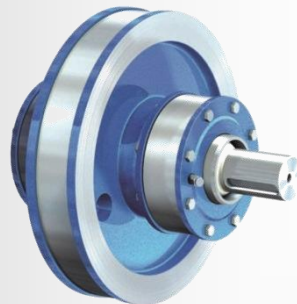




Sure to be Safe

Crane Wheels



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	page
General	4
Applications	4
Driven- and Non-Driven Assemblies with roller bearing similar to DIN 15090	4
codification of Wheels	5
Wheel shape codification	5
Shaft Types of driven Wheel Assemblies	6
Selection Parameter	6
Support of Wheel Assemblies	7
Dimensions and Nomenclature of Wheel Assemblies	8
Driven- & Non-Driven Assemblies with spherical roller bearing series 222	9
approx. Weights of Driven- & Non-Driven Wheel Assemblies	9
Parts List for Driven- & Non Driven Wheel Assemblies	10
Basics of Wheel Assembly Calculation (extract of DIN 15070)	11
Mating of materials Rail / Wheel	12
Rectified nominal life time of bearings L_{10h} in hours [h]	13
Example of calculation	14

General

Wheels are machine-components with load bearing function.

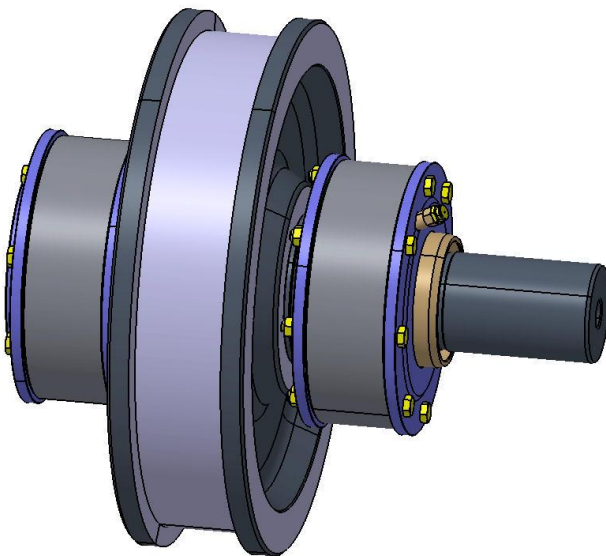
When selecting wheels and their material quality, a broad variety of options is available. Our production portfolio includes separate wheels of diameter 315 to 1000 mm as well as complete wheel assemblies similar to DIN, as per customer drawing or as design proposal approved by our customer.

SIBRE standard wheels are made of forged cylinders of material 42CrMo4V. For particularly high demands the wheels can be deep-hardened for reduced tread-wear.

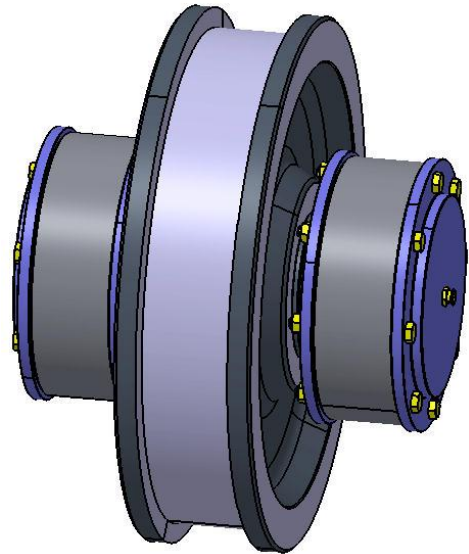
Applications

- Gantry Travel Drives
- Trolley Travel Drives
- Slewing Drives
- etc.

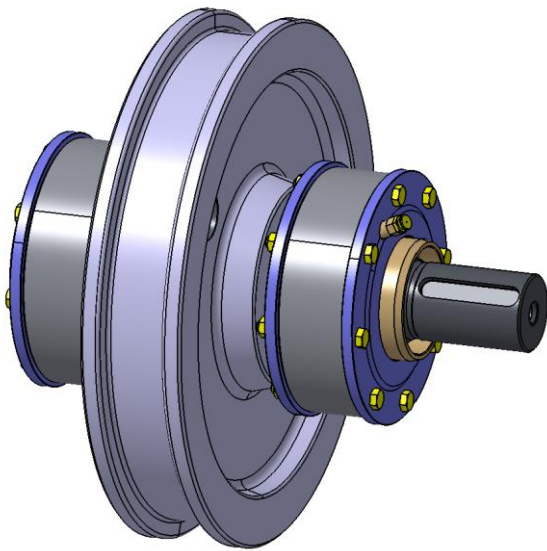
Driven- and Non-Driven Assemblies with roller bearing similar to DIN 15090



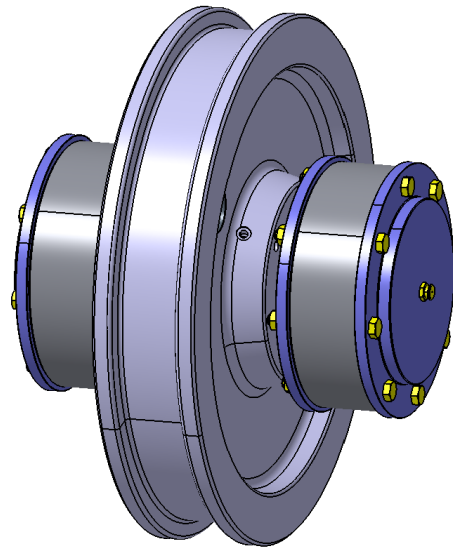
pict. 1:
Driven Wheel Assembly:
T- BHKE 500x90 Z 100x152 – 222



pict. 2:
Non-Driven Wheel Assembly:
M- BHKE 500x90 – 222



pict. 3:
Driven Wheel Assembly:
T- SHKD 500x90 P 90x132



pict. 4:
Non-Driven Wheel Assembly:
M- SHKD 500x90 – 222

codification of Wheels

T – BHKE 500x90 Z100x152 – 222

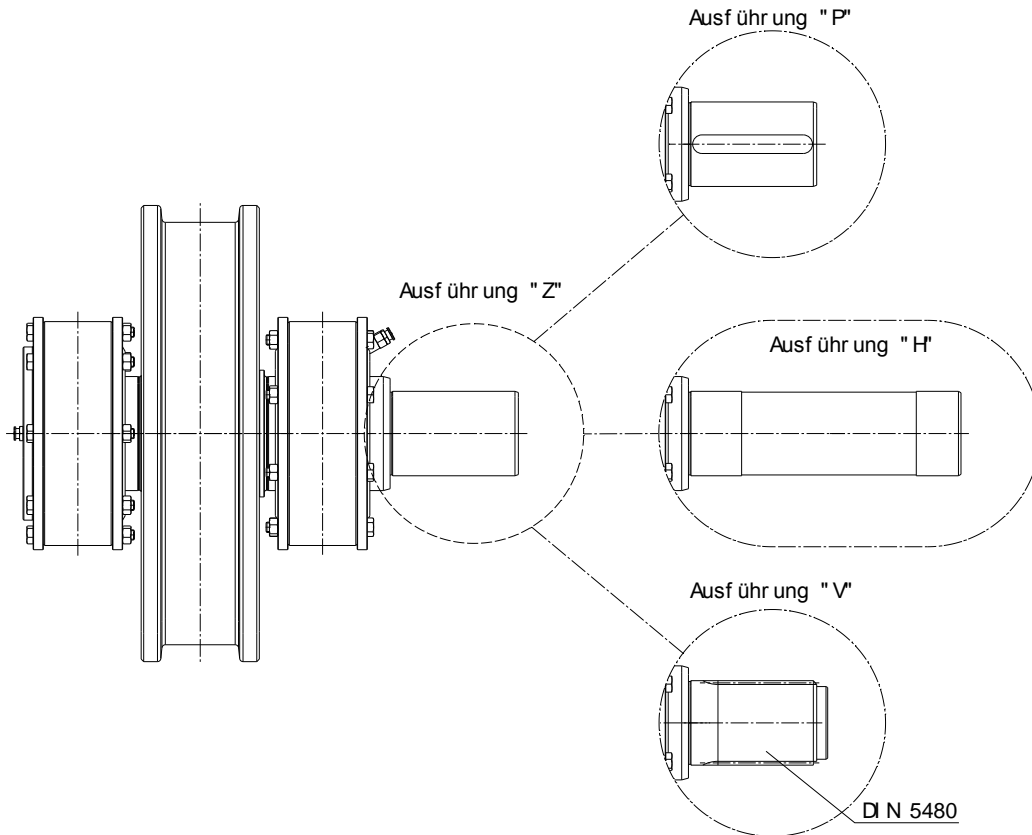


Wheel shape codification

code	meaning
S	narrow wheel
B	wide wheel
H	wheel with flanges
G	wheel without flanges
K	wheel without rim
D	with oil-pressure interference fit assembly
E	without oil-pressure interference fit assembly

Shaft Types of driven Wheel Assemblies

We supply driven wheel assemblies with shafts for any type of drive



pict. 5

- | | |
|---|--------|
| • with connecting shaft resp. coupling hub | type Z |
| • with key-way acc. DIN 6885 T1 | type P |
| • with gearing acc. DIN 5480 | type V |
| • with extended shaft for slide on gear box
with shrink disc | type H |

Selection Parameter

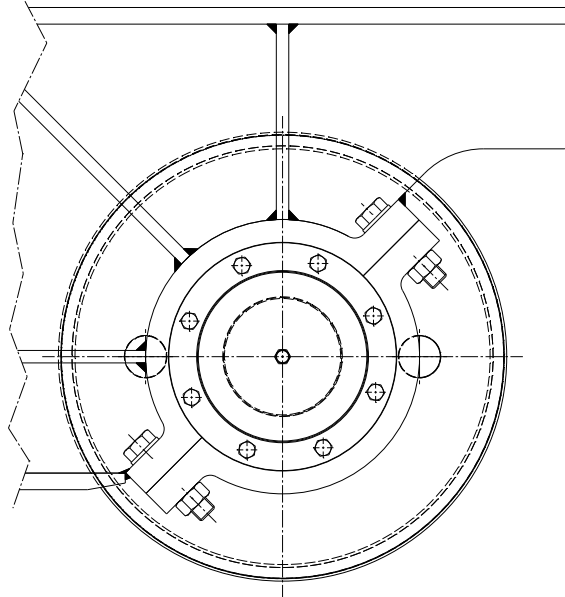
For an optimum selection, the following parameter must be indicated by the customer

- wheel load
- rail profile and material
- travelling speed, rotation speed
- life expectation
- ambient conditions
- available assembly dimensions
- wheel shape "B" (wide), "S" (narrow)
- type of shaft end for drive wheel assemblies

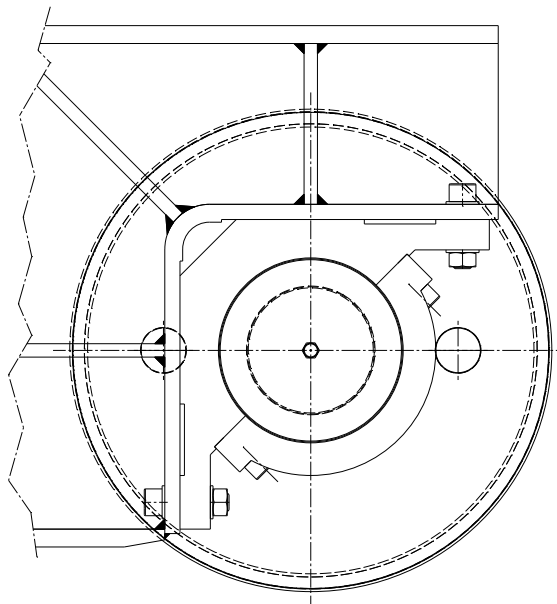
Wheel calculation is made acc. to DIN 15070 and the bearing calculation is made acc. to DIN 15071. Correlation of wheel profile and rail is selected acc. to DIN 15072.

Support of Wheel Assemblies

In parallel to the wheel assemblies with 45° split support (pict. 6), we can also supply driven- and non-driven wheel assemblies with rectangular split support (pict. 7) similar to TGL 34968.



pict. 6:
45° split support

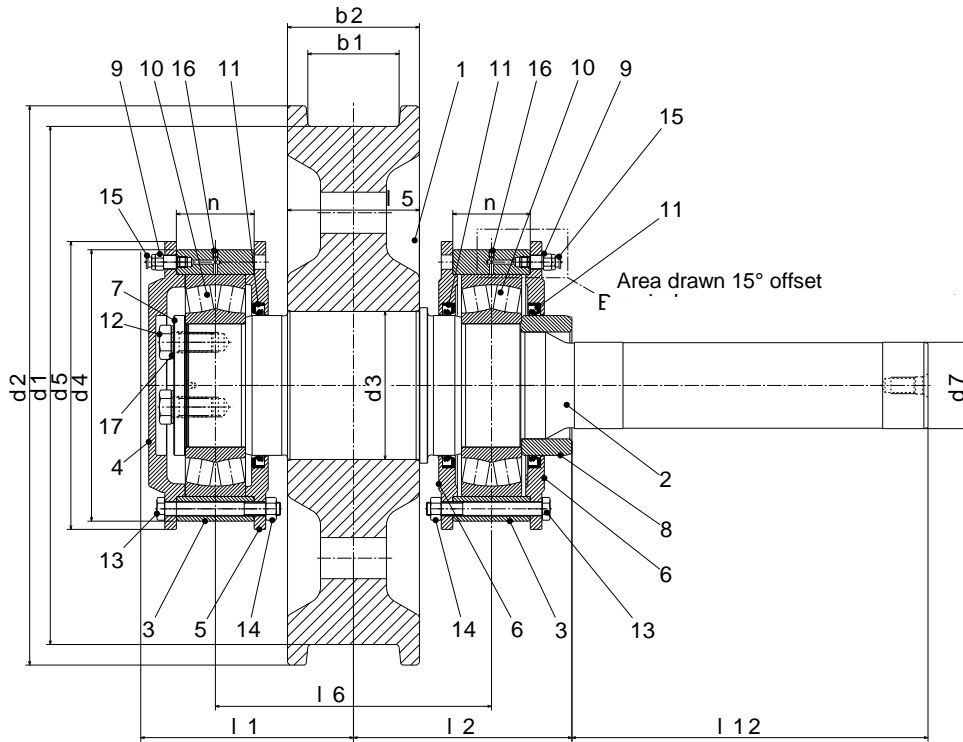


pict. 7:
rectangular split support

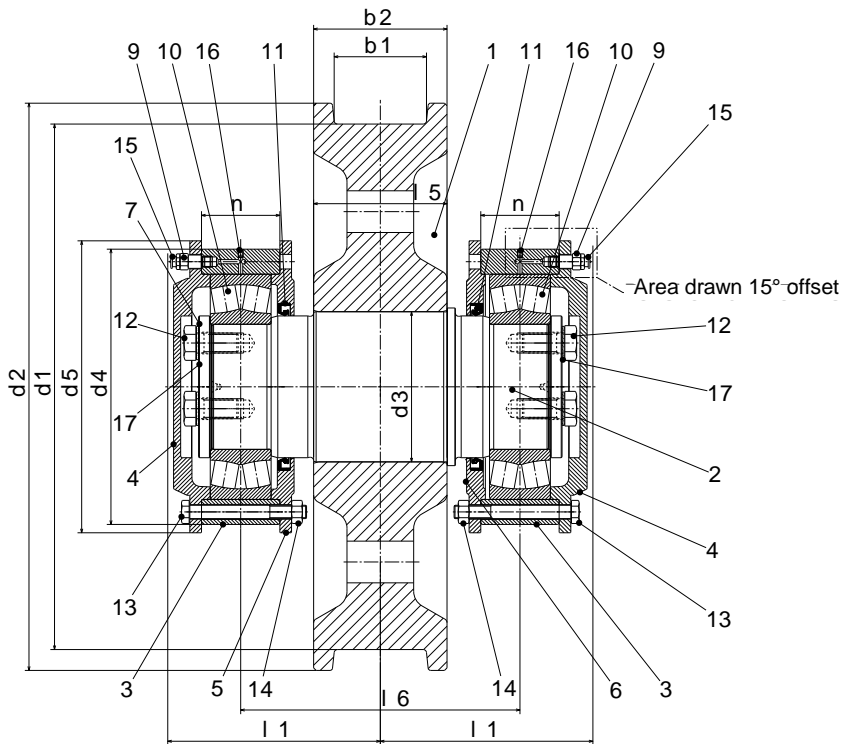
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Dimensions and Nomenclature of Wheel Assemblies



pict. 8:
driven wheel assembly type T-BHKE



pict. 9:
non-driven wheel type M-BHKE

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Dimensions and Nomenclature of Wheel Assemblies

d ₁ h ₉	dimensions and shape for wheels								l ₁ ≈	l ₆	n +0,15 +0,05	Roller bearings acc. DIN 635-2	dim's. only for driven wheel assemblies				
	Form ¹⁾	b ₁ ²⁾	b ₂ ⁶⁾	d ₂	d ₃ ³⁾	d ₄	d ₅	l ₅ ⁶⁾					h ₇	l ₂	d ₇ ⁴⁾	l ₁₂	d ₇ ⁴⁾
315	S	45-55	90	350	110	210	220	110	171	235	62	222 18	185	-	-	70	105
	B	55-65	110		120	230	240		173			222 20	190	70	105	80	120
400	S	55-65	110	440	120	230	240	140	188	265	62	222 20	205	70	105	80	120
	B	70-90	140		130	250	260		202			280	72	222 22	215	80	120
500	S	55-65	110	540	130	250	260	140	202	280	72	222 22	215	80	120	90	132
	B	70-90	140		140	265	275		210			290	82			222 24	225
630	S	65-75	120	680	160	290	305	150	237	325	94	222 26	250	-	-	100	152
	B	80-110	160		180	330	345		160			245	335	222 30	265	100	
710	S	75-90	140	760	170	310	325	180	249	350	94	222 28	260	100	152	110	152
	B	95-160	210		190	350	365		210			278	395	104		222 32	300
800	S	75-90	140	850	180	330	345	180	255	355	94	222 30	275	110	152	120	172
	B	95-160	210		200	370	385		210			289	405	114	222 34	310	130
900	S	75-90	140	950	190	350	365	190	268	375	104	222 32	290	-	-	130	172
	B	95-160	210		230	420	435		210			315	430	134	222 40	335	140
1000	S	75-90	140	1050	200	370	385	190	279	385	114	222 34	300	-	-	140	202
	B	95-160	210		250	480	500		210			332	450	146	222 44	355	160

- 1) S = narrow wheel B = wide wheel
- 2) dimension for track gauge b₁ when ordering please advise
- 3) interference fit of wheel and shaft; H7 / u6
- 4) tolerance for d₇ acc. to DIN 15091.
- 5) series 2 is in accordance with cardan shaft classification acc. to DIN 15450.
- 6) for wheel shape S dimensions b₂ and l₅ are not identical

approx. Weights of Driven- & Non-Driven Wheel Assemblies

series 222

d ₁ h ₉	Wheel shape ¹⁾	weight ²⁾ = in kgs			
		driven ³⁾		non-driven ³⁾	
		HK	GK	HK	GK
315	S	100	-	95	-
	B	150	-	145	-
400	S	155	-	150	-
	B	230	220	220	210
500	S	215	-	205	-
	B	315	300	305	290
630	S	360	-	345	-
	B	560	530	540	515
710	S	475	-	460	-
	B	820	780	790	755
800	S	580	-	560	-
	B	1010	960	975	930
900	S	700	-	675	-
	B	1310	1240	1260	1220
1000	S	865	-	835	-
	B	1680	1590	1610	1570

- 1) S = narrow wheel B = wide wheel.
- 2) weight calculation is based on series 2 of shaft ends, without connecting flange resp. coupling disc, referring to max. b₁. Indicated weights are approx. figures and are supposed to provide an orientation. The actual weight depends on the selected version and the selected manufacturing process.
- 3) see codification

Parts List for Driven-& Non-Driven Wheel Assemblies

Pos. No.	Nomenclature	quantities for wheel- Ød ₁																		material / DIN											
		Driven Wheel ass'y										Non-driven wheel ass'y																			
		315		400		500		630		710		800		900		1000		315			400		500		630		710		800		900
S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B		
1	wheel	1										1								42CrMo4V											
2	wheel shaft	1										1								42CrMo4V											
3	bearing frame	2										1								St 52-3											
4	cover	1										2								St 52-3											
5	cover	1										2								St 52-3											
6	cover	1										1								St 52-3											
7	shaft washer	1										1								St 52-3											
8	wheel bushing	1										-								C 45											
9	nipple adapter	2										2								9SMn28K											
10	spherical roller bearing	2										2								222 SNR premier											
11	shaft sealing	3										2								NBR											
12	hexagon screw	3										6								DIN 933-8.8 VZ											
13	hexagon screw	16	16	16	16	24	16	24	24	24	24	16	16	16	16	24	16	24	24	24	24	24	24	24	24	24	24	24	24	DIN 931-8.8 VZ	
14	hexagon nut	16	16	16	16	24	16	24	24	24	24	16	16	16	16	24	16	24	24	24	24	24	24	24	24	24	24	24	24	DIN 934-8 VZ	
15	grease nipple	2										2								DIN 3404 A2											
16	grub screw	2										2								DIN 913-45H VZ											
17	lock washer	3										6								B 53070 VZ											

Basics of Wheel Assembly Calculation (extract of DIN 15070)

Calculation of wheels:

The wheel force is calculated acc. following formula:

$$R \leq p_{zul} \cdot c_2 \cdot c_3 \cdot d_1 \cdot \left(k - 2r_1 \right) \quad (1)$$

The result is the wheel diameter:

$$d_1 = \frac{R}{p_{zul} \cdot c_2 \cdot c_3 \cdot \left(k - 2r_1 \right)} \quad (2)$$

- R = wheel force [N]
 $k-2r$ = ideal usable width of rail head [mm]
 p_{zul} = allowed compression between wheel and rail [N/mm²]
 d_1 = diameter of wheel [mm]
 c_2 = rotation speed factor [chart mating of materials]
 c_3 = operating time factor [chart mating of materials]

The characteristic wheel force R_0 is the result of equation (1) if:

$$\begin{aligned}
 p_{zul} &= 5,6 \text{ N/mm}^2 \\
 c_2 &= 1 \\
 c_3 &= 1
 \end{aligned}$$

inserted to:

$$R_0 = 5,6 \cdot d_1 \cdot \left(k - 2r_1 \right) \quad (3)$$

R_0 = characteristic wheel force

By usage of characteristic wheel force the allowed wheel force can be calculated simplified by following formula

$$R \leq R_0 \cdot c_1 \cdot c_2 \cdot c_3 \quad (4)$$

For crane wheels:

$$R = \frac{R_{min} + 2 \cdot R_{max}}{3} \quad (5)$$

- R_{max} = max wheel force [N]
 R_{min} = min. wheel force [N]

For trolley wheels:

$$R = R_{max} \quad (6)$$

R_{max} and R_{min} should be found by the frequent operating position of charged trolley.

Mating of Materials Rail / Wheel

allowed compression p_{zul} and material- factor c_1

material tensile strength at least N/mm ²		p_{zul} N/mm ²	c_1
rail	wheel		
590	330	2.8	0.5
	410	3.6	0.63
	490	4.5	0.8
	590	5.6	1.0
690	740	7.0	1.25

operating time- factor c_3

Operating time of travel drive (referred to 1 hour)	c_3
up to 16%	1.25
over 16 – 25%	1.12
over 25 – 40%	1
over 40 – 63%	0.9
over 65%	0.8

wheel - rotation speed - factor n, c_2

$n \text{ min}^{-1}$	200	160	125	112	100	90	80	71	63	58	50	45	40	35.5	31.5
c_2	0.66	0.7	0.77	0.79	0.82	0.84	0.87	0.89	0.91	0.92	0.94	0.96	0.97	0.99	1.0

wheel - rotation speed - factor n, c_2

$n \text{ min}^{-1}$	28	25	22.4	20	18	16	14	12.5	11.2	10	8	6.3	5.6	5
c_2	1.02	1.03	1.04	1.06	1.07	1.09	1.1	1.11	1.12	1.13	1.14	1.15	1.16	1.17

Characteristic Wheel Force R0

Chart I

wheel-diameter d_1 [mm]	R_0 in N narrow wheel				R_0 in N wide wheel				
	for crane rail:				for crane rail:				
	A 45	A 55	A 65	A 75	A 55	A 65	A 75	A 100	A 120
315	65000	-	-	-	79000	-	-	-	-
400	83000	101000	-	-	-	119000	132000	-	-
500	104000	126000	-	-	-	148000	165000	-	-
630	-	159000	187000	-	-	-	208000	282000	-
710	-	-	211000	235000	-	-	-	318000	398000
800	-	-	-	264000	-	-	-	358000	448000
900	-	-	-	297000	-	-	-	403000	504000
1000	-	-	-	330000	-	-	-	448000	560000

Rectified nominal life time of bearings L_{10h} in hours [h]

Nominal characteristic- life time of bearings L_{Kenn} in hours [h] (calculated with characteristic wheel forces R_0 and the factors $c_1 = c_2 = c_3 = 1,0$) for spherical roller bearings, type 222, SNR premium.

Chart II

wheel-diameter d_1 [mm]	narrow wheel				wide wheel				
	for crane rail:				for crane rail:				
	A 45	A 55	A 65	A 75	A 55	A 65	A 75	A 100	A 120
315	336000	-	-	-	355000	-	-	-	-
400	297000	154000	-	-	-	215000	152000	-	-
500	330000	174000	-	-	-	155000	108000	-	-
630	-	210000	122000	-	-	-	218000	79000	-
710	-	-	119000	83000	-	-	-	83000	39000
800	-	-	-	95000	-	-	-	91000	43000
900	-	-	-	100000	-	-	-	135000	64000
1000	-	-	-	114000	-	-	-	183000	87000

The figures for bearing lifetime L_{Kenn} as mentioned in chart II are based on characteristic wheel force R_0 with factors $c_1 = c_2 = c_3 = 1,0$ according DIN 15070.

Differing wheel forces and factors can be calculated simplified as follows:

Nominal life time of bearings:

$$L_{10h} = L_{Kenn} \cdot \left(\frac{1}{C_{Ges}} \right)^{10/3} \cdot \frac{31,5}{n_{vorh}} \quad (7)$$

L_{Kenn} : according Chart II [h]
 n_{vorh} : existing rotation speed [min^{-1}]
 C_{ges} : total factor

Based on given wheel force R and by usage of characteristic wheel force acc. DIN 15070, the total factor can be calculated simplified with following formula:

$$R \leq R_0 \cdot c_1 \cdot c_2 \cdot c_3 \leq R_0 \cdot C_{Ges} \quad (8)$$

$$C_{Ges} = \frac{R}{R_0} \quad (9)$$

Example of calculation

- wheel diameter : $d_1 = 400 \text{ mm}$
- wheel type : B
- existing rail : A = 75
- average rotation speed : $n_{\text{vorh}} = 77 \text{ min}^{-1}$
- max. wheel force : $R_{\text{max}} = 145 \text{ kN}$
- min. wheel force : $R_{\text{min}} = 45 \text{ kN}$

Wheel force:

$$R = \frac{R_{\text{min}} + 2 \cdot R_{\text{max}}}{3} \quad (5)$$

$$R = \frac{45 + 2 \cdot 145}{3} = \underline{111,7 \text{ kW}}$$

Total factor:

$$c_{\text{Ges}} = \frac{R}{R_0} \quad (6)$$

$R_0 = 132 \text{ kN DIN 15070}$
 wheel = $\varnothing 400 \text{ mm}$
 crane rail = A 75

$$c_{\text{Ges}} = \frac{111,7}{132} = \underline{0,85}$$

Nominal life time:

$$L_{10h} = L_{\text{Kenn}} \cdot \left(\frac{1}{c_{\text{Ges}}} \right)^{10/3} \cdot \frac{31,5}{n_{\text{vorh}}} \quad (7)$$

$L_{\text{Kenn}} = 152000 \text{ h}$ [from chart II]

$$L_{10h} = 152000 \text{ h} \cdot \left(\frac{1}{0,85} \right)^{10/3} \cdot \frac{31,5}{77} =$$

$$\underline{\underline{L_{10h} = 106800 \text{ h}}}$$

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