

NF METAL

Solid State Self-Lubricating Composite Materials

Vacuum
Heat resistance
Corrosion resistance

Our special bearings will support
sliding in all the environments.
Please try once by all means!!

FUJILLOY

FUJI DIE CO.,LTD
Function Material Section

NF METALS

No-Friction Metals

Unprecedented Solid State Self-Lubricating Composite Materials have been Developed Applying Fuji Die's Powder Metallurgy Know-How Accumulated Over the Years for Cemented Carbide Wear Tools

Lubricants such as oil and grease cannot be used in high temperatures and or in vacuums. This means that the sliding part materials used in such environments need to have a peculiarity of self-lubricant.

The self-lubricating composite material "NF Metal" developed by Fuji Die is a composite material made by dispersing solid-state lubricants such as black graphite, tungsten disulfide and boric nitride in metallic materials. It is applicable for sliding part materials used in various environments such as vacuum and high temperatures.

●Date Type <For vacuum>

Shows the outstanding lubrication properties from room temperature to 300°C. Can also be used to approx 700 to 800°C in vacuum.

●Orange Type <For heat resistance>

Has the outstanding toughness compared with the dates type, as well as electric conductivity.

●Melon Type <For corrosion resistance>

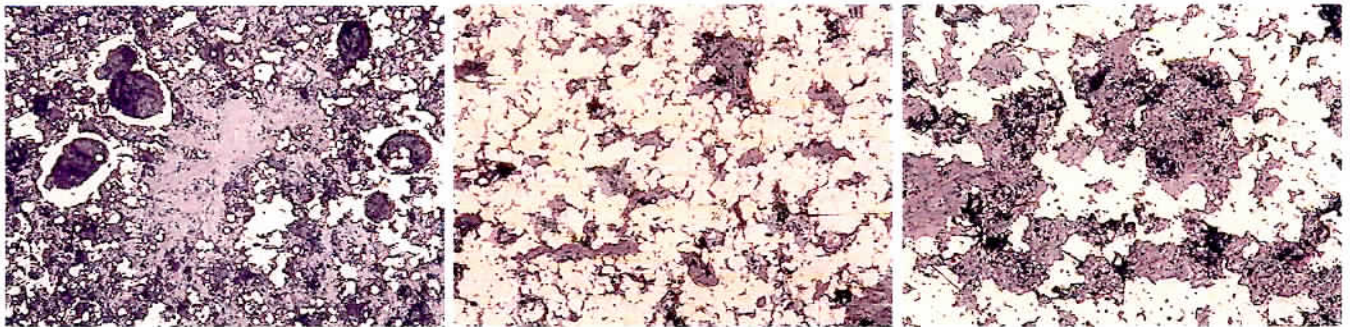
Can be used in air from 700 or 800°C.

Also has the outstanding corrosion-resistance, which realizes lubricating properties even in corrosion environment such as alkali solution.



Characteristic

Alloy structure × 200



Date type

Sintered material made by mixing the solid lubricant tungsten disulfide with other metals.

Orange type

Sintered material made by mixing tungsten disulfide, or black graphite with copper alloy, and etc.

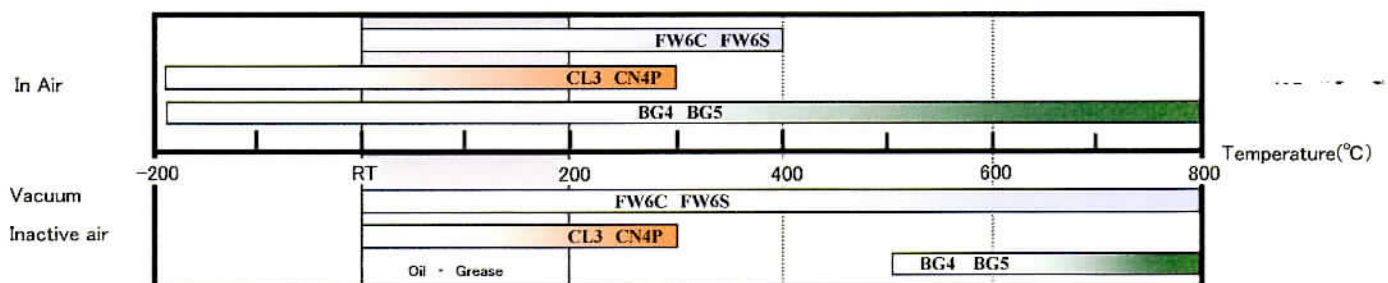
Melon type

Sintered material made by joining black graphite with boric nitride using a non organic binder, and then mixing these lubricants with nickel alloy.

Mechanical Property

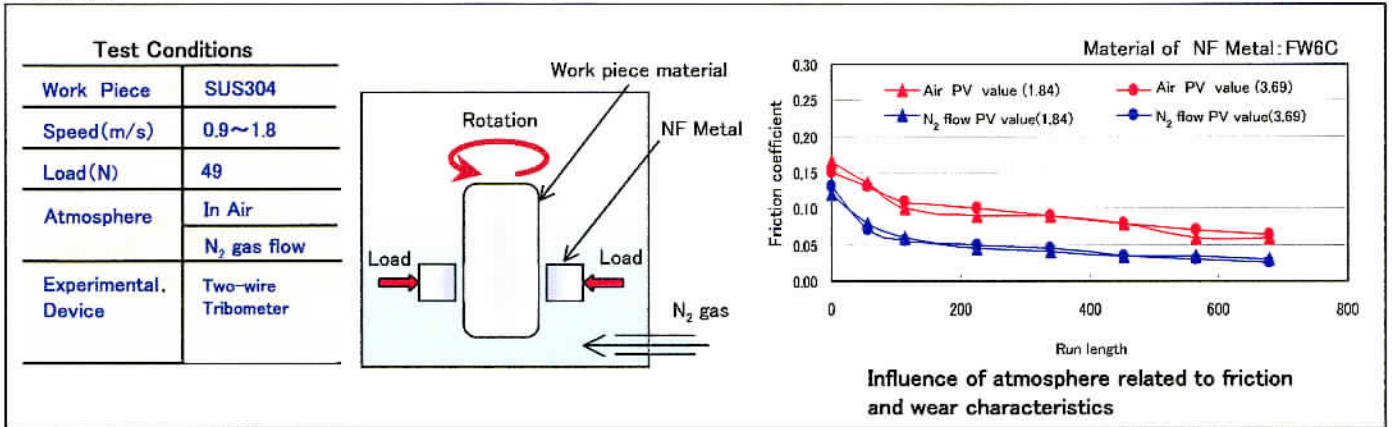
	type	Specific Gravity	Hardness HB	Compression Strength MPa	Radical Crushing Strength Contact MPa	Thermal Expansion $\times 10^{-6}K^{-1}$	Specific Resistance $\times 10^{-8}\Omega \cdot m$	Youngs Modulus GPa	Solid Lubricant	Matrix
Date	FW6C	9.4	35	140	70	6.1	2800	60	WS ₂	W
	FW6S	8.8	80	260	120	8.0	198	72	WS ₂	W
Orange	CL3	6.1	50	250	140	14.3	142	20	C+WS ₂ +BN	Cu-Sn-Ni
	CN4G	5.6	45	230	220	14.5	160	50	C+WS ₂ +BN	Cu-Sn-Ni
Melon	BG4	5.3	22	240	200	13.0	123	20	C+BN	Ni
	BG5	4.6	18	150	150	12.1	130	13	C+BN	Ni

Application Range of NF Metals

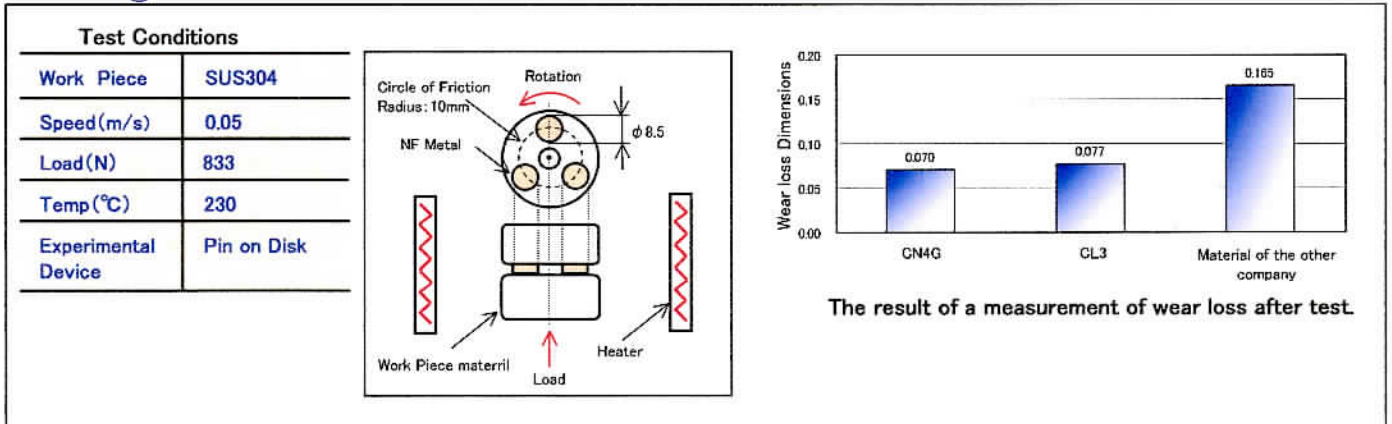


Friction and Wear Characteristics

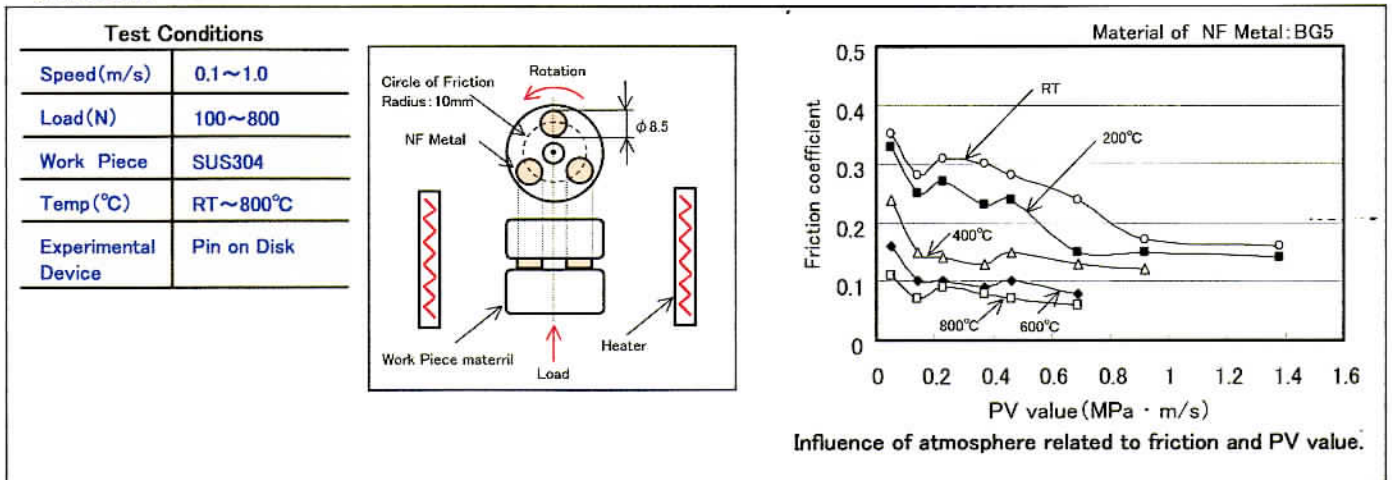
Date



Orange



Melon



Plain Bearings

- Since it can be manufactured to order, a free bearing design can be applicable.
- The combination bearing concluded with back metals, such as stainless steel, can also be manufactured.

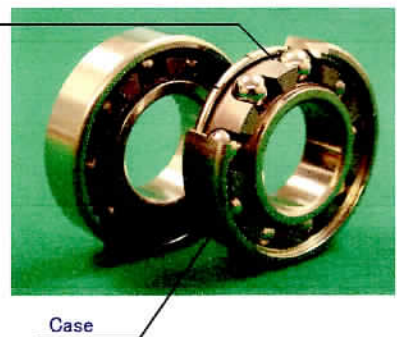
TYPE	Tempo		Dimension
	Vacuum	Air	
<i>FW</i>	~800°C	~400°C	Ring : $\phi 100 \times \phi 80$ or O.D : Less than $\phi 62$
<i>CL</i>	~200°C	~200°C	
<i>BG</i>	—	~800°C	



Ball Bearings

- The bearing for special environment with retainer which consists of NF metal
- Since the retainer has self lubrication, it can be used with non oil and grease.
- Since the viscous resistance of grease is not generated, a low torque is realize.

Use environment	Temp	Pressure	Bearing Materials
Vacuum	~350°C	~10 ⁻⁵ Pa	Inner and outer rings : SUS440C Balls: SUS440C Shield : SUS304
Solutions	—	—	
High Temp	~350°C	—	



Use environment	Permission Number of Revolutions	Permission Load	Material of NF-Metal
Vacuum	Dn value < 4000	Less than 5% of the Basic dynamic load rating	<i>FW6C</i>
Solutions			<i>BG5</i>
High Temp			<i>CS3</i>

- BOUNDARY DIMENSIONS
#6800~#6808 #6200~#6210
#6900~#6906 #6300~#6306
#6000~#6010

Please do not hesitate to ask us regarding the other bearing (angular, thrust and miniature) or unstated parts numbers.

Miracle Pillows

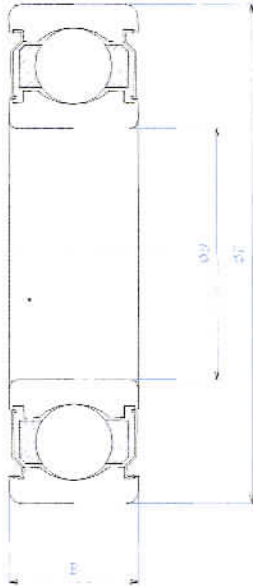
- It is suitable for the application of the swivel table of vacuum machine.
- Solid lubricant film supplied from miracle pillow,

Number	Dimension	Balls
<i>MLP-030C</i>	$\Phi 8.5 \times 9$	3/8 in
<i>MLP-040C</i>	$\Phi 11 \times 9$	1/2 in
<i>MLP-050C</i>	$\Phi 14.5 \times 10$	5/8 in



Although the three above-mentioned part numbers are standard sizes, Dimensions other than the above can be also respond. Please do not hesitate to ask us.

DIMENSIONS of NF Bearings



- Material: Martensite Stainless Steel
- Shield: Austenitic Stainless Steel
- ※Red Marking Point: There is no stainless steel and it becomes manufacture by SUJ2.

● Bearing Number
SS □□□□ZZ - ○○

Stainless Steel | Bearing Number | Symbol of NF-Metal | FW (Vacuum) | BG (Solution) | CS (High Temp) | ○○
 SJ: High Carbon Chromium Bearing Steel

BORE	d	D	B	NF Bearings			Max Load N	Max Speed min ⁻¹
				Vacuum	Solution	High Temp		
φ 10	10	19	5	SS6800ZZ FW	SS6800ZZ BG	SS6800ZZ CS	90	400
	10	22	6	SS6900ZZ FW	SS6900ZZ BG	SS6900ZZ CS	140	
	10	26	8	SS6000ZZ FW	SS6000ZZ BG	SS6000ZZ CS	230	
	10	30	9	SS6200ZZ FW	SS6200ZZ BG	SS6200ZZ CS	250	
	10	35	11	SS6300ZZ FW	SS6300ZZ BG	SS6300ZZ CS	400	
φ 12	12	21	5	SS6801ZZ FW	SS6801ZZ BG	SS6801ZZ CS	100	330
	12	24	6	SS6901ZZ FW	SS6901ZZ BG	SS6901ZZ CS	145	
	12	28	8	SS6001ZZ FW	SS6001ZZ BG	SS6001ZZ CS	255	
	12	32	10	SS6201ZZ FW	SS6201ZZ BG	SS6201ZZ CS	340	
	12	37	12	SS6301ZZ FW	SS6301ZZ BG	SS6301ZZ CS	485	
φ 15	15	24	5	SS6802ZZ FW	SS6802ZZ BG	SS6802ZZ CS	100	300
	15	28	7	SS6902ZZ FW	SS6902ZZ BG	SS6902ZZ CS	215	
	15	32	9	SS6002ZZ FW	SS6002ZZ BG	SS6002ZZ CS	280	
	15	35	11	SS6202ZZ FW	SS6202ZZ BG	SS6202ZZ CS	380	
	15	42	13	SS6302ZZ FW	SS6302ZZ BG	SS6302ZZ CS	570	
φ 17	17	26	5	SS6803ZZ FW	SS6803ZZ BG	SS6803ZZ CS	130	240
	17	30	7	SS6903ZZ FW	SS6903ZZ BG	SS6903ZZ CS	230	
	17	35	10	SS6003ZZ FW	SS6003ZZ BG	SS6003ZZ CS	300	
	17	40	12	SS6203ZZ FW	SS6203ZZ BG	SS6203ZZ CS	480	
	17	47	14	SS6303ZZ FW	SS6303ZZ BG	SS6303ZZ CS	680	
φ 20	20	32	7	SS6804ZZ FW	SS6804ZZ BG	SS6804ZZ CS	200	200
	20	37	9	SS6904ZZ FW	SS6904ZZ BG	SS6904ZZ CS	320	
	20	42	12	SS6004ZZ FW	SS6004ZZ BG	SS6004ZZ CS	470	
	20	47	14	SS6204ZZ FW	SS6204ZZ BG	SS6204ZZ CS	640	
	20	52	15	SS6304ZZ FW	SS6304ZZ BG	SS6304ZZ CS	790	
φ 25	25	37	7	SS6805ZZ FW	SS6805ZZ BG	SS6805ZZ CS	215	160
	25	42	9	SS6905ZZ FW	SS6905ZZ BG	SS6905ZZ CS	380	
	25	47	12	SS6005ZZ FW	SS6005ZZ BG	SS6005ZZ CS	505	
	25	52	15	SS6205ZZ FW	SS6205ZZ BG	SS6205ZZ CS	700	
	25	62	17	SS6305ZZ FW	SS6305ZZ BG	SS6305ZZ CS	1,030	
φ 30	30	42	7	SS6806ZZ FW	SS6806ZZ BG	SS6806ZZ CS	225	130
	30	47	9	SS6906ZZ FW	SS6906ZZ BG	SS6906ZZ CS	360	
	30	55	13	SS6006ZZ FW	SS6006ZZ BG	SS6006ZZ CS	660	
	30	62	16	SS6206ZZ FW	SS6206ZZ BG	SS6206ZZ CS	970	
	30	72	19	SS6306ZZ FW	SS6306ZZ BG	SS6306ZZ CS	1,330	
φ 35	35	47	7	SS6807ZZ FW	SS6807ZZ BG	SS6807ZZ CS	240	120
	35	55	10	SS6907ZZ FW	SS6907ZZ BG	SS6907ZZ CS	540	
	35	62	14	SS6007ZZ FW	SS6007ZZ BG	SS6007ZZ CS	800	
	35	72	17	SS6207ZZ FW	SS6207ZZ BG	SS6207ZZ CS	1,290	
	35	80	21	SJ6307ZZ FW	SJ6307ZZ BG	SJ6307ZZ CS	1,330	
φ 40	40	52	7	SS6808ZZ FW	SS6808ZZ BG	SS6808ZZ CS	250	100
	40	62	12	SS6908ZZ FW	SS6908ZZ BG	SS6908ZZ CS	690	
	40	68	15	SS6008ZZ FW	SS6008ZZ BG	SS6008ZZ CS	840	
	40	80	18	SS6208ZZ FW	SS6208ZZ BG	SS6208ZZ CS	1,455	
	40	90	23	SJ6308ZZ FW	SJ6308ZZ BG	SJ6308ZZ CS	2,030	
φ 45	45	58	7	SJ6809ZZ FW	SJ6809ZZ BG	SJ6809ZZ CS	310	90
	45	68	12	SJ6909ZZ FW	SJ6909ZZ BG	SJ6909ZZ CS	705	
	45	75	16	SS6009ZZ FW	SS6009ZZ BG	SS6009ZZ CS	1,050	
	45	80	19	SS6209ZZ FW	SS6209ZZ BG	SS6209ZZ CS	1,640	
	45	100	25	SJ6309ZZ FW	SJ6309ZZ BG	SJ6309ZZ CS	2,445	
φ 50	50	65	7	SJ6810ZZ FW	SJ6810ZZ BG	SJ6810ZZ CS	330	80
	50	72	12	SJ6910ZZ FW	SJ6910ZZ BG	SJ6910ZZ CS	725	
	50	80	16	SS6010ZZ FW	SS6010ZZ BG	SS6010ZZ CS	1,090	
	50	90	20	SS6210ZZ FW	SS6210ZZ BG	SS6210ZZ CS	1,755	
	50	110	27	SJ6310ZZ FW	SJ6310ZZ BG	SJ6310ZZ CS	3,100	

DIMENSIONS of Plain Bearings

- There is no technical standard in Plain Bearing, and manufacturing for all shape is possible for a Flange-type, and etc.
- In addition, please do not hesitate to ask about mechanical parts of low friction materials.

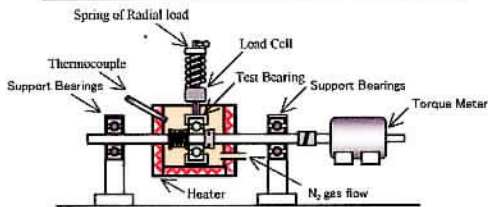


The Reference Drawing of Plane Bearings

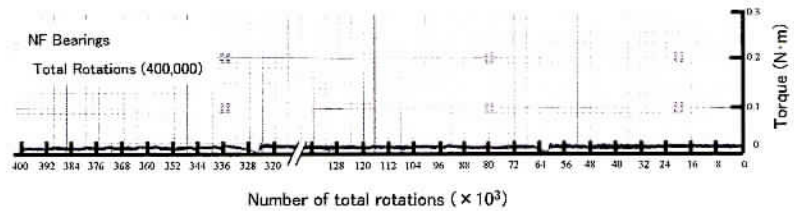
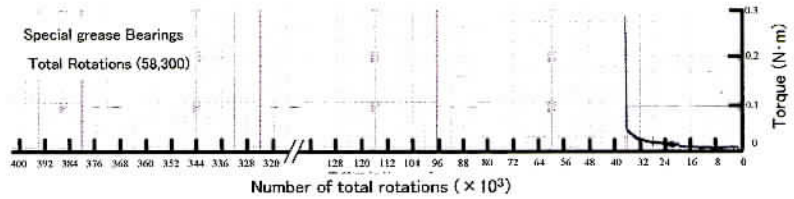
Properties of Ball Bearings

The rotation performance of NF-Bearing in a virtual vacuum.

Test Bearings	#6004
Radial Load	280N [3% of Basic dynamic load rating]
Axial Load	13.2N
Rotation speed	100rpm
Temp	300°C
Atmosphere	N ₂ flow [1ℓ/min]
Number of total rotations	Rotation of 4 hundred thousand
Remark	①Rotation : Start from RT, 10°C/min · Hold at 200°C ②Marginal Torque : 0.3N·m



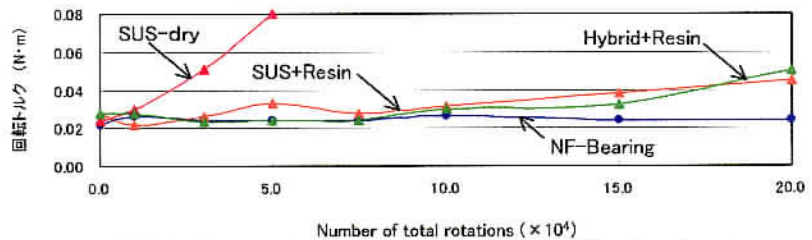
Schematic diagram of the Radial Bearing Tester .



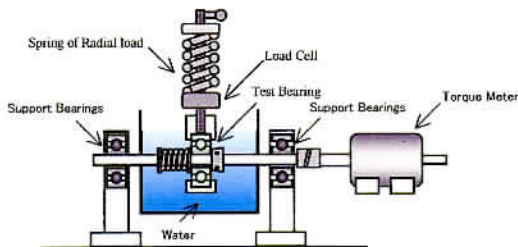
Relation between torque and total rotations of Bearings in false vacuum.

The rotation performance of NF-Bearing in a solution.

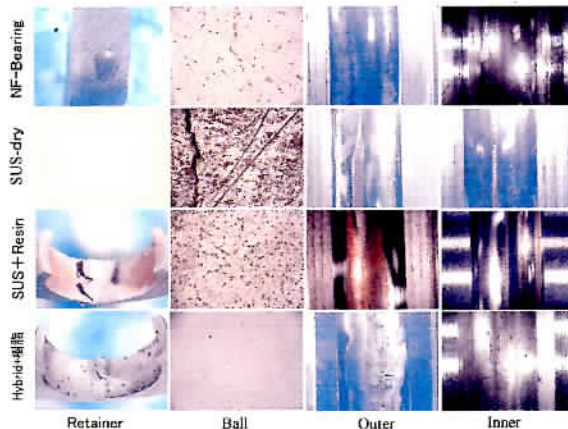
Test Bearings	#6004
Radial Load	468N [5% of Basic dynamic load rating]
Axial Load	13.2N
Rotation speed	100rpm
Number of total rotations	Rotation of 2 hundred thousand
Test time	33.33hr
Temp	RT
Environment	In water
The article examines	①Measurement of Torque ②Observation of appearance



Relation between torque and total rotations of Bearings in water



Schematic diagram of the Radial Bearing Tester .



Appearance photograph of each Bearing unit (x 2).