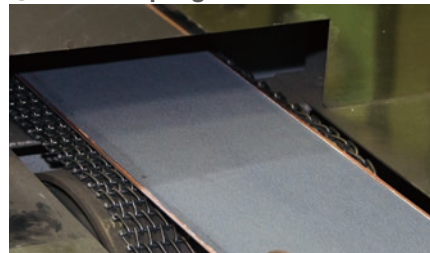
Powder sintering technology that achieves a resin impregnated structure with excellent resistance to abrasion

◎ Eco-Friendly



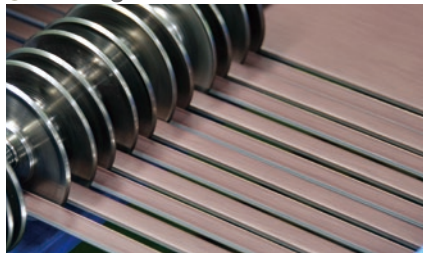
Environment-friendly facilities which includes ovens with efficient thermal insulation that contributes to saving energy

◎ Resin Impregnation



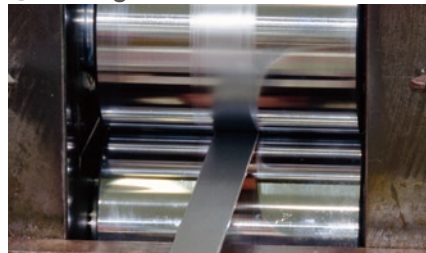
Files porous layer with resin using an impregnation technology that influences abrasion resistant property

◎ Cutting



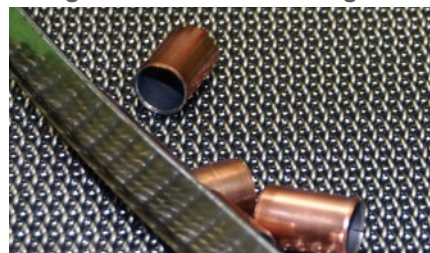
Cuts combined metals and resins of different physical properties with high dimensional precision

◎ Rolling



Rolls combined metals and resins of different physical properties with high dimensional precision

◎ High-Precision Processing



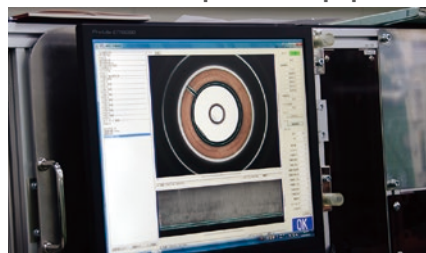
High precision deformation processing of composite materials of different physical properties with a unique technology

◎ Automation



Excellent work environment and one hundred percent visual inspection ensures security and high quality

◎ Automatic Inspection Equipment



Automatic inspection instrument that measures every product to ensure high dimensional precision

◎ Development of resin materials for various uses



▲ Products Developed

By testing our bearings under severe conditions and analyzing the results, we have succeeded in developing a resin material that is best suited for velocity and surface pressure of driving.

◀ ISO/TS16949 Certified

We have established a managing system that allows us to produce the high quality plain bearings that are essential to manufacturing automobiles



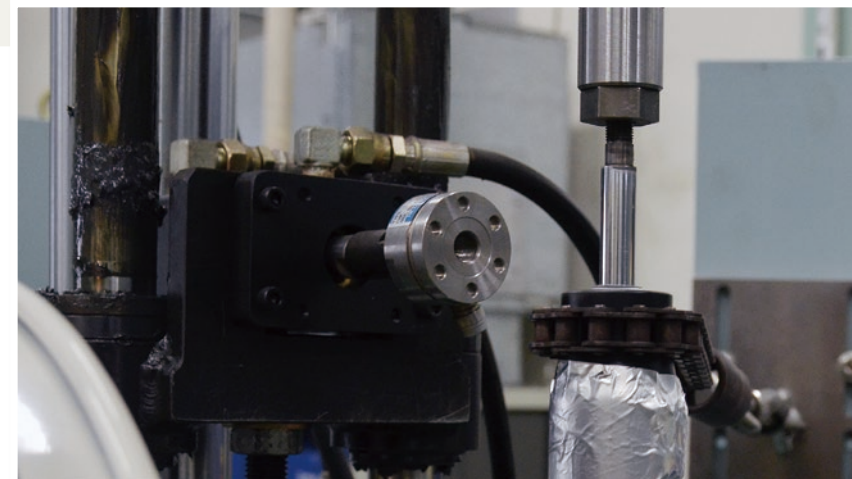
Development of High-Quality Alloy Powder and Resin Materials through Tests under Severe Environments

Our bearing development team is driven to develop new products that affirm reliability. They conduct tests under severe conditions to assess the pressure tolerance and strength of our products. They have also developed a new alloy and resin material that has excellent resistance to abrasions, and has come to realize the next-generation of plain bearings. Our products are used for variety of purposes all over the world and are highly regarded and trusted as one of the best in the world.

Thoroughly pursuing comfort in cars and motorcycles

Friction Test

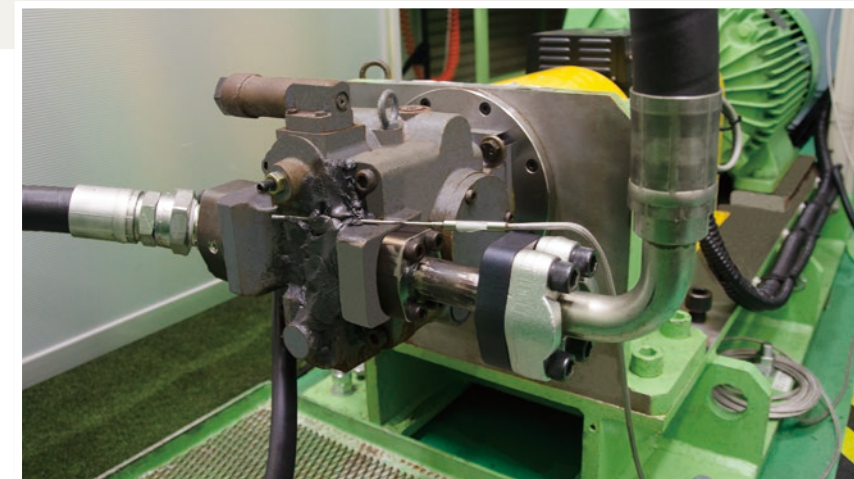
We conduct an endurance test with a friction tester that is able to reproduce the loads imposed on shock absorbers when driving a car or motorcycle. With this, we are able to check the deterioration of frictional resistance and the attenuation, which affects the comfort of the ride. The evaluation results are, then, utilized to develop new materials.



Endurance test of hydraulic machinery with one of the best instruments in the industry

Hydraulic Bench Test

Our hydraulic bench tester is able to replace testing with an actual product. We conduct a 500-hour life test to assess the displacement of the product. If the displacement has changed, we disassemble the product to find the cause by visually checking for wears and damages. The results are utilized to improve our products and to develop new products.



Evaluating friction and abrasion property: the basic property of bearing materials

Friction and Abrasion Test

We conduct an endurance test on variety of our sintered bimetal plates made of resin composite materials to assess the most basic properties of bearing materials: friction and abrasion. Our test is set according to the customers' use conditions to assess the changes in friction coefficient, thickness, temperature, burns, and more. The results are utilized to develop materials that can satisfy customers' needs.

