



12 Materials

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12.1 Bearing Material

Ball bearing inserts are comprised of inner and outer rings, balls, and steel ball cages all of which are made from the highest quality of bearing steel.

These bearings possess the following features.

- (1) High elastic limit to resist strong opposing force
- (2) High rolling fatigue strength to allow for heavy loads
- (3) Superior hardness
- (4) Superior wear resistance
- (5) Superior toughness against impact and shock loads
- (6) Superior precision of dimensional tolerances

High carbon chrome bearing steel is utilized for the bearing components as specified in JIS (Japanese Industrial Standards).

To increase reliability and reduce contamination within the material, a vacuum degassing process is executed to reduce non-metallic elements and any oxygen in the steel.

After the bearing is assembled it is heat tempered and quenched until the hardness reaches 60HRC.

Table 12.1 shows the chemical components of high carbon chrome bearing steel. Stainless steel bearing inserts (suffix: S6) utilize superior corrosion resistant JIS certified stainless steel.

Riveted steel ball cages are made of JIS certified cold rolled steel which is shown in Table 12.2.

12.2 Housing Material

FYH housings are made primarily of gray cast iron, and stamped steel. Gray cast iron is the most popular choice for mounted units because of its optimal characteristics of vibration absorption, high strength, and excellent heat dissipation.

Table 12.3 shows the mechanical properties of gray cast iron (FC200).

Nodular graphite cast iron, or ductile iron, (FCD450-10 of JIS G 5502) provides a good combination of rigidity and fracture resistance, and it is suitable where heavy vibration or impact forces are present.

Housings for units within the Clean Series are available in die-cast zinc alloy as well as stainless steel. Housing material for stamped steel units consists of thick gauge cold rolled sheet steel and steel strip.

Table 12.4 to 12.8 show the mechanical properties of these housing materials.

Table 12.1 Chemical components of high carbon chrome bearing steel (JIS G 4805)

Code	Chemical components (%)						
	C	Si	Mn	P	S	Cr	Mo
SUJ 2	0.95– 1.10	0.15– 0.35	0.50 or less	0.025 or less	0.025 or less	1.30– 1.60	–
SUJ 3	0.95– 1.10	0.40– 0.70	0.90– 1.15	0.025 or less	0.025 or less	0.90– 1.20	–

Table 12.2 Chemical components of cold rolled steel and steel strip (SPCC) (JIS G 3141)

Code	Chemical components (%)						
	C	Si	Mn	P	S	Ni	Cr
SPCC	0.15 or less	–	0.60 or less	0.100 or less	0.050 or less	–	–
SPCD	0.12 or less	–	0.50 or less	0.040 or less	0.040 or less	–	–

Table 12.3 Mechanical properties of gray cast iron (FC200)

Type code	Tensile strength N/mm ²	Hardness HB
FC200	200 or more	223 or less

Table 12.4 Mechanical properties of cast carbon steel products (JIS G 3101)

Type code	Yielding point or bearing force N/mm ²			Tensile strength N/mm ²	Thickness of steel mm	Tensile test piece	Elongation %	Bending property		
	Thickness of steel mm							Bending angle	Inside dia.	Test piece
	incl. 16	Over 16 incl. 40	Over 40							
SS400	245 or more	235 or more	215 or more	400– 510	Over 5, 16 max.	No.1A	17 or more	180°	1.5 times of thickness	No.1
					Over 16, 40 max.	No.1A	21 or more			
					Over 40	No.4	23 or more			

Table 12.5 Mechanical properties of zinc alloy die-cast (ZDC02) (JIS H 5301) (Reference)

Code	Tensile strength N/mm ²	Elongation %	Impact N · m/cm ²	Hardness HB
ZDC2	285	10	140	82

Table 12.6 Mechanical properties of stainless cast steel products (SCS 13, SCS 14) (JIS G 5121)

Type code	Bearing force N/mm ²	Tensile strength N/mm ²	Elongation %	Hardness HB
SCS 13	185 or more	440 or more	30 or more	183 or less
SCS 14	185 or more	440 or more	28 or more	183 or less

Correspondence standards

SCS 13: ISO GX5CrNi 19 9, ASTM CF-8 (AISI 304)

SCS 14: ISO GX5CrNiMo 19 11 2, ASTM CF-8M (AISI 316)

Table 12.7 Mechanical properties of cold rolled sheet steel and steel strip (SPCC) (JIS G 3141)

Type code	Tensile strength N/mm ²	Elongation %
SPCC	270 or more	34 or more
SPCD	270 or more	36 or more

Table 12.8 Mechanical properties of ductile cast iron (FCD450-10) (JIS G 5502)

Type code	Tensile strength N/mm ²	Elongation %
FCD	450 or more	10 or more

12.3 Materials of Parts and Accessories

Table 12.9 shows materials of parts and accessories of a ball bearing unit.

Table 12.9 Materials of parts and accessories of ball bearing units

Designations	Materials	Code	Standard code
Seal (standard type)	Nitrile rubber	NBR	–
Seal (heat resistant, cold resistant)	Silicone rubber	VMQ	–
Slinger (flinger)	Cold rolled steel plate and steel strip	SPCC	JIS G 3141
Stainless steel slinger (flinger)	Cold rolled stainless steel plate and steel strip	SUS304-CP, SUS304-CS	JIS G 4305
Steel plate cover	Cold rolled steel plate and steel strip	SPCD	JIS G 3141
Stainless steel plate cover	Cold rolled stainless steel plate and steel strip	SUS304-CP, SUS304-CS	JIS G 4305
Cast iron cover	Gray cast iron products	FC200	JIS G 5501
Hexagon socket set screw	Chrome molybdenum steel	SCM435	JIS G 4053
Stainless steel hexagon socket set screw	Stainless bar steel	SUS304	JIS G 4303
Adapter sleeve for bearing	Mechanical structural carbon steel	S17C	JIS G 4051
Lock nut for bearing	Mechanical structural carbon steel	S17C	JIS G 4051
Washer for bearing	Cold rolled steel plate and steel strip	SPCC	JIS G 3141
Locking collar	Mechanical structural carbon steel	S17C	JIS G 4051
Grease fitting	Copper and copper alloy rod	SUM24L	JIS G 4804