NRB
INDUSTRIAL

DOUBLE-ROW
SPHERICAL ROLLER BEARINGS

MOVING THE WHEELS OF INDUSTRY

DOUBLE-ROW SPHERICAL ROLLER BEARINGS

NIBL 'EA type' double-row spherical roller bearing, a choice for the most difficult applications

NIBL self-aligning double-row spherical roller bearing is a combination of radial and axial bearing. It is designed to operate even if shaft and housing are, or become, misaligned under load. The internal design of bearing enables them to withstand very high radial loads and axial loads in both directions. This type of heavy duty bearing is the favored choice when conditions include heavy loads, difficulties in establishing or maintaining housing alignment, or when shaft deflection is expected. Bearing can take high degrees of misalignment depending on the size and series of the bearing.

Shaft deflection and housing distortion caused by shock or heavy loads, which lead to misalignment, are compensated for by the internal self-alignment of the bearing elements during operation. Corner loading of rollers, a condition that limits service life on other types of bearings, cannot develop in spherical roller bearings.

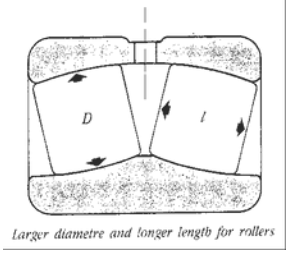
The inherent compensation for misalignment provided by the spherical roller bearing offers the designer the opportunity to use weldments for housing frames instead of complex castings, eliminating high cost machining operations. Even when castings may be preferred, bore alignment is less critical if spherical roller bearings are specified. Unit design and construction also make the spherical roller bearing convenient to handle during installation or maintenance.

Most types have circular groove and lubricating holes in the outer ring. This feature facilitates more effective lubrication. NIBL manufactures spherical roller bearings with cylindrical and tapered bore. Tapered bore bearings may be used either in Plummer blocks or conventional housings.

FEATURES of NIBL EA double-row spherical roller bearings

- **Symmetrical rollers of LARGE DIAMETER** by optimizing the wall thickness of rings. This became possible by making improvements in steel, heat treatment techniques and machining.

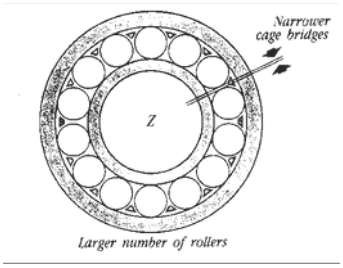
- **Rollers LONGER in LENGTH** by eliminating the central collar in E design of bearing.



Larger diametre and longer length for rollers

DOUBLE-ROW SPHERICAL ROLLER BEARINGS

MORE NUMBER of ROLLERS by optimizing the design of cage which enabled to reduce the distance between rollers, hence it became possible to accommodate more number of rollers in a cage.



Redesigned bearing tracks for
- Greater contact area
- Better load distribution
- Improved contact between track and rollers.

Maximum dynamic load rating for longer life and better reliability.

High static load rating for high performance under low speeds and heavy loads.

Lower operating temperature (down by 10°C) due to reduced internal friction.

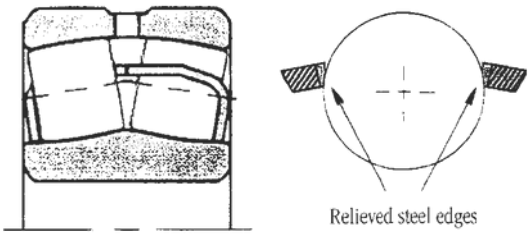
Higher limiting speed, diversifying the application range for NIBL double-row spherical roller bearings.

Ability to operate at high temperatures, for bearings with a metallic cage. Dimensional stability is assured by a specific heat treatment. (Please specify the operating temperature while ordering).

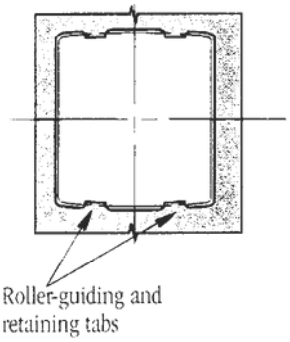
Misalignment capability, about 0.5° without reducing bearing loading capacity

The precision in the design and in the production, with respect to the micro- geometry of the profiles and surfaces enabled to obtain
- An elimination of concentrated stresses which lead to abnormal metal fatigue due to unevenly distributed contact pressures.
- A reduction in friction. Efficient machining and inspection techniques enabled to control the profiles, surface finish, and dimensional tolerances.
- Self aligning rollers. The raceway curvatures are designed to assure that the rollers are perfectly guided.
- Rollers are perfectly guided by the raceways and the cage thus eliminating the guide ring.

Advantages offered by EA series Steel cage
- Resistance at high temperatures
- Accurate cage positioning, ground inner ring raceway supports cage to keep it perfectly centered.
- Reliable and enveloping profile, cage is located above the center of rollers to secure them and hence will not be squeezed between rollers and inner ring in the event of breakdown.



- Accurate guiding of rollers, the cage pockets incorporate 4 guiding flats to maintain rollers. The main guidance being assured by bearing raceways. The cage is simplified and lightened.



- Excellent lubrication: Cage design maximizes amount of lubricant in the bearing. Phosphate surface treatment of steel cage protects it from corrosion and helps in retaining a lubricating film at cage contact with rollers and inner race and thus reducing friction wear.

SUFFIXES

EA Internal design feature, high capacity bearing with steel cage.

EM Internal design feature, high capacity bearing with machined brass cage.

K Tapered bore, 1:12 taper

B33 Lubrication groove & holes in outer ring (= W33)

C2 ISO C2 radial clearance < C0, marked C2

C0 ISO Normal radial clearance not marked

C3 ISO C3 radial clearance > C0, marked C3

C4 ISO C4 radial clearance > C3, marked C4

C5 ISO C5 radial clearance > C4, marked C5

BEARING TOLERANCES

Dimensional and geometrical tolerances correspond to ISO 492 Standard.

NIBL can supply bearings with closer tolerances on bore, outside diameter, specific radial clearance to suit the application, etc.

RADIAL CLEARANCE

The radial clearance as defined in ISO 5753 Standard, the values for tapered bore bearings are different for bearings with cylindrical bore. In tapered bore bearings there is reduction of the internal clearance when fitting them on their seat.

Approximate recommended **residual clearance**, **Jrm** after fitting:

$$\mathbf{Jrm = 5\ d^{1/2}\ 10^{-3}\ mm}$$

d, bearing bore in mm

DOUBLE-ROW SPHERICAL ROLLER BEARINGS

Double-row spherical rollers bearings with cylindrical bore
Series 213-222-223

Bearing bore diameter	Radial Internal Clearance (values in µm)									
d	C2		NORMAL		C3		C4		C5	
mm	min	max	min	max	min	max	min	max	min	max
14 < d ≤ 18	10	20	20	35	35	45	45	60	60	75
18 < d ≤ 24	10	20	20	35	35	45	45	60	60	75
24 < d ≤ 30	15	25	25	40	40	55	55	75	75	95
30 < d ≤ 40	15	30	30	45	45	60	60	80	80	100
40 < d ≤ 50	20	35	35	55	55	75	75	100	100	125
50 < d ≤ 65	20	40	40	65	65	90	90	120	120	150
65 < d ≤ 80	30	50	50	80	80	110	110	145	145	180
80 < d ≤ 100	35	60	60	100	100	135	135	180	180	225
100 < d ≤ 120	40	75	75	120	120	160	160	210	210	260
120 < d ≤ 140	50	95	95	145	145	190	190	240	240	300
140 < d ≤ 160	60	110	110	170	170	220	220	280	280	350
160 < d ≤ 180	65	120	120	180	180	240	240	310	310	390
180 < d ≤ 200	70	130	130	200	200	260	260	340	340	430
200 < d ≤ 225	80	140	140	220	220	290	290	380	380	470
225 < d ≤ 250	90	150	150	240	240	320	320	420	420	520

Double-row spherical rollers bearings with tapered bore
Series 213K-222K-223K

Bearing bore diameter	Radial Internal Clearance (values in µm)									
d	C2		NORMAL		C3		C4		C5	
mm	min	max	min	max	min	max	min	max	min	max
18 < d ≤ 24	15	25	25	35	35	45	45	60	60	75
24 < d ≤ 30	20	30	30	40	40	55	55	75	75	95
30 < d ≤ 40	25	35	35	50	50	65	65	85	85	105
40 < d ≤ 50	30	45	45	60	60	80	80	100	100	130
50 < d ≤ 65	40	55	55	75	75	95	95	120	120	160
65 < d ≤ 80	50	70	70	95	95	120	120	150	150	200
80 < d ≤ 100	55	80	80	110	110	140	140	180	180	230
100 < d ≤ 120	65	100	100	135	135	170	170	220	220	280
120 < d ≤ 140	80	120	120	160	160	200	200	260	260	330
140 < d ≤ 160	90	130	130	180	180	230	230	300	300	380
160 < d ≤ 180	100	140	140	200	200	260	260	340	340	430
180 < d ≤ 200	110	160	160	220	220	290	290	370	370	470
200 < d ≤ 225	120	180	180	250	250	320	320	410	410	520
225 < d ≤ 250	140	200	200	270	270	350	350	450	450	570

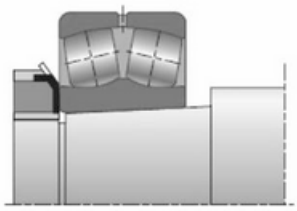
AXIAL CLEARANCE

Axial clearance, J_a depends on the radial clearance, J_r. Approximately it can be calculated by using the formula:

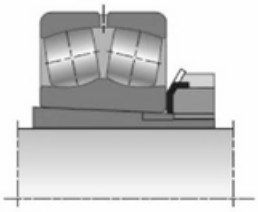
$$J_a = 2.27\ Y_0 J_r$$

(Refer to Dimensions Table for value of Y_0)

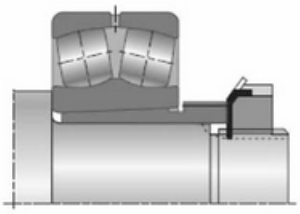
BEARING MOUNTING and CONTROL OF CLEARANCE OF TAPERED BORE DOUBLE-ROW SPHERICAL ROLLER BEARING



Tapered bore bearing mounting directly on to the shaft



Tapered bore bearing mounting using adapter sleeve

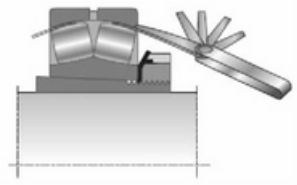


Tapered bore bearing mounting using withdrawal sleeve

While fitting the bearing on the sleeve the inner ring expands thus radial internal clearance of the bearing reduces.

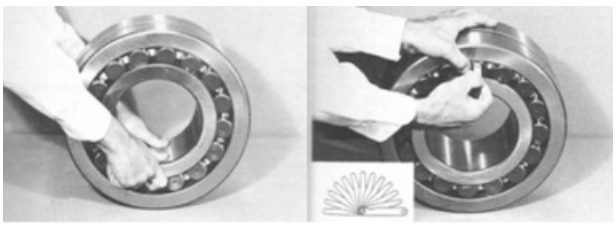
It is very important to monitor the reduction of radial internal clearance while the bearing is being fitted to ensure that the final radial internal clearance is adequate for the proper functioning of the bearing.

Principle of measurement



The clearance can be measured by sliding a feeler gauge between the outer ring and the rollers. For large bearings do not use feeler gauges over 0.150 mm thick since they are too stiff to take the shape of the outer ring raceway. Instead of thick gauge use a combination of thin gauges by stacking them up for measurement.

Method of measurement



Place the bearing upright, the rings must be parallel. Manually rotate the inner ring to ensure that the rollers are properly seated.

Find in the column 2 of the table below, the minimum value of the standardized clearance that corresponds to the bore and clearance class of the bearing. Choose a feeler gauge slightly smaller than this value. Slide the gauge at an angle between the unloaded rollers and the outer ring race. Progressively increase the gauge thickness. The clearance value will be situated between the last « pass » gauge and the next one that failed to « pass ».

Monitoring of bearing fitting and radial clearance

- Radially

Drive up the bearing until the clearance has been reduced to the indicated limits. Check that the final residual clearance is no smaller than the value stated for the particular clearance class (column 3)

- Axially (shaft with tapered seat)

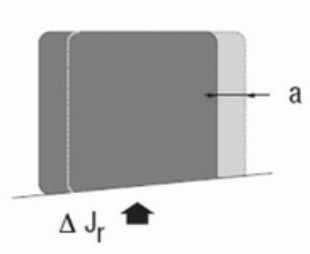
The axial movement corresponding to the tightening must be within the indicated limits (column 4). Check that the final residual clearance is no smaller than the value stated for the particular clearance class.

Measurement of radial clearance during fitting

Bearing bore mm		Prior to mounting						After mounting						Axial drive-up			
		C0		C3		C4		C0		C3		C4		mm			
		According to ISO 5753 (in mm)						Feeler gauge*		Feeler gauge*		Feeler gauge*		Taper 1:30		Taper 1:30	
from	Incl.	min	max	min	max	min	max	yes	no	yes	no	yes	no	min	max	min	max
30	40	0.035	0.050	0.050	0.065	0.065	0.085	2	3	3	4	4	5	0.350	0.400	–	–
40	50	0.045	0.060	0.060	0.080	0.080	0.100	3	4	3	5	4	6	0.400	0.450	–	–
50	65	0.055	0.075	0.075	0.095	0.095	0.120	3	5	4	6	5	7	0.450	0.600	–	–
65	80	0.070	0.095	0.095	0.120	0.120	0.150	4	6	5	7	6	8	0.600	0.750	–	–
80	100	0.080	0.110	0.110	0.140	0.140	0.180	4	6	6	8	7	10	0.700	0.900	1.700	2.200
100	120	0.100	0.135	0.135	0.170	0.170	0.220	5	7	7	9	9	12	0.750	1.100	1.900	2.700
120	140	0.120	0.160	0.160	0.200	0.200	0.260	8	11	10	13	12	17	1.100	1.400	2.700	3.500
140	160	0.130	0.180	0.180	0.230	0.230	0.300	8	12	11	15	14	19	1.200	1.600	3.000	4.000
160	180	0.140	0.200	0.200	0.260	0.260	0.340	9	13	12	17	16	21	1.300	1.700	3.200	4.200
180	200	0.160	0.220	0.220	0.290	0.290	0.370	11	16	15	20	20	26	1.400	2.000	3.500	5.000
200	225	0.180	0.250	0.250	0.320	0.320	0.410	12	17	17	22	22	28	1.600	2.200	4.000	5.500
225	250	0.200	0.270	0.270	0.350	0.350	0.450	14	19	18	24	24	31	1.700	2.400	4.200	6.700

Practical measurement of clearance to within 1/1000 of an mm by means thickness shims. For values smaller than 4/100th of an mm, use peel shims.

Bearing mounting criteria



The residual clearance of the bearing must be checked after fitting. This check is vital for bearings with a tapered bore. Relation between the axial displacement 'a' of a tapered bore bearing and the corresponding reduction in its radial clearance, Δ Jr:

taper 1:12 $a = 12 \Delta Jr / ti$

taper 1:30 $a = 30 \Delta Jr / ti$

a: axial displacement

Δ Jr: reduction in radial clearance

ti: repercussion factor for the interference fit of the inner ring

ti= 0.75 if the bearing is mounted directly on a tapered seat of a solid shaft
ti = 0.7 if the bearing is mounted on a tapered adapter sleeve

Axial load

Double-row spherical roller bearings can withstand axial loads. It is recommended not to exceed a value of:

$Fa / Fr = 0,6$

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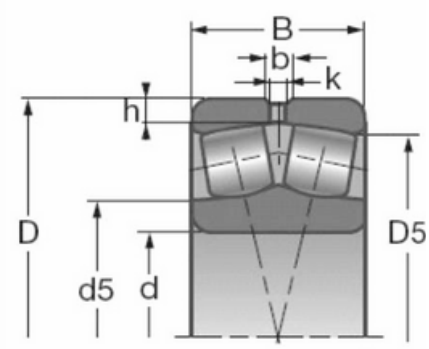

Shaft Ø d	Designation	Dimendions					Basic capacities	
		D	B	b	k	h	Dynamic Cr	Static Cor
mm		mm	mm	mm	mm	mm	kN	kN
25	22205 EAB33	52	18	3	1.5	2.8	54.4	46.1
	21305	62	17			3.5	48.5	37.5
30	22206 EAB33	62	20	4.4	2	2.8	72	64.5
	21306	72	19			3.5	63	50
35	22207 EAB33	72	23	4.9	2	3.5	95.4	92
	21307	80	21			4.5	79	66
40	22208 EAB33	80	23	5.4	2.5	3.5	110	105
	21308	90	23			4.5	96	84
	22308 EAB33	90	33	5.9	3	4.5	161	152
45	22209 EAB33	85	23	5.8	2.5	3.5	115	113
	21309	100	25			4.5	119	106
	22309 EAB33	100	36	6.4	3	4.5	196	187
50	22210 EAB33	90	23	5.8	2.5	3.5	124	124
	21310	110	27			5.5	137	128
	22310 EAB33	110	40	7.4	3.5	5.5	237	232
55	22211 EAB33	100	25	6.3	3	4.5	147	148
	21311	120	29			5.5	167	158
	22311 EAB33	120	43	7.8	3.5	5.5	282	274
60	22212 EAB33	110	28	6.9	3.0	4.5	178	181
	21312	130	31			6	186	179
	22312 EAB33	130	46	8.7	4	6	323	319
65	22213 EAB33	120	31	7.8	3.5	4.5	215	224
	21313	140	33			6	224	215
	22313 EAB33	140	48	9.2	4	6	351	343
70	22214 EAB33	125	31	7.4	3.5	4.5	224	240
	21314	150	35			6	246	240
	22314 EAB33	150	51	10.4	5	6	400	396
75	22215 EAB33	130	31	7.4	3.5	4.5	232	249
	21315	160	37			6	280	275
	22315 EAB33	160	55	10.3	5	6	467	467
80	22216 EAB33	140	33	7.9	3.5	5.5	265	287
	21316	170	39			6	305	305
	22316 EAB33	170	58	10.4	5	6	515	522
85	22217 EAB33	150	36	7.9	3.5	5.5	308	330
	21317	180	41			7	355	365
	22317 EAB33	180	60	11	5	7	570	604

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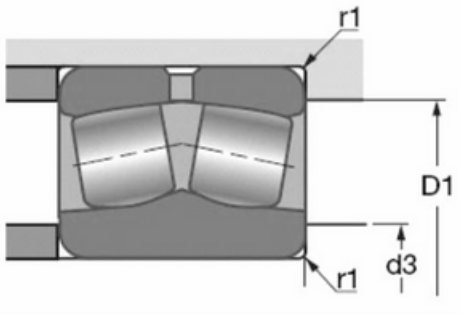

e	Factors			Speed limit			Abutment dimensions				Weight approx.
	Y		Y0	greese	oil	d_5 ~	d_3 min.	D_1 max.	d_5 ~	r1 max.	
	Fa/Fr ≤ e	Fa/Fr > e		rpm	rpm	mm	mm	mm	mm	mm	kg
0.34	2	2.98	1.96	8 600	11 000	30	30	47	46	1	0.170
0.29	2.33	3.47	2.28	6 800	9 100	34	32	55	52	1.1	0.257
0.31	2.15	3.2	2.1	7 200	9 300	37	36	57	55	1	0.272
0.28	2.45	3.64	2.39	5 800	7 700	40	37	65	60	1.1	0.394
0.31	2.21	3.29	2.16	6 100	7 900	45	42	66	63	1.1	0.440
0.27	2.48	3.69	2.42	5 200	6 900	46	44	71	68	1.5	0.513
0.27	2.47	3.67	2.41	5 500	7 100	50	47	74	71	1.1	0.515
0.26	2.55	3.8	2.5	4 500	6 100	53	49	81	76	1.5	0.715
0.36	1.87	2.79	1.83	4 100	5 300	52	49	83	78	1.5	1.006
0.26	2.64	3.93	2.58	5 100	6 600	54	52	79	76	1.1	0.565
0.26	2.64	3.93	2.58	4 100	5 400	59	54	91	85	1.5	0.949
0.36	1.9	2.83	1.86	3 700	4 800	58	54	93	87	1.5	1.352
0.24	2.84	4.23	2.78	4 800	6 200	59	57	84	81	1.1	0.603
0.25	2.71	4.04	2.65	3 700	4 900	66	61	99	93	2	1.251
0.36	1.87	2.79	1.83	3 400	4 400	63	61	101	95	2	1.810
0.23	2.95	4.4	2.89	4 300	5 500	66	64	93	90	1.5	0.823
0.24	2.82	4.2	2.76	3 300	4 500	73	66	109	102	2	1.537
0.36	1.87	2.79	1.83	3 100	4 000	68	66	111	104	2	2.290
0.24	2.84	4.23	2.78	3 900	5 100	71	69	103	99	1.5	1.134
0.24	2.81	4.19	2.75	3 100	4 100	79	72	118	110	2.1	1.986
0.35	1.95	2.9	1.91	2 900	3 700	75	72	120	113	2.1	2.804
0.24	2.79	4.15	2.73	3 600	4 700	78	74	113	107	1.5	1.512
0.23	2.91	4.33	2.84	2 900	3 800	85	77	128	120	2.1	2.410
0.33	2.06	3.06	2.01	2 700	3 400	81	77	130	122	2.1	3.413
0.22	3.01	4.48	2.94	3 400	4 400	84	79	118	113	1.5	1.586
0.23	2.9	4.31	2.83	2 700	3 600	91	82	138	127	2.1	2 990
0.34	2	2.98	1.96	2 500	3 200	85	82	140	131	2.1	4 176
0.22	3.14	4.67	3.07	3 200	4 200	88	84	123	118	1.5	1.644
0.23	2.94	4.37	2.87	2 500	3 400	97	87	148	137	2.1	3.590
0.34	2	2.98	1.96	2 300	3 000	91	87	150	139	2.1	5.083
0.22	3.14	4.67	3.07	3 000	3 900	94	91	131	127	2	2.071
0.23	2.95	4.4	2.89	2 400	3 200	104	92	158	145	2.1	4.260
0.34	2	2.98	1.96	2 200	2 800	98	92	160	148	2.1	6 030
0.22	3.07	4.57	3	2 800	3 600	100	96	141	137	2	2.560
0.23	2.99	4.46	2.93	2 200	3 000	111	99	166	154	3	5.230
0.32	2.09	3.11	2.04	2 000	2 600	107	99	166	157	3	7.061

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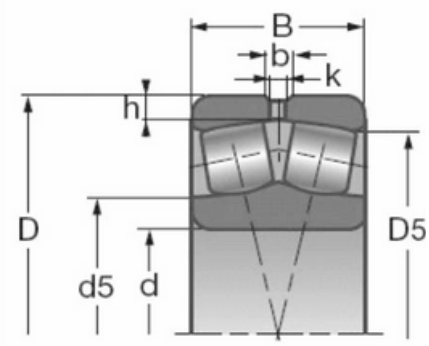
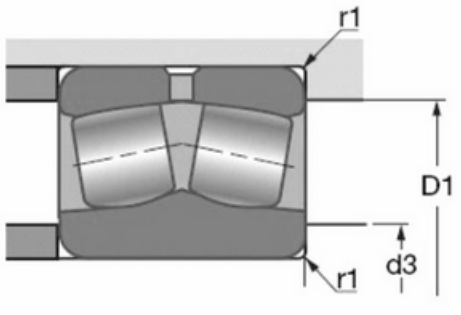


Shaft Ø d	Designation	Dimendions					Basic capacities	
		D	B	b	k	h	Dynamic Cr	Static Cor
mm		mm	mm	mm	mm	mm	kN	kN
90	22218 EAB33	160	40	10.2	4.5	5.5	366	398
	21318	190	43			7	385	400
	22318 EAB33	190	64	11.56	5	7	636	652
95	22219 EAB33	170	43	9.93	4.5	6	395	417
	22319 EAB33	200	67	12.15	6	7	696	751
100	22220 EAB33	180	46	11.2	5	6	449	495
	22320 EAB33	215	73	13.3	6	7	787	844
110	22222 EAB33	200	53	12.2	6	6	573	643
	22322 EAB33	240	80	15.6	7	7	928	972
120	22224 EAB33	215	58	12.16	6	6	654	753
130	22226 EAB33	230	64	13.21	6	7	768	898
140	22228 EAB33	250	68	14.18	7	7	867	1 010

DOUBLE-ROW SPHERICAL ROLLER BEARINGS



e	Factors			Speed limit			Abutment dimensions				Weight approx.
	Y		Y0	greese	oil	d_5 ~	d_3 min.	D_1 max.	d_5 ~	r1 max.	
	Fa/Fr ≤ e	Fa/Fr > e		rpm	rpm	mm	mm	mm	mm	mm	kg
0.23	2.9	4.31	2.83	2 700	3 500	105	101	151	144	2	3.283
0.23	3	4.47	2.93	2 100	2 800	117	104	176	162	3	6.110
0.33	2.06	3.06	2.01	1 900	2 500	110	104	176	166	3	8.285
0.23	2.95	4.4	2.89	2 500	3 200	110	107	158	153	2.1	3.950
0.32	2.09	3.11	2.04	1 800	2 300	120	109	186	174	3	9.890
0.24	2.84	4.23	2.78	2 400	3 100	118	112	170	161	2.1	4.900
0.34	1.98	2.94	1.93	1 700	2 200	127	114	201	187	3	12.470
0.25	2.69	4	2 63	2 200	2 800	130	122	190	179	2.1	6.929
0.31	2.09	3.11	2.04	1 600	2 000	139	124	226	209	3	16.870
0.25	2.74	4.08	2.68	1 900	2 500	141	132	203	193	2.1	8.693
0.25	2.69	4	2.63	1 800	2 400	151	144	216	206	3	10.771
0.25	2.74	4.08	2.68	1 700	2 200	163	154	236	224	3	14.200

N R B I N D U S T R I A L B E A R I N G S L T D.

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