



12.11 BEARINGS FOR RAILWAY APPLICATIONS

The rail industry is a promising field world-wide. Dunlop BTL therefore dedicates special attention to bearings for rail vehicles. The product range of these bearings includes bearings for various types of drives, pumps, and fans, as well as for rail vehicle axles. Traction motors of electrical locomotives and driving electrical units are a special category. Dunlop BTL is expanding its product line by the addition of compact tapered units as well as conventional and electrically insulated bearings for traction motors. Aside from special bearings, Dunlop BTL offers additional technical support in this industry through servicing. We recommend that the customer consults delivery conditions of manufactured bearings with Dunlop BTL qualified personnel.

Axle bearings

The development and production of Dunlop BTL railway bearings meet CSN EN 12080 and UIC 510-1 standard requirements. Bearings are designed using modern engineering and computer programs. Parameters are verified through rigorous testing of bearings at testing stations according to Dunlop BTL methodology, UIC 515-5 and CSN EN 12082 standards.

Cylindrical roller bearings

They are particularly suitable for transferring high radial loads as well as shock axial loads at high revolution speeds. They are manufactured in pairs that comprise two single row bearings. The internal bearings are designed with a single flange on the inner ring (NJ). The external bearing is designed with an inner ring and without a fixed flange. This bearing includes an independent guiding collar, which attaches from the external side of the bearing pair.

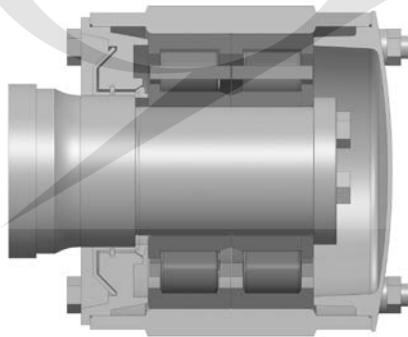


Fig. 12.11.1

The bearings correspond in design to bearings with international markings:

NJ/NJP (WJ/WJP) 120x240	Dunlop BTL: PLC 410-13/14 or PLC 410-13/14.2, resp.
NJ/NJP (WJ/WJP) 130x240	Dunlop BTL: PLC 410-33/34.2



PLC 410-15/16 (PLC 410-15/16.2) bearings differ from PLC 410-33/34 bearings in the diameter of the inner ring raceway (parameter F in the catalogue table). These bearings are not interchangeable except in those applications approved in the customer documentation.

Cylindrical roller bearings have an optimized internal design for capturing dynamic forces both in a radial and axial direction and for ensuring perfect lubrication under all operating conditions.

Bearings are manufactured with a massive brass cage or plastic cage. Bearings with a plastic cage are marked with index 2 to differentiate the markings. Massive plastic cages (fig. 12.11.2) meet the most demanding operating requirements for railway vehicles. They are made from fibre glass reinforced polyamide PA66-GF25.

The bearing arrangement according to fig. 12.11.1 is an advantage, because it allows separate installation of inner rings on the journal and outer rings with rollers in the bearing housing. Recommended loading tolerances are provided in table 12.11.1.

Table 12.11.1

Component		Diameter tolerances	Shape and position deviations
journal	$\varnothing d_1$	t7	7
journal	$\varnothing d$	p6	5
housing	$\varnothing D$	H7	6

The grease type for the particular application is determined by the operator upon receiving consent from the bearing manufacturer.

Bearings are also manufactured with a reduced inner ring bore diameter for use on axles with re-machined journals. Bearings are marked with an index rating. The parameters of all bearings, including clearances and speeds, for which the bearings are structurally designed, are specified in the catalogue tables.

Tabered bearing units

These are special double row tapered roller bearings for supporting axles of high-speed personal and commercial rail vehicles (fig. 12.11.3).



Fig. 12.11.2



Fig. 12.11.3



Bearings consist of a common outer ring, two internal rings, and two rows of tapered rolls with cages made from fibreglass reinforced polyamide PA66-GF25. Bearing rings are surface treated with zinc phosphate. The optimum axial clearance of the bearings is set and the bearings are supplied prepared for direct installation. The internal space is sealed using special seals or covers that ensure reliable operation of bearings. The service intervals for bearings are determined according to the rail vehicle operating conditions and servicing of bearings is performed by the manufacturer. Installation and removal of these units for railway vehicle axles is easy, quick, and safe with the use of hydraulic equipment. Installation instructions are issued for installing bearings in individual loadings.

The bearings correspond in design to bearings with international markings:

TBU (CTBU) 130x230 Dunlop BTL: PLC 810-13

TBU 130x210 Dunlop BTL: PLC 810-15

Bearing alternatives for various loadings differ from the basic marking in their index rating, which comprises a number or combination of number and letter.

Spherical roller bearings

They are suitable for handling large radial forces. Their design also enables simultaneous transfer of substantial axial loads in both directions. The bearings are inclined; they are thus able to compensate for some misalignment or shaft deflection. These characteristics make them very suitable for all heavy load applications. In addition to axle loadings, particularly of older types of railway vehicles, these bearings are used, for example, in gearboxes and fan drives.

Bearings are manufactured with a massive brass cage (M, EMH) and increased radial clearance in line with special technical conditions.

Calculations

The equations specified in chapter 5.5 Basic durability equations apply for bearing durability calculations. To properly determine the equivalent load P of dynamically loaded axle bearings, we recommend the use of auxiliary load factors, where are 1.2 to 1.3 for personal wagons, 1.2 to 1.4 for freight wagons, and 1.3 to 1.8 for driving vehicles.

Bearings for traction motors

Bearings for traction motors are designed to meet demands for efficiency, high durability, and reliability. Traction motor bearings work under heavy-duty operating conditions with high loads and rotation speeds. They may consequently be manufactured with a higher degree of precision (P6, P5) and with increased radial clearance (C3, C4). The thermal treatment of bearing rings guarantees stability of component dimensions during operation at higher temperatures. The internal design of bearings ensures their high axial load-bearing capacity during operation. Bearings are manufactured with a solid brass cage that is guided along rolling elements (M) or along an external ring (MA). The cage and guiding surfaces are designed to provide optimal lubrication and low generation of heat.

Traction motor bearings are usually single row ball bearings, for supporting reduced radial loads and high speed operation, or single row roller bearings for supporting high radial loads. Roller bearings are also used for loadings that enable axial displacement of components due to thermal dilatation of dimensions.



Traction motor bearings are supplied in a non-insulated version with an insulated ceramic Al_2O_3 coating that prevents the passage of electrical current through the bearing and prevents the formation of damage to raceways and the lubricant. The resistance of the coating is guaranteed up to 1 000 V DC. The suffix for bearings with this insulation coating on the outer ring is TM01. Information about the ceramic coating is provided in the chapter on electrically insulated bearings in the chapter Special bearings. For more detailed information, refer to the Dunlop BTL Technical and Consultation Services Department.



Fig. 12.11.4

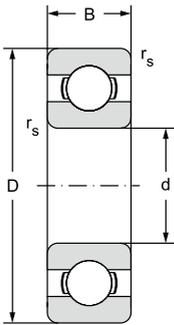
Recommended loading tolerances are provided in table 12.11.2.

Table 12.11.2

	Shaft diameter			Bore diameter	
	Ball	Roller	Tolerances		Tolerances
Fans	80-100	up to 40	j6		J7
Generators	100-200	40-140	k6		K7
Electric motors	18-100	up to 40	k5		M7
	100-200	40-140	m5		
	140-200	100-140	m6		
Traction motors		50-140	n6*		H7
		140-500	p6		

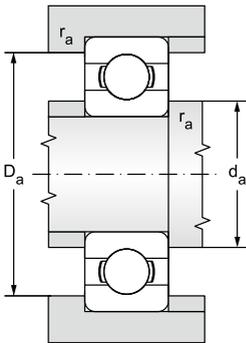


Single row ball bearings for traction motors d = 65 to 150 mm



12.11.1

d	Main dimensions			Basic load rating		Fatigue load limit
	D	B	r _s	Dynamic C _r	Static C _{or}	P _u
mm				kN		kN
65	100	18,0	1,1	30,50	25,10	1,141
	120	23,0	1,5	57,20	40,01	1,891
70	110	20,0	1,1	37,96	30,96	1,407
	125	24,0	1,5	62,00	43,80	2,016
75	115	20,0	1,1	39,75	33,17	1,547
	130	25,0	1,5	66,18	49,31	2,214
80	125	22,0	1,1	47,50	39,80	1,787
	140	26,0	2,0	72,20	53,10	2,301
	170	37,0	2,1	122,85	86,23	3,506
85	150	28,0	2,0	83,30	63,68	2,670
	180	41,0	3,0	132,51	96,07	3,794
90	160	30,0	2,0	96,20	70,80	2,878
	190	43,0	3,0	144,00	108,00	4,149
95	170	32,0	2,1	108,00	81,00	3,199
	200	45,0	3,0	152,44	117,37	4,393
100	180	34,0	2,1	123,00	92,60	3,557
	215	47,0	3,0	174,00	141,00	5,107
110	200	38,0	2,1	144,00	117,00	4,272
	240	50,0	3,0	203,00	180,00	6,185
120	215	40,0	2,1	144,00	117,00	4,109
	260	55,0	3,0	208,00	186,00	6,134
130	230	40,0	3,0	156,00	132,00	4,472
	280	58,0	4,0	229,00	216,00	6,857
140	250	42,0	3,0	166,00	150,00	4,883
	300	62,0	4,0	251,00	245,00	7,508
150	270	45,0	3,0	190,00	181,00	5,677
	320	65,0	4,0	276,00	285,00	8,451



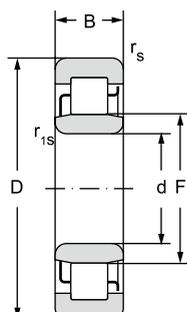
Limiting speed for lubrication with		Bearing designation		Abutment and fillet dimensions			Weight
grease	oil		electrically insulated	d _a min	D _a max	r _a max	~
min ⁻¹				mm			kg
6300	7500	6013M	6013M TM01	70,0	93,0	1,0	0,44
5300	6300	6213M	6213M TM01	72,0	111,0	1,5	1,00
5600	6700	6014M	6014M TM01	75,0	103,0	1,0	0,61
5300	6300	6214M	6214M TM01	77,0	116,0	1,5	1,07
5300	6300	6015M	6015M TM01	80,0	108,0	1,0	0,65
5000	6000	6215M	6215M TM01	82,0	122,0	1,5	1,18
5000	6000	6016M	6016M TM01	85,0	118,0	1,0	0,87
4700	5600	6216M	6216M TM01	90,0	130,0	2,0	1,40
4000	4700	6316M	6316M TM01	91,0	158,0	2,0	3,63
4200	5000	6217M	6217M TM01	95,0	140,0	2,0	1,80
3800	4500	6317M	6317M TM01	98,0	166,0	2,5	4,20
4000	4700	6218M	6218M TM01	100,0	150,0	2,0	2,16
3500	4200	6318M	6318M TM01	103,0	176,0	2,5	4,95
3800	4500	6219M	6219M TM01	107,0	158,0	2,0	2,60
3300	4000	6319M	6319M TM01	109,0	186,0	2,5	5,72
3500	4200	6220M	6220M TM01	112,0	169,0	2,0	3,13
3200	3800	6320M	6320M TM01	113,0	201,0	2,5	7,07
3200	3800	6222M	6222M TM01	122,0	188,0	2,0	4,37
2600	3200	6322M	6322M TM01	123,0	227,0	2,5	9,58
3000	3500	6224M	6224M TM01	132,0	203,0	2,0	5,15
2500	3000	6324M	6324M TM01	134,0	246,0	2,5	12,5
2600	3100	6226M	6226M TM01	144,0	216,0	2,5	5,75
2350	2800	6326M	6326M TM01	147,0	263,0	3,0	15,2
2500	3000	6228M	6228M TM01	154,0	236,0	2,5	7,56
2350	2800	6328M	6328M TM01	157,0	283,0	3,0	21,8
2200	2700	6230M	6230M TM01	164,0	256,0	2,5	9,85
2000	2400	6330M	6330M TM01	167,0	303,0	3,0	24,0



Single row cylindrical roller bearings for traction motors d = 35 to 150 mm



NJ

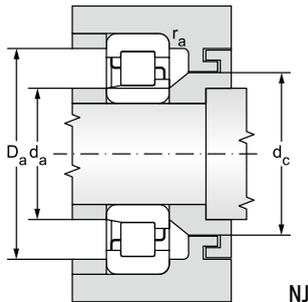


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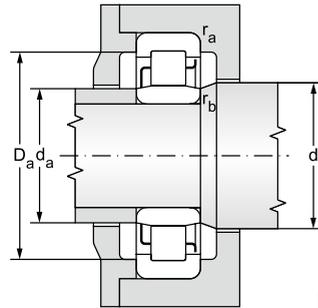
d = 35 to 90 mm

12.11.2

Main dimensions							Basic load rating		Fatigue load limit	Limiting speed for lubrication with	
d	D	B	r _s min	r _{1s} min	F	s ₁	dynamická C _r	statická C _{or}	P _u	grease	oil
mm							kN		kN	min ⁻¹	
35	62	14,00	1,0	0,6	42,000	1,0	22,6	23,2	2,83	11000	13000
40	68	15,00	1,0	0,6	47,000	1,0	27,3	29,0	3,54	10000	12000
45	75	16,00	1,0	0,6	52,500	1,0	32,5	35,5	4,33	9000	11000
50	80	16,00	1,0	0,6	57,500	1,5	32,0	36,0	4,39	8000	10000
55	90	18,00	1,1	1,0	64,500	1,5	37,5	44,0	5,37	7500	9000
60	95	18,00	1,1	1,0	69,500	2,0	41,0	51,0	6,22	6700	8500
65	100	18,00	1,1	1,0	74,500	2,0	44,0	57,0	6,95	6300	8000
70	110	20,00	1,1	1,0	80,000	2,0	59,0	71,0	8,66	6000	7100
	125	24,00	1,5	1,5	83,500	1,6	119,0	137,0	16,71	5000	6300
	125	24,00	1,5	1,5	83,500	1,6	119,0	137,0	16,71	5000	6300
	150	35,00	2,1	2,1	89,000	1,5	205,0	222,0	26,31	4000	5000
	150	35,00	2,1	2,1	89,000	1,5	205,0	222,0	26,31	4000	5000
75	115	20,00	1,1	1,0	85,000	2,5	60,0	74,5	9,23	5600	6700
	130	25,00	1,5	1,5	88,500	1,6	130,0	156,0	18,88	4800	6000
	130	25,00	1,5	1,5	88,500	1,6	130,0	156,0	18,88	4800	6000
	160	37,00	2,1	2,1	95,000	1,5	240,0	263,0	30,56	3800	4800
	160	37,00	2,1	2,1	95,000	1,5	240,0	263,0	30,56	3800	4800
80	125	22,00	1,1	1,0	91,500	2,5	72,5	90,5	10,96	5300	6300
	140	26,00	2,0	2,0	95,300	2,0	139,0	167,0	19,79	4500	5300
	140	26,00	2,0	2,0	95,300	2,0	139,0	167,0	19,79	4500	5300
	170	39,00	2,1	2,1	101,000	1,5	256,0	282,0	32,16	3600	4300
	170	39,00	2,1	2,1	101,000	1,5	256,0	282,0	32,16	3600	4300
85	150	28,00	2,0	2,0	100,500	2,0	167,0	199,0	23,12	4300	5000
	150	28,00	2,0	2,0	100,500	2,0	167,0	199,0	23,12	4300	5000
	180	41,00	3,0	3,0	108,000	2,0	291,0	330,0	36,99	3300	4000
	180	41,00	3,0	3,0	108,000	2,0	291,0	330,0	36,99	3300	4000
90	160	30,00	2,0	2,0	107,000	2,0	182,0	217,0	24,75	4000	4800
	160	30,00	2,0	2,0	107,000	2,0	182,0	217,0	24,75	4000	4800
	190	43,00	3,0	3,0	113,500	2,0	315,0	355,0	39,14	3200	3800
	190	43,00	3,0	3,0	113,500	2,0	315,0	355,0	39,14	3200	3800



NJ



NU

¹⁾ Admissible axial movement

Bearing designation		Abutment and fillet dimensions							Weight
	electrically insulated	d	d _a min	d _a max	d _b min	D _a max	r _a max	r _b max	~
mm									
kg									
NU1007M	NU1007M TM01	35	38,2	41,0	44,0	56	1,0	0,6	0,18
NU1008M	NU1008M TM01	40	43,2	45,0	49,0	63,4	1,0	0,6	0,23
NU1009M	NU1009M TM01	45	48,2	51,0	54,0	70,4	1,0	0,6	0,28
NU1010M	NU1010M TM01	50	53,2	56,0	60,0	75,4	1,0	6,0	0,30
NU1011M	NU1011M TM01	55	59,6	63,0	67,0	84	1,0	1,0	0,45
NU1012M	NU1012M TM01	60	64,6	68,0	72,0	89	1,0	1,0	0,48
NU1013M	NU1013M TM01	65	69,6	72,0	77,0	94	1,0	1,0	0,52
NU1014M	NU1014M TM01	70	74,6	78,0	82,0	104	1,0	1,0	0,70
NU214EM	NU214EM TM01		77	82,0	86,0	116	1,5	1,5	1,30
NJ214EM	NJ214EM TM01		77	82,0	86,0	116	1,5	1,5	1,30
NU314EM	NU314EM TM01		81	85,0	92,0	138	2,0	2,0	3,10
NJ314EM	NJ314EM TM01		81	85,0	92,0	138	2,0	2,0	3,10
NU1015M	NU1015M TM01	75	79,6	83,0	87,0	109	1,0	1,0	0,74
NU215EM	NU215EM TM01		82	85,0	90,0	121	1,5	1,5	1,50
NJ215EM	NJ215EM TM01		82	85,0	90,0	121	1,5	1,5	1,50
NU315EM	NU315EM TM01		86	93,0	97,0	148	2,0	2,0	3,70
NJ315EM	NJ315EM TM01		86	93,0	97,0	148	2,0	2,0	3,70
NU1016M	NU1016M TM01	80	86	90,0	94,0	119	1,0	1,0	1,00
NU216EM	NU216EM TM01		90	92,0	97,0	130	2,0	2,0	1,70
NJ216EM	NJ216EM TM01		90	92,0	97,0	130	2,0	2,0	1,70
NU316EM	NU316EM TM01		99	97,0	105,0	158	2,0	2,0	4,50
NJ316EM	NJ316EM TM01		99	97,0	105,0	158	2,0	2,0	4,50
NU217EM	NU217EM TM01	85	95	99,0	104,0	140	2,0	2,0	2,10
NJ217EM	NJ217EM TM01		95	99,0	104,0	140	2,0	2,0	2,10
NU317EM	NU317EM TM01		98	103,0	110,0	166	2,5	2,5	5,30
NJ317EM	NJ317EM TM01		98	103,0	110,0	166	2,5	2,5	5,30
NU218EM	NU218EM TM01	90	100	105,0	109,0	150	2,0	2,0	2,60
NJ218EM	NJ218EM TM01		100	105,0	109,0	150	2,0	2,0	2,60
NU318EM	NU318EM TM01		103	110,0	116,0	176	2,5	2,5	6,10
NJ318EM	NJ318EM TM01		103	110,0	116,0	176	2,5	2,5	6,10

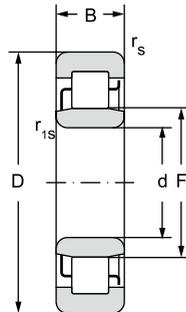


Single row cylindrical roller bearings for traction motors

d = 95 to 150 mm



NJ

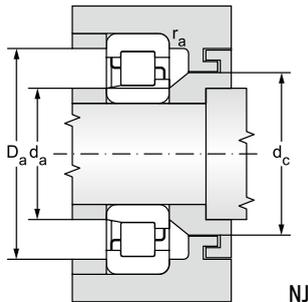


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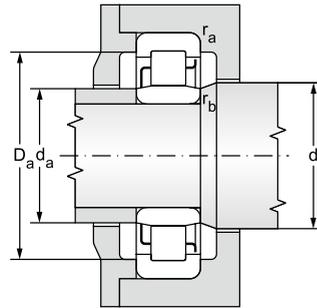
12.11.2

Main dimensions							Basic load rating		Fatigue load limit	Limiting speed for lubrication with	
d	D	B	r _s min	r _{1s} min	F	s ₁	dynamická C _r	statická C _{or}	P _u	grease	oil
mm							kN		kN	min ⁻¹	
95	170	32,00	2,1	2,1	112,500	2,0	220,0	265,0	29,70	3800	4500
	170	32,00	2,1	2,1	112,500	2,0	220,0	265,0	29,70	3800	4500
	200	45,00	3,0	3,0	121,500	1,9	335,0	385,0	41,78	3000	3600
	200	45,00	3,0	3,0	121,500	1,9	335,0	385,0	41,78	3000	3600
100	180	34,00	2,1	2,1	119,000	2,0	249,0	305,0	33,62	3600	4300
	180	34,00	2,1	2,1	119,000	2,0	249,0	305,0	33,62	3600	4300
	215	47,00	3,0	3,0	127,500	2,0	380,0	425,0	45,23	2800	3400
	215	47,00	3,0	3,0	127,500	2,0	380,0	425,0	45,23	2800	3400
110	240	50,00	3,0	3,0	143,000	2,7	450,0	525,0	54,13	2600	3000
	240	50,00	3,0	3,0	143,000	2,7	450,0	525,0	54,13	2600	3000
120	260	55,00	3,0	3,0	154,000	2,7	530,0	610,0	61,36	2200	2800
	260	55,00	3,0	3,0	154,000	2,7	530,0	610,0	61,36	2200	2800
130	280	58,00	4,0	4,0	167,000	2,9	615,0	735,0	72,27	2200	2600
	280	58,00	4,0	4,0	167,000	2,9	615,0	735,0	72,27	2200	2600
140	300	62,00	4,0	4,0	180,000	2,7	665,0	795,0	76,53	2000	2400
	300	62,00	4,0	4,0	180,000	2,7	665,0	795,0	76,53	2000	2400
150	320	65,00	4,0	4,0	193,000	2,7	760,0	920,0	86,83	1800	2200
	320	65,00	4,0	4,0	193,000	2,7	760,0	920,0	86,83	1800	2200





NJ



NU

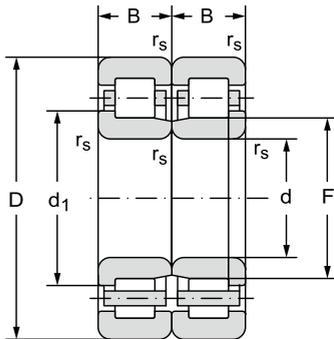
¹⁾ Admissible axial movement

Bearing designation		Abutment and fillet dimensions							Weight
	electrically insulated	d	d _a min	d _a max	d _b min	D _a max	r _a max	r _b max	~ kg
mm									
NU219EM	NU219EM TM01	95	107	111,0	116,0	158	2,0	2,0	3,20
NJ219EM	NJ219EM TM01		107	111,0	116,0	158	2,0	2,0	3,20
NU319EM	NU319EM TM01		109	119,0	124,0	186	2,5	2,5	7,10
NJ319EM	NJ319EM TM01		109	119,0	124,0	186	2,5	2,5	7,10
NU220EM	NU220EM TM01	100	112	117,0	122,0	168	2,0	2,0	3,80
NJ220EM	NJ220EM TM01		112	117,0	122,0	168	2,0	2,0	3,80
NU320EM	NU320EM TM01		113	125,0	132,0	201	2,0	2,0	8,60
NJ320EM	NJ320EM TM01		113	125,0	132,0	201	2,0	2,0	8,60
NU322EM	NU322EM TM01	110	124	135,0	145,0	226	2,5	2,5	11,8
NJ322EM	NJ322EM TM01		124	135,0	145,0	226	2,5	2,5	11,8
NU324EM	NU324EM TM01	120	134	145,0	156,0	246	2,5	2,5	15,0
NJ324EM	NJ324EM TM01		134	145,0	156,0	246	2,5	2,5	15,0
NU326EM	NU326EM TM01	130	148	155,0	169,0	262	3,0	3,0	18,7
NJ326EM	NJ326EM TM01		148	155,0	169,0	262	3,0	3,0	18,7
NU328EM	NU328EM TM01	140	158	166,0	182,0	282	3,0	3,0	23,0
NJ328EM	NJ328EM TM01		158	166,0	182,0	282	3,0	3,0	23,0
NU330EM	NU330EM TM01	150	168	185,0	195,0	302	3,0	3,0	27,0
NJ330EM	NJ330EM TM01		168	185,0	195,0	302	3,0	3,0	27,0



Special single row rolling bearings for railway vehicle axles

d = 118 to 130 mm



12.113

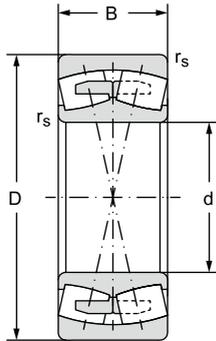
d	D	Main dimensions					Basic load rating		Fatigue load limit	
		B	r _s min	r _{1s} min	d ₁	d ₂	F	Dynamic C _r	Static C _{or}	P _u
mm									kN	kN
118	240	80	3	7,5	160,8		150	553	742	75,86
	240	80	3	7,5		160,8	150	553	742	75,86
119	240	80	3	7,5	160,8		150	553	742	75,86
	240	80	3	7,5		160,8	150	553	742	75,86
119,3	240	80	3	7,5	160,8		150	553	742	75,86
	240	80	3	7,5		160,8	150	553	742	75,86
120	200	62	2,1	2,1	148		140	371	565	57,76
	200	62	2,1	2,1		148	140	371	565	57,76
120	240	80	3	7,5	160,8		150	553	742	75,86
	240	80	3	7,5	160,8		150	553	742	75,86
120	240	80	3	7,5		160,8	150	553	742	75,86
	240	80	3	7,5		160,8	150	553	742	75,86
125	215	73	3	2,1	150,8		140,5	520	730	76,26
	215	73	3	2,1		150,8	140,5	520	730	76,26
127	240	80	3	7,5	170,5		159	517	752	76,25
	240	80	3	7,5		170,5	159	517	752	76,25
128	240	80	3	7,5	170,5		159	517	752	76,25
	240	80	3	7,5		170,5	159	517	752	76,25
129	240	80	3	7,5	170,5		159	517	752	76,25
	240	80	3	7,5		170,5	159	517	752	76,25
129	240	80	3	7,5	170,5		157	540	775	78,58
	240	80	3	7,5		170,5	157	540	775	78,58
129,3	240	80	3	7,5	170,5		157	540	775	78,58
	240	80	3	7,5		170,5	157	540	775	78,58
130	240	80	3	7,5	170,5		159	517	752	76,25
	240	80	3	7,5	170,5		159	517	752	76,25
130	240	80	3	7,5		170,5	159	517	752	76,25
	240	80	3	7,5		170,5	159	517	752	76,25
130	240	80	3	7,5	170,5		157	540	775	78,58
	240	80	3	7,5	170,5		157	540	775	78,58



Bearing designation	Maximum speed of rail vehicle	Radial clearance		Axial clearance		Weight	Precision class
		min.	max.	min.	max.		
	km.h ⁻¹	mm		mm		kg	
PLC 410-13.2.3	200	0,12	0,16	0,3	0,9	16,2	P6
PLC 410-14.2.3	200	0,12	0,16	0,3	0,9	16,2	P6
PLC 410-13.2.4	200	0,12	0,16	0,3	0,9	16,1	P6
PLC 410-14.2.4	200	0,12	0,16	0,3	0,9	16,1	P6
PLC 410-13.2.5	200	0,12	0,16	0,3	0,9	16,0	P6
PLC 410-14.2.5	200	0,12	0,16	0,3	0,9	16,0	P6
PLC 49-8	120	0,125	0,165	0,3	0,9	8,27	P0
PLC 49-9	120	0,125	0,165	0,3	0,9	8,27	P0
PLC 410-13	160	0,12	0,16	0,3	0,9	16,8	P6
PLC 410-13.2	200	0,12	0,16	0,3	0,9	16,0	P6
PLC 410-14	160	0,12	0,16	0,3	0,9	16,8	P6
PLC 410-14.2	200	0,12	0,16	0,3	0,9	16,0	P6
PLC 410-53.2	160	0,125	0,165	0,2	0,4	10,4	P0
PLC 410-54.2	160	0,125	0,165	0,2	0,4	10,4	P0
PLC 410-15.2.5	160	0,135	0,18	0,3	0,9	14,8	P0
PLC 410-16.2.5	160	0,135	0,18	0,3	0,9	14,8	P0
PLC 410-15.2.3	160	0,135	0,18	0,3	0,9	14,7	P0
PLC 410-16.2.3	160	0,135	0,18	0,3	0,9	14,7	P0
PLC 410-15.2.4	160	0,135	0,18	0,3	0,9	14,6	P0
PLC 410-16.2.4	160	0,135	0,18	0,3	0,9	14,6	P0
PLC 410-33.2.4	200	0,135	0,18	0,3	0,9	15,2	P6
PLC 410-34.2.4	200	0,135	0,18	0,3	0,9	15,2	P6
PLC 410-33.2.9	200	0,135	0,18	0,3	0,9	15,1	P6
PLC 410-34.2.9	200	0,135	0,18	0,3	0,9	15,1	P6
PLC 410-15	160	0,135	0,18	0,3	0,9	15,2	P0
PLC 410-15.2	160	0,135	0,18	0,3	0,9	14,5	P0
PLC 410-16	160	0,135	0,18	0,3	0,9	15,2	P0
PLC 410-16.2	160	0,135	0,18	0,3	0,9	14,5	P0
PLC 410-33.2	200	0,135	0,18	0,3	0,9	15,1	P6
PLC 410-34.2	200	0,135	0,18	0,3	0,9	15,1	P6



Double row spherical roller bearings for railway vehicle axles d = 100 to 190 mm



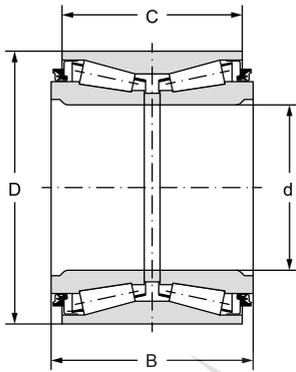
12.11.4	Main dimensions						Basic load rating		Fatigue load limit	Limiting speed for lubrication with	
	d	D	B	r _s min	a	b	Dynamic C _r	Static C _{or}	P _u	grease	oil
	mm						kN		kN	min ⁻¹	
100	180	60,3	2,1	4,5	8,3	390	532	67	1700	2000	
110	200	69,8	2,1	4,5	8,3	502	706	75,5	1500	1800	
120	215	76	2,1	4,5	8,3	750	1020	107	1500	1900	
	215	58	2,1	4,5	8,3	439	580	60,6	1600	1900	
130	230	80	3	6	11,1	636	948	96,9	1300	1600	
	280	93	4	7,5	13,9	904	1130	111	1300	1600	
140	210	53	2	4,5	8,3	511	781	80,5	1800	2400	
	250	68	3	6	11,1	605	822	82	1400	1700	
170	310	110	4	7,5	13,9	1280	1880	176	950	1300	
190	290	75	2,1	6	11,1	759	1310	123	940	1200	
	340	120	4	9	16,7	1550	2420	220	850	1100	



Bearing designation	Abutment and fillet dimensions			Weight	Factors			
	d_a min	D_a max	r_a max		e	Y_1	Y_2	Y_0
	mm			kg				
23220W33M	112	168	2	6,9	0,34	2	2,8	1,9
23222W33M	122	188	2	9,9	0,36	1,9	2,7	1,8
23224EW33MH	132	203	2	12,1	0,33	2	3	2
22224W33M	132	203	2	9,4	0,28	2,4	3,4	2,3
23226W33M	144	216	2,5	15	0,35	1,9	2,7	1,8
22326W33M	148	262	3	28,6	0,36	1,8	2,7	1,8
23028EW33MH	150	200	2	6,58	0,22	3	4,5	3
22228W33M	154	236	2,5	15	0,28	2,4	3,4	2,2
23234W33M	188	292	3	37,7	0,36	1,9	2,8	1,8
23038W33M	202	278	2	18,8	0,25	2,7	3,8	2,5
23238CW33M	208	322	3	47,7	0,36	1,9	2,8	1,9



Tapered bearing units TBU



12.11.5

Main dimensions				Basic load rating		Fatigue load limit
d	D	C	B	Dynamic C _r	Static C _{or}	P _u
mm				kN		kN
130	230	160	176,35	913	1620	165,62
	210	132	148	658	1260	131





Bearing designation	Equivalent	Maximum speed of rail vehicle	Weight
		max	
		km.h ⁻¹	kg
PLC 810-13	CTBU 130x230	160	31,7
PLC 810-15	CTBU 130x210	100	18

