Koyo

Bearings and Related Products for Continuous Casting Machines

JTEKT

JTEKT CORPORATION

CAT.NO.B2011E

Bearings and Related Products for Continuous Casting Machines

Introduction

In continuous casting machines, roll support bearings are used under heavy loads and at extremely low speed.
In addition, the operating conditions are severe, resulting in exposure to splashing water and scales.

Accordingly, roll support bearings may be failed in an extremely short period of time, typically due to wear and cracking.

To solve these problems, **JTEKT** has developed a series of products optimized to support the rolls of continuous casting machines, including bearings, oil seals, HSC (Half Split Cylindrical Roller) bearing units and Oil/Air lubrication systems, providing a systematic solution for extending the service life of bearings in this application.

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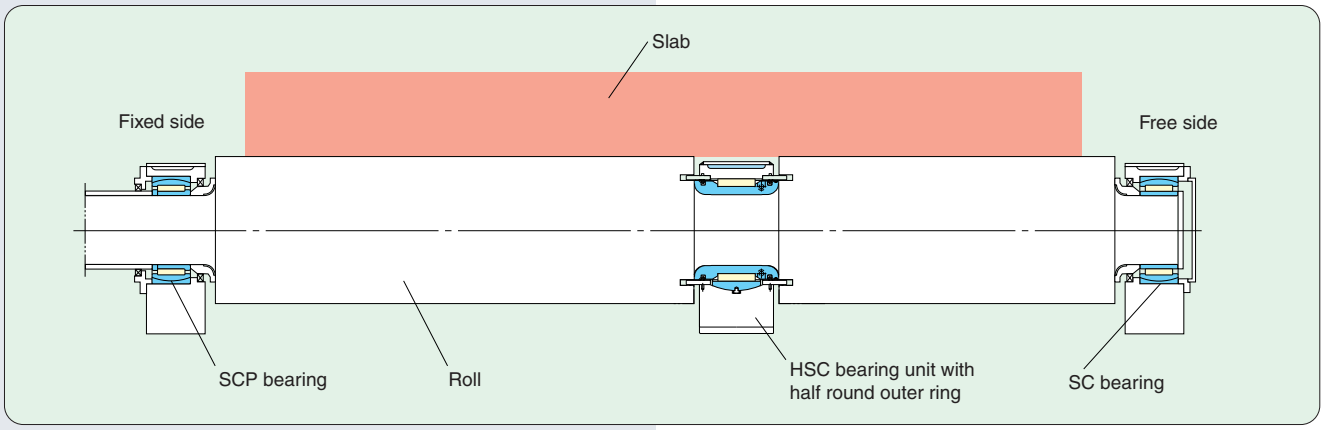


1. Failure mechanism of Bearing

In continuous casting machines, rolls are loaded under excessively heavy loads and may be bent considerably. Accordingly, to support the rolls, spherical roller bearings, which have a self-aligning, are commonly used.

JTEKT has performed a variety of verification tests and analyses concerning this application, and concluded that differential slip occurs in the spherical roller bearings on the rolls of the continuous casting machines when excessively heavy loads at extremely low speed are imposed on the bearings under severe lubrication conditions (Refer to Fig. 1). **JTEKT** therefore recommends full complement cylindrical roller bearings for this application.

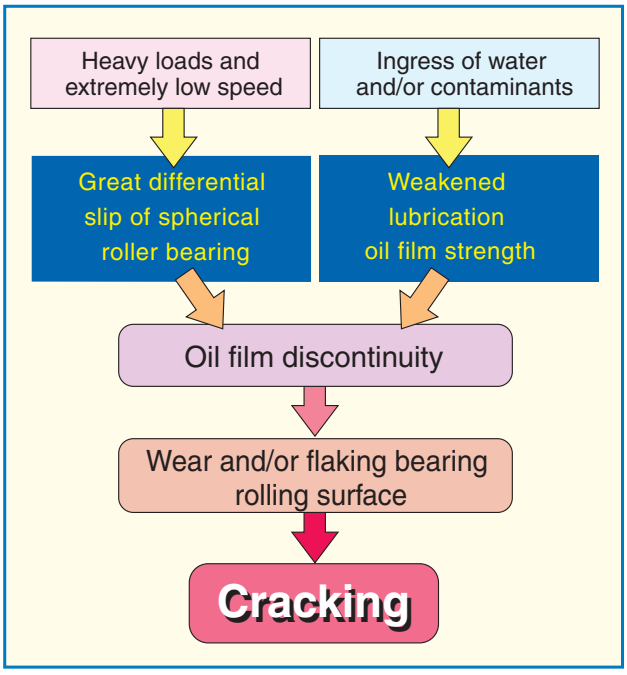
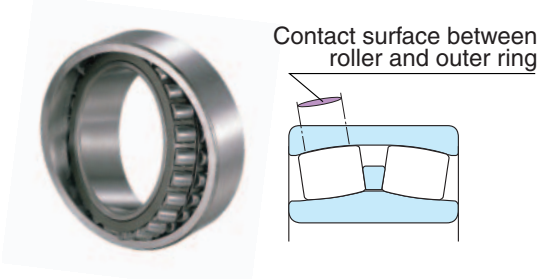


Fig. 1 Typical Failure Mechanism of Roll Support Bearing in Continuous Casting Machines

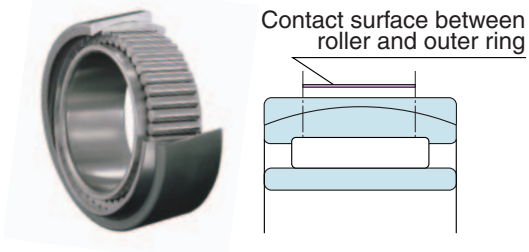
● Spherical roller bearing



When a spherical roller bearing is loaded, elastic deformation occurs on the contact surface between each roller and bearing raceway, producing an ellitical contact surface. This oval surface causes differential slip, which is attributed to the rolling mechanism of the spherical roller bearing.

Under normal load conditions, this differential sliding is negligible. However, under the excessively heavy loads, the major axis of the contact ellipse may become excessively enlarged, resulting in an increase in slip rate.

● Cylindrical roller bearing (with self aligning ring)



When a cylindrical roller bearing is used to carry the loads, differential slip does not occur on the contact surface.

Fig. 2 Differential Slip of Spherical Roller Bearing

Fig. 3 Typical failure to Spherical Roller Bearings Supporting the Rolls of Continuous Casting Machines

2. High performance Products and Their Features

(1) Roll support bearings

Compared with spherical roller bearings, cylindrical roller bearings do not produce differential slip on the contact surface between each roller and bearing raceway under the excessively heavy loads, delaying the development of wear and thus extending bearing service life.

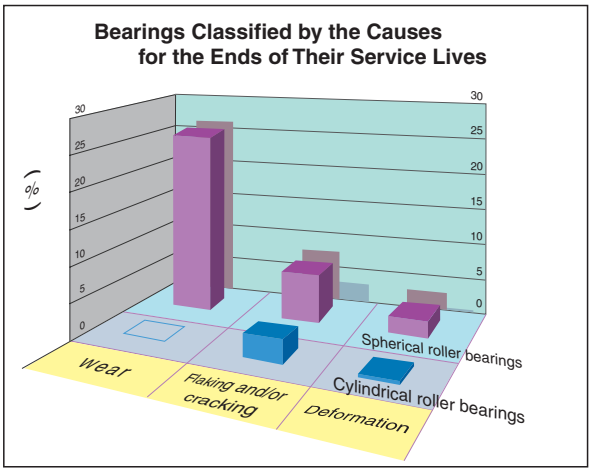


Fig. 4 Advantages of Cylindrical Roller Bearings

● SCP bearing at fixed side

This bearing is designed based on a full complement cylindrical roller bearing, with reference to maximized static load ratings. Crowning are set up on rolling surface of its rollers, according to the size of loads, which contributes to solve stress concentration at specific location. The ribs provided for the inner and outer rings and loose rib, adjacent to the inner ring, accommodate axial loads.

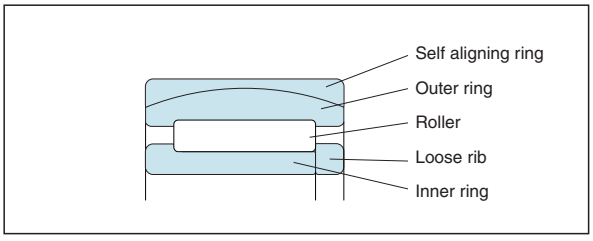


Fig. 5 SCP Bearing Structure

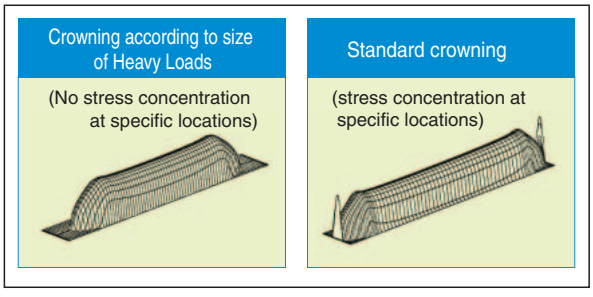


Fig. 6 Advantages of Roller Crowning According to the Size of Heavy Loads

● SC bearing at free side

To accommodate thermal roll contraction and expansion, the inner ring of this bearing are designed to move smoothly in the axial direction.

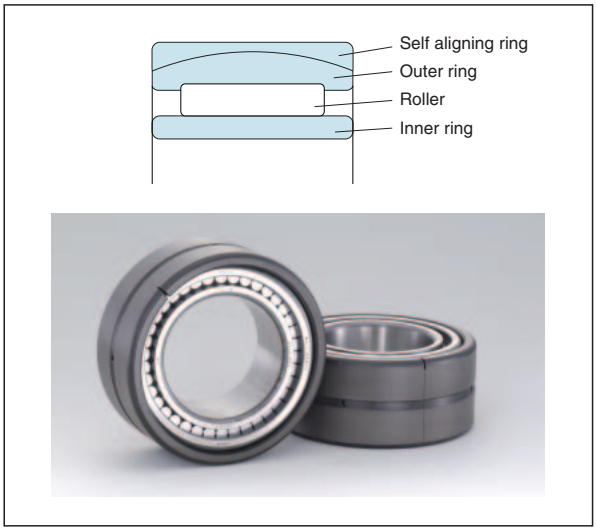


Fig. 7 SC Bearing Structure

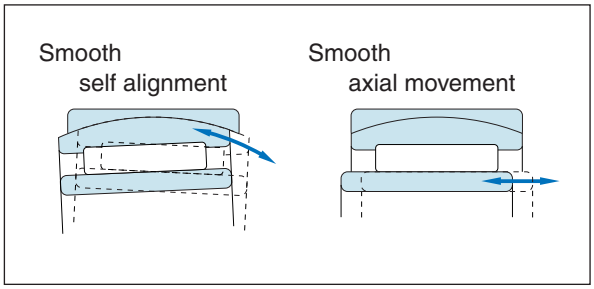


Fig. 8 SC Bearing Functions

(2) HSC bearing units with half-round outer ring

This unit is designed to support the rolls of continuous casting machines at their middle position under heavy loads, and has high cooling efficiency.

This unit has unique structure, with a half-round outer ring placed on the loaded side only.

This special half-round outer ring and compact seal design realizes a 15% increase in static load rating over that of conventional products.

The outside diameter surface of the outer ring is finished spherically, providing a self aligning to the housing.

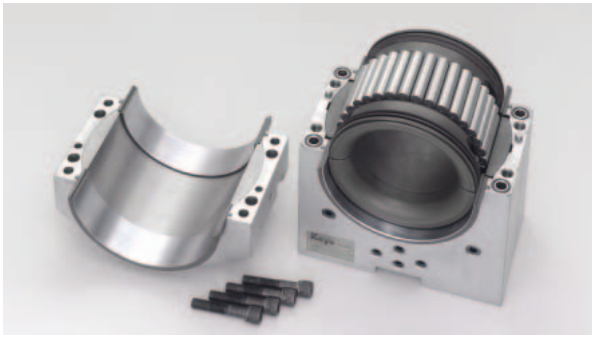


Fig. 9 HSC bearing Units with Half-round Outer Ring

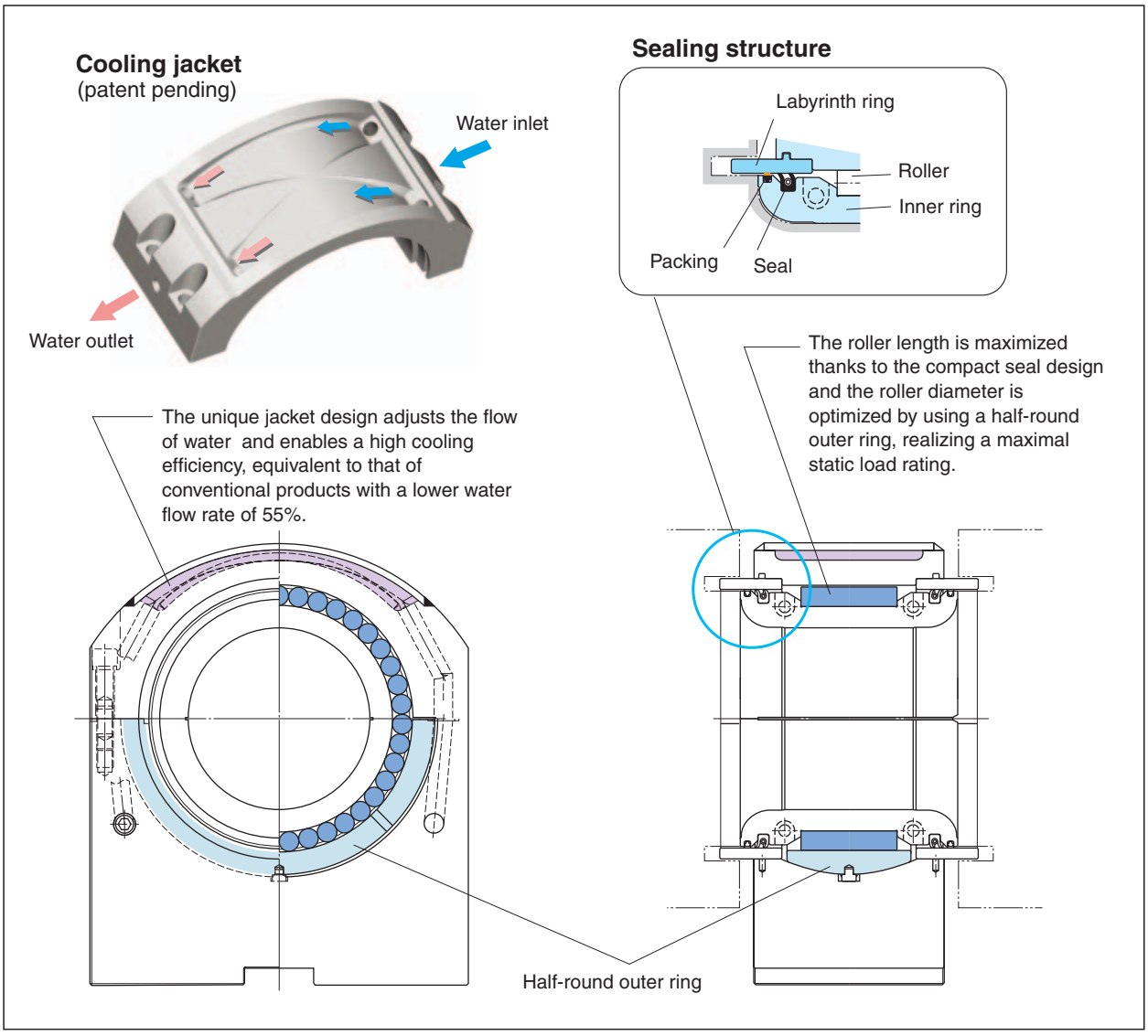


Fig. 10 Structure and Features of the HSC bearing Unit with Half-round Outer Ring

2. High performance Products and Their Features

(3) Oil seals for roll support housings

This oil seal is applied for non grease evacuated type (Called Seal Out Type) housing. The standard material of seal rubber is H-NBR, which well resists to high temperature and stable under steam.

For the roll barrel side, the GE type seal having a dust lip that securely prevents the ingress of water and scales is recommended.
For the roll end side, the ME type seal with a dust lip is recommended.

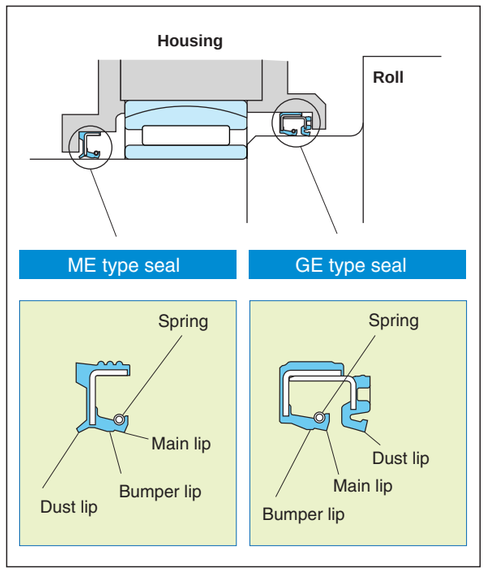


Fig. 11 Type and shape of oil seals

All these oil seals have a main lip equipped with a spring, delaying deterioration in sealing performance due to thermal rubber deformation. The bumper lip adjacent to the main lip distributes contact stress on the roll, delaying roll wear and thus extending sealing durability.

Oil seals applied for grease evacuated type (Called Seal In Type) housing are also available from **JTEKT**. Please contact **JTEKT** for further details.

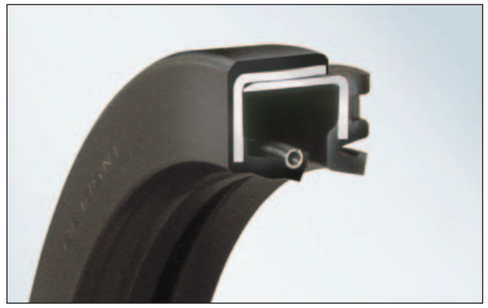


Fig. 12 GE Type Oil Seal

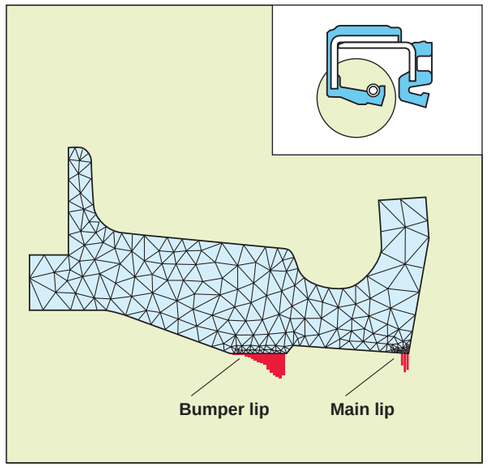


Fig. 13 FEM Analysis for Effects of Bumper Lip

(4) Oil/Air lubrication system

This system supplies lubrication oil into the housing by means of compressed air. Therefore, the internal pressure of the housing is essentially high, preventing the ingress of contaminants.
This lubrication method is the most suitable for bearings used under severe environments where they may be exposed to scattering water and scales.

JTEKT supplies Oil/Air lubrication systems. Please contact **JTEKT** for further details.

Fig. 14 Example of Koyo Oil/Air Lubrication System

Features of Oil/Air lubrication system

- **Low environmental pollution**
  Oil emissions to the atmosphere are low, realizing a clean work environment.
- **Prevention of contaminants ingress into the housing**
  Compared with oil mist lubrication and grease lubrication, this system provides the housing interior with a higher pressure, essentially preventing the ingress of contaminants.
- **Less restrictions for piping**
  Restrictions on pipe branching are lessened compared with oil mist lubrication.
- **Lubrication oil saving**
  Consumption of lubrication oil is reduced.

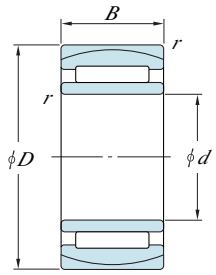
Rust on the raceway of outer and inner rings

Fig. 15 Rust on Spherical Roller Bearing Caused by Water Ingress

Fig. 16 Rust on Bearing Supporting Roll at Middle Position

3. Dimensions Tables

SC Bearings and SCP Bearings

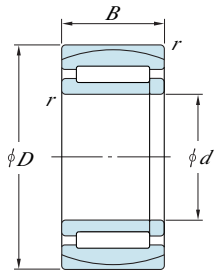


SC Bearing (Free side)

SC Bearings (Free side)

Boundary Dimensions (mm)				Acceptable roll heat expansion	Basic Load Ratings (kN)		Bearing No.	Mass	Corresponding Spherical Roller Bearing		
									Bearing No.	Basic Load Ratings (kN)	
d	*D*	*B*	*r* (Min.)	(mm)	*C*r	*C*0r		(kg)		*C*r	*C*0r
50	110	40	2	±4.5	164	254	**SC101140VA**	2.1	**22310RHR**	204	237
55	90	32	1.1	±3.5	89.9	202	**SC119032VA**	0.9	—	—	—
	100	25	1.5	±4	95.9	143	**SC111025VA**	0.9	**22211RHR**	124	144
65	120	31	1.5	±4	118	206	**SC131231V-1A**	1.7	**22213RHR**	178	211
	140	48	2.1	±5.5	238	393	**SC131448VA**	4.0	**22313RHR**	305	360
70	125	31	1.5	±6	126	213	**SC141331VA**	1.8	**22214RHR**	187	222
	150	51	2.1	±7.5	273	406	**SC141551VA**	4.7	**22314RHR**	348	413
75	130	31	1.5	±5	129	220	**SC151331V-1A**	1.9	**22215RHR**	193	236
85	150	65	3	±8	280	621	**SC171565VA**	5.4	**24217RHB**	370	558
90	160	40	2	±4.5	240	427	**SC181640-1VA**	3.8	**22218RHR**	298	381
	160	45/48*	2	±5.5	249	507	**SC181645/48V-1A**	4.4	—	—	—
	160	52.4	2	±5.5	309	555	**SC181652VA**	4.9	**23218RH**	336	482
100	150	50	1.5	±6	232	543	**SC201550VA**	3.4	—	—	—
	165	52	2	±5.5	279	600	**SC201752V-1A**	4.8	**23120RH**	328	510
105	160	56	2	±9	242	594	**SC211656VA**	4.4	**24021RHA**	317	550
110	170	45	2	±5.5	220	533	**SC221745V-2A**	4.1	**23022RH**	300	486
	170	60	2	±8	279	722	**SC221760V-1A**	5.5	**24022RH**	375	647
	170	64	2	±10	279	722	**SC221764VA**	5.8	—	—	—
	180	56	2	±7.5	296	667	**SC221856V-8A**	6.1	**23122RH**	385	605
	180	69	2	±9	355	842	**SC221869V-3A**	7.6	**24122RH**	469	778
120	180	46	2	±6	231	588	**SC241846V-2A**	4.5	**23024RH**	314	524
	180	54	2	±12	246	516	**SC241854VA**	5.0	—	—	—
	180	56/46*	2	±10	279	626	**SC241856/46VA**	5.2	—	—	—
	180	58	2	±12	273	589	**SC241858VA**	5.4	—	—	—
	180	60	2	±9	274	726	**SC241860V-1A**	5.8	**24124RH**	397	709
	200	80	2	±9.5	521	1120	**SC242080VA**	11.1	**24124RH**	605	1020
130	200	69	2	±9	381	969	**SC262069V-1A**	8.7	**24026RH**	512	914
	200	79/69*	2	±11	443	1090	**SC262079/69VA**	9.6	—	—	—
	210	64	2	±10	408	882	**SC262164VA**	9.2	**23126RH**	494	799
	210	80	2	±11.5	448	1120	**SC262180V-2A**	11.9	**24126RH**	620	1080
	230	64	3	±9	442	950	**SC262364V-2A**	12.5	**22226RHR**	658	914
140	210	53	2	±6	331	834	**SC282153V-1A**	7.1	**23028RH**	422	723
	210	69	2	±9.5	431	1010	**SC282169RVA**	8.8	**24028RH**	524	957
	225	68	2.1	±7	512	1150	**SC282368RVA**	11.1	**23128RH**	565	940
	225	85	2.1	±11.5	521	1300	**SC282385V-1A**	14.4	**24128RH**	702	1220
150	225	75	2.1	±9.5	468	1220	**SC302375V-4A**	11.7	**24030RH**	593	1100
	250	100	2.1	±14	666	1650	**SC3025100V-1A**	21.9	**24130RH**	915	1590
	270	96	3	±12	806	1670	**SC302796VA**	26.2	**23230RH**	959	1540

Note *** indicates width of outer ring and inner ring, respectively.**



SCP Bearing (Fixed side)

Boundary Dimensions

SC Bearings (Free side)

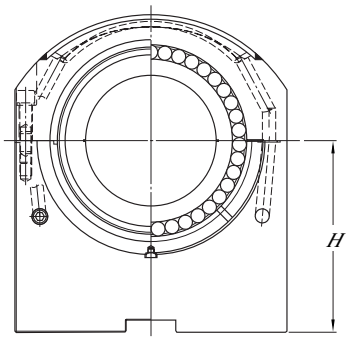
Boundary Dimensions (mm)				Acceptable roll heat expansion	Basic Load Ratings (kN)		Bearing No.	Mass	Corresponding Spherical Roller Bearing		
									Bearing No.	Basic Load Ratings (kN)	
d	*D*	*B*	*r* (Min.)	(mm)	*C*r	*C*0r		(kg)		*C*r	*C*0r
160	240	80	2.1	±13	542	1280	SC322480-2VA	13.6	24032RH	679	1270
	270	109	2.1	±13.5	869	1980	SC3227109VA	28.0	24132RH	1070	1890
	340	114	4	±15	1230	2300	SC3234114VA	55.3	22332RHA	1420	1940
170	260	90	2.1	±14	622	1560	SC342690V-1A	18.7	24034RH	828	1540
	310	110	4	±14	1010	2180	SC3431110VA	40.1	23234RHA	1210	1940
180	280	100	2.1	±14	743	1890	SC3628100V-1A	25.0	24036RH	984	1830
	320	112	4	±15	950	2350	SC3632112V-1A	43.5	23236RHA	1320	2170
190	290	100	2.1	±14	768	2030	SC3829100V-1A	26.1	24038RHA	1010	1920
	320	104	3	±12	1030	2270	SC3832104VA	37.2	23138RHA	1210	2080
	320	128	4	±15.5	1120	2790	SC3832128VA	46.7	24138RHA	1460	2630
	340	120	4	±16	1110	2720	SC3834120V-1A	53.0	23238RHA	1490	2470
200	310	109	2.1	±11	978	2550	SC403111RVA	33.5	24040RHA	1180	2230
	340	112	3	±16	1080	2490	SC4034112V-1A	46.0	23140RHA	1380	2340
	340	140	3	±19	1350	3090	SC4034140VA	56.1	24140RHA	1660	2970
220	370	150	4	±19	1540	3750	SC4437150VA	72.3	24144RHA	1920	3550

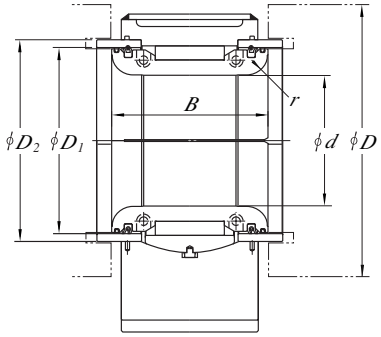
SCP Bearings (Fixed side)

Boundary Dimensions (mm)				Acceptable roll heat expansion	Basic Load Ratings (kN)		Bearing No.	Mass	Corresponding Spherical Roller Bearing		
									Bearing No.	Basic Load Ratings (kN)	
d	*D*	*B*	*r* (Min.)	(mm)	*C*r	*C*0r		(kg)		*C*r	*C*0r
85	150	65	3	—	280	621	SCP171565VA	5.5	24217RHB	370	558
90	160	40	2	—	194	400	SCP181640V-1A	3.9	22218RHR	298	381
	160	52.4	1.1	—	271	566	SCP181652V-2A	5.1	23218RH	336	482
100	150	50	1.5	—	232	543	SCP201550VA	3.4	—	—	—
110	170	45	2	—	220	533	SCP221745V-2A	4.2	23022RH	300	486
	180	69	2	—	355	842	SCP221869V-3A	7.8	24122RH	469	778
	200	53	2.1	—	333	626	SCP222053VA	8.2	22222RHR	491	642
120	180	46	2	—	231	588	SCP241846V-2A	4.6	23024RH	314	524
	200	80	2	—	431	1040	SCP242080V-3A	12.0	24124RH	605	1020
130	200	52	2	—	295	701	SCP262052V-1A	6.7	23026RH	404	674
	200	69	2	—	381	969	SCP262069V-1A	8.9	24026RH	512	914
	210	80	2	—	448	1120	SCP262180V-2A	12.2	24126RH	620	1080
140	210	53	2	—	331	834	SCP282153V-1A	7.2	23028RH	422	723
	225	85	2.1	—	521	1300	SCP282385V-1A	14.8	24128RH	702	1220
150	225	75	2	—	468	1220	SCP302375V-4A	11.7	24030RH	593	1100
180	320	112	4	—	950	2350	SCP3632112V-1A	44.1	23236RHA	1320	2170
190	290	100	2.1	—	768	2030	SCP3829100V-1A	26.8	24038RHA	1010	1920
	320	128	4	—	1120	2790	SCP3832128VA	47.8	24138RHA	1460	2630

3. Dimensions Tables

HSC bearing Units with Half-round Outer Ring





Boundary Dimensions (mm)							Housing No. 1)	Bearing No.	Acceptable roll heat expansion (mm)	Basic Load Ratings (kN)	
Roll Dia. D	Bore d	Width B	Height H	D_1	D_2	r 2)				C_r	C_{0r}
195	100	145	175	133	143	C8*	**PBA391H**	**HSC2017-1C3**	±7	373	876
220	110	139	225	155	168	18	**PBA399H**	**HSC2219-7C3**	±9	402	876
	110	139	225	155	168	18	**PBA360H**	**HSC2219-6C3**	±9	433	966
225	100	169	132	140	150	15	**PBA328H**	**HSC2019C3**	±8	603	1250
230	110	113	185	160	173	13	**PBA171H**	**HSC2219-3C3**	±8	337	619
	110	141	246	160	173	18	**PBA171AXH**	**HSC2219-1C3**	±8	528	1120
	110	150	190	160	173	15	**PBA208H**	**HSC2219-2C3**	±8	554	1190
	110	154	180	160	173	20	**PBA368H**	**HSC2219-4C3**	±8	554	1190
	110	154	180	160	173	20	**PBA404H**	**HSC2220C3**	±9	575	1270
235	140	145	175	175	186.5	C8*	**PBA339H**	**HSC2821C3**	±5	431	1160
240	115	202	251	160	175	15	**PBA316H**	**HSC2321C3**	±10	745	1550
	120	173	230	165	180	15	**PBA396H**	**HSC2421-2C3**	±9	673	1510
250	120	151	190	172	185	20	**PBA411H**	**HSC2421-6C3**	±9	576	1310
	120	153	185	175	190	20	**PBA336H**	**HSC2421C3**	±8	651	1380
	120	153	145	175	190	20	**PBA336AH**	**HSC2421C3**	±8	651	1380
	120	154	175	170	188	20	**PBA378H**	**HSC2421-1C3**	±10	578	1190
	120	154	190	175	190	20	**PBA251H-2**	**HSC2421-4C3**	±9	605	1400
	120	154	180	175	190	20	**PBA251H**	**HSC2421-3C3**	±9	605	1400
	120	154	180	170	185	20	**PBA407H**	**HSC2421-5C3**	±9	605	1400
255	125	174	180	180	195	20	**PBA410H**	**HSC2522C3**	±9	793	1740
260	120	154	180	170	188	20	**PBA379H**	**HSC2421-1C3**	±10	578	1190
	130	157	180	185	200	20	**PBA412H**	**HSC2622-2C3**	±9	623	1480
265	140	175	242.5	190	205	20	**PBA397H**	**HSC2823-2C3**	±9	699	1640
	140	191	250	190	205	20	**PBA355H**	**HSC2823-1C3**	±7	721	1710
270	130	154	190	185	200	20	**PBA252H**	**HSC2622C3**	±9	623	1480
	140	126	205	199	212	16	**PBA176H**	**HSC2823C3**	±8	505	992
	140	174	205	199	212	20	**PBA207H**	**HSC2824-1C3**	±8	863	1980
275	150	163	175	190	203.5	C10*	**PBA389H**	**HSC3024C3**	±7	711	1800
280	130	174	205	185	200	20	**PBA337H**	**HSC2624C3**	±8	846	1910
	130	174	160	185	200	20	**PBA337AH**	**HSC2624C3**	±8	846	1910
	145	196	260	200	215	20	**PBA356H**	**HSC2925-1C3**	±6	840	1930
290	140	139	215	208	223	16	**PBA177H**	**HSC2825C3**	±8	863	1980
	145	178	215	208	223	20	**PBA206H**	**HSC2925C3**	±8	967	2260
295	145	208	270	200	215	20	**PBA357H**	**HSC2926C3**	±6	880	2260
305	150	169	205	205	220	20	**PBA408H**	**HSC3025C3**	±8.5	855	1990
310	140	184	215	205	220	20	**PBA338H**	**HSC2827C3**	±8	1000	2210
	140	184	175	205	220	20	**PBA338AH**	**HSC2827C3**	±8	1000	2210
320	150	187	220	220	235	20	**PBA380H**	**HSC3028C3**	±9	1040	2370
	160	150	291	240	255	18	**PBA178H**	**HSC3228C3**	±8	816	1680
	160	199	270	215	230	20	**PBA398H**	**HSC3227C3**	±9	1000	2410
	165	228	280	230	245	25	**PBA358H**	**HSC3328C3**	±6	1030	2550
340	180	235	280	245	260	25	**PBA359H**	**HSC3630C3**	±6	1140	2720
370	190	233	280	326	336	20	**PBA324H**	**HSC3834C3**	±7	1540	3540

Notes 1) The housing numbers do not includes a bearing.
2) * indicates a special design.

GLOBAL NETWORK
BEARING BUSINESS OPERATIONS

JTEKT CORPORATION NAGOYA HEAD OFFICE
No.1-1, Asahimachi, Kariya, Aichi 448-8652, JAPAN
(move to Midland Square at Meieki 4-chome, Nakamura-ku, Nagoya, is planned for Dec. 2006)
TEL : 81-566-25-5111
FAX : 81-566-25-5470

JTEKT CORPORATION OSAKA HEAD OFFICE
Sales & Marketing Headquarters
No.5-8, Minamisemba 3-chome, Chuo-ku, Osaka 542-8502, JAPAN
TEL : 81-6-6245-6087
FAX : 81-6-6244-9007

OFFICES

KOYO CANADA INC.
5324 South Service Road, Burlington, Ontario L7L 5H5, CANADA
TEL : 1-905-681-1121
FAX : 1-905-681-1392

KOYO CORPORATION OF U.S.A.
-Cleveland Office-
29570 Clemens Road, P.O.Box 45028 Westlake, OH 44145, U.S.A.
TEL : 1-440-835-1000
FAX : 1-440-835-9347

-Detroit Office-
47771 Halyard Drive, Plymouth, MI 48170, U.S.A.
TEL : 1-734-454-1500
FAX : 1-734-454-4076

KOYO MÉXICANA, S.A. DE C.V.
Rio Nazas No.171, 3er piso, Col. Cuauhtemoc, México, D.F. C.P. 06500, MÉXICO
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FAX : 52-55-5207-3873

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Rua Desmbargador Eliseu Ghilherme 304,7-Ander,Paraiso CEP 04004-30, BRASIL
TEL : 55-11-3887-9173
FAX : 55-11-3887-3039

JTEKT (THAILAND) Co., LTD.
172 Moo 12 Tambol Bangwua, Amphur Bangpakong, Chachoengsao 24180, THAILAND
TEL : 66-38-533-310-7
FAX : 66-38-532-776

KOYO SINGAPORE BEARING (PTE.) LTD.
#09-01, C&P Logistics Hub2,27,Penjuru Lane, SINGAPORE, 609195
TEL : 65-6274-2200
FAX : 65-6862-1623

-India Branch-
1104, GD-ITL Tower, B-08, NETAJI SUBHASH PLACE, PITAM PURA, DELHI 110034 INDIA
TEL : 91-11-2735-3502Å`04
91-11-5537-4803Å`04
FAX : 91-11-2715-3501

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Rm.504, Comfoods Bldg., Cor. Gil Puyat Ave. and Pasong Tamo, Makati City, PHILIPPINES
TEL : 63-2-817-8881/8901
FAX : 63-2-867-3148

JTEKT KOREA CO., LTD.
Inwoo Building 6F, 539-11, Shinsa-Dong, Kangnam-Ku, Seoul, KOREA
TEL : 82-2-549-7922
FAX : 82-2-549-7923

JTEKT CORPORATION BEIJING LIAISON OFFICE
Room 1108 Tower-B Winterless-Center, No.1 Xidawang-Road, Chaoyang-District, Beijing, CHINA
TEL : 86-10-6538-8070
FAX : 86-10-6538-8077

KOYO (SHANGHAI) CO., LTD.
Rm.1905, Aetna Tower, 107 Zunyi Road, Shanghai 200051, CHINA
TEL : 86-21-6237-5280
FAX : 86-21-6237-5277

JTEKT CORPORATION SHANGHAI LIAISON OFFICE
Rm.1907, Aetna Tower, 107 Zunyi Road, Shanghai 200051, CHINA
TEL : 86-21-6237-5280
FAX : 86-21-6237-5277

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FAX : 61-2-9638-3368

JTEKT CORPORATION EUROPEAN BEARING CENTRAL OFFICE
Markerkant 13-01, 1314 AN Almere, THE NETHERLANDS
TEL : 31-36-5383333
FAX : 31-36-5347212

KOYO KULLAGER SCANDINAVIA A.B.
Johanneslundsvagen 4 194 61 Upplands Väsby, SWEDEN
TEL : 46-8-594-212-10
FAX : 46-8-594-212-29

KOYO (U.K.) LTD.
Whitehall Avenue, Kingston, Milton Keynes MK10 OAX, UNITED KINGDOM
TEL : 44-1908-289300
FAX : 44-1908-289333

EUROPA-KOYO B.V.
Lekdijk 187, 2967 GJ Langerak, THE NETHERLANDS
TEL : 31-184-606800
FAX : 31-184-602572/606857

KOYO ROMANIA REPRESENTATIVE OFFICE
Str. Frederic Jolliot-Curie, Nr.3, Etaj 1, Ap.2, Sector 5
Bucharest, ROMANIA
TEL : 40-21-410-4170/4182/0984
FAX : 40-21-410-1178

KOYO DEUTSCHLAND GMBH.
Bargkoppelweg 4, D-22145 Hamburg, GERMANY
TEL : 49-40-67-9090-0
FAX : 49-40-67-9203-0

KOYO FRANCE S.A.
8 Rue Guy Moquet, B.P.189 Z.I., 95105 Argenteuil Cedex, FRANCE
TEL : 33-1-3998-4202
FAX : 33-1-3998-4244/4249

KOYO IBERICA, S.L.
Avda.da la Industria, 52-2 izda 28820
Coslada Madrid, SPAIN
TEL : 34-91-329-0818
FAX : 34-91-747-1194

KOYO ITALIA S.R.L.
Via Bronzino 9, 20133 Milano, ITALY
TEL : 39-02-2951-0844
FAX : 39-02-2951-0954

Value & Technology

JTEKT

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