



Bearings and Related Products for Continuous Casting Machines



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.

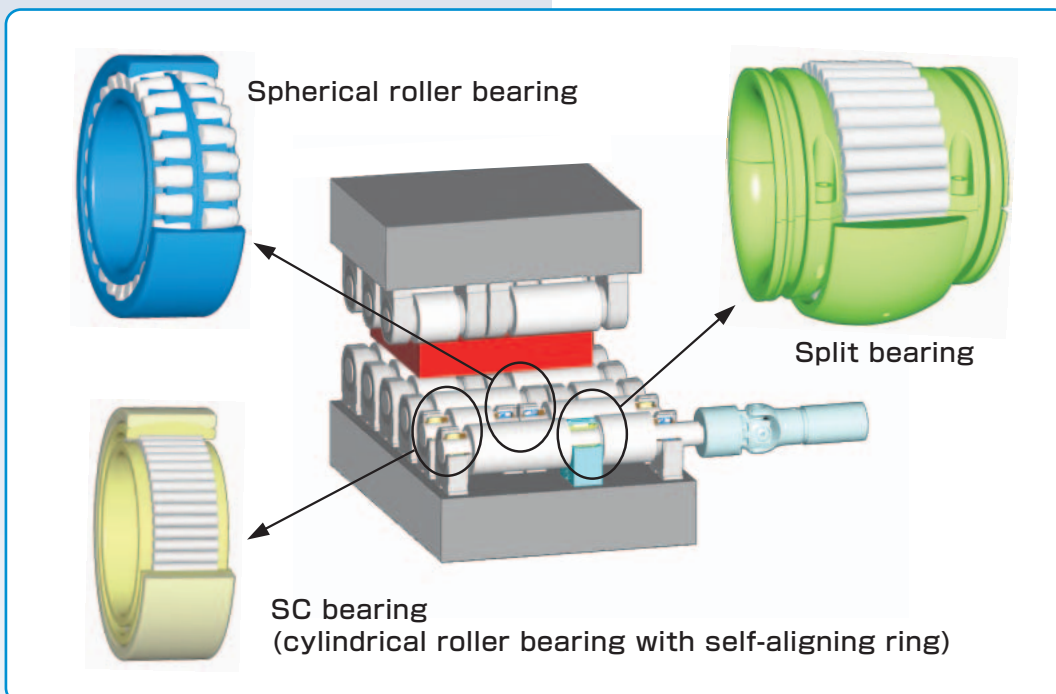
Accordingly, roll support bearings may be failed in an extremely short period of time, typically due to wear and cracking.

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.

Contents

Introduction	1
1. Failure mechanism of Bearing	2
2. High performance Products and Their Features	
(1) Roll support bearings	3
(2) HSC bearing units with half round outer ring	4
(3) Oil seals for roll support housings	5
(4) Oil/Air lubrication system	6
3. Dimensions Tables	
SC and SCP Bearings	7
HSC Bearing Units with Half round Outer Ring . . .	9

■ Typical Arrangement of Roll Support Bearings in Continuous Casting Machines



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.

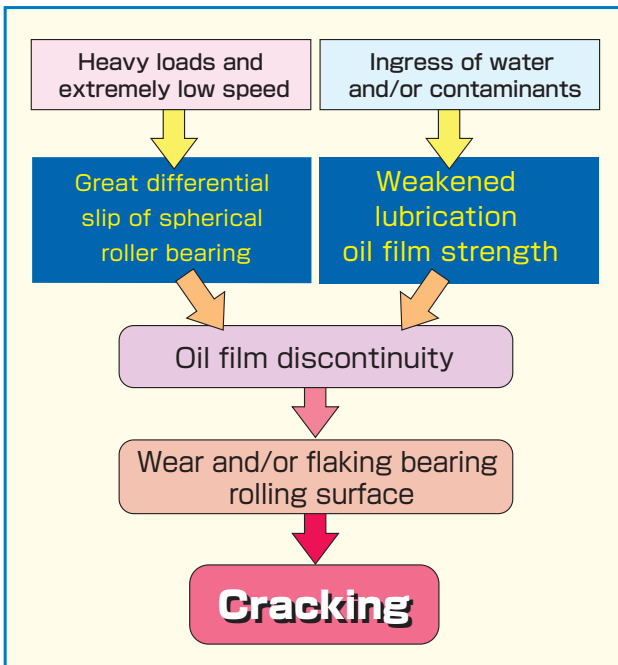
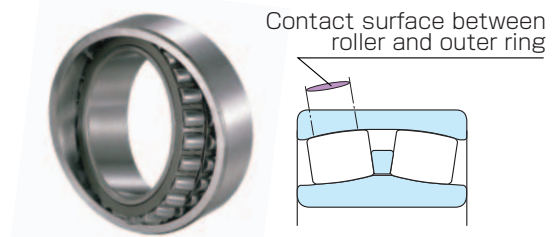


Fig. 1 Typical Failure Mechanism of Roll Support Bearing in Continuous Casting Machines

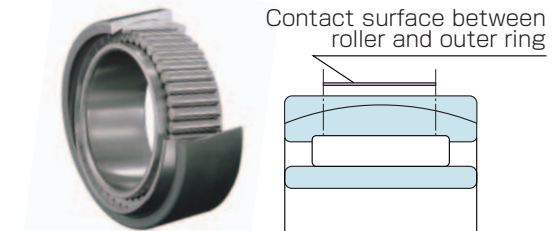
● Spherical roller bearing



When a spherical roller bearing is loaded, elastic deformation occurs on the contact surface between each roller and bearing raceway, producing an elliptical 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

Bearings and Related Products for 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.

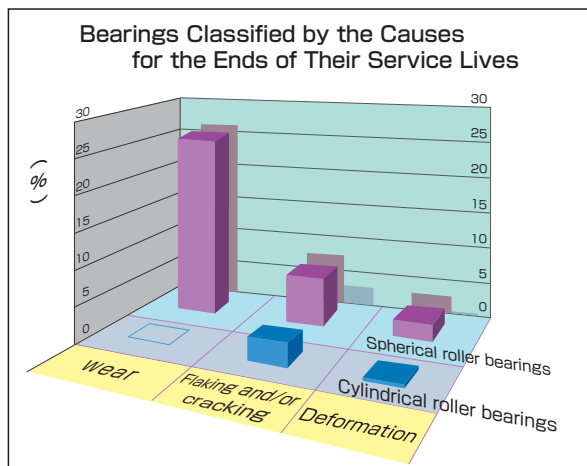


Fig. 4 Advantages of Cylindrical Roller Bearings

● 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.

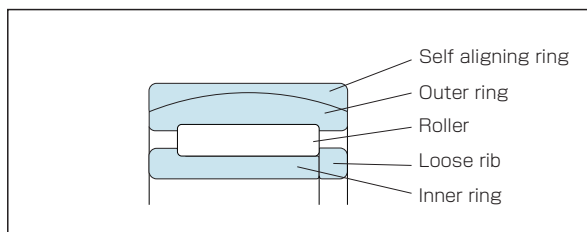


Fig. 5 SCP Bearing Structure

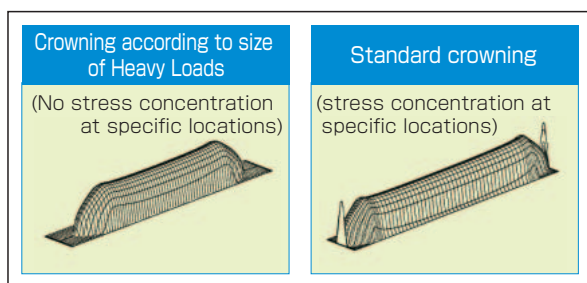


Fig. 6 Advantages of Roller Crowning According to the Size of Heavy Loads

● 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.

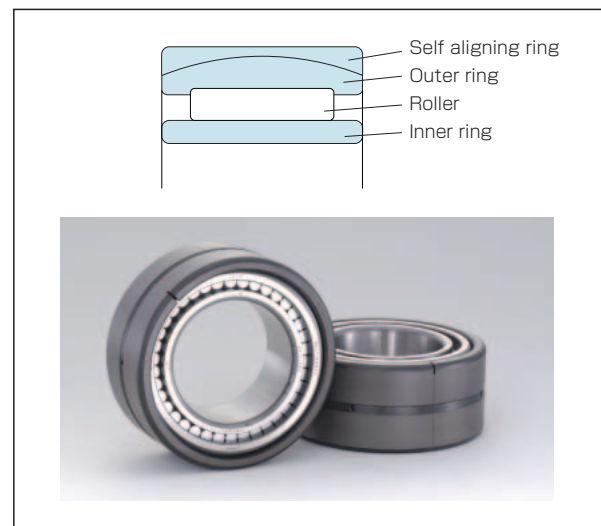


Fig. 7 SC Bearing Structure

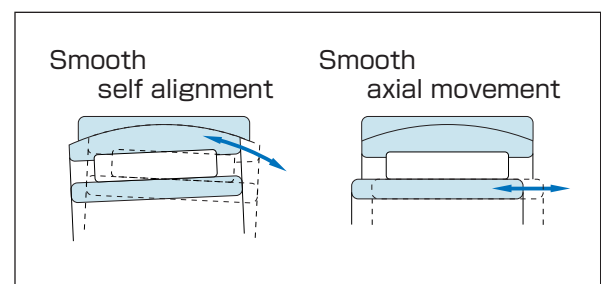


Fig. 8 SC Bearing Functions

(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.

JTEKT can supply all lubricated (grease and oil/air) and non-lubricated (rotating and non-rotating) bearing units. Consult us for all your bearing needs.



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

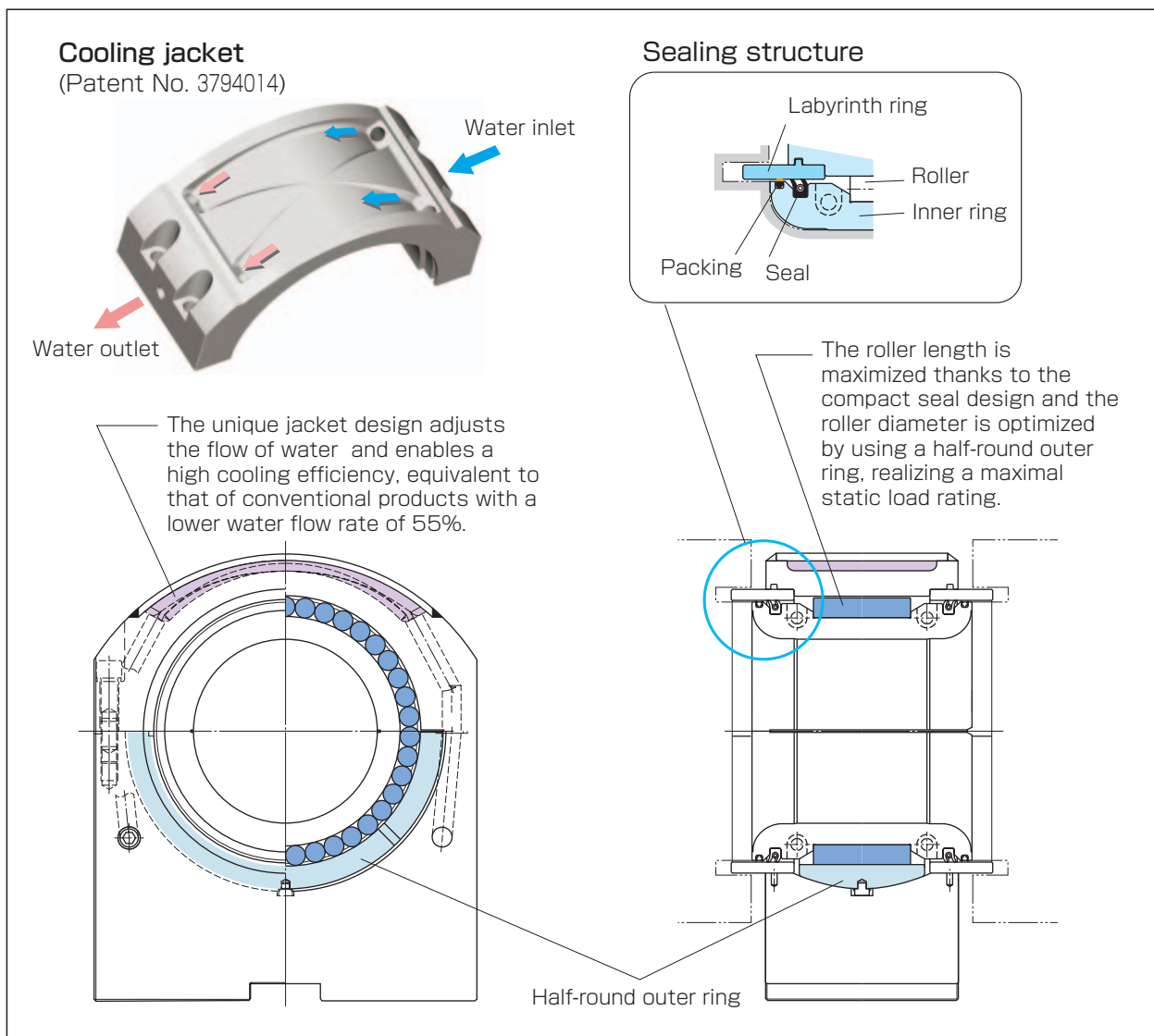


Fig. 10 Structure and Features of the HSC bearing Unit with Half-round Outer Ring

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.

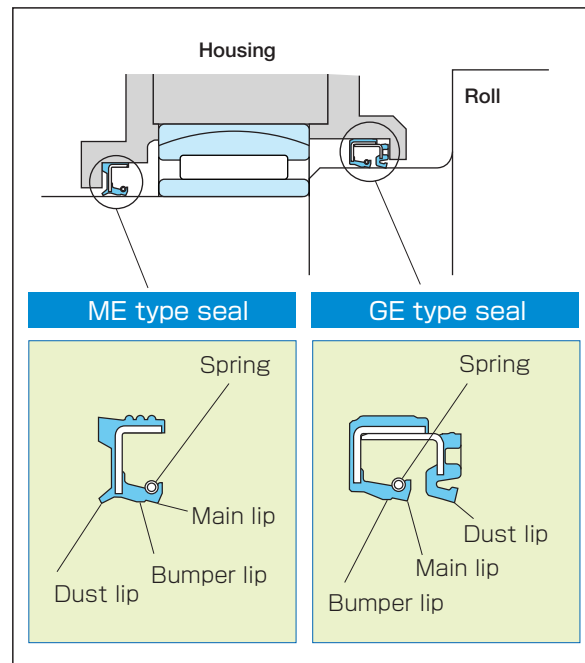


Fig. 11 Type and shape of oil seals



Fig. 12 GE Type Oil Seal

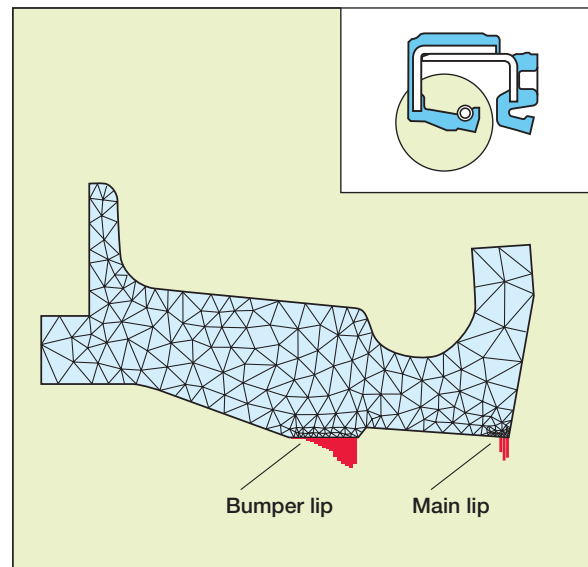


Fig. 13 FEM Analysis for Effects of Bumper Lip

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.

(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 JTEKT 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



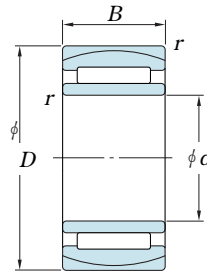
Fig. 16 Rust on Bearing Supporting Roll at Middle Position

The incidence of the types rust shown in Figures 15 and 16 can be dramatically reduced through the use of high-performance products.

Bearings and Related Products for Continuous Casting Machines

3. Dimensions Tables

SC Bearings and SCP Bearings

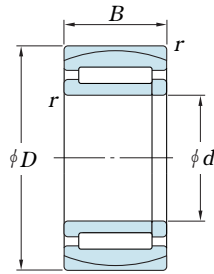


SC Bearing (Free side)

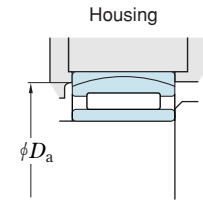
SC Bearings (Free side)

Boundary Dimensions (mm)				Acceptable roll heat expansion (mm)	Basic Load Ratings (kN)		Bearing No.	Corresponding Spherical Roller Bearing		Mass (kg)	Mounting dimensions (mm)		
d	D	B	r (Min.)		C_r	C_{or}		Bearing No.	Basic Load Ratings (kN)		D_a	min.	max.
50	110	40	2	±4.5	164	254	SC101140VA	22310RHR	204	237	2.1	96	99
55	90	32	1.1	±3.5	89.9	202	SC119032VA	—	—	—	0.9	81	82
	100	25	1.5	±4	95.9	143	SC111025VA	22211RHR	124	144	0.9	93	93
65	120	31	1.5	±4	118	206	SC131231V-1A	22213RHR	178	211	1.7	110	111
	140	48	2.1	±5.5	238	393	SC131448VA	22313RHR	305	360	4.0	123	127
70	125	31	1.5	±6	126	213	SC141331VA	22214RHR	187	222	1.8	116	117
	150	51	2.1	±7.5	273	406	SC141551VA	22314RHR	348	413	4.7	132	137
75	130	31	1.5	±5	148	237	SC151331VA	22215RHR	193	236	1.9	120	121
85	150	65	3	±8	280	621	SC171565VA	24217RHB	370	558	5.4	129	137
90	160	40	2	±4.5	240	427	SC181640-1VA	22218RHR	298	381	3.8	147	149
	160	45/48*	2	±5.5	249	507	SC181645/48V-1A	—	—	—	4.4	147	150
	160	52.4	2	±5.5	309	555	SC181652VA	23218RH	336	482	4.9	144	148
100	150	50	1.5	±6	232	543	SC201550VA	—	—	—	3.4	137	139
	165	52	2	±5.5	279	600	SC201752V-1A	23120RH	328	510	4.8	149	153
105	160	56	2	±9	242	594	SC211656VA	24021RHA	317	550	4.4	144	149
110	170	45	2	±5.5	260	523	SC221745V-3A	23022RH	300	486	4.0	158	160
	170	60	2	±8	279	722	SC221760V-1A	24022RH	375	647	5.5	152	157
	170	64	2	±10	279	722	SC221764VA	—	—	—	5.8	151	157
	180	56	2	±7.5	296	667	SC221856V-8A	23122RH	385	605	6.1	162	167
	180	69	2	±9	355	842	SC221869V-3A	24122RH	469	778	7.6	157	164
120	180	46	2	±6	231	588	SC241846V-2A	23024RH	314	524	4.5	168	170
	180	54	2	±12	246	516	SC241854VA	—	—	—	5.0	165	169
	180	56/46*	2	±10	279	626	SC241856/46VA	—	—	—	5.2	165	169
	180	58	2	±8	274	726	SC241858V-1A	—	—	—	5.7	164	168
	180	60	2	±9	274	726	SC241860V-1A	24024RH	397	709	5.8	163	168
	200	80	2	±9.5	521	1120	SC242080VA	24124RH	605	1020	11.1	174	183
130	200	69	2	±9	381	969	SC262069V-1A	24026RH	512	914	8.7	179	186
	200	79/69*	2	±11	443	1090	SC262079/69VA	—	—	—	9.6	177	185
	210	64	2	±10	408	882	SC262164VA	23126RH	494	799	9.2	190	196
	210	80	2	±11.5	448	1120	SC262180V-2A	24126RH	620	1080	11.9	184	193
	230	64	3	±9	442	950	SC262364V-2A	22226RHR	658	914	12.5	209	215
140	210	53	2	±6	331	834	SC282153V-1A	23028RH	422	723	7.1	195	199
	210	69	2	±9.5	431	1010	SC282169RVA	24028RH	524	957	8.8	191	196
	225	68	2.1	±7	512	1150	SC282368RVA	23128RH	565	940	11.1	204	210
	225	85	2.1	±11.5	521	1300	SC282385V-1A	24128RH	702	1220	14.4	199	208
150	225	75	2.1	±9	492	1220	SC302375V-6A	24030RH	593	1100	11.4	203	209
	250	100	2.1	±14	666	1650	SC3025100V-1A	24130RH	915	1590	21.9	218	230
	270	96	3	±12	806	1670	SC302796VA	23230RH	959	1540	26.2	236	247
160	240	80	2.1	±13	542	1280	SC322480-2VA	24032RH	679	1270	13.6	216	225
	270	109	2.1	±13.5	867	1980	SC3227109VA	24132RH	1070	1890	28.0	233	247
	340	114	4	±15	1230	2300	SC3234114VA	22332RHA	1420	1940	55.3	303	316

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



SCP Bearing (Fixed side)



Mounthing

SC Bearings (Free side)

Boundary Dimensions (mm)				Acceptable roll heat expansion (mm)	Basic Load Ratings (kN)		Bearing No.	Corresponding Spherical Roller Bearing			Mass (kg)	Mounting dimensions (mm)	
<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> (Min.)		<i>C_r</i>	<i>C_{or}</i>		Bearing No.	Basic Load Ratings (kN)			<i>D_a</i>	min.
170	260	90	2.1	±14	622	1560	SC342690V-1A	24034RH	828	1540	18.7	232	241
	310	110	4	±14	1010	2180	SC3431110VA	23234RHA	1210	1940	40.1	270	285
180	280	100	2.1	±14	743	1890	SC3628100V-1A	24036RH	984	1830	25.0	248	260
	320	112	4	±15	950	2350	SC3632112V-1A	23236RHA	1320	2170	43.5	280	295
190	290	100	2.1	±14	768	2030	SC3829100V-1A	24038RHA	1010	1920	26.1	259	269
	320	104	3	±12	1030	2270	SC3832104VA	23138RHA	1210	2080	37.2	288	298
	320	128	4	±15.5	1120	2790	SC3832128VA	24138RHA	1460	2630	46.7	278	293
	340	120	4	±16	1110	2720	SC3834120V-1A	23238RHA	1490	2470	53.0	301	315
200	310	109	2.1	±11	978	2550	SC403111RV-1A	24040RHA	1180	2230	33.5	273	286
	340	112	3	±16	1080	2490	SC4034112V-1A	23140RHA	1380	2340	46.0	304	317
	340	140	3	±19	1350	3090	SC4034140VA	24140RHA	1660	2970	56.1	292	313
220	370	150	4	±19	1540	3750	SC4437150VA	24144RHA	1920	3550	72.3	320	340

SCP Bearings (Fixed side)

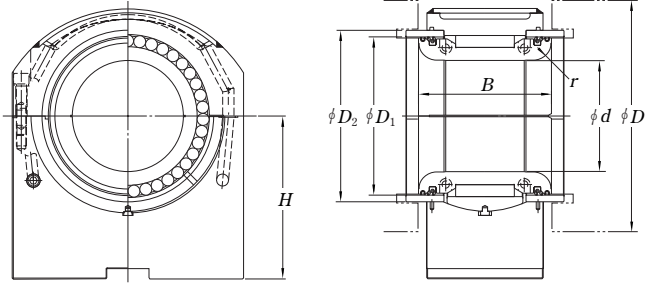
Boundary Dimensions (mm)				Acceptable roll heat expansion (mm)	Basic Load Ratings (kN)		Bearing No.	Corresponding Spherical Roller Bearing			Mass (kg)	Mounting dimensions (mm)	
<i>d</i>	<i>D</i>	<i>B</i>	<i>r</i> (Min.)		<i>C_r</i>	<i>C_{or}</i>		Bearing No.	Basic Load Ratings (kN)			<i>D_a</i>	min.
85	150	65	3	—	280	621	SCP171565VA	24217RHB	370	558	5.5	129	137
90	160	40	2	—	194	400	SCP181640V-1A	22218RHR	298	381	3.9	147	149
	160	52.4	1.1	—	271	566	SCP181652V-2A	23218RH	336	482	5.1	144	148
100	150	50	1.5	—	232	543	SCP201550VA	—	—	—	3.4	137	139
110	170	45	2	—	260	523	SCP221745V-3A	23022RH	300	486	4.1	158	160
	180	69	2	—	355	842	SCP221869V-3A	24122RH	469	778	7.8	157	164
	200	53	2.1	—	333	626	SCP222053VA	22222RHR	491	642	8.2	182	187
120	180	46	2	—	231	588	SCP241846V-2A	23024RH	314	524	4.6	168	170
	200	80	2	—	431	1040	SCP242080V-3A	24124RH	605	1020	12.0	174	183
130	200	52	2	—	295	701	SCP262052V-1A	23026RH	404	674	6.7	186	189
	200	69	2	—	381	969	SCP262069V-1A	24026RH	512	914	8.9	179	186
	210	80	2	—	448	1120	SCP262180V-2A	24126RH	620	1080	12.2	184	193
140	210	53	2	—	331	834	SCP282153V-1A	23028RH	422	723	7.2	195	199
	210	69	2	—	431	1010	SCP282169RVA	24028RH	524	957	9.3	191	196
	225	68	2.1	—	465	1020	SCP282368V-1A	23128RH	565	940	11.6	204	210
	225	85	2.1	—	521	1300	SCP282385V-1A	24128RH	702	1220	14.8	199	208
150	225	75	2.1	—	492	1220	SCP302375V-6A	24030RH	593	1100	11.8	203	209
170	260	90	2.1	—	622	1560	SCP342690V-1A	24034RH	828	1540	19.1	232	241
180	320	112	4	—	950	2350	SCP3632112V-1A	23236RHA	1320	2170	44.1	280	295
	290	75	2.1	—	595	1530	SCP382975V-1A	23038RHA	789	1430	20.3	268	274
190	290	100	2.1	—	768	2030	SCP3829100V-1A	24038RHA	1010	1920	26.8	259	269
	320	128	4	—	1120	2790	SCP3832128VA	24138RHA	1460	2630	47.8	278	293
	200	310	82	2.1	692	1810	SCP403182VA	23040RHA	940	1680	25.9	282	291

Bearings and Related Products for Continuous Casting Machines



3. Dimensions Tables

HSC bearing Units with Half-round Outer Ring



Boundary Dimensions (mm)							Housing No. ¹⁾	Seal type		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⁾		Recovery type	Non-Recovery type			C _r	C _{0r}	
195	100	145	175	133	143	C8**	PBA391H	—	○	HSC2017-1C3	±7	373	876	
	110	139	225	155	168	18	PBA399H	○	—	HSC2219-7C3	±9	402	876	
220	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	—	○	HSC2219-8C3	±8	337	619
		110	148	351	160	173	13	PBA171AH	—	○	HSC2219C3	±8	421	846
									○	—	HSC2219-9C3	±8	421	846
		110	150	190	160	173	15	PBA208H	—	○	HSC2219-2C3	±8	554	1190
		110	154	180	160	173	20	PBA368H	—	○	HSC2219-11C3	±8	554	1190
		110	154	180	160	173	20	PBA404H	○	—	HSC2219-4C3	±8	554	1190
235	140	145	175	175	186.5	C8**	PBA339H	—	○	HSC2220C3	±9	575	1270	
								—	○	HSC2821C3	±5	431	1160	
240	115	202	251	160	175	15	PBA316H	—	○	HSC2321C3	±10	745	1550	
								○	—	HSC2321-2C3	±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	
	120	154	180	170	188	20	PBA379H	○	—	HSC2421-1C3	±10	578	1190	
260	130	157	180	185	200	20	PBA412H	○	—	HSC2622-2C3	±9	623	1480	
	140	175	242.5	190	205	20	PBA397H	○	—	HSC2823-2C3	±9	699	1640	
265	140	191	250	190	205	20	PBA355H	—	○	HSC2823-1C3	±7	721	1710	
	130	154	190	185	200	20	PBA252H	—	○	HSC2622C3	±9	623	1480	
	140	126	205	199	212	16	PBA176H	—	○	HSC2823C3	±8	505	992	
270								○	—	HSC2823-3C3	±8	505	992	
								—	○	HSC2824-1C3	±8	863	1980	
	140	174	205	199	212	20	PBA207H	—	○	HSC2824-4C3	±8	863	1980	
275	150	163	175	190	203.5	C10**	PBA389H	—	○	HSC3024C3	±7	711	1800	
	130	174	205	185	200	20	PBA337H	—	○	HSC2624C3	±8	846	1910	
280	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	
								○	—	HSC2825-1C3	±8	863	1980	
								—	○	HSC2925C3	±8	967	2260	
	145	178	215	208	223	20	PBA206H	—	○	HSC2925-2C3	±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	
	140	184	215	205	220	20	PBA338H	—	○	HSC2827C3	±8	1000	2210	
310	140	184	175	205	220	20	PBA338AH	—	○	HSC2827C3	±8	1000	2210	
	150	187	220	220	235	20	PBA380H	—	○	HSC3028C3	±9	1040	2370	
								—	○	HSC3228C3	±8	816	1680	
								○	—	HSC3228-2C3	±8	816	1680	
	160	150	291	240	255	18	PBA178H	—	○	HSC3227C3	±9	1000	2410	
320	165	228	280	230	245	25	PBA358H	—	○	HSC3328C3	±6	1030	2550	
	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.

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CAT.NO.B2011E
Printed in japan '09.5-5BM('05.2)