



General Catalogue





# bearings

**CR** s.r.l. ®

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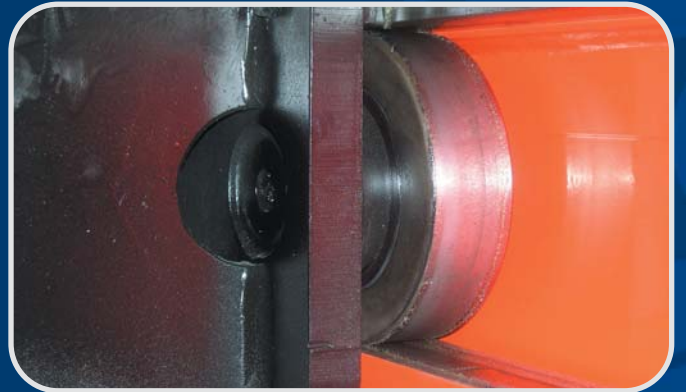


# HANDLING

Handling represents the history of C.R.

In 1984 C.R. production was basically addressed to builders of fork lifts, transpallets and paletization plants with products that later would change the sliding rolling system.

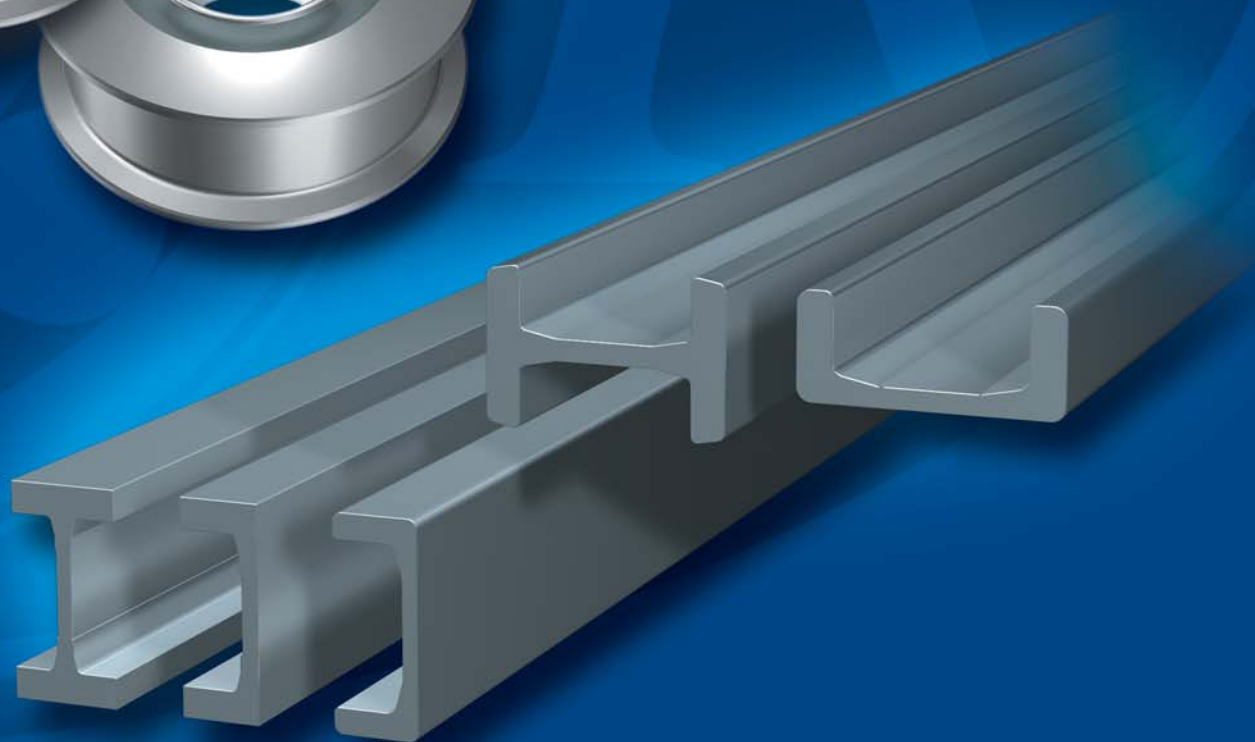
Combined bearings were the first bearings to be manufactured and put on the market.





Later C.R. improved its production range by manufacturing chain stretcher pulleys.

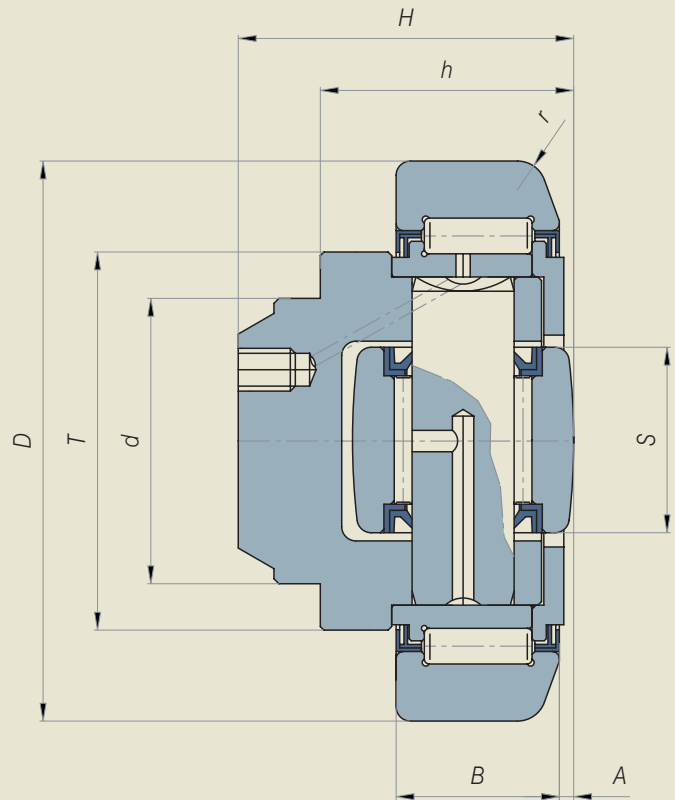
At present C.R. can guarantee an extremely complete service, commercializing medium and large size roller profiles.



# FIXED COMBINED BEARINGS

Fixed combined bearings are particularly suitable to be used in forklift masts and in any other moving and handling system, where rolled or extruded profiles are used.

The best combination axial part/radial part allows to get high load capacity with extremely small dimensions of the bearing, in addition to easiness of assembling on any kind of structure.



C.R.

ref.	d	T	D	H	h	B	A	S	r	C	C <sub>0</sub>	C <sub>a</sub>	C <sub>0a</sub>	Ø on request	PROFILE
	mm	mm	mm	mm	mm	mm	mm	mm	mm	KN	KN	KN	KN	mm	
400-0053	30	40	52,5	33	27	17	5	15	2	24,8	34,5	9,2	11,7	*	EC 053
400-0054	30	42	62	37,5	30,5	20	2,5	20	3	39	65,2	14,4	21	62,5	2890
400-0055	35	48	70,1	44	36	23	2,5	22	4	55,5	91,7	17,6	25	70,7 / 70,4	2867
400-0056	40	53	77,7	48	36,5	23	3	24	4	58,4	100	23,2	35,8	78,1 / 78,5	2810
400-0058	45	59	88,4	57	44	30	3,5	26	3	83,8	132,3	27,7	42	88,9	2811
400-0061	60	71	107,7	69	55	31	4	34	5	94,2	160,7	38,6	65,2	108,2/108,5	2862
400-0062	60	80	123	72,3	56	37	5	40	5	128	226,8	53	92	*	2891
400-0063	60	108	149	78,5	58,5	45	5,5	50	3	172,3	325,9	133,3	244	*	2757
400-0011	60	108	149	86	67	45	5,5	50	3	172,3	325,9	133,3	244	*	2757
400-0037	80	120	174	95	71	55	7	63	7	265	488	205,3	381	*	*
400-0039	80	120	185	95	71	55	7	63	7	265	488	205,3	381	*	*

THE BEARINGS ARE IN ZRS EXECUTION

C : Dynamic load

C<sub>0</sub> : Static load

C<sub>a</sub> : Dynamic axial load

C<sub>0a</sub> : Static axial load

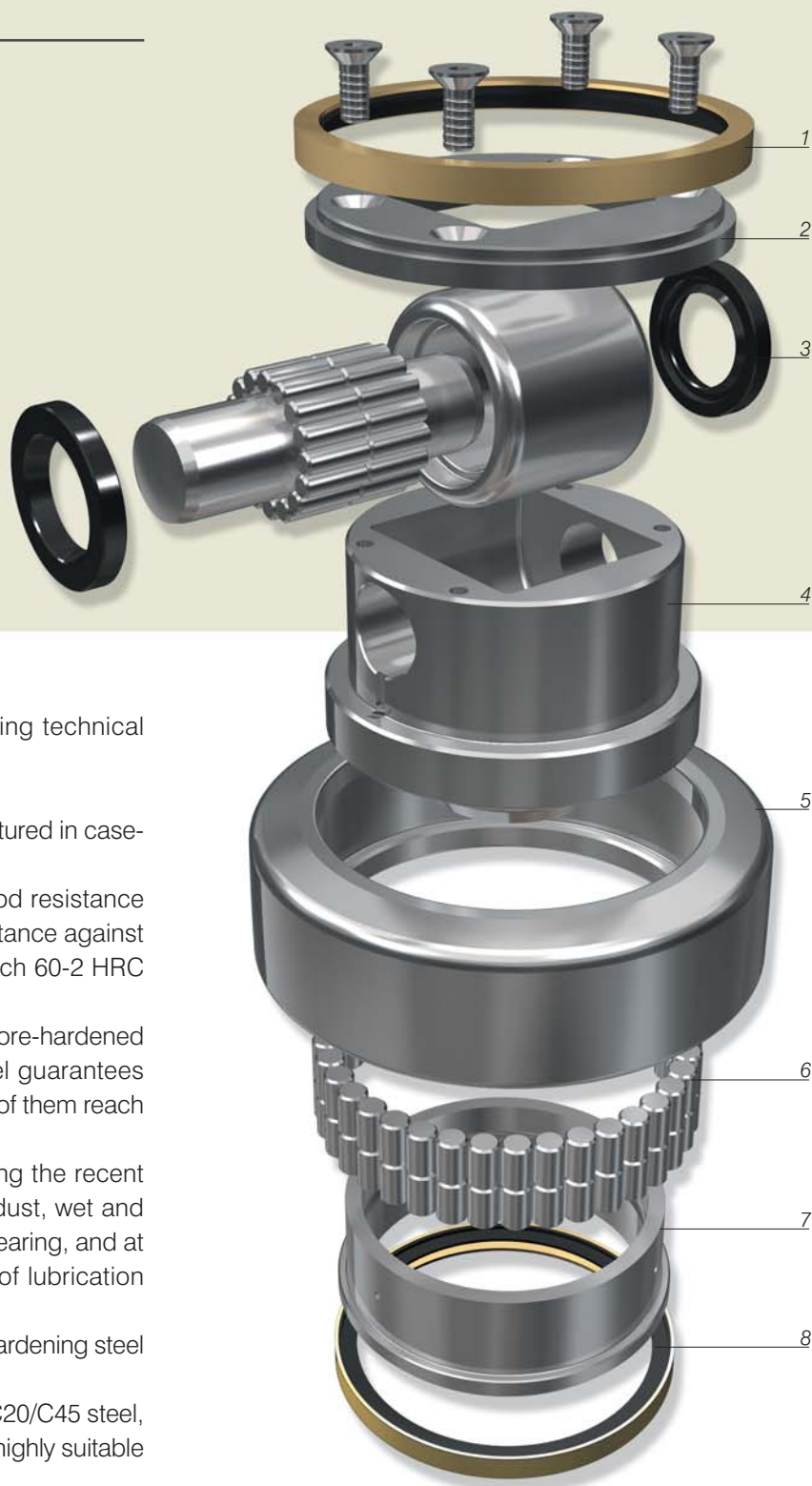
400-0053 AND 400-0054 ARE SUPPLIED WITHOUT LUBRICATION HOLE





# FIXED COMBINED BEARINGS

- 
1. ZRS SEAL RING
  2. SUPPORT THRUST RING
  3. AXIAL PART
  4. PIVOT
  5. OUTER RING
  6. CYLINDRICAL ROLLERS
  7. INNER RING
  8. ZRS SEAL RING
- 



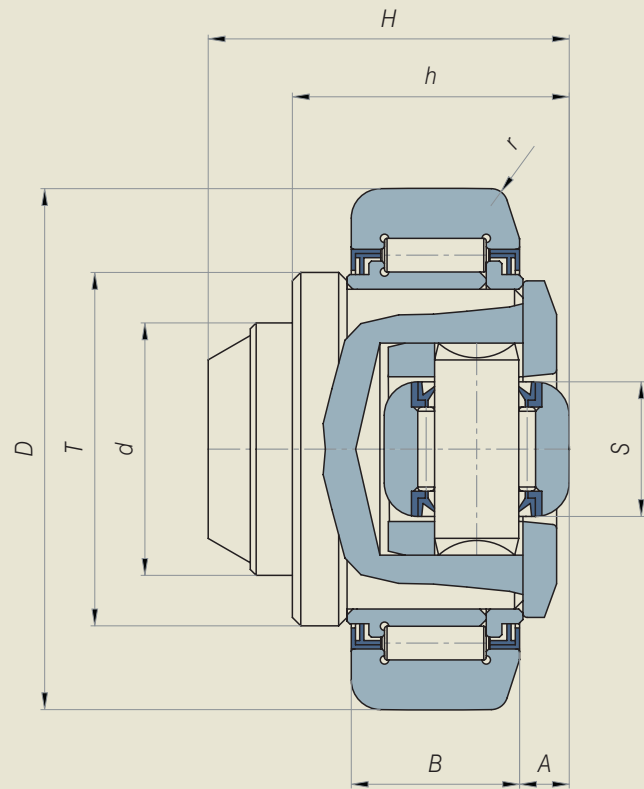
Fixed combined bearings have the following technical characteristics:

- Outer ring and axial little roll are manufactured in case-hardening steel type 20CrMnTi. This kind of steel guarantees a very good resistance to stress, and assures a very good resistance against crashes. The surface hardness can reach 60-2 HRC for both of them.
- Inner ring and pin are manufactured in core-hardened 100 Cr6 steel. The total-hardening steel guarantees high resistance to wear and stress; both of them reach 60-2 HRC hardness value.
- ZRS seal system, realized by C.R. during the recent years, prevents outer agents, such as dust, wet and mill scale, to enter the inner part of the bearing, and at the same time it prevents the leakage of lubrication grease.
- The lateral thrust cover is made in case-hardening steel as well.
- The central pivot is made in low carbon C20/C45 steel, which guarantees high resistance and is highly suitable for welding.

# ADJUSTABLE COMBINED BEARINGS

Adjustable combined bearings have the same characteristics as fixed combined bearings.

The only difference is the possibility to adjust the distance between bearing and profile through the use of washers.



C.R.

ref.	d	T	D	H	h	B	A	S	r	C	C <sub>0</sub>	C <sub>a</sub>	C <sub>oa</sub>	Ø on request	PROFILE
	mm	mm	mm	mm	mm	mm	mm	mm	mm	KN	KN	KN	KN	mm	
400-0072	30	42	62	43	33	20	5,5	16	3	39	65,2	5,8	6	62,5	2890
400-0073	35	48	70,1	48	40	23	6,5	16	4	55,5	91,7	5,8	6	70,7 / 70,4	2867
400-0074	40	53	77,7	51	39,5	23	7	21	4	58,4	100	13,2	14,5	78,1 / 78,5	2810
400-0076	45	59	88,4	61	48	30	7	21	3	83,8	132,3	13,2	14,5	88,9	2811
400-0078 / L	60	71	107,7	73	59	31	8	33	5	94,2	160,7	25	28	108,2 / 108,5	2862
400-0079	60	80	123	75,8	59,5	37	8	33	5	128	226,8	25	28	*	2891
400-0080	60	103	149	89	69	45	15	50	5	172,3	325,9	83	130	*	2757

THE BEARINGS ARE IN ZRS EXECUTION.

C : Dynamic load

C<sub>0</sub> : Static load

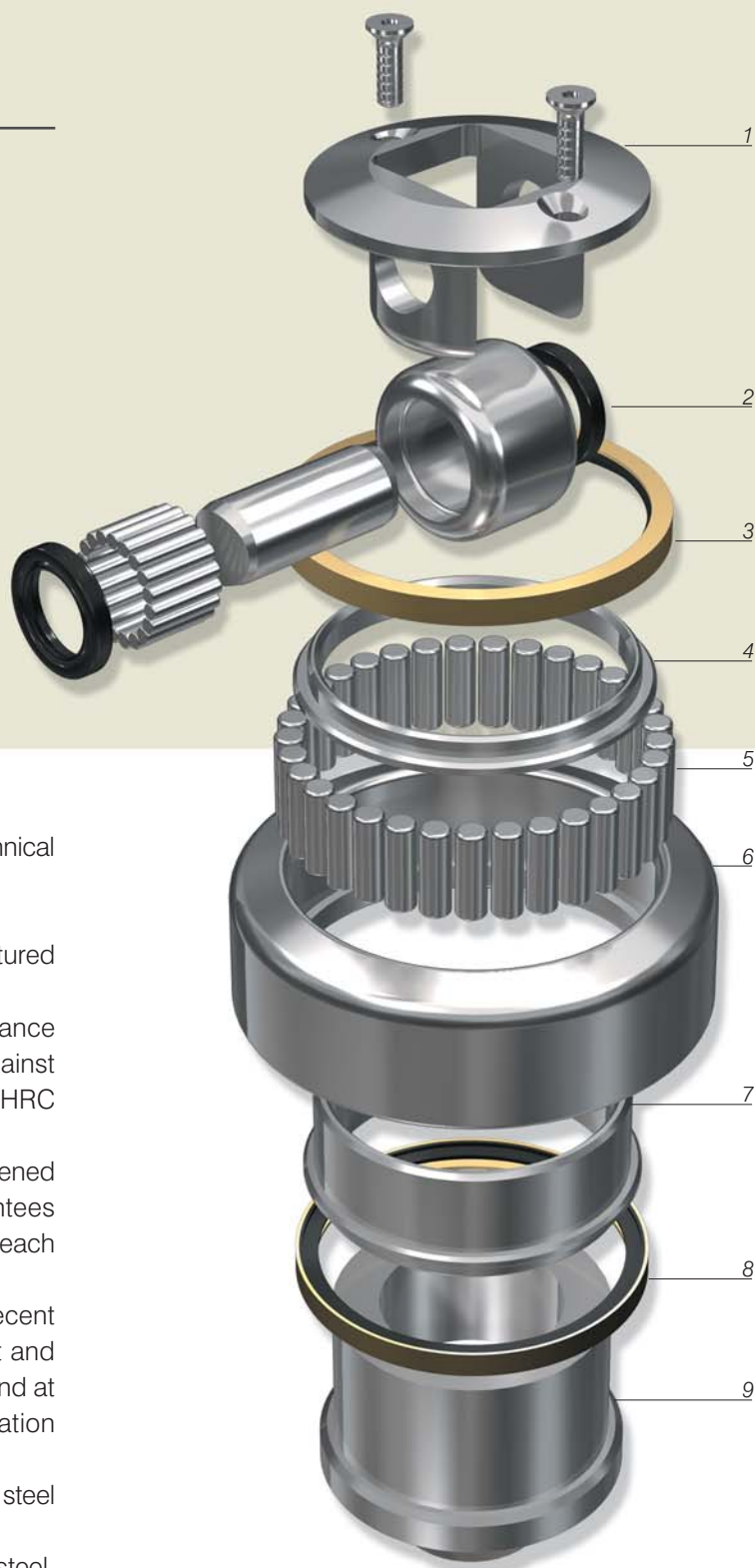
C<sub>a</sub> : Dynamic axial load

C<sub>oa</sub> : Static axial load

The adjusting of dimension "A" is made through washer rings put between the main support roll and the support roll of the lateral guide bearing. Adjusting washers are available with thickness 0,3-0,5-1 mm.

# ADJUSTABLE COMBINED BEARINGS

- 
1. SUPPORT
  2. AXIAL PART
  3. ZRS SEAL RING
  4. SUPPORT THRUST RING
  5. CYLINDRICAL ROLLERS
  6. OUTER RING
  7. INNER RING
  8. ZRS SEAL RING
  9. PIVOT
- 



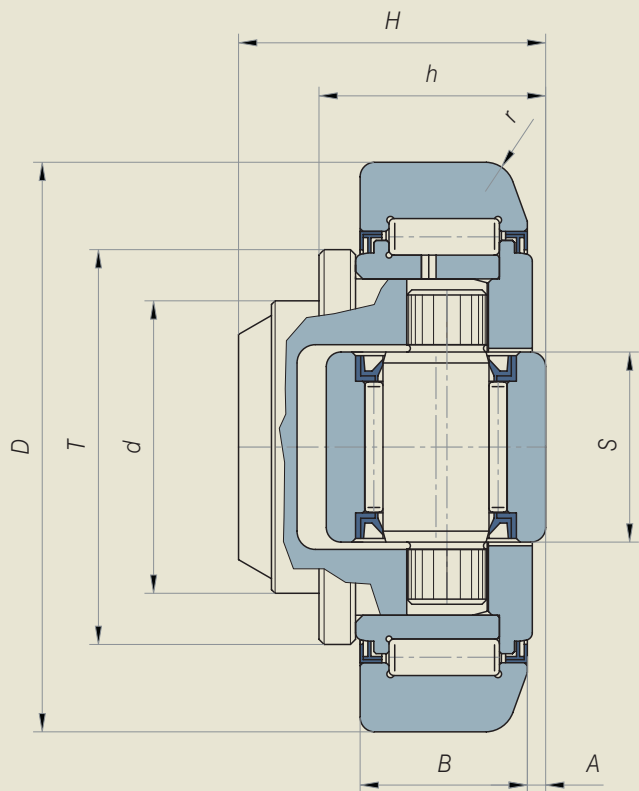
Adjustable combined bearings have the following technical characteristics:

- The outer ring and the axial little roll are manufactured in case-hardening steel type 20CrMnTi. This kind of steel guarantees a very good resistance to stress, and assures a very good resistance against crashes. The surface hardness can reach 60-2 HRC for both of them.
- Inner ring and pin are manufactured in core-hardened 100 Cr6 steel. The total-hardening steel guarantees high resistance to wear and stress; both of them reach 60-2 HRC hardness value.
- ZRS seal system, realized by C.R. during the recent years, prevents outer agents, such as dust, wet and mill scale, to enter the inner part of the bearing, and at the same time it prevents the leakage of lubrication grease.
- The lateral thrust cover is made in case-hardening steel as well.
- The central pivot is made in low carbon C20/C45 steel, which guarantees high resistance and is highly suitable for welding.
- The support roll, which allows the adjusting of the axial clearance between profile and bearing through washers of 0,3 to 0,5 mm, is manufactured in 20 CrMo steel.

# ADJUSTABLE COMBINED BEARINGS WITH ECCENTRIC PIN

Adjustable combined bearings with eccentric pin have the same characteristics as adjustable combined bearings.

In this case, the adjusting of the distance is made through the rotation of the whole axial part (pin and little roll) in the central pivot.



C.R. ref.	d	T	D	H	$h_{min.}$	$h_{max.}$	B	A	S	r	C	$C_0$	$C_a$	$C_{0a}$	PROFILE
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	KN	KN	KN	KN	
400-0454	30	42	62	37,5	30,5	32	20	4	20	3	39	65,2	16	25	2890
400-0455	35	48	70,1	44	36	37,5	23	4	20	4	55,5	91,7	16	25	2867
400-0456	40	54	77,7	48	37	38,5	23	3,5	26	4	58,4	100	23	36	2810
400-0458	45	59	88,4	57	44	45,5	30	4	26	4	83,8	132,3	23	36	2811
400-0461	60	69	107,7	69	55	57	31	4	30	5	94,2	160,7	32	50	2862
400-0462*	60	80	123	72,3	56	60	37	4,5	34	5	128	226,8	41	72	2891
400-0463*	60	108	149	78,5	58,5	62,5	45	6	34	3	172,3	325,9	41	72	2757

THE BEARINGS ARE IN ZRS EXECUTION.

C : Dynamic load

$C_0$  : Static load

$C_a$  : Dynamic axial load

$C_{0a}$  : Static axial load

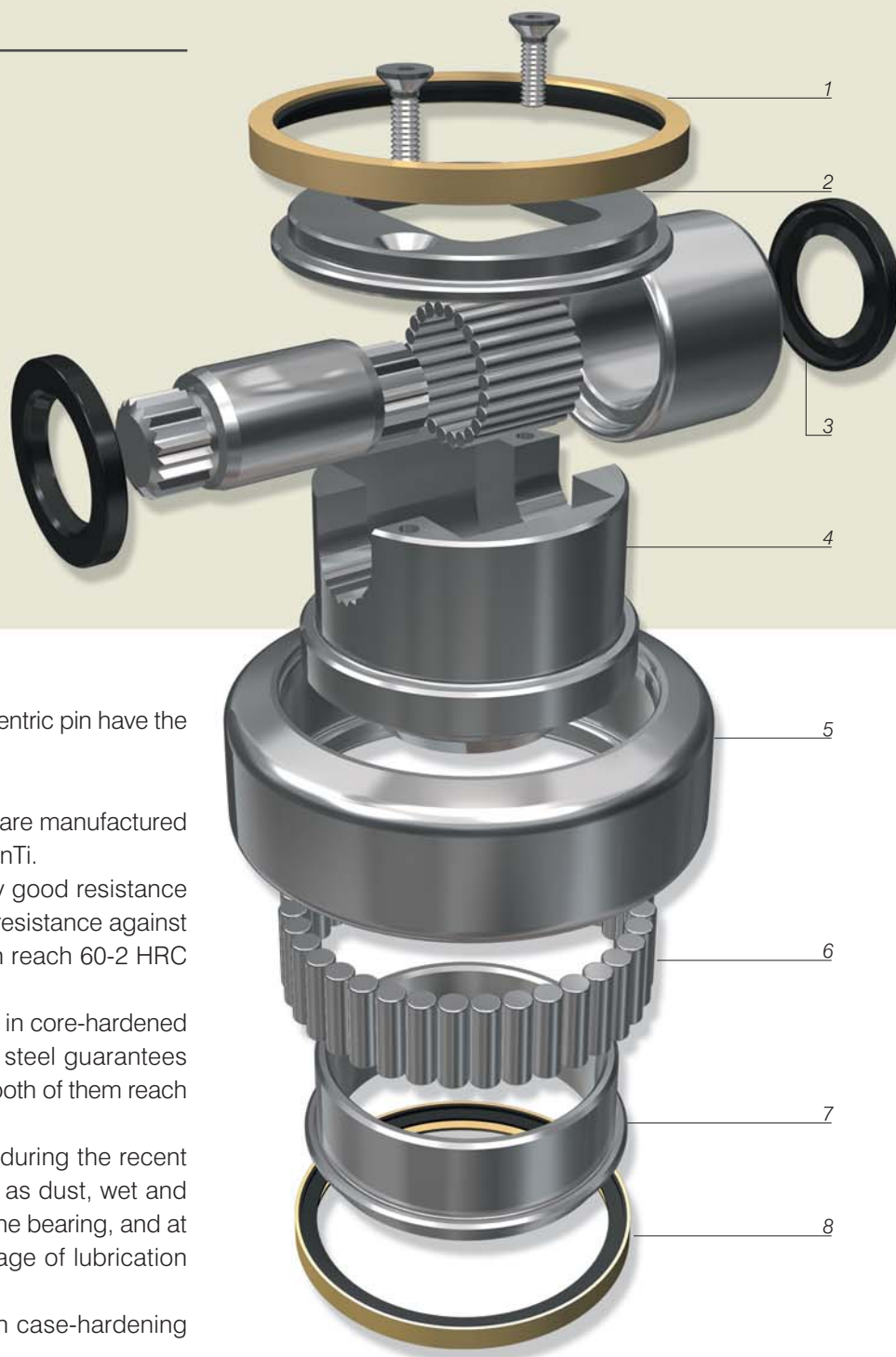
The adjusting of dimension "A" can be made through the rotation of the axial pivot.

\* "JUMBO" EXECUTION



# ADJUSTABLE COMBINED BEARINGS WITH ECCENTRIC PIN

- 
1. ZRS SEAL RING
  2. SUPPORT THRUST RING
  3. AXIAL PART
  4. PIVOT
  5. OUTER RING
  6. CYLINDRICAL ROLLERS
  7. INNER RING
  8. ZRS SEAL RING
- 

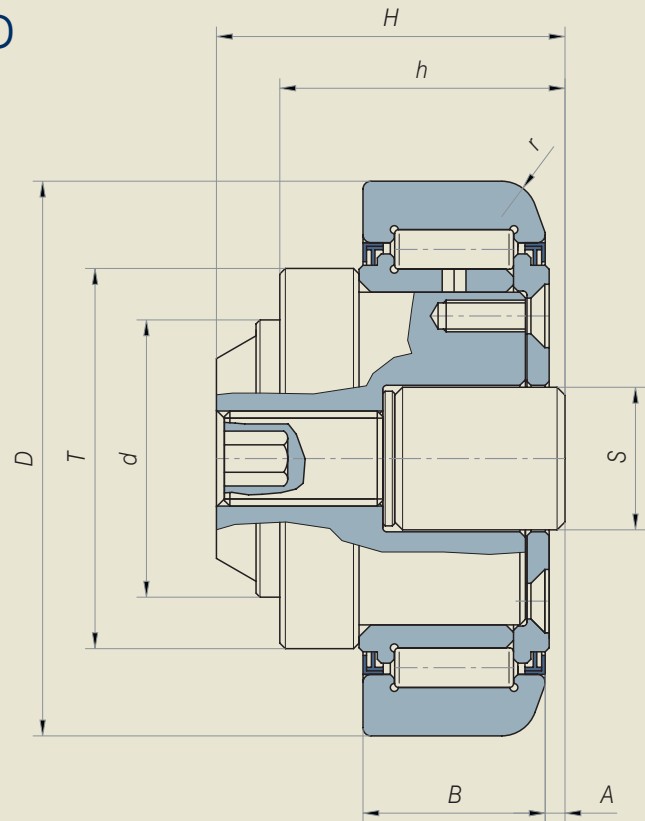


Adjustable combined bearings with eccentric pin have the following technical characteristics:

- The outer ring and the axial little roll are manufactured in case-hardening steel type 20CrMnTi. This kind of steel guarantees a very good resistance to stress, and assures a very good resistance against crashes. The surface hardness can reach 60-2 HRC for both of them.
- Inner ring and pin are manufactured in core-hardened 100 Cr6 steel. The total-hardening steel guarantees high resistance to wear and stress; both of them reach 60-2 HRC hardness value.
- ZRS seal system, realized by C.R. during the recent years, prevents outer agents, such as dust, wet and mill scale, to enter the inner part of the bearing, and at the same time it prevents the leakage of lubrication grease.
- The thrust cover is manufactured in case-hardening steel as well.
- The central pivot is made in low carbon C20/C45 steel, which guarantees high resistance and is highly suitable for welding.

# ADJUSTABLE COMBINED BEARINGS WITH CAP

Adjustable combined bearings with cap made in plastic material maintain high resistance to the load applied on them, and at the same time have an easy system of adjusting the distance between profile and bearing. The adjusting is made through the shifting of a screw which is put in the core of the pivot and lays on the cap.



C.R. ref.	d	T	D	H	h	B	A	S	r	C	C <sub>0</sub>	Ø on request	PROFILE
	mm	mm	mm	mm	mm	mm	mm	mm	mm	KN	KN	mm	
400-0562	30	42	62	37,5	30,5	20	2,5	18	3	39	65,2	62,5	2890
400-0563	35	48	70,1	44	36	23	2,5	18	4	55,5	91,7	70,7 / 70,4	2867
400-0564	40	53	77,7	48	36,5	23	3	18	4	58,4	100	78,1 / 78,5	2810
400-0565	45	59	88,4	57	44	30	3,5	18	3	83,8	132,3	88,9	2811
400-0566	60	71	107,7	69	55	31	4	25	5	94,2	160,7	108,2 / 108,5	2862
400-0567	60	80	123	72,3	56	37	5	40	5	128	226,8	*	2891
400-0568	60	108	149	78,5	58,5	45	5,5	40	3	172,3	325,9	*	2757
400-0569	60	108	149	86	67	45	5,5	40	3	172,3	325,9	*	2757

THE BEARINGS ARE IN ZRS EXECUTION.

C: Dynamic load

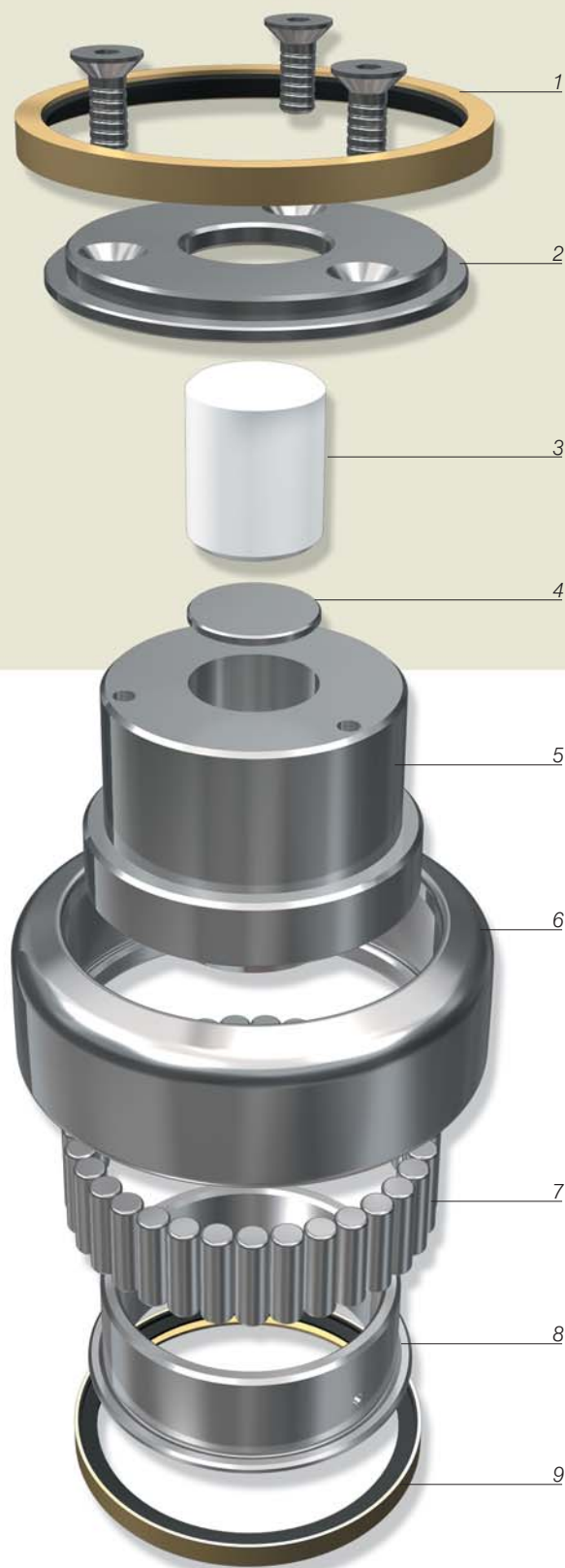
C<sub>0</sub>: Static load

The adjusting of dimension "A" can be made through the rotation of the screw inserted in the pivot.



# ADJUSTABLE COMBINED BEARINGS WITH CAP

- 
1. ZRS SEAL RING
  2. SUPPORT THRUST RING
  3. CAP
  4. WASHER
  5. PIVOT
  6. OUTER RING
  7. CYLINDRICAL ROLLERS
  8. INNER RING
  9. ZRS SEAL RING
- 



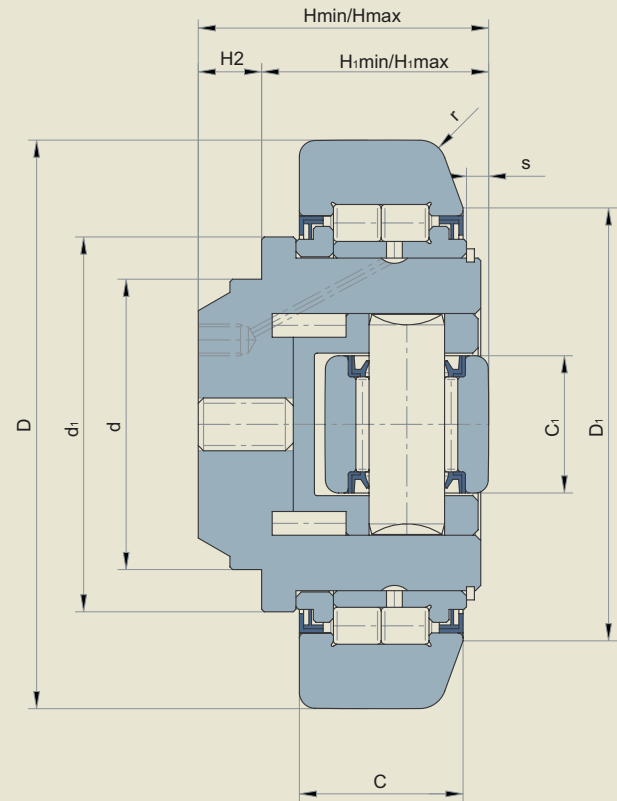
Adjustable combined bearings with plastic cap have the following technical characteristics:

- The outer ring is made in case-hardening steel type 20 CrMnTi. It guarantees high resistance to stress and very good resistance against crashes. Surface hardness reaches 60-2 HRC.
- The inner ring is made in core-hardened 100 Cr6 steel with hardness 60-2 HRC. Total-hardening steel guarantees high resistance to wear and stress.
- ZRS seal system, realized by C.R. during the recent years, prevents outer agents, such as dust, wet and mill scale, to enter the inner part of the bearing, and at the same time it prevents the leakage of lubrication grease.
- The lateral thrust cover is made in case-hardening steel as well.
- The central pivot is made in low carbon C20/C45 steel, which guarantees high resistance and is highly suitable for welding.
- The guiding lateral cap is manufactured in plastic alloy, which is very resistant to wear and damaging outer agents.

# ADJUSTABLE COMBINED BEARINGS WITH STEEL CAP

As for the previous series, adjustable combined bearings with steel cap maintain a very high resistance to applied loads, and at the same time, they have an easy system of axial adjusting.

Also in this case, the adjusting is made through the shifting of a central screw laid on the cap. In comparison to the adjustable execution with plastic cap, this execution can bear much higher axial loads, and therefore its wear is definitely lower.



C.R.

ref.	d	D	C	H <sub>min.</sub>	H <sub>max.</sub>	H1 <sub>min.</sub>	H1 <sub>max.</sub>	H2	D1	C1	d1	r	C	C <sub>0</sub>	C <sub>a</sub>	C <sub>0a</sub>	PROFILE
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	KN	KN	KN	KN	
400-0301	30	62	20	38	40	30,5	32,5	7	50	-	42	3	31	35,5	-	-	2890
400-0302	30	70,1	23	38,5	40,5	31,5	33,5	7	57	-	48	4	45,5	51	-	-	2867
400-0303	35	77,7	23	40,7	42,7	31,7	33,7	9	61	-	54	4	48	56,8	-	-	2810
400-0305	40	88,9	30	48,5	51	36,5	39	12	68	21	59	3	68	72	15	15	2811
400-0306	45	101,9	28	46	48,5	33	35,5	13	77	24	67	4	73	82	18	19	2912
400-0307	60	107,7	31	53,5	56,5	41,5	44,5	12	82	30	71	5	81	95	31	36	2862
400-0308	60	123	33	61,5	64,5	49,5	52,5	12	94	30	80	5	110	132	31	36	2891
400-0309	60	149	43	75,5	79	58,5	62	17	116	45	103	3	151	192	68	71	2757

THE BEARINGS ARE IN ZRS EXECUTION.

C : Dynamic load

C<sub>0</sub> : Static load

C<sub>a</sub> : Dynamic axial load

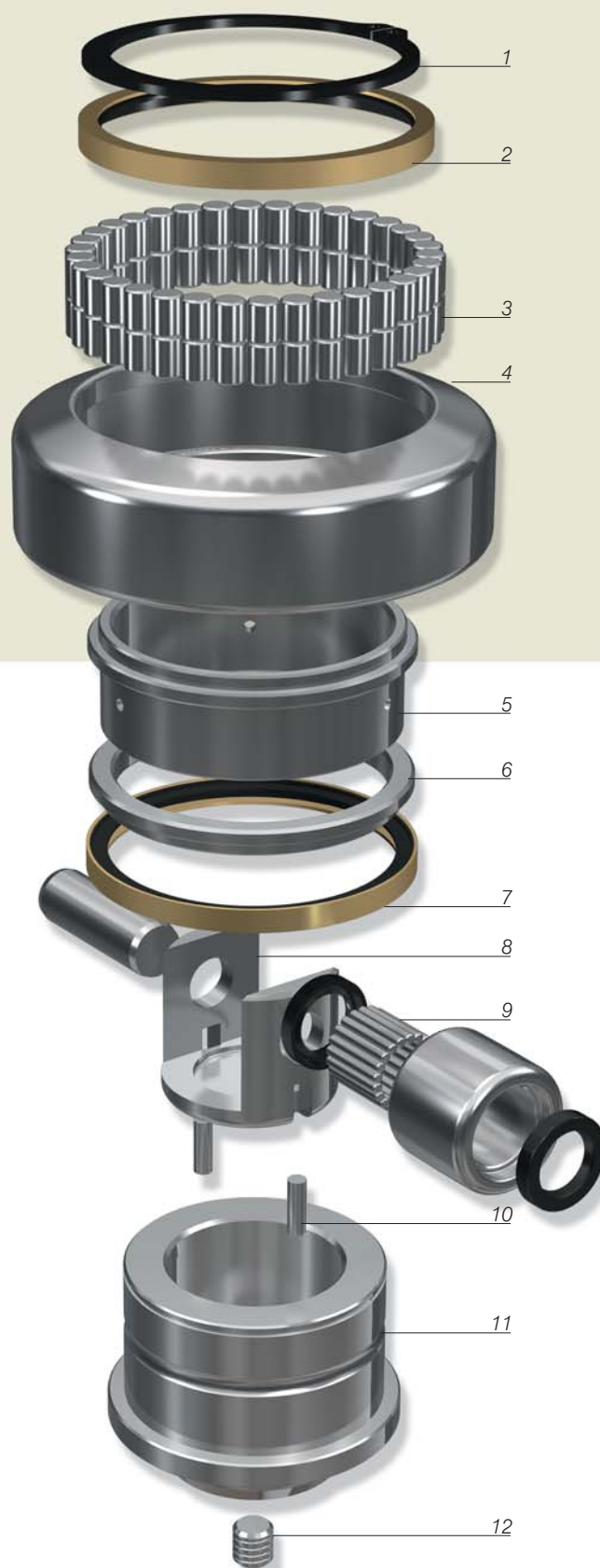
C<sub>0a</sub> : Static axial load

# ADJUSTABLE COMBINED BEARINGS WITH STEEL CAP

- 
1. SEEGER LOCKING RING
  2. ZRS SEAL RING
  3. CYLINDRICAL ROLLERS
  4. OUTER RING
  5. INNER RING
  6. SUPPORT THRUST RING
  7. ZRS SEAL RING
  8. SUPPORT
  9. AXIAL PART
  10. PIN
  11. PIVOT
  12. ADJUSTING SCREW
- 

Adjustable combined bearings with steel cap have the following technical characteristics:

- The outer ring is made in case-hardening steel type 20 CrMnTi. It guarantees high resistance to stress and against crashes. Surface hardness reaches 60-2 HRC.
- The inner ring is manufactured in 60-2 HRC core-hardening 100 Cr6 steel. Total-hardening steel guarantees high resistance to wear and stress.
- ZRS seal system, realized by C.R. during the recent years, prevents outer agents, such as dust, wet and mill scale, to enter the inner part of the bearing, and at the same time it prevents the leakage of lubrication grease.
- The lateral thrust cover is made in case-hardening steel as well.
- The central pivot is made in low carbon C20/C45 steel, which guarantees high resistance and is highly suitable for welding.
- Lateral guiding cap is manufactured in case-hardening 20 CrMnTi steel. It guarantees a very high resistance to stress and crashes. Surface hardness reaches 60-2 HRC.

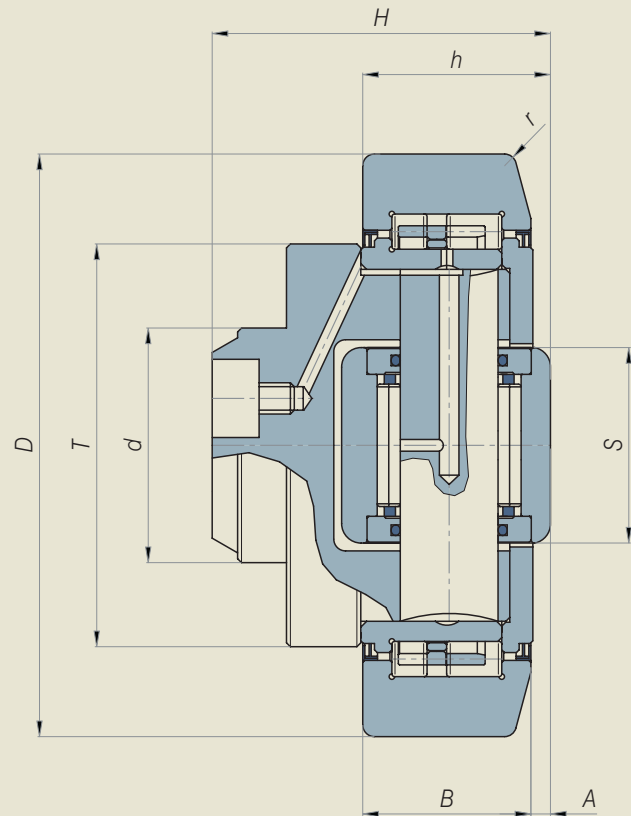


# COMBINED BEARINGS FOR HIGH SPEED

Combined bearings for high speed maintain the same technical characteristics as fixed combined bearings.

They are provided with bronze cages both in the radial and in the axial part, therefore they can rotate at a high number of revolutions.

They are provided also with Viton seals, so that they can bear heavy working conditions and high temperatures.



C.R. ref.	d	T	D	H	h	B	A	S	r	C	C <sub>0</sub>	C <sub>a</sub>	C <sub>0a</sub>
	mm	mm	mm	mm	mm	mm	mm	mm	mm	KN	KN	KN	KN
400-0235	45	59	88,9	57	44	30	3,5	26	3	46,6	50	26	32,2
400-0227	60	71	107,7	69	55	31	4	34	5	76	90	30	32
400-0228	60	80	123	72,3	56	37	5	40	5	106	120	42	46
400-0229	60	108	149	86	67	45	5	50	3	129	180	62	70
400-0230	80	120	185	90,5	76	55	7	65	7,5	170	250	80	104

THE BEARINGS ARE IN ZRS OR ZZ EXECUTION .

C : Dynamic load

C<sub>0</sub> : Static load

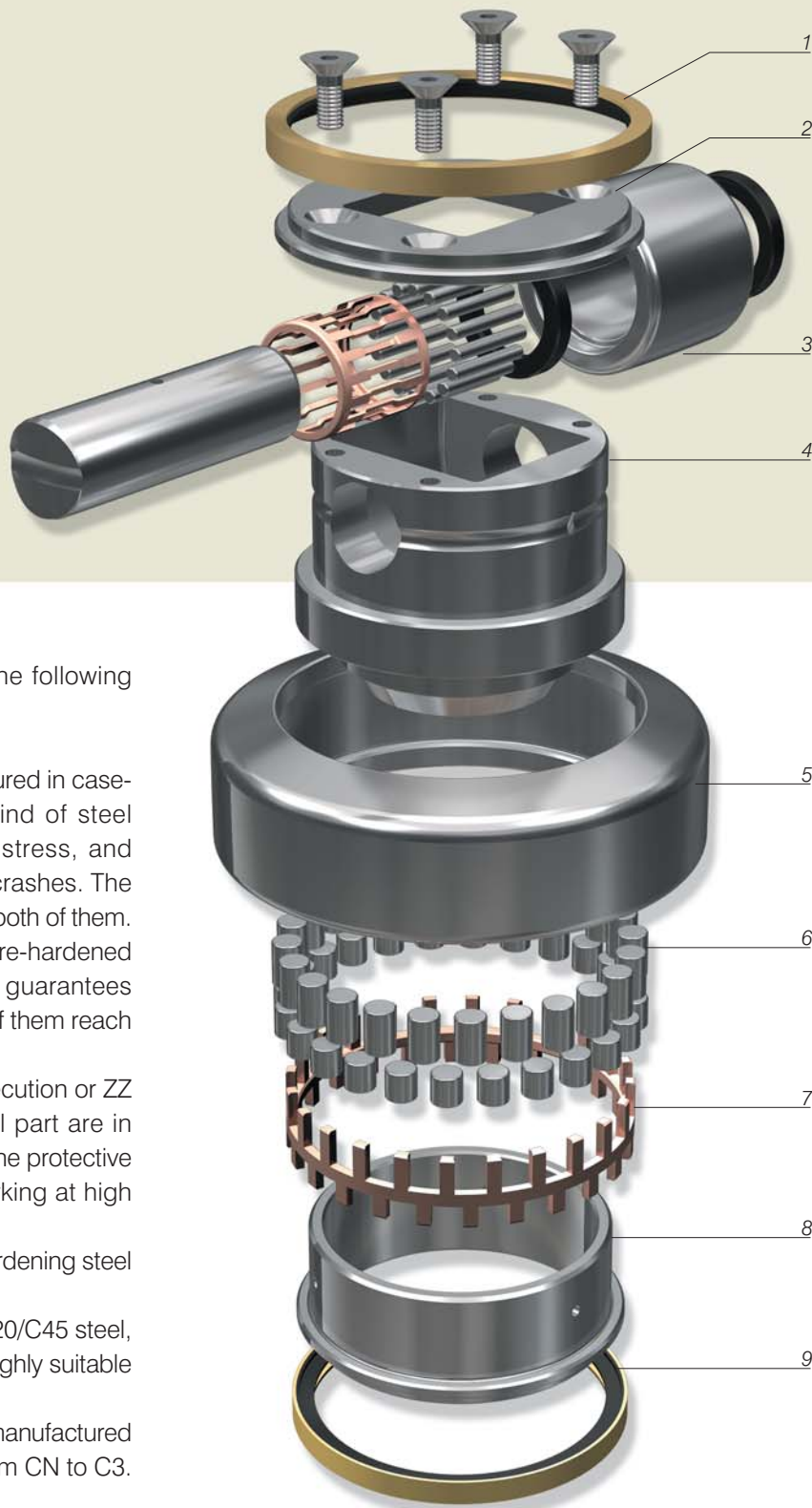
C<sub>a</sub> : Dynamic axial load

C<sub>0a</sub> : Static axial load

The bearings are supplied with lubrication hole.

# COMBINED BEARINGS FOR HIGH SPEED

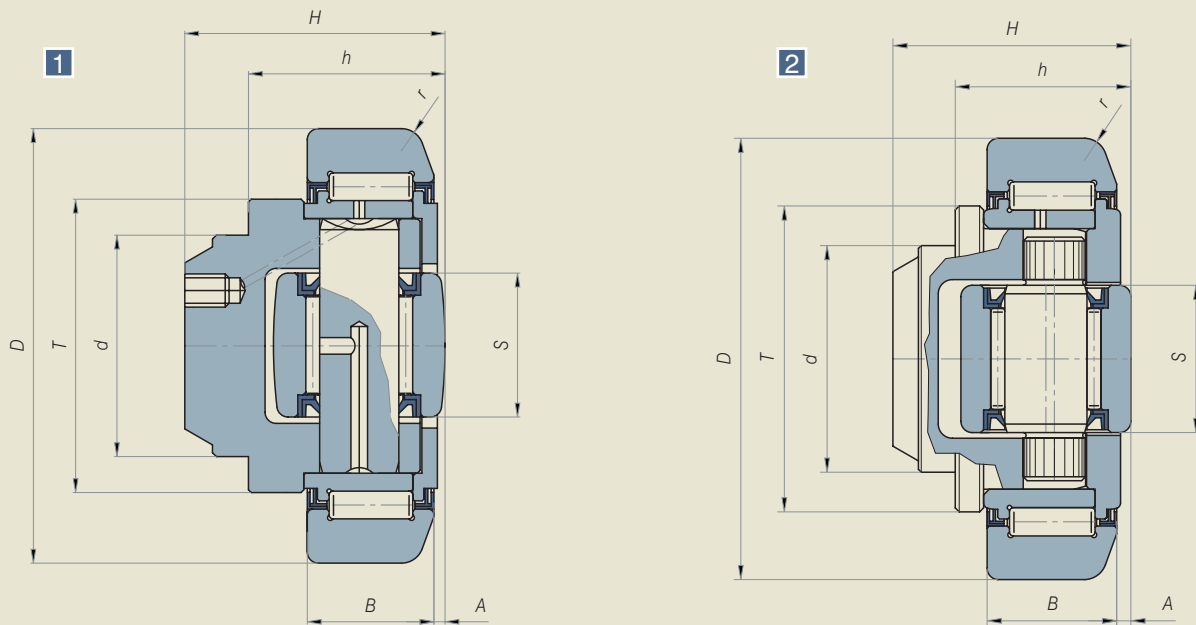
- 
1. ZRS SEAL RING
  2. SUPPORT THRUST RING
  3. AXIAL PART
  4. PIVOT
  5. OUTER RING
  6. CYLINDRICAL ROLLERS
  7. CAGE
  8. INNER RING
  9. ZRS SEAL RING
- 



Combined bearings for high speed have the following technical characteristics:

- Outer ring and little axial roll are manufactured in case-hardening steel type 20CrMnTi. This kind of steel guarantees a very good resistance to stress, and assures a very good resistance against crashes. The surface hardness can reach 60-2 HRC for both of them.
- Inner ring and pin are manufactured in core-hardened 100 Cr6 steel. The total-hardening steel guarantees high resistance to wear and stress; both of them reach 60-2 HRC hardness value.
- The seals in the radial part are in ZRS execution or ZZ execution whereas the seals in the axial part are in Viton. This is made in order to guarantee the protective device to the bearing also during its working at high temperature.
- The lateral thrust cover is made in case-hardening steel as well.
- The central pivot is made in low carbon C20/C45 steel, which guarantees high resistance and is highly suitable for welding.
- The cages inside radial and axial part are manufactured in bronze. Radial clearances may vary from CN to C3.

# PRECISION COMBINED BEARINGS



Precision combined bearings maintain the same characteristics as the previous series. They are manufactured with a wider diameter than the standard ones, because they are used in machined profiles. The very precise coupling between profile and bearing represents a very good and economic solution in comparison to linear guides. These bearings are being used in alternative to the linear guides more often.

C.R. ref.	d	T	D	H	h <sub>min./max.</sub>	B	A	S	r	C	C <sub>0</sub>	C <sub>a</sub>	C <sub>0a</sub>	PROFILE	Ref.
	mm	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	KN	KN	KN	KN		
DR 400-0054	30	42	64,8	37,5	30,5	20	2,5	20	3	39	65,2	14,4	21	EC 065 L	1
DR 400-0454	30	42	64,8	37,5	30,5 - 32	20	4	20	3	39	65,2	16	25	EC 065 L	2
DR 400-0055	35	48	73,8	44	36	23	2,5	22	4	55,5	91,7	17,6	25	EC 074 L	1
DR 400-0455	35	48	73,8	44	36 - 37,5	23	4	20	4	55,5	91,7	16	25	EC 074 L	2
* DR 400-0056	40	54	81,8	48	36,5	23	3	26	4	58,4	100	23,2	35,8	EC 082 L	1
DR 400-0456	40	54	81,8	48	37 - 38,5	23	3,5	26	4	58,4	100	23	36	EC 082 L	2
* DR 400-0058	45	59	92,8	57	44	30	3,5	26	3	83,8	132,3	27,7	42	EC 093 L	1
DR 400-0458	45	59	92,8	57	44 - 45,5	30	4	26	4	83,8	132,3	23	36	EC 093 L	2
* DR 400-0061	60	71	111,8	69	55	31	4	34	5	94,2	160,7	38,6	65,2	EC 112 L	1
DR 400-0461	60	69	111,8	69	55 - 57	31	4	30	5	94,2	160,7	32	50	EC 112 L	2
* DR 400-0062	60	80	127,8	72,3	56	37	5	40	5	128	226,8	53	92	EC 128 L	1
DR 400-0462	60	80	127,8	72,3	56 - 60	37	5	34	5	128	226,8	41	72	EC 128 L	2
* DR 400-0063	60	103	153,8	78,5	58,5	43	5,5	50	3	172,3	325,9	133,3	244	EC 154 L	1
DR 400-0463	60	108	153,8	78,5	58,5 - 62,5	45	6	34	3	172,3	325,9	41	72	EC 154 L	2

THE BEARINGS ARE IN ZRS EXECUTION.

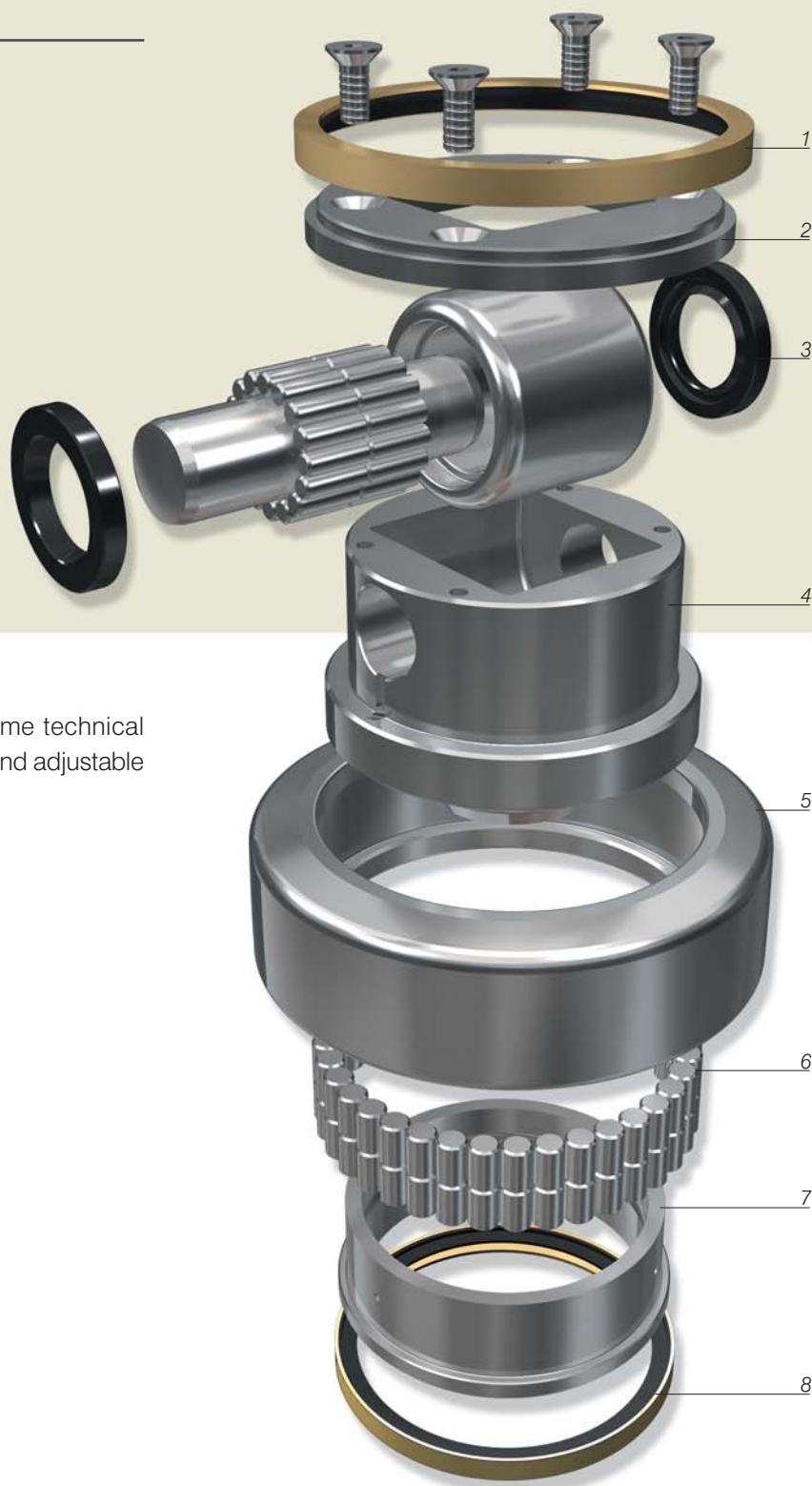
C: Dynamic load      C<sub>0</sub>: Static load      C<sub>a</sub>: Dynamic axial load      C<sub>0a</sub>: Static axial load

\* DR400-0056, DR400-0058, DR400-0063 are executed with lubrication holes.



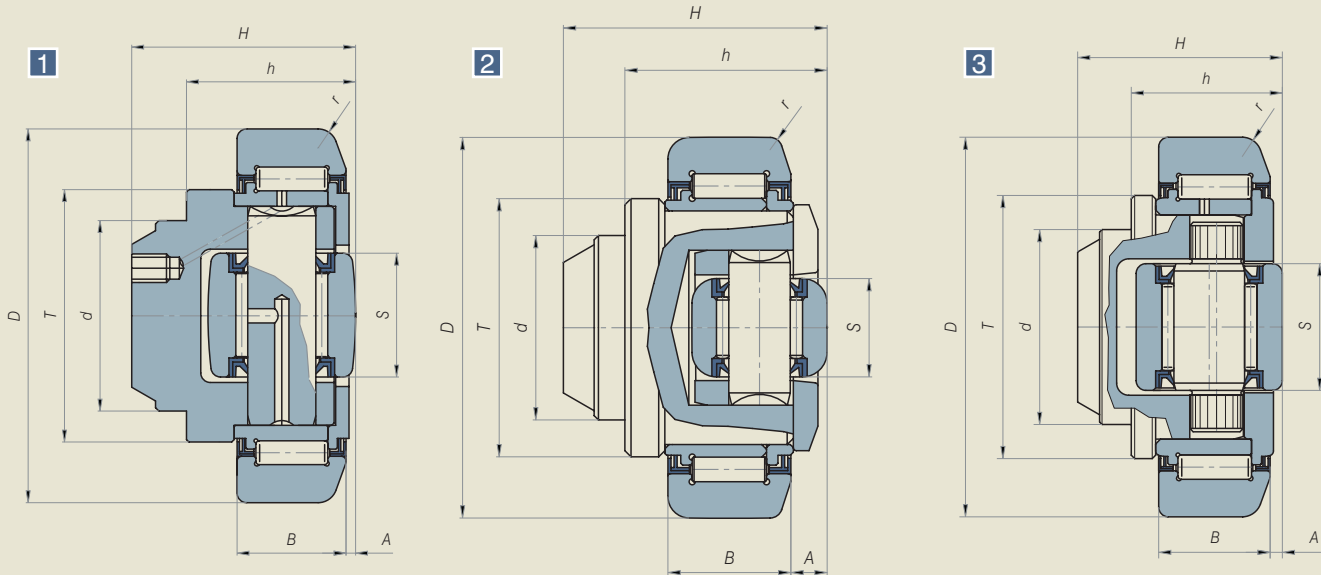
# PRECISION COMBINED BEARINGS

- 
1. ZRS SEAL RING
  2. SUPPORT THRUST RING
  3. AXIAL PART
  4. PIVOT
  5. OUTER RING
  6. CYLINDRICAL ROLLERS
  7. INNER RING
  8. ZRS SEAL RING
- 



Precision combined bearings have the same technical characteristics as fixed combined bearings and adjustable combined bearings with eccentric pin.

# COMBINED BEARINGS FOR "I" STANDARD RAILS



The combined bearings for I profiles keep the standard features. They are exclusively used by the manufacturers of fort lift masts.

C.R. ref.	d	T	D	H	h	B	A	S	r	C	C <sub>0</sub>	C <sub>a</sub>	C <sub>0a</sub>	Ø on request	PROFILE	Ref.
	mm	mm	mm	mm	mm	mm	mm	mm	mm	KN	KN	KN	KN			
															mm	
400-0055 / 1	35	48	70,1	40	30,5	23	2,5	22	4	55,5	91,7	17,6	25	70,4 / 70,7	3018	1
400-0057	40	53	77,7	40,7	29	23	3	26	4	58,4	100	28,2	35,8	78,1 / 78,5	3019	1
400-0075	40	53	77,7	45	34	23	7	21	4	58,4	100	28,2	35,8	78,1 / 78,5	3019	2
400-0457	40	54	77,7	40	29	23	3,5	26	4	58,4	100	28,2	35,8	*	3019	3
400-0058 / 52	45	59	88,4	52	39	30	3,5	26	3	83,8	132,3	27,7	42	88,9	3020	1
400-0059	50	67	101,2	46	33	28	3	30	3	91	150	31	49	101,9	2912	1
400-0077	50	67	101,2	50,5	37,5	28	7	21	3	91	150	13,2	14,5	101,9	2912	2
400-0459	50	69	101,2	46	33	26	4,5	30	3	91	150	31	49	*	2912	3
400-0060	55	71	107,7	53	39	31	3	34	5	92,5	157	38	65	108,2 / 108,5	3100	1
400-0078	55	71	107,7	58,5	44,5	31	8	33	5	92,5	157	25	28	108,2 / 108,5	3100	2
400-0460	55	69	107,7	54	40	31	4	30	5	92,5	157	31	49	*	3100	3
400-0259	55	76	123,5	57	42	33	4,5	33	5	109,7	185,7	25	28	*	3353	2

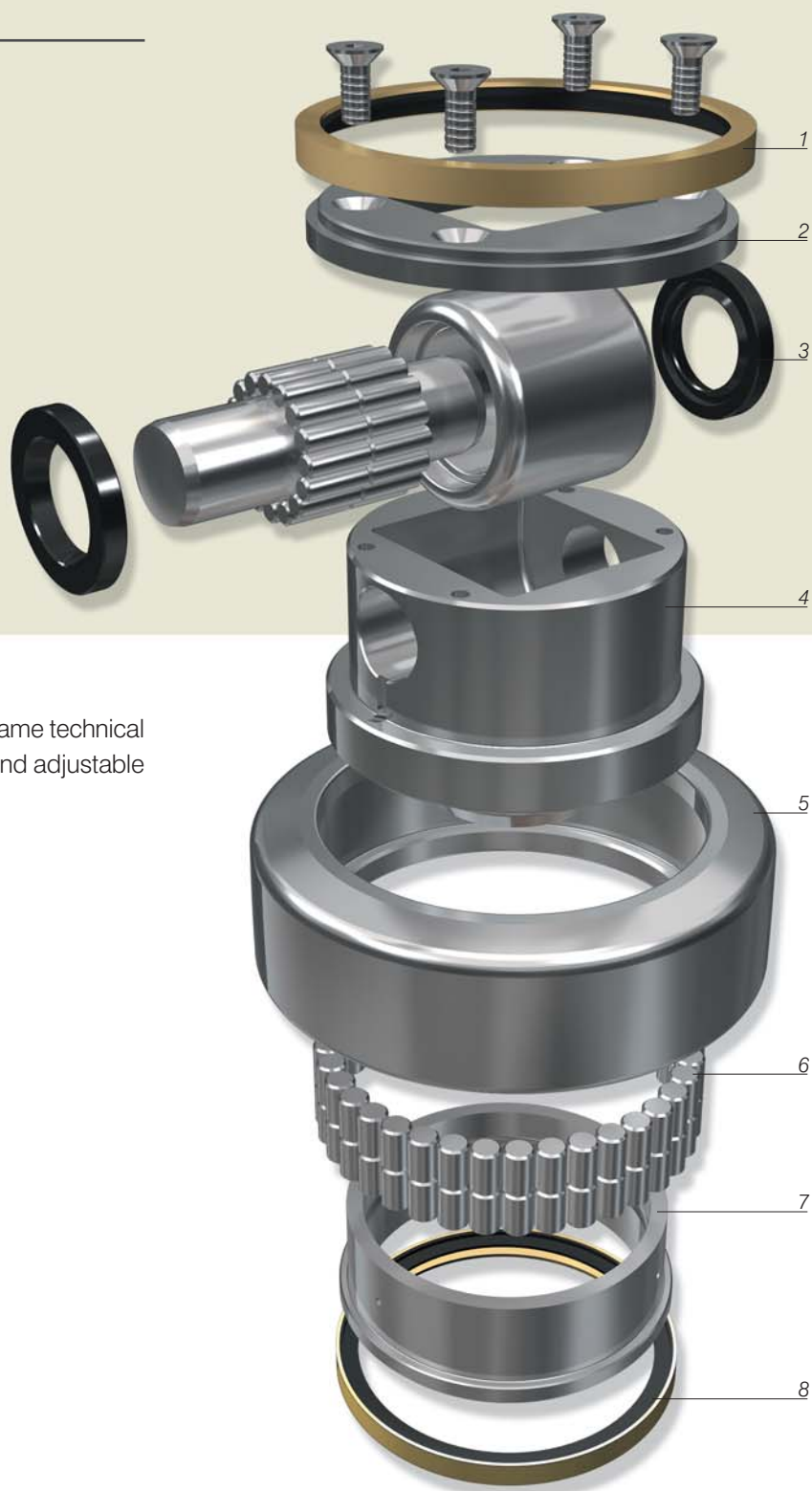
THE BEARINGS ARE IN ZRS EXECUTION.

C: Dynamic load      C<sub>0</sub>: Static load      C<sub>a</sub>: Dynamic axial load      C<sub>0a</sub>: Static axial load

\* 400-0457, 400-0058/52, 400-0059, 400-0060 are executed with lubrication holes.

# COMBINED BEARINGS FOR "I" STANDARD RAILS

- 
1. ZRS SEAL RING
  2. SUPPORT THRUST RING
  3. AXIAL PART
  4. PIVOT
  5. OUTER RING
  6. CYLINDRICAL ROLLERS
  7. INNER RING
  8. ZRS SEAL RING
- 



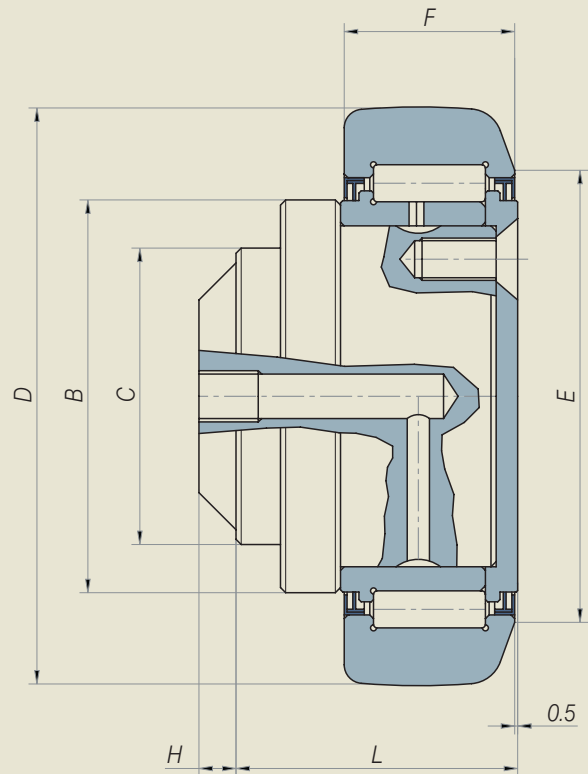
Combined bearings for "I" profiles have the same technical characteristics as fixed combined bearings and adjustable combined bearings with eccentric pin.

# RADIAL BEARINGS WITH PIVOT

The radial bearings with pivot keep the same structural features as the combined bearings.

In this case there is no axial guide inside the bearing.

For this reason these bearings are used in application fields where it is not necessary to bear differentiated loads.



C.R. ref.	C mm	B mm	D mm	L mm	F mm	H mm	E mm	C KN	C <sub>0</sub> KN	PROFILE
* 200-0856	25	42	62	23,5	20	7	50	39	65,2	2890
* 200-0363	30	42	62	29,5	20	7	50	39	65,2	2890
200-0360	35	48	70,1	33,5	23	8,2	57	55,5	91,7	2867
9.2102	40	53	78,1	32	23	11	61	58,4	100	2810
200-0448	45	59	88,9	41	30	13	68	83,8	132,3	2811
200-1641	55	69	107,7	35	31	14	82	94,2	160,7	3100
200-1641 / 1	60	69	107,7	50,5	31	14	82	94,2	160,7	2862
200-1642	60	79	123	51,5	37	16,3	92	128	226,8	2891
200-1643	60	103	149	54	43	20	116	172,3	325,9	2757

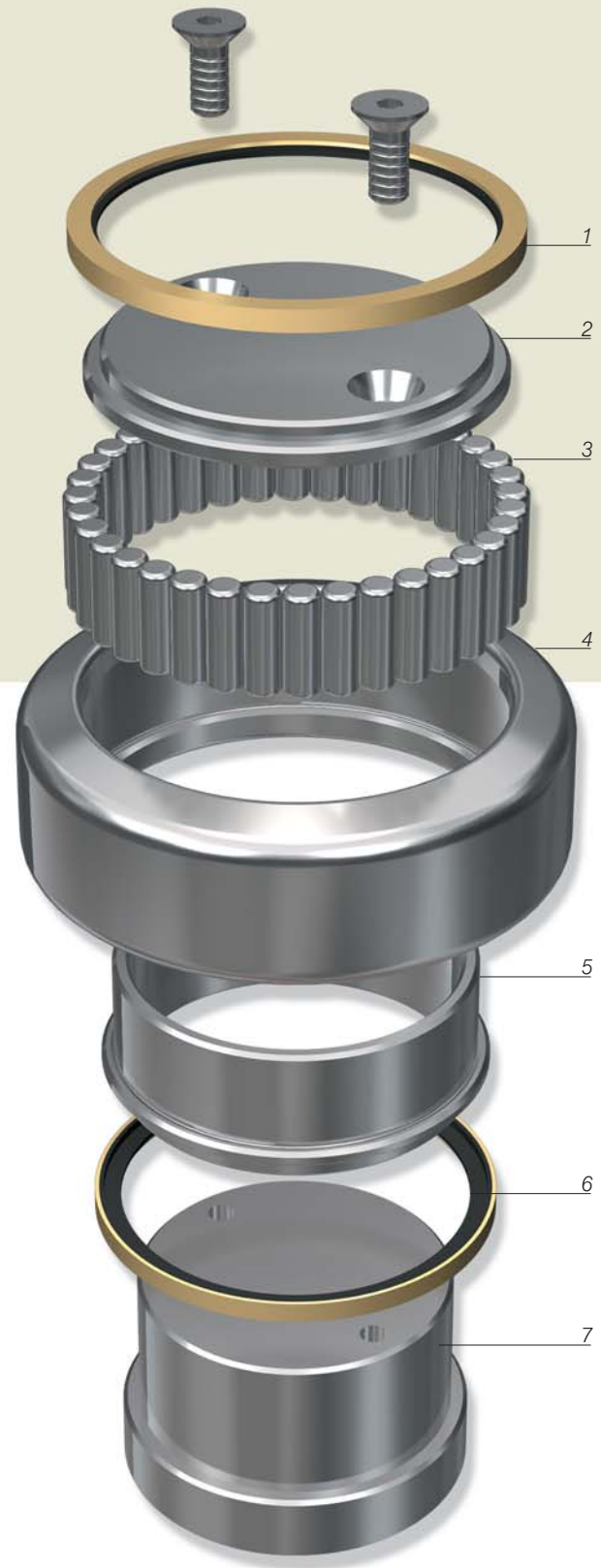
THE BEARINGS ARE IN ZRS EXECUTION.

C : Dynamic load      C<sub>0</sub> : Static load

\* 200-0856 and 200-0363 are supplied in "Long life" execution.

# RADIAL BEARINGS WITH PIVOT

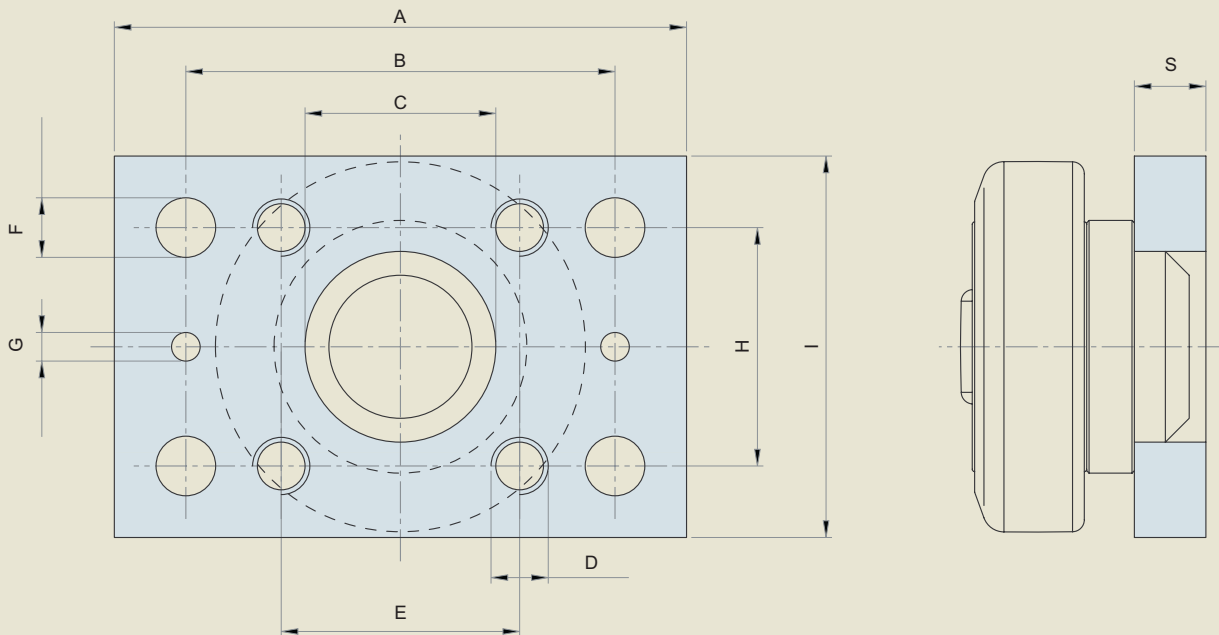
- 
1. ZRS SEAL RING
  2. SUPPORT THRUST RING
  3. CYLINDRICAL ROLLERS
  4. OUTER RING
  5. INNER RING
  6. ZRS SEAL RING
  7. PIVOT
- 



The radial bearings with pivot have the following technical features:

- The outer ring is manufactured in 20CrMnTi cementation steel. This kind of steel can guarantee a very high resistance to stress and can assure a strong resistance against shocks. The surface hardness is 60-2 HRC.
- The inner ring is manufactured in core hardened 100Cr6. The core hardening guarantees a high resistance to wearing and to fatigue. The hardness is 60-2 HRC.
- ZRS seal system, realized by C.R. during the recent years, prevents outer agents, such as dust, wet and mill scale, to enter the inner part of the bearing, and at the same time it prevents the leakage of lubrication grease.
- Also the side thrust ring is manufactured in cementation steel.
- The central pivot is manufactured in low C20/C45 carbon steel. This kind of material guarantees a good resistance and a perfect welding.

# COMBINED BEARINGS WELDED ON PLATE



Bearing ref. + plate	Bearing ref.	Plate ref.	A	B	C	D	E	F	G	H	I	S	PROFILE
			mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	
400-0631	400-0053	800-0288	90	70	30	M.8	40	8,5	6	30	50	10	EC053
400-0608	400-0054	800-0276	100	80	30	M.10	40	10,5	6	40	60	10	2890
400-0609	400-0072	800-0276	100	80	30	M.10	40	10,5	6	40	60	10	2890
400-0610	400-0055	800-0277	120	90	35	M.12	50	12,5	6	50	80	15	2867
400-0611	400-0073	800-0277	120	90	35	M.12	50	12,5	6	50	80	15	2867
* 400-0612	400-0056	800-0278	120	90	40	M.12	50	12,5	6	50	80	15	2810
400-0613	400-0074	800-0278	120	90	40	M.12	50	12,5	6	50	80	15	2810
* 400-0614	400-0058	800-0279	120	90	45	M.16	90	-	-	90	120	20	2811
400-0615	400-0076	800-0279	120	90	45	M.16	90	-	-	90	120	20	2811
* 400-0616	400-0061	800-0280	180	140	60	M.16	80	17	6	80	120	20	2862
400-0617	400-0078 / L	800-0280	180	140	60	M.16	80	17	6	80	120	20	2862
* 400-0618	400-0062	800-0280	180	140	60	M.16	80	17	6	80	120	20	2891
400-0619	400-0079	800-0280	180	140	60	M.16	80	17	6	80	120	20	2891
* 400-0620	400-0063	800-0281	200	160	60	M.16	100	17	6	100	150	20	2757
400-0621	400-0080	800-0281	200	160	60	M.16	100	17	6	100	150	20	2757
* 400-0624	400-0011	800-0281	200	160	60	M.16	100	17	6	100	150	20	2757

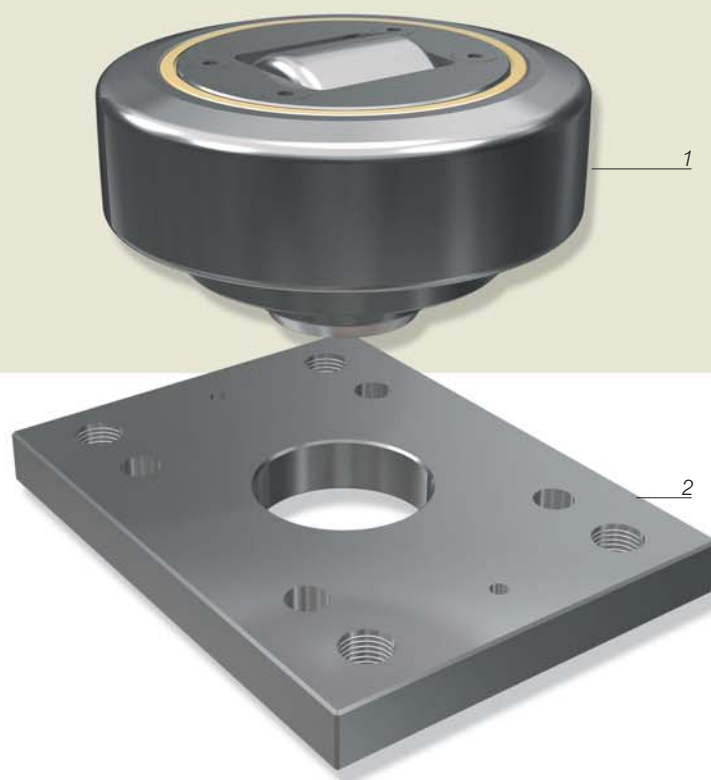
THE BEARINGS ARE IN ZRS EXECUTION.

\* 400-0612, 400-0614, 400-0616, 400-0618, 400-0620, 400-0624 are supplied with lubrication holes.



## COMBINED BEARINGS WELDED ON PLATE

- 
1. *COMBINED BEARING*
  2. *PLATE*
- 



C.R. combined bearings are usually welded on plate.

This is an ideal solution because the bearing welded on plate is directly applied on the structure of the plant, with the big advantage that the assembling and disassembling operations are extremely fast and cheap.

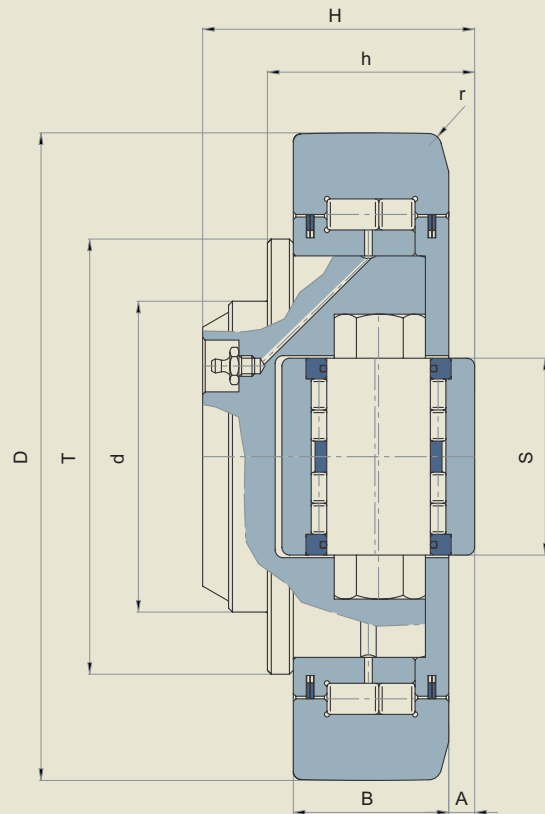
The combined bearings on plate can be supplied in the fixed or adjustable execution.

# "JUMBO" ADJUSTABLE COMBINED BEARINGS

The Jumbo adjustable combined bearings represent a special range both for dimensions and technical features.

They are used both for big size fork lift masts and for different industrial applications in the following fields: ship, aircraft, steel industry.

High load capacity and a limited width represent the fundamental features of this bearing.



C.R. ref.	d	T	D	H	h min.	h max.	B	A	S	r	C	C <sub>0</sub>	C <sub>a</sub>	C <sub>0a</sub>	PROFILE
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	KN	KN	KN	KN	
400-0089	80	113	165	69	53	56	40	5	50	3	213	388	85	133	FM 165
400-0090	100	124	190	84,5	64,5	67,5	48	6,5	60	4	266	500	100	180	FM 190
400-0091	110	146	220	94,5	74,5	77,5	58	6,5	75	5	326	681	138	257	FM 220
400-0092	120	168	250	102	77	80	60	7	75	5	369	748	138	257	FM 250
400-0093	150	188	280	119,5	89,5	93,5	72	7,5	90	5	489	1066	182	488	FM 280
400-0094	140	218	320	135	110	114	85	10	90	8	542	1370	210	422	*

THE BEARINGS ARE IN 2ZL EXECUTION.

C : Dynamic load

C<sub>0</sub> : Static load

C<sub>a</sub> : Dynamic axial load

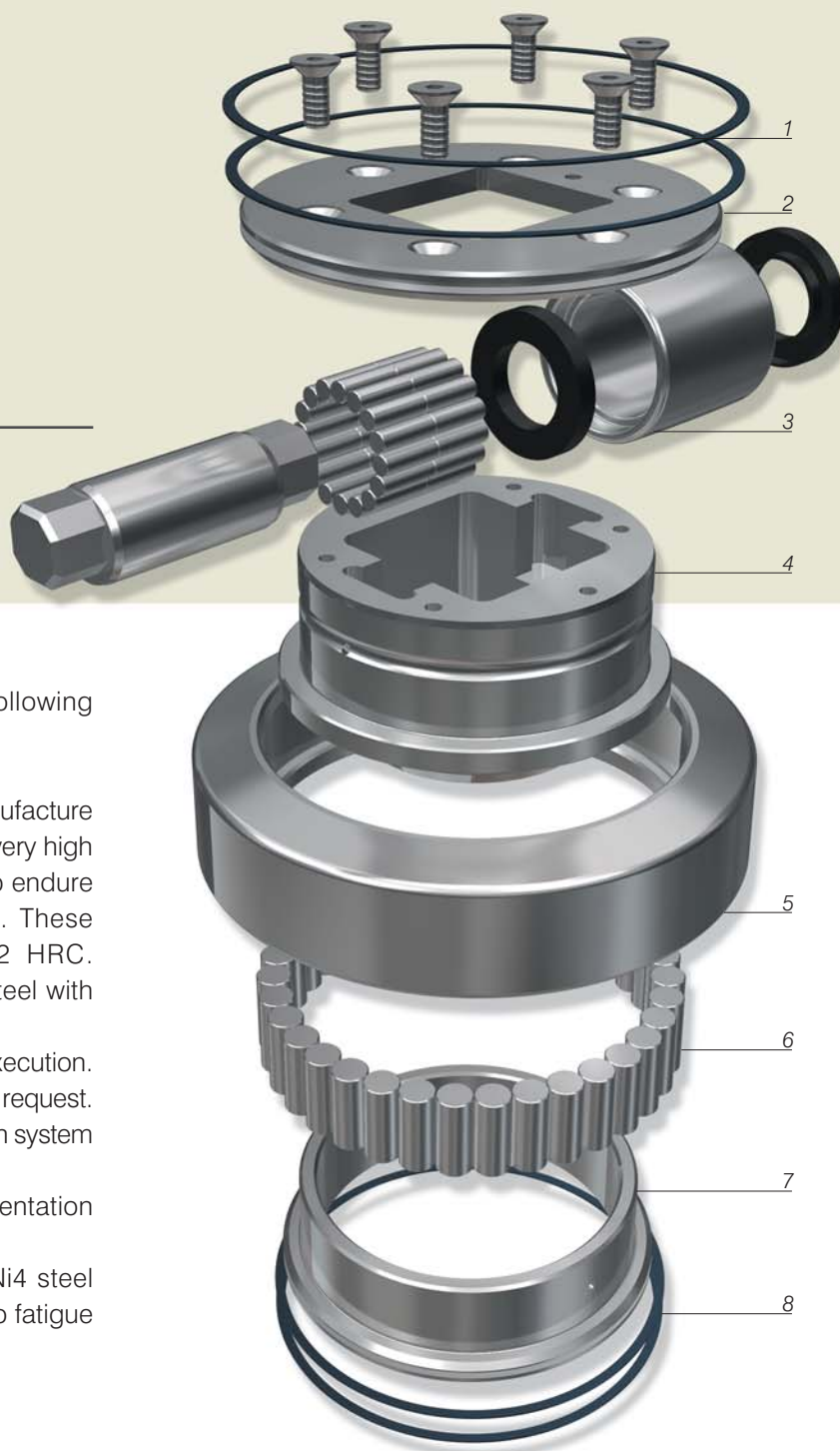
C<sub>0a</sub> : Static axial load

The adjusting of dimension "H" is possible through the rotation of the axial pivot.

The bearings are supplied with lubrication holes.

# "JUMBO" ADJUSTABLE COMBINED BEARINGS

- 
1. FEY SEAL RING
  2. SUPPORT THRUST RING
  3. AXIAL PART
  4. PIVOT
  5. OUTER RING
  6. CYLINDRICAL ROLLERS
  7. INNER RING
  8. FEY SEAL RING
- 



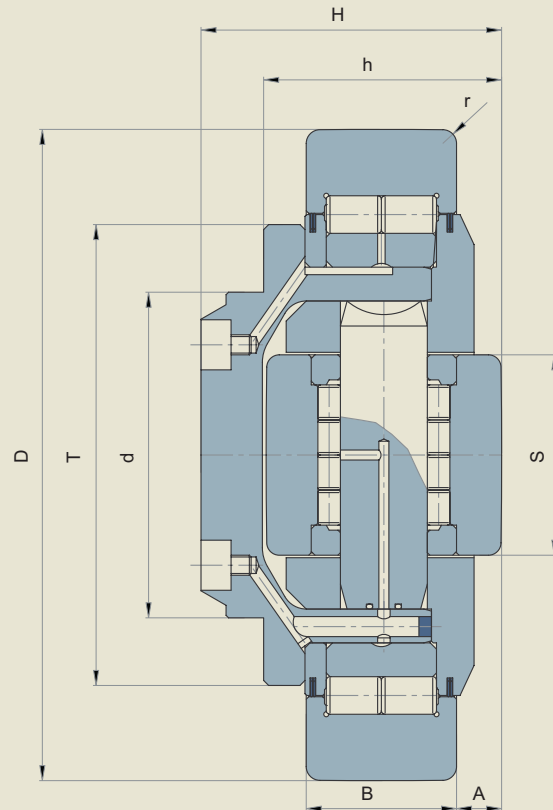
The "Jumbo" adjustable bearings have the following features:

- Outer ring, axial little roll and little pin are manufacture in 16CrNi4 steel . This kind of material has a very high core resistance and is particularly suitable to endure shocks and to support the applied loads. These components reach a hardness of 60-2 HRC.
- The inner ring is manufactured in 100Cr6 steel with hardness 60+2 HRC.
- They are normally supplied with seals in ZZ execution. They can also be supplied in 2RS execution on request. "Jumbo" bearings are provided with a lubrication system of the radial part.
- Also the thrust ring is manufactured in cementation steel.
- The central pivot is manufactured in 16CrNi4 steel which guarantees the maximum resistance to fatigue and a good welding.

# ADJUSTABLE COMBINED BEARINGS FOR HEAVY INDUSTRY

Big size adjustable combined bearings can bear very high loads.

They are mainly used for masts of fork lifts up to 50TN and in steel industry where they are used as a wheel for rolling mills carrying cars.



C.R. ref.	d	T	D	H	h	B	A	S	r	C	C <sub>o</sub>	C <sub>a</sub>	C <sub>oa</sub>
	mm	mm	mm	mm	mm	mm	mm	mm	mm	KN	KN	KN	KN
400-0069	70	98	170	109,7	84,7	51	11,2	49,7	4	195	361	83	129
400-0087	80	115	185	100	75	47	15	49,7	3	235	440	83	130
400-0019	110	150	220	115	90	60	13,5	70	5	367	719	103	230
400-0038	130	184	260	120	95	60	18,5	80	5	475	1.000	167	279
400-0274	150	187	260	135	110	80	10	80	5	566	1.300	167	279
400-0088	140	190	300	140	110	80	10	86	8	549	1.272	195	335
400-0278	140	240	315	240	120	89	10	100	8	785	1.690	227	392
400-0084	140	240	340	150	120	89	10	100	8	785	1.690	227	392
400-0275	170	242	390	200	150	118	11	100	8	1.076	2.535	227	392

THE BEARINGS ARE IN ZZ EXECUTION, THEY CAN BE EXECUTED IN 2RS ON REQUEST.

C : Dynamic load      C<sub>o</sub> : Static load      C<sub>a</sub> : Dynamic axial load      C<sub>oa</sub> : Static axial load

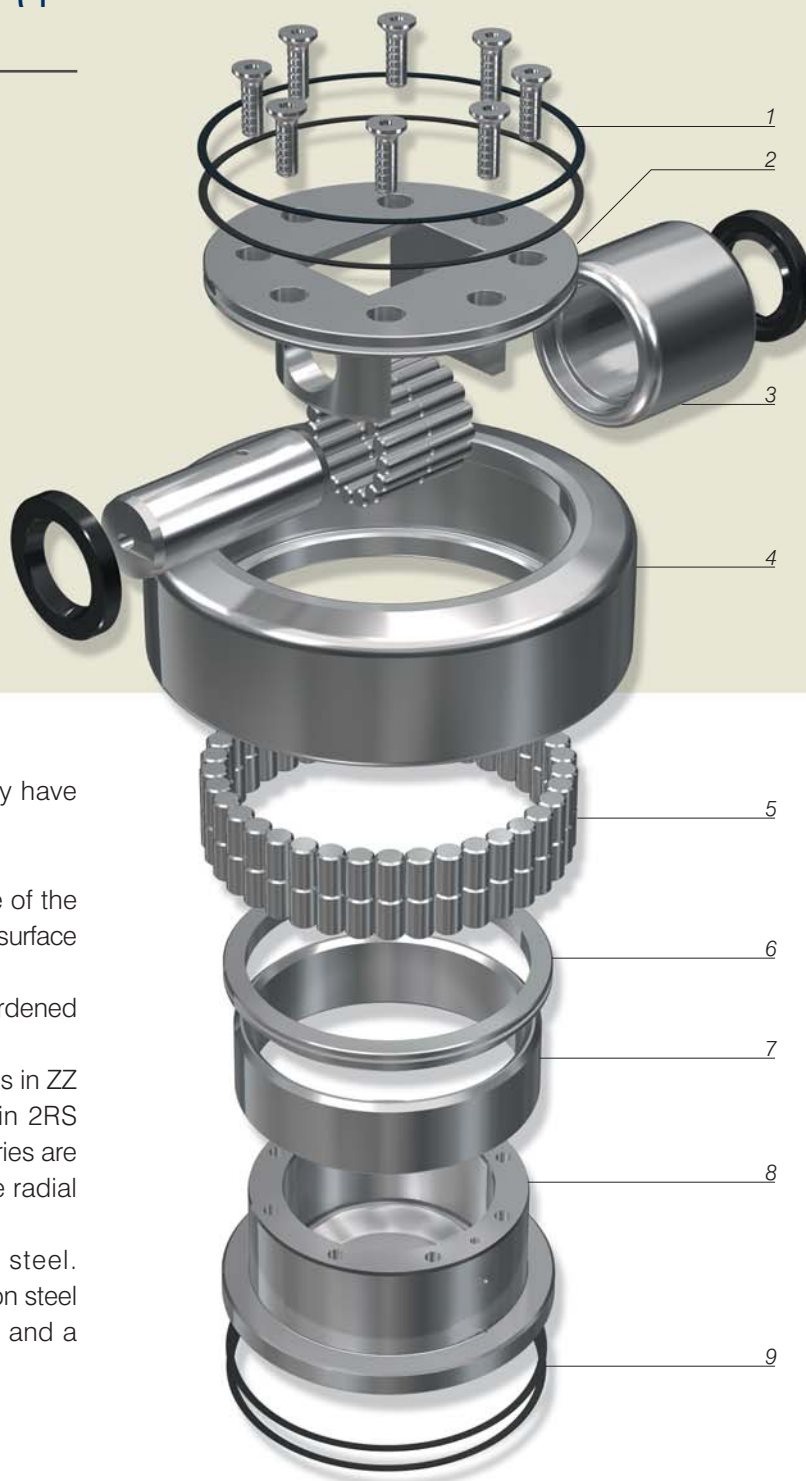
The adjusting of "A" size is made through washer rings put between the main support roll and the lateral guide bearing.

Adjusting washers with 0,3-0,5-1 mm thickness are available.

The bearings are supplied with lubrication holes.

# ADJUSTABLE COMBINED BEARINGS FOR HEAVY INDUSTRY

- 
1. FEY SEAL RINGS
  2. SUPPORT
  3. AXIAL PART
  4. OUTER RING
  5. CYLINDRICAL ROLLERS
  6. SUPPORT THRUST RING
  7. INNER RING
  8. PIVOT
  9. FEY SEAL RINGS
- 



Adjustable combined bearings for heavy industry have the following features:

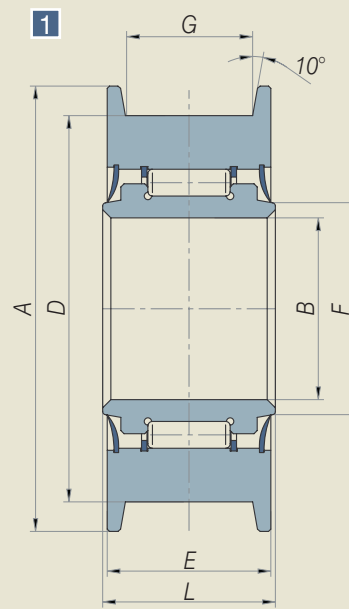
- The outer ring and the axial little roll are made of the best possible 18NiCrMo5 cementation steel. The surface hardness is 60-2 HRC.
- The inner ring and little pin are made of core hardened 100Cr6 with hardness 60+2 HRC.
- These bearings are normally supplied with seals in ZZ execution. They can also be manufactured in 2RS execution on request. All the bearings of this series are provided with a lubrication system both for the radial and the axial part.
- The thrust ring is made of cementation steel.
- The central pivot is made of 16CrNi4 cementation steel which guarantees a high resistance to stress and a good welding.

# CHAIN PULLEYS

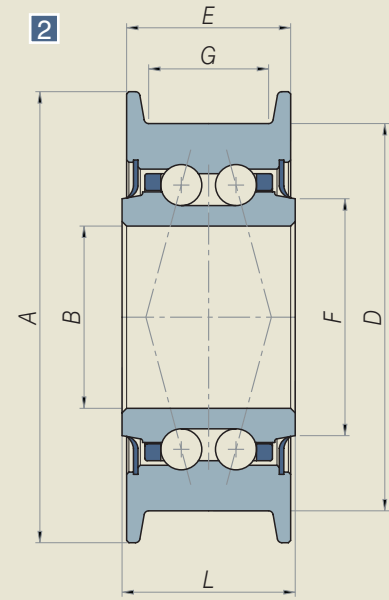
C.R. chain pulleys are suitable to gear Fleyer chains.

They are used as lifting parts in fork lifts masts.

They are supplied pre-lubricated and with seals.



Cylindrical roller execution



Ball execution

1	C.R. ref.	B	D	L	E	G	A	F	C	C <sub>0</sub>	CHAIN
		mm	mm	mm	mm	mm	mm	mm	KN	KN	
	200-0247 / 2	40	70	26,5	25	19	78	50	44	46	BL 534 - AL 544 - LL 1044
	200-1644 / 2	40	80	28	26	19	90	50	50	54	BL 534 - AL 544 - LL 1244
	200-0252	40	80	43	41	33	98	50	81	87	BL 634 - AL 666 - LL 1288
	200-1080 / 2	40	85	38	36	28	98	50	64	70	BL 634 - AL 644 - LL 1266
	200-0241 / 2	50	100	42	40	33	115	60	89	162	BL 834 - AL 844 - LL 1644
	200-1190	55	110	58	56	45	135	65	135	146	BL 846 - AL 866 - LL 1666
	200-1191	55	130	67	65	55	158	65	200	218	BL 1046 - AL 1066 - LL 2066

2	C.R. ref.	B	D	L	E	G	A	F	C	C <sub>0</sub>	CHAIN
		mm	mm	mm	mm	mm	mm	mm	KN	KN	
	900-3481	40	70	26,5	25	19	78	50	25	32	BL 534 - AL 544 - LL 1044
	900-3822	40	80	28	26	19	90	50	25	32	BL 534 - AL 544 - LL 1244
	900-3823	40	80	43	41	33	98	50	37	45	BL 634 - AL 666 - LL 1288
	900-2975	40	85	38	36	28	98	50	37	45	BL 634 - AL 644 - LL 1266
	900-3283	50	100	42	40	33	115	60	52,8	58,5	BL 834 - AL 844 - LL 1644
	900-3468	55	110	58	56	45	135	65	57,2	67	BL 846 - AL 866 - LL 1666
	900-3376	55	130	67	65	55	158	65	72,1	85	BL 1046 - AL 1066 - LL 2066

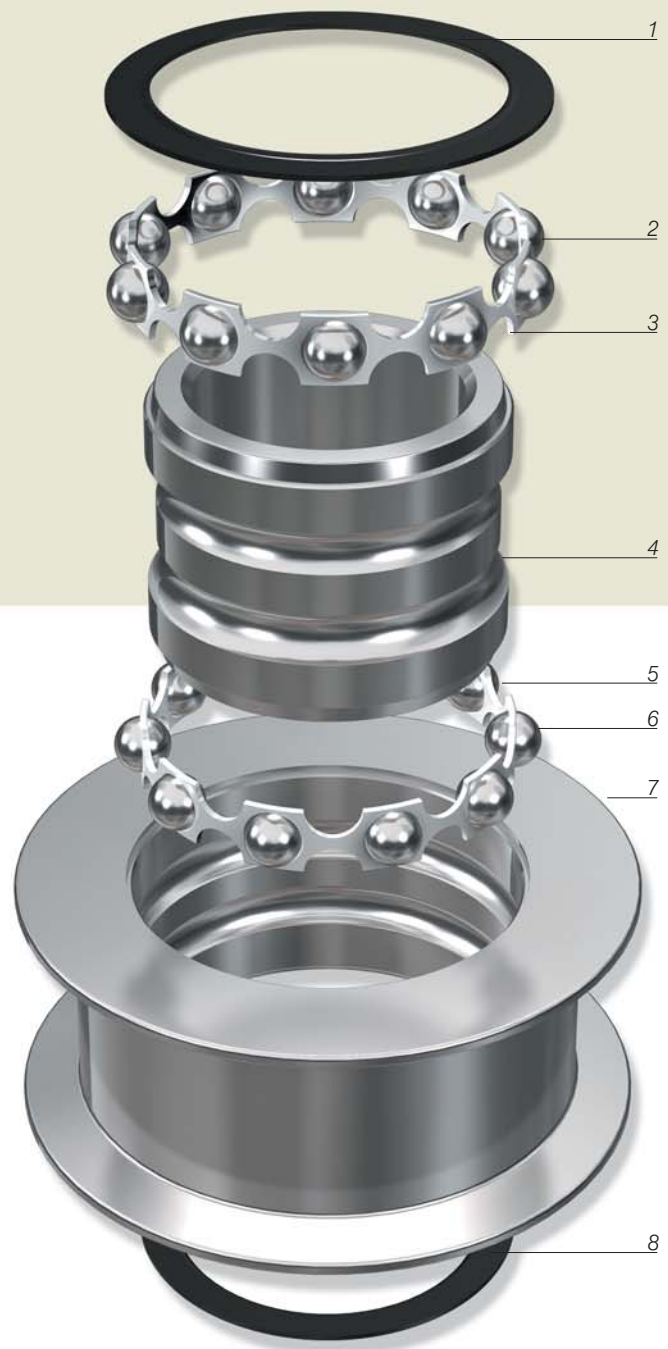
C : Dynamic load

C<sub>0</sub> : Static load



# CHAIN PULLEYS

- 
1. *RS SEAL RING*
  2. *BALLS*
  3. *CAGE*
  4. *INNER RING*
  5. *CAGE*
  6. *BALLS*
  7. *OUTER RING*
  8. *RS SEAL RING*
- 



Chain pulleys have the following features:

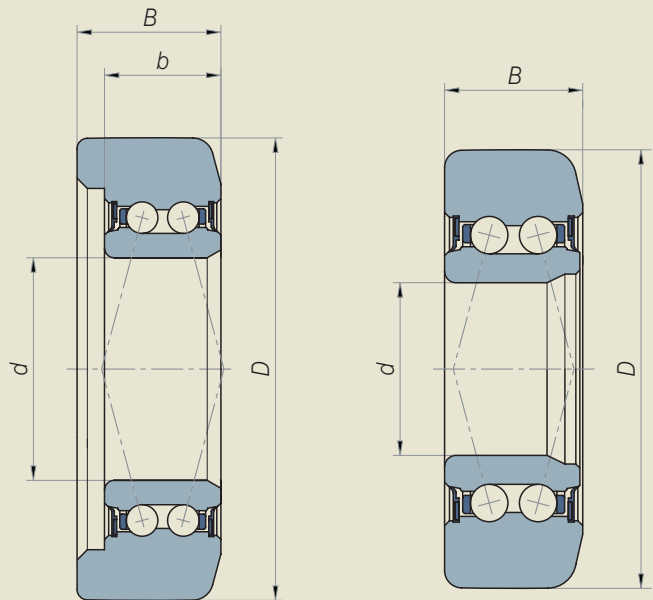
- The outer ring is made of 20CrMnTi cementation steel with surface hardness 60-2 HRC.
- The inner ring is made of 100Cr6 total hardened steel with hardness 60+2 HRC.

# BALL BEARINGS WITH **CAGE** FOR **FORK LIFT MASTS**

C.R. radial ball bearings are mainly used for fork lift masts.

They are manufactured in rigid execution, with two or four contact points and with one or two crowns of balls which are separated by a polyamide cage.

This series of bearings presents a quite good radial load capacity and a very good resistance against the axial thrusts.



C.R. ref.	<i>d</i> mm	<i>D</i> mm	<i>b</i> mm	<i>B</i> mm	<i>C</i> KN	<i>C</i> <sub>0</sub> KN
900-3945	35	80,9	25,2	26	35,5	72
900-3945/A	35	81,2	25,2	26	35,5	72
900-3945/B	35	81,5	25,2	26	35,5	72
900-3945/C	35	81,8	25,2	26	35,5	72
900-3494	40	89,9	-	29	74,0	93
900-3494/A	40	90,2	-	29	74,0	93
900-3494/B	40	90,5	-	29	74,0	93
900-3493	45	106,1	-	34	94,0	122
900-3493/A	45	105,8	-	34	94,0	122
900-3493/B	45	105,4	-	34	94,0	122
900-3522	65	135,1	34,0	42	130,0	200
900-3522/A	65	135,6	34,0	42	130,0	200
900-3522/B	65	136,0	34,0	42	130,0	200

*C* : Dynamic load

*C*<sub>0</sub> : Static load

# BALL BEARINGS WITH **CAGE** FOR **FORK** LIFT **MASTS**

- 
1. *RS SEAL RING*
  2. *CAGE*
  3. *BALLS*
  4. *CAGE*
  5. *OUTER RING*
  6. *INNER RING*
  7. *RS SEAL RING*
- 



I cuscinetti radiali a sfere per montanti di carrelli elevatori presentano le seguenti caratteristiche.

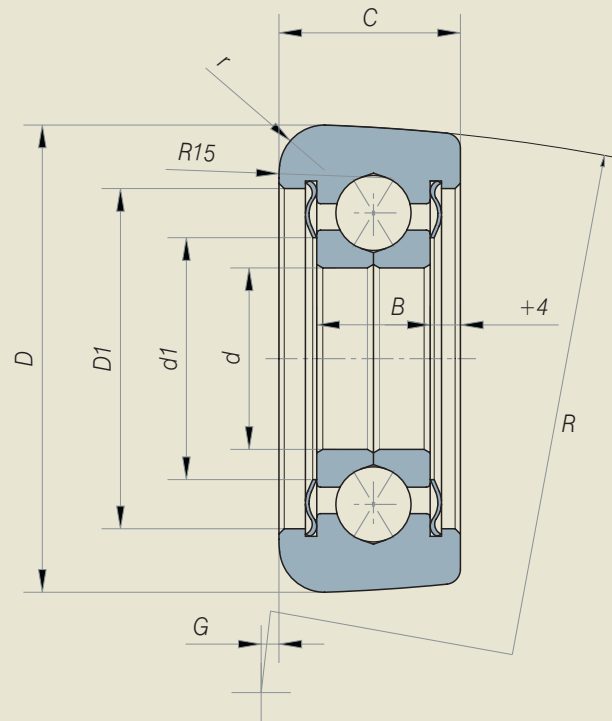
- The outer ring is made of UNI 20 CrMnTi cementation steel, with surface hardness degree 60-2 HRC.
- The inner ring is made of total hardened UNI 100Cr6 steel, with surface hardness degree  $60\pm 2$  HRC.
- These bearings are designed with a limited radial clearance and with small size sections.

# FULL COMPLEMENT BALL BEARINGS FOR FORK LIFT MASTS

Full complement radial ball bearings, like the previous series, are mainly used in fork lift masts.

They are manufactured with one row of balls with four contact points.

The full complement execution guarantees a very high radial load capacity and a very good axial support.



C.R. ref.	d	D	C	B	d <sub>1</sub>	D <sub>1</sub>	R	G	C	C <sub>0</sub>	C <sub>a</sub>	C <sub>0a</sub>
	mm	mm	mm	mm	mm	mm	mm	mm	KN	KN	KN	KN
900-3596	24	69,5	26	15	30	45	250	4,25	38	28	32,5	24
900-3377	28	77,5	28	18	37	57	250	4,85	51	31,5	44	29
900-3568	33	88,5	30	20	43	62,5	500	4,9	66	42	56	37,5
900-3801	40	107	34	23	51	79	500	2,35	92	70	75	59
900-3597	50	122,5	38	26	63	93	1000	21,4	119	98	93	77
900-3598	65	149	44	30	80	115	1000	17,25	178	155	131	111

C: Dynamic load      C<sub>0</sub>: Static load      C<sub>a</sub>: Dynamic load as roller      C<sub>0a</sub>: Static load as roller

# FULL COMPLEMENT BALL BEARINGS FOR FORK LIFT MASTS

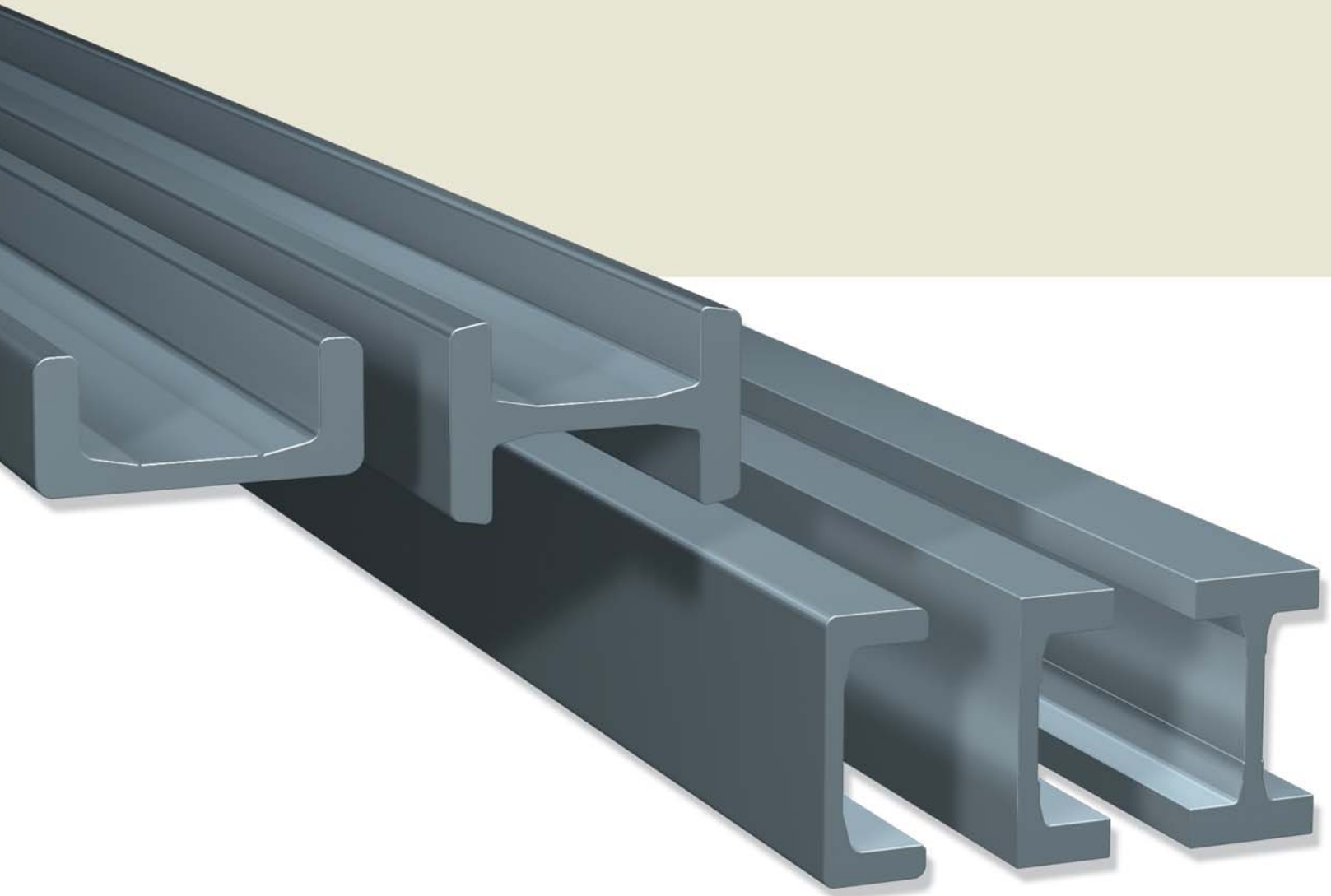
- 
1. PROTECTION COVER
  2. INNER RING
  3. OUTER RING
  4. BALLS
  5. INNER RING
  6. PROTECTION COVER
- 



Full complement ball bearings for fork lift masts have the following characteristics:

- The outer ring is manufactured in case hardened UNI 20CrMnTi steel with hardness degree 60-2 HRC.
- The inner ring, which is made of two half-rings, is manufactured in total hardening UNI 100Cr6 steel with hardness degree  $60 \pm \text{HRC}$ .
- The calculation of these bearings is made with restricted radial clearance and sections.

# LIFT GUIDES



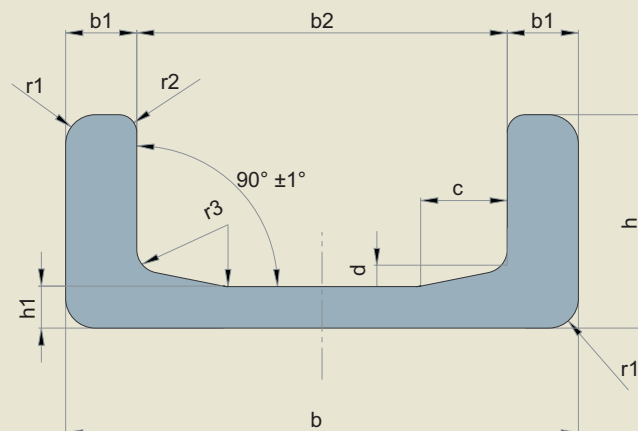


# “U” STANDARD LIFT GUIDES

“U” standard lift guides are used in different industrial fields: fork lift masts, food industry, car industry, ceramic industry, machine tool industry.

Normally small and medium size combined bearings are used inside these guides.

They are manufactured in ST 52.3 steel.



C.R. ref.	Dimensions															WEIGHT Wx	
	(b)	b1	Tol.	b2	Tol.	h	Tol.	h1	Tol.	c	d	r1	r2	r3	Kg/m	Cm <sup>3</sup>	
EC 053	65	6	±0,5	53	±0,4	30	±0,5	6	±0,5	4	4	6	4	*	5,3	11,9	
2890	86,5	12	±0,5	62,5	+1	36	±0,8	7	±0,5	15	3	≤6	2-3	4	10,5	32	
2867	103,2	16,2	±0,5	70,8	±0,5	40	±0,8	7,7	±0,5	15	3	≤6	2-3	5	14,8	53	
2810	121,3	21,3	±0,5	78,7	±0,5	41	±0,8	10,8	±0,5	15	5	≤6	2-3	5	20,9	81	
2811	135,4	23	±0,5	89,4	±0,5	53	±0,8	12,7	±0,5	15	5	≤6	2-3	5	28,6	128	
2862	157,2	24,4	±0,5	108,4	±0,5	61,2	±0,8	14	±0,5	15	5	≤6	2-3	5	35,9	190	
2891	175	25,6	±0,5	123,8	±0,5	66,2	±0,8	16,2	±0,5	15	5	≤6	2-3	5	42,9	250	
2757	201,5	25,7	±0,5	150,1	±0,5	71,2	±0,8	19,4	±0,5	20	5	≤8	2-3	6	52,3	340	

Material: UNI Fe 510 C – DIN St 52.3

The profiles can be cut on request of the customer, maximum length is 12 m.

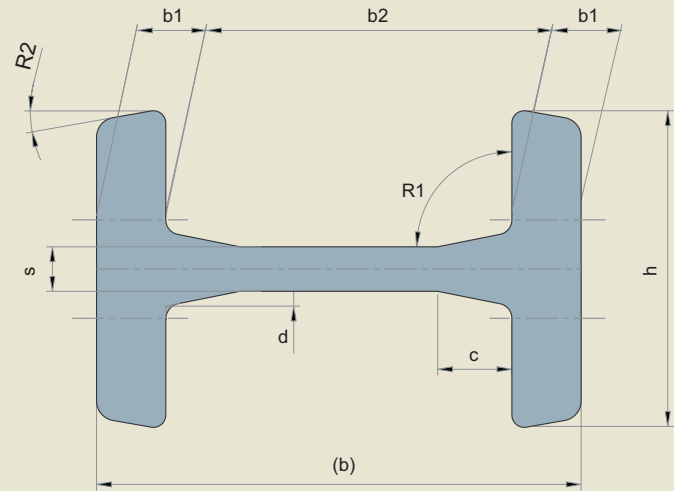
# “I” STANDARD LIFT GUIDES

Standard “I” profiles are exclusively used to build the fork lift masts.

The “I” profile has been realized in order to satisfy the needs of the manufacturers of fork lifts.

The combined bearings are used inside these profiles, like in the case of the “U” profiles.

They are manufactured in ST 52.3 steel.



C.R. ref.	Dimensions												WEIGHT $W_x$		
	(b)	$b_1$	Tol.	$b_2$	Tol.	$h$	Tol.	$s$	Tol.	$c$	$d$	$R_1$	$R_2$	Kg/m	$Cm^3$
3018	98	14	$\pm 0,5$	70	+1	65	$\pm 1$	9	$\pm 0,5$	15	3	$91^\circ+1^\circ$	$10^\circ$	19,4	70
3019	113,9	18	$\pm 0,5$	77,9	+1	66	$\pm 1$	11	$\pm 0,5$	15	3	$91^\circ+1^\circ$	$10^\circ$	25,3	102
3275	129,6	20,5	$\pm 0,5$	88,6	+1	72	$\pm 1,25$	12	$\pm 0,5$	15	3	$91^\circ+1^\circ$	$10^\circ$	31,2	143
3020	129,6	20,5	$\pm 0,5$	88,6	+1	81	$\pm 1,25$	12	$\pm 0,5$	15	3	$91^\circ+1^\circ$	$10^\circ$	34,1	160
2912	140,2	18,96	$\pm 0,8$	102,28	-0,8	69,9	+1,60	12,7	$\pm 0,5$	*	*	*	*	31,2	157
3100	152,4	22	$\pm 0,5$	108,4	$\pm 0,5$	83	$\pm 1$	14	$\pm 0,5$	20	3	$91^\circ+1^\circ$	$12^\circ$	40,8	219
3353	175	25,6	$\pm 0,5$	123,8	$\pm 0,5$	90	$\pm 1,3$	15	$\pm 0,5$	20	5	$91^\circ+1^\circ$	$5^\circ$	51,4	322

Material: UNI Fe 510 C – DIN St 52.3

The profiles can be cut on request of the customer, maximum length is 12 m.

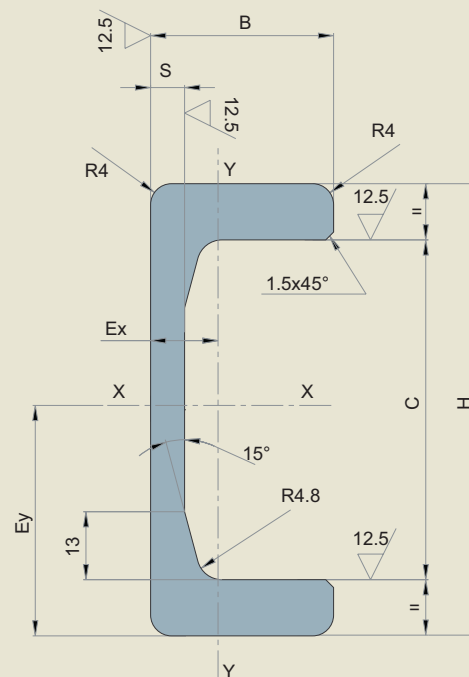
# “U” PRECISION LIFT GUIDES

“U” precision lift guides are obtained from “U” standard lift guides.

They are processed by a machine tool in order to have a high level of processing with extremely limited tolerances.

Used with “DR” special combined bearings inside, they represent a very good alternative to the linear guide system.

They are made of ST 52.3 steel.



C.R. ref.	Dimensions				Moments of Inertia		Modulus of Resistance		WEIGHT Kg/m	Ex mm	Ey mm
	C	H	B	S	Jx Cm <sup>4</sup>	Jy Cm <sup>4</sup>	Wx Cm <sup>3</sup>	Wy Cm <sup>3</sup>			
EC 065 L	65	86,5	35	6,5	125,1	12,9	28,9	10,7	9,44	12,09	43,25
EC 074 L	74	103	39	7	248,9	23,2	48,3	16,3	13,14	14,22	51,5
EC 082 L	82	121	39,2	9	439,1	30,3	73,4	21,4	17,87	14,44	60,5
EC 093 L	93	135,5	51	11	792	75	116,9	39,6	25,16	18,94	67,75
EC 112 L	112	157	59	12	1357,5	126,8	172,9	59,1	31,47	21,46	78,5
EC 128 L	128	175	64	14	1891,5	174,2	227,6	77,4	37,71	22	87
EC 154 L	154	201	69	17	3098,7	230,8	308,3	46	45,98	22,8	100,51

Material: UNI Fe 510 C – DIN St 52.3

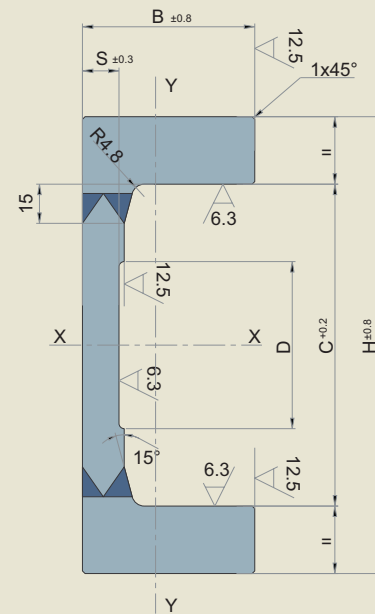
The profiles can be cut on request of the customer, maximum length is 10 m.

# “U” WELDED LIFT GUIDES

The “U” welded lift guides are obtained from the assembling of welded laminated plates.

They are used in heavy industry, in high load fork lift masts, in big size handling plants.

They are made of ST 52.3 steel.



C.R. ref.	Nominal Capacity KN	Centre of Gravity mm	Dimensions					Moments of Inertia		Modulus of Resistance		WEIGHT Kg/m
			C	H	B	S	D	Jx Cm <sup>4</sup>	Jy Cm <sup>4</sup>	Wx Cm <sup>3</sup>	Wy Cm <sup>3</sup>	
FC 123 L	50	600	123,3	175	66	16	*	2181,6	206	249,3	86,7	42,37
FC 149 L	60	600	149,4	202	71,2	19,4	*	3480,6	276,5	344,6	114	52,31
FC 165	80	600	165,4	230	57,5	18	80	4410,5	174,6	383,5	87,5	53,3
FC 190	100	600	190,4	255	77	22	80	7631,6	434,2	598,6	167,7	73,7
FC 220	160	600	220,4	295	85	20	125	12632,7	6720,4	856,5	231,7	86,1
FC 250	200	600	250,4	344	94	26,5	125	23371,6	1117,4	1358,8	344,9	122,8

Material: UNI Fe 510 C – DIN St 52.3

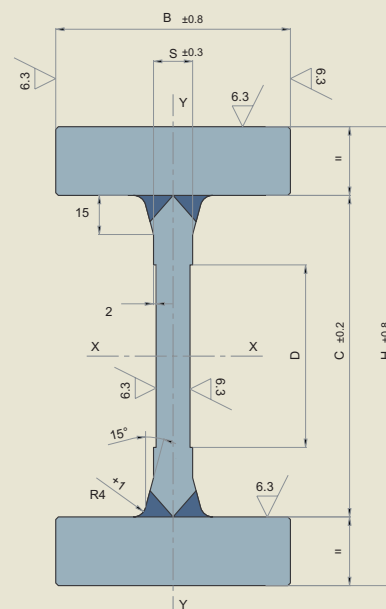
The profiles can be cut on request of the customer, maximum length is 10 m.

# “I” WELDED LIFT GUIDES

The “I” welded lift guides are obtained from the welding of laminated plates.

They are used in the same application fields as the “U” welded lift guides.

Jumbo series combined bearings are used inside these guides.



C.R. ref.	Nominal Capacity KN	Centre of Gravity mm	Dimensions					Moments of Inertia		Modulus of Resistance		WEIGHT Kg/m
			C	H	B	S	D	Jx Cm <sup>4</sup>	Jy Cm <sup>4</sup>	Wx Cm <sup>3</sup>	Wy Cm <sup>3</sup>	
FI 123	60	800	123,3	176	90	15	*	2960	325	336	72	52,8
FI 149	80	800	149,3	205	110	16	*	5320	615	519	112	68,7
FM 165	100	600	165,4	230	95	16	80	6825	475	593	100	71
FM 190	160	600	190,4	255	130	20	80	11983	1203	940	185	100
FM 220	180	1.200	220,4	295	150	20	125	21035	2123	1426	283	128
FM 250	280	1.200	250,4	345	160	25	125	37883	3279	2196	410	175
FM 280	360	1.200	280,4	375	190	30	125	55210	5498	2945	578	215
FM 280 R	420	1.200	280,4	395	190	30	125	69230	6642	3505	700	245

Material: UNI Fe 510 C – DIN St 52.3

The profiles can be cut on request of the customer, maximum length is 10 m.

# STEEL INDUSTRY





This field identifies C.R. trade mark. C.R. development in technology, production and quality allowed the manufacturing of more and more reliable and sophisticated bearings, suitable to the improvement of the hard running conditions of straightening and sheet flattening machines, shears, rolling mills and conveyor belts. This field of steel industry has been one of the most prolific sectors for the last ten years and is steadily increasing.



# BACK-UP ROLLERS WITH PIVOT FOR METAL FLATTENING MACHINES

Back-up rollers for metal flattening machines are made in two different executions:

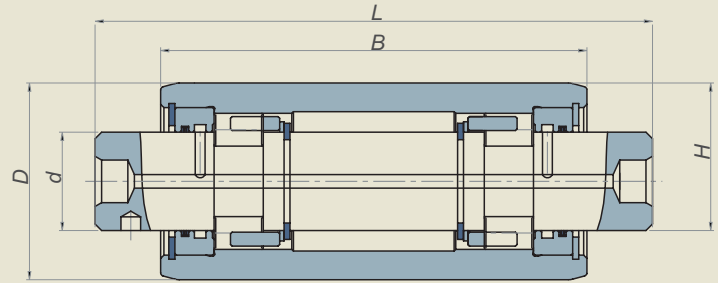
- full complement of cylindrical rollers
- with roller cages in mould steel or bronze.

The full complement execution allows the bearing to reach a high load capacity both dynamic and static. The wide working surface, along with the rolling system, made of two or more cages, allow the plant to reach very high flattening performance and high speed.

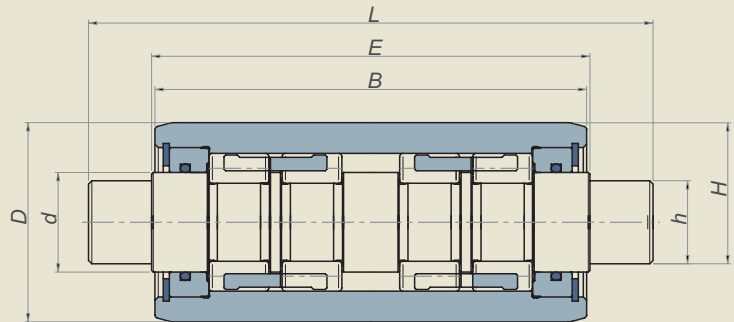
The distance rings, which are obtained entirely on the outer ring and on the pivot, and the circle clearance, which is calculated at the minimum, allow a good support of axial loads.

The execution with roller cages represent the most advanced series of back-up rolls.

This series of back-up rollers is usually manufactured with two lateral thrust bearings in the inner body, either with balls or rollers, which guarantee a very strong support of axial loads.



Execution with 2 rows of rollers



Execution with 4 rows of rollers

C.R. Ref.	outer Ø	Reference	D	d	L	B	E	h	PDA	Rows	Cages	C <sub>w</sub>	C <sub>ow</sub>
	mm.		mm.	mm.	mm.	mm.	mm.	mm.	seals	of rollers		KN	KN
300-0001	24,5	CRAT 24.5X12X75	24,5	12	75	41	43	-	-	2	•	10	16,8
300-0002	33	CRAT 33X19X90	33	19	90	57	58	-	-	2	•	18	33
300-0003	47	CRAT 47X20X155	47	20	155	125	126	-	-	4	•	57,2	65,9
300-0004	47	CRAT 47X22X145	47	22	145	115	-	21	-	2	•	46,4	49,2
300-0005	50	CRAT 50X20X165	50	20	166	128	130	-	•	4	-	69,1	83,2
300-0006	52	CRAT 52X20X55	52	20	55	24	27,4	-	-	2	•	33	43
300-0007	52	CRAT 52X20X125	52	20	125	94	95	-	-	4	•	65,1	77,7
300-0008	55	CRAT 55X25X159.5	55	25	159,5	125	-	21	-	4	•	100,4	131,8
300-0009	60	CRAT 60X25X90	60	25	90	50	52	-	•	2	•	36,2	43
300-0010	60	CRAT 60X25X160	60	25	160	130	132	-	•	2	•	71,3	84,3
300-0011	60	CRAT 60X25X170	60	25	170	130	132	-	•	2	•	71,3	84,3
300-0012	60	CRAT 60X30X151.25	60	30	151,25	109,25	111,3	27	•	2	•	70,2	82
300-0013	60	CRAT 60X30X189	60	30	189	160,3	-	25	-	2	•	72,4	85,3
300-0014	60	CRAT 60X30X201	60	30	201	160,3	-	-	•	2	•	72,4	85,3
300-0015	60	CRAT 60X30X202	60	30	202	160,3	162	27	•	2	•	72,4	85,3
300-0016	65	CRAT 65X25X198	65	25	198	156	168	21,5	-	4	-	124,2	170,6
300-0017	75	CRAT 75X40X165	75	40	165	140	143	29,5	-	4	-	149	208,5
300-0018	76	CRAT 76X40X165	76	40	165	140	143	30	-	4	•	152,3	213,8
300-0019	80	CRAT 80X35X201	80	35	201	160,3	-	-	•	2	•	111,2	115,6
300-0020	80	CRAT 80X35X210	80	35	210	170	-	-	•	2	•	111,2	115,6
300-0021	80	CRAT 80X35X230	80	35	230	200	-	30,5	-	2	•	114,5	118,8
300-0022	80	CRAT 80X35X302.5	80	35	302,5	261,8	-	-	•	2	•	111,2	115,6
300-0023	80	CRAT 80X40X180	80	40	180	140	143	-	•	4	•	127,5	171,7
300-0024	80	CRAT 80X40X210	80	40	210	150	156	-	-	4	-	136	188
300-0025	90	CRAT 90X45X134.3	90	45	134,3	100	102	-	•	2	-	139,3	167,4
300-0026	90	CRAT 90X45X140	90	45	140	100	102	-	•	2	•	157,7	195,5
300-0027	95	CRAT 95X45X288	95	45	288	236	240	-	•	2	•	173,9	229
300-0028	95	CRAT 95X45X362	95	45	362	310	314	-	•	2	•	179,3	238,7
300-0029	100	CRAT 100X45X245	100	45	245	200	201,4	-	•	2	•	175	231,1
300-0030	100	CRAT 100X45X246	100	45	246	200	201,4	-	•	2	•	175	231,1
300-0031	100	CRAT 100X45X246	100	45	246	200	201,4	-	•	4	-	280,8	415,8
300-0032	134	CRAT 134X55X146	134	55	146	83	85	50	•	2	-	227,9	315

C<sub>w</sub> Dynamic load

C<sub>ow</sub> Static load



# BACK-UP ROLLERS WITH PIVOT FOR METAL FLATTENING MACHINES

1. SEEGER LOCKING RING
2. FEY SEAL RING
3. SUPPORT THRUST RING
4. O-RING SEAL
5. OUTER RING
6. O-RING SEAL
7. SUPPORT THRUST RING
8. FEY SEAL RING
9. SEEGER LOCKING RING
10. O-RING SEAL
11. CYLINDRICAL ROLLERS
12. CAGE
13. SUPPORT LITTLE THRUST RING
14. SEEGER SEAL RING
15. PIVOT
16. SEEGER SEAL RING
17. SUPPORT LITTLE THRUST RING
18. CAGE
19. CYLINDRICAL ROLLERS

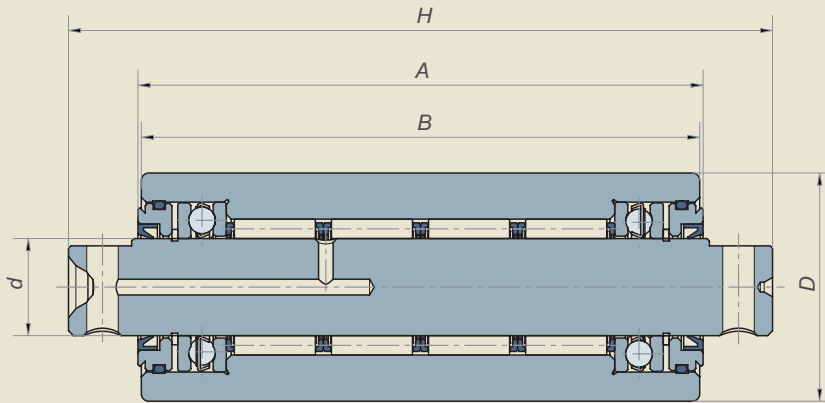
- the bearings are supplied with 2ZL seals or PP seals, on request
- the back-up rolls are grease lubricated according to DIN 51825
- Air filling is provided for PDA execution
- Dimension H is selected in groups of 0.008 mm

Back-up rollers with pivot for metal flattening machines have the following characteristics:

- The outer ring is supplied in UNI 100Cr6/100CrMo7 core hardened steel that can reach hardness 60-2 HRC.
- Once seen the condition of coupling with working cylinders, the degree of hardness can be reduced to 53÷58 on request.
- The profile of the outer ring is usually cambered in order to optimize the distribution of the applied load.
- The pivot is made in two different steel types, according to dimension and shape:
  - 1) core hardened steel UNI 100 Cr6/100 CrMo7;
  - 2) case hardened steel UNI 18 NiCrMo5.
 In both cases the degree of hardness is 60-HRC.
- The bearings have a grease lubrication system and are supplied already pre-lubricated. The lubrication system foresees both the entrance and the exit of grease. They can be supplied also in Long-life execution.
- The sealing system is very efficient, it does not allow outer agents (such as, dust, mill scale, humidity) to enter the back-up roll; at the same time, it prevents the leakage of grease.
- Precision class P0; on request the rollers can be manufactured with precision class P5 (DIN 620) and selected in groups.
- On request, they can be manufactured in stainless steel.

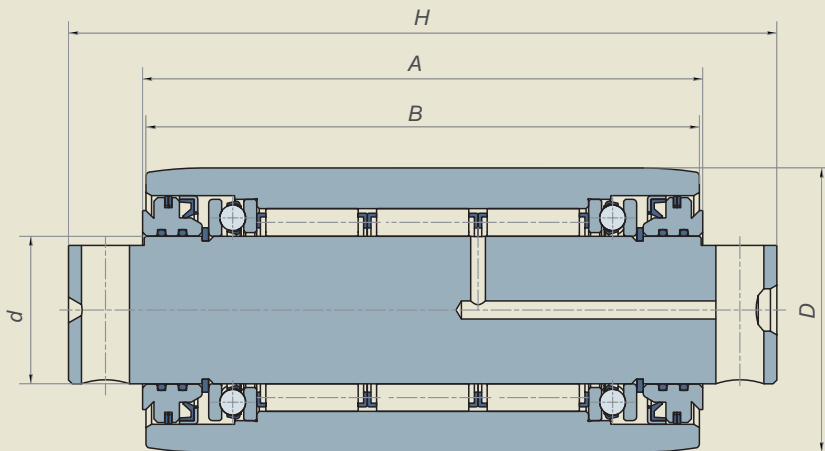


# BACK-UP ROLLERS WITH PIVOT (900-2469/2)



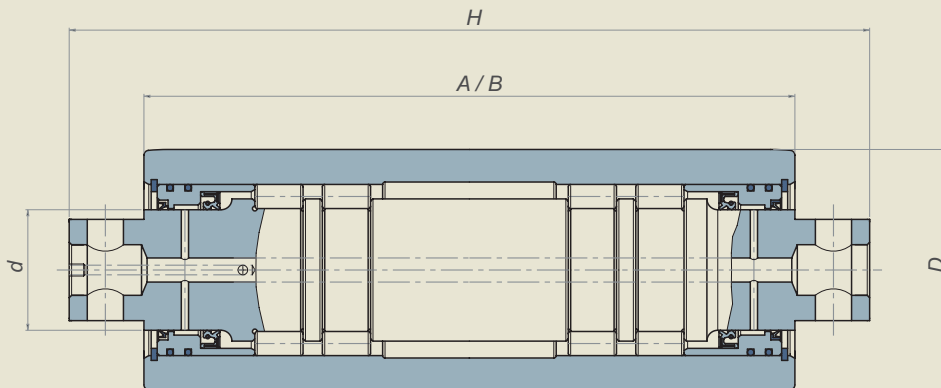
C.R. ref.	d	D	H	A	B	C	C <sub>o</sub>	C <sub>w</sub>	C <sub>ow</sub>	Max speed
	mm	mm	mm	mm	mm	KN	KN	KN	KN	RPM min <sup>-1</sup>
900-2469/2	20	47	145	116.6	115	102.2	124.5	87	105	5.600
Bearing	C	Dynamic load		C <sub>o</sub>	Static load					
Roller	C <sub>w</sub>	Dynamic load		C <sub>ow</sub>	Static load					

# BACK-UP ROLLERS WITH PIVOT (900-2721)



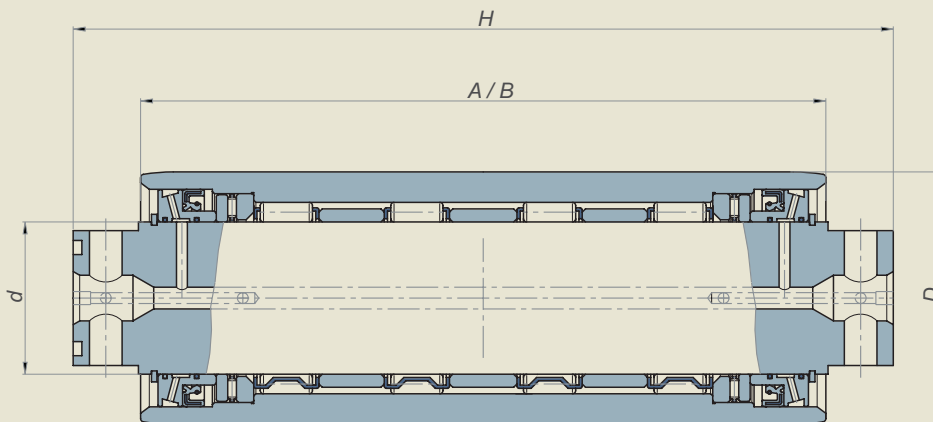
C.R. ref.	d	D	H	A	B	C	C <sub>o</sub>	C <sub>w</sub>	C <sub>ow</sub>	Max speed
	mm	mm	mm	mm	mm	KN	KN	KN	KN	RPM min <sup>-1</sup>
900-2721	40	74	192	151.8	150	194	258	155	205	4.000
Bearing	C	Dynamic load		C <sub>o</sub>	Static load					
Roller	C <sub>w</sub>	Dynamic load		C <sub>ow</sub>	Static load					

# BACK-UP ROLLERS WITH PIVOT (900-2863)



C.R. ref.	d	D	H	A	B	C	C <sub>o</sub>	C <sub>w</sub>	C <sub>ow</sub>	Max speed
	mm	mm	mm	mm	mm	KN	KN	KN	KN	RPM min <sup>-1</sup>
900-2863	50	100	332	270	270	300	561	270	480	1.000
Bearing	C	Dynamic load		C <sub>o</sub>	Static load					
Roller	C <sub>w</sub>	Dynamic load		C <sub>ow</sub>	Static load					

# BACK-UP ROLLERS WITH PIVOT (900-2752/2)



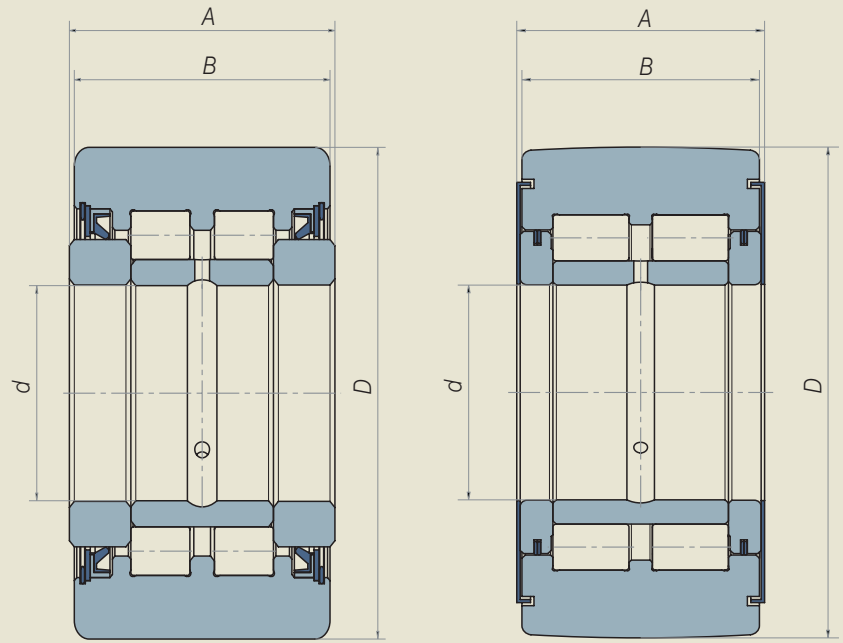
C.R. ref.	d	D	H	A	B	C	C <sub>o</sub>	C <sub>w</sub>	C <sub>ow</sub>	Max speed
	mm	mm	mm	mm	mm	KN	KN	KN	KN	RPM min <sup>-1</sup>
900-2752/2	70	120	377	317	315	440	798	333	510	2.500
Bearing	C	Dynamic load		C <sub>o</sub>	Static load					
Roller	C <sub>w</sub>	Dynamic load		C <sub>ow</sub>	Static load					

# BACK-UP ROLLERS WITHOUT PIVOT

The series of back-up rollers without pivot is manufactured with two or more full-complement-cylindrical-roller rows; they are separated by spacers obtained entirely on the outer ring.

These bearings are particularly used on machines that work continuously and in extremely tough conditions, because of their high dynamic and static load capacity.

The spacers between the rolling raceways guarantee the bearing of the axial thrusts.



Execution with tightness

Execution with Fey

C.R. ref.	d	D	A	B	C	C <sub>o</sub>	C <sub>w</sub>	C <sub>ow</sub>	Max speed
	mm	mm	mm	mm	KN	KN	KN	KN	RPM min <sup>-1</sup>
900-1907	20	48	36	27	38	56	32	47	2000
900-2742	25	52	44	42	48	80	40	61	1500
900-2744	25	60	50	48	71	108	60	91	1500
900-1857	25	65	45	41	80	111	68	95	1300
900-2323	30	72	42	40	70	100	59	94	1300
200-1741	25	74	50	47	99	139	84	118	1400
900-2741	35	80	54	50	92	134	78	114	1200
200-1197	35	80	48	44	100	161	87	137	1100
200-0059	40	90	35	32	74	102	63	87	900
900-2030	40	95	55	51	124	192	107	163	1000
200-1198	50	105	60	56	189	314	162	268	900
900-2012	50	120	70	66	231	390	195	330	900
900-2011	50	130	70	66	260	365	221	310	700
200-0695	55	140	60	56	227	375	193	320	600
200-0696	70	150	63	61	287	475	245	402	600
200-0697	65	160	71	67	286	452	243	385	600
900-1966	90	180	102	98	493	1107	420	940	500
900-2008	90	200	92	88	525	890	446	756	500
900-2270/1	90	220	120	117	655	1182	556	1005	500
900-2312	120	250	124	121	878	1687	745	1433	400
900-1967	120	280	124	121	892	1665	758	1415	400

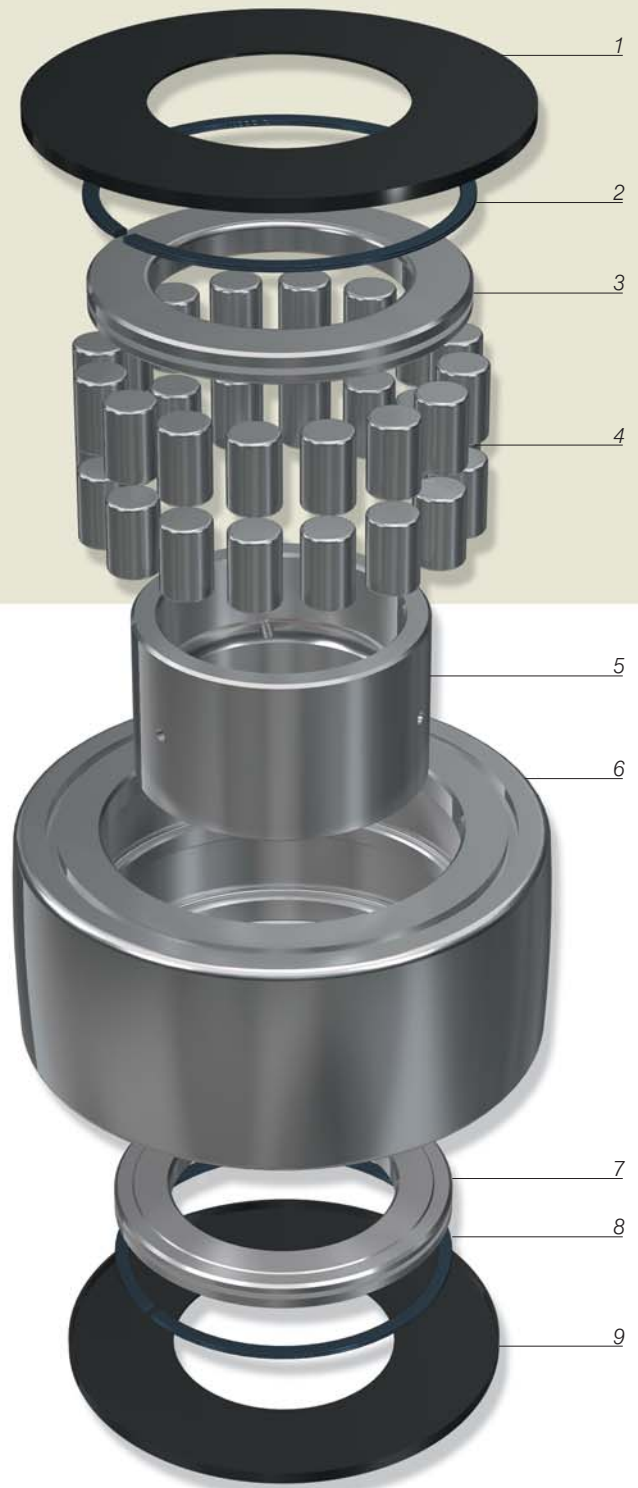
Bearing C Dynamic load C<sub>o</sub> Static load  
 Roller C<sub>w</sub> Dynamic load C<sub>ow</sub> Static load





# BACK-UP ROLLERS WITHOUT PIVOT

- 
1. SEAL SHEET
  2. FEY SEAL RING
  3. SUPPORT THRUST RING
  4. CYLINDRICAL ROLLERS
  5. INNER RING
  6. OUTER RING
  7. SUPPORT THRUST RING
  8. FEY SEAL RING
  9. SEAL SHEET
- 



Back-up rollers without pivot have the following technical characteristics:

- The inner rings and the outer rings are manufactured in UNI 100Cr6 core hardened steel, with hardness  $60 \pm 2$  HRC. The outer ring has a cambered radius on the outer diameter; this allows to improve the distribution of the loads during functioning.
- Back-up rollers with surface hardness of the outer ring reduced to  $53 \div 58$  HRC can be supplied on request.
- Inner ring with holes and grooves for the inflow of the lubricant.
- Full-complement of cylindrical rollers to ensure the highest possible load capacity.
- Double system of protection and tightness, through shields and sealing spring rings made of steel. The sealing system can be also with lip shearing rubber seals.
- The tolerances during execution are according normal class P0; special execution according class P5 (DIN 620) can be manufactured on request .
- On request, they can be manufactured in stainless steel.

# SINGLE CYLINDRICAL BACK-UP ROLLERS (EXECUTION IN INCHES)

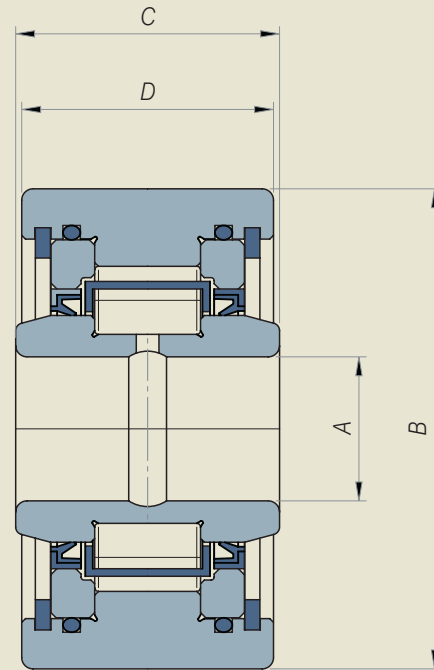
The single cylindrical back-up roller executed in inches is manufactured as alternative to the same series with tapered rollers.

The bearing is extremely tough and massive; it is made of one outer ring – which makes a unique body, once linked to the lateral thrust rings – and of an inner ring with entire borders, from which the rolling raceway comes out.

This series can be manufactured with cages or with full-complement of cylindrical rollers.

This back up roller is particularly suitable to work with high radial loads; thanks to its toughness, it maintains all its primary technical characteristics for a long flattening lifetime.

The entire borders made from the inner ring allow to bear the axial thrusts.



C.R. ref.	A	B	C	D	C <sub>w</sub>
	mm./inch	mm./inch	mm./inch	mm./inch	Radial N/Lbf
100-0001	7.938	28.575	22.225	21.463	8970
100-0001	0.3125	1.1250	0.8750	0.8450	2016
100-0002	11.113	38.100	28.578	26.988	14340
100-0002	0.4375	1.5000	1.1251	1.0625	3240
100-0003	12.700	41.275	28.578	26.988	16500
100-0003	0.500	1.6250	1.1251	1.0625	3720
100-0004	12.700	44.450	28.578	26.988	16500
100-0004	0.500	1.7500	1.1251	1.0625	3720
100-0005	15.875	50.800	36.515	34.925	30000
100-0005	0.6250	2.0000	1.4376	1.3750	6780
100-0006	15.875	52.388	36.515	34.925	30000
100-0006	0.6250	2.0625	1.4376	1.3750	6780
100-0007	15.875	53.975	36.515	34.925	30000
100-0007	0.6250	2.1250	1.4376	1.3750	6780
100-0008	19.050	57.150	34.928	33.338	33600
100-0008	0.7500	2.2500	1.3751	1.3125	7530
100-0009	19.050	63.500	34.928	33.338	33600
100-0009	0.7500	2.5000	1.3751	1.3125	7530
100-0010	20.638	76.200	48.423	46.883	54600
100-0010	0.8125	3.0000	1.9064	1.8438	12300
100-0011	30.005	85.725	50.800	49.213	63300
100-0011	1.1813	3.3750	2.0000	1.9375	14250
100-0012	30.005	88.900	50.800	49.213	63300
100-0012	1.1813	3.5000	2.0000	1.9375	14250
100-0013	38.100	101.600	58.735	57.150	94800
100-0013	1.5000	4.0000	2.3124	2.2500	21300
100-0014	38.100	107.950	58.735	57.150	94800
100-0014	1.5000	4.2500	2.3124	2.2500	21300
100-0015	44.450	127.000	66.673	65.088	159000
100-0015	1.7500	5.0000	2.6249	2.5625	35700
100-0016	44.450	127.000	71.438	65.088	159000
100-0016	1.7500	5.0000	2.8125	2.5625	35700
100-0017	50.800	120.650	69.850	68.265	162600
100-0017	2.0000	4.7500	2.7500	2.6876	36600
100-0018	50.800	127.000	69.850	68.265	162600
100-0018	2.0000	5.0000	2.7500	2.6876	36600
100-0019	53.975	120.650	69.850	68.265	162600
100-0019	2.1250	4.7500	2.7500	2.6876	36600

C.R. ref.	A	B	C	D	C <sub>w</sub>
	mm./inch	mm./inch	mm./inch	mm./inch	Radial N/Lbf
100-0020	53.975	127.000	69.850	68.265	162600
100-0020	2.1250	5.0000	2.7500	2.6876	36600
100-0021	53.975	152.400	69.850	68.265	162600
100-0021	2.1250	6.0000	2.7500	2.6876	36600
100-0022	60.000	142.875	65.090	73.025	179700
100-0022	2.3622	5.6250	2.5626	2.8750	40500
100-0023	60.000	149.225	65.090	73.025	179700
100-0023	2.3622	5.8750	2.5626	2.8750	40500
100-0024	69.850	177.800	69.850	69.058	179700
100-0024	2.7500	7.0000	2.7500	2.7188	40500
100-0025	70.000	149.225	74.615	73.025	179700
100-0025	2.7559	5.8750	2.9376	2.8750	40500
100-0026	70.000	158.750	74.615	73.025	179700
100-0026	2.7559	6.2500	2.9376	2.8750	40500
100-0027	70.000	159.974	74.615	73.025	179700
100-0027	2.7559	6.2982	2.9376	2.8750	40500
100-0028	70.000	177.800	74.615	73.025	179700
100-0028	2.7559	7.0000	2.9376	2.8750	40500
100-0029	70.000	199.974	74.615	76.200	179700
100-0029	2.7559	7.8730	2.9376	3.0000	40500
100-0030	70.000	203.200	74.615	76.200	179700
100-0030	2.7559	8.0000	2.9376	3.0000	40500
100-0031	70.000	228.600	74.615	76.200	179700
100-0031	2.7559	9.0000	2.9376	3.0000	40500
100-0032	71.438	177.800	98.422	96.838	339000
100-0032	2.8125	7.0000	2.8749	3.8125	75900
100-0033	85.725	158.750	73.025	71.435	193800
100-0033	3.3750	6.2500	2.8750	2.8124	43500
100-0034	85.725	203.200	73.025	71.435	193800
100-0034	3.3750	8.0000	2.8750	2.8124	43500
100-0035	88.900	206.375	104.775	103.185	411000
100-0035	3.5000	8.1250	4.1250	4.0624	92100
100-0036	88.900	249.974	92.075	101.600	270900
100-0036	3.5000	9.8415	3.6250	4.0000	60900
100-0037	88.900	250.825	92.075	101.600	270900
100-0037	3.5000	9.8750	3.6250	4.0000	60900
100-0038	101.600	260.350	136.525	133.350	669000
100-0038	4.0000	10.2500	5.3750	5.2500	150300

C<sub>w</sub> Dynamic load

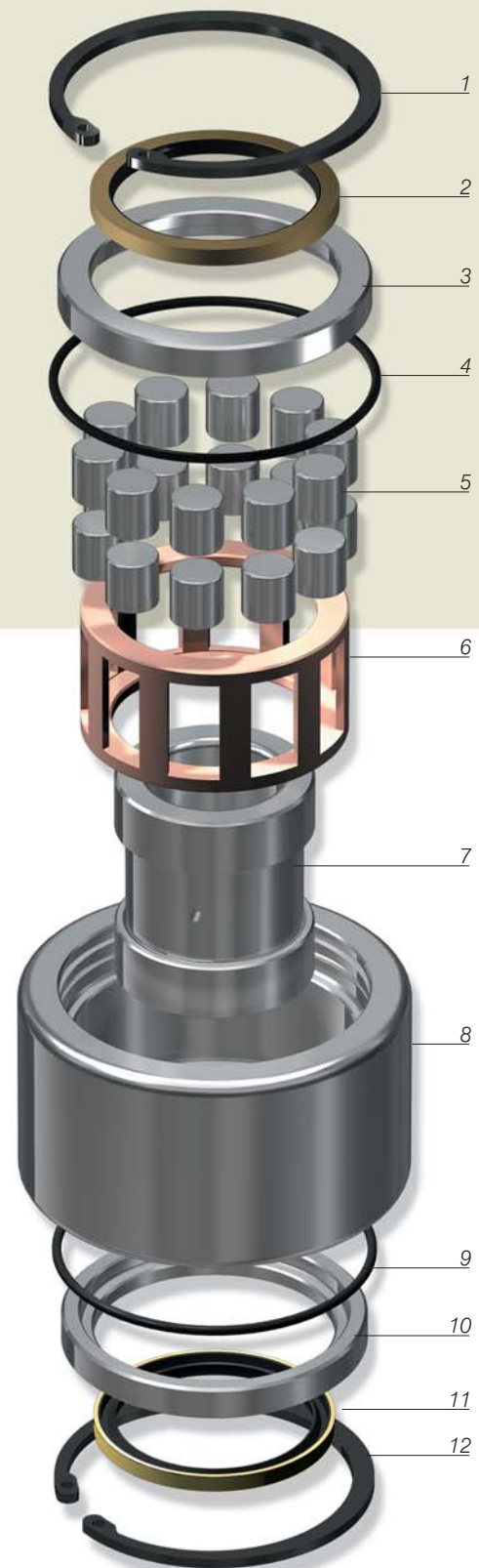


# SINGLE CYLINDRICAL BACK-UP ROLLERS (EXECUTION IN INCHES)

- 
1. SEEGER SEAL RING
  2. ZRS SEAL RING
  3. SUPPORT THRUST RING
  4. O-RING SEAL
  5. CYLINDRICAL ROLLERS
  6. CAGE
  7. INNER RING
  8. OUTER RING
  9. O-RING SEAL
  10. SUPPORT THRUST RING
  11. ZRS SEAL RING
  12. SEEGER SEAL RING
- 

The single back-up roller with cylindrical rollers (execution in inches) has the following characteristics:

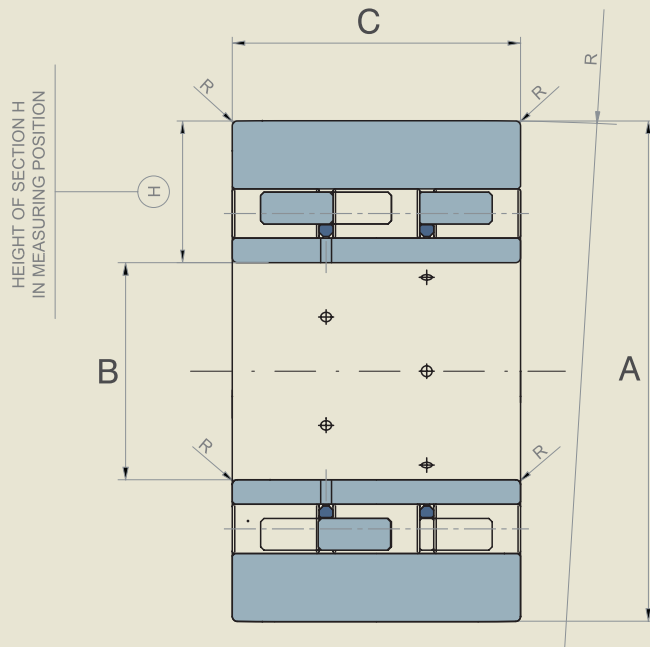
- The outer ring and the inner ring are manufactured in case hardened UNI 100Cr6/SAE 52100 steel.
- They reach hardness degree of 60+2 HRC.
- Usually, the cages are made in bronze; in some cases, when the dimensions are small, the cage can be manufactured in press-forged sheet.
- The sealing system is highly efficient, because it prevents outer agents (dust, mill scale and humidity) to enter the back-up roller; at the same time it prevents the leakage of grease. Grease lubrication is made through a groove on the inner ring.
- Precision class P0. It can be manufactured with precision class P5, on request.
- On request, they can be manufactured in stainless steel.



# SHOULDER BEARINGS FOR SENDZIMIR STEEL MILLS

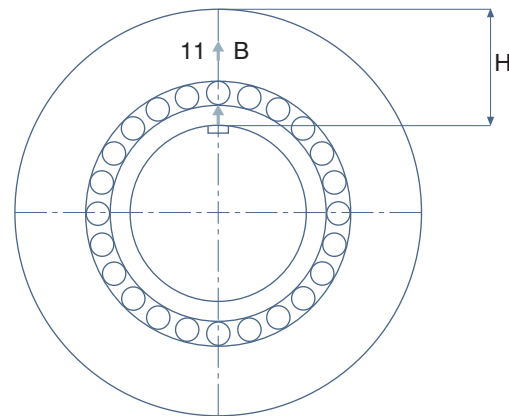
Shoulder bearings have been projected on purpose for Sendzimir cold steel mills; they can be used also in straightening or flattening machines. Shoulder bearings show different shapes in construction, in order to fulfil several application requirements.

Cylindrical roller shoulder bearings can have up to 4 rows of rollers, with cages or without cages. They have the advantage of having a simple shape and a high radial load capacity. Some series are manufactured with entire edges obtained on the outer ring, other series are without entire parts, with distance rings and lateral thrust rings.



Outer diameter (mm)	from 110 to 406,42
Inner diameter (mm)	from 50 to 180
Thickness (mm)	from 52 to 224

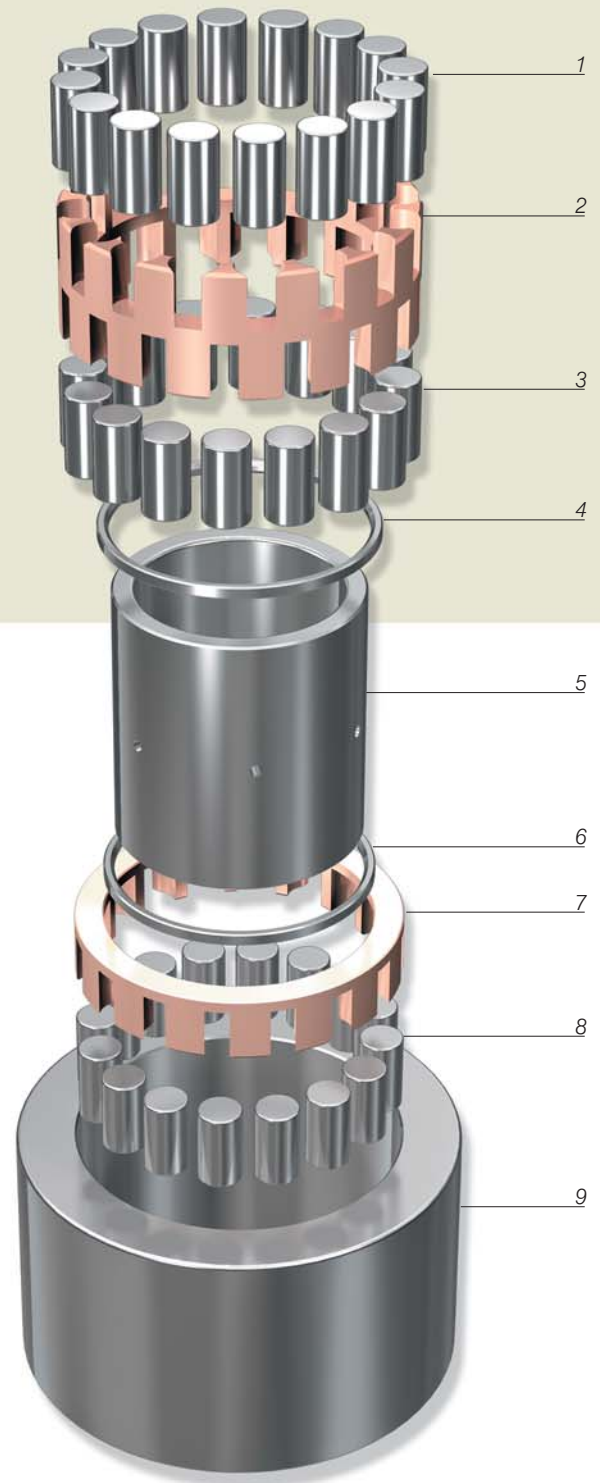
Section height groups	Tolerances on section height "H"(mm)	
A	0	- 0.005
B	- 0.005	- 0.010
C	- 0.010	- 0.015
4	0	- 0.002
3	- 0.002	- 0.004
2	- 0.004	- 0.006
1	- 0.006	- 0.008
0	- 0.008	- 0.010



- ↑ = Point of maximum thickness of the ring
- 11 = Order nr. (example)
- B = Section height group (example)

# SHOULDER BEARINGS FOR SENDZIMIR STEEL MILLS

- 
1. *CYLINDRICAL ROLLERS*
  2. *CAGE*
  3. *CYLINDRICAL ROLLERS*
  4. *DISTANCE RING*
  5. *INNER RING*
  6. *DISTANCE RING*
  7. *CAGE*
  8. *CYLINDRICAL ROLLERS*
  9. *OUTER RING*
- 



Shoulder cylindrical roller bearings have the following technical characteristics:

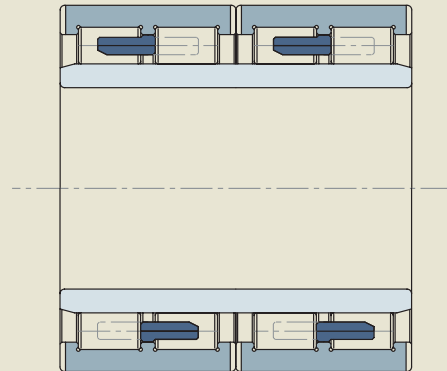
- Outer and inner rings are mainly supplied in UNI 100Cr6/100CrMo7 core hardened steel; some series can be supplied with outer rings in case hardened UNI 18NiCrMo5 steel, with  $60 \pm 2$  HRC hardness degree.
- Lateral thrust rings and distance rings are made in UNI 100Cr6/100CrMo7 steel too. The cages are made in bronze and have high thickness which guarantees resistance against high pressures.
- Shoulder bearings are manufactured with higher rotation precision than class P4 and with reduced tolerances as far as the height between the inner diameter and the outer diameter is concerned. They are classified in three groups, in which the difference between the heights is  $5\mu$ , or in 5 groups in which the difference is  $2\mu$ . The point of maximum thickness of the rings is indicated with an arrow stamped on their surface, where the group of height "H" is marked.
- Shoulder bearings are usually oil lubricated and have different lubrication holes on the inner ring.
- In some series, some elastic no-shearing layered seals are foreseen.

# MULTIROLL BEARINGS

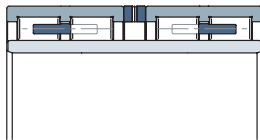
Four-row cylindrical roller bearings are generally used on the neck of milling cylinders, of calenders and of rolling presses. They are particularly suitable on high speed steel mills.

Thanks to the high quantity of rolling raceways, the radial load capacity is extremely high. Four-row cylindrical roller bearings are dismountable, that is to say, the outer ring and the cages form a unique body named "R" and can be fixed independently from the inner ring, named "L". This makes the assembling and the maintenance of milling plant easier. This series of bearings is available with different executions, according to specifications, application conditions and maintenance.

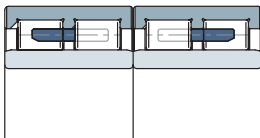
They differ from each other in the shape and in the number of parts that build the whole.



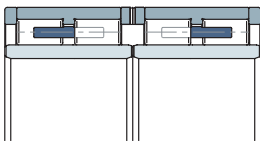
*Execution ECR1*  
Two outer rings, each with three entire borders. One inner ring. Two massive side-to-side bronze cages, guided on rolls. With or without grooves and lubrication holes on the outer ring.



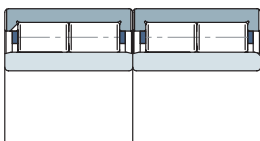
*Execution ECR 2*  
As ECR1, but with an intermediate distance ring between the outer rings.



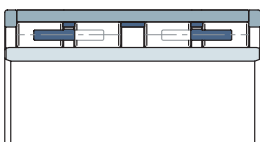
*Execution ECR 3*  
Two outer rings, each with three central entire borders. Two inner rings. Two massive side-to-side bronze cages, guided on rolls. With or without grooves and lubrication holes on the outer ring.



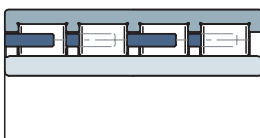
*Execution ECR 4*  
Two outer rings, each with one central entire border and one inserted border; one intermediate distance ring. Two inner rings. Two massive side-to-side bronze cages, guided on rolls. With or without grooves and lubrication holes on the outer ring.



*Execution ECR 5*  
Two outer rings, each with two entire borders. Two inner rings. Two massive bronze cages with millings, for both rows of rollers.



*Execution ECR 6*  
One outer ring with three guide inserted rings and two inserted borders. One inner ring. Two massive side-to-side bronze cages. With or without grooves and lubrication holes on the outer ring.



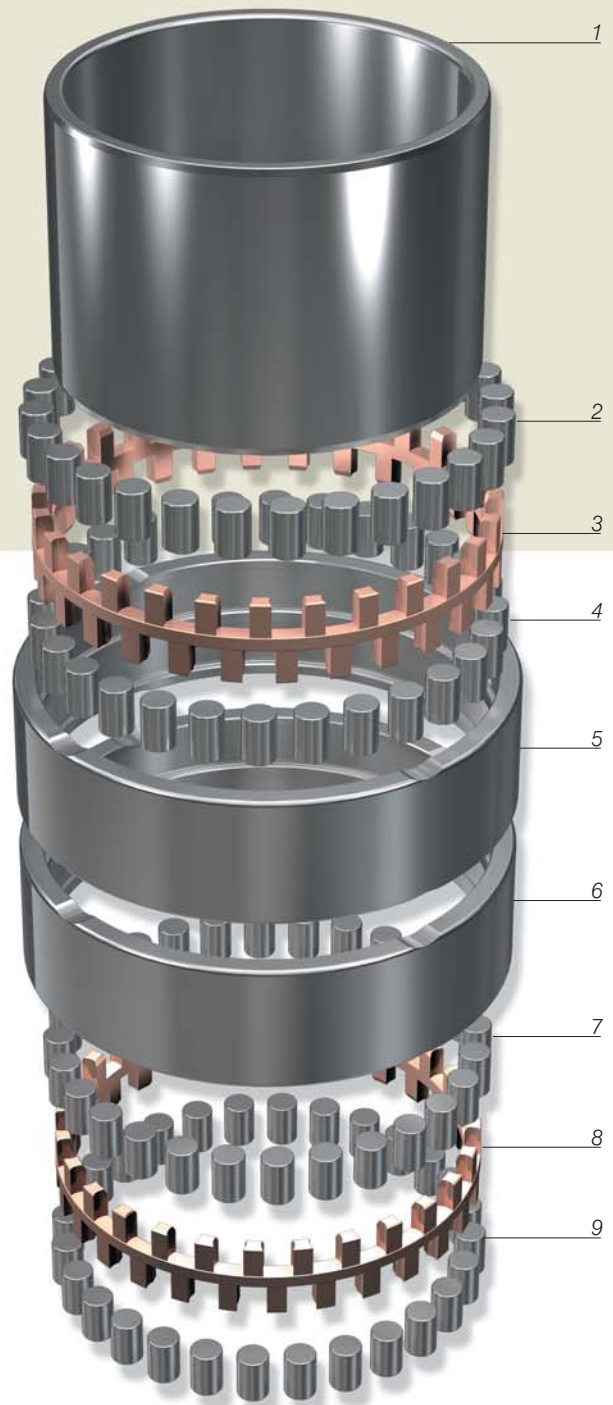
*Execution ECR 7*  
One outer ring with five inserted borders. One inner ring. Four massive rack-tooth bronze cages, guided on rolls. With or without grooves and lubrication holes on the outer ring.





# MULTIROLL BEARINGS

- 
1. *INNER RING*
  2. *CYLINDRICAL ROLLERS*
  3. *CAGE*
  4. *CYLINDRICAL ROLLERS*
  5. *OUTER RING*
  6. *OUTER RING*
  7. *CYLINDRICAL ROLLERS*
  8. *CAGE*
  9. *CYLINDRICAL ROLLERS*
- 



Multiroll cylindrical roller bearings have the following technical features:

- Outer and inner rings are mainly supplied in UNI 100Cr6/100CrMo7 core hardened steel and reach hardness 60-2 HRC.
- Also thrust rings and distance rings are manufactured in UNI 100Cr6 steel. Cages are supplied in bronze; sometimes, for some particular applications, they can be made in steel.
- Four-row cylindrical roller bearings are manufactured in P6/P5 precision class. Radial clearance is generally executed in C3 or C4.
- Multiroll bearings undergo stabilization treatment, which allows their use with temperatures up to 150° C, without any particular dimensional change. On request, stabilized bearings for working temperature up to 250° C can be supplied.



# FOUR-ROW TAPERED ROLLER BEARINGS

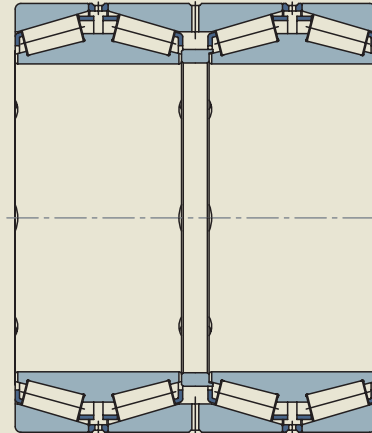
C.R. four-row tapered roller bearings are used on the neck of the cylinders, on steel mills in which the speed of milling is moderate. Their construction shape allows them to bear high axial loads, along with radial loads. Therefore they do not need lateral thrust bearings. The bearings of this series are manufactured with cylindrical hole and with tapered hole.

Four-row tapered roller bearings should be fixed as complete units in the correct housings, in order to allow a correct functioning and a quick replacement of the cylinders in case of maintenance.

Four-row tapered roller bearings are manufactured like the similar series with cylindrical rollers, with different executions, according to the specific needs of the working condition of the steel mill plant. They are manufactured both in metric and inch execution.

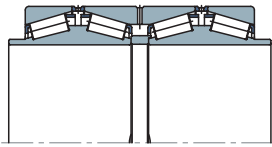
C.R. four-row tapered roller bearings are manufactured with normal tolerance class, the precision of rotation belongs to class P5. The bearings are supplied in complete units ready to be assembled. The internal clearances are settled according to the application and in any case they are always marked with suffixes and numbers written on the drawings.

C.R. tapered roller bearings of this series undergo stabilization treatment, which allows them to be used up to 300° C without any dimensional modification.



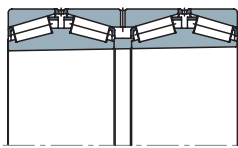
Execution ETO

The bearings of this execution have two couples of rows with "X" shape. They have two double cones, one double cup and two single cups or four single cups.



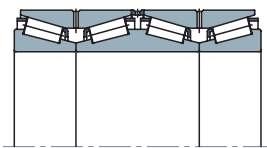
Execution ETOE

Like ETO execution, but with larger inner rings. Their extensions are grinded and act as ball raceways for the seals.



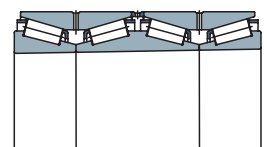
Execution ETOT

Like ETO execution, but with the tapered hole, taper 1:12.



Execution ETI

The bearings of this execution have two couples of "O" rows. They are made of one double cone and of two single cones or two double cups or four single cups. These bearings usually have press-forged steel cages. ETI bearings are generally used when a high stiffness is needed and high tilting moments must be born. They are also used on the vertical cylinders of all-purpose steel mills.



Execution ETIT

Like ETI execution, but with taper hole, taper 1:12 or 1:30.

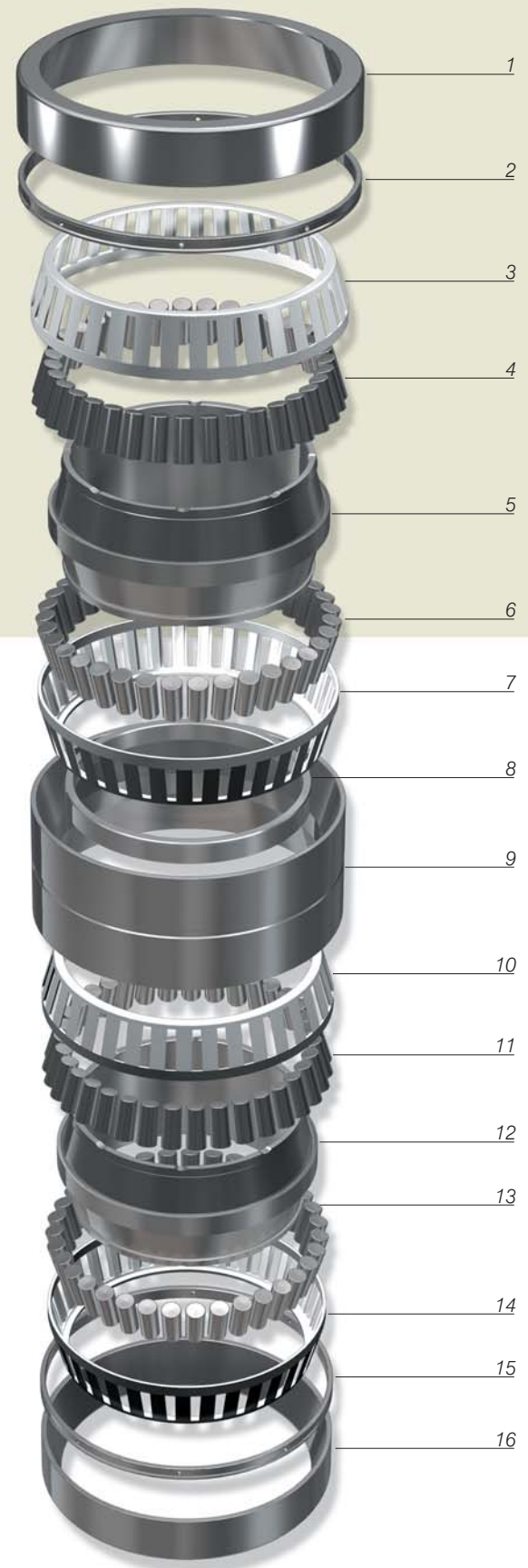
# FOUR-ROW TAPERED ROLLER BEARINGS

- 
- |     |                        |
|-----|------------------------|
| 1.  | <i>CONE</i>            |
| 2.  | <i>DISTANCE RING</i>   |
| 3.  | <i>CAGE</i>            |
| 4.  | <i>TAPERED ROLLERS</i> |
| 5.  | <i>DOUBLE CUP</i>      |
| 6.  | <i>TAPERED ROLLERS</i> |
| 7.  | <i>CAGE</i>            |
| 8.  | <i>DISTANCE RING</i>   |
| 9.  | <i>DOUBLE CONE</i>     |
| 10. | <i>CAGE</i>            |
| 11. | <i>TAPERED ROLLERS</i> |
| 12. | <i>DOUBLE CUP</i>      |
| 13. | <i>TAPERED ROLLERS</i> |
| 14. | <i>CAGE</i>            |
| 15. | <i>DISTANCE RING</i>   |
| 16. | <i>CONE</i>            |
- 

- Cones and cups of four-row cylindrical roller bearings are manufactured in two types of steel according to the application:

- 1 - Core hardened UNI 100Cr6 steel.
- 2 - Case hardened UNI 18NiCrMo5 steel.

- In both cases, hardness reaches the degree of 60-2 HRC.
- The distance rings are manufactured in the same type of steel, whereas the cages are manufactured in press-forged steel.
- All the bearings are provided with holes and lubrication grooves on the outer part.

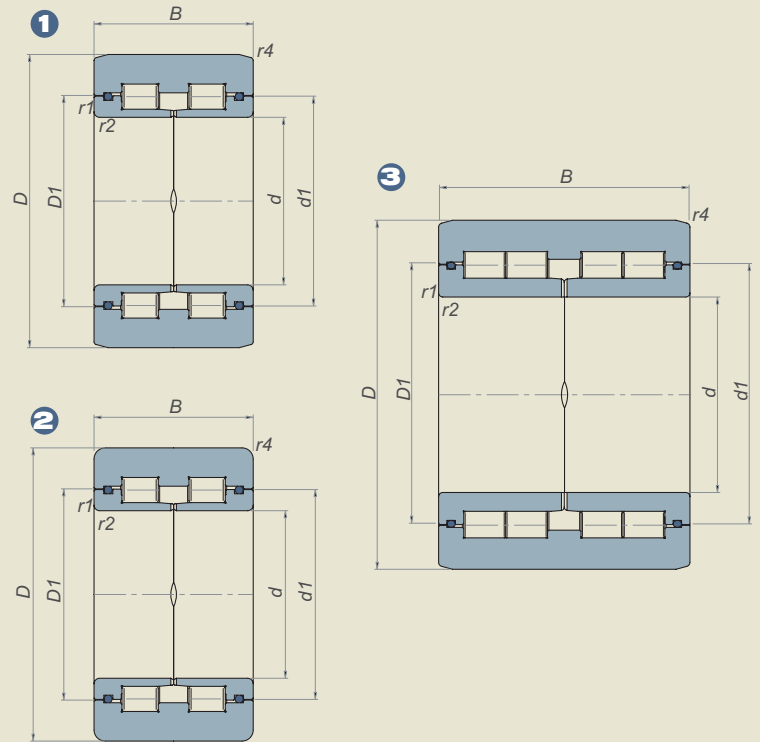


# PRESSURE ROLLS

C.R. pressure rolls are mainly used in the continuous furnaces of sintering plants. They are massive bearings ready to be fixed.

They are used with heavy loads and where the rotation reverses continuously at low speed. The outer ring shows three entire borders, one section and one outer surface which is highly resistant to wear.

The inner ring is made of two parts, each one has an entire border expressly developed in order to bear high axial thrusts, in addition to radial loads. Pressure rolls do not need maintenance.



C.R. ref.	d	d <sub>1</sub>	D	D <sub>1</sub>	B	r <sub>1,2 min.</sub>	r <sub>3,4 min.</sub>	Execution type	C	C <sub>o</sub>	C <sub>w</sub>	C <sub>ow</sub>
	mm	mm	mm	mm	mm	mm	mm		KN	KN	KN	KN
900-2340	93	126	170	127	95	2	10x15°	1 TB2	429	655	286	390
900-3852	100	148	200	149	114	4	10x15°	1 TB2	605	1000	413	600
900-3853	105	151	215	153	87	3	3	2 TB1	501	695	358	450
900-2339	110	157	210	158	110	2	10x15°	1 TB2	402	610	255	325
900-2818	120	157	210	158	114	4	10x15°	1 TB2	550	915	330	455
900-3854	128,665	160	210	162	114	4	10x15°	1 TB2	583	1120	352	560
900-3855	140	178	250	180	110	3	11.5x17°	1	825	1400	561	850
900-3446	140	187	250	188	114	3	13.5x17°	1	825	1400	512	750
900-3856	140	187	280	188	114	3	13.5x15°	1 TB1	913	1460	671	1000
900-3857	160	195	250	197	140	3	13.5x17°	3 TB1	2120	4400	1100	1830
900-3858	160	231	320	233	120	4	13x17°	1	1140	2040	737	1140
900-3859	160	227	330	228	140	4	6.5x15°	1	1140	2040	825	1340
900-3860	180	238	330	240	125	4	6.5x15°	1	968	1930	644	1100

Bearing	C	Dynamic load	C <sub>o</sub>	Static load
Roller	C <sub>w</sub>	Dynamic load	C <sub>ow</sub>	Static load

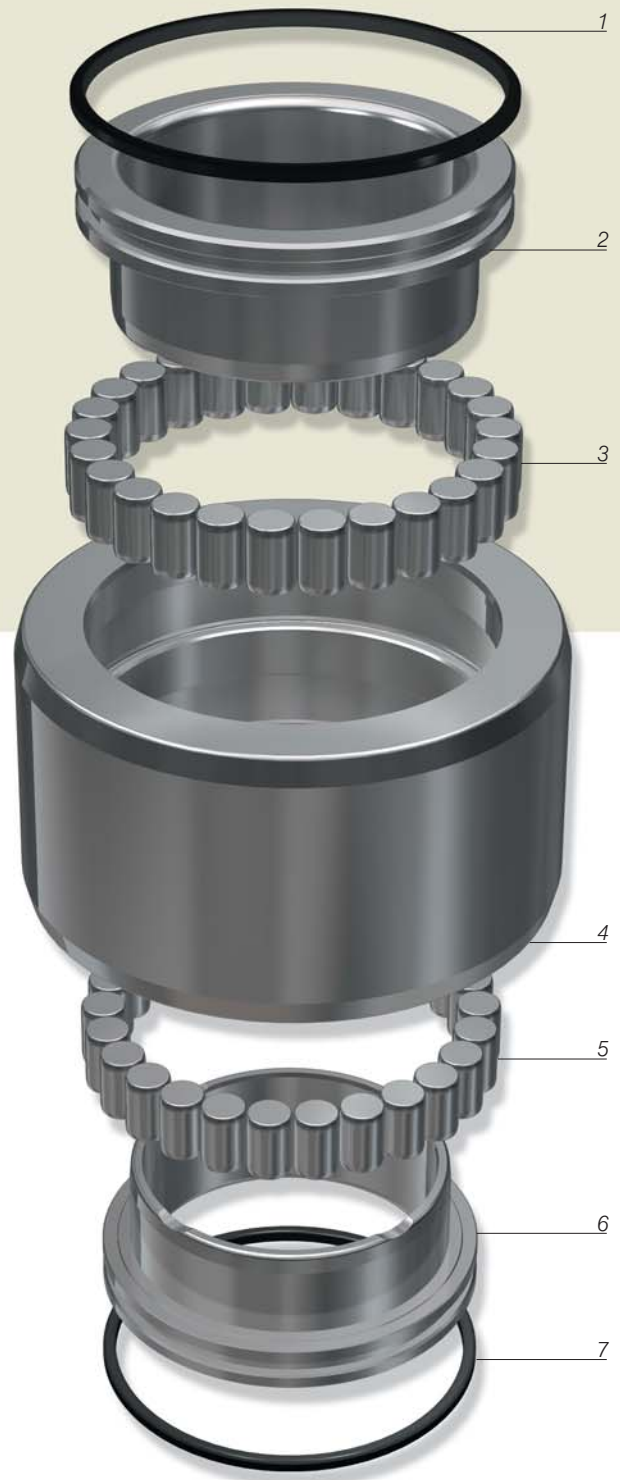
**Notes:**

TB1= bainitic temper of inner and outer ring  
 TB2= bainitic temper of outer ring



# PRESSURE ROLLS

- 
1. *VITON O-RING*
  2. *INNER RING*
  3. *CYLINDRICAL ROLLERS*
  4. *OUTER RING*
  5. *CYLINDRICAL ROLLERS*
  6. *INNER RING*
  7. *VITON O-RING*
- 



C.R. pressure rolls have the following technical characteristics:

- The outer ring and the inner ring are manufactured in core-hardened UNI 100CrMo7 steel.
- This type of steel guarantees an excellent distribution of core-hardening.
- The degree of hardness is 60-2 HRC.
- In order to increase the resistance to wear – due to high load and contamination of outer agents – pressure rolls usually undergo bainitic temper treatment with the following suffixes: TB1 means bainitic temper of both rings, TB2 means bainitic temper only of the outer ring.
- Pressure rolls usually work at high temperatures, therefore they undergo stabilization treatment up to 250° C, named S2.
- The sealing system foresees the presence of Viton O-rings, which are inserted in the proper grooves on the inner ring. The seals allow the bearing to be disassembled, they prevent the entrance of contaminating agents and in the meantime, the leakage of lubricant.

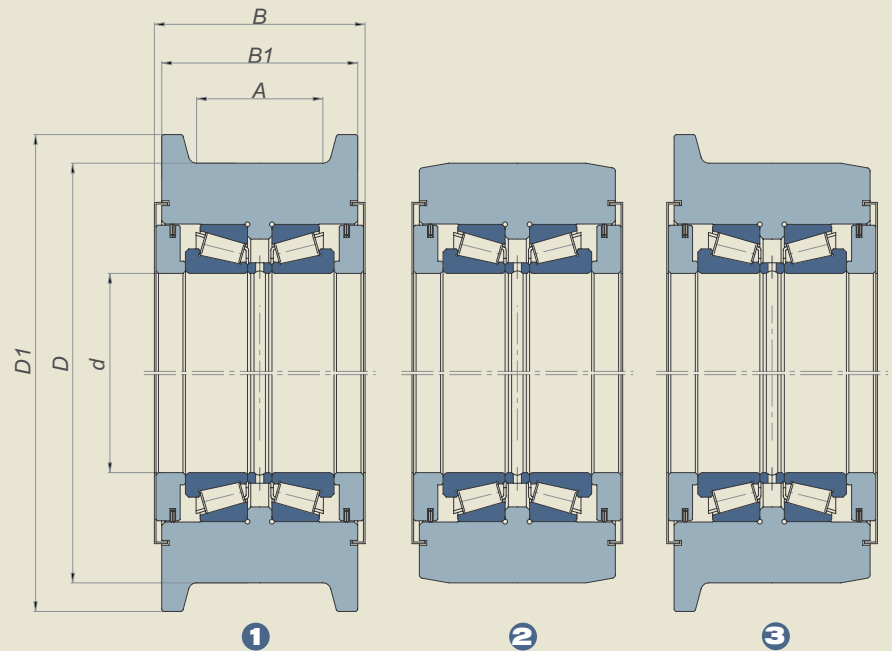
# TAPERED ROLLERS FOR CONVEYOR BELTS

Series of rollers with different profiles of the outer ring have been developed for various applications in the field of steel industry.

They are mainly used as support bearings in conveyor belts for coils.

The execution with tapered rollers is particularly suitable in case of high radial loads and strong axial thrusts, which are due to the shape and the length of the belt. As the path of transportation is not linear, variations of directions of the applied load should be foreseen.

These tapered roller bearings are fixed in pre-loaded groups through an adjusted central distance ring.

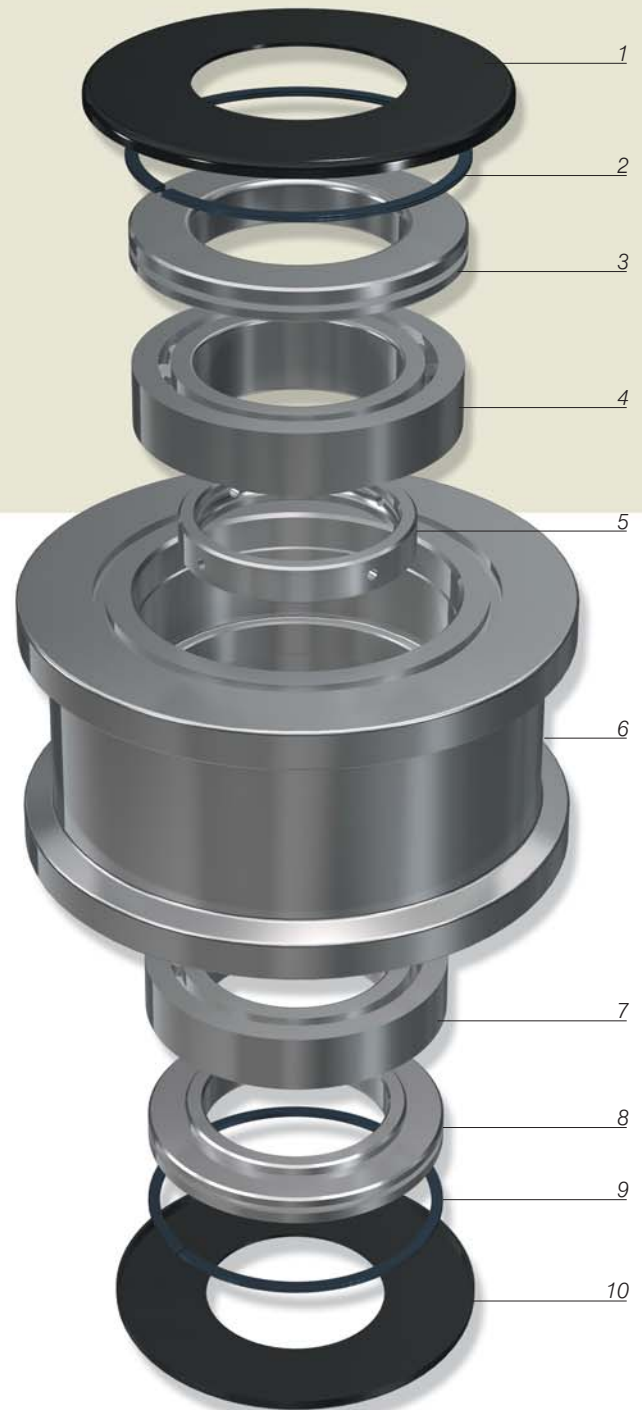


<i>C.R. ref.</i>	<i>d</i> <i>mm</i>	<i>D</i> <i>mm</i>	<i>D<sub>1</sub></i> <i>mm</i>	<i>A</i> <i>mm</i>	<i>B<sub>1</sub></i> <i>mm</i>	<i>B</i> <i>mm</i>	<i>C</i> <i>KN</i>	<i>C<sub>0</sub></i> <i>KN</i>	<i>Max speed</i> <i>RPM min<sup>-1</sup></i>
900-1946 / A	50	125	140	45	70	75	98	177	2.400
900-1946 / B	60	150	170	55	80	85	131	246	2.100
900-1946 / C	70	165	190	60	85	90	163	306	1.800
900-1946 / D	80	185	210	65	95	100	219	426	1.600
900-1946 / E	100	215	250	75	105	115	275	552	1.300
900-1946 / F	120	255	290	85	120	130	390	824	1.100

*C* Dynamic load      *C<sub>0</sub>* Static load

# TAPERED ROLLERS FOR CONVEYOR BELTS

- 
1. SEAL SHEET
  2. FEY SEAL RING
  3. SUPPORT THRUST RING
  4. TAPERED ROLLER BEARING
  5. DISTANCE RING
  6. OUTER RING
  7. TAPERED ROLLER BEARING
  8. SUPPORT THRUST RING
  9. FEY SEAL RING
  10. SEAL SHEET
- 



Tapered rollers for conveyor belts have the following characteristics:

- The outer ring is usually supplied in cementation steel UNI 16NiCr4 and reaches hardness degree of 60-2 HRC. The profile of the outer ring is available in three different executions:
  - 1) ring with double guide border on the outer surface,
  - 2) ring with outer surface without borders;
  - 3) ring with one guide border on the outer surface.
- The rollers have a double protection system, which is made of steel shields and steel elastic layered steel.
- Grease lubrication is made through a groove on the inner distance ring.

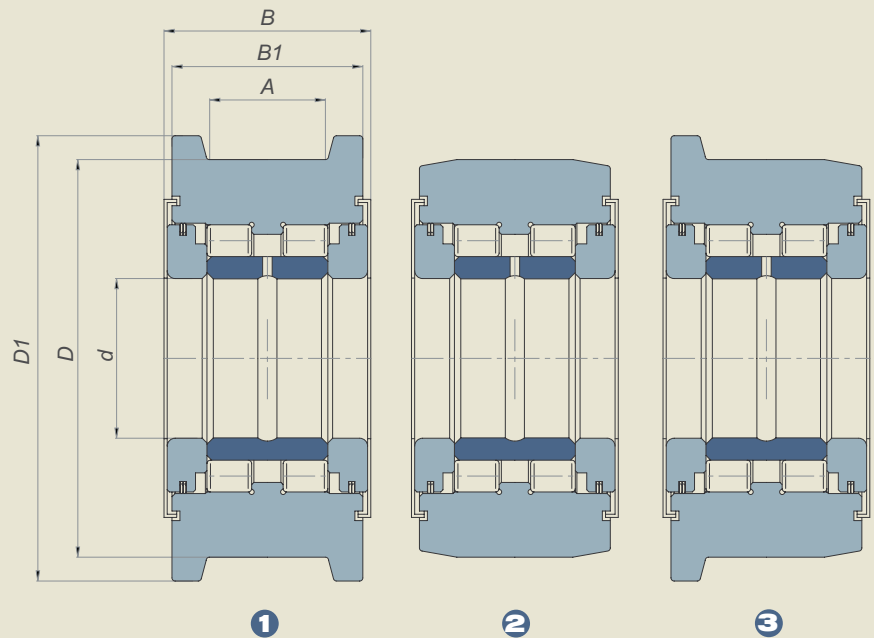
# CYLINDRICAL ROLLERS FOR CONVEYOR BELTS

Full-complement cylindrical rollers for conveyor belts, like the previous series with tapered rollers, are manufactured with a different profile of the outer ring.

They are mainly used as support bearings in conveyor belts for coils. The execution with cylindrical rollers is generally used with high radial loads, as this can absorb distortions and dilatations.

In comparison with the execution with tapered rollers, this execution is used near high heat sources.

The entire borders obtained in the outer ring allow the absorption of average axial thrusts.

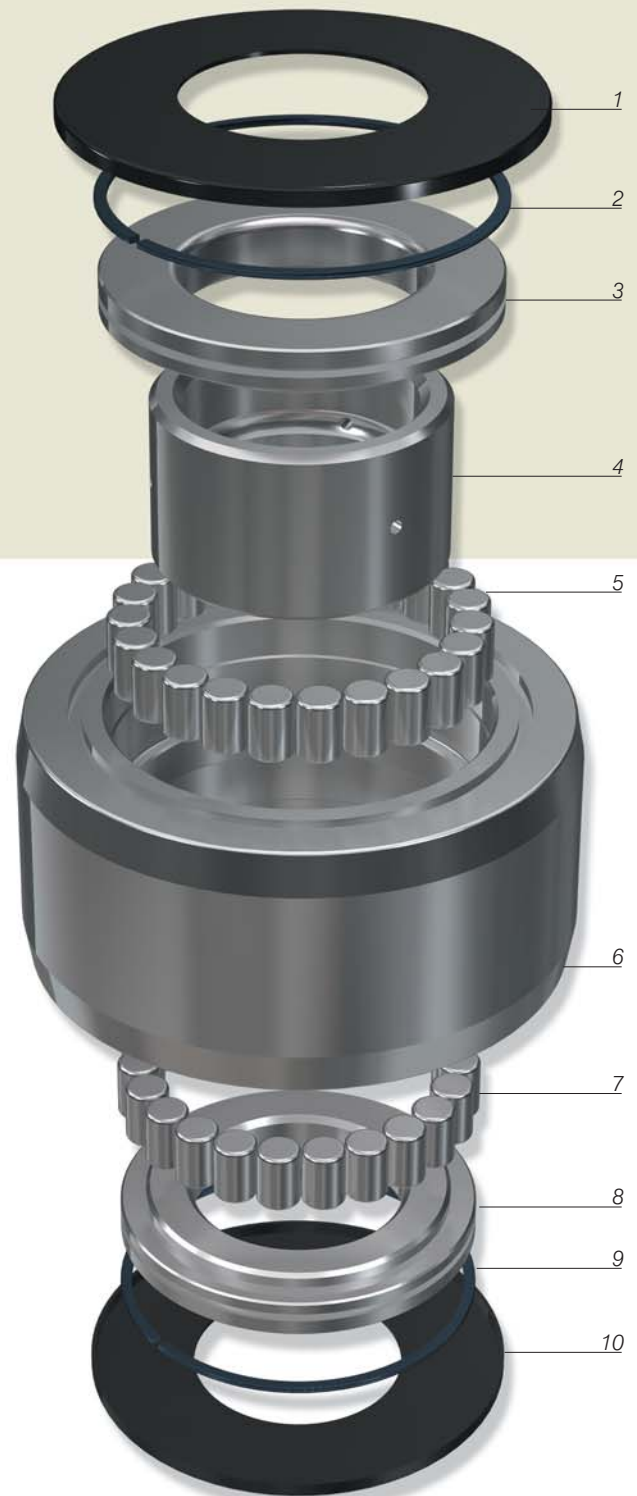


<i>C.R. ref.</i>	<i>d</i> <i>mm</i>	<i>D</i> <i>mm</i>	<i>D<sub>1</sub></i> <i>mm</i>	<i>A</i> <i>mm</i>	<i>B<sub>1</sub></i> <i>mm</i>	<i>B</i> <i>mm</i>	<i>C</i> <i>KN</i>	<i>C<sub>0</sub></i> <i>KN</i>	<i>Max speed</i> <i>RPM min<sup>-1</sup></i>
900-1947 / A	50	125	140	40	60	65	128	133	1.100
900-1947 / B	60	150	170	50	70	75	195	214	900
900-1947 / C	70	165	190	55	75	80	228	246	700
900-1947 / D	80	185	210	60	80	85	283	319	550
900-1947 / E	100	215	250	65	85	90	356	411	400
900-1947 / F	120	255	290	70	95	100	472	581	300
<i>C</i>	<i>Dynamic load</i>		<i>C<sub>0</sub> Static load</i>						



# CYLINDRICAL ROLLERS FOR CONVEYOR BELTS

- 
1. SEAL SHEET
  2. FEY SEAL RING
  3. SUPPORT THRUST RING
  4. INNER RING
  5. CYLINDRICAL ROLLERS
  6. OUTER RING
  7. CYLINDRICAL ROLLERS
  8. SUPPORT THRUST RING
  9. FEY SEAL RING
  10. SEAL SHEET
- 



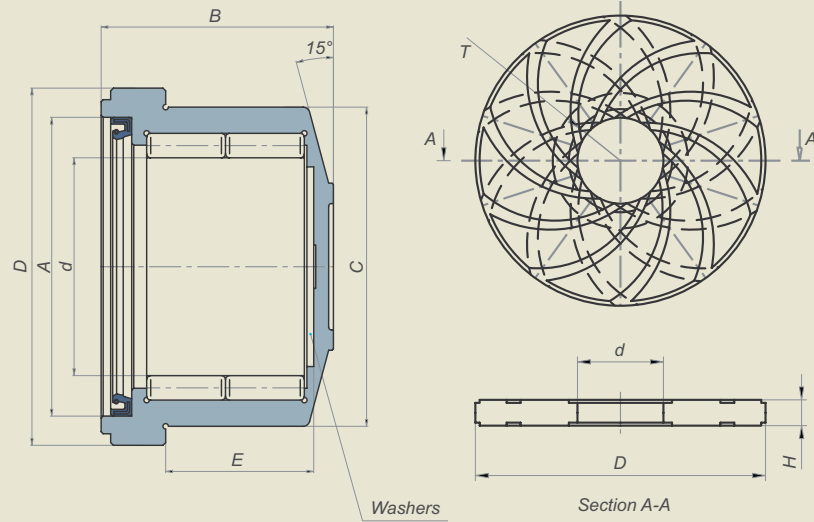
Full-complement cylindrical rollers have the following technical characteristics:

- The outer ring is usually manufactured in cementation UNI 16NiCr4 steel and reaches hardness degree of 60-2 HRC. The profile of the outer ring is available in three different executions: 1) ring with double guide border on the outer surface; 2) ring with outer surface without borders; 3) ring with one guide border on the outer surface.
- The inner ring is manufactured in case hardened UNI 100Cr6 steel with maximum hardness degree 60-2 HRC.
- Protection system has steel shields made with elastic layered steel rings.
- Grease lubrication is made through a groove on the inner distance ring.
- Considering the application of the cylindrical rollers, C.R. can supply execution with radial clearance C3/C4 and stabilizing heat treatment up to 250° C, on request.

# CARDAN JOINT BUSHINGS AND WASHERS

Cardan joint bushings allow the coupling of two rotating shafts in order to transmit a stiff torque.

An adequate radial clearance prevents noise and vibrations during functioning.



C.R. ref.	d mm	D mm	A mm	B mm	C mm	E mm	Washers
900-2061	45,85	84	70	60	74	39,5	8.0403
900-2062	51,5	92	80	70	83	45,5	8.0414
900-2059*	60,5	105	85	76,5	95	49,5	8.0402
900-2063	70	122	100	84,8	110	56	8.0406
900-2064	76,3	135	115	96,5	120	62	8.0404
900-2065	82,75	147	128	102,5	130	70,8	8.0405
900-2055	98,18	174	150	113,5	154	75,5	8.0409
900-2066	98,18	174	160	113,5	154	75,5	8.0409
900-2056	119,28	192	170	124	170	83,5	8.0410
900-2057	133,266	220	200	140	195	94	8.0411
900-2060	152,2	243	210	162,5	220	107	8.0413
900-2058	160,4	263	220	171	235	109	8.0412

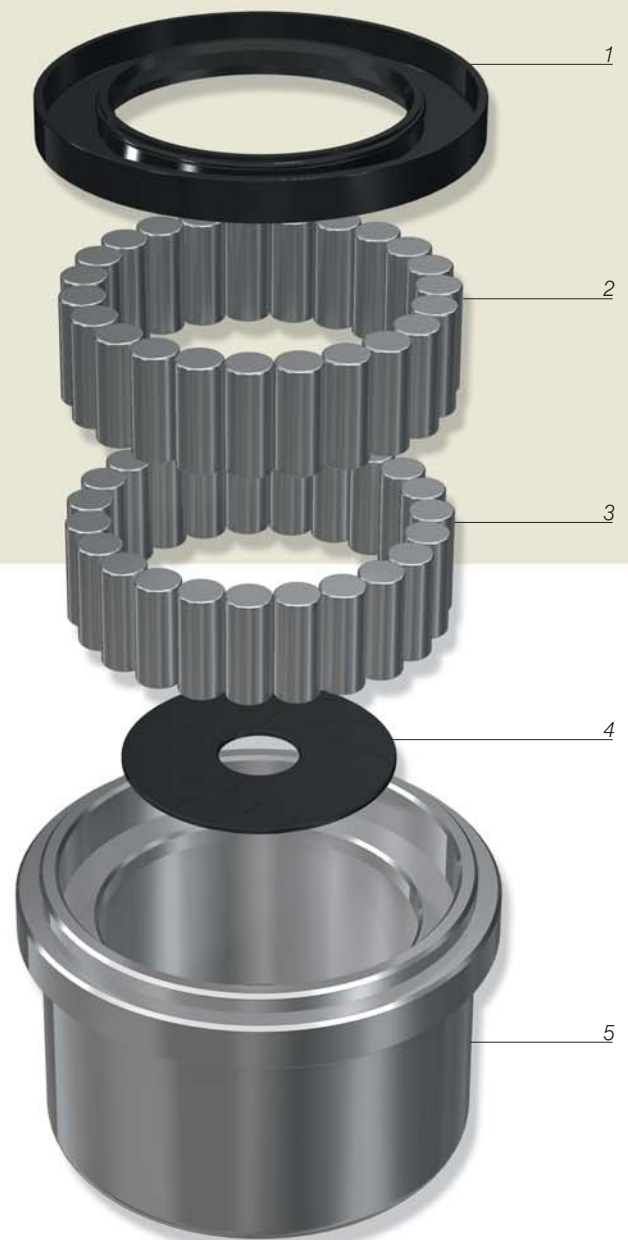
\* the chamfer is not 15° but 38°

C.R. ref.	d mm	D mm	T mm	H mm
800-0403	18	44,5	20	2,46 - 2,5 - 2,6 - 2,7 - 2,75 - 2,8 - 2,85
800-0414	18,5	49,5	20	2,96 - 3 - 3,04
800-0402	19,5	59	21	2,96 - 3 - 3,04
800-0406	20	67,5	24	2,9 - 3 - 3,1
800-0404	22	72	24	3,46 - 3,5 - 3,54
800-0405	27	82	30	3,46 - 3,5 - 3,54
800-0409	27	96	30	3,46 - 3,5 - 3,54
800-0410	27	105	30	3,96 - 4 - 4,04
800-0411	27	121	30	4,46 - 4,5 - 4,54
800-0413	27	138	30	4,96 - 5 - 5,04
800-0412	27	145	30	4,96 - 5 - 5,04



# CARDAN JOINT BUSHINGS AND WASHERS

- 
1. SEAL "G" TYPE
  2. CYLINDRICAL ROLLERS
  3. CYLINDRICAL ROLLERS
  4. WASHER IN DURETANO
  5. BUSHING
- 



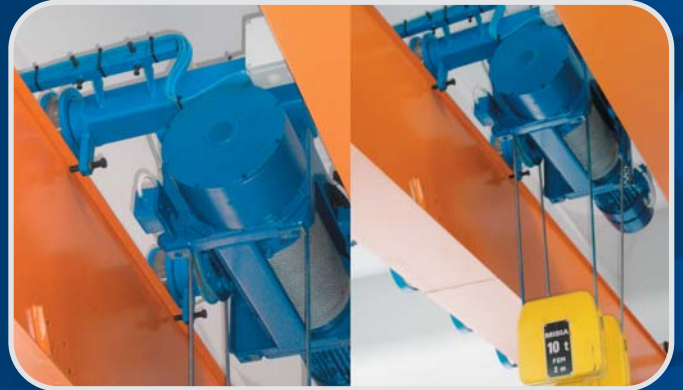
- C.R. cardan joint bushings are manufactured in UNI 100Cr6/100CrMo7 core hardened steel and reach hardness 60-2 HRC.
- A threaded hole for greaser UNI 7663 can be executed on the bottom on request.
- Washers in Duretano with different dimensions can be supplied along with the bushings.

# TRACKROLLERS

C.R. track rollers are indifferently used both in handling and iron industry.

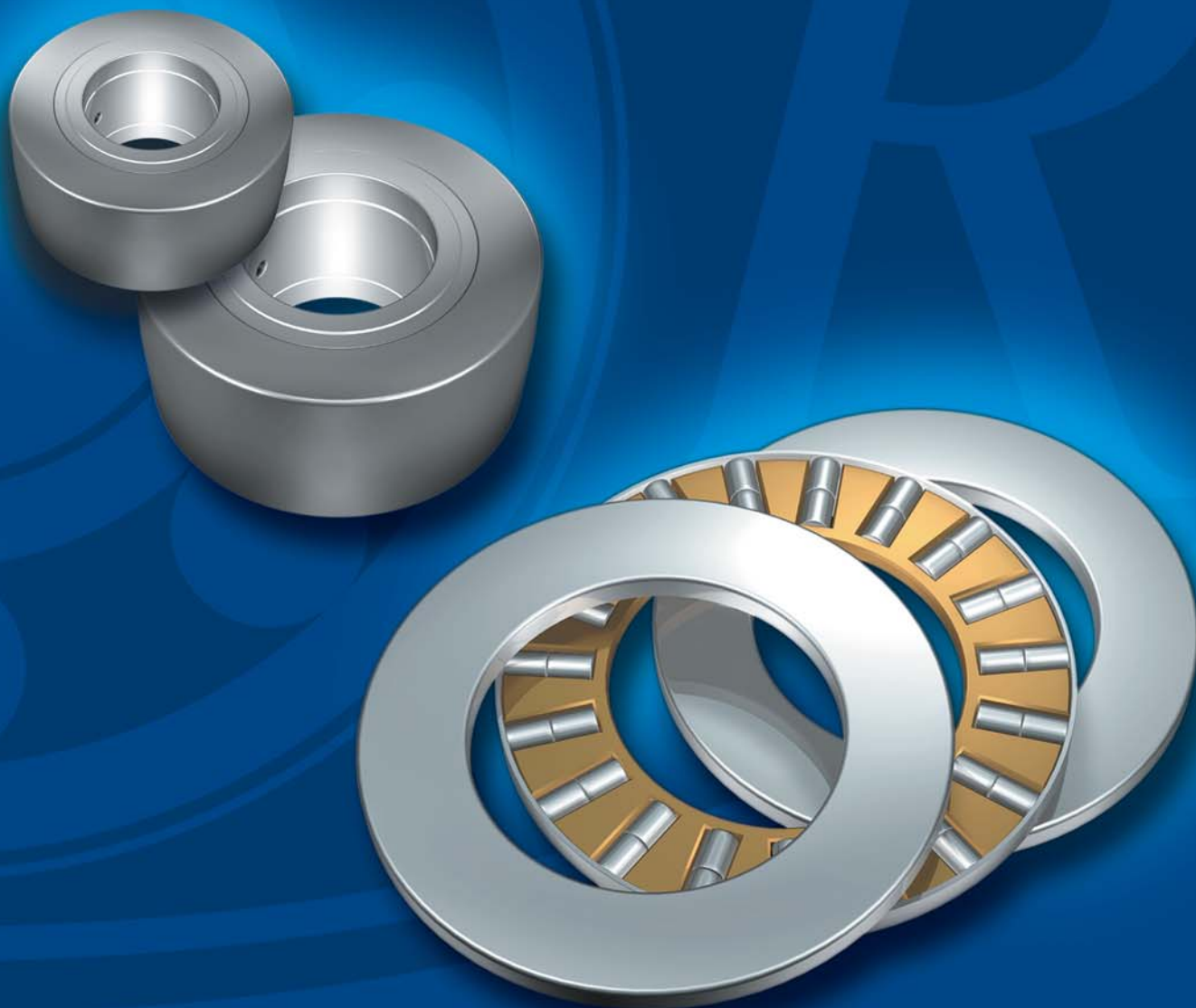
They are also used for:

- Drilling
- Machine tools
- Multiblade marble and granite cutter looms
- Bottle filling and parcelling machines.



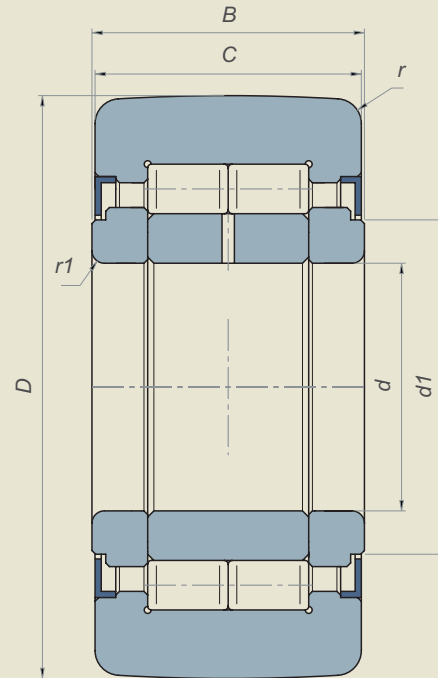


C.R. bearings practically cover the whole panorama of mechanics, assuring both technical reliability and production continuity, especially in the big size range, identified with the RSU series.



# NUTR TRACK ROLLERS

The main characteristic of this series of rollers is the high thickness of the outer ring, which is suitable to bear high specific pressures and the thrusts deriving from the use of these bearings as pressure rollers, cam followers, conveyor belt rollers, bearings for fork lift masts.



C.R. SPECIAL PROFILE

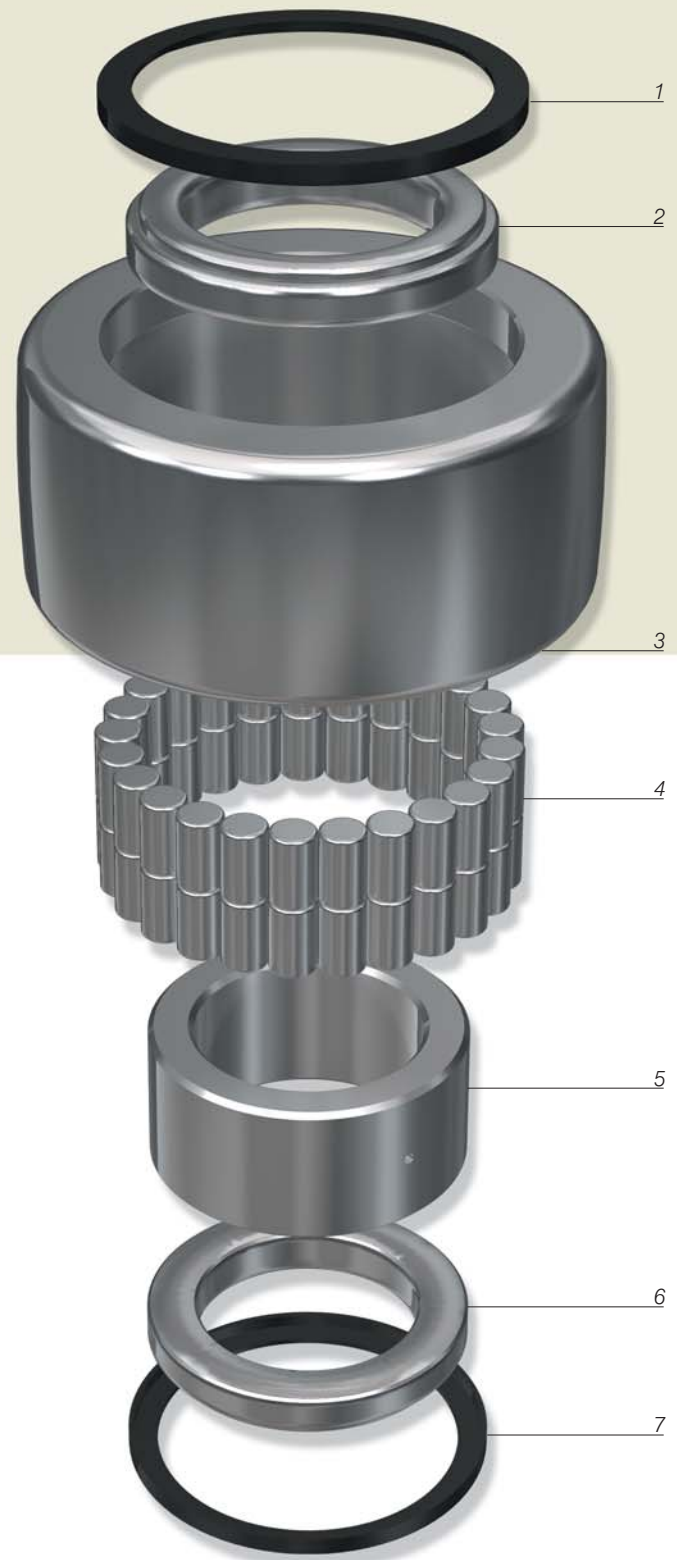
C.R. ref.	d	D	B	C	d1	r min.	r1 min.	C <sub>w</sub>	C <sub>OW</sub>	Max speed
	mm	mm	mm	mm	mm	mm	mm	KN	KN	RPM min <sup>-1</sup>
NUTR 15	15	35	19	18	20	0,6	0,3	15	16,8	6500
NUTR 17	17	40	21	20	22	1	0,5	18,4	22,6	5500
NUTR 15 42	15	42	19	18	20	0,6	0,3	18,1	21,9	6500
NUTR 17 47	17	47	21	20	22	1	0,5	21,3	28	5500
NUTR 20	20	47	25	24	27	1	0,5	28	35	4200
NUTR 20 52	20	52	25	24	27	1	0,5	31,5	41	4200
NUTR 25	25	52	25	24	31	1	0,5	29	37,5	3400
NUTR 25 62	25	62	25	24	31	1	0,5	35,5	50	3400
NUTR 30	30	62	29	28	38	1	0,5	40	50	2600
NUTR 30 72	30	72	29	28	38	1	0,5	47,5	64	2600
NUTR 35	35	72	29	28	44	1,1	0,6	44,5	60	2100
NUTR 35 80	35	80	29	28	44	1,1	0,6	51	72	2100
NUTR 40	40	80	32	30	51	1,1	0,6	55	75	1600
NUTR 45	45	85	32	30	55	1,1	0,6	56	78	1400
NUTR 40 90	40	90	32	30	51	1,1	0,6	66	95	1600
NUTR 50	50	90	32	30	60	1,1	0,6	57	81	1300
NUTR 45 100	45	100	32	30	55	1,1	0,6	71	107	1400
NUTR 50 110	50	110	32	30	60	1,1	0,6	76	120	1300

C<sub>w</sub> Dynamic load      C<sub>OW</sub> Static load



# NUTR TRACK ROLLERS

- 
1. SEAL SHEET
  2. SUPPORT THRUST RING
  3. OUTER RING
  4. CYLINDRICAL ROLLERS
  5. INNER RING
  6. SUPPORT THRUST RING
  7. SEAL SHEET
- 



Other important features of these bearings are:

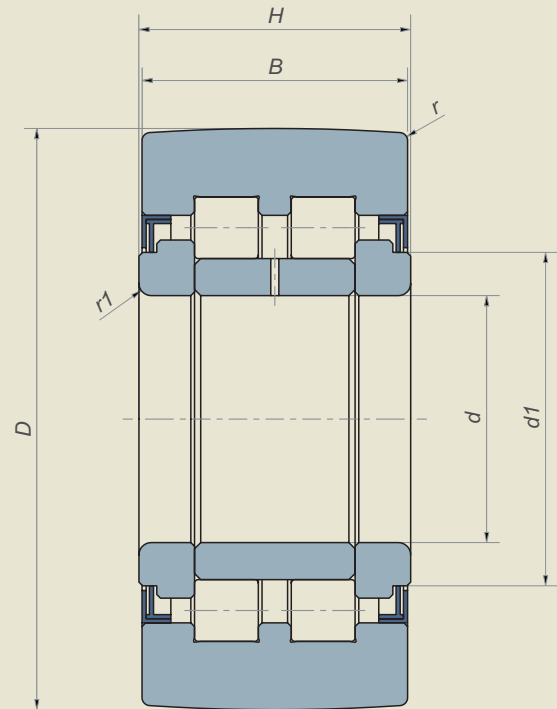
- Outer ring with double border of the rollers obtained entirely and accurately grinded to allow the roller to bear loads with axial components. The ring is usually cambered on the outer part, in order to improve working condition with heavy loads and to prevent the concentration of load onto side bands of the raceway. On request, C.R. can supply rollers with cylindrical outer surface.
- Inner ring with holes and channels for the inflow of lubricants.
- Grinded thrust rings, which form a labyrinth protection system, along with steel sealing sheets forced on the outer ring. One of the lateral thrust rings can be a closed thrust ring, to allow the fixing of the rollers at the edge of the shaft.
- Full-complement of grinded flat head rollers.
- Tolerance of execution according to normal class, possibility of special execution according to class P5 (DIN 620).



# PWTR TRACK ROLLERS

The main characteristic of this series of rollers is the high thickness of outer ring, which is suitable to bear high specific pressures and the impacts deriving from the use of these bearings as pressure rollers, cam followers, conveyor belt rollers, bearings for fork lift masts.

It differs from NUTR series as far as the characteristics of the seals are concerned, as they are of ZRS type (steel and rubber).



C.R. SPECIAL PROFILE

C.R. ref.	d	D	B	C	d <sub>1</sub>	r min.	r <sub>1</sub> min.	C <sub>w</sub>	C <sub>ow</sub>	Max speed
	mm	mm	mm	mm	mm	mm	mm	KN	KN	RPM min <sup>-1</sup>
PWTR 15 2RS	15	35	19	18	20	0,6	0,3	11,6	11,3	6000
PWTR 17 2RS	17	40	21	20	22	1	0,5	13,2	13,8	5000
PWTR 15 42 2RS	15	42	19	18	20	0,6	0,3	13,5	14,1	6000
PWTR 17 47 2RS	17	47	21	20	22	1	0,5	14,8	16,4	5000
PWTR 20 2RS	20	47	25	24	27	1	0,5	23,2	25,5	3800
PWTR 20 52 2RS	20	52	25	24	27	1	0,5	25,5	29,5	3800
PWTR 25 2RS	25	52	25	24	31	1	0,5	24,2	28	3800
PWTR 25 62 2RS	25	62	25	24	31	1	0,5	29	36	3800
PWTR 30 2RS	30	62	29	28	38	1	0,5	35	39,5	2200
PWTR 30 72 2RS	30	72	29	28	38	1	0,5	41	49	2200
PWTR 35 2RS	35	72	29	28	44	1,1	0,6	38,5	46,5	1800
PWTR 35 80 2RS	35	80	29	28	44	1,1	0,6	43,5	55	1800
PWTR 40 2RS	40	80	32	30	51	1,1	0,6	44,5	53	1500
PWTR 45 2RS	45	85	32	30	55	1,1	0,6	45	55	1300
PWTR 40 90 2RS	40	90	32	30	51	1,1	0,6	52	66	1500
PWTR 50 2RS	50	90	32	30	60	1,1	0,6	45,5	57	1100
PWTR 45 100 2RS	45	100	32	30	55	1,1	0,6	56	74	1300
PWTR 50 110 2RS	50	110	32	30	60	1,1	0,6	59	82	1100

C<sub>w</sub> Dynamic load      C<sub>ow</sub> Static load



# PWTR TRACK ROLLERS

- 
1. ZRS SEAL RING
  2. SUPPORT THRUST RING
  3. OUTER RING
  4. CYLINDRICAL ROLLERS
  5. INNER RING
  6. SUPPORT THRUST RING
  7. ZRS SEAL RING
- 

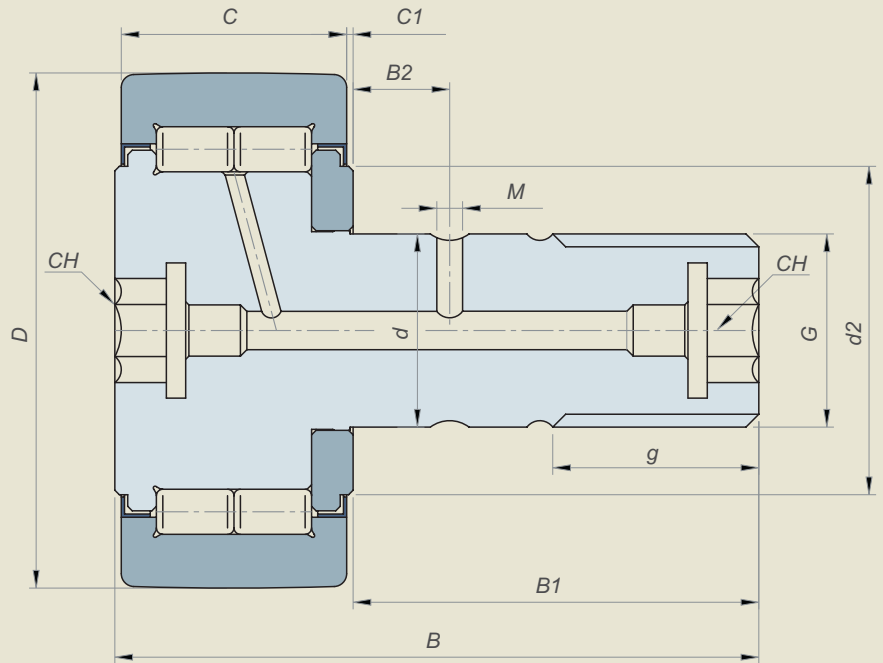


Other important features of these bearings are:

- Outer ring with double border of rollers obtained entirely on the outer ring and accurately grinded in order to allow the roller to bear loads with axial components. Usually, the ring is cambered on the outer part, in order to improve working condition with heavy loads and to prevent the concentration of load onto side bands of the raceway. On request, rollers with cylindrical outer surface can be supplied.
- Inner ring with holes and channels for the inflow of lubricants.
- Grinded thrust rings which, along with ZRS seals forced on the outer ring, guarantee an extremely efficient protection system. One of lateral thrust rings can be a closed thrust ring, to allow the fixing of the rollers at the edge of the shaft.
- Full-complement of grinded flat head cylindrical rollers.
- Tolerance of execution according to normal class, possibility of special execution according to class P5 (DIN 620).

# NUKR CAM FOLLOWERS

The main characteristic of this series of rollers is the high thickness of the outer ring, which is suitable to bear specific high pressures and the impacts that characterize the use of these bearings (ex. cam followers).



C.R. SPECIAL PROFILE

C.R. ref.	D	d(h7)	C	r min.	B	B <sub>1</sub>	B <sub>2</sub>	G	g	M	C1	d2	CH	C <sub>w</sub>	C <sub>OW</sub>	Max. speed	Nut locking couple
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	KN	KN	RPM min <sup>-1</sup>	Nm
NUKR 35	35	16	18	0,6	52	32,5	7,8	M16x1,5	17	3	0,8	20	8	15	16,8	6500	58
NUKR 40	40	18	20	1	58	36,5	8	M18x1,5	19	3	0,8	22	8	18,4	22,6	5500	87
NUKR 47	47	20	24	1	66	40,5	9	M20x1,5	21	4	0,8	27	10	28	35	4200	120
NUKR 52	52	20	24	1	66	40,5	9	M20x1,5	21	4	0,8	31	10	29	37,5	3400	120
NUKR 62	62	24	28	1	80	49,5	11	M24x1,5	25	4	1,3	38	14	40	50	2600	220
NUKR 72	72	24	28	1,1	80	49,5	11	M24x1,5	25	4	1,3	44	14	44,5	60	2100	220
NUKR 80	80	30	35	1,1	100	63	15	M30x1,5	32	4	1	47	14	69	98	1800	450
NUKR 90	90	30	35	1,1	100	63	15	M30x1,5	32	4	1	47	14	79	117	1800	450

Pressure greaser	NIP A2x7,5	NUKR 35 - NUKR 40 - NUKR 47 - NUKR 52
	NIP A3x9,5	NUKR 62 - NUKR 72 - NUKR 80 - NUKR 90
Adaptor for central lubrication	AP8	NUKR 35 - NUKR 40
	AP10	NUKR 47 - NUKR 52
	AP14	NUKR 62 - NUKR 72 - NUKR 80 - NUKR 90
C <sub>w</sub> Dynamic load	C <sub>OW</sub> Static load	

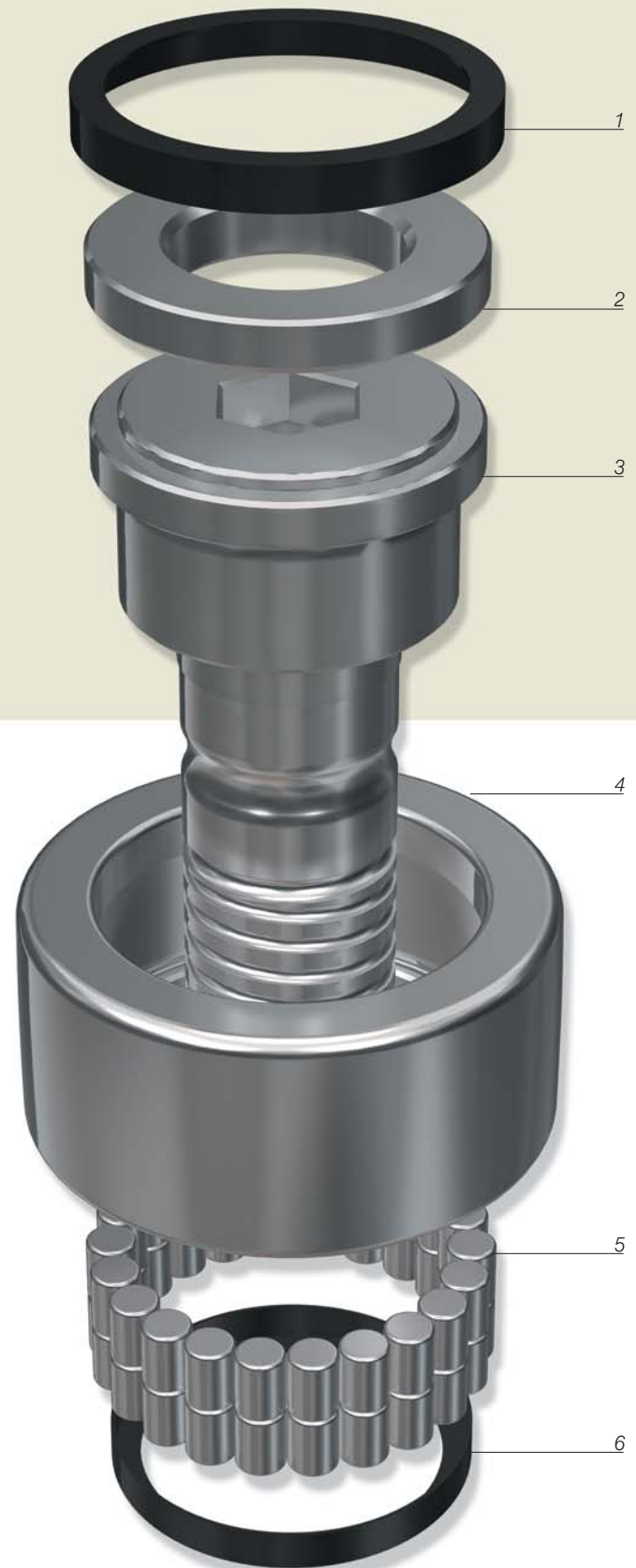


# NUKR CAM FOLLOWERS

- 
1. SEAL SHEET
  2. SUPPORT THRUST RING
  3. PIVOT
  4. OUTER RING
  5. CYLINDRICAL ROLLERS
  6. SEAL SHEET
- 

Other important features of these bearings are:

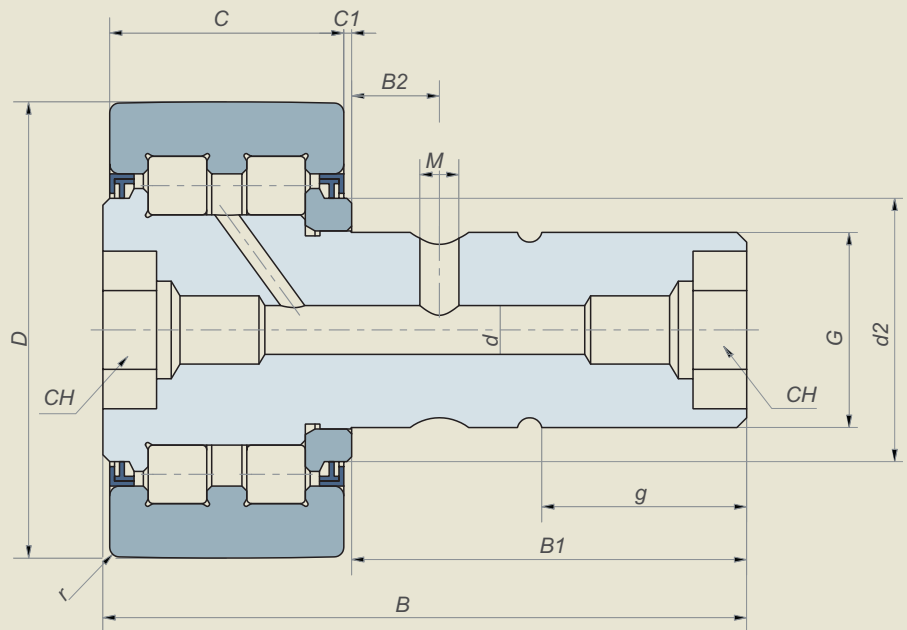
- Outer ring with double border of the rollers obtained entirely on the outer ring and accurately grinded to allow the roller to bear loads with axial components. The ring is usually cambered on the outer part, in order to improve working condition with heavy loads and to prevent the concentration of load onto side bands of the raceway. Rollers with cylindrical outer surface can be supplied on request.
- Pivot with threaded shank, one guide border of rollers obtained entirely and tempered rolling raceway. On the front part, a seat for hexagon wrench or for corkscrew (on request) can be foreseen.
- Sealing steel sheets forced on the outer diameter to form a safe labyrinth protection system.
- Full complement of grinded flat-head cylindrical rollers.
- Lubrication channels and holes in the pivot.
- Tolerance of execution according to normal class, possibility of special execution according to class P5 (DIN 620).



# PWKR CAM FOLLOWERS

The main characteristic of this series of rollers is the high thickness of the outer ring, which is suitable to bear specific high pressures and the impacts that characterize the use of these bearings (ex. cam followers).

It differs from NUKR series as far as the characteristics of the seals are concerned, as they are of ZRS type (steel and rubber). Furthermore, a chamber for the lubrication grease is foreseen between the rolling raceways of the outer ring.



C.R. SPECIAL PROFILE

C.R. ref.	D	d <sub>h7</sub>	C	r <sub>min.</sub>	B	B <sub>1</sub>	B <sub>2</sub>	G	g	M	C1	d2	CH	C <sub>w</sub>	C <sub>ow</sub>	Max. speed	Nut locking couple
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	KN	KN	RPM min <sup>-1</sup>	Nm
PWKR 35 2RS	35	16	18	0,6	52	32,5	7,8	M16x1,5	17	3	0,8	20	8	11,6	11,3	6000	58
PWKR 40 2RS	40	18	20	1	58	36,5	8	M18x1,5	19	3	0,8	22	8	13,2	13,8	5000	87
PWKR 47 2RS	47	20	24	1	66	40,5	9	M20x1,5	21	4	0,8	27	10	23,2	25,5	3800	120
PWKR 52 2RS	52	20	24	1	66	40,5	9	M20x1,5	21	4	0,8	31	10	24,2	28	3800	120
PWKR 62 2RS	62	24	28	1	80	49,5	11	M24x1,5	25	4	1,3	38	14	35	39,5	2200	220
PWKR 72 2RS	72	24	28	1,1	80	49,5	11	M24x1,5	25	4	1,3	44	14	38,5	46,5	2200	220
PWKR 80 2RS	80	30	35	1,1	100	63	15	M30x1,5	32	4	1	47	14	56	70	1800	450
PWKR 90 2RS	90	30	35	1,1	100	63	15	M30x1,5	32	4	1	47	14	63	82	1800	450

Pressure greaser	NIP A2x7,5	PWKR 35 2RS - PWKR 40 2RS - PWKR 47 2RS - PWKR 52 2RS
	NIP A3x9,5	PWKR 62 2RS - PWKR 72 2RS - PWKR 80 2RS - PWKR 90 2RS

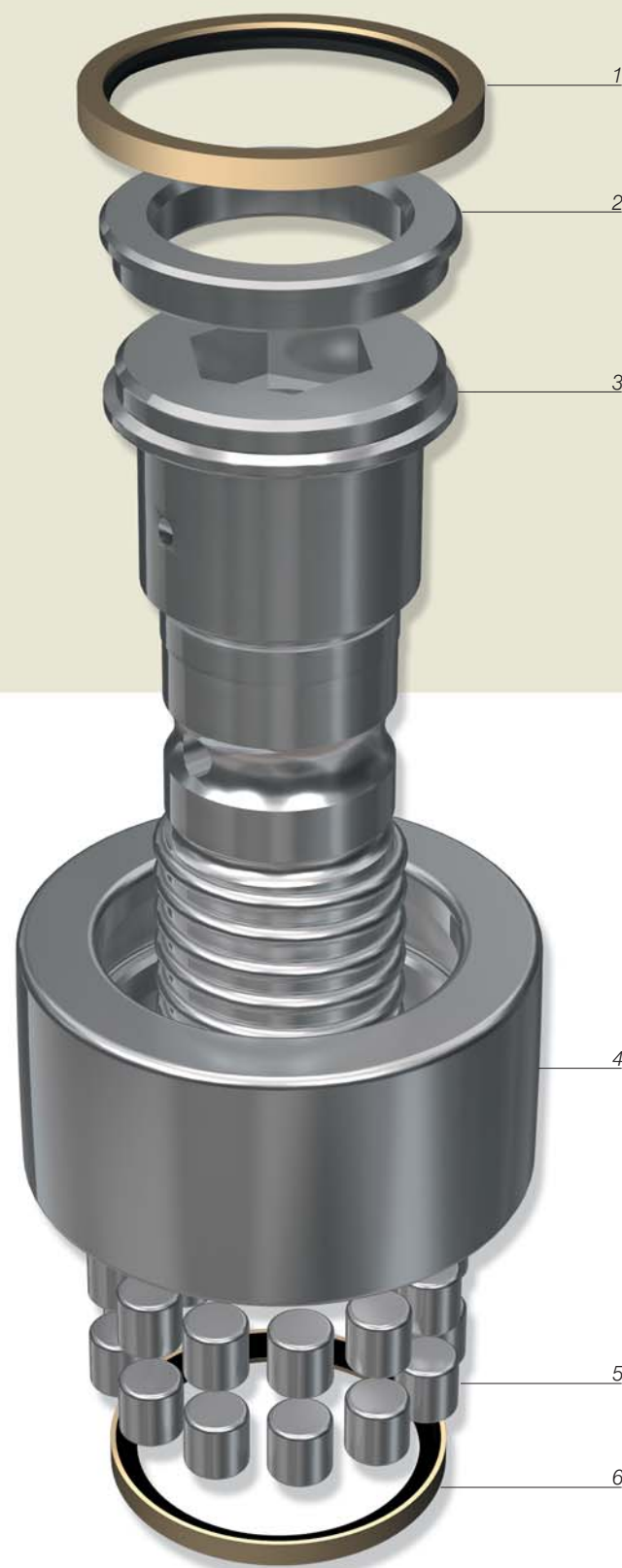
Adaptor for central lubrication	AP8	PWKR 35 2RS - PWKR 40 2RS
	AP10	PWKR 47 2RS - PWKR 52 2RS
	AP14	PWKR 62 2RS - PWKR 72 2RS - PWKR 80 2RS - PWKR 90 2RS

C<sub>w</sub> Dynamic load      C<sub>ow</sub> Static load



# PWKR CAM FOLLOWERS

- 
1. ZRS SEAL RING
  2. SUPPORT THRUST RING
  3. PIVOT
  4. OUTER RING
  5. CYLINDRICAL ROLLERS
  6. ZRS SEAL RING
- 

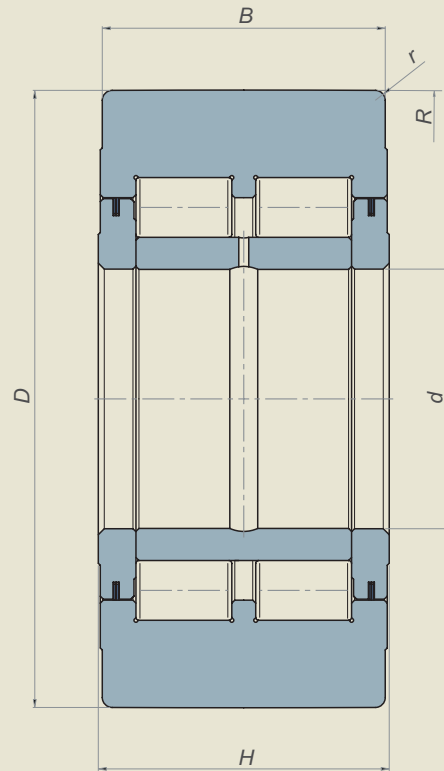


Other important features of these bearings are:

- Outer ring with double border of the rollers obtained entirely and accurately grinded to allow the roller to bear loads with axial components. The ring is usually cambered on the outer part, in order to improve working condition with heavy loads and to prevent the concentration of load onto side bands of the raceway. On request, C.R. can supply rollers with cylindrical outer surface.
- Pivot with threaded shank, one guide border of rollers obtained entirely and tempered rolling raceway. On the front part, a seat for hexagon wrench or for corkscrew (on request) are foreseen.
- The ZRS seals forced on the outer ring guarantee an extremely efficient protection system.
- Full complement of grinded flat head cylindrical rollers.
- Lubrication channels and holes in the pivot.
- Tolerance of execution according to normal class, possibility of special execution according to class P5 (DIN 620).

# RSU TRACK ROLLERS

The main characteristic of this series of rollers is the high thickness of outer ring, which is suitable to bear high specific pressures and the impacts deriving from the use of these bearings as pressure rollers, cam followers, conveyor belt rollers, bearings for fork lift masts.



<i>C.R. ref.</i>	<i>d</i>	<i>D</i>	<i>B</i>	<i>H</i>	<i>R</i>	<i>r</i>	<i>C<sub>w</sub></i>	<i>C<sub>ow</sub></i>	<i>Max. speed</i>
	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>mm</i>	<i>KN</i>	<i>KN</i>	<i>RPM min<sup>-1</sup></i>
RSU 55-120	55	120	40	43	10.000	2	128	195	1.000
RSU 50-130	50	130	63	65	10.000	3	192	250	1.100
RSU 55-140	55	140	68	70	10.000	3	223	300	850
RSU 60-150	60	150	73	75	10.000	3	255	350	800
RSU 65-160	65	160	73	75	10.000	3	275	370	700
RSU 70-180	70	180	83	85	10.000	3	350	490	600
RSU 80-200	80	200	88	90	10.000	4	410	580	500
RSU 90-220	90	220	98	100	10.000	4	495	720	400
RSU 100-240	100	240	103	105	10.000	4	560	830	340
RSU 110-260	110	260	113	115	10.000	4	670	1020	300
RSU 120-290	120	290	133	135	15.000	4	890	1370	260
RSU 130-310	130	310	144	146	15.000	5	1020	1600	240
RSU 140-340	140	340	160	162	15.000	5	1215	1950	200
RSU 150-360	150	360	171	173	15.000	5	1360	2210	180

*C<sub>w</sub>* Dynamic load      *C<sub>ow</sub>* Static load



# RSU TRACK ROLLERS

- 
1. FEY SEAL RING
  2. SUPPORT THRUST RING
  3. OUTER RING
  4. CYLINDRICAL ROLLERS
  5. INNER RING
  6. SUPPORT THRUST RING
  7. FEY SEAL RING
- 



Other important features of these bearings are:

- Outer ring with double border of the rollers obtained entirely on the outer ring and accurately grinded in order to allow the roller to bear loads with axial components. The ring is usually cambered on the outer part, in order to improve working condition with heavy loads and to prevent the concentration of load onto side bands of the raceway. On request, C.R. can supply rollers with cylindrical outer surface.
- Inner ring with holes and channels for the inflow of lubricants.
- Grinded thrust rings, which form a labyrinth protection system, along with steel sealing sheets forced on the outer ring. One of lateral thrust rings can be a closed thrust ring, to allow the fixing of the rollers at the edge of the shaft.
- Full-complement of grinded flat-head rollers.
- Tolerance of execution according to normal class, possibility of special execution according to class P5 (DIN 620).

# NEEDLE BEARINGS WITH ENTIRE BORDERS

Massive needle bearings with entire borders obtained on the outer ring form a unique body that cannot be disassembled, as the outer ring, the cages and the needle rollers cannot be disassembled.

These bearings have very small dimensions but a great load capacity. The bearings are available with inner ring or without inner ring.

Needle bearings without inner ring are used in plants whose project foresees a grinded and tempered shaft that acts as rolling raceway.

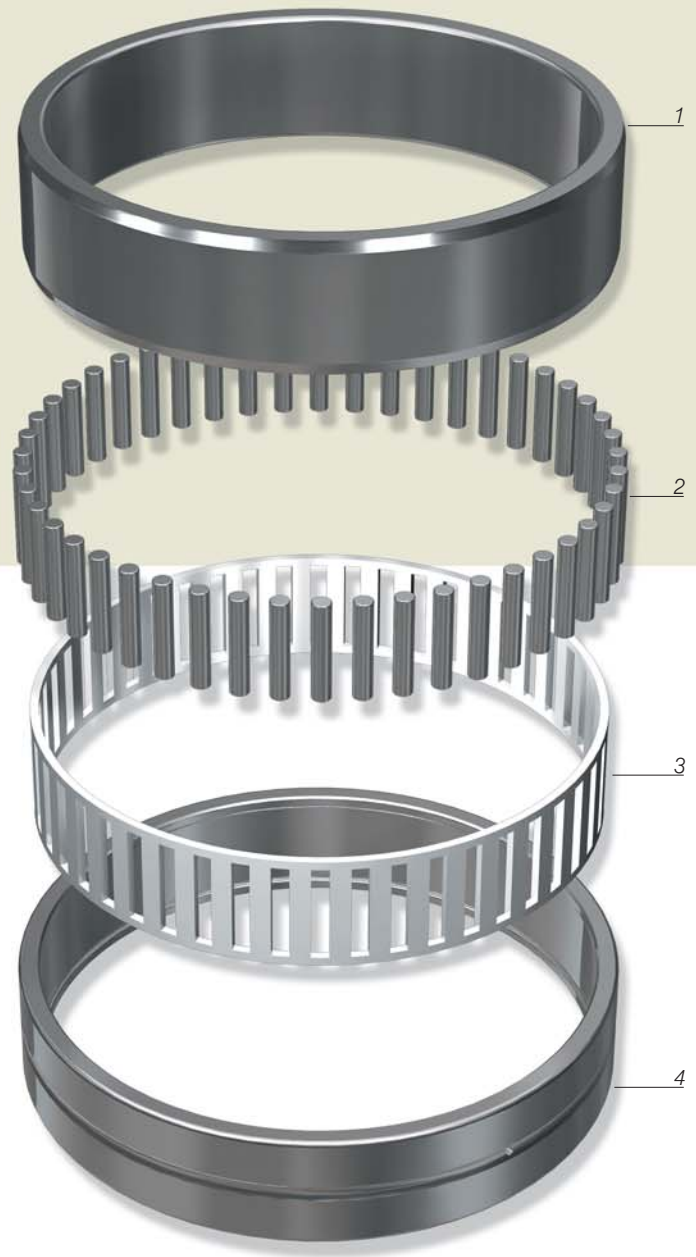


C.R. ref.	d	F	D	B	r <sub>1 min.</sub>	s	C <sub>w</sub>	C <sub>ow</sub>	Max. speed
	mm	mm	mm	mm	mm	mm	KN	KN	RPM min <sup>-1</sup>
NA 4822	110	120	140	30	1	0,8	106	216	3900
NA 4824	120	130	150	30	1	0,8	112	239	3150
NA 4826	130	145	165	35	1,1	1	134	310	3300
NA 4828	140	155	175	35	1,1	1	136	325	3100
NA 4830	150	165	190	40	1,1	1,5	172	400	2900
NA 4832	160	175	200	40	1,1	1,5	181	435	2700
NA 4834	170	185	215	45	1,1	1,5	209	510	2550
NA 4836	180	195	225	45	1,1	1,5	219	550	2420
NA 4838	190	210	240	50	1,5	1,5	255	690	2280
NA 4840	200	220	250	50	1,5	1,5	260	720	2180
NA 4844	220	240	270	50	1,5	1,5	275	790	2000
NA 4848	240	265	300	60	2	2	400	1080	1810
NA 4852	260	285	320	60	2	2	415	1160	1690
NA 4856	280	305	350	69	2	2,5	510	1300	1560
NA 4860	300	330	380	80	2,1	2	700	1770	1440
NA 4864	320	350	400	80	2,1	2	710	1850	1360
NA 4868	340	370	420	80	2,1	2	730	1940	1290
NA 4872	360	390	440	80	2,1	2	740	2020	1230
NA 4876	380	415	480	100	2,1	2	1130	2900	1140

C<sub>w</sub> Dynamic load      C<sub>ow</sub> Static load

# NEEDLE BEARINGS WITH ENTIRE BORDERS

- 
1. OUTER RING
  2. NEEDLE ROLLERS
  3. CAGE
  4. INNER RING
- 



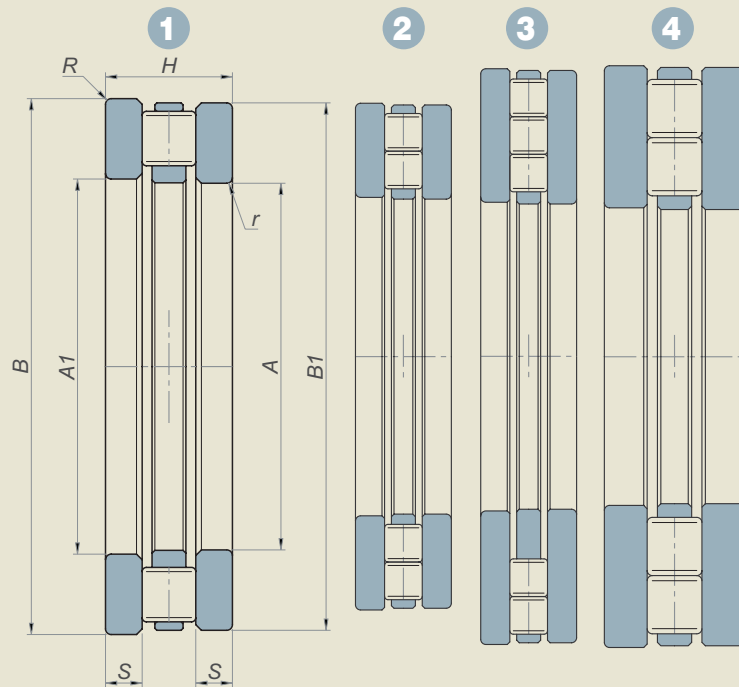
Needle bearings with entire borders have the following characteristics:

- Outer ring and inner ring are manufactured in core-hardened UNI 100Cr6 steel and reach hardness of  $60 \pm 2$  HRC.
- The cages are in moulded sheet.
- Lubrication is made through one groove and hole on the outer ring.
- The inner ring allows an axial shifting. The bearings can be supplied with RS seals on request.
- Needle bearings with inner ring are used when the shaft cannot act as rolling raceway.

# AXIAL CYLINDRICAL ROLLER BEARINGS

Axial cylindrical roller bearings are made up of one cylindrical roller axial cage, one support thrust ring per GS housing and one thrust ring per WS shaft.

The bearings of series 811 and 812 are used when very high loads must be born. The bearings of series 874, 893 and 894 are used when even higher loads must be born.



Cylindrical roller axial cages have massive structure and have seats like the spokes of a wheel, in which the cylindrical rollers are guided and held.

All axial cylindrical roller cages can be combined with the thrust rings for GS housing and with the thrust rings for WS shaft.

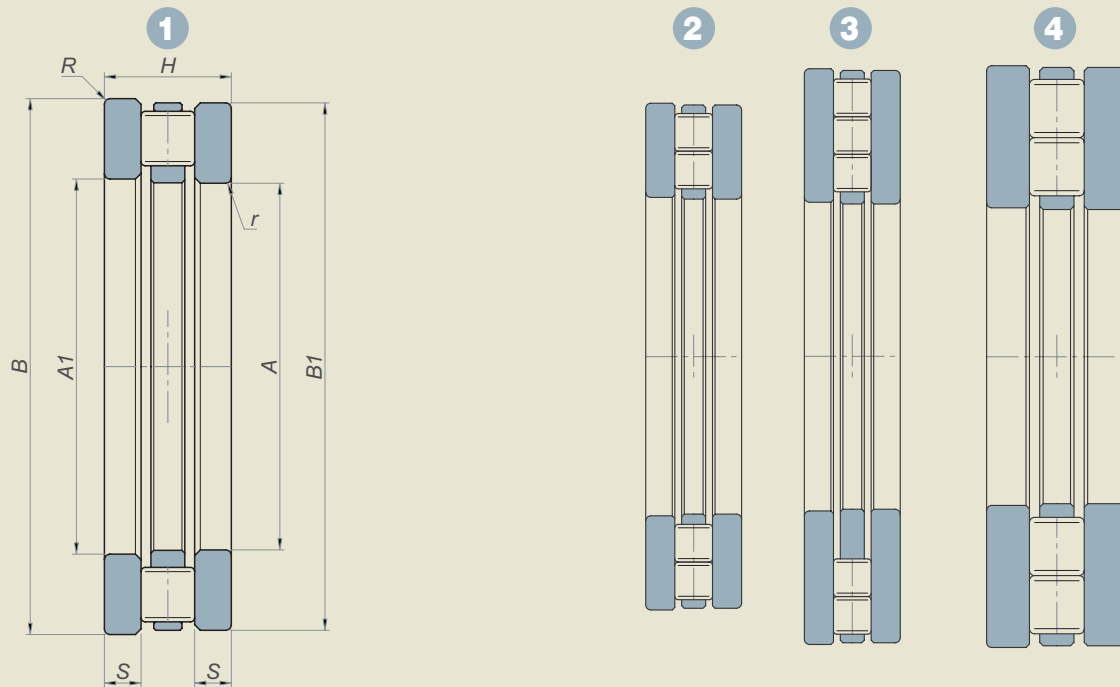
C.R. ref.	Series	A	B	H	S	R	r	A1	B1	C	C <sub>0</sub>	Max. speed	Exec.	
		mm	mm	mm	mm	mm	mm	mm	mm	KN	KN	RPM min <sup>-1</sup>		
M300-0020	81120	100	135	25	7	1	1	102	135	199	650	1.900	1	
M300-0120	81220	100	150	38	11,5	1,1	1,1	103	150	340	1080	900	1	
M300-0220	89320	100	170	42	14,5	1,5	1,5	103	170	380	1400	750	2	
M300-0320	87420	100	210	50	17,5	3	3	103	210	590	1250	550	3	
	89420	89420	100	210	67	22,5	3	3	103	210	850	2850	550	4
M300-0022	81122	110	145	25	7	1	1	112	145	207	700	2.300	1	
M300-0122	81222	110	160	38	11,5	1,1	1	113	160	325	1030	2.100	1	
M300-0222	89322	110	190	48	16,5	2	2	113	190	500	1870	1.900	2	
M300-0322	87422	110	230	54	18,5	3	3	113	230	710	1490	1.700	3	
	89422	89422	110	230	73	24,5	3	3	113	230	1000	3400	1.700	4
M300-0024	81124	120	155	25	7	1	1	122	155	214	760	2.100	1	
M300-0124	81224	120	170	39	12	1,1	1,1	123	170	340	1120	2.000	1	
M300-0224	89324	120	210	54	18,5	2,1	2,1	123	210	640	2420	1.700	2	
M300-0324	87424	120	250	58	20	4	4	123	250	1010	1790	1.600	3	
	89424	89424	120	250	78	26	4	4	123	250	1160	4000	1.600	4
M300-0026	81126	130	170	30	9	1	1	132	170	250	900	1.900	1	
M300-0126	81226	130	190	45	13	1,5	1,5	133	190	480	1520	1.800	1	
M300-0226	89326	130	225	58	20	2,1	2,1	134	225	710	2700	1.600	2	

C Dynamic load

C<sub>0</sub> Static load



# AXIAL CYLINDRICAL ROLLER BEARINGS

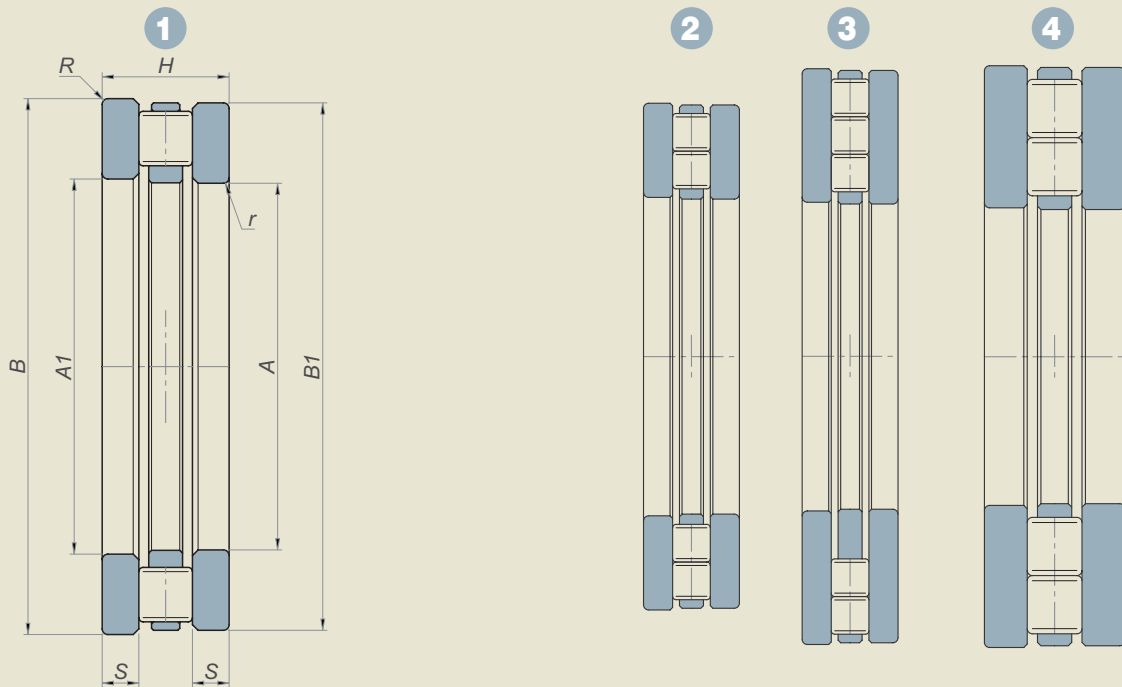


C.R. ref.	Series	A mm	B mm	H mm	S mm	R mm	r mm	A1 mm	B1 mm	C KN	C <sub>0</sub> KN	Max. speed RPM min <sup>-1</sup>	Exec.
M300-0326	87426	130	270	63	22	4	4	134	270	920	2040	1.400	3
89426	89426	130	270	85	28,5	4	4	134	270	1130	4600	1.400	4
M300-0028	81128	140	180	31	9,5	1	1	142	180	260	960	1.800	1
M300-0128	81228	140	200	46	13,5	1,5	1,5	143	200	455	1450	1.700	1
M300-0228	89328	140	240	60	20,5	2,1	2,1	144	240	820	3200	1.500	2
M300-0328	87428	140	280	63	22	4	4	144	280	970	2200	1.400	3
89428	89428	140	280	85	28,5	4	4	144	280	1380	4950	1.400	4
M300-0030	81130	150	190	31	9,5	1	1	152	190	270	1020	1.700	1
M300-0130	81230	150	215	50	14,5	1,5	1	153	215	590	1940	1.600	1
M300-0230	89330	150	250	60	20,5	2,1	2,1	154	250	840	3350	1.400	2
M300-0330	87430	150	300	67	23	4	4	154	300	1100	2470	1.300	3
89430	89430	150	300	90	30	4	4	154	300	1570	5700	1.300	4
M300-0032	81132	160	200	31	9,5	1	1	162	200	260	990	1.600	1
M300-0132	81232	160	225	51	15	1,5	1,5	163	225	600	2030	1.500	1
M300-0232	89332	160	270	67	23	3	3	164	270	850	1730	1.300	2
M300-0332	87432	160	320	73	25,5	5	5	164	320	1270	2950	1.200	3
89432	89432	160	320	95	31,5	5	5	164	320	1780	6500	1.200	4
M300-0034	81134	170	215	34	10	1,1	1,1	172	215	360	1380	1.500	1
M300-0134	81234	170	240	55	16,5	1,5	1,5	173	240	680	2340	1.400	1
M300-0234	89334	170	280	67	23	3	3	174	280	870	1810	1.300	2

C Dynamic load

C<sub>0</sub> Static load

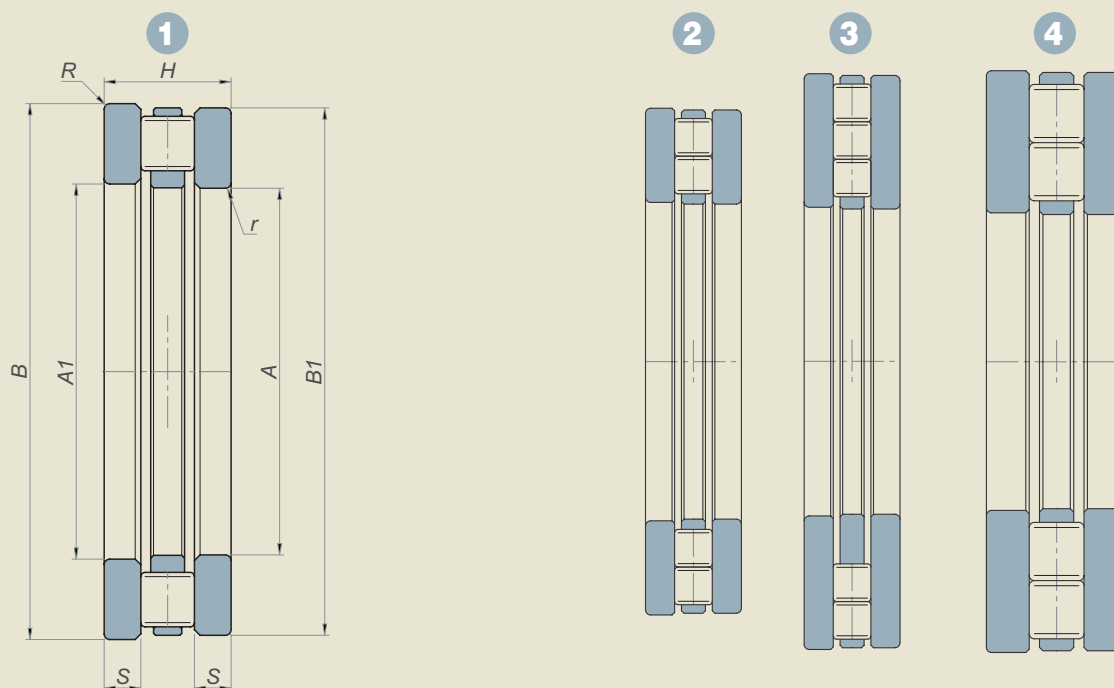
# AXIAL CYLINDRICAL ROLLER BEARINGS



C.R. ref.	Series	A mm	B mm	H mm	S mm	R mm	r mm	A1 mm	B1 mm	C KN	C <sub>0</sub> KN	Max. speed RPM min <sup>-1</sup>	Exec.
M300-0334	87434	170	340	78	27	5	5	174	340	1410	3250	1.100	3
	89434	170	340	103	34,5	5	5	174	340	1990	7400	1.100	4
M300-0036	81136	180	225	34	10	1,1	1,1	183	225	340	1300	1.400	1
M300-0136	81236	180	250	56	17	1,5	1,5	183	250	690	2440	1.300	1
M300-0236	89336	180	300	73	24,5	3	3	184	300	1100	2270	1.200	2
M300-0336	87436	180	360	82	28,5	5	5	184	360	1620	3850	1.100	3
	89436	180	360	109	36,5	5	5	184	360	2210	8200	1.100	4
M300-0038	81138	190	240	37	11	1,1	1,1	193	240	385	1500	1.300	1
M300-0138	81238	190	270	62	18	2	1	194	270	880	3000	1.300	1
M300-0238	89338	190	320	78	26	4	4	195	320	1230	2550	1.100	2
M300-0338	87438	190	380	85	29,5	5	5	195	380	1730	4150	1.000	3
	89438	190	380	115	38,5	5	5	195	380	2450	9200	1.000	4
M300-0040	81140	200	250	37	11	1,1	1,1	203	250	390	1550	1.300	1
M300-0140	81240	200	280	62	18	2	2	204	280	900	3150	1.200	1
M300-0240	89340	200	340	85	28,5	4	4	205	340	1420	2950	1.100	2
M300-0340	87440	200	400	90	31	5	5	205	400	1990	4800	950	3
	89440	200	400	122	41	5	5	205	400	2700	10200	950	4
M300-0044	81144	220	270	37	11	1,1	1,1	223	270	420	1730	1.200	1
M300-0144	81244	220	300	63	18,5	2	2	224	300	940	3450	1.100	1
M300-0344	89444	220	420	122	41	6	6	225	420	2900	11500	900	4

C Dynamic load      C<sub>0</sub> Static load

# AXIAL CYLINDRICAL ROLLER BEARINGS

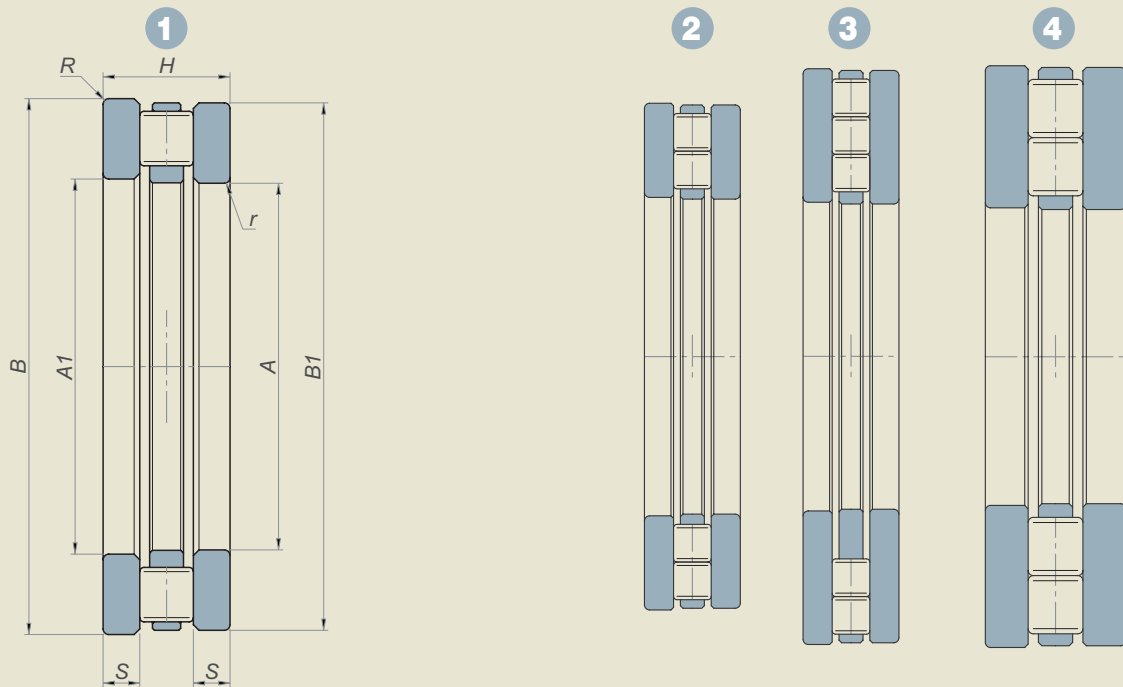


C.R. ref.	Series	A mm	B mm	H mm	S mm	R mm	r mm	A1 mm	B1 mm	C KN	C <sub>0</sub> KN	Max. speed RPM min <sup>-1</sup>	Exec.
M300-0048	81148	240	300	45	13,5	1,5	1,5	243	300	600	2500	1.100	1
M300-0148	81248	240	340	78	23	2,1	2,1	244	340	1370	5000	1.000	1
M300-0348	89448	240	440	122	41	6	6	245	440	3000	12200	850	4
M300-0052	81152	260	320	45	13,5	1,5	1,5	263	320	620	2650	1.000	1
M300-0152	81252	260	360	79	23,5	2,1	2,1	264	360	1440	5400	950	1
M300-0352	89452	260	480	132	44	6	6	265	480	3600	14700	800	4
M300-0056	81156	280	350	53	15,5	1,5	1,5	283	350	860	3650	900	1
M300-0156	81256	280	380	80	24	2,1	2,1	284	380	1460	5600	850	1
M300-0356	89456	280	520	145	48,5	6	1	285	520	4200	17600	700	4
M300-0060	81160	300	380	62	18,5	2	2	304	380	1060	4500	850	1
M300-0160	81260	300	420	95	28,5	3	3	304	420	1930	7300	800	1
M300-0360	89460	300	540	145	48,5	6	6	305	540	4350	18500	700	4
M300-0064	81164	320	400	63	19	2	2	324	400	1100	4750	800	1
M300-0164	81264	320	440	95	28,5	3	3	325	440	1960	7600	750	1
M300-0068	81168	340	420	64	19,5	2	2	344	420	1130	5000	750	1
M300-0168	81268	340	460	96	29	3	3	345	460	2060	8300	700	1
M300-0072	81172	360	440	65	20	2	2	364	440	1140	5100	700	1
M300-0172	81272	360	500	110	32,5	4	4	365	500	2700	10600	650	1
M300-0076	81176	380	460	65	20	2	2	384	460	1170	5400	700	1
M300-0176	81276	380	520	112	33,5	4	4	385	520	2750	11000	650	1

C Dynamic load      C<sub>0</sub> Static load



# AXIAL CYLINDRICAL ROLLER BEARINGS



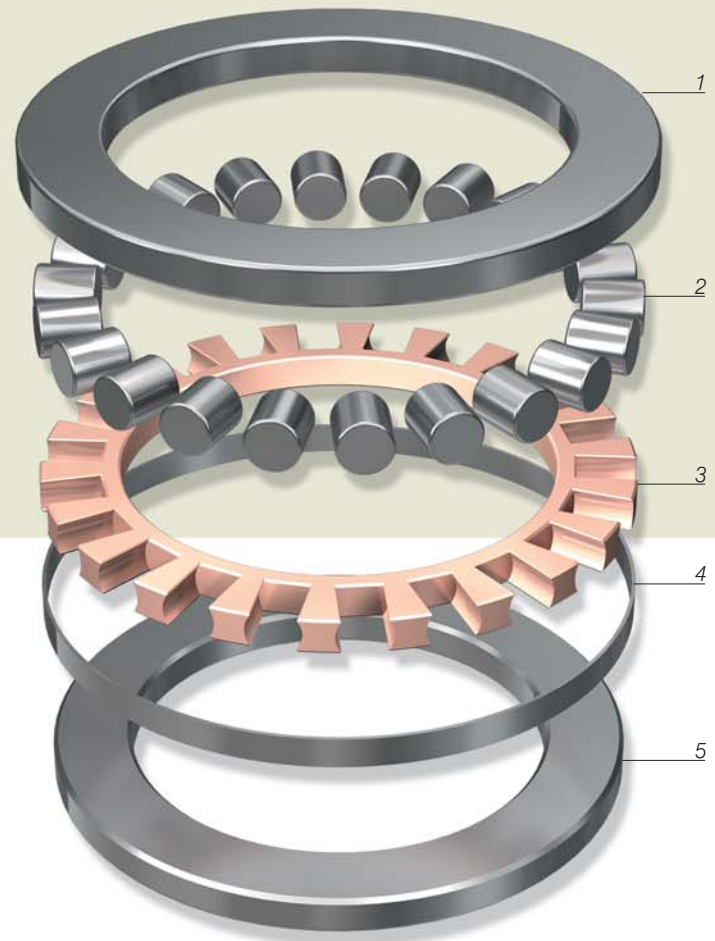
C.R. ref.	Series	A	B	H	S	R	r	A1	B1	C	C <sub>0</sub>	Max. speed	Exec.
		mm	mm	mm	mm	mm	mm	mm	mm	KN	KN	RPM min <sup>-1</sup>	
M300-0080	81180	400	480	65	20	2	2	404	480	1.200	5.700	650	1
M300-0180	81280	400	540	112	33,5	4	4	405	540	2.800	11.400	600	1
M300-0084	81184	420	500	65	20	2	2	424	500	1.230	5.900	650	1
M300-0184	81284	420	580	130	39	5	5	425	580	3.500	14.200	600	1
M300-0088	81188	440	540	80	24	2,1	2,1	444	540	1.780	8.200	600	1
M300-0188	81288	440	600	130	39	5	5	445	600	3.600	14.800	550	1
M300-0092	81192	460	560	80	24	2,1	1	464	560	1.840	8.700	550	1
M300-0192	81292	460	620	130	39	5	5	465	620	3.650	15.400	550	1
M300-0096	81196	480	580	80	24	2,1	2,1	484	580	1.860	8.900	550	1
M300-0196	81296	480	650	135	39,5	5	5	485	650	4.100	17.000	500	1
M300-0400	811 / 500	500	600	80	24	2,1	2,1	505	600	1.910	9.300	500	1
	812 / 500	500	670	135	39,5	5	5	505	670	4.150	17.600	490	1
	811 / 530	530	640	85	25,5	3	3	535	640	2.140	10.500	490	1
	812 / 530	530	710	140	40	5	5	535	710	4.750	20.300	460	1
	811 / 560	560	670	85	25,5	3	3	565	670	2.190	11.000	470	1
	811 / 560	560	750	150	45	5	5	565	750	4.850	21.100	440	1
	811 / 600	600	710	85	25,5	3	3	605	710	2.230	11.500	440	1
	812 / 600	600	800	160	48	5	5	605	800	5.500	24.000	410	1

C Dynamic load      C<sub>0</sub> Static load



# AXIAL CYLINDRICAL ROLLER BEARINGS

- 
1. *WS SUPPORT THRUST RING*
  2. *CYLINDRICAL ROLLERS*
  3. *CAGE*
  4. *LOCKING LITTLE RING*
  5. *GS SUPPORT THRUST RING*
- 



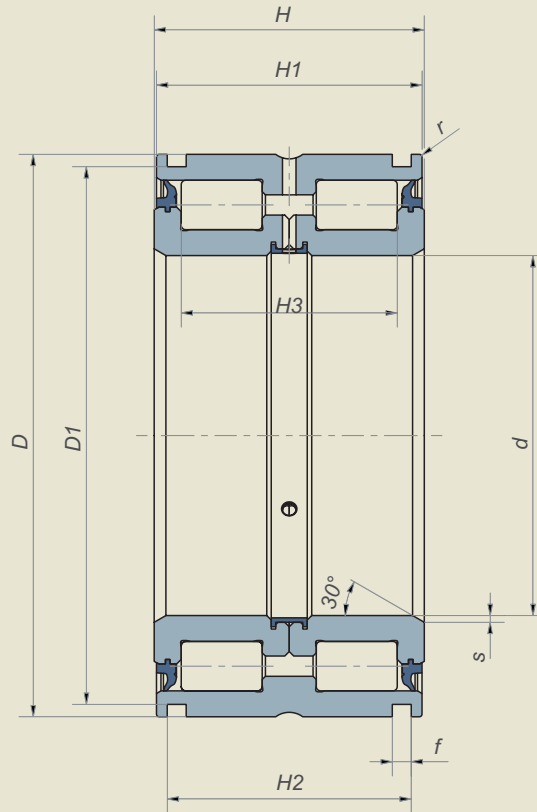
Thanks to the stiffness of the cages, the rolling elements are held and guided with high precision. In the cases in which the surfaces adjacent to the cages have suitable rolling raceways, small sized supports can be obtained. On the contrary, the various C.R. thrust rings for axial bearings allow to fulfil other support possibilities which adapt to the surrounding structure. Even though the rotation of the cylindrical bodies on a flat circular raceway generates a rolling/dragging effect, these axial bearings allow favourable friction coefficients, which can be compared to those of other types of rolling bearings. Axial cylindrical roller bearings have the following characteristics:

- GS and WS support thrust rings are made in UNI 100Cr6/100CrMo7 steel. They can be supplied in case-hardened 18 NiCrMo5 steel. They reach hardness 60 +2 HRC.
- The massive axial cages are usually supplied in bronze, which guarantees high sturdiness and high toughness, and maintains good elasticity. They can be executed in light alloy on request.
- The bearings are manufactured in standard precision class; on request they can be supplied with precision class P5/P6.

# RADIAL CYLINDRICAL ROLLER BEARINGS

with grooves on the outer ring

Radial bearings with grooves on the outer ring are manufactured with two rows of cylindrical rollers; they are made of one outer ring and two inner rings with entire massive borders, which act as an efficient axial guide for the rolling bodies. The high sturdiness of the sections, along with the number of rollers inserted in the rolling raceways, allow this series of bearings to achieve a very high load capacity, both dynamic and static.



C.R. ref.	d	D	H	H <sub>1</sub>	H <sub>2</sub>	D <sub>1+0,2</sub>	f	r	s	H <sub>3</sub>	C	C <sub>0</sub>	Max. speed RPM min <sup>-1</sup>
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kn	kn	
NNF 5004-PP	20	42	30	29	24,7	40,2	1,8	0,3	0,5	22,5	40,5	49	4000
NNF 5005-PP	25	47	30	29	24,7	45,2	1,8	0,3	0,5	22,5	44,5	58	3600
NNF 5006-PP	30	55	34	33	28,2	53	2,1	0,3	0,5	25,5	50	67	3000
NNF 5007-PP	35	62	36	35	30,2	60	2,1	0,3	0,5	27,5	63	88	2600
NNF 5008-PP	40	68	38	37	32,2	65,8	2,7	0,6	0,8	28,5	76	103	2400
NNF 5009-PP	45	75	40	39	34,2	72,8	2,7	0,6	0,8	30,5	92	130	2200
NNF 5010-PP	50	80	40	39	34,2	77,8	2,7	0,6	0,8	30,5	97	142	2000
NNF 5011-PP	55	90	46	45	40,2	87,4	3,2	0,6	1	36	115	175	1800
NNF 5012-PP	60	95	46	45	40,2	92,4	3,2	0,6	1	36	120	189	1700
NNF 5013-PP	65	100	46	45	40,2	97,4	3,2	0,6	1	36	125	203	1600
NNF 5014-PP	70	110	54	53	48,2	107,1	4,2	0,6	1	42	168	265	1400
NNF 5015-PP	75	115	54	53	48,2	112,1	4,2	0,6	1	42	194	300	1400
NNF 5016-PP	80	125	60	59	54,2	122,1	4,2	0,6	1,5	48	203	325	1300
NNF 5017-PP	85	130	60	59	54,2	127,1	4,2	0,6	1,5	48	211	350	1200
NNF 5018-PP	90	140	67	66	59,2	137	4,2	0,6	1,5	54	305	510	1100
NNF 5019-PP	95	145	67	66	59,2	142	4,2	0,6	1,5	54	315	530	1100
NNF 5020-PP	100	150	67	66	59,2	147	4,2	0,6	1,5	54	330	550	1000
NNF 5022-PP	110	170	80	79	70,2	167	4,2	0,6	1,8	64	395	680	900
NNF 5024-PP	120	180	80	79	71,2	176	4,2	0,6	1,8	64	410	740	900
NNF 5026-PP	130	200	95	94	83,2	196	4,2	0,6	1,8	77	540	960	800
NNF 5028-PP	140	210	95	94	83,2	206	5,2	0,6	1,8	77	610	1100	750
NNF 5030-PP	150	225	100	99	87,2	221	5,2	0,6	2	80	710	1260	700
NNF 5032-PP	160	240	109	108	95,2	236	5,2	0,6	2	89	740	1360	650
NNF 5034-PP	170	260	122	121	107,2	254	5,2	0,6	2	100	960	1750	600
NNF 5036-PP	180	280	136	135	118,2	274	5,2	0,6	2	112	1140	2130	550
NNF 5038-PP	190	290	136	135	118,2	284	5,2	0,6	2	112	1160	2210	550
NNF 5040-PP	200	310	150	149	128,2	304	6,3	0,6	2	126	1350	2600	500
NNF 5044-PP	220	340	160	159	138,2	334	6,3	1	2	132	1570	3050	480
NNF 5048-PP	240	360	160	159	138,2	354	6,3	1	2	132	1630	3300	440
NNF 5052-PP	260	400	190	189	162,2	394	6,3	1,1	3	150	2380	4700	400
NNF 5056-PP	280	420	190	189	163,2	413	7,3	1,1	3	150	2600	5200	380
NNF 5060-PP	300	460	218	216	185,2	453	7,3	1,1	3	170	3000	5800	340

C Dynamic load

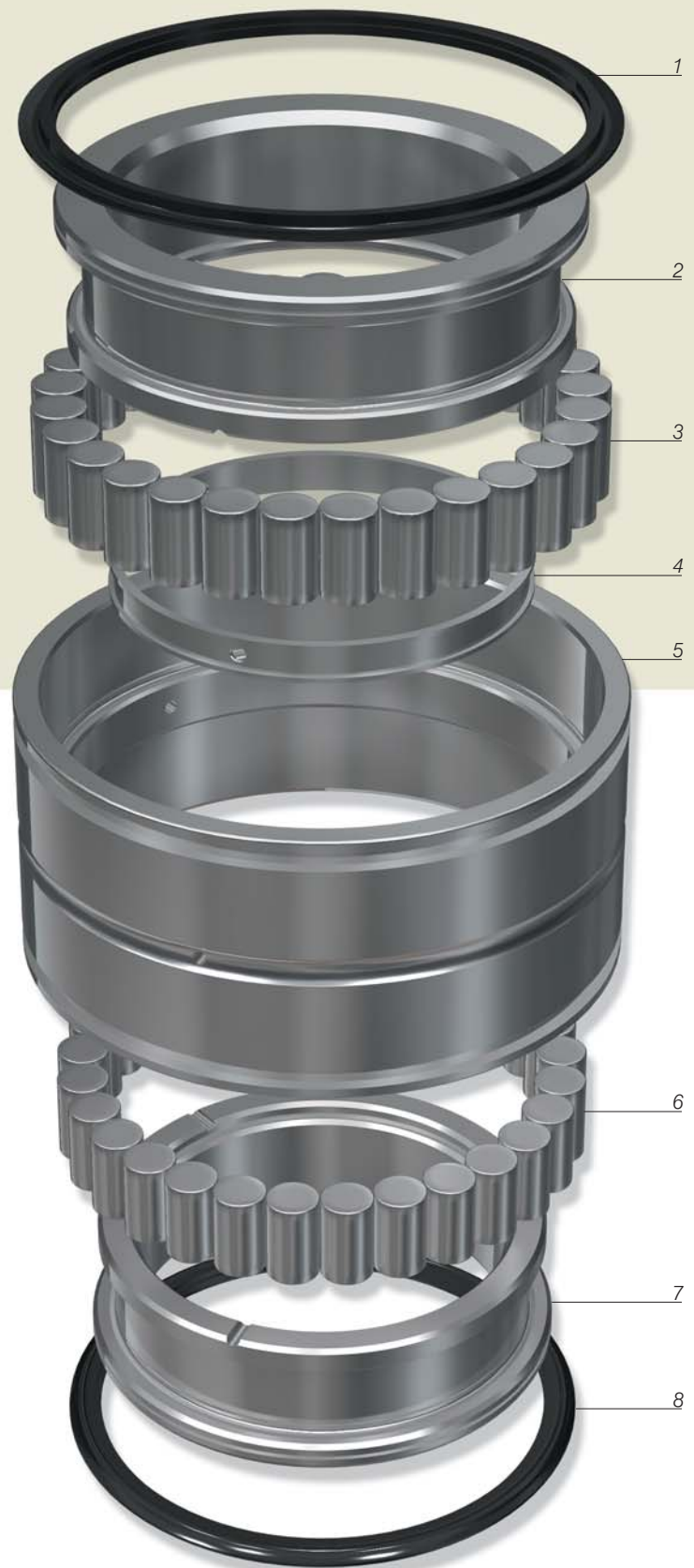
C<sub>0</sub> Static load



# RADIAL CYLINDRICAL ROLLER BEARINGS

with grooves on the outer ring

- 
1. SEAL RING
  2. INNER RING
  3. CYLINDRICAL ROLLERS
  4. CONNECTING LINK
  5. OUTER RING
  6. CYLINDRICAL ROLLERS
  7. INNER RING
  8. SEAL RING
- 



Radial cylindrical roller bearings with grooves on the outer ring have the following characteristics:

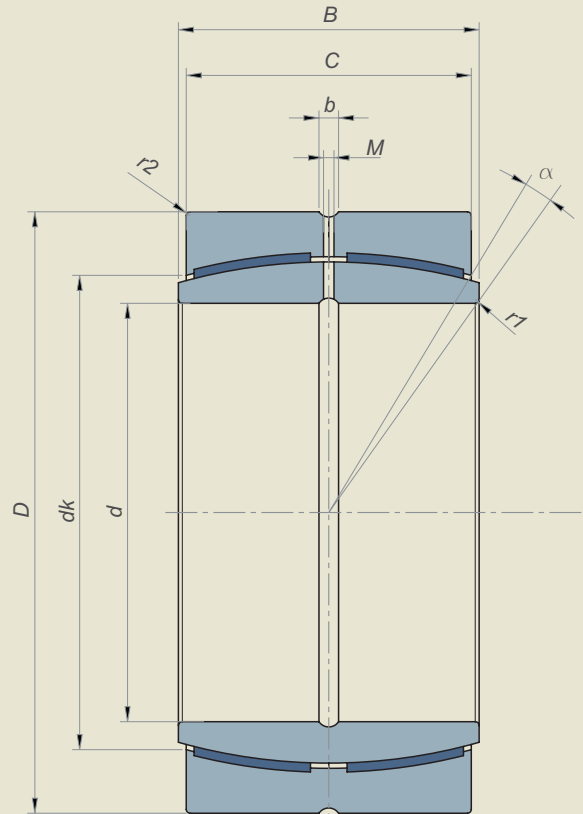
- The outer rings and the inner rings are manufactured in 100Cr6 steel; sometimes, in some specific working condition, mainly when hard impacts occur, they can be supplied in case-hardened 18NiCrMo5 steel.
- They reach hardness degree of  $60 \pm 2$  HRC.
- The inner rings are divided into two parts, on axial direction, which are linked to each other through a shaped steel ring.
- They are supplied with execution with lateral plastic seals and are already lubricated with lithium soap grease.
- Lubrication can be made both on the outer ring and on the inner ring.

# BALL JOINTS

Ball joints are made of one inner ring with spherical and convex surface, which matches with the concavity of the inner surface of the outer ring. They are particularly used in case it is necessary to align the shaft to the housing, with low shearing speeds.

C.R. ball joints have different surface materials and can be divided into two groups:

- 1 Steel-to-steel ball joints (thanks to the high resistance of the working surface, they are particularly suitable for application with alternating loads)
- 2 Maintenance-free ball joints (they are generally used in working condition with high loads with constant direction, and when the lubrication system is not adequate and therefore the use of steel-to-steel ball joints is not recommended).



	C.R. ref.	d	D	B	C	$\alpha$	dk	b	M	r1 min.	r2 min.	C	C <sub>0</sub>
		mm	mm	mm	mm	°	mm	mm	mm	mm	mm	kn	kn
1	GE 100 FS	100	150	70	55	7	130	11,3	5	1	1	610	3050
	GE 110 FS	110	160	70	55	6	140	11,5	5	1	1	655	3250
	GE 120 FS	120	180	85	70	6	160	13,5	6	1	1	950	4750
	GE 140 FS	140	210	90	70	7	180	13,5	6	1	1	1080	5400
	GE 160 FS	160	230	105	80	8	200	13,5	6	1	1	1370	6800
	GE 180 FS	180	260	105	80	6	225	13,5	6	1,1	1,1	1530	7650
	GE 200 FS	200	290	130	100	7	250	15,5	7	1,1	1,1	2120	10600
	GE 220 FS	220	320	135	100	8	275	15,5	7	1,1	1,1	2320	11600
	GE 240 FS	240	340	140	100	8	300	15,5	7	1,1	1,1	2550	12700
	GE 260 FS	260	370	150	110	7	325	15,5	7	1,1	1,1	3050	15300
	GE 280 FS	280	400	155	120	6	350	15,5	7	1,1	1,1	3550	18000
	GE 300 FS	300	430	165	120	7	375	15,5	7	1,1	1,1	3800	19000
2	GEP 100 FS	100	150	71	67	2	135	7,4	4	1	1	600	900
	GEP 110 FS	110	160	78	74	2	145	7,5	4	1	1	720	1080
	GEP 120 FS	120	180	85	80	2	160	7,5	4	1	1	850	1270
	GEP 140 FS	140	210	100	95	2	185	7,5	4	1	1	1200	1800
	GEP 160 FS	160	230	115	109	2	210	7,5	4	1	1	1600	2400
	GEP 180 FS	180	260	128	122	2	240	7,5	4	1,1	1,1	2080	3100
	GEP 200 FS	200	290	140	134	2	260	11,5	5	1,1	1,1	2450	3650
	GEP 220 FS	220	320	155	148	2	290	13,5	6	1,1	1,1	3050	4550
	GEP 240 FS	240	340	170	162	2	310	13,5	6	1,1	1,1	3550	5400
	GEP 260 FS	260	370	185	175	2	340	15,5	7	1,1	1,1	4250	6400
	GEP 280 FS	280	400	200	190	2	370	15,5	7	1,1	1,1	5000	7500
	GEP 300 FS	300	430	212	200	2	410	15,5	7	1,1	1,1	5600	8300

C Dynamic load      C<sub>0</sub> Static load



## BALL JOINTS

- 
1. OUTER RING
  2. INNER RING
  3. OUTER RING
- 



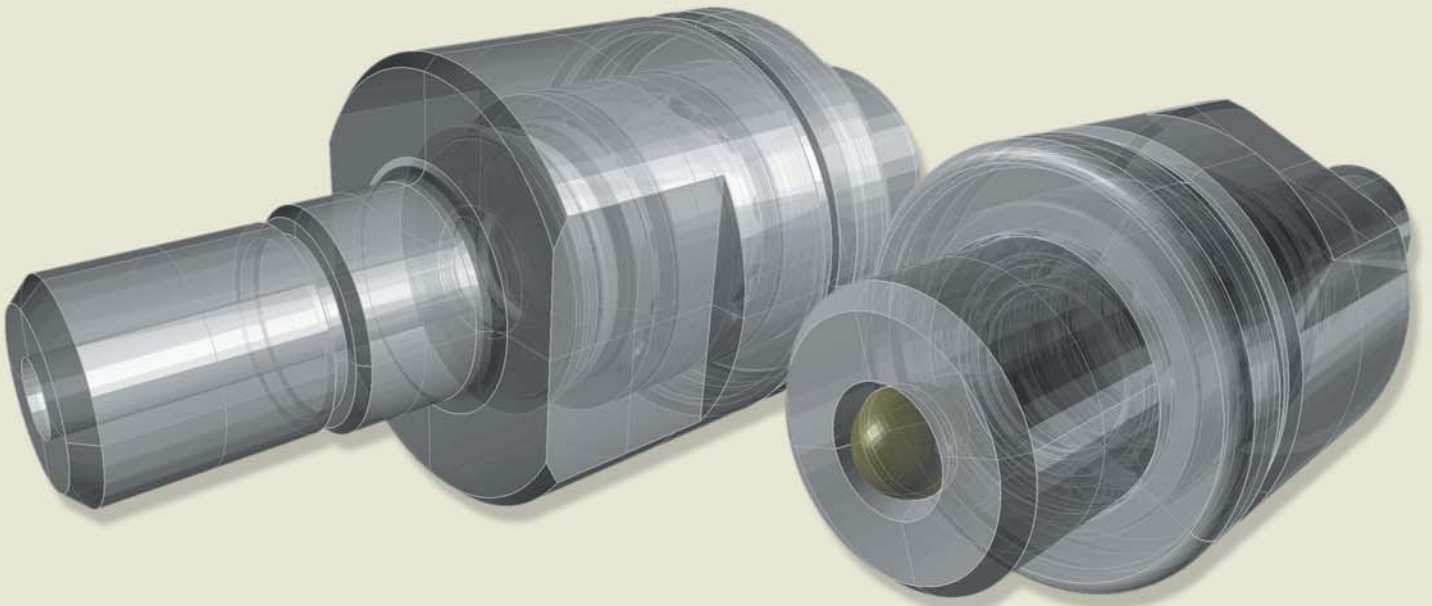
C.R. ball joints have the following technical characteristics:

- Steel-to-steel ball joints are manufactured in hardened and phosphatized UNI 100 Cr6/100CrMo7 steel.
- Contact surfaces undergo an additional special treatment, to make them completely resistant to wear.
- They cannot be disassembled and they have a groove and a hole on both rings to favour the lubrication.
- Ball joints with 2RS execution have double lip sliding seals on both sides.
- Maintenance-free ball joints have the outer ring covered with a layer of special plastic material, stiffened with glass fibre, absolutely resistant to wear.
- The outer ring is divided into two parts, which are perpendicular to the axis.
- The inner ring is manufactured in UNI 100Cr6/100CrMo7.
- Even though the ball joints are maintenance-free, it is possible to make an anti-corrosion lubrication.
- C.R. ball joints are provided with groove and holes on both rings, to favour lubrication.



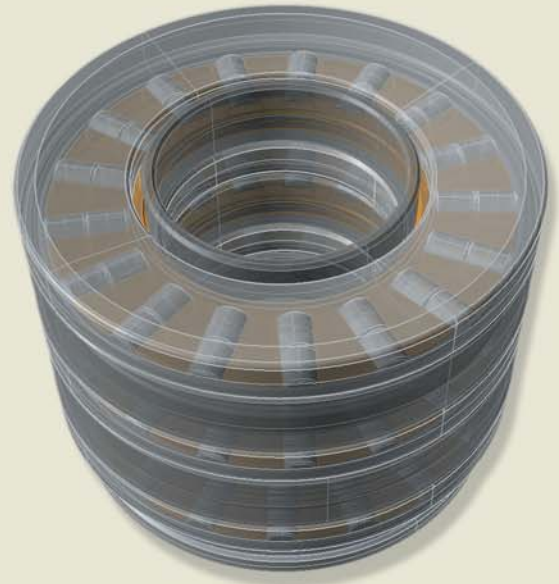
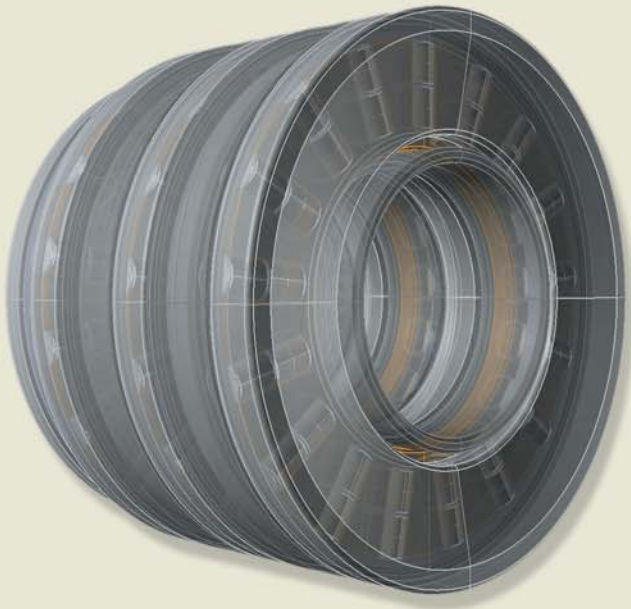
# FURTHER PRODUCTION PLANNING

## **SUPPORT BEARING** FOR METAL FLATTENING CYLINDERS 900-3561

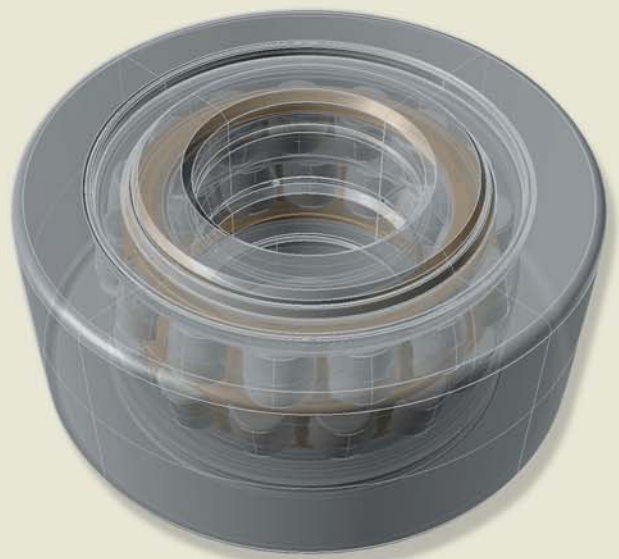
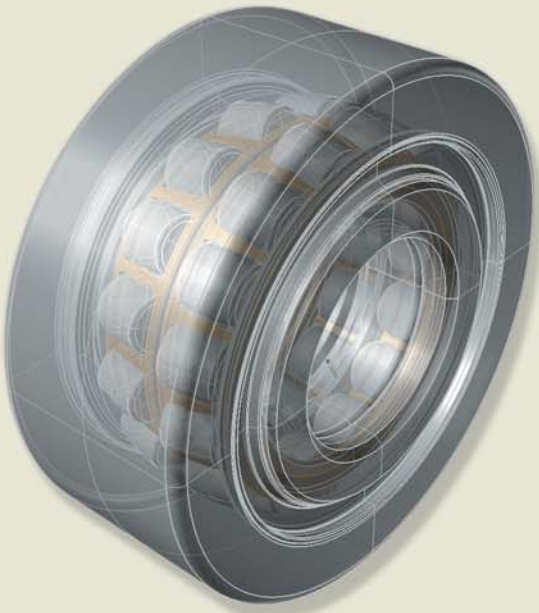




## **MULTI-STAGE THRUST BEARING** FOR PLASTIC MATERIAL EXTRUSION M600-0007



## **SPHERICAL ROLLER BEARING** FOR METAL FLATTENING MACHINE 900-4023



## **FULL COMPLEMENT CYLINDRICAL** ROLLER BEARING SERIES NCF - NNCF

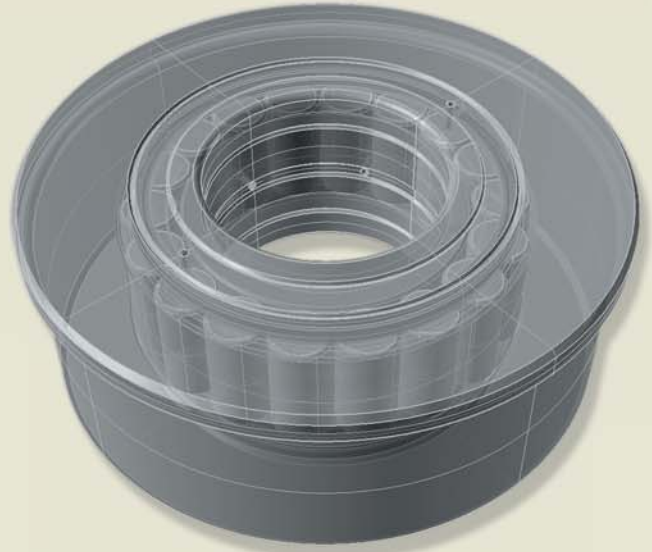
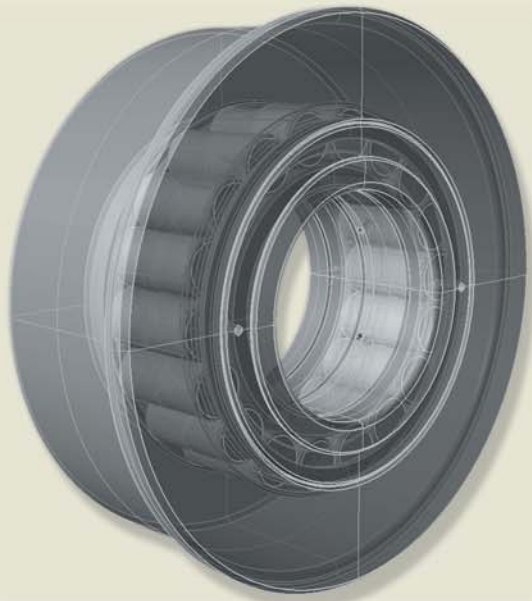


## **FULL COMPLEMENT CYLINDRICAL** ROLLER BEARING SERIES NNC - NNCL



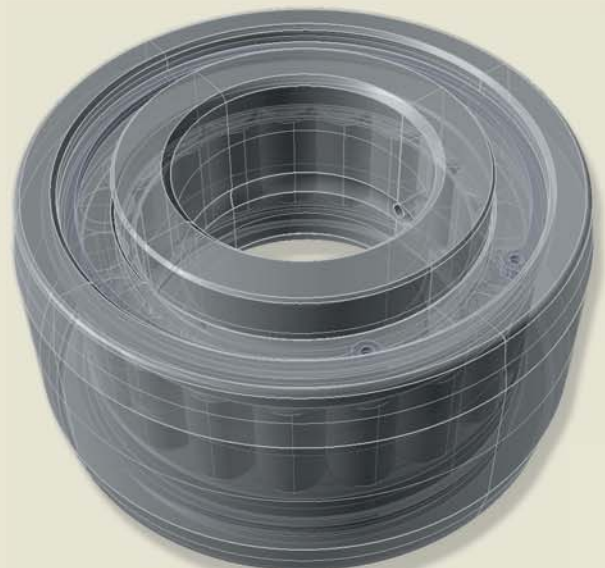
## **TRACK ROLLER**

FOR COILS CONVEYOR BELT 900-2786



## **TRACK ROLLER**

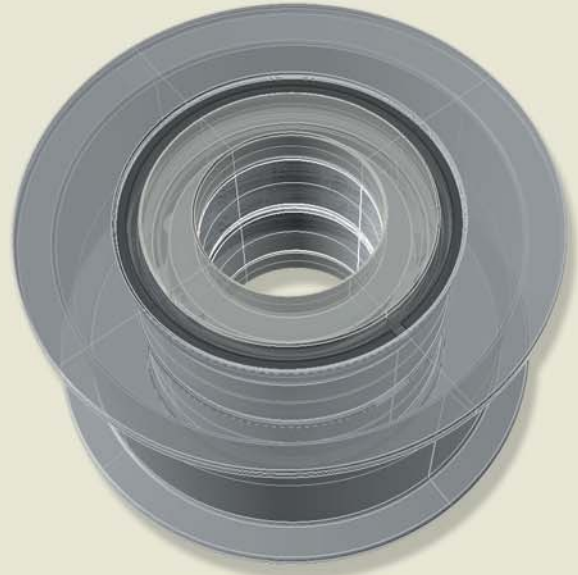
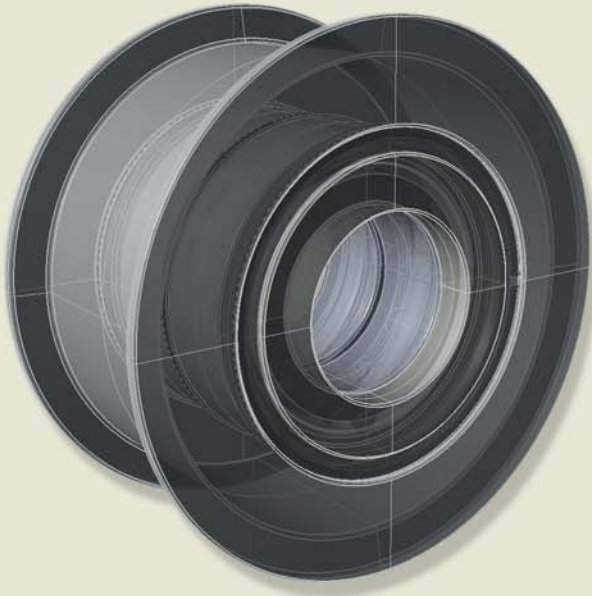
FOR COILS CONVEYOR BELT 900-3007



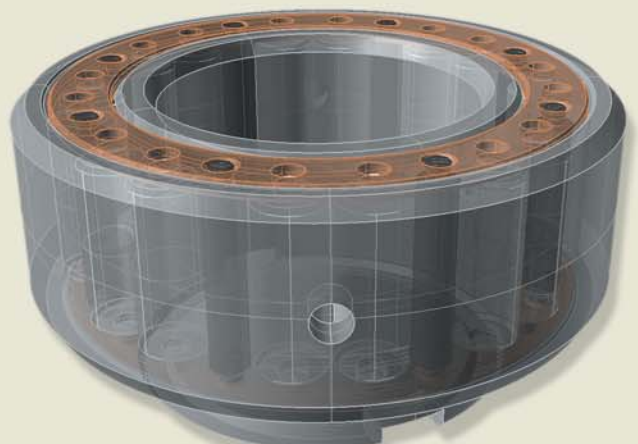


## **CHAIN PULLEY**

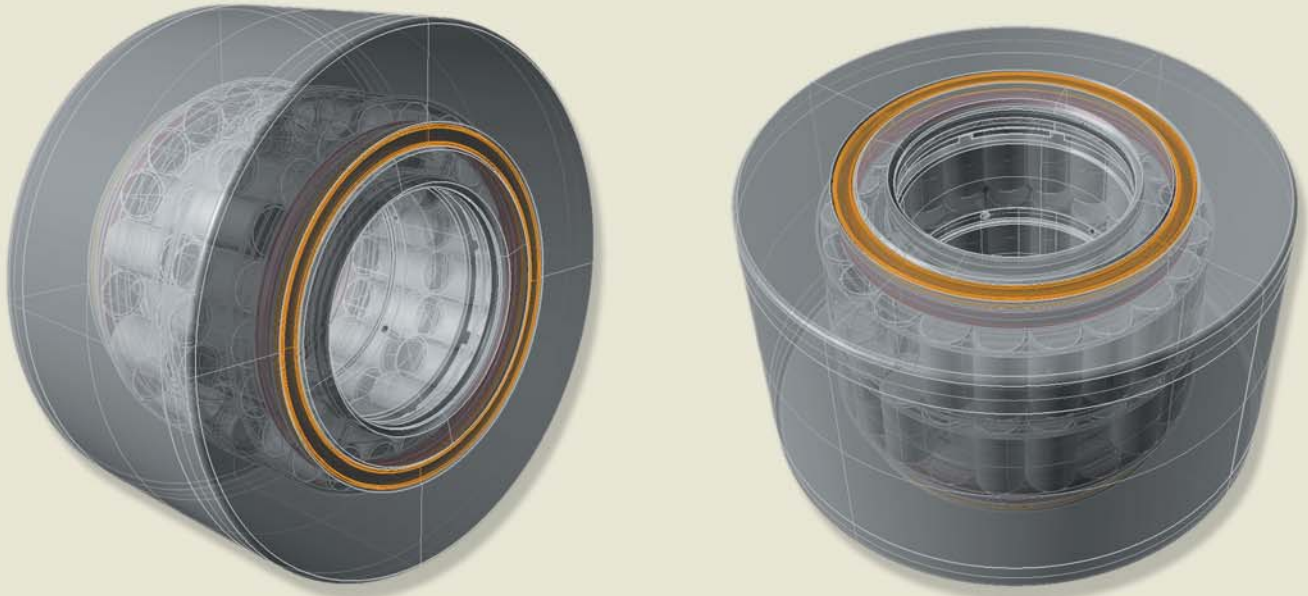
FOR HIGH LOAD FORK LIFT MASTS 200-0339



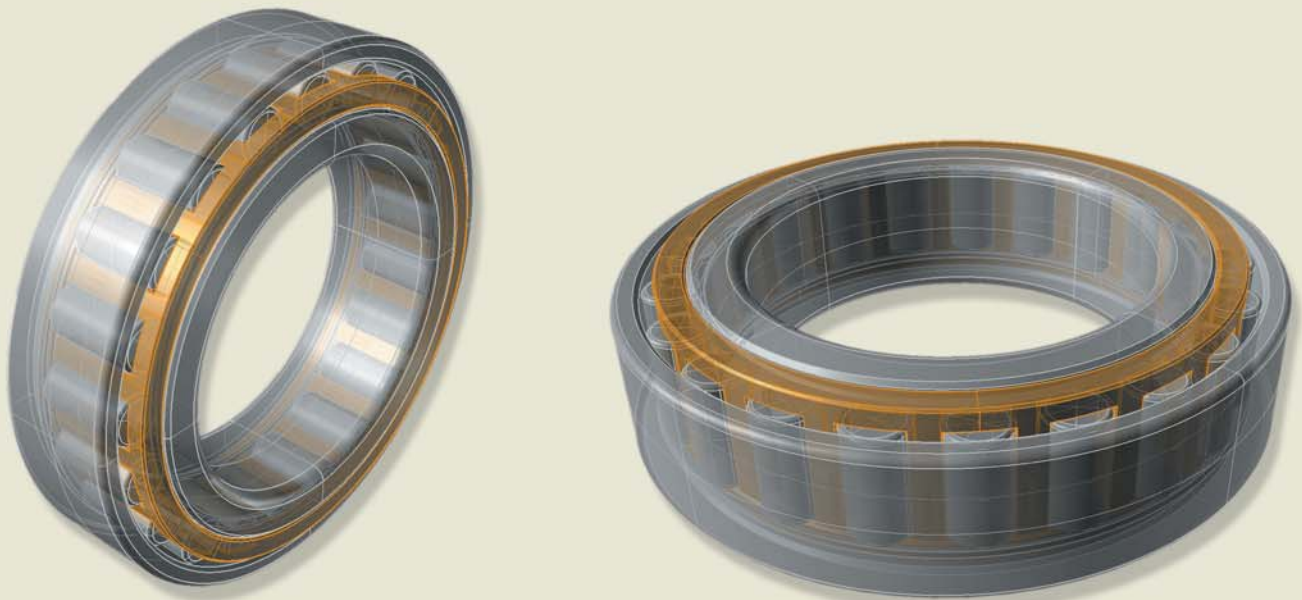
## **CYLINDRICAL ROLLER BEARING WITH BRONZE CAGE FOR STEEL MILL AXIS LINE 900-3515**



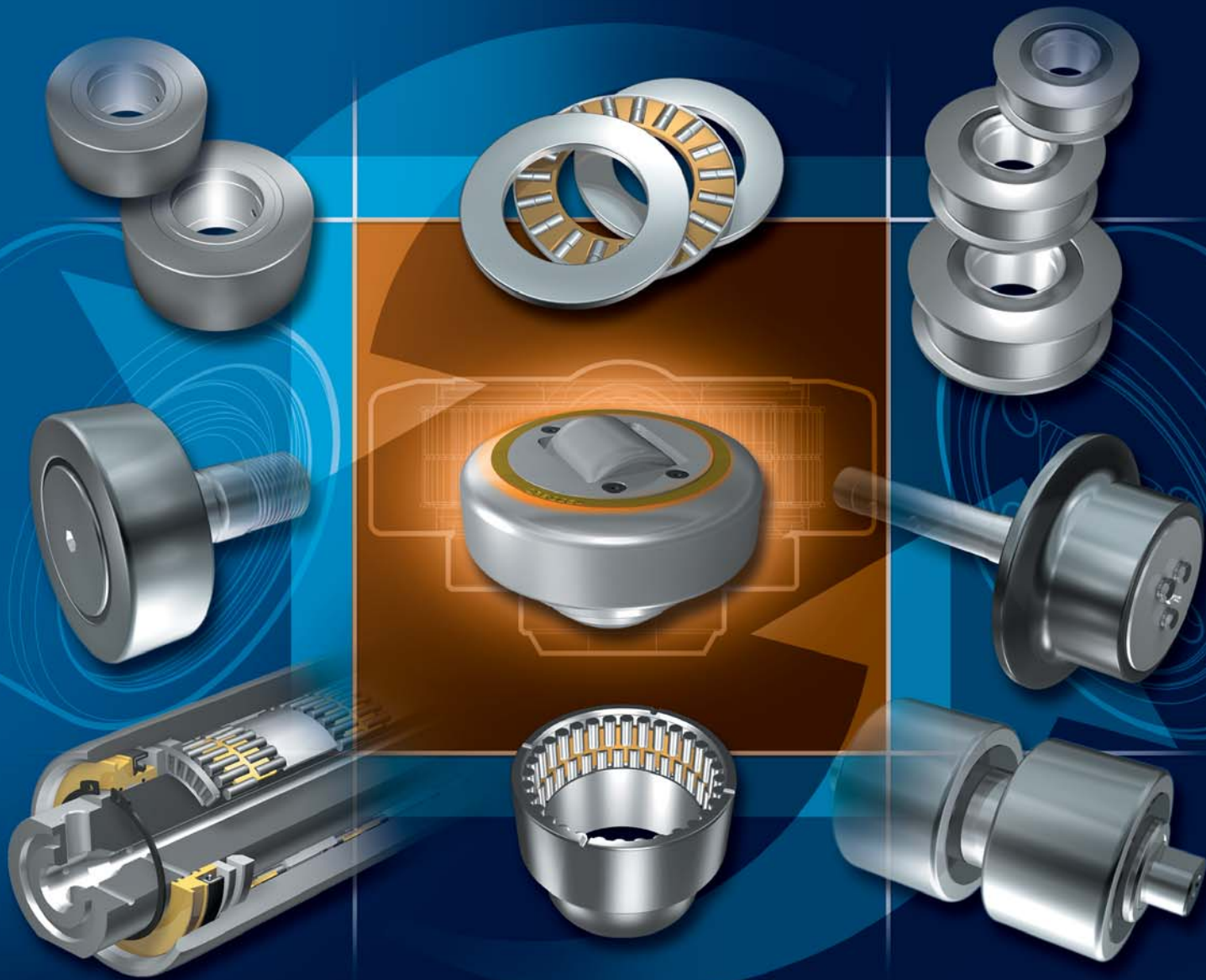
## **BACK-UP BEARING** FOR HOT FLATTENING MACHINE 900-2517



## **CYLINDRICAL ROLLER BEARING** WITH REDUCED THICKNESS FOR RAILWAY CART 900-2498







## **TECHNICAL CHARACTERISTICS**

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## LOAD CAPACITY OF CYLINDRICAL ROLLER BEARINGS

The dimensioning of cylindrical roller bearings is based on their load capacity and lifetime. About rotating bearings, the dynamic load coefficient must be taken into consideration; for roller bearings that have an occasional rotation, the static load coefficient must be considered. The load coefficients and the calculation procedures refer to DIN ISO 281/1 and ISO 76 regulations. Load capacities for cylindrical roller bearings are adequate to their practical use and performance.

## DYNAMIC LOAD CAPACITY OF CYLINDRICAL ROLLER BEARINGS

Dynamic coefficient “C” is necessary for the calculation of rotating bearings, that is to say bearings subject to dynamic strain. It indicates the maximum possible load that a bearing can bear (in Kg/N): in theory the lifetime is 1 million rotations.

## STATIC LOAD CAPACITY OF CYLINDRICAL ROLLER BEARINGS

Static coefficient  $C_0$  is used for the calculation of non-revolving bearings (that is to say fixed or subject to slow oscillations) or rotating at very low speed. The static load coefficient  $C_0$  is defined as the static load which causes a permanent deformation of the revolving bodies and of the raceways equal to 1/10.000 of the diameter of the revolving bodies, on the most stressed contact point.

## AXIAL LOAD CAPACITY OF RADIAL CYLINDRICAL ROLLER BEARINGS

C.R. cylindrical roller bearings can bear high axial thrusts and very high radial loads. The axial capacity of radial bearings depends on the dimensions of the edges, in relation to the front surfaces of the rolling bodies. The load capacity of the contact surfaces depends on the shearing speed and on the lubrication. With specific formulas it is possible to obtain axial load values that C.R. bearings can bear: continuous, temporary and alternate loads.

## LUBRICATION

Regular lubrication and maintenance are essential for a long lifetime of revolving bearings. The lubricant has the following functions:

- It provides a film, which is enough to separate the surfaces of contact.
- It allows the removal of heat (oil lubrication)
- It prevents the entry of liquid or solid agents inside the bearing (grease lubrication).
- It decreases the noise of the bearing
- It protects against corrosion.

Revolving bearings can be lubricated – according to a technical choice – with grease or oil, depending on:



- Form of construction and dimension of the bearing.
- Type of execution of the housings and of the parts in contact with the bearing.
- Working condition.

## **GREASE LUBRICATION**

The choice of the lubricant grease must be executed according to the specific instruction of lubricant suppliers. Revolving bearings are usually provided with lubricant greases that do not have high density at low temperature. Bearings working at high speed are provided with greases with low dynamic viscosity. In case the bearing is subject to high strain, C.R. recommends the use of EP greases and high viscosity of the oil.

Normally, the bearing should not reach higher temperature than 90° C. In this way, the characteristics of the grease will not be altered. The lifetime of the lubricant is influenced by environmental conditions. According to C.R. experience, the lifetime of the lubricant is guaranteed for three years, provided that the following conditions are fulfilled:

- Closed environment (warehouse)
- Temperature range 0°-40°C
- Air humidity below 70%
- Non-contamination by chemical agents.

After 3-year store time, the grease can lose some of its lubricant power. When re-lubrication is not possible, the lifetime of the grease becomes a main point. For security reason, it is necessary to take into consideration that generally the grease does not have a lifetime of more than three years.

In case the bearing is still functional, it must be cleaned and lubricated with the same quantity of grease used which was used at the beginning. When possible, re-lubrication must be done at working temperature and while the bearing is rotating.

The necessary quantity of grease can vary from 20% to 80% compared to the original one.

It is necessary to verify that the old grease can go out without any problem.

Lubrication range can be exactly calculated only with verifications made during real working conditions. It is possible to establish an indicative value of lubrication range following specific formulas.

## **OIL LUBRICATION**

Oil lubrication guarantees a good distribution of the lubricant and of the bearing surfaces. Oil lubrication is used when the mechanical elements adjacent to the bearing are already lubricated with oil, or in case it is necessary to remove heat from the support. Oils with mineral base or synthesis oils are suitable for oil lubrication.

Mineral oils with additive can be used for continuous working temperatures up to 120° C; synthesis oils up to 210° C.

For working security, C.R. recommends lubricant oils with EP additive. They must be used in the following cases:

- Radial cylindrical roller bearings subject to very high loads and axial thrusts.
- Axial cylindrical roller bearings: before using lubricant oils, it is necessary to verify their compatibility with plastic materials, non-ferrous metals or light alloys.

These are the most popular lubrication systems:

- Drop oil lubrication: it is used for high speed radial bearings provided with a lubrication hole on the outer ring.
- Oil bath lubrication, immersion lubrication or oil sump lubrication: it is used for radial bearings.
- Oil mist lubrication, and oil-air lubrication: they are particularly suitable for radial bearings working at very high speed with low load.
- Oil recirculation lubrication: it is possible to filter the lubricant and cool it continuously. It is particularly suitable to remove heat from bearings working at high temperature.

During the run-in of the device, a high contamination of the lubricant can be noticed: in this case, the oil must be changed when the test is over.

According to C.R. experience, it is enough to change the oil once a year, if the bearing temperature is kept below 60° C with a minimum amount of impurities.

In case of unfavourable working condition, C.R. recommends to control the lubricant on regular basis, according to the manufacturer's instructions.

## **ASSEMBLING, DISASSEMBLING AND WASHING**

C.R. cylindrical roller bearings are precision products.

This is the reason why they need to be treated with very high care, before and during the assembling. Correct functioning mainly depends on good maintenance.

### **ASSEMBLING**

The environment where the bearings are assembled must be clean and without dust. Before the assembling, it is useful to have a suitable equipment and a press. If a press is not available, the assembling can be done by strokes on the bushing's edges. Warning!

During the assembling, no thrusts nor strokes must be transferred on the revolving bodies! Deforming actions on the bearing rings must be avoided.

The assembling of the outer and inner rings can be facilitated by grooves or radii manufactured for this reason, and by a light lubricating treatment of the different surfaces. The assembling of the inner rings on the shaft, with interference, is made through their heating with a suitable induction device.

If this device is not available, the heating of the rings can be done in an oil bath or in an oven at a temperature of about 110° C. C.R. recommends the cooling of the housing, before assembling the bearing in it.

It is necessary to make a working test of the bearing, once the assembling is finished.

## DISASSEMBLING

During design phase, bordering holes or suitable cavities for the extractor should be foreseen in order to allow the bearing to be disassembled. If the bearing is re-used, be careful and avoid strokes and thrusts. After disassembling, the bearing must be cleaned in all its parts.

## WASHING

The following cleansers can be used to degrease and wash the bearings:

- Water-based cleansers
- Organic cleansers

Water-based cleansers can be neutral, acid or alkaline.

Organic cleansers are: petroleum, provided that it is without water or acids, - and gasoline (not the one used for vehicles). After the procedure of washing, the bearings must be immediately dried and treated with a suitable lubricant.

## LIFETIME CALCULATION

The lifetime of the bearing depends on the applied load and number of rotations, and it is calculated in the following way:

$$L = (C/P)^p \qquad L_h = (16666/n) \cdot (C/P)^p$$

**L = 10<sup>6</sup>** The lifetime of the bearings depends on the load. Rated duration in million of rotations, which is achieved or overcome by 90% of a representative number of equal bearings, before the material shows signs of wear.

**L<sub>h</sub> = h** Rated duration in hours of working corresponding to L.

**C = N** Dynamic load coefficient. With reference to radial bearings, C corresponds to a load with constant entity and direction. The test on a representative number of bearings proved that the rated duration is one million rotations. With reference to axial bearings, C corresponds to the axial load which operates in central position.

**P = N** Equivalent load on the bearings for radial or axial bearings.

**p** Lifetime exponent  
p= 10/3 for needle roller and cylindrical roller bearings

**n = min<sup>-1</sup>** Number of rotations

## BASIC LUBRICATION RANGE

Basic lubrication range “ $t_f$ ” depends on the GWK speed coefficient and is shown in diagram 02 according to the following formula, considering  $K_L$  bearing type, the number of rotation  $n$  and the medium diameter  $d_M$  of the bearing.

$$GKW = \frac{K_L \cdot 270.000}{(n \cdot d_M)}$$

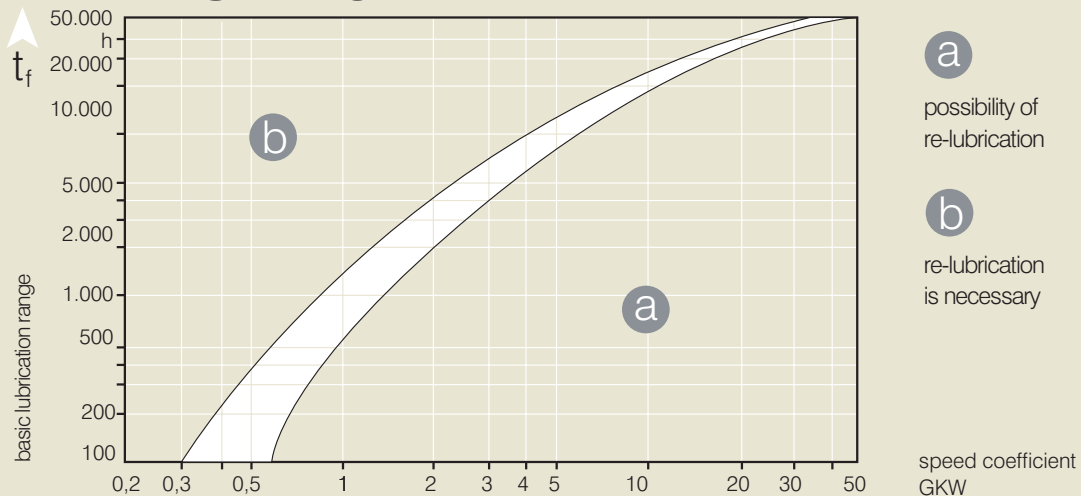
GKW = Speed coefficient  
 $K_L$  = Tab 01  
 $n$  = Number of rotation  
 $d_M$  = Medium diameter

TAB 01 BEARING TYPE	$K_L$
Support rolls and cam followers, with full-complement cage	0,3
Support rolls and cam followers, with full-complement rollers	0,15
Cylindrical roller bearings	0,8
Axial cylindrical roller bearings	0,08

### DETAILS FOR LUBRICATION RANGE

PREMISES	CONDITIONS
Bearing temperature	Up to 70°C
Load ratio	$C_0/p=20$
Number of rotations and load	steady
Load in the main direction	radial on radial bearing – axial on axial bearing
Lubrication grease	grease with lithium soap
Rotation axis	horizontal for radial bearings
Inner ring	revolving
Influence of the external	no influence

DIAGRAM 02



## STATIC SECURITY COEFFICIENT

Static security coefficient defines the security grade against bearing deformations and is calculated with the following formula:

$$S_0 = C_0 / F_0$$

$S_0$  = static security coefficient  
 $C_0$  = static load coefficient (N)  
 $F_0$  = maximum load of the bearing (N)

With a static security coefficient  $S_0 < 8$ , the bearings are very pressed and with coefficient  $S_0 \geq 8$ , the bearings are medium or lightly pressed.

## APPROXIMATE VALUES OF STATIC SECURITY COEFFICIENT

APPLICATION CASE	$S_0$
Silent working with few vibrations and normal working with minimum need for quietness: bearing with minimum rotation.	3/1
Normal working with more need for quietness.	3/2
Working with high impact loads.	3/3
Supports with high demand for precision of rotation and quietness.	3/4

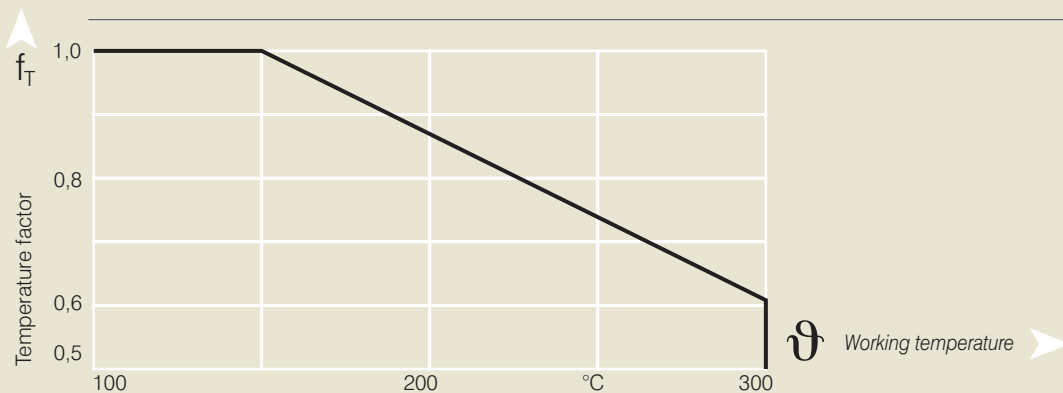
## INFLUENCE OF TEMPERATURE ON THE BEARING

Temperature influences the bearing by decreasing the dynamic load capacity "C"; such output is calculated according to this correction formula:

$$C_T = f_T \cdot C$$

$C_T$  = effective dynamic load coefficient for high temperatures  
 $f_T$  = temperature factor according to graph 03  
 $C$  = dynamic load coefficient

The reduction of hardness due to the increase of temperature does not affect the static load capacity " $C_0$ ", therefore it can be overlooked for temperatures up to +300° C.



## BEARING CLEARANCE AND WORKING CLEARANCE

The good functioning of revolving bearings depends on a correct working. This depends on radial clearance and on the change of radial clearance as a consequence of the assembling interference and of working temperature.

### WORKING CLEARANCE

The radial moving of the shaft with regard to the outer ring of the bearing determines the working clearance.

The working clearance depends on the reduction of the radial clearance, as a consequence of the assembling interference and the temperature.

The reduction of the radial clearance of the assembled bearing – due to the couplings – is the result of the inner ring expansion and the contraction of the outer ring.

The difference of temperature between inner ring and outer ring can cause a reduction or an increase of working clearance

### RADIAL CLEARANCE OF THE BEARING

The radial clearance of the disassembled revolving bearing is expressed through the value of the radial shifting from edge to edge of the inner ring towards the outer ring.

The bearing radial clearance is divided into four groups (see table 04).

C.R. bearings manufactured with normal CN clearance guarantee a correct working clearance in normal working conditions, considering the suitable tolerances for shaft and housing. C3 and C4 radial clearances are taken into consideration for bearings having big dimensions, subject to high loads; in case of assembling interference and big difference of temperature between the inner ring and outer ring.

Bearings with C2 radial clearance are to be employed only in special cases (for example, in case of high combined alternate loads with swinging movements or a limited number of rotations).

In these particular cases it is highly recommended to check the bearings during the functioning, since they are subject to heating.

The values of C2, CN, C3 and C4 radial clearances are listed in table 05.

The customer must specify the bearing clearance, except for CN clearance.

TAB 04	FIELD	MEANING
	C2	Bearing radial clearance lower than CN
	CN	Normal bearing radial clearance
	C3	Bearing radial clearance higher than CN
	C4	Bearing radial clearance higher than C3



TAB 05	Rated Ø of the holes in mm.		bearing radial clearance in µm.							
	d		C2		CN		C3		C4	
	More than	up to	min.	max.	min.	max.	min.	max.	min.	max.
-	24	0	25	20	45	35	60	50	75	
24	30	0	25	20	45	35	60	50	75	
30	40	5	30	25	50	45	70	60	85	
40	50	5	35	30	60	50	80	70	100	
50	65	10	40	40	70	60	90	80	110	
65	80	10	45	40	75	65	100	90	125	
80	100	15	50	50	85	75	110	105	140	
100	120	15	55	50	90	85	125	125	165	
120	140	15	60	60	105	100	145	145	190	
140	160	20	70	70	120	115	165	165	215	
160	180	25	75	75	125	120	170	170	220	
180	200	35	90	90	145	140	195	195	250	
200	225	45	105	105	165	160	220	220	280	
225	250	45	110	110	175	170	235	235	300	
250	280	55	125	125	195	190	260	260	330	
280	315	55	130	130	205	200	275	275	350	
315	355	65	145	145	225	225	305	305	385	
355	400	100	190	190	280	280	370	370	460	
400	450	110	210	210	310	310	410	410	510	
450	500	110	220	220	330	330	440	440	550	

## RADIAL BEARING TOLERANCES

The tolerances of cylindrical roller bearings are according to DIN 620 part 2 and 3. Generally C.R. bearings correspond to PN class; in case of need of higher precision bearings, the tolerances can be reduced to the values of classes P6 and P5.

### Dimensional and tolerance symbols

Symbol	d	C4
<b>d</b>	rated hole diameter	
<b>D<sub>dmp</sub></b>	tolerance of the medium diameter of the hole in a plan	
<b>V<sub>dp</sub></b>	variation of hole diameter in a single radial plan	○ circularity
<b>V<sub>dmp</sub></b>	variation of the medium diameter of the hole	// parallelism
<b>D</b>	rated outer diameter	
<b>D<sub>Dmp</sub></b>	tolerance of medium outer diameter in a single radial plan	
<b>V<sub>Dp</sub></b>	variation of medium outer diameter in a single radial plan	○ circularity
<b>V<sub>Dmp</sub></b>	variation of medium outer diameter	// parallelism
<b>D<sub>Bs</sub></b>	tolerance of one single size of inner ring width	
<b>V<sub>Bs</sub></b>	variation of inner ring width	// parallelism
<b>D<sub>Cs</sub></b>	tolerance of one single width of outer ring	
<b>V<sub>Cs</sub></b>	variation of outer ring width	// parallelism
<b>K<sub>ia</sub></b>	radial defect of inner ring rotation, to be measured on the assembled bearing	◎ concentricity
<b>K<sub>ea</sub></b>	radial defect of outer ring rotation, to be measured on the assembled bearing	◎ concentricity
<b>S<sub>d</sub></b>	defect of quadrature of the surfaces with regard to the hole	∟ flatness
<b>S<sub>D</sub></b>	variation of outer cylindrical surface inclination related to lateral surfaces	∟ flatness





## CLASS OF TOLERANCE PN (normal tolerance)

**TAB 06**

Tolerance values in  $\mu\text{m}$

d		Tolerance		Range of diameters			V <sub>dmp</sub>	K <sub>ia</sub>	Tolerance		V <sub>Bs</sub>
		$\Delta_{dmp}$		V <sub>dp</sub>					$\Delta_{Bs}$		
mm.				8,9	0	2,3					
more than	up to	more than	up to	max			max	max	sup.	inf.	max
0,6 <sup>(1)</sup>	2,5	0	-8	10	8	6	6	10	0	-40	12
2,5	10	0	-8	10	8	6	6	10	0	-120	15
10	18	0	-8	10	8	6	6	10	0	-120	20
18	30	0	-10	13	10	8	8	13	0	-120	20
30	50	0	-12	15	12	9	9	15	0	-120	20
50	80	0	-15	19	19	11	11	20	0	-150	25
80	120	0	-20	25	25	15	15	25	0	-200	25
120	180	0	-25	31	31	19	19	30	0	-250	30
180	250	0	-30	38	38	23	23	40	0	-300	30
250	315	0	-35	44	44	26	26	50	0	-350	35
315	400	0	-40	50	50	30	30	60	0	-400	40
400	500	0	-45	56	56	34	34	65	0	-450	50
500	630	0	-50	63	63	38	38	70	0	-500	60
630	800	0	-75	-	-	-	-	80	0	-750	70
800	1000	0	-100	-	-	-	-	90	0	-1000	80
1000	1250	0	-125	-	-	-	-	100	0	-1250	100
1250	1600	0	-160	-	-	-	-	120	0	-1600	120
1600	2000	0	-200	-	-	-	-	140	0	-2000	140

(1) This diameter is included

**TAB 06.1**

Tolerance values in  $\mu\text{m}$

D		Tolerance		Range of diameters			V <sub>Dmp</sub>	K <sub>ea</sub>	Tolerance	
		$\Delta_{Dmp}$		V <sub>Dp</sub> (2)					$\Delta_{Cs}$	V <sub>Cs</sub>
mm.				8,9	0	2,3				
more than	up to	more than	up to	max			max	max	Identical to $\Delta_{Bs}$ and V <sub>Bs</sub> for inner ring of same bearing (see tab. 06)	
2,5 <sup>(1)</sup>	6	0	-8	10	8	6	6	15		
6	18	0	-8	10	8	6	6	15		
18	30	0	-9	12	9	7	7	15		
30	50	0	-11	14	11	8	8	20		
50	80	0	-13	16	13	10	10	25		
80	120	0	-15	19	19	11	11	35		
120	150	0	-18	23	23	14	14	40		
150	180	0	-25	31	31	19	19	45		
180	250	0	-30	38	38	23	23	50		
250	315	0	-35	44	44	26	26	60		
315	400	0	-40	50	50	30	30	70		
400	500	0	-45	56	56	34	34	80		
500	630	0	-50	63	63	38	38	100		
630	800	0	-75	94	94	55	55	120		
800	1000	0	-100	125	125	75	75	140		
1000	1250	0	-125	-	-	-	-	160		
1250	1600	0	-160	-	-	-	-	190		
1600	2000	0	-200	-	-	-	-	220		
2000	2500	0	-250	-	-	-	-	250		

(1) This diameter is included

(2) Valid before the assembling of the bearing and/or after disassembling the outer and inner spring rings.



## CLASS OF TOLERANCE P6

**TAB 07**

Tolerance values in  $\mu\text{m}$

d		Tolerance		Range of diameters			V <sub>dmp</sub>	K <sub>ia</sub>	Tolerance		V <sub>Bs</sub>
		$\Delta_{\text{dmp}}$		V <sub>dp</sub>					$\Delta_{\text{Bs}}$		
mm.				8,9	0	2,3					
more than	up to	more than	up to	max			max	max	sup.	inf.	max
0,6 <sup>(1)</sup>	2,5	0	-7	9	7	5	5	5	0	-40	12
2,5	10	0	-7	9	7	5	5	6	0	-120	15
10	18	0	-7	9	7	5	5	7	0	-120	20
18	30	0	-8	10	8	6	6	8	0	-120	20
30	50	0	-10	13	10	8	8	10	0	-120	20
50	80	0	-12	15	15	9	9	10	0	-150	25
80	120	0	-15	19	19	11	11	13	0	-200	25
120	180	0	-18	23	23	14	14	18	0	-250	30
180	250	0	-22	28	28	17	17	20	0	-300	30
250	315	0	-25	31	31	19	19	25	0	-350	35
315	400	0	-30	38	38	23	23	30	0	-400	40
400	500	0	-35	44	44	26	26	35	0	-450	45
500	630	0	-40	50	50	30	30	40	0	-500	50

(1) This diameter is included

**TAB 07.1**

Tolerance values in  $\mu\text{m}$

D		Tolerance		Range of diameters			V <sub>Dmp</sub>	K <sub>ea</sub>	Tolerance	
		$\Delta_{\text{Dmp}}$		V <sub>Dp</sub> (2)					$\Delta_{\text{Cs}}$	V <sub>Cs</sub>
mm.				8,9	0	2,3				
more than	up to	more than	up to	max			max	max	Identical to $\Delta_{\text{Bs}}$ and V <sub>Bs</sub> for inner ring of same bearing (see tab. 07)	
2,5 (1)	6	0	-7	9	7	5	5	8		
6	18	0	-7	9	7	5	5	8		
18	30	0	-8	10	8	6	6	9		
30	50	0	-9	11	9	7	7	10		
50	80	0	-11	14	11	8	8	13		
80	120	0	-13	16	16	10	10	18		
120	150	0	-15	19	19	11	11	20		
150	180	0	-18	23	23	14	14	23		
180	250	0	-20	25	25	15	15	25		
250	315	0	-25	31	31	19	19	30		
315	400	0	-28	35	35	21	21	35		
400	500	0	-33	41	41	25	25	40		
500	630	0	-38	48	48	29	29	50		
630	800	0	-45	56	56	34	34	60		
800	1000	0	-60	75	75	45	45	75		

(1) This diameter is included

(2) Valid before the assembling of the bearing and/or after disassembling the outer and inner spring rings.



## CLASS OF TOLERANCE P5

**TAB 08**

Tolerance values in  $\mu\text{m}$

d		Tolerance		Range of diameters			Kia	Tolerance		VBs
		$\Delta_{\text{dmp}}$		V <sub>dp</sub>		V <sub>dmp</sub>		$\Delta_{\text{Bs}}$		
mm.				8,9	0,2,3					
more than	up to	more than	up to	max		max	max	sup.	inf.	max
0,6 <sup>(1)</sup>	2,5	0	-5	5	4	3	4	0	-40	5
2,5	10	0	-5	5	4	3	4	0	-40	5
10	18	0	-5	5	4	3	4	0	-80	5
18	30	0	-6	6	5	3	4	0	-120	5
30	50	0	-8	8	6	4	5	0	-120	5
50	80	0	-9	9	7	5	5	0	-150	6
80	120	0	-10	10	8	5	6	0	-200	7
120	180	0	-13	13	10	7	8	0	-250	8
180	250	0	-15	15	12	8	10	0	-300	10
250	315	0	-18	18	14	9	13	0	-350	13
315	400	0	-23	23	18	12	15	0	-400	15

(1) This diameter is included

**TAB 08.1**

Tolerance values in  $\mu\text{m}$

D		Tolerance		Range of diameters			Kea	Tolerance		VCs
		$\Delta_{\text{Dmp}}$		V <sub>Dp</sub> (2)		V <sub>Dmp</sub>		$\Delta_{\text{Cs}}$		
mm.				8,9	0,2,3					
more than	up to	more than	up to	max		max	max	Identical to		max
2,5 <sup>(1)</sup>	6	0	-5	5	4	3	5	Identical to $\Delta_{\text{Bs}}$ and $\text{VBs}$ for inner ring of same bearing (see tab. 08)		5
6	18	0	-5	5	4	3	5			5
18	30	0	-6	6	5	3	6			5
30	50	0	-7	7	5	4	7			5
50	80	0	-9	9	7	5	8			6
80	120	0	-10	10	8	5	10			8
120	150	0	-11	11	8	6	11			8
150	180	0	-13	13	10	7	13			8
180	250	0	-15	15	11	8	15			10
250	315	0	-18	18	14	9	18			11
315	400	0	-20	20	15	10	20	13		
400	500	0	-23	23	17	12	23	15		
500	630	0	-28	28	21	14	25	18		
630	800	0	-35	35	26	18	30	20		

(1) This diameter is included

(2) Valid before the assembling of the bearing and/or after disassembling the outer and inner spring rings.



## PROBLEMS DURING WORKING

### Causes of damages

#### Introduction

The surrounding environment is a permanent source of troubling events, the majority of which cannot be easily predicted. In the case of bearings, the possible causes of damages and wrong-functioning are several.

#### Causes

It is possible to detect the following causes of wrong-functioning:

working loads;  
speed of rotation;  
surrounding environment.

#### Working loads

The project phase foresees ideal load conditions; entity, direction and distribution of the load are supposed to be already known. Nevertheless, the real working conditions can lead to destabilizing factors which are completely different compared to those foreseen during the project phase.

But when the component is considered to be an integrating part of a machine or a plant, the bearing must bear: load not correctly distributed, shocks, vibrations... It is not easy to find the causes of wrong-functioning, because of the complexity of production systems which the bearings are a part of. Nevertheless the visual analysis of wear marks can help detecting the causes.

The two following pictures show an example of simple radial load which, because of a non-correct alignment, is applied only to a reduced contact surface as regard to the one foreseen. As a result, the part of the surface which does not bear load is polished, whereas on one edge wear mark due to overload can be clearly seen.



Outer ring with evident marks of wrong functioning, due to a non correct alignment; the part of the outer ring which is not damaged is still polished.



Pivot with marks of damages due to a non correct alignment; the part of the pivot which is not damaged is still polished.

Such a non correct alignment implies the onset of an unforeseen axial component, which cannot be easily quantified; the bearing cannot bear such component. This axial force implies the shearing of the rollers on the guiding shoulder and therefore the blocking of the bearing (see next picture).

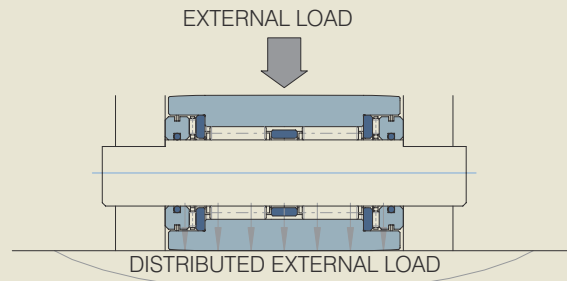


Bearing damaged on the guide brims and on the raceways of the outer ring, due to the axial thrusts.

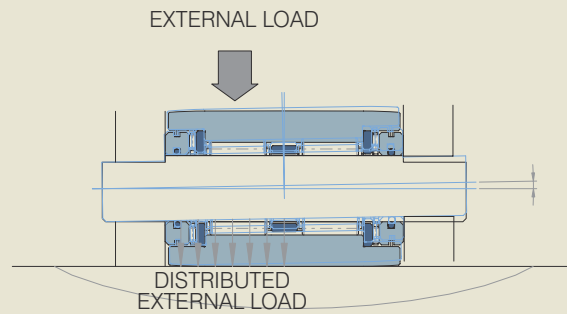
The association of these two factors (axial thrust and shearing) generates a high wear in a short time, along with the separation of material and related contamination and degradation of the lubricant; the wear itself is linked to a considerable raise in temperature, until the tempering of the steel (hardness < 40 HRC).

In order to make things clearer, a table is here below enclosed with a numerical example, in order to better understand the importance of the alignment.

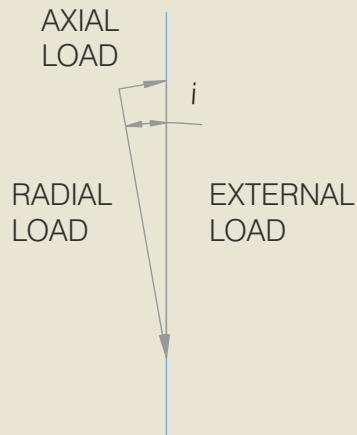
Configuration of load with perfect alignment: the load is distributed in adjusted way on all the contact surface; the bearing works in a correct way along the whole surface.



Configuration of load with incorrect alignment: the load is not distributed in adjusted way along the whole contact surface; the bearing works in an anomalous way along a part of the surface, which ends up to be overloaded in relation to the correct working.



Vector scheme of configuration of load with incorrect alignment. It engenders an unforeseen axial component due to  $i$  corner.



Numerical example:

It is clear to see that, from light incorrect alignments, strong axial thrusts can derive, which increase in intensity along with the increase of the  $i$  corner of incorrect alignment.

- $i$  corner of incorrect alignment =  $1^\circ$**
- Project external load = 300kN**
- Effective axial load =  $300 \cdot \text{sen}(1^\circ) \cong 5\text{kN}$**
- Effective radial load =  $300 \cdot \text{cos}(1^\circ) \cong 299.9\text{kN}$**

Other causes of probable wrong functioning and reduction of the lifetime of the bearing are the shocks and/or vibrations.

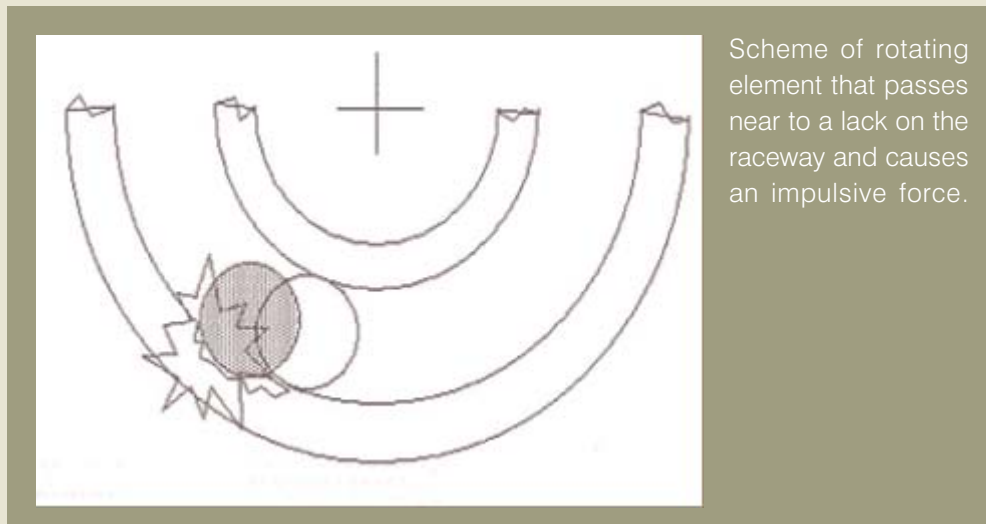
There are shocks any time the changes of the load are applied impulsively, by generating high stresses in certain points; these stresses may cause marks and fillings on the sensitive parts of the bearing.

The above mentioned damages can arouse the formation of cracks and fissures that may bring to structural collapse.

The most worrying phenomenon is that of vibrations, as they represent a kind of stress which cannot be easily found, and which are often due to preceding damages caused by shocks.

In a specific case, the raise of vibration happens each time that a rotating element crosses a surface damage, or when the damage itself is on the rotating part. The reiterated shocks arouse series of impulsive forces, which are the source of vibrations, and therefore of noise.

The specific frequency of such vibrations is proportional to the speed of rotation of the bearing, to the geometry of the bearing, to the quantity of rotating elements and to the localization of the damage.



Scheme of rotating element that passes near to a lack on the raceway and causes an impulsive force.

What has just been said can be easily verified by appraising the factors that influence the appearance of vibrations in two different working condition, you can find here below:

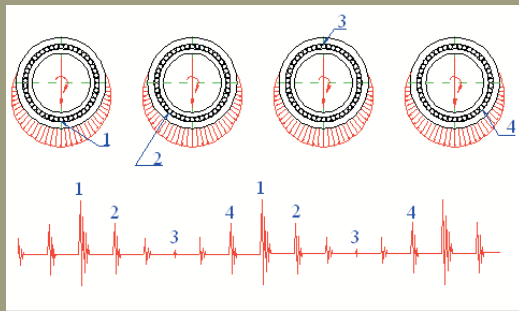
**1st CONDITION OF WORKING**

This situation shows the following characteristics

- Constant load;
- Inner ring/ fixed pivot;
- Rotating outer ring;
- Lack found on the raceway of the outer ring or on the surface of the rotating part.

In the first condition of working, the load applied at the moment of the passage on the lack depends on the radial position of the lack itself, and therefore the intensity of the impulse is modulated.





# 1

1<sup>st</sup> condition of working: in this case we can find 4 situations:

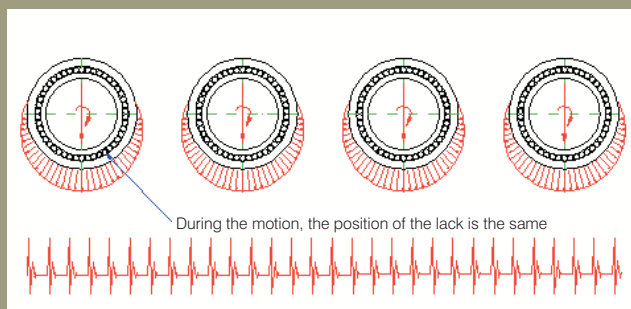
1. the lack is on the part of the outer ring that is mainly loaded; therefore an impulse of maximum breadth is generated;
2. the lack is on the part of the outer ring with medium load. therefore an impulse of medium breadth is generated;
3. the lack is on the part which is not loaded; the breadth of the impulse is negligible
4. the lack is once again on the part of the outer ring with medium load; the cycle of impulses starts to repeat itself.

## 2<sup>nd</sup> CONDITION OF WORKING

This situation shows the following characteristics:

- constant load;
- inner ring/fixed pivot;
- rotating outer ring;
- lack found on the raceway of rotation of the inner ring/pivot.

In the second working condition, the load applied on the lack is constant, and only determines the intensity of the impulse; no modulation is generated, which is the opposite of what happened in the first situation.



# 2

2<sup>nd</sup> condition of working:

in this case we point out that the breadth of the impulse is constant as the lack is still.

Independently from the condition of working, the vibrations are an important matter, as they work by overloading the bearing with toil stresses; moreover they cannot be easily determined, as they are influenced by several factors.

### **Rotation speed**

An essential factor of the planning of the bearing is the speed of rotation, which is determined on the basis of dimensions and of the execution, compatibly with the specific necessity of the customer.

This matter is extremely important, as the degradation of the lubricant and the lifetime of the bearing itself are directly linked to it.

In addition to these matters, the speed of rotation acts in indirect way on the bearing, as it strengthens the effects of vibrations and likely damages on the rotating elements and /or rotating raceways.

### **External environment**

The environment in which the bearing works must be taken into consideration, as in it you can find:

- vibrations deriving from moving parts of the machine, which influence the bearing in indirect way; in this case, the worst situation can be noticed when the bearing submitted to those vibrations is unloaded and still.
- corrosive and/or contaminated environment; factor to be kept in mind since the phase of planning of the bearing, as there can be intrusions of fine dust in the bearing (if so, provide for more efficient than usual systems of seal), or there can be particularly corrosive atmospheres (if so, provide for suitable protective agents to safeguard the integrity of the bearing);
- high temperatures; in this case, the bearing must be planned according to the likely thermal expansions of its components, by foreseeing suitable clearances and tolerances; the heating treatment should be provided according to the range of temperature under which the bearing will work. Therefore a suitable stabilizing of the components should be provided, in order to prevent the tempering of the materials.

## **Events of damages**

### **Introduction**

Bearings represent one of the “critical” components in a plant where they work, as they have to fulfil the requirements of load projected by the designer of the plant and at the same time, they have to guarantee high levels of reliability and safety during working. Unluckily, there are different causes that make the bearing no more suitable to its task, by reducing the theoretical lifetime estimated during the project and concept development. Each of these factors causes a typical structural damage, by leaving a particular mark.

Once considered this mark by testing a damaged bearing, the source of the inconvenient can be found, in order to take the necessary measures to avoid the reiteration of this problem.

### **Types of damages**

The main cause of failure generates a typical damage which is called primary damage, which gives vent to another damage, called secondary damage, made of crumbling and cracks.

Usually, the damage of a bearing is due to a combination of both primary and secondary damage.

The classification of the types of damage is the following:

#### **PRIMARY DAMAGES**

- wear;
- marks;
- fillings;
- transfer of current;

#### **SECONDARY DAMAGES**

- crumbling;
- cracks.

## **PRIMARY DAMAGES: WEAR**

### **General remarks**

We can define as wear the surface loss of material that happens progressively on the surface of contact parts subject to relative motion.

Wear shows itself along with friction, but cannot be related to it in a simple and unambiguous way: there are couples of surfaces that show a low coefficient of friction and a high rate of wear and vice versa.

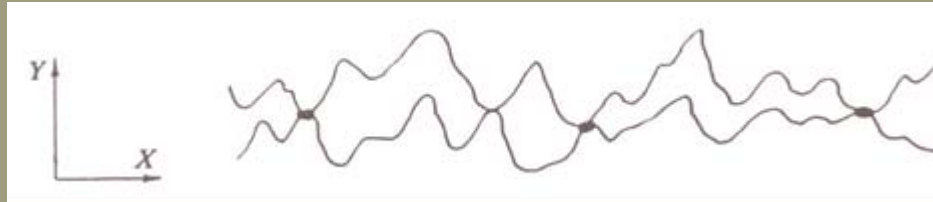
Wear can be classified according to four main types:

- adhesive wear;
- abrasive wear;
- corrosive wear;
- surface fatigue.

## **Adhesive wear**

Adhesive wear happens when, in correspondence to the asperities of the surface of two parts pushed one against the other, there are some micro-joints or micro-welding, that break during the relative motion of the two parts.

One typical cause of wear is the lack of lubricant. Wear occurs also when the lubricant has lost its lubricating characteristic and therefore there is no suitable lubricating film which has enough load capacity; therefore there are direct contacts steel-against-steel between the rotating parts and the rolling raceways.



Adhesive wear: the contact starts among the blackest surface crests ( in the picture, scale Y has been increased in comparison to scale X).

The crest of the microscopic asperities left by the mechanical process tear, whereas at the same time there is a certain rolling action on them; as a result, the surface is more or less polished.

When the bearing does not rotate, there is no lubrication film between the rotating elements and the raceways; so there is a contact between the metals.

As a result of the small relative movements generated by the vibrations, some small particles are removed from the surfaces; these particles form little tilts, and jags.

Obviously, the spheres produce spherical tilts, whereas the rollers produce longer tilts. In many cases we can find a rusty colour on the bottom of the tilts, which is due to the oxidation of the detached particles, which have a bigger surface in comparison to their volume. On the rotating parts there is no visible damage.



Outer ring of an adjustable roller bearing not adequately lubricated; the raceways are polished.



Cylindrical roller with polished surface, due to the scarcity of lubricant.

The bigger is the vibration, the bigger is the damage, whose evolution is also influenced by time and by the dimension of internal clearance of the bearing; it seems that the frequency of the vibrations does not produce any relevant effect. It has been proved that cylindrical roller bearings are more sensitive to this kind of damage than ball bearings;

the balls can rotate in all directions, whereas the rollers can rotate in one direction only around their axis; the other movements happen by shearing. The bearings who are the most subject to this event are the cylindrical roller bearings.

We usually find damages due to vibrations on the bearings of machines that lay still and are put near elements that produce vibrations.

When we can foresee the possibility of a constant presence of vibration, it is useful to find a solution at the moment of the project. Therefore ball bearing should be preferred in comparison to roller bearings. We can also increase the capability of the ball bearings to bear the vibrations without damages, by pre-loading them with springs. Also the lubrication in a bath of oil has proved to be a good solution, as the loaded parts of the rotating elements are always immersed. We can also provide for a base that can dampen the vibrations.

The bearings of the machines that have to be transported can be protected by keeping the shafts blocked, in order to prevent small movements, which are very harmful.



Outer ring of a tapered roller bearing damaged by the vibrations during functioning.



Inner ring of a cylindrical roller bearing damaged by vibrations. The damages occurred when the bearing was not rotating. It is clear, by seeing the littlest tracks between the more marked tilts (with corrosion on the bottom), that the ring has changed its position for small periods



Outer and inner ring of a cylindrical roller bearing subject to vibrations. The inner ring has changed its position.

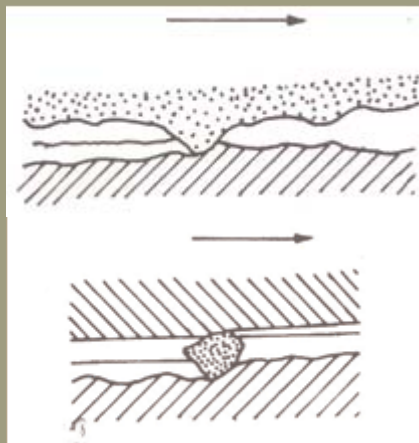
**ADHESIVE WEAR**

CHARACTERISTIC MARKS	CAUSES	POSSIBLE REMEDIES
<i>Small marks along the raceway and on the rotating parts. Opaque and worn surfaces.</i>	<i>Insufficient cleaning before and during the assembling process.</i>	<i>Remove the bearing from its packing only at the moment of its assembling/fixing. Keep the factory, the working table clean and use clean tools.</i>
<i>Worn surfaces, often polished; as time goes by, the colour turns from blue to brown.</i>	<i>The lubricant is now consumed or has lost its lubricant property.</i>	<i>Be sure that the lubricant is suitable to working conditions. Be sure that the lubricant reaches the bearing; re-lubricate with greater frequency.</i>
<i>Little tilts in the raceways, with a rectangular shape in cylindrical roller bearings and round shape in ball bearings. The bottom of such tilts can be shiny or opaque and oxidized.</i>	<i>The bearing has been subject to vibrations when motionless.</i>	<i>Pre-load the bearing during transportation. Provide for a base suitable to absorb vibrations. When possible, use ball bearings instead of roller bearings.  If possible, lubricate in a bath of oil.</i>

**Abrasive wear**

This mechanism of wear is due to the action of grooving applied on a softer material, or by the ledges of the surface roughness of the hardest coupled element (this action is smaller just as much as the surface roughness of the hardest material is smaller), or by hard particles which are between the touching elements.

These particles can come from the surrounding environment or can be generated by other wear mechanisms (adhesive wear).



Abrasive wear: two different mechanisms of abrasive wear.



Outer ring of an revolving roller bearing with raceways worn by abrasive particles.

It is easy to see the border between worn part and entire part.



The little abrasive particles, such as sand and scraps, which somehow entered the bearing, produce wear of the raceways, the rotating parts and the cages. In this case, the surfaces become more or less opaque, according to the dimension and the nature of the particles. Sometimes some little fragments detach from the brass cage, they become in a copper-green colour and make the grease become greenish.

The quantity of abrasive particles increases gradually, as the material of the rolling surfaces and of the cage becomes weary. Wear is therefore a quick process, so much that in the end the surfaces become so weary that the bearing cannot be used anymore. Nevertheless it is not always necessary to discard a bearing that is only slightly damaged, as we can use it again once carefully cleaned.

In the bearing the abrasive particles can penetrate because of the inefficiency of the seals, but they can also be introduced by a contaminated lubricant or during the assembling process.

<b>ABRASIVE WEAR</b>		
<b>CHARACTERISTIC MARKS</b>	<b>CAUSES</b>	<b>POSSIBLE REMEDIES</b>
<i>Small marks along the raceway and on the rotating parts. Opaque and worn surfaces.</i>	<i>Insufficient cleaning before and during the assembling process.</i>	<i>Remove the bearing from its packing only at the moment of its assembling/fixing.. Keep the factory, the working table clean and use clean tools.</i>
	<i>Inefficient seals</i>	<i>Check and develop the system of seals, if necessary. Always use fresh and clean lubricant. Clean the greasers.</i>
<i>Greenish grease</i>	<i>Lubricant contaminated by particles that have moved from a brass cage.</i>	<i>Filter the grease Check the functioning of the lubrication plant: efficiency of the seals and of the filtering power of the filters.</i>

## **Corrosive wear**

On the metal surfaces there are some layers of compounds, due to the chemical action of the substances in the environment. These surface films have a protective action on the metal underneath and if they are removed by the creeping, they are rapidly re-generated.

In a corrosive environment, the mechanical action and the chemical can strengthen their effects respectively: the superficial layers, chemically protective but easily removable, are continually removed and re-generated. Wearing process can become very quick.

The lubricants are usually a good protection against corrosive wear.

There is rust in the bearings when water or corrosive substances penetrate in it, in such a quantity that the lubricant cannot protect the surfaces any more and the is replaced by water. This process leads quickly to “deep rust”.



If there is a thin protective layer of oxide, which is impenetrable though, on the clean surfaces of the steel exhibited to the air, and, if water or corrosive substances touch those surfaces, there are some stains of a chemical attack, from which deep rust develops itself. Deep rust is very dangerous for bearings, as it can generate cleavages and cracks.



Deep rust on the outer ring of a cylindrical roller bearing.



Widespread chemical attack due to water on the inner ring of an adjustable roller bearing.

Acid liquids quickly corrode steel, whereas alkaline solutions are less harmful. The salts which are in water generate an electrolyte with it, which arouses a galvanic corrosion ("water etching")

Sea water is therefore very harmful for bearings, as the aggressiveness of the chlorides in variable percentages in sea water is very well known.

Another kind of corrosion is the contact rust. If the thin oxide film is crossed and the oxidation proceeds deeper in the material, we can say we have contact rust.



Contact rust ("fretting corrosion") on the outer ring of an adjustable bearing.



Widespread development of contact rust in the hole of an adjustable ball bearing.

A typical example of such an event is the corrosion that happens when there is a reciprocal movement between the ring of the bearing and its seat, when the coupling is too free.

This kind of damage can be called contact rust, or coupling rust or “fretting corrosion” and can be somehow quite deep. The reciprocal movement can also generate the detachment of small particles of material, which oxidise quickly once exposed to the oxygen of the atmosphere.

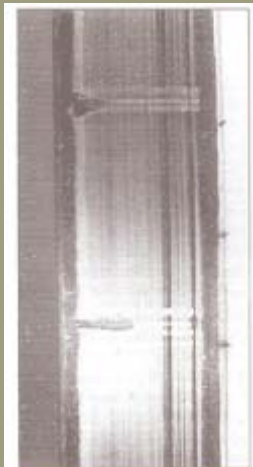
Because of the contact rust, the rings of the bearings can rest in an unjust way, which compromises the distribution of the load on the bearings themselves. The rusty parts act also as a trigger for breaking.

<b>CORROSIVE WEAR</b>		
<b>CHARACTERISTIC MARKS</b>	<b>CAUSES</b>	<b>POSSIBLE REMEDIES</b>
<p><i>Rusty parts on the outer surface of the outer ring or the hole of inner ring.</i></p> <p><i>Mark of working on the raceways deeply marked on the correspondent positions.</i></p>	<p><i>Too free of a coupling.</i></p> <p><i>Seats on the joints or in the housing with mistakes in the shape.</i></p>	<p><i>Mend the seats.</i></p>

## **Primary damages: the marks**

### **General remarks**

During the functioning of the bearing, there can be some marks on the rolling raceways and on the rotating parts. This happens when the assembling stress is applied on the wrong ring and therefore passes through the rollers, or when the bearing is subject to abnormal loads when motionless. Also the foreign particles can cause marks.



Example of an unwise manipulation: the roller of a bearing with two rows of cylindrical rollers has been hit by a hammer.

Therefore we can see on it that there are two opposite marks, and in its turn the roller has created a mark on the outer ring.



In this situation the distance between the marks is the same as that between the rotating parts. In cylindrical roller bearings the damage has the shape of a material filling and, subsequently, if pressure increases, the shape of a mark.

**Marks due to foreign particles**

If the external particles, such as scraps and butts, penetrate into the bearing, they cause marks on the raceways when the rotating parts pass on them.

The particles do not have to be hard to generate such marks: thin pieces of paper or threads of the cloth can be enough.

Usually the marks are distributed along the whole rolling surface and have small dimensions.

<b>MARKS</b>		
<b>CHARACTERISTIC MARKS</b>	<b>CAUSES</b>	<b>POSSIBLE REMEDIES</b>
<i>Marks on the raceways of both rings, at the same distance as the rotating parts.</i>	<i>Assembling stress applied on the wrong ring.  Overload applied on motionless bearing</i>	<i>Apply the assembling stress on the ring that must be stressed during assembling.  Avoid overload or prefer other bearings with higher Co value.</i>
<i>Marks along the rolling Raceways and on the Surface of rotating parts.</i>	<i>Entrance of foreign substances or particles in the bearing</i>	<i>Improve the cleaning of the assembling department, use a clean lubricant and improve the efficiency of seal systems.</i>

**Primary damages: material fillings**

**General remarks**

The material filling, better known as “smearing”, takes place when two contact surfaces that are not enough lubricated shear one against the other under applied load. The contact surfaces become rough.

Because of friction generated in the contact with shearing and with insufficient lubrication, the materials reach a temperature which is close to that of temper; this generates a strain that can lead to cracks and cleavages.

In the case of roller bearings, the shearing is mainly located in the part of contact between the head of the roller and the shoulders.

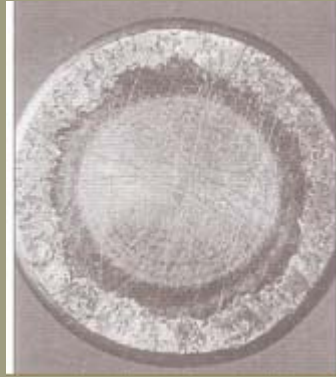
The material fillings may be generated when the rollers, which are subject to strong acceleration, pass in the loaded part of the bearing.

**Material fillings on rollers and shoulders**

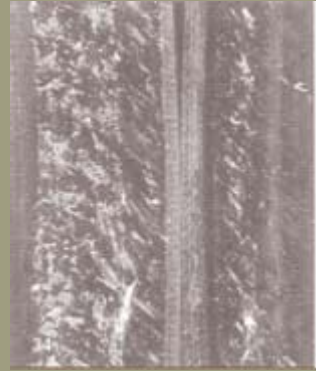
The damage with material filling in cylindrical roller bearings is mainly located on the heads of the rollers that are into contact with the shoulders and on the faces of the shoulders themselves.



This fact is due to an insufficient lubrication between the surfaces that are into contact or to a strong axial load applied in the same direction for a long time. On the other hand, if the axial load was applied in both the directions, the problem would be of little importance, as the lubricant would have greater chance to go between the two surfaces. This kind of trouble can be partially avoided by using suitable lubricants with high oiliness/greasiness and higher stability towards viscosity.



Head of a cylindrical roller with evident signs of material filling, due to high axial loads and insufficient lubrication.



Magnification of a guide roller shoulder with damages due to material fillings

## Material fillings on rolling raceways

Among the trouble related to the assembling process of cylindrical roller bearings we can find the situation in which the ring that bears the rollers and the cage are fixed sideways on the other ring and without rotating it. In this case, the rollers damage the ring and cause material filling in the shape of transverse streaks; the rollers themselves are damaged.



Cylindrical roller bearing with streaks on the rolling raceway of the inner ring and on the rollers due to wrong assembling operations.

This type of damage can be avoided by lubricating the bearing correctly and by rotating one of the rings.

FILLINGS		
CHARACTERISTIC MARKS	CAUSES	POSSIBLE REMEDIES
<i>Coloured and rough had of rollers and faces of the shoulders</i>	<i>Creeping when the loads are high and the lubrication is not enough</i>	<i>Use suitable lubricants</i>
<i>Fillings on rolling raceways of cylindrical roller bearings with the shape of transverse streaks, located at the same distance as that of the rollers.</i>	<i>During the operations of assembling, the ring with cage and rollers has been put obliquely in comparison to the other ring.</i>	<i>Rotate the inner ring and the outer ring during assembling. Lubricate the surfaces very well.</i>

### Primary damages: transfer of electric current

This kind of damage is often neglected, as it is rarer than the previous ones, but it leads to serious consequences when it happens.

The transfer of electric current through a bearing happens when the electric current is transferred from a ring to another through the rotation parts; the damage occurs because we have a process similar to a welding arch where there is a contact.

The material is heated under a tempering temperature, until it comes closer to a melting temperature. In this kind of situation there are some coloured parts of different dimensions, where the material is tempered, re-hardened or melted. There are little craters where the material melts. The transfer of electric current leads to the forming of teeth on the raceways and on the rollers.

This kind of damage can be mistaken with that created by the vibrations; the difference lies in the fact that the hallows generated by electric current have a dark bottom, whereas those created by vibrations have a sparkly bottom, or a rusty one.

Both A/C and D/C are harmful for the bearing, as well as low-intensity current. The entity of damage depends on several factors:

- intensity of electric current;
- duration of electric transfer on the bearing;
- speed of rotation of the bearing;
- lubricant.

There are different solutions to prevent the transfer of electric current in the bearing; the easiest one seems to be the insulation of electric engines.





<b>TRANSFER OF ELECTRIC CURRENT</b>		
<b>CHARACTERISTIC MARKS</b>	<b>CAUSES</b>	<b>POSSIBLE RIMEDIES</b>
<i>Dark teeth or craters on the rolling raceways and on the rollers.</i>	<i>Transfer of electric current through the rotating bearing.</i>	<i>Provide for preventing the electric current to be transferred through the bearing. Use insulated bearings.</i>
<i>Burns located on the rolling raceways and on the rotating parts.</i>	<i>Transfer of electric current through the motionless bearing.</i>	<i>Provide for preventing the electric current to be transferred through the bearing. Use insulated bearings.</i>

## **Secondary damages: cleavages**

The cleavages (also known as “flaking” o “spalling”), classified as secondary damage, are the consequence of normal fatigue of the material once the bearing has reached his natural lifetime end, of rust, of transfer of current, of material fillings.

What said here above is not the usual cause of damage, as the cleavages seen on the bearings can be also due to other causes:

- external loads higher than foreseen;
- ovalization of the seats;
- axial dolly device (ex.: expansion of the joint)

Usually we realize that there is a cleavage when we perceive noise and vibrations in the bearing, which should therefore be replaced.

<b>CLEAVAGES</b>		
<b>CHARACTERISTIC MARKS</b>	<b>CAUSES</b>	<b>POSSIBLE RIMEDIES</b>
<i>Very evident working marks on the raceways of both rings.</i>	<i>Pre-load due to excessive fatigue of the rings.</i>	<i>Change the coupling or choose bearings with higher internal clearance.</i>
<i>Cleavages on the most loaded part</i>	<i>Excessive difference of temperature between the inner and the outer ring.</i>	<i>Choose bearings with higher internal clearance.</i>
<i>Very evident working marks on two opposite positions of the rings. Cleavages in those parts.</i>	<i>Out of roundness seat on the joint or in the seat.</i>	<i>Manufacture a new joint or a new seat.</i>
<i>Cleavages on the edge of the raceway</i>	<i>Oblique fixing of the bearing.</i>	<i>Use a “button” with parallel faces</i>
<i>Cleavages at the beginning on the loaded part on the raceway of the bearing.</i>	<i>Material fillings due to sliding.</i>	
<i>Cleavages at the same distance as the rotating parts and on the rolling raceways.</i>	<i>Transverse material fillings due to wrong assembling operations.</i>	
<i>Cleavages due to rust</i>	<i>Deep rust</i>	
<i>Cleavages on the raceway of one of the two rings.</i>	<i>Contact rust</i>	
<i>Corroded zone in the correspondent part of the outer diameter surface or of the hole of the bearing.</i>		

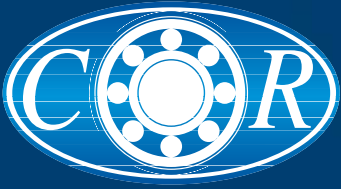


## Secondary damages: cracks

The forming of cracks in the rings of the bearings can have various causes:

- unwise manipulation during the assembling and disassembling process;
- hammer hits on the rings;
- forced assembling with heat of a ring on an out of tolerance joint;
- fillings, contact rust and cleavages.

<b>CRACKS</b>		
<b>CHARACTERISTIC MARKS</b>	<b>CAUSES</b>	<b>POSSIBLE RIMEDIES</b>
<i>Cracks or fragments that detach, usually on one face of the ring.</i>	<i>Hammer or chisel hits on the ring during the assembling process.</i>	<i>Always interpose a soft material coupling bow. Do not hit the bearing directly.</i>
<i>Cracks and material fillings on the ring. The ring can be broken in transverse direction. The filling cracks are usually formed in transverse direction in comparison to the trend of the fillings.</i>	<i>Fillings</i>	



How to reach C.R.

- Exit "Piacenza Nord"
- Follow direction "Milano"
- Exit "Codogno"
- Go straightforward into "Via A. Moro"
- Turn left
- Turn right into "Via S. Pertini"

