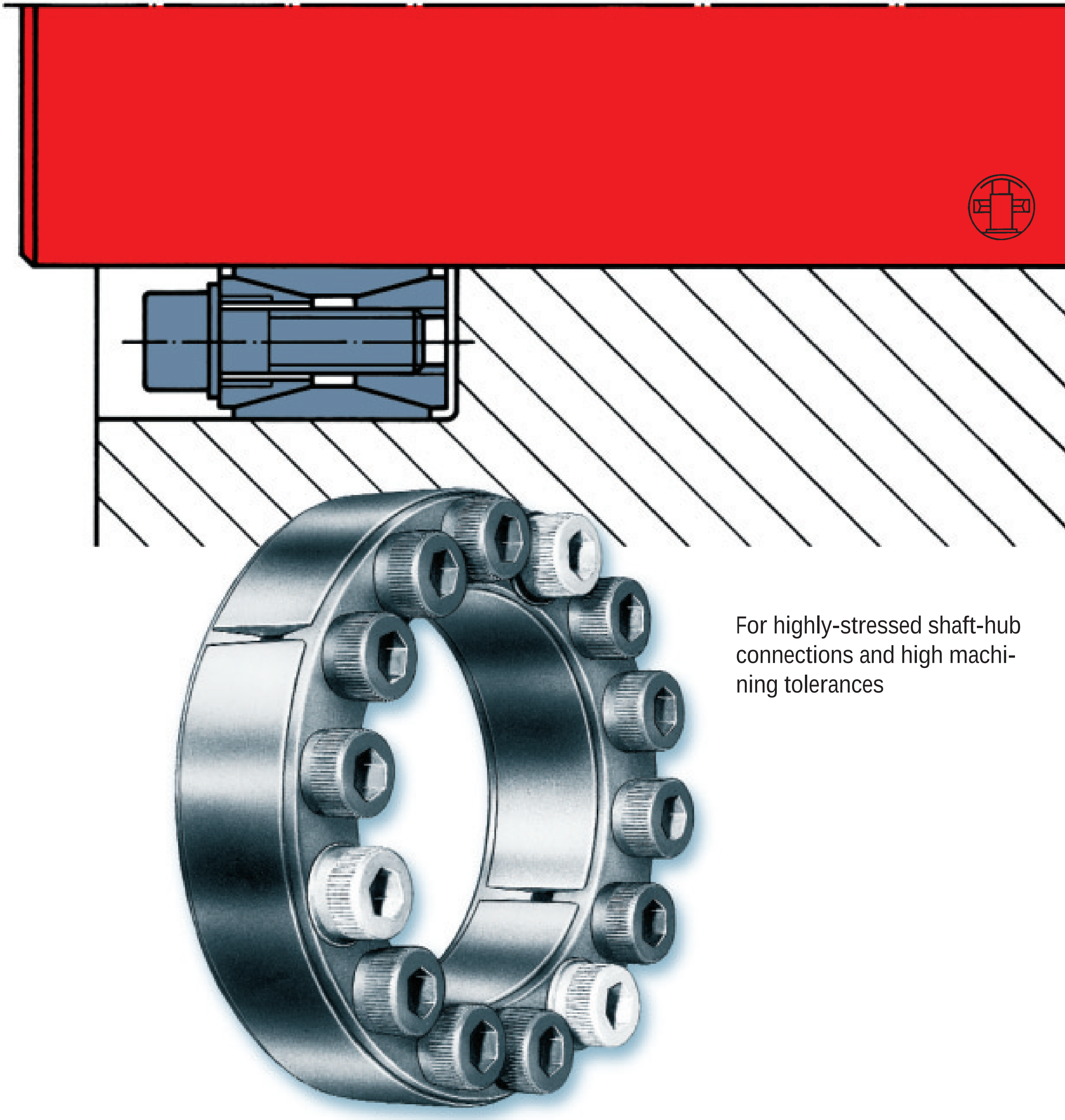
RINGFEDER® Locking Assemblies

RfN 7012



For highly-stressed shaft-hub connections and high machining tolerances

RINGFEDER

Locking Connections

RINGFEDER® Locking Assemblies RfN 7012

Please note that our guarantee refers to our products only. Because of the unlimited number of applications and all different types of machines, it is not possible for our engineers to know all factors that may affect or change the technical data or our products.

We reserve the right to modify design by way of technical improvement.

RINGFEDER

Locking Connections

Certified by DIN EN ISO 9001 and VDA 6.1

Index

	Page

RINGFEDER® Locking Assemblies RfN 7012

For highly-stressed shaft-hub connections

The shrink fit is unsurpassable. No other shaft-hub connections can offer anywhere near the same performance regarding fatigue strength under alternating torsional stresses. These fits are nevertheless rare, as they call for involved calculations, extremely close machining tolerances, cause considerable trouble when fitting and removing the parts in question, and give rise to problems during repair work (exchangeability, adjustments, centering, etc.).

The locking Assembly RINGFEDER Connections is a shrink fit - a shrink fit of special kind.

Fig. 1 · Locking Assembly RINGFEDER® RfN 7012

CHARACTERISTICS

TRANSMISSION OF HIGH PERIPHERAL FORCES

Several Locking Assemblies RfN 7012 can be used in series. The transmissible torques and axial loads are added (see page 7)

OPTIMUM DEPENDABILITY

We guarantee the torque/axial load transmission values as given in this publication, regardless of whether the connection is subjected to static, dynamic or impact loads. However, the values given in this catalogue must not be exceeded.

SIMPLIFIED MANUFACTURES

Locking Assemblies RfN 7012 can bridge large clearances between k 11 and h 11 resp. N 11 and H 11 are possible (cf. Page 7).

EASY EXCHANGEABILITY

Locking Assemblies RfN 7012 bridge large clearances and need no stops or other mechanical devices of this type. In contrast to all other shafthub connections, close machining tolerances are unnecessary.

EASY MOUNTING

The temperature difference between shaft and hub for shrinkage fits is eliminated. Locking Assemblies RfN 7012 are tightened using standard screws and standard tools. Machining or fitting work is not required.

EASY REMOVAL

Release the locking screws, and the Locking Assembly RfN 7012 can be removed. The steep angle of the double tapers (approx. 28∞) prevents selflocking and ensures that the Locking Assembly can be released without difficulty.

RINGFEDER® Locking Assemblies RfN 7012

LOW SUSCEPTIBILITY TO CONTAMINATION

When the locking screws are tightened down, the contact (functional) surfaces are pressed firmly together, so preventing the ingress of dirt and moisture.

UNLIMITED APPLICATION RANGE

Locking Assemblies RfN 7012 are most suitable for securing all types of bosses and hubs on shafts and axles. They efficiently replace shrink fits, key and polygon connections, splined shafts, etc. These Locking Assemblies are used for the connection of gearwheels, chain sprockets, levers, cams, cam plates, belt pulleys, brake drums, flywheels, couplings and clutches, shaft-mounted gearings, flanges, rope sheaves, track wheels, impellers, ship and aircraft propellers, etc. and are giving every satisfaction in these and countless other applications.

EASY ADJUSTABILITY

Locking Assemblies RfN 7012 need no stops. Bosses and hubs can therefore be located and locked at any point of the shaft.

PERFECT TRUE RUNNING

Forming a frictional lock connention, Locking Assemblies RfN 7012 have absolutely no play.

FREEDOM FROM WEAR

Having no moving parts, Locking Assemblies RfN 7012 can be tightened and released as often as required. The locking screws are standard items and thus readily available.

HIGH FATIGUE STRENGTH UNDER ALTERNATING TORSIONAL STRESSES

Neither shaft nor hub have keyways. Thus, notch effect is minimized and a high polar section modulus is at the disposal of the designer.

OVERLOAD PROTECTION EFFECT

When the permissible load is exceeded, Locking Assemblies RfN 7012 will slip. In this way, they can safeguard valuable machine components against damage. However, the Locking Assembly connection is subject to the same laws as all other frictional lock connections, and is not suitable for use as slipping clutches.

EASY CALCULATIONS

This catalogue lists all interesting data in the form of quick-reference tables.

RINGFEDER® Locking Assemblies RfN 7012

Locking Assembly designation for shaft diameter = 70 mm: Locking Assembly RINGFEDER® 70 x 110 RfN 7012

Ident-No.	Locking Assembly dimensions d x D mm	L	l mm	L_1	Transmissible torques T or Nm	axial forces F_{ax} kN	Surface pressures between Locking Assembly and shaft p N/mm²	hub p´ N/mm²	Locking screws DIN EN ISO 4762 (DIN 912) – 12.9 Thread Qty.	d_G	T_A Nm	Hilfs-gewinde d_D	Weigh t ≈ kg
6 996 124	19 x 47	20	17	27,5	255	27	220	90	8	M 6 x 18	14	M 8	0,24
990 930	**20 x 47**	**20**	**17**	**27,5**	**270**	**27**	**210**	**90**	**8**	**M 6 x 18**	**14**	**M 8**	**0,24**
990 957	22 x 47	20	17	27,5	300	27	195	90	8	M 6 x 18	14	M 8	0,23
990 985	24 x 50	20	17	27,5	360	30	195	95	9	M 6 x 18	14	M 8	0,26
990 937	**25 x 50**	**20**	**17**	**27,5**	**380**	**30**	**190**	**95**	**9**	**M 6 x 18**	**14**	**M 8**	**0,25**
990 981	28 x 55	20	17	27,5	470	33	185	95	9	M 6 x 18	14	M 8	0,3
990 981	**30 x 55**	**20**	**17**	**27,5**	**500**	**33**	**175**	**95**	**9**	**M 6 x 18**	**14**	**M 8**	**0,29**
7 990 332	32 x 60	20	17	27,5	630	40	192	105	12	M 6 x 18	14	M 8	0,34
991 007	**35 x 60**	**20**	**17**	**27,5**	**700**	**40**	**180**	**105**	**12**	**M 6 x 18**	**14**	**M 8**	**0,32**
5 996 236	38 x 65	20	17	27,5	870	46	188	110	15	M 6 x 18	14	M 8	0,36
991 015	**40 x 65**	**20**	**17**	**27,5**	**920**	**46**	**180**	**110**	**15**	**M 6 x 18**	**14**	**M 8**	**0,34**
7 990 359	42 x 75	24	20	33,5	1500	72	226	125	12	M 8 x 22	35	M 10	0,6
991 023	**45 x 75**	**24**	**20**	**33,5**	**1610**	**72**	**210**	**125**	**12**	**M 8 x 22**	**35**	**M 10**	**0,57**
7 990 367	48 x 80	24	20	33,5	1700	71	196	115	12	M 8 x 22	35	M 10	0,62
991 031	**50 x 80**	**24**	**20**	**33,5**	**1770**	**71**	**190**	**115**	**12**	**M 8 x 22**	**35**	**M 10**	**0,6**
991 040	**55 x 85**	**24**	**20**	**33,5**	**2270**	**83**	**200**	**130**	**14**	**M 8 x 22**	**35**	**M 10**	**0,63**
991 058	**60 x 90**	**24**	**20**	**33,5**	**2470**	**83**	**180**	**120**	**14**	**M 8 x 22**	**35**	**M 10**	**0,69**
991 066	**65 x 95**	**24**	**20**	**33,5**	**3040**	**93**	**190**	**130**	**16**	**M 8 x 22**	**35**	**M 10**	**0,73**
991 074	**70 x 110**	**28**	**24**	**39,5**	**4600**	**132**	**210**	**130**	**14**	**M 10 x 25**	**70**	**M 12**	**1,26**
991 082	75 x 115	28	24	39,5	4900	131	195	125	14	M 10 x 25	70	M 12	1,33
991 090	**80 x 120**	**28**	**24**	**39,5**	**5200**	**131**	**180**	**120**	**14**	**M 10 x 25**	**70**	**M 12**	**1,4**
991 104	85 x 125	28	24	39,5	6300	148	195	130	16	M 10 x 25	70	M 12	1,49
991 112	**90 x 130**	**28**	**24**	**39,5**	**6600**	**147**	**180**	**125**	**16**	**M 10 x 25**	**70**	**M 12**	**1,53**
991 120	**95 x 135**	**28**	**24**	**39,5**	**7900**	**167**	**195**	**135**	**18**	**M 10 x 25**	**70**	**M 12**	**1,62**
991 139	**100 x 145**	**33**	**26**	**47**	**9600**	**192**	**195**	**135**	**14**	**M 12 x 30**	**125**	**M 14**	**2,01**
991 147	**110 x 155**	**33**	**26**	**47**	**10500**	**191**	**180**	**125**	**14**	**M 12 x 30**	**125**	**M 14**	**2,15**
991 155	**120 x 165**	**33**	**26**	**47**	**13100**	**218**	**185**	**135**	**16**	**M 12 x 30**	**125**	**M 14**	**2,35**
991 163	**130 x 180**	**38**	**34**	**52**	**17600**	**272**	**165**	**115**	**20**	**M 12 x 35**	**125**	**M 14**	**3,51**
991 171	**140 x 190**	**38**	**34**	**52**	**20900**	**298**	**165**	**125**	**22**	**M 12 x 35**	**125**	**M 14**	**3,85**
991 180	**150 x 200**	**38**	**34**	**52**	**24200**	**324**	**170**	**125**	**24**	**M 12 x 35**	**125**	**M 14**	**4,07**
991 198	**160 x 210**	**38**	**34**	**52**	**28000**	**350**	**170**	**130**	**26**	**M 12 x 35**	**125**	**M 14**	**4,3**
991 201	**170 x 225**	**44**	**38**	**60**	**32800**	**386**	**160**	**120**	**22**	**M 14 x 40**	**190**	**M 16**	**5,78**
991 210	**180 x 235**	**44**	**38**	**60**	**37800**	**420**	**165**	**125**	**24**	**M 14 x 40**	**190**	**M 16**	**6,05**
991 228	190 x 250	52	46	68	46500	490	150	115	28	M 14 x 45	190	M 16	8,25
991 236	**200 x 260**	**52**	**46**	**68**	**52500**	**525**	**150**	**115**	**30**	**M 14 x 45**	**190**	**M 16**	**8,65**
991 244	**220 x 285**	**56**	**50**	**74**	**68000**	**620**	**150**	**115**	**26**	**M 16 x 50**	**295**	**M 20**	**11,22**
991 252	**240 x 305**	**56**	**50**	**74**	**85500**	**715**	**160**	**125**	**30**	**M 16 x 50**	**295**	**M 20**	**12,2**
991 260	260 x 325	56	50	74	104000	800	165	130	34	M 16 x 50	295	M 20	13,2
991 279	**280 x 355**	**66**	**60**	**86,5**	**128000**	**915**	**145**	**115**	**32**	**M 18 x 60**	**405**	**M 22**	**19,2**
991 287	300 x 375	66	60	86,5	153000	1020	150	120	36	M 18 x 60	405	M 22	20,5
991 295	**320 x 405**	**78**	**72**	**100,5**	**210000**	**1310**	**150**	**120**	**36**	**M 20 x 70**	**580**	**M 24**	**29,6**
991 309	**340 x 425**	**78**	**72**	**100,5**	**224000**	**1310**	**145**	**115**	**36**	**M 20 x 70**	**580**	**M 24**	**31,1**
991 317	**360 x 455**	**90**	**84**	**116**	**294000**	**1630**	**145**	**115**	**36**	**M 22 x 80**	**780**	**M 27**	**42,2**
991 325	380 x 475	90	84	116	308000	1620	135	110	36	M 22 x 80	780	M 27	44
991 333	400 x 495	90	84	116	322000	1610	130	105	36	M 22 x 80	780	M 27	46
991 341	420 x 515	90	84	116	374000	1780	135	110	40	M 22 x 80	780	M 27	50
991 350	440 x 545	102	96	130	455000	2060	130	105	40	M 24 x 90	1000	M 30	64,6
991 368	460 x 565	102	96	130	470000	2040	125	100	40	M 24 x 90	1000	M 30	67,4
991 376	480 x 585	102	96	130	515000	2160	125	100	42	M 24 x 90	1000	M 30	71
991 384	500 x 605	102	96	130	560000	2240	125	100	44	M 24 x 90	1000	M 30	72,6
991 392	520 x 630	102	96	130	600000	2320	125	100	45	M 24 x 90	1000	M 30	80
991 406	540 x 650	102	96	130	630000	2340	120	100	45	M 24 x 90	1000	M 30	82
991 414	560 x 670	102	96	130	680000	2440	120	100	48	M 24 x 90	1000	M 30	85
991 422	580 x 690	102	96	130	735000	2540	120	100	50	M 24 x 90	1000	M 30	88
991 430	600 x 710	102	96	130	775000	2580	120	100	50	M 24 x 90	1000	M 30	91
991 449	620 x 730	102	96	130	825000	2660	120	100	52	M 24 x 90	1000	M 30	93
991 457	640 x 750	102	96	130	865000	2700	115	100	54	M 24 x 90	1000	M 30	96
991 465	660 x 770	102	96	130	925000	2800	120	100	56	M 24 x 90	1000	M 30	99
991 473	680 x 790	102	96	130	965000	2840	115	100	56	M 24 x 90	1000	M 30	102
991 481	700 x 810	102	96	130	1030000	2960	115	100	60	M 24 x 90	1000	M 30	104
991 490	720 x 830	102	96	130	1070000	2980	115	100	60	M 24 x 90	1000	M 30	107
	740 x 850	102	96	130	1140000	3080	115	100	62	M 24 x 90	1000	M 30	110
991 511	760 x 870	102	96	130	1210000	3180	115	100	64	M 24 x 90	1000	M 30	113
991 520	780 x 890	102	96	130	1250000	3220	115	100	65	M 24 x 90	1000	M 30	116
	800 x 910	102	96	130	1300000	3260	115	100	66	M 24 x 90	1000	M 30	118
	820 x 930	102	96	130	1370000	3340	115	100	68	M 24 x 90	1000	M 30	121
	840 x 950	102	96	130	1450000	3460	115	100	70	M 24 x 90	1000	M 30	124
	860 x 970	102	96	130	1520000	3540	115	100	72	M 24 x 90	1000	M 30	127
	880 x 990	102	96	130	1590000	3620	115	100	74	M 24 x 90	1000	M 30	129
	900 x 1010	102	96	130	1650000	3680	115	100	75	M 24 x 90	1000	M 30	132
	920 x 1030	102	96	130	1710000	3720	110	100	76	M 24 x 90	1000	M 30	135
	940 x 1050	102	96	130	1790000	3820	110	100	78	M 24 x 90	1000	M 30	138
	960 x 1070	102	96	130	1870000	3900	115	100	80	M 24 x 90	1000	M 30	140
	980 x 1090	102	96	130	1940000	3960	110	100	81	M 24 x 90	1000	M 30	143
	1000 x 1110	102	96	130	2000000	4000	110	100	82	M 24 x 90	1000	M 30	146

Bold printed types are standard

Explanations to the opposite table

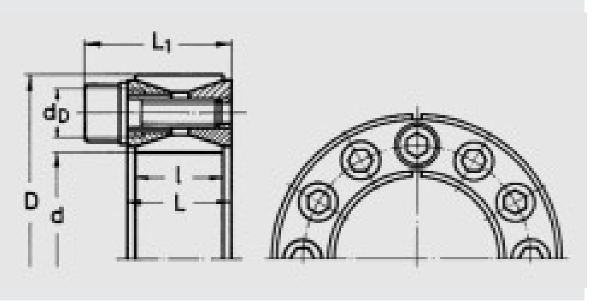


Fig. 2 · Locking Assembly RINGFEDER® RfN 7012

d x D, L, l, L_1 = Basic dimensions, Locking Assembly not tightened

T = Transmissible torque

F_{ax} = Transmissible axial force

p = Approx. Surface pressure between Locking Assembly and shaft

p´ = Approx. Surface pressure between Locking Assembly and hub

T_A = Required tightening torque per locking screw (tighten with torque wrench)

d_D = Auxiliary thread in the front thrust ring. The screws at these points are special marked for easy indentification.

Typical application:

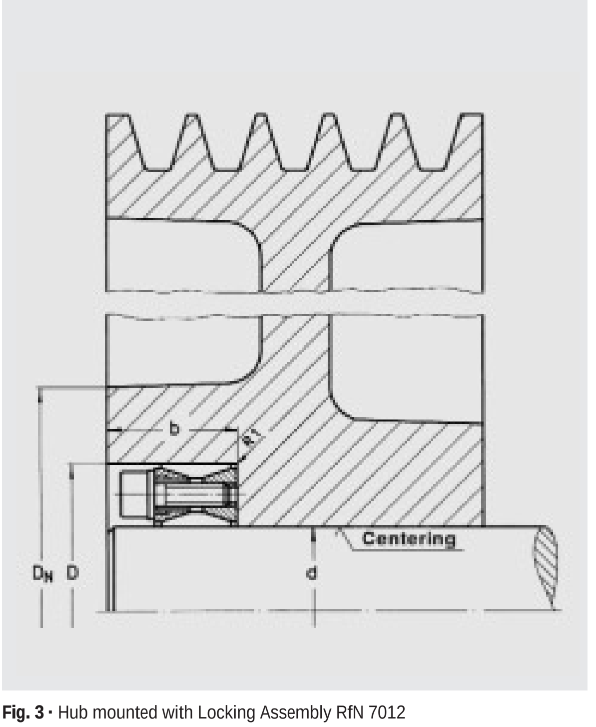


Fig. 3 · Hub mounted with Locking Assembly RfN 7012

D_N = Diameter of the hub above the Locking Assembly, see pages 8, 9 and 10 (radial load).
b $\geqq L_1$; L_1 table on page 6

Locking Assemblies RINGFEDER® RfN 7012 are not selfcentering. Consequently, the true running of hubs mounted with these Locking Assemblies is governed by the efficiency of the shaft centering action is governed by the play between the remaining boss or hub bore and the shaft, as well as by the mating length between hub and shaft

Fitting Locking Assemblies:

The values for T, F_{ax}, p and p´ apply to Locking Assemblies that are lightly oiled prior to being fitted (µ = 0,12).

For more details see page 12.

Surfaces finishes:

For shafts and hub bores:
$R_a \leqq 3{,}2$ µm
Corresponds to RMS < 125 micro-inches.

Tolerances:

Locking Assemblies RfN 7012 can bridge large deviations from nominal sizes without any torque losses.

We do not stipulate any particular clearances. The following may be taken as guide values:

Shaft: all fits between k11 and h 11.
Hub: all fits between N 11 and H 11.

The Locking Assembly should be located as symmetrically as possible between shaft and hub bore in order to avoid excessive deformations of the relatively thickwalled thrust rings. If the shaft is smaller than nominal d, the bore should exceed nominal D to the same extent and vice versa. The difference between both deviations of the nominal dimensions should not exceed IT 9 (with regard to d).

Location of several Locking Assemblies RfN 7012:

If several Locking Assemblies are to be installed the transmission values of the opposite table can be added in case the Locking Assemblies are located within a distance of 4 · L_1.

Change of screw tightening torques:

The Locking Assemblies are generally equipped with screws of the quality 12.9. If required, the transmission values can be increased by increasing the tightening torques of the screws (for quality 12.9 see page 10). A reduction of the surface pressures and the transmission values by diminished tightening of the screws also is possible. The admissible lower limit results from the multiplication of theT_A-values of the opposite table by 0,6.

There is an approximate linear relationship between T_A, T, F_{ax}, p and p´ (Hub and hollow shaft calculation according to the equations on page 11)!

RINGFEDER® Locking Assemblies RfN 7012

Required hub outside diameter D_N when using one Locking Assembly RfN 7012 depending on the yield point of the hub material

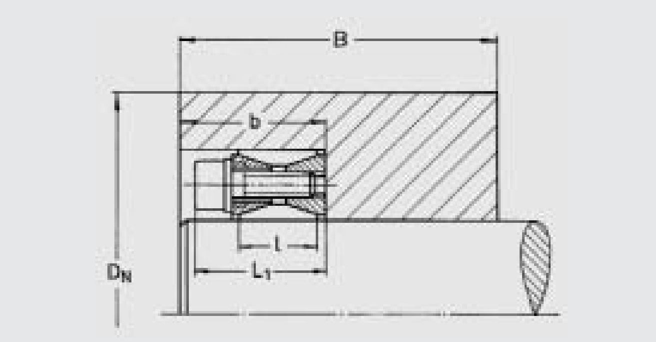
The values in the table for D_N apply to:

The use of one Locking Assembly RfN 7012

Width of the hub $B \geqq 2\,l$
Depth of the bore $b \approx L_1$

Hub section unweakened
(see hub calculation page 11)

Cast hubs should be of perfect quality (flawless).



Locking Assembly RfN 7012 dimension d x D mm	tightening torque per screw T_A Nm	Required min. hub outside diameter D_N (mm) for: yield point $R_{p0,2}$ (N/mm²) 150	180	200	220	250	270	300	350	400
19 x 47	14	69	65	62	61	59	58	57	55	54
20 x 47	14	69	65	62	61	59	58	57	55	54
22 x 47	14	69	65	62	61	59	58	57	55	54
24 x 50	14	75	70	67	66	63	62	61	59	58
25 x 50	14	75	70	67	66	63	62	61	59	58
28 x 55	14	82	77	74	72	69	68	67	65	64
30 x 55	14	82	77	74	72	69	68	67	65	64
32 x 60	14	96	87	84	81	78	76	74	72	71
35 x 60	14	96	87	84	81	78	76	74	72	71
38 x 65	14	105	96	92	89	85	84	81	79	77
40 x 65	14	105	96	92	89	85	84	81	79	77
42 x 75	35	130	117	111	107	103	100	97	93	91
45 x 75	35	130	117	111	107	103	100	97	93	91
48 x 80	35	132	120	114	111	106	104	101	98	95
50 x 80	35	132	120	114	111	106	104	101	98	95
55 x 85	35	151	136	128	123	118	115	111	107	104
60 x 90	35	152	138	131	126	121	118	115	111	108
65 x 95	35	169	152	143	138	132	128	124	120	116
70 x 110	70	196	176	166	160	152	149	144	138	134
75 x 115	70	200	180	171	165	157	153	148	143	139
80 x 120	70	203	184	175	169	161	158	154	148	144
85 x 125	70	223	199	189	181	173	169	164	158	153
90 x 130	70	226	203	193	186	178	173	168	162	157
95 x 135	70	247	219	208	199	189	185	178	172	166
100 x 145	125	265	236	223	214	203	198	192	184	178
110 x 155	125	269	242	230	222	212	206	200	193	187
120 x 165	125	302	268	254	243	231	225	218	209	203
130 x 180	125	297	270	257	250	240	234	228	220	214
140 x 190	125	330	296	282	272	260	252	245	237	230
150 x 200	125	347	312	297	286	273	266	258	249	242
160 x 210	125	374	335	317	304	291	284	275	265	257
170 x 225	190	380	344	328	316	302	296	288	278	270
180 x 235	190	408	366	349	336	321	313	303	292	284
190 x 250	190	413	375	357	346	333	325	316	305	298
200 x 260	190	430	390	372	360	346	338	329	317	310
220 x 285	295	470	428	408	395	379	370	360	348	339
240 x 305	295	530	475	453	436	416	405	394	380	369
260 x 325	295	578	518	490	472	450	440	425	410	396
280 x 355	405	585	533	507	492	472	462	450	433	423
300 x 375	405	642	572	545	526	505	493	480	462	450
320 x 405	580	693	618	590	568	545	533	517	500	486
340 x 425	580	700	636	610	588	564	553	537	519	506
360 x 455	780	748	680	653	630	605	592	575	556	542
380 x 475	780	762	700	670	646	623	610	594	576	562
400 x 495	780	790	715	690	665	640	630	615	595	585
420 x 515	780	828	758	726	705	675	660	650	625	608
440 x 545	1000	853	786	755	732	705	695	675	655	640
460 x 565	1000	865	800	770	750	725	715	695	675	660
480 x 585	1000	895	825	800	775	750	740	715	695	680
500 x 605	1000	925	855	825	805	775	765	740	720	705

RINGFEDER® Locking Assemblies RfN 7012

Required hub outside diameter D_N when using two or more Locking Assemblies RfN 7012 depending on the yield point of the hub material

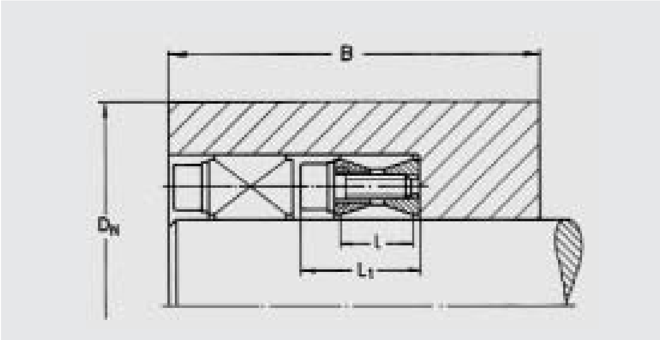
The values in the table for D_N apply to:

The use of two or more Locking Assembly RfN 7012

Width
of the hub $B \geqq L_1 \cdot (1+n)$
n = number of Locking Assemblies used

Hub section unweakened
(see hub calculation page 11)

Cast hubs should be of perfect quality (flawless).



Locking Assembly RfN 7012 dimension d x D (mm)	tightening torque per screw T_A (Nm)	Required min. hub outside diameter D_N (mm) for: yield point $R_{p0,2}$ (N/mm²) 150	180	200	220	250	270	300	350	400
19 x 47	17	79	72	69	66	63	62	60	58	56
20 x 47	14	79	72	69	66	63	62	60	58	56
22 x 47	14	79	72	69	66	63	62	60	58	56
24 x 50	14	87	78	75	72	68	67	65	62	61
25 x 50	14	87	78	75	72	68	67	65	62	61
28 x 55	14	96	86	82	79	75	73	71	69	67
30 x 55	14	96	86	82	79	75	73	71	69	67
32 x 60	14	113	99	94	90	85	83	80	77	74
35 x 60	14	113	99	94	90	85	83	80	77	74
38 x 65	14	127	111	104	99	94	91	88	84	81
40 x 65	14	127	111	104	99	94	91	88	84	81
42 x 75	35	168	140	130	122	115	111	106	101	97
45 x 75	35	168	140	130	122	115	111	106	101	97
48 x 80	35	163	141	132	125	118	114	110	105	101
50 x 80	35	163	141	132	125	118	114	110	105	101
55 x 85	35	200	164	151	142	132	128	122	115	111
60 x 90	35	192	163	152	144	135	131	125	119	115
65 x 95	35	223	184	169	159	148	143	136	129	124
70 x 110	70	258	213	196	184	171	165	158	149	144
75 x 115	70	257	215	199	188	176	170	163	154	148
80 x 120	70	256	218	202	192	180	174	167	159	153
85 x 125	70	294	242	222	209	195	188	179	170	163
90 x 130	70	291	243	225	212	199	192	184	174	168
95 x 135	70	335	270	247	231	214	206	197	186	178
100 x 145	125	359	290	265	248	230	221	211	199	191
110 x 155	125	347	290	268	253	237	229	219	208	200
120 x 165	125	409	330	302	282	262	252	241	227	218
130 x 180	125	368	316	296	281	265	257	247	236	227
140 x 190	125	425	355	329	310	290	280	269	255	245
150 x 200	125	447	374	346	327	306	295	283	268	258
160 x 210	125	493	406	374	351	327	315	301	285	274
170 x 225	190	480	408	380	359	337	326	313	298	287
180 x 235	190	525	440	407	384	359	347	332	315	303
190 x 250	190	511	440	411	390	368	357	343	327	316
200 x 260	190	531	457	428	406	383	371	357	340	329
220 x 285	295	582	501	469	445	419	406	391	373	360
240 x 305	295	682	571	528	498	466	450	431	409	394
260 x 325	295	764	628	578	543	506	488	467	442	424
280 x 355	405	725	624	584	554	522	506	487	465	449
300 x 375	405	800	680	633	599	562	544	522	497	479
320 x 405	580	864	734	683	647	607	587	564	537	517
340 x 425	580	868	747	699	664	625	606	583	556	537
360 x 455	780	929	800	748	710	669	649	625	596	575
380 x 475	780	931	811	762	726	686	666	643	614	594
400 x 495	780	932	821	775	740	702	683	660	632	613
420 x 515	780	1009	879	826	787	744	722	697	666	644
440 x 545	1000	1026	904	853	815	773	752	727	696	674
460 x 565	1000	1024	911	863	827	787	767	743	713	692
480 x 585	1000	1060	943	894	856	815	794	769	738	716
500 x 605	1000	1097	976	924	886	843	821	795	763	741

Calculations

Transmissible torques T

Transmissible axial forces F_{ax}

A connection made with a Locking Assembly RfN 7012 is similar to a shrink fit. In both cases, transmission of peripheral force F_{ax} or torque T is effected by contact pressures in the joints between inner ring and shaft and outer ring and hub. In the case of shrink fits, the pressure is generated by contraction or expansion (after heating the hub or chilling the shaft), and in the case of the Locking Assembly RfN 7012 by radial deformation of the inner and outer rings following axial displacement of two double tapers.

Formulae 1 and 2 are generally applicable.

$$T = F_N \cdot \mu \cdot \frac{d}{2} \qquad 1)$$

$$F_{ax} = F_N \cdot \mu \qquad 2)$$

Formulae 3 to 5 give due consideration to the special shape of the Locking Assembly (cf. Fig. 4). In formula 3, k is a safety factor governed by the size of the Locking Assembly.

$$T = F_N \cdot \mu \cdot \frac{d}{2} \cdot k \qquad 3)$$

$$F_{ax} = \frac{2}{d} \cdot T \qquad 4)$$

$$F_N = \frac{F}{\tan(\beta + \rho)} = \frac{F}{0{,}381} \qquad 5)$$

$\tan \beta = 0{,}25$
$\tan \rho = \mu = 0{,}12$

In the Locking Assemblies RfN 7012 the clamping force F is obtained by screws. F corresponds to the sum of initial clamping forces F_V.

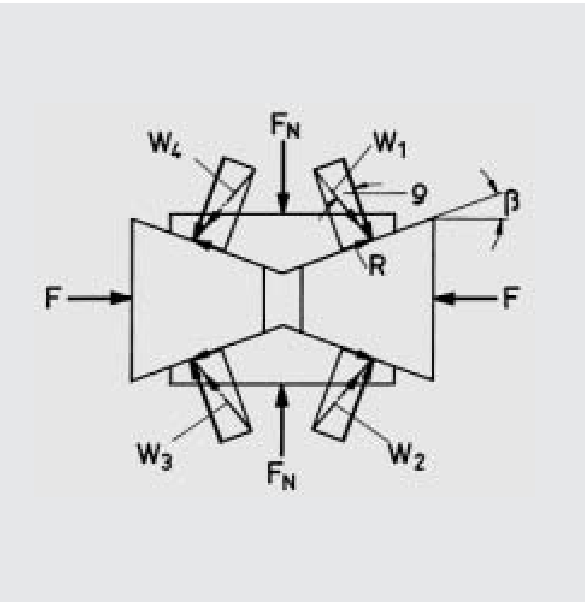


Fig. 4 · Forces acting on the plane Locking Assembly profile.

Resulting torques T_R

When torque and axial force act simultaneously, one has to check whether the resulting torque T_R can be safely transmitted by the Locking Assemblies.

$$T_R = \sqrt{T_g^2 + \left(F_g \cdot \frac{d}{2}\right)^2} \qquad 6)$$

Where:
T_g = max. torque to be transmitted
F_g = max. axial force to be transmitted
d = shaft diameter

Radial load F_r

If the Locking Assemblies RfN 7012 are subject to radial forces, the surface pressure p_{rad} generated by them (table on page 6) must be higher than the surface pressure prad resulting from the radial load F_r.

$$p_{rad} = \frac{F_r}{d \cdot l} \qquad 7)$$

Where d = shaft diameter and l the load-bearing width of the Locking Assembly. The admissible pressure prad is limited. We like to be of assistance.
The composed surface pressure(p + p_{rad}) must be borne in mind when calculating the hub and the hollow shaft (page 11)

Screws, technical data

The formulae given above clearly show that the obtainable frictional connection is directly proportional to the sum of screw pre-tension forces F_V. For this reason, the locking screws must always be tightened down using a torque wrench.
Information about the torque wrench on page 26.

The following table contain the most important data on common screw sizes and grades.

Regular thread[1] (metric)

	8.8		10.9		12.9	
d_G	T_A	F_V	T_A	F_V	T_A	F_V
M 4	2,9	3900	4,1	5450	4,9	6550
M 5	6,0	6350	8,5	8950	10	10700
M 6	10	9000	14	12600	17	15100
(M 7)	16	13200	23	18500	28	22200
M 8	25	16500	35	23200	41	27900
(M 9)	36	22000	51	30900	61	37100
M 10	49	26200	69	36900	83	44300
M 12	86	38300	120	54000	145	64500
M 14	135	52500	190	74000	230	88500
M 16	210	73000	295	102000	355	123000
M 18	290	88000	405	124000	485	148000
M 20	410	114000	580	160000	690	192000
M 22	550	141000	780	199000	930	239000
M 24	710	164000	1000	230000	1200	276000
M 27	1050	215000	1500	302000	1800	363000
M 30	1450	262000	2000	368000	2400	442000

1) According to Bauer & Schaurte
T_A = Tightening torque (Nm)
F_V = Initial clamping force (N)
(Screws oiled, μ_{total} = 0,14)

Hub and hollow shaft calculation

Equations for thick-walled cylinders give good service in the estimation of the tangential (tension) stresses occuring in the hub and hollow shaft. Exact determination of the true stresses and deformations (expanding, contraction) is very difficult in view of the wide scatter of the coefficients of friction and because of the differing hub and hollow shaft configurations. Constructions in which Locking Assemblies are intended to be arranged under or above bearings should therefore be avoided as far as possible, or be more closely investigated (e.g. test clamping).

Hub calculation

1) $p' \approx p \cdot \frac{d}{D}$

2) $a_N = \frac{D_N}{D}$

3) $\sigma_{tiN} = \frac{p'(a_N^2 + 1)}{a_N^2 - 1}$; $B = l$

4) $\sigma_{taN} = \frac{2 \cdot p'}{a_N^2 - 1}$; $B = l$

5) $\sigma_{tiN} = \frac{C_3 \cdot p'(a_N^2 + 1)}{a_N^2 - 1}$; $B > 2\,l$

6) $\sigma_{taN} = \frac{C_3 \cdot p' \cdot 2}{a_N^2 - 1}$; $B > 2\,l$

7) $D_N \geqq D \cdot \sqrt{\frac{R_{p0,2N} + C_3 \cdot p'}{R_{p0,2N} - C_3 \cdot p'}}$ *a)*

8) $D_N \geqq D \cdot \sqrt{\frac{R_{p0,2N} + C_3 \cdot p'}{R_{p0,2N} - C_3 \cdot p'}} + d_G$ *b)*

9) $\Delta D_N \approx \frac{D_N \cdot \sigma_{taN}}{E_N}$ *c)*

10) $p'_{zul.} \approx \frac{R_{p0,2N}}{C_3} \cdot \frac{D_N^2 - D^2}{D_N^2 + D^2}$ *a)*

a) cross section of the hub above the Locking Assembly, unweakened.

C_3 = 0,6 for one Locking Assembly and $B \geqq 2\,l$

C_3 = 0,8 for two or more Locking Assemblies and $B \geqq L_1 \cdot (1 + n)$; n = number of Locking Assemblies

C_3 = 1 for one or more Locking Assemblies and $B = l$ bzw. $B = L_1 \cdot n$

b) if bores or threads(d_G) in the hub.

C_3 = 0,8 if $B \geqq 2\,l$ or $B \geqq L_1 \cdot (1 + n)$

C_3 = 1 if $B = l$ or $B = L_1 \cdot n$

c) approximated value. A higher scatter range is possible, as the value depends on the actual coefficient of friction and the shape of the hub.

Shaft calculation

1) $a_W = \frac{d}{d_B}$

2) $\sigma_{tiW} \approx 2 \cdot p \cdot C_3 \cdot \frac{a_W^2}{a_W^2 - 1}$

3) $\sigma_{taW} \approx p \cdot C_3 \cdot \frac{a_W^2 + 1}{a_W^2 - 1}$

4) $d_B \leqq d \cdot \sqrt{\frac{R_{p0,2W} - 2 \cdot p \cdot C_3}{R_{p0,2W}}}$ *a)*

5) $d_B \leqq d \cdot \sqrt{\frac{R_{p0,2W} - 2 \cdot p \cdot C_3}{R_{p0,2W}}} - d_G$ *b)*

6) $\Delta d_B \approx \frac{d_B \cdot \sigma_{tiW}}{E_W}$

7) $\Delta d \approx \frac{p \cdot d \cdot (m - 1)}{E_W \cdot m}$ *c)*

8) $R_{p0,2W} > p$ *c)*

9) $p_{zul.} \approx \frac{R_{p0,2W}\left[1 - \left(\frac{d_B}{d}\right)^2\right]}{C_3 \cdot 2}$ *a)*

a) cross section of the hollow shaft below the Locking Assembly, unweakened and hollow shaft longer than 2 l (generally the case. Hollow shafts < 2 l are very rare).

C_3 = 0,6 for one Locking Assembly

C_3 = 0,8 for two or more Locking Assemblies

b) if bores or threads (d_G) in the hollow shaft.

C_3 = 0,8

c) for solid shafts

for steel:

E = 210000 N/mm²

m = 10/3

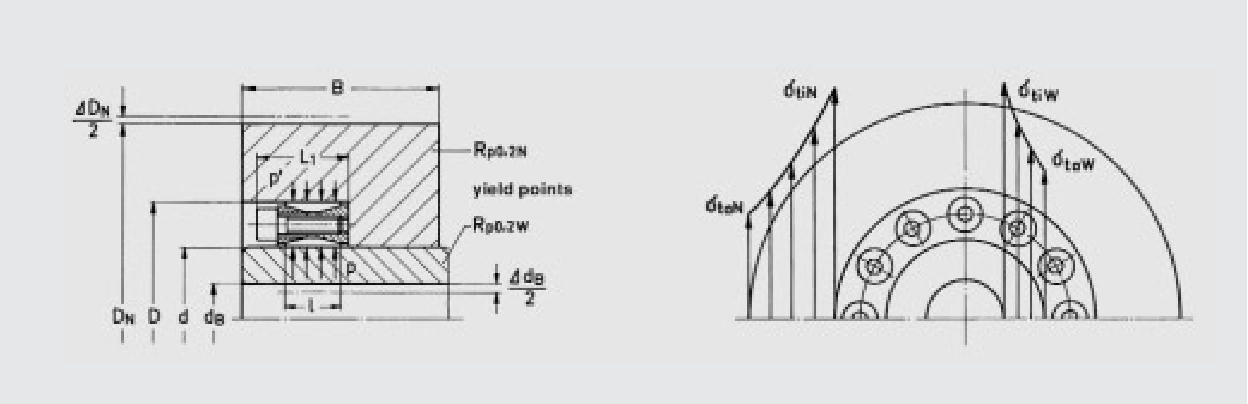


Fig. 5 Sketch for hub and hollow shaft calculation

RINGFEDER® Locking Assemblies RfN 7012

Installation and removal instructions*

Installation

Since the force is transmitted by contact pressure and friction between functional surfaces, condition of contact surfaces and proper tightening of the locking screws are of great importance (see point 1).

1. All contact surfaces, including screw threads and screw head bearing surfaces, must be clean and slightly oiled. In this condition, the shaft, hub and Locking Assemblies are to be assembled. (Do not use Molybdenum Disulphide!)

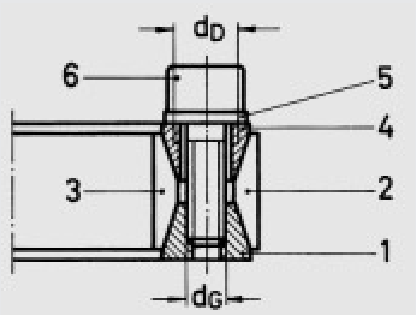
2. Tighten locking screws lightly and align hub.

3. Tighten screws evenly in diametrically opposite sequence and do this in two or three stages up to the indicated tightening torque T_A.

4. Re-check tightening torque by applying it to all screws all the way around. When no screw will turn any more, the assembly is completed.

Information about the torque wrench on page 26.

Dirty or used Locking Assemblies must be disassembled and cleaned before fitting. For reassembly the sequence as per fig. 6 is recommended.
The special marked screws are fitted with washers in order to protect the auxiliary threads in the front thrust ring. In all other respects they have the same function as the other screws and serve only to identify the position of the auxiliary threads.



1 rear thrust ring
2 outer ring
3 inner ring
4 front thrust ring
5 washer
6 locking screw

Fig. 6 · Locking Assembly RINGFEDER® RfN 7012. Designation of components.

Removal

Locking Assemblies RINGFEDER® RfN 7012 are not self-locking. The taper of the individual rings is such that the inner and outer rings spring apart. On the last screw being loosened.

The washers under the special marked screws protect the auxiliary (removal) threads against damage; these washers must be replaced after having been used several times.

If relatively high forces are needed to to extract a Locking Assembly that has already been loosened (e.g. if the Locking Assembly has to be pushed against the weight of a heavy boss or hub), any type of removal device may be used, but the screws must only be slackened and not screwed out too far. As long as this instruction is followed, there is no objection against the use of a removal device, provided the forces applied are kept low.

The auxiliary threads have only abour 3-5 effective courses and are not cut right through.
Do not use these holes for jack screws.

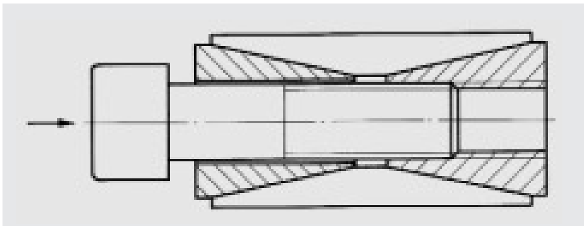


Fig. 7 If the rear thrust ring is not automatically released, the screws have to be turned out by a few threads. Light tapping against the screw heads causes the rear thrust ring to spring backwards.

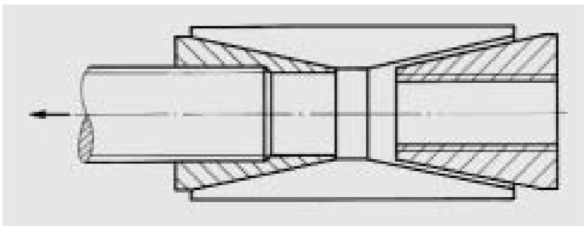


Fig. 8 Should the front thrust ring jam, it is released in a similar way. The special marked screws are removed to expose the auxiliary threads of the front thrust ring. The front thrust ring can be released and a Locking Assembly which is located deeply in the hub bore can be removed by corresponding screws.

Constructions hints

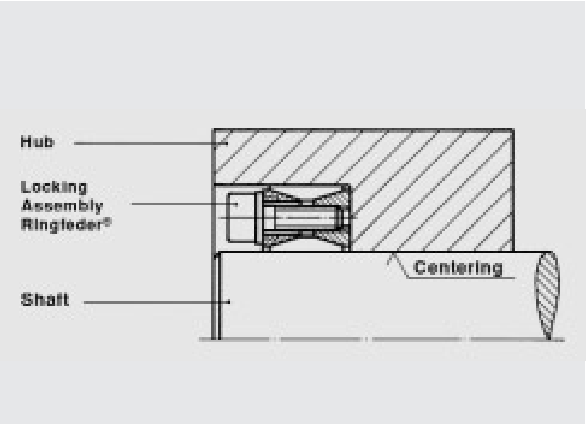


Fig. 9 · Locking Assembly RINGFEDER®. Connection. Design, designations

Fig. 10 · Locking Assembly RINGFEDER® RfN 7012

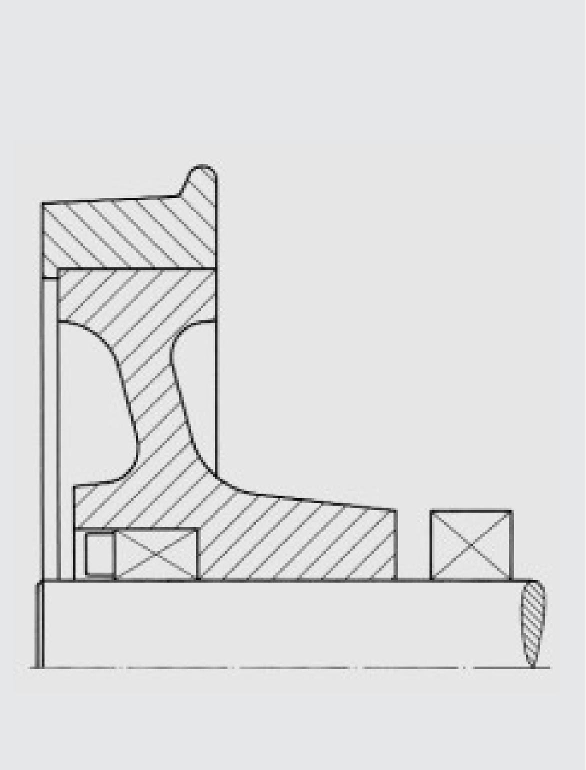


Fig. 11 · Track wheel mounted using one Locking Assembly RfN 7012.
The Locking Assembly must transmit above all the torque. The minor bore of the hub should be as long as possible and have close clearances in order to improve true running and to absorb stresses resulting from the axial force acting off-centre on the rim.

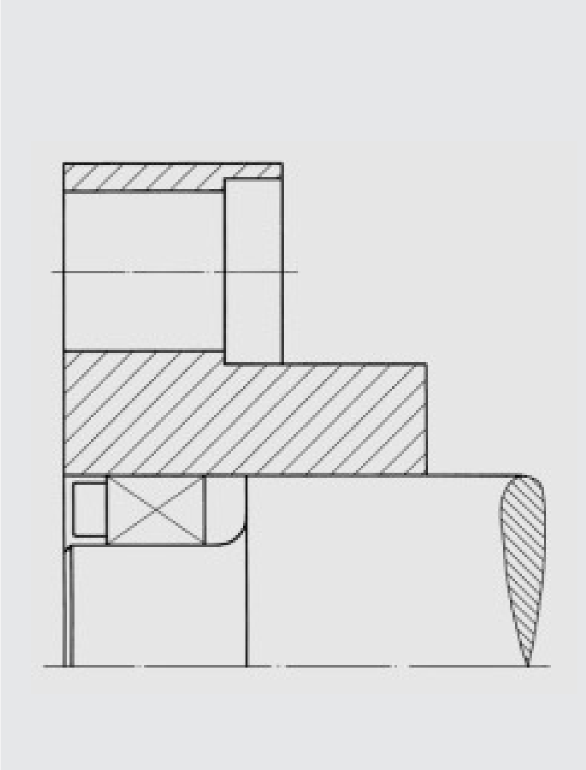


Fig. 12 · Coupling half mounted with one Locking Assembly RfN 7012.
In this arrangement, the shaft is stepped to permit the largest possible hub cross-section.

Constructions hints

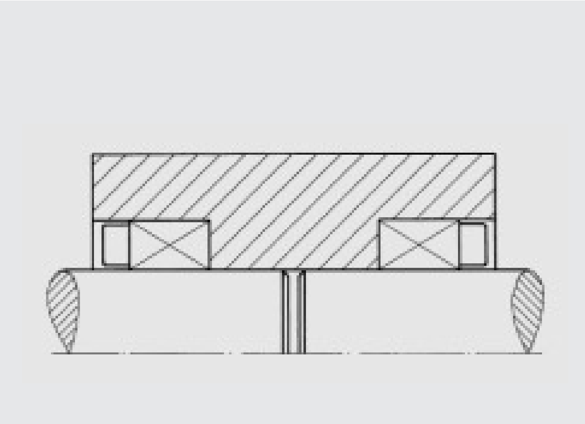


Fig. 13 · Connection of two shafts using one Locking Assembly RfN 7012 per shaft. The hub bore need not be stepped; if a through-bore hub is used, it is recommended that a centering ring be fitted to improve trueness of running.

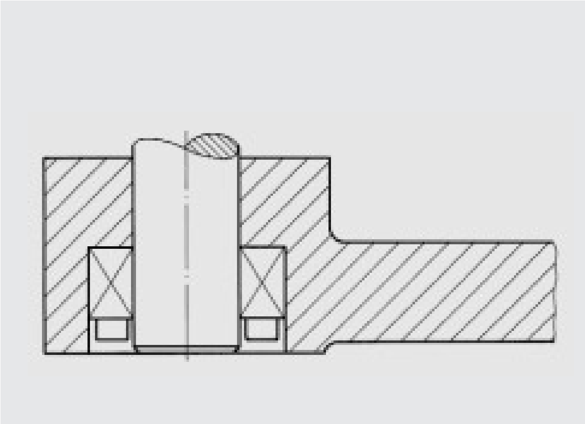


Fig. 14 · Lever mounted using one Locking Assembly RfN 7012.
Frictional-connection Locking Assembly permits stepless movement of the lever to any degree of accuracy required.

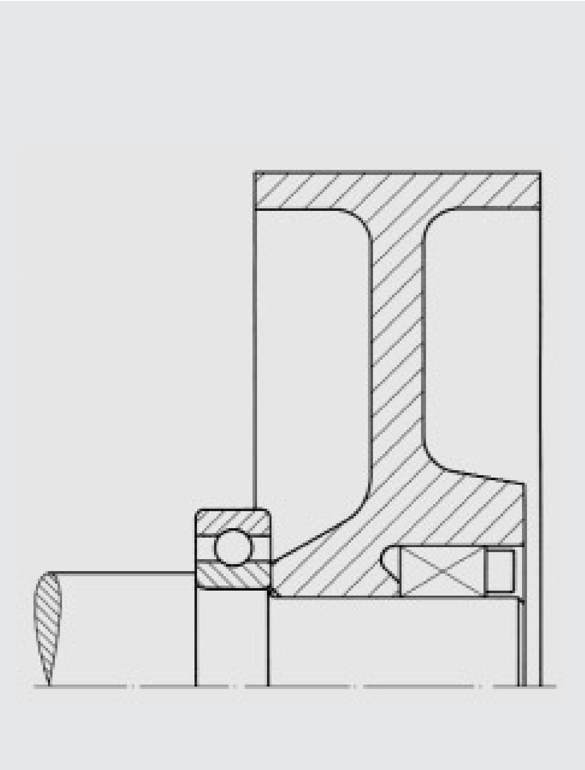


Fig. 15 · Flywheel mounted using one Locking Assembly RfN 7012.

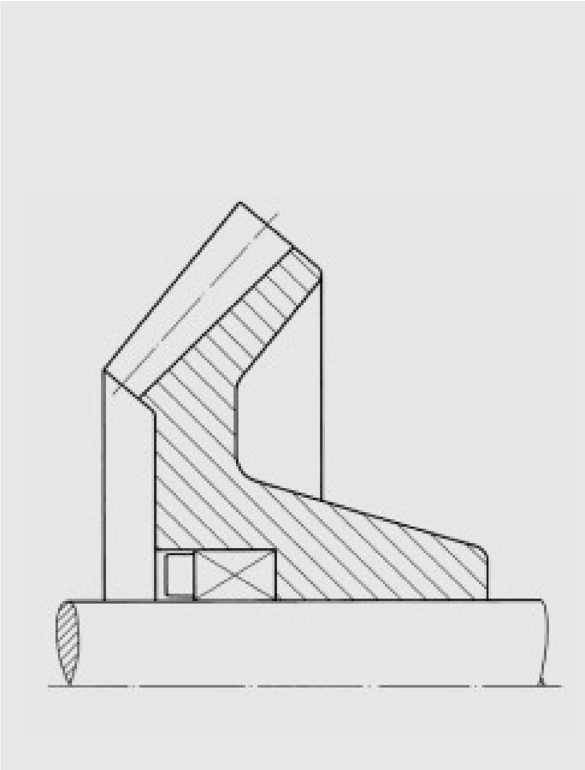


Fig. 16 · Bevel gear mounted using one Locking Assembly RfN 7012.
In this case the Locking Assembly transmits both the torque and the tooth pressure axial component.

Constructions hints

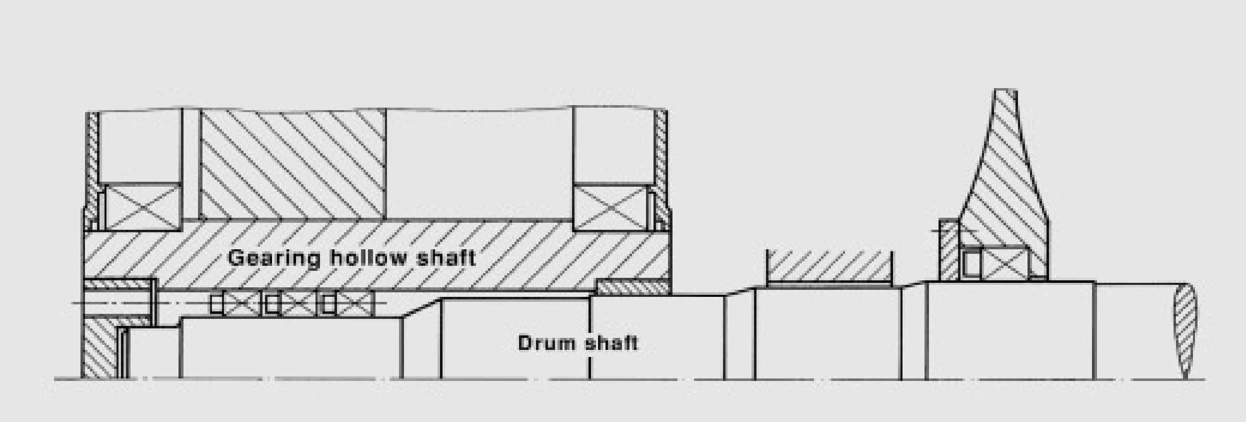


Fig. 17 · Shaft-mounted gearing secured using 3 Locking Assemblies RfN 7012.
Belt drum mounted using 2 Locking Assemblies RfN 7012.

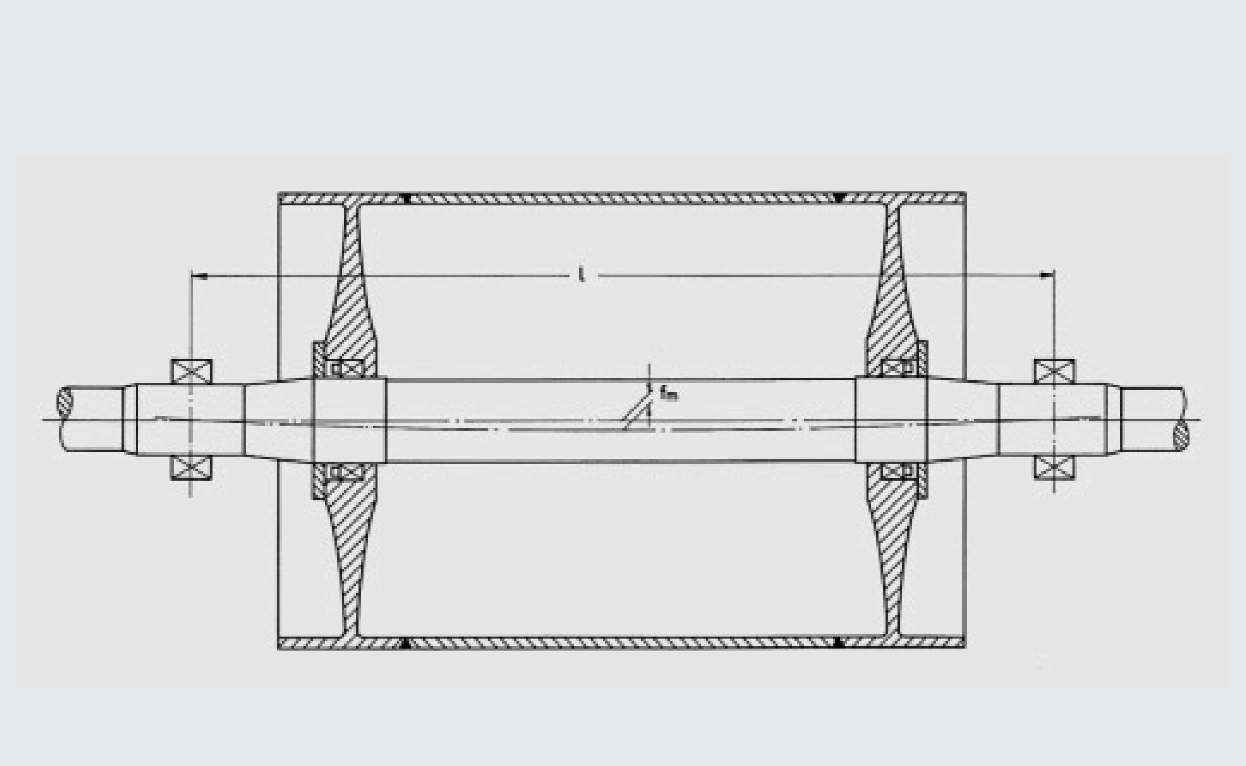


Fig. 18 · Belt drum mounted with Locking Assemblies RfN 7012.
With this and similar constructions, it must be ensured that the shaft deflections are kept within permissible limits. For practical purposes, the shaft deflection of $^1/_{2000}$ to $^1/_{3000}$ as related to the bearing spacing (recommended empirical value as quoted by the relevant industry). The drum-shaft connection on the drive side must be calculated for the full torque to be transmitted.

Constructions examples

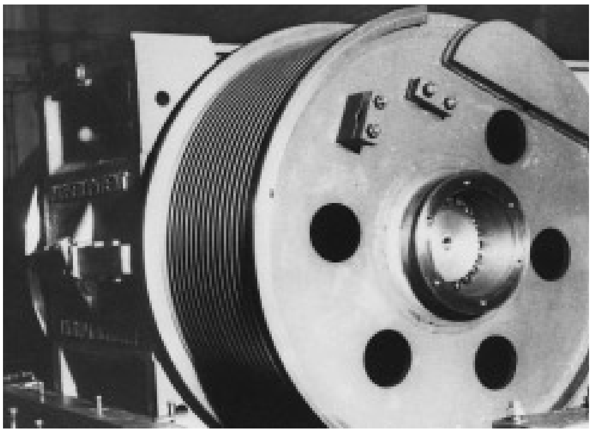


Fig. 19 · Cable drum of a 400 kN foundry crane.
The drum is mountedusing Locking Assemblies RfN 7012
Messrs. Koninklijke Nederlandsche Grofsmederij, Leiden, Netherlands, works photograph

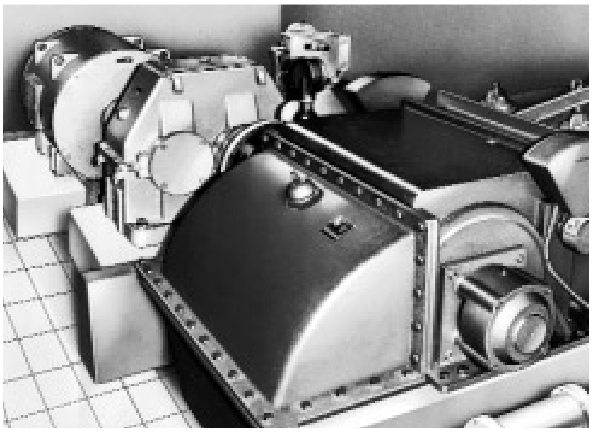


Fig. 20 · Ossberger turbine
The rotor is mounted using 2 Locking Assemblies RfN 7012.
Messrs. Ossberger Turbinenfabrik, Weissenburg, works photograph

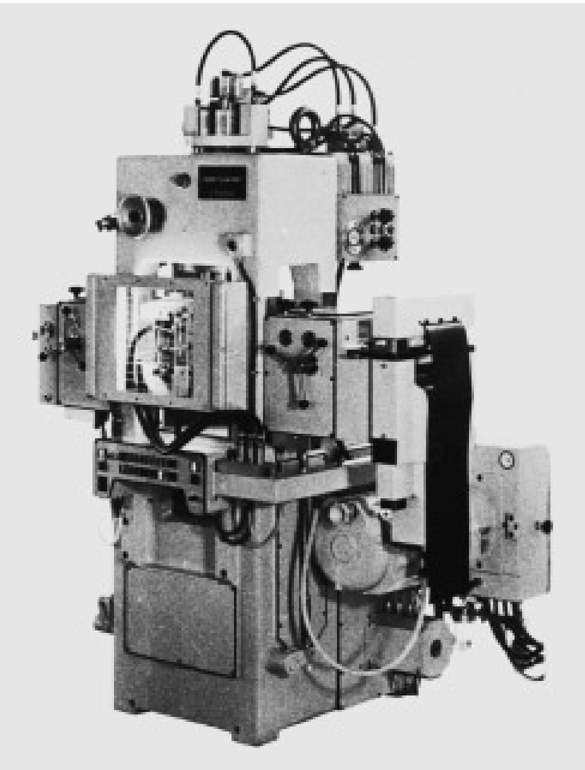


Fig. 21 · Precision stamping press.
Gearwheels mounted using Locking Assemblies RfN 7012.
Messrs. Osterwalder AG, Lyss/Switzerland, works photograph

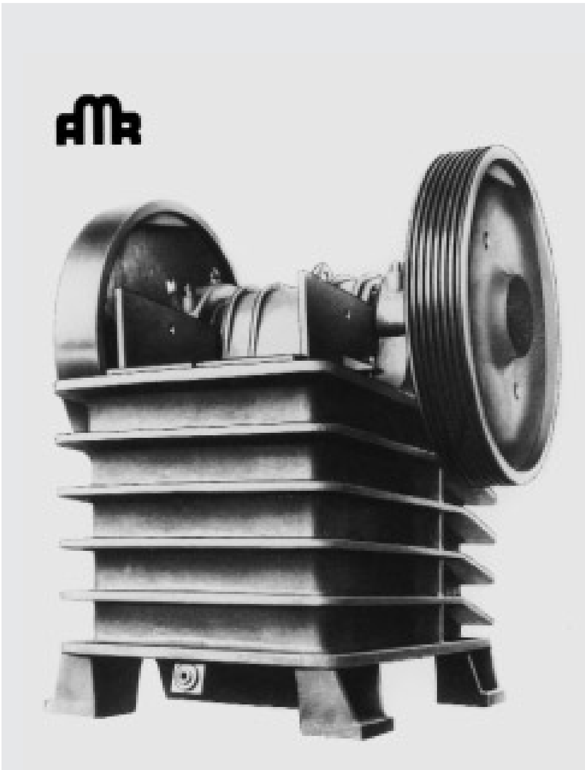


Fig. 22 · Primary crusher, Type 2 -1001.
Vee-belt pulley and disc-type flywheel mounted with Locking Assemblies RfN 7012.
Messrs. A. M¸ller, Rottweil, works photograph

Constructions examples

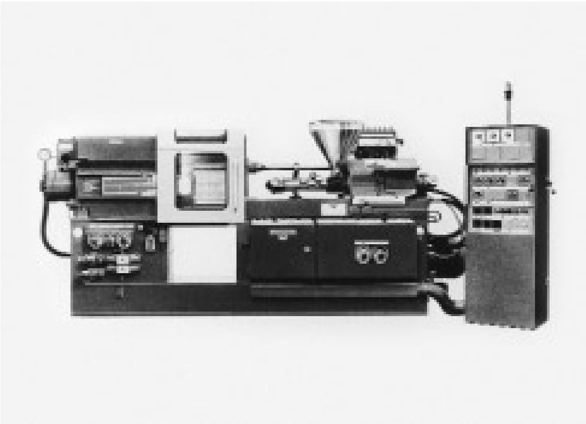


Fig. 23 · ANKER (R) Screw-type automatic injection moulding machine.
Locking Assemblies RfN 7012 are used for securing the cranks actuating the clamping plate.
Messrs. Ankerwerk Gebr. Goller, N¸rnberg, works photograph

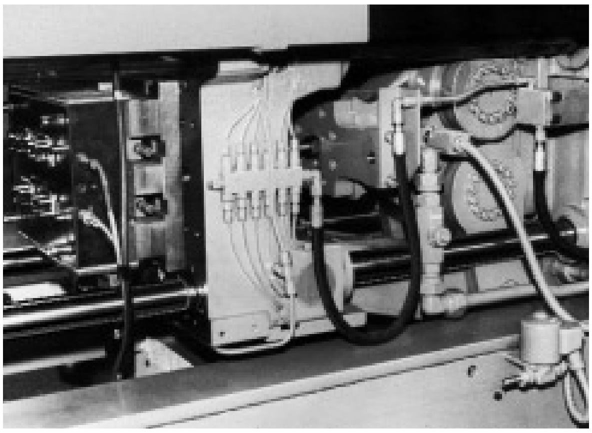


Fig. 24 · Details of the injection moulding machine shown in Fig. 23, with the cranks, Locking Assemblies RfN 7012, and plate.
Messrs. Ankerwerk Gebr. Goller, N¸rnberg, works photograph

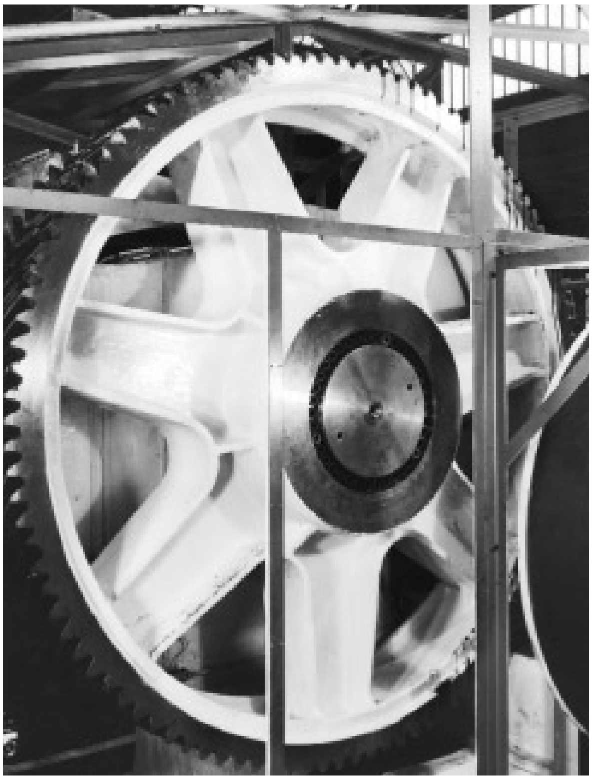


Fig. 25 · Crank press.
Gearwheel mounted with Locking Assemblies RfN 7012.
Messrs. Hatebur, works photograph

Fig. 26 · Bucket wheel excavator.
Locking Assemblies RfN 7012 used in bucket wheel, the bucket wheel drive, travelling gear drive, the belt drums, etc.
Messrs. Krupp, works photograph

Constructions examples

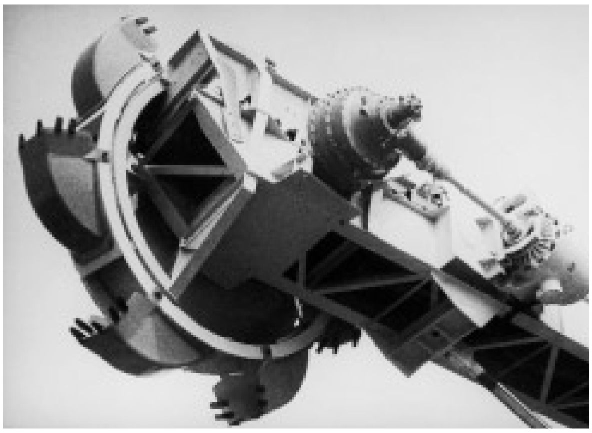


Fig. 27 · Bucket-wheel excavator.
Locking Assemblies RfN 7012 used in the bucket-wheel, slewing and travelling drives.
Messrs. DEMAG-Lauchhammer, works photograph

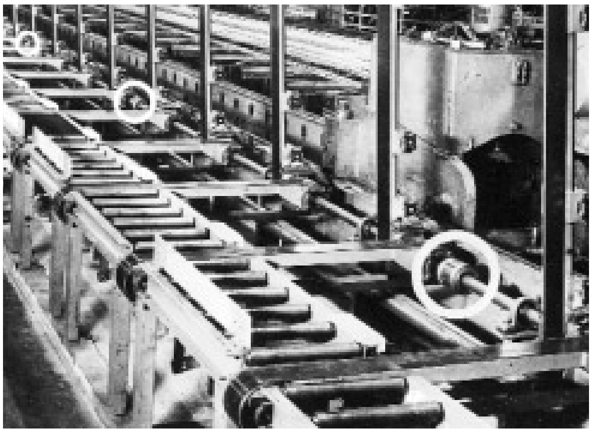


Fig. 28 · Shaft couplings.
Fitted with Locking Assemblies RfN 7012.
Messrs. B. Willy Lein, Hilden, works photograph

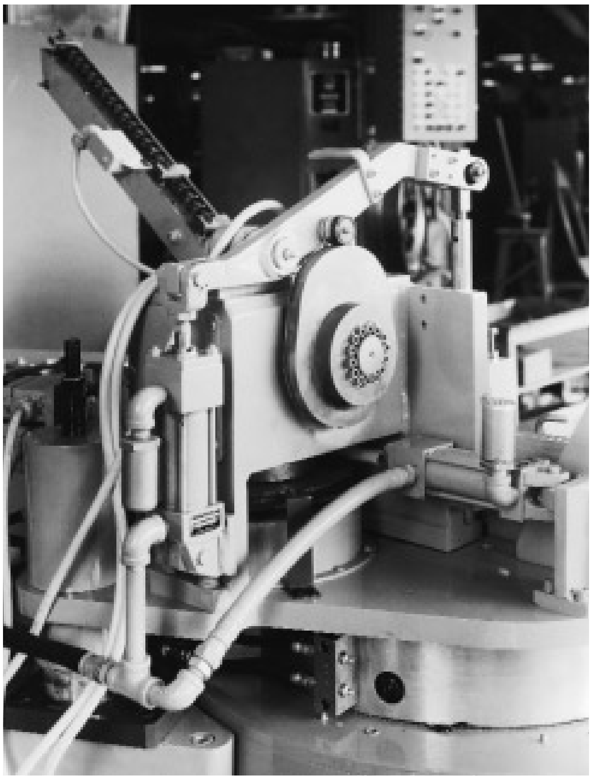


Fig. 29 · Automatic thread rolling machine.
Cam disc mounted using one Locking Assembly RfN 7012.
Messrs. Reed Rolled Thread Die Co., Holden/USA, works photograph

Fig. 30 · Single-column eccentric press.
Gearwheels mounted on the crankshaft with Locking Assemblies RfN 7012.
Messrs. A. Richter, Kassel-Lohfelden, works photograph

Constructions hints

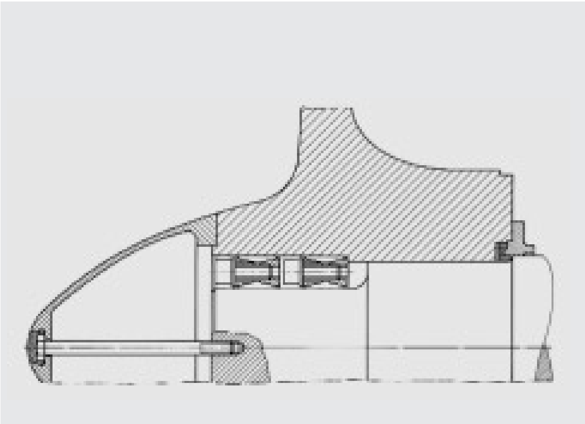


Fig. 31 · Ship propeller.
Mounted with 2 Locking Assemblies RfN 7012.

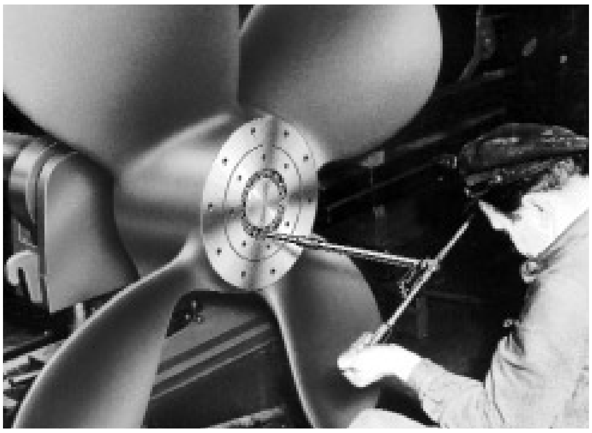


Fig. 32 · Ship propeller being fitted-fig. 31.
Deutsche Werft, works photograph

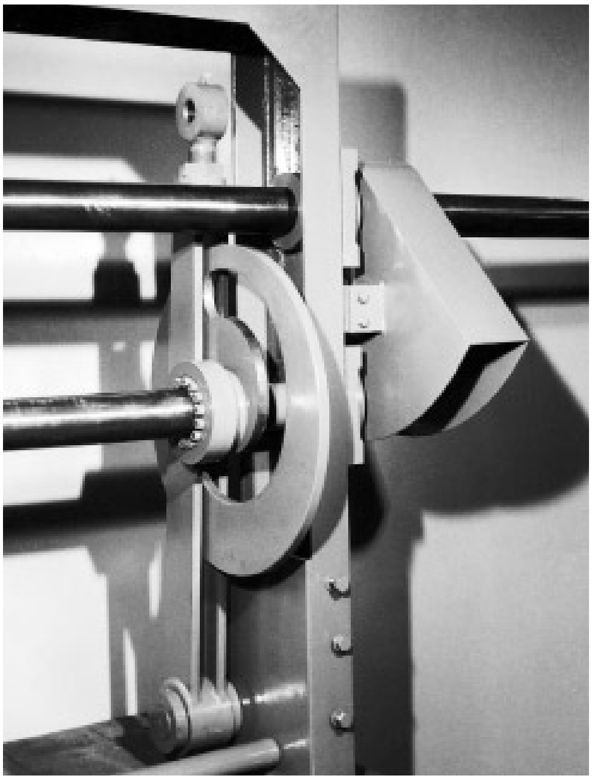


Fig. 33 · Cam actuator.
For the Ossberger turbine, cams mounted using Locking Assemblies RfN 7012.
Messrs. Ossberger Turbinenfabrik, Weissenburg, works photograph

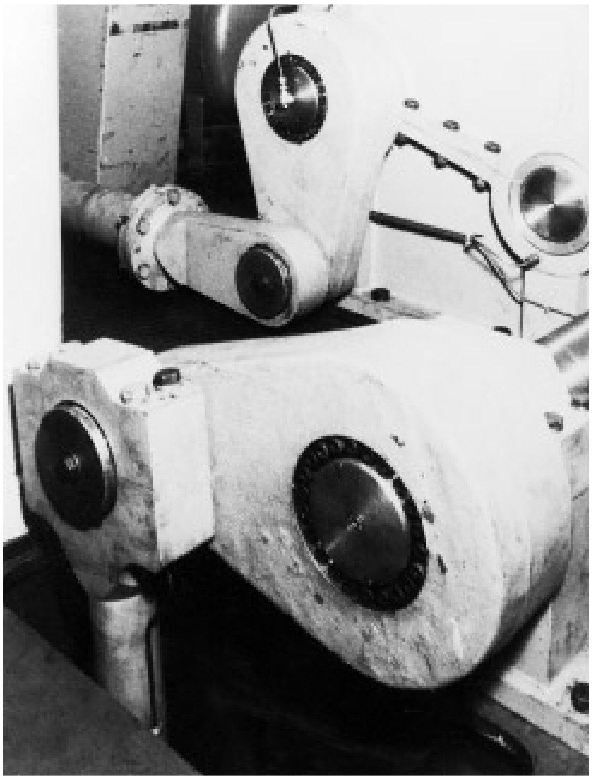


Fig. 34 · Lever mountings.
These levers are used in a hydraulic welding press; they are mounted using Locking Assemblies RfN 7012.
Messrs. Keller & Knappich GmbH, Augsburg, works photograph

Constructions examples

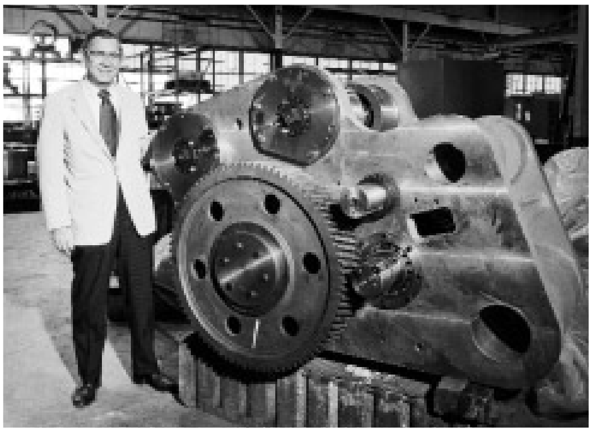


Fig. 35 · Bogiflex Drive TSP.
Locking Assemblies RfN 7012 in the pinion support.
Messrs. Tool Steel Gear & Pinion Co., Cincinnati/USA

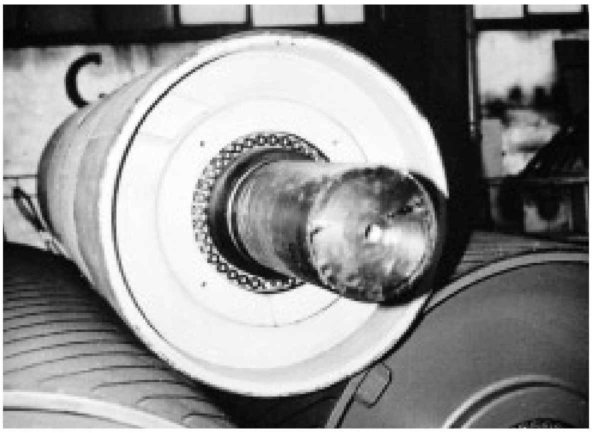


Fig. 36 · Conveying belt drums.
Mounted on the drum shaft using Locking Assemblies RfN 7012.
Messrs. Italsider Co./Italy

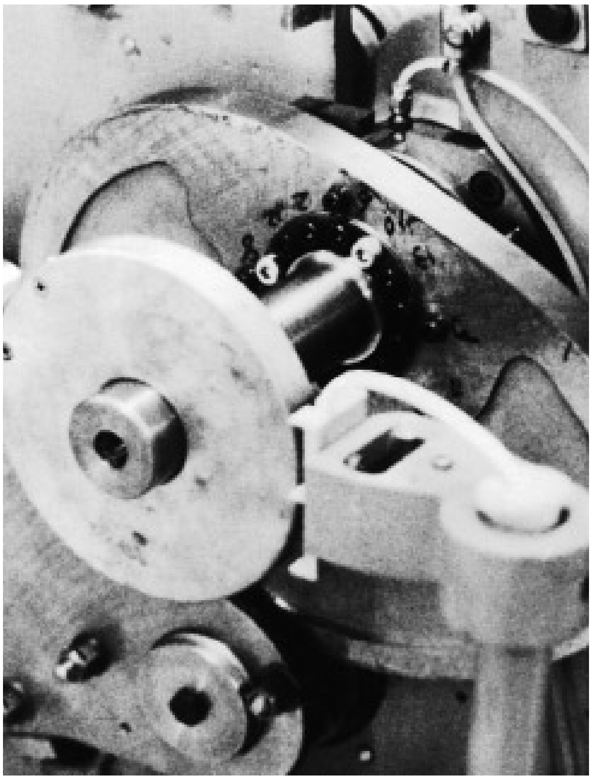


Fig. 37 · Textile machine.
A Locking Assembly 55 x 85 RfN 7012 is used for mounting the cam.
Messrs. Tsudakoma Industrial Co., Ltd., Kanazawa/Japan
SACAM, Mulhouse / France

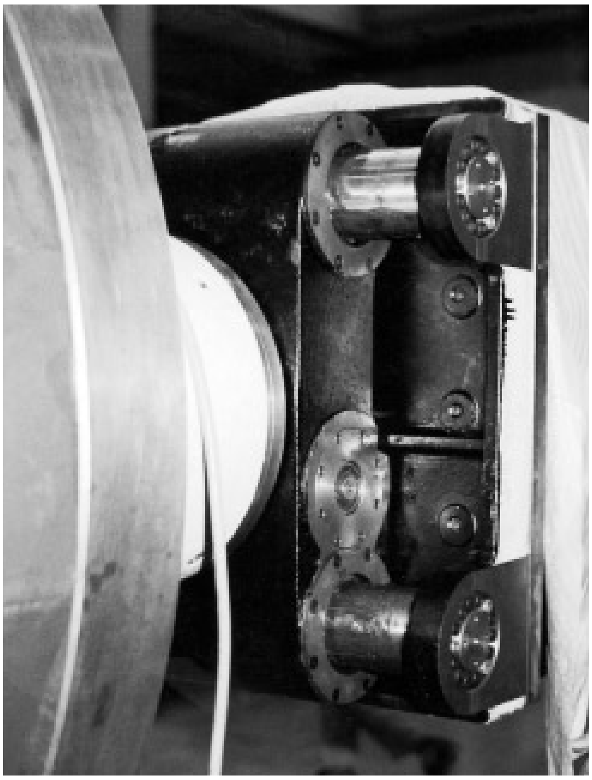


Fig. 38 · Medical betatron ray machine for cancer treatment.
Positioning for radial guide with Locking Assemblies 70 x 110 RfN 7012.
Messrs. Shimazu Seisakusho, Kyoto/Japan

Constructions examples

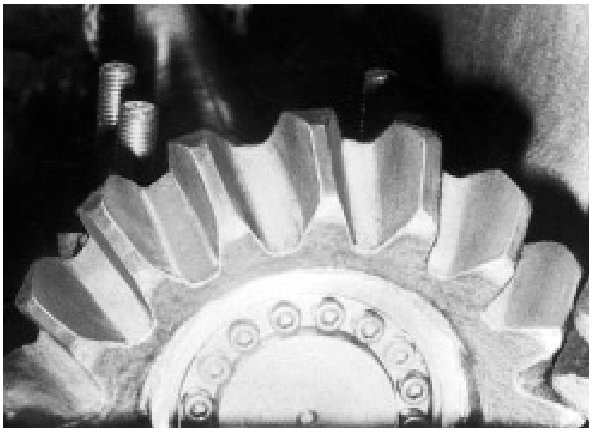


Fig. 39 · DEMAG standard-gauge Diesel-driven crane.
Bevel gears mounted with Locking Assemblies RfN 7012.
Waggonfabrik Uerdingen AG, works photograph

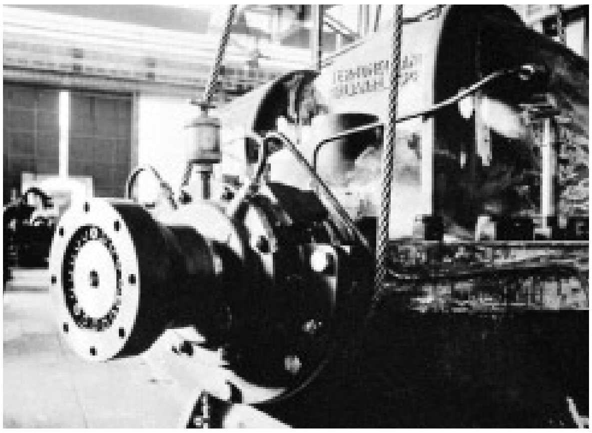


Fig. 40 · Ore transporter.
Locking Assemblies RfN 7012 used in belt drums and shaft mounted gearings.
Pohlig-Heckel-Bleichert AG, Rohrbach, works photograph

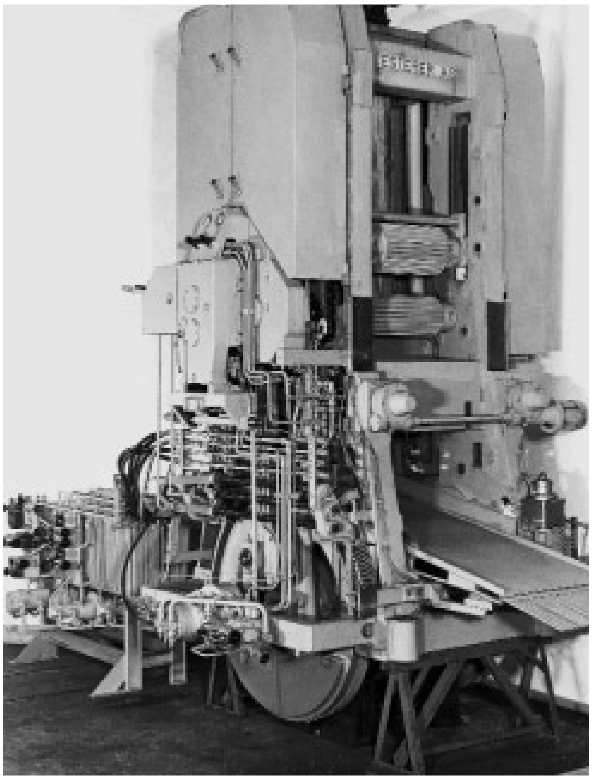


Fig. 41 · Saw frame.
Connecting rod mounted with Locking Assembly RfN 7012.
Esterer AG, Altˆtting, works photograph

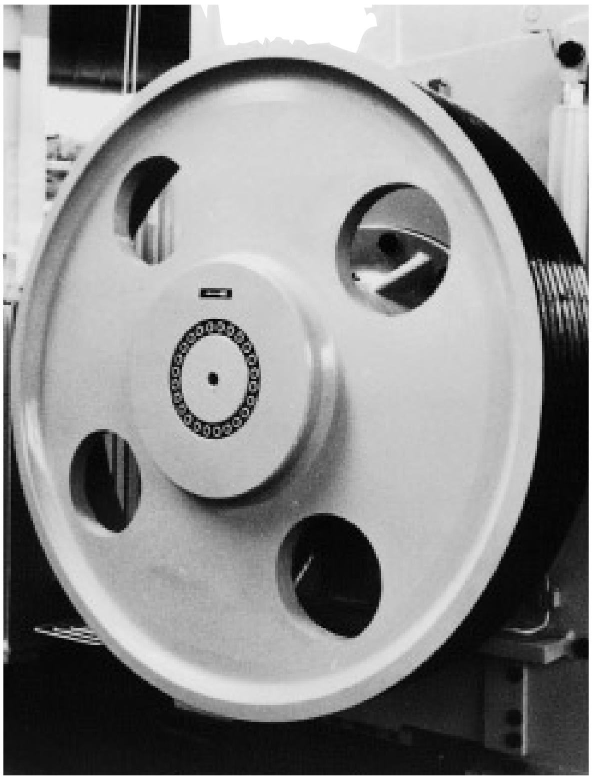


Fig. 42 · Pipe cutting mill.
Locking Assemblies RfN 7012 used in vee-belt pulleys.
Messrs. Pallman, Zweibrücken

Constructions examples

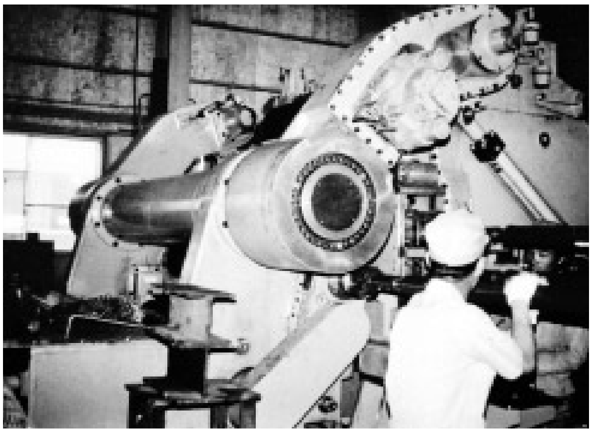


Fig. 43 · Winder machine.
Lever mounted with Locking Assemblies 300 x 375 RfN 7012.
Messrs. Nishimura Co. Ltd., Japan

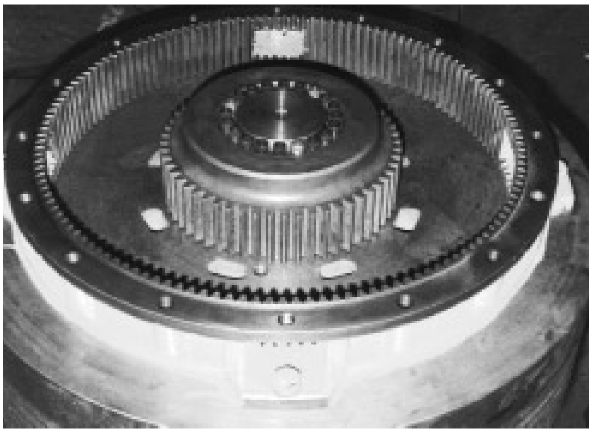


Fig. 44 · Bolt forming machine.
Pinion mounted with Locking Assembly 120 x 165 RfN 7012.
Messrs. Sakamura Machine Mfg. Co. Ltd., Japan

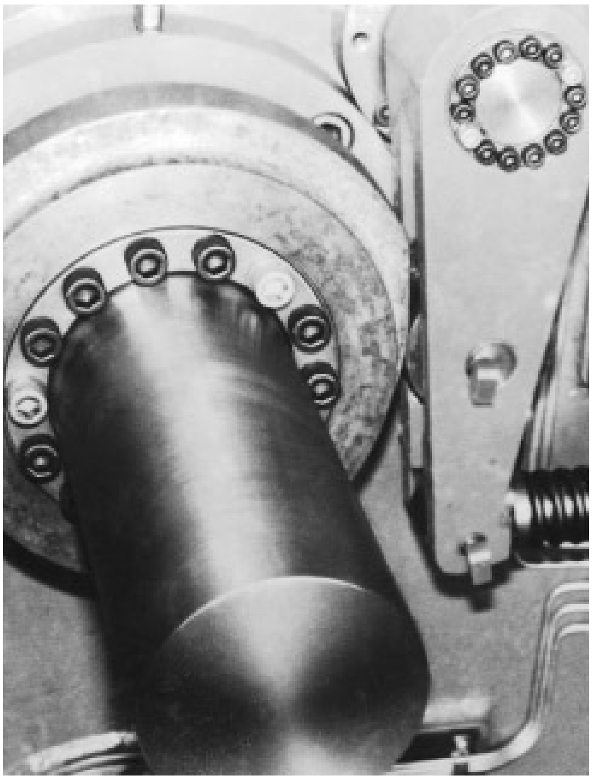


Fig. 45 · Bolt forming machine.
Locking Assemblies RfN 7012 used in levers, can discs and vee-belt pulleys.
Messrs. Sakamura Machine Mfg. Co. Ltd. Japan

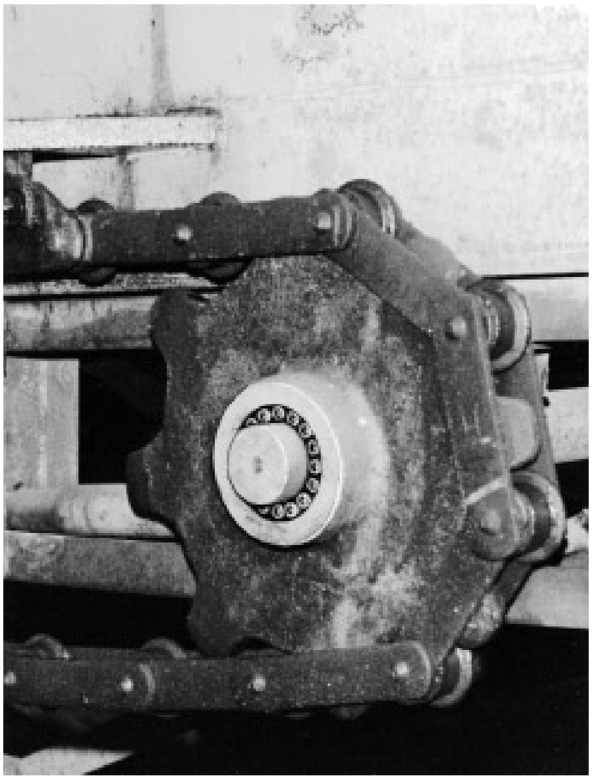


Fig. 46 · Chain conveyor.
Sprockets mounted with Locking Assemblies 70 x 110 RfN 7012.
Messrs. Hitachi Zosen Co. Ltd., Japan

The ABC of Locking Assemblies RINGFEDER® RfN 7012

Adjustability

The friction-lock connection by means of Locking Assemblies RfN 7012 is infinitely variable and can be adjusted with a high degree of accuracy.

Axial force F_{ax}

The axial thrust that can be transmitted by Locking Assemblies RfN 7012, regardless of the type of load encountered (static, increasing, alternating or impact). Fax can be calculated by dividing the torque by the shaft radius (Fax = 2 x T/d). In comparison with these theoretical values, substantially higher values have been established in practical operations. (values for Fax see table on page 6.)

Calculations

Locking Assemblies RfN 7012:	see page 10
Hubs:	see page 11
Hollow shafts:	see page 11

Centering action

Guiding action of the shaft in the minor bore of the hub. The clearance between shaft and hub bore and the length of the minor bore have the greatest effect on True running of the mounted hub.

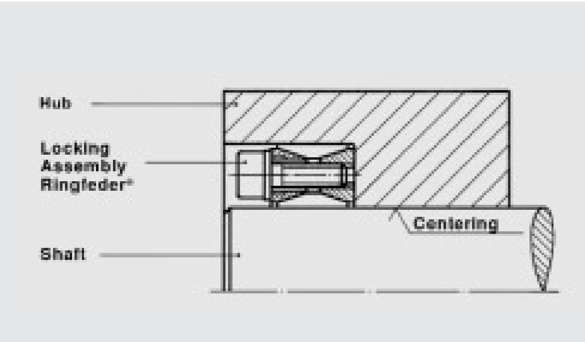


Fig. 47 · Locking Assembly RINGFEDER®
Principle sketch.

Clearances see page 7

Coefficient of friction

The catalogue values (table page 6) apply to μ = 0,12. Surfaces of the Locking Assemblies, shaft and hub bore slightly oiled with lubricants which do not contain → Molykote.

Contact pressure p, p'

p = contact pressure between inner ring and shaft.
p' = contact pressure between outer ring and hub
p and p' – together with the → Coefficient of friction μ – determine the frictional connection value. In order to avoid deformation in the plastic range, the following values must obtain:

$p < Rp_{0,2W}$ and
$p' < Rp_{0,2N}$

Deformations see page 11

Exchangeability see page 4

Fatigue strength under alternating torsion stresses

The greatest variable stress component oscillating about the mean stress zero a specimen can resist an unlimited number of times without fracture or inadmissible deformation (see DIN 50100). This value is influenced by shape and surface finish. The ratio between the fatigue strength of the unnotched and polished specimen is referred to a notch factor β_K.
β_K varies from material to material and decreases in value as the static tensile strength value increases.

When Locking Assemblies RINGFEDER® RfN 7012 are used, both shaft and hung retain their full crosssections, i.e. are not grooved. Consequently, the stress states at the connection point are virtually identical with those of a smooth shaft, i.e. the material is utilized by almost 100%.

Fitting see page 12

Fretting / Galling

Damage to or destruction of shaft, hub bore or Locking Assembly surfaces as a result of overloading followed by → Slip.
Fretting can always be avoided by correct dimensioning of the connection.

Fretting corrosion

Corrosion between the contact surfaces of ferrous metals. Even the smallest relative movements favour and accelerate fretting corrosion; lubricants can delay the process, but not stop it altogether. Longterm prevention of fretting corrosion can be achieved only by designing the connection in such a way that relative movement is impossible. Locking Assemblies RfN 7012 greatly facilitate the solving of this problem.

Locking screws – securing of

Screws subjected to static loads need not be secured against slackening (in some cases, lock washers, etc. can even be harmful). The screws used in conjunction with Locking Assemblies are normally subjected to static loads only; consequently, they need not be secured against loosening. Tightening down to the specified torque value is quite adequate.

Molykote

Trade name of a lubricant containing molybdenum disulphide (MoS_2). As MoS_2 reduces the Coefficient of friction, it is used for frictional connections between shafts and hubs in exceptional cases only. We urgently recommend that our advice be sought if it is intended that lubricants containing MoS_2 be used in conjunction with Locking Assemblies.

Notch factor β_k

→ Fatigue strength under alternating torsion stresses.

Notch impact strength figure η_k

Produkt of the → Shape factor α_k (governed by material configuration) and the → Notch factor β_k (governed by material properties):

$$\eta_k = \frac{\beta_k - 1}{\alpha_k - 1}$$

0,4...0,8 – light metals and c-steels
0,6...1 – heat-treatable steels.

Overload protection see page 5

Play, freedom from

Connections with Locking Assemblies RfN 7012 are absolutely free of play. Like other frictional connections there is no danger of lateral oscillation.

Polar section modulus W_p

In the case of circular cross sections, W_p is defined thus:
$W_p = d^3 \cdot \pi/16$

The value of Wp is significantly reduced by keyways, grooves for Woodruff and feather keys, etc. When using Locking Assemblies RfN 7012, the full cross-section of the shaft is available (see Shape factor α_k).

Radial load, admissible

Locking Assemblies RINGFEDER® RfN 7012 can also absorb radial loads. It must be considered, however, that the surface pressure resulting from the radial load with respect to the projected surface of the locking Assembly, is smaller than the surface pressure generated by the clamping (see also calculation on page 10).

Releasability

Locking Assemblies RfN 7012 are not self-locking. The angel of the tapered rings is such that releasability is guaranteed even after prolonged heavy loading. Extractors are not required.

Removal see page 12

Rust

Because of the relatively high pressures per unit of area, rusting cannot take place between the effective surfaces of a Locking Assembly as well as shaft and hub Because of their split inner and outer rings the Locking Assemblies RfN 7012 cannot hermetically seal the clamping point. In this case we advise to use corrosion inhibitors, seals, etc. in order to protect the Locking Assemblies (locking screws) against corrosion.

Safety

The frictional connection values given in the tables are achieved or even exceeded if designing is correct and the connection properly made. The theoretical values are higher. Frictional connections of all types – including shrink fits and press fits – must be designed in such a way that the load peaks vary so greatly from case to case that we are unable to give any recommendations as regards specific safety factors.
Locking Assembly connections are insensitive to impact loads (see fig. 48).

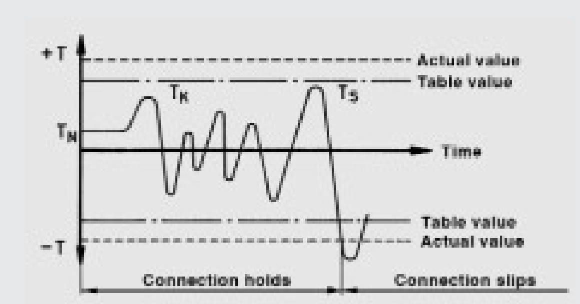


Fig. 48

Shape factor α_k

Proportionally factor covering stress conditions at bores, cross-section transitions, clamping points, grooves, etc. The following applies:

$$\alpha_k = \frac{\sigma_{max}}{\sigma_n} = \frac{\text{Höchstspannung}}{\text{Nennspannung}}$$

(use smallest cross-sections and/or resistance moments when determining σ_n).
For smooth shafts $\alpha_k = 1$

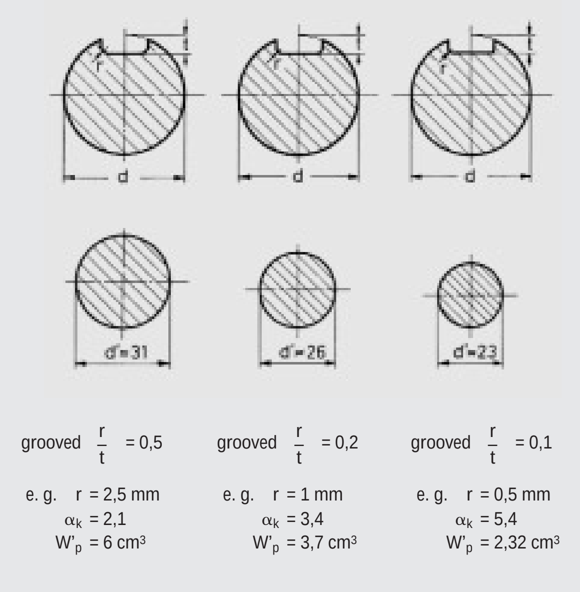


Fig. · 49 · Influence of the groove shape on shape factor α_k and thus on the →Polar moment of resistance; extract from the work of Prof. Thum. 40 mm (Wp = 12,56 cm³).

For smooth shafts $\alpha_k = 1$.

Slip

All shrink fits slip on overloading taking place.
→ Fretting of the contact (slipping) surfaces normally unavoidable. Locking Assemblies subjected to high pressures per unit of area and rotating at high peripheral speeds can be completely destroyed. Under normal circumstances, the degree and type of destruction do not indicate the cause of slipping.

Slipping clutch

Locking Assemblies RINGFEDER® RfN 7012 are not suitable for use as a slipping clutch. With their overload protection effect they can only safeguard valuable machine components against damage (see also page 5).

Surface finish

Surface condition of shaft and hub bore. When using Locking Assemblies RfN 7012, $R_t \leqq 16$ µm.
(RMS ≦ 125 micro-inches).

Tangential stresses

Tensile stress in the hub bore or compression stress in the bore of hollow shafts as a result of the
→ Contact pressures between outer locking ring and hub and/or inner locking ring and hollow shaft. See page 11 for calculation.

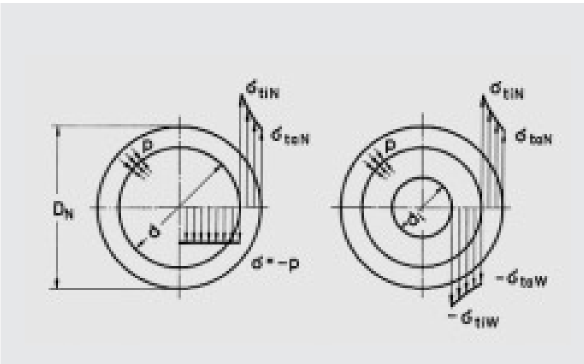


Fig. 50 · Tangential stresses in shrink fits.

Temperature, influence of

Shrink fits – and thus Locking Assembly RfN 7012 connections, too – give perfect service as long as the contact pressure in the joint does not drop below a certain minimum value. Consequently, contact pressure in the joint at operating temperature must be the subject of close attention. Please contact us for advice.

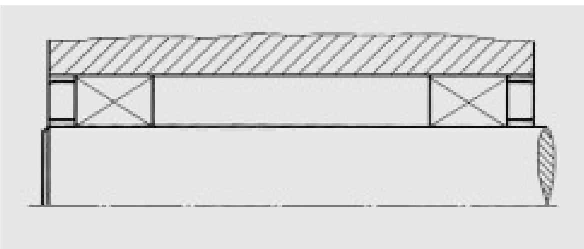


Fig. 51 · The air cushion between shaft and hub/boss has an insulating effect; consequently, heat transmission is poor. The result is a difference in temperature between shaft and hub. If both hub and shaft have the same linear expansion coefficients, the hub undergoes a higher degree of expansion than the shaft; the diminishing contact pressure reduces the frictional connection value.

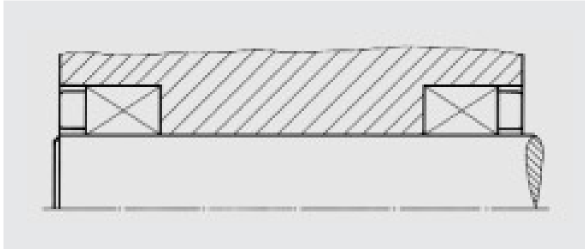


Fig. 52 · Due to the relatively close fit between shaft and hub, the heat is dissipated readily and no significant difference in temperature occurs. The contact pressure and thus the transmissible torque remain constant.

Tightening torque T_A

Controlled torque per locking screw generated by the torque wrench (see page 6, 7 and 10).

Torque wrench

Standard tool indicating the tightening torque exerted on the screw heads. As the friction lock of the Locking Assemblies RINGFEDER® RfN 7012 is proportional to the srew tightening torque, it is advised to use a torque wrench (see page 26).

True running

The relatively narrow Locking Assembly RINGFEDER® RfN 7012 serve mainly to transmit high torques and axial forces. They are not self-centering. True running of the hub/boss is thus governed by the → Centering action and the care taken during → Fitting.

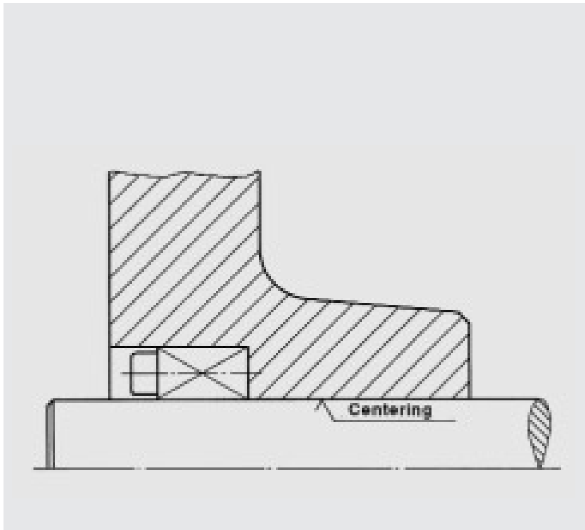


Fig. 53 · Pre-centering by selection of correct fit between shaft and hub.

Wear see page 5

Torque Wrenches

For controlled tightening of locking screws of Locking Assemblies RINGFEDER®, we offer suitable torque wrenches and attachments. These tools facilitate the installation of our Locking Assemblies RfN 7012 particularly on straight through shafts. They can be used, of course, also for mounting of Locking Assemblies RINGFEDER® RfN 7013, 7014, 7015 and Locking Elements RINGFEDER® RfN 8006 and other screwed or bolted connections.

The rigid square drives SSD and hex bit sockets exhibit compact over-all dimensions and can be combined with commercially available extensions. The SSD-drives fit with all MCCM torque handles. Square drives and hex bit sockets drives required for any given Locking Assembly size are listed in following table.

Locking Assemblies RfN 7012 Size		Recommended Tools		
from d	to d	Hex bit Sockets	Square Drives	Torque Wrench Handles
19	40	1/4– 5	SSD– 1/4	MCCM - 20 Nm
42	65	1/4– 6		MCCM - 100 Nm
70	95	3/8– 8	SSD– 3/8	
100	160	3/8–10		MCCM - 200 Nm
170	200	1/2–12	SSD– 1/2	
220	300	1/2–14		MCCM - 600 Nm

Torque wrenches for larger Locking Assemblies are readily available

Description and operation

When preset torque is reached, you hear a click and feel the breakover. No disadvantages are caused by dials and indicators.

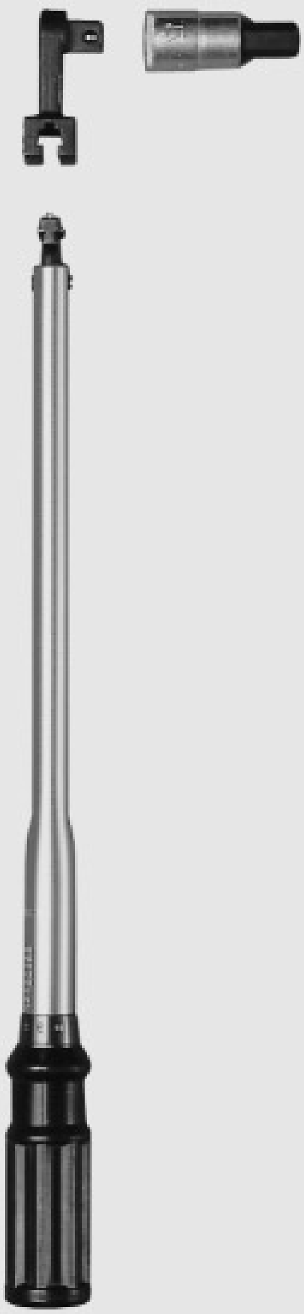
Torque setting is achieved by turning the adjustable micrometer torque habdle. Every setting point is felt by a distinct stop.

Torque setting cannot accidentally change while wrench is in use. By turning the lock screw located at the end of handle counter-clockwise (“Lock”), the adjustable handle is locked. By turning it clockwise (“Unlock”), the handle is unlocked.

Frictionless adjustment mechanism permits high torque accuracy even after prolonged use.

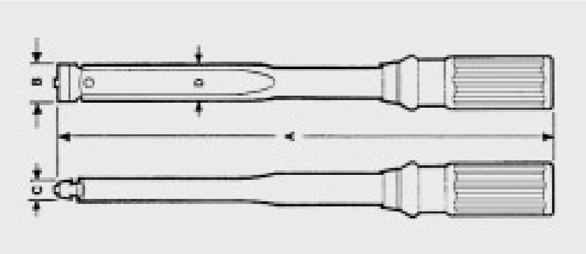
Slim design and light weight for better accessibility to fasteners and minimum operator fatigue.

Required attachments slide on easy onto the dovetailed and pin locked torque handle. For release of attachments, the spring loaded lock pin can be easily depressed by a pin or screw driver.



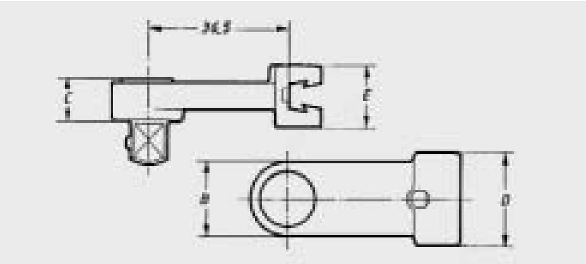
…and accessories

Torque Wrench Handles



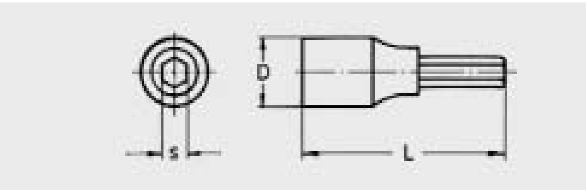
Designation		MCCM - 20 Nm	MCCM - 100 Nm	MCCM - 200Nm	MCCM - 600 Nm
Calibration in		Nm	Nm	Nm	Nm
Torque range		4 – 20	20 – 100	50 – 200	100 - 600
Graduation		0,2	1	1	0,5
Weight	kg	0,32	0,5	0,64	3,9
A max.	mm	235	330	406	915
A min.	mm	216	303	384	903
B	mm	78	107	107	254
C	mm	51	102	118	660
F	mm	25	25	25	51

Square Drives



Designation	Square Drive size	A	B	C	D
			mm		
SSD – 4	4 "	44	14	19	19
SSD – s	s "	46	20	22	25
SSD – 2	2 "	48	22	25	28

Hex bit Sockets



Designation	Square Drive size	S	L	D
			mm	
4 – 5	4 "	5	55	11
4 – 6	4 "	6	55	11
s – 8	s "	8	52	18
s – 10	s "	10	52	18
2 – 12	2 "	12	60	24
2 – 14	2 "	14	60	24

Material standards – selection

Hints for material specifications and according values of yield strength

DIN	replaced by DIN EN	designation	aproximate range of yield point* N/mm²
1629		seamless tubes for special requirements	215 up to 355
1681		cast steel for common use	200 up to 300
Beibl. 1 1691		cast iron	98 up to 228 (0,1 – limit of elongation)
1692		malleable cast iron	200 up to 530
1693		spheroidal graphite cast iron	250 up to 500
1705		copper - tin and copper - tin - zinc - alloys	90 up to 180
1725	575	aluminium alloys	70 up to 380
17100	10025	structural and constructural steels	175 up to 365
17200	10083	heat-treatable steel	300 up to 560
17245		ferritic creep resistant cast steel	125 up to 540
17440		stainless steels	185 up to 600

* dependent on quality, kind of product and intended use

ISO-tolerances for shafts and bores

Allowances in µm (1 µm = 39.37 µin)

Nominal diameter of shaft (mm)		d 11		e 8		e 7		f 8		f 7		g 6		h 11		h 9		h 8		h 7	
above	to	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower
3	6	– 30	–105	– 20	– 38	– 20	– 32	– 10	– 28	– 10	– 22	– 4	– 12	0	– 75	0	– 30	0	– 18	0	– 12
6	10	– 40	–130	– 25	– 47	– 25	– 40	– 13	– 35	– 13	– 28	– 5	– 14	0	– 90	0	– 36	0	– 22	0	– 15
10	18	– 50	–160	– 32	– 59	– 32	– 50	– 16	– 43	– 16	– 34	– 6	– 17	0	–110	0	– 43	0	– 27	0	– 18
18	30	– 65	–195	– 40	– 73	– 40	– 61	– 20	– 53	– 20	– 41	– 7	– 20	0	–130	0	– 52	0	– 33	0	– 21
30	50	– 80	–240	– 50	– 89	– 50	– 75	– 25	– 64	– 25	– 50	– 9	– 25	0	–160	0	– 62	0	– 39	0	– 25
50	80	–100	–290	– 60	–106	– 60	– 90	– 30	– 76	– 30	– 60	– 10	– 29	0	–190	0	– 74	0	– 46	0	– 30
80	120	–120	–340	– 72	–126	– 72	–107	– 36	– 90	– 36	– 71	– 12	– 34	0	–220	0	– 87	0	– 54	0	– 35
120	180	–145	–395	– 85	–148	– 85	–125	– 43	–106	– 43	– 83	– 14	– 39	0	–250	0	–100	0	– 63	0	– 40
180	250	–170	–460	– 100	–172	– 100	–146	– 50	–122	– 50	– 96	– 15	– 44	0	–290	0	–115	0	– 72	0	– 46
250	315	–190	–510	– 110	–191	– 110	–162	– 56	–137	– 56	–108	– 17	– 49	0	–320	0	–130	0	– 81	0	– 52
315	400	–210	–570	– 125	–214	– 125	–182	– 62	–151	– 62	–119	– 18	– 54	0	–360	0	–140	0	– 89	0	– 57
400	500	–230	–630	– 135	–232	– 135	–198	– 68	–165	– 68	–131	– 20	– 60	0	–400	0	–155	0	– 97	0	– 63

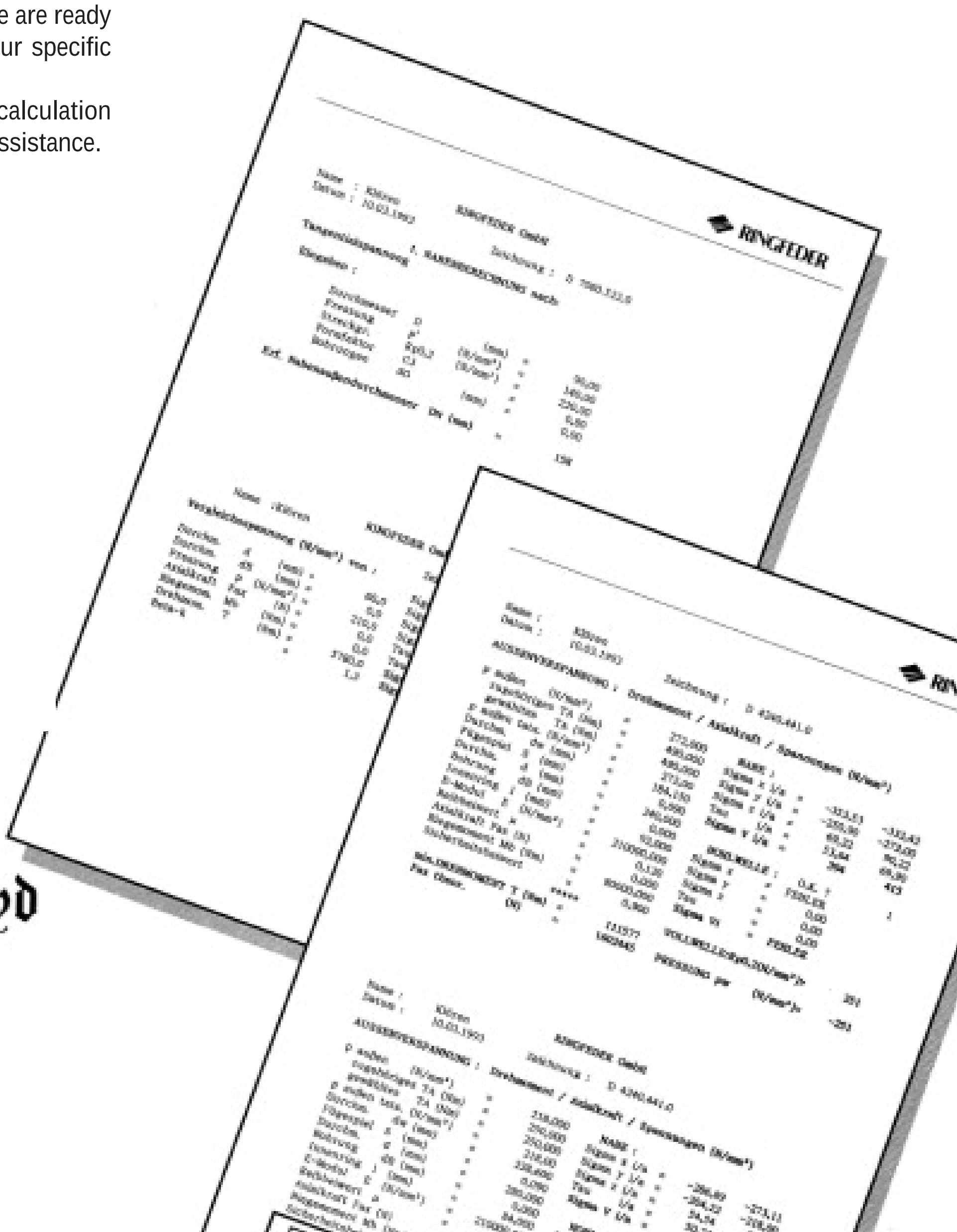
Nominal diameter of shaft (mm)		h 6		h 5		j 6		k 6		k 5		m 6		m 5		n 6		p 6	
above	to	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower
3	6	0	– 8	0	– 5	+ 7	– 1	–	–	–	–	+ 12	+ 4	+ 9	+ 4	+ 16	+ 8	+ 20	+ 12
6	10	0	– 9	0	– 6	+ 7	– 2	+ 10	+ 1	+ 7	+ 1	+ 15	+ 6	+ 12	+ 6	+ 19	+10	+ 24	+ 15
10	18	0	– 11	0	– 8	+ 8	– 3	+ 12	+ 1	+ 9	+ 1	+ 18	+ 7	+ 15	+ 7	+ 23	+12	+ 29	+ 18
18	30	0	– 13	0	– 9	+ 9	– 4	+ 15	+ 2	+11	+ 2	+ 21	+ 8	+ 17	+ 8	+ 28	+15	+ 35	+ 22
30	50	0	– 16	0	– 11	+ 11	– 5	+ 18	+ 2	+13	+ 2	+ 25	+ 9	+ 20	+ 9	+ 33	+17	+ 42	+ 26
50	80	0	– 19	0	– 13	+ 12	– 7	+ 21	+ 2	+15	+ 2	+ 30	+ 11	+ 24	+11	+ 39	+20	+ 51	+ 32
80	120	0	– 22	0	– 15	+ 13	– 9	+ 25	+ 3	+18	+ 3	+ 35	+ 13	+ 28	+13	+ 45	+23	+ 59	+ 37
120	180	0	– 25	0	– 18	+ 14	– 11	+ 28	+ 3	+21	+ 3	+ 40	+ 15	+ 33	+15	+ 52	+27	+ 68	+ 43
180	250	0	– 29	0	– 20	+ 16	– 13	+ 33	+ 4	+24	+ 4	+ 46	+ 17	+ 37	+17	+ 60	+31	+ 79	+ 50
250	315	0	– 32	0	– 23	+ 16	– 16	+ 36	+ 4	+27	+ 4	+ 52	+ 20	+ 43	+20	+ 66	+34	+ 88	+ 56
315	400	0	– 36	0	– 25	+ 18	– 18	+ 40	+ 4	+29	+ 4	+ 57	+ 21	+ 46	+21	+ 73	+37	+ 98	+ 62
400	500	0	– 40	0	– 27	+ 20	– 20	+ 45	+ 5	+32	+ 5	+ 63	+ 23	+ 50	+23	+ 80	+40	+108	+ 68

Nominal diameter of bore (mm)		D 11		E 8		E 7		F 8		F 7		G 7		H 11		H 9		H 8		H 7	
above	to	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower
3	6	+ 105	+ 30	+ 38	+ 20	+ 32	+ 20	+ 28	+ 10	+ 22	+ 10	+ 16	+ 4	+ 75	0	+ 30	0	+ 18	0	+ 12	0
6	10	+ 130	+ 40	+ 47	+ 25	+ 40	+ 25	+ 35	+ 13	+ 28	+ 13	+ 20	+ 5	+ 90	0	+ 36	0	+ 22	0	+ 15	0
10	18	+ 160	+ 50	+ 59	+ 32	+ 50	+ 32	+ 43	+ 16	+ 34	+ 16	+ 24	+ 6	+ 110	0	+ 43	0	+ 27	0	+ 18	0
18	30	+ 195	+ 65	+ 73	+ 40	+ 61	+ 40	+ 53	+ 20	+ 41	+ 20	+ 28	+ 7	+ 130	0	+ 52	0	+ 33	0	+ 21	0
30	50	+ 240	+ 80	+ 89	+ 50	+ 75	+ 50	+ 64	+ 25	+ 50	+ 25	+ 34	+ 9	+ 160	0	+ 62	0	+ 39	0	+ 25	0
50	80	+ 290	+ 100	+ 106	+ 60	+ 90	+ 60	+ 76	+ 30	+ 60	+ 30	+ 40	+ 10	+ 190	0	+ 74	0	+ 46	0	+ 30	0
80	120	+ 340	+ 120	+ 126	+ 72	+ 107	+ 72	+ 90	+ 36	+ 71	+ 36	+ 47	+ 12	+ 220	0	+ 87	0	+ 54	0	+ 35	0
120	180	+ 395	+ 145	+ 148	+ 85	+ 125	+ 85	+106	+ 43	+ 83	+ 43	+ 54	+ 14	+ 250	0	+100	0	+ 63	0	+ 40	0
180	250	+ 460	+ 170	+ 172	+100	+ 146	+100	+122	+ 50	+ 96	+ 50	+ 61	+ 15	+ 290	0	+115	0	+ 72	0	+ 46	0
250	315	+ 510	+ 190	+ 191	+110	+ 162	+110	+137	+ 56	+108	+ 56	+ 69	+ 17	+ 320	0	+130	0	+ 81	0	+ 52	0
315	400	+ 570	+ 210	+ 214	+125	+ 182	+125	+151	+ 62	+119	+ 62	+ 75	+ 18	+ 360	0	+140	0	+ 89	0	+ 57	0
400	500	+ 630	+ 230	+ 232	+135	+ 198	+135	+165	+ 68	+131	+ 68	+ 83	+ 20	+ 400	0	+155	0	+ 97	0	+ 63	0

Nominal diameter of bore (mm)		H 6		J 7		J 6		K 7		K 6		M 7		M 6		N 7		N 6		P 7	
above	to	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower	upper	lower
3	6	+ 8	0	+ 5	– 7	+ 4	– 4	–	–	–	–	0	– 12	– 1	– 9	– 4	– 16	– 5	– 13	– 8	– 20
6	10	+ 9	0	+ 8	– 7	+ 5	– 4	+ 5	– 10	+ 2	– 7	0	– 15	– 3	– 12	– 4	– 19	– 7	– 16	– 9	– 24
10	18	+ 11	0	+ 10	– 8	+ 6	– 5	+ 6	– 12	+ 2	– 9	0	– 18	– 4	– 15	– 5	– 23	– 9	– 20	– 11	– 29
18	30	+ 13	0	+ 12	– 9	+ 8	– 5	+ 6	– 15	+ 2	– 11	0	– 21	– 4	– 17	– 7	– 28	– 11	– 24	– 14	– 35
30	50	+ 16	0	+ 14	– 11	+ 10	– 6	+ 7	– 18	+ 3	– 13	0	– 25	– 4	– 20	– 8	– 33	– 12	– 28	– 17	– 42
50	80	+ 19	0	+ 18	– 12	+ 13	– 6	+ 9	– 21	+ 4	– 15	0	– 30	– 5	– 24	– 9	– 39	– 14	– 33	– 21	– 51
80	120	+ 22	0	+ 22	– 13	+ 16	– 6	+ 10	– 25	+ 4	– 18	0	– 35	– 6	– 28	– 10	– 45	– 16	– 38	– 24	– 59
120	180	+ 25	0	+ 26	– 14	+ 18	– 7	+ 12	– 28	+ 4	– 21	0	– 40	– 8	– 33	– 12	– 52	– 20	– 45	– 28	– 68
180	250	+ 29	0	+ 30	– 16	+ 22	– 7	+ 13	– 33	+ 5	– 24	0	– 46	– 8	– 37	– 14	– 60	– 22	– 51	– 33	– 79
250	315	+ 32	0	+ 36	– 16	+ 25	– 7	+ 16	– 36	+ 5	– 27	0	– 52	– 9	– 41	– 14	– 66	– 25	– 57	– 36	– 88
315	400	+ 36	0	+ 39	– 18	+ 29	– 7	+ 17	– 40	+ 7	– 29	0	– 57	– 10	– 46	– 16	– 73	– 26	– 62	– 41	– 98
400	500	+ 40	0	+ 43	– 20	+ 33	– 7	+ 18	– 45	+ 8	– 32	0	– 63	– 10	– 50	– 17	– 80	– 27	– 67	– 45	– 108

Technical service

Based on your technical drawings and data we are ready to execute installation proposals to solve your specific problems.
Many years of experience and modern calculation methods open extraordinary possibilities of assistance.



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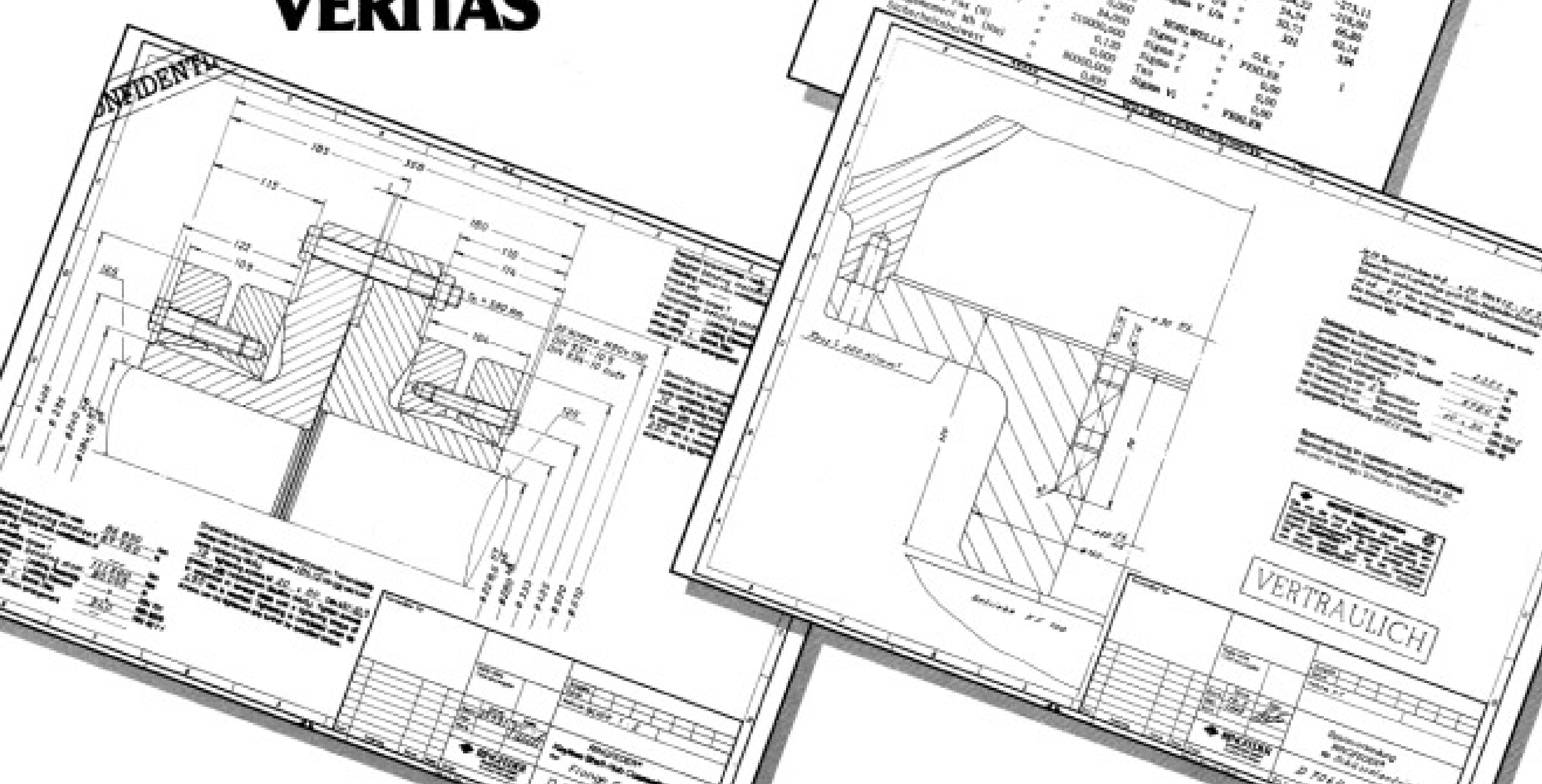

Fax enquiry (410)358-3142 (800)872-9329 Maryland Metrics

For technical assistance

To: RINGFEDER VBG GMBH, department KM
From:

Messrs.: ....
....
....

address: ....
....
....

contact: ....

phone: ....

department: ....

fax: ....

To make it easier for our technical staff and to avoid errors or mistakes your enquiry should include the following information:

Information for technical service

Expected maximum loads:

Max. torque	T_g	max.	=	.... Nm
Max. bending moment	M_g	max.	=	.... Nm
Max. axiall load	F_g	max.	=	.... kN
Max. radial load	F_r	max.	=	.... kN

Dimensionens, materials:

shaft diameter	d_W	=	.... mm
In case of hollow shaft, internal diameter	d_B	=	.... mm
Speed/revolutions	n	=	.... 1/min
Hub outside diameter	D_N	=	.... mm
Hub width	B	=	.... mm
Hub material/yield strength	$R_{p0,2N}$	=	.... N/mm^2
Shaft material/yield strength	$R_{p0,2W}$	=	.... N/mm^2
Temperature at the connection	Temp.	=	.... °C

Additional information: ....
....
....
....

Please send a drawing or sketch together with your enquiry!

RINGFEDER Products are available from MARYLAND METRICS

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For shaft-hub connections we supply:

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RINGFEDER® Locking Assemblies RfN 7013	for higher demands to concentricity
RINGFEDER® Locking Assemblies RfN 7013-IN	for shafts with inch-dimensions
RINGFEDER® Locking Assemblies RfN 7014	for extremely stressed shaft-hub connections
RINGFEDER® Locking Assemblies RfN 7015	self-centering, for highest transmission values as well as for the use in belt drums
RINGFEDER® Locking Elements RfN 8006	adaptable design for special requirements
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RINGFEDER® Shrink Discs RfN 4071 / 4091 / 4051 / 4073 / 4171	for external clamping
RINGFEDER® Shaft Couplings	for an absolutely rigid connection of shafts and high accuracy of alignment
Special designs	on request
Torque wrenches and accessories	for correct tightening conditions

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