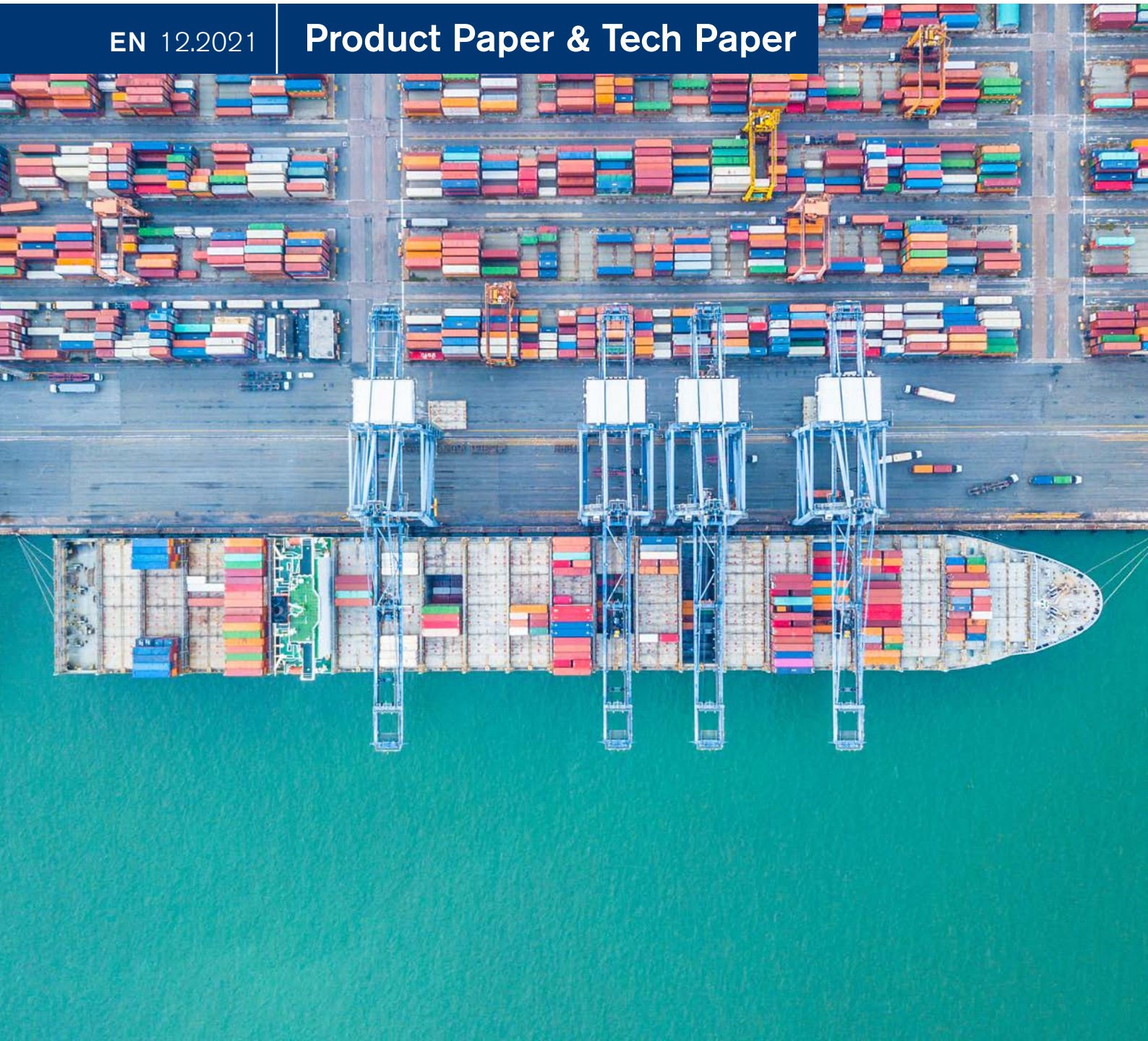
Partner for Performance

RINGFEDER

Barrel Couplings

RINGFEDER® TNK

EN 12.2021 | Product Paper & Tech Paper



Welcome


Machine Building


Aerospace


Process


Movement


Energy


Extraction

RINGFEDER
POWER TRANSMISSION

Your system supplier for every aspect of power transmission

We say what we mean and mean what we say.

We see things from our customers‘ perspective.

We are considerate of our employees and their families as well as of our environment and society.

RINGFEDER POWER TRANSMISSION is the global market leader in the niche markets of drive technology and is well regarded for its customer-specific, application-oriented solutions that ensure excellent and failure-free operation for its clients. We offer locking devices, damping technology and couplings for OEMs but also for the final customer under our strong brand name RINGFEDER®.

We do not only provide competent advice to our customers on the basis of our 90 years of experience but also develop innovative ideas in cooperation with them. This is part of our aspiration to be a **Partner for Performance**.

Around the power transmission we promise

- Excellent know-how for our challenging customers
- Best cost-benefit ratio
- Short reaction times and a high product availability


Know-how
Over 90 years of expertise.
Your expert partner
From development to the finished product.
Online calculation program
Always find the right solution.
On-site worldwide
We are there for you. Anytime, anywhere.
Customer
Value

RINGFEDER
POWER TRANSMISSION

Your projects are our drive

Know-how: Over 90 years of expertise.

Rely on decades of engineering expertise from the inventor of the friction spring. As an expert in drive and damping technology, we are your reliable partner wherever forces are at work. Be it the permanent transfer of very high torques due to non-positive or positive connections or the absorption and trapping of extreme energies to protect expensive constructions.

Your expert partner:
From development to the finished product.

We accompany you through to the successful completion of your project. Beginning with the development phase of your project, we offer our know-how and professional solutions. By working together with global market leaders and as an international supplier of outstanding products and special solutions, we are a reliable partner for you.

Online calculation program:
Always find the right solution.

In response to the complex requirements involved in the correct selection and design of the required products under practical conditions, we have developed our online calculation program. Engineers and experts are able to calculate transferable torques and other important values, taking into account various parameters. Visit our website **www.ringfeder.com!**

On-site worldwide:
We are there for you. Anytime, anywhere.

With our locations in Germany, the Czech Republic, the USA, Brazil, China and India as well as a worldwide service and partner network, we are there for you around the clock. This ensures our support for the successful completion of your projects at any time.

RINGFEDER®
Barrel Couplings

Introduction

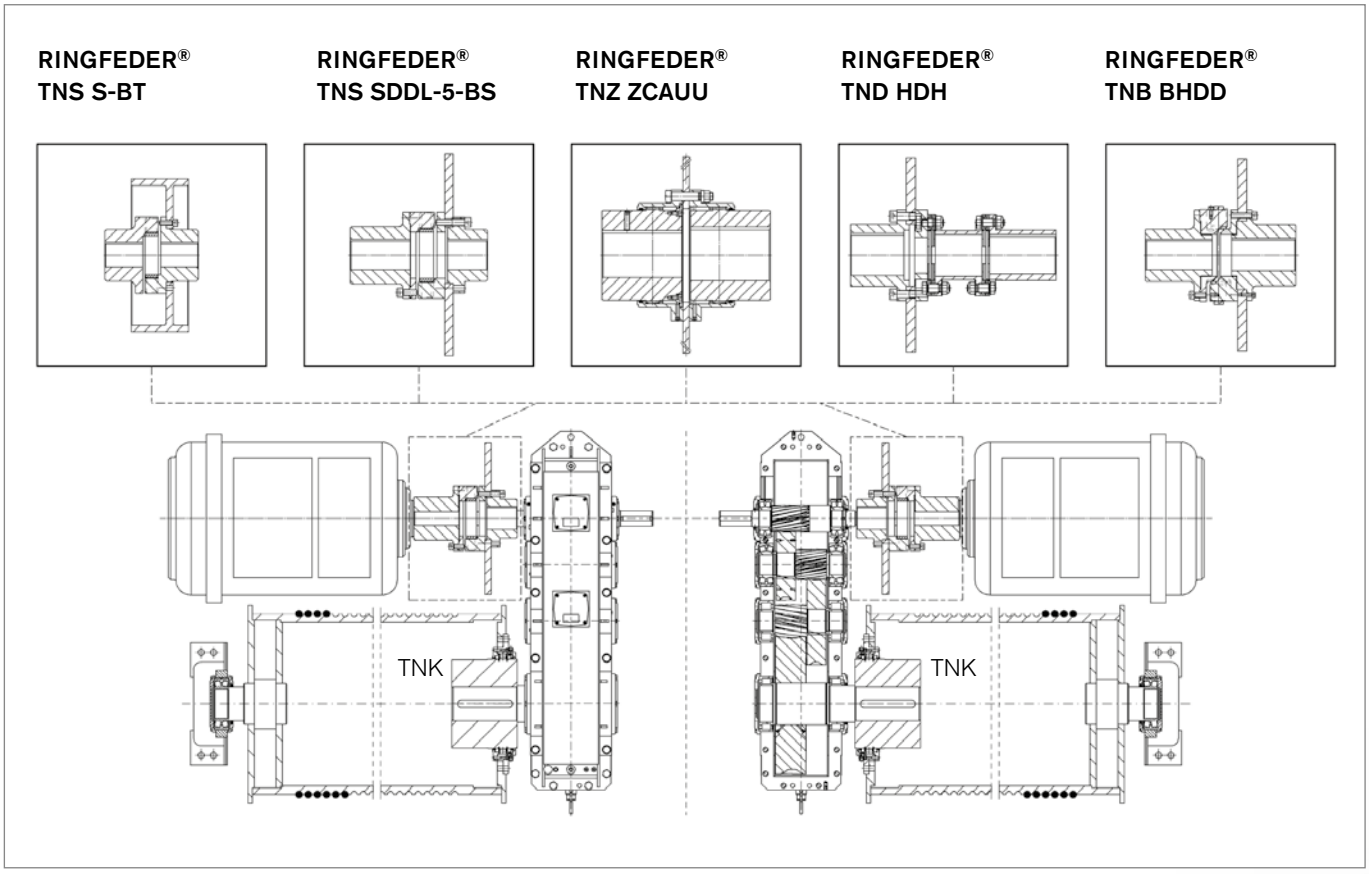
The barrel couplings complement the portfolio of the well-proven RINGFEDER® couplings for crane and hoisting gear applications. The comprehensive range of RINGFEDER® drive couplings that connect the driving motor with the gearbox and which are generally equipped with brake discs, or brake drums, where required, have been offered for decades as a package solution by brake manufacturers and distributed under their own name.

The optimized barrel coupling series for connecting the gearbox output shaft with the rope drum extends the RINGFEDER® portfolio of drive components and increases the interest of manufacturers and operators in selecting RINGFEDER® as their direct and reliable supplier for crane components.

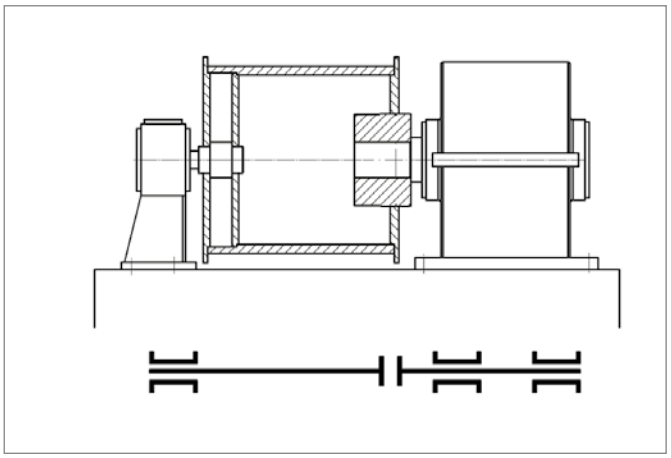
The particular feature of the barrel coupling, i.e. to transmit the torque via barrel-shaped hardened bodies being embedded in the spaces formed by the semi-circular toothings of the hub and the sleeve, ensures the safe transmission of radial forces while simultaneously compensating angular misalignments of the connected units.

The barrel coupling thus represents an articulated joint that turns a statically indeterminate system to a statically determinate one and, as a result, compensates operation-related deformations and prevents constraining forces.

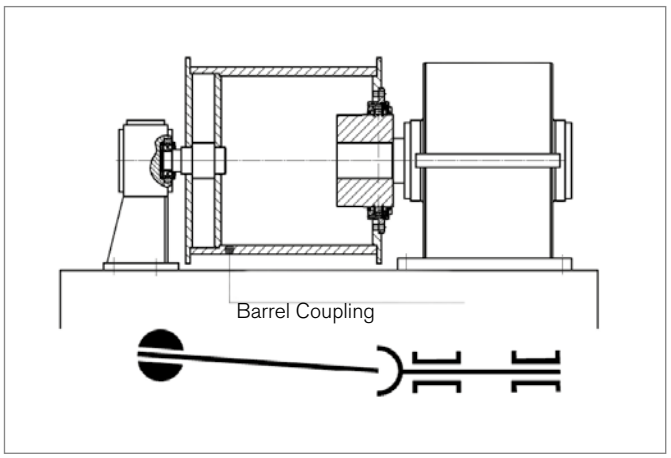
The wide range of RINGFEDER® drive couplings comprises the elastomeric, shock absorbing and fail-safe claw couplings of type RINGFEDER® TNS, the RINGFEDER® TNB couplings for very high torques, the gear couplings of type RINGFEDER® TNZ, to accommodate larger shaft misalignments and the maintenance-free steel disc couplings RINGFEDER® TND which are preferably equipped with brake discs, and optionally with brake drums.



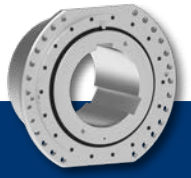
Configuration of a double rope drum drive in a hoisting gear



Statically indeterminate because of three-point bearing. Misalignment errors cause considerable undesired reaction forces.



Statically determinate situation produced by the barrel coupling (joint). Discrepancies from the alignment will be balanced out.

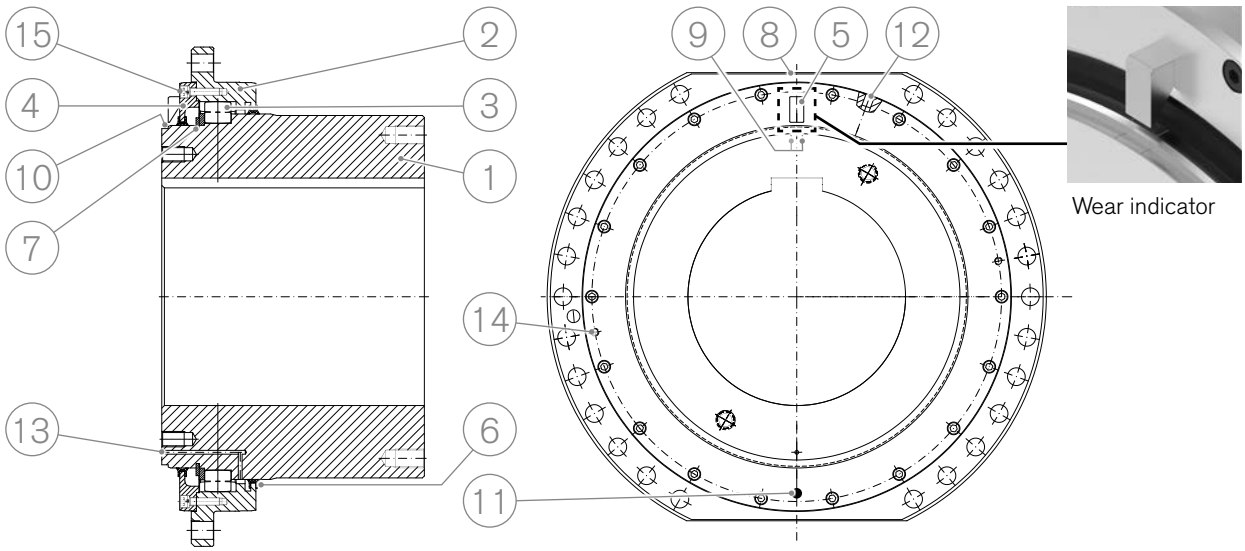


RINGFEDER® TNK TKVO

Performance and Application Optimized Type, Construction acc. to Operation Sheet of the German Steel Iron Industry SEB 666212

Disclaimer of liability
All technical details and notes are non-binding and cannot be used as a basis for legal claims. The user is obligated to determine whether the represented products meet his requirements. We reserve the right carry out modifications at any time in the interests of technical progress.

The barrels in the coupling typically dispose of an axial clearance so that axial movements between the rope drum and the gearbox are compensated. In such a configuration, the joint acts like a non-locating bearing. The inner cover integrated in the housing allows the hub diameter and thus also the bore diameter to be increased and fixes the barrel roller axially to the drum. To the outside and thus in the direction of the gear unit, axial fixation is provided by a retaining ring, which is also supported by an additional thrust ring. This construction complies with the specifications of the operation sheet of the German Steel Iron Industry SEB 666212. In some applications, the barrel coupling has to take the role of a fixed bearing what can be realized by design modifications. The use of high-strength materials allows a considerable increase of the transmission capability without requiring any change of the design and overall dimensions. As a result, a smaller coupling size can often be selected. The lower weight and the resulting lower acceleration forces contribute significantly to the energy efficiency of the crane.



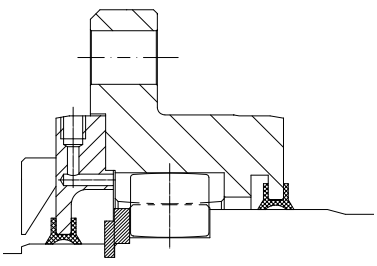
1. Hub
2. Sleeve
3. Barrel roller
4. External coverl
5. Wear indicator
6. Sealing ring
7. Retaining ring
8. Carrier face
9. Wear marking
10. Axial alignment marking
11. Assembly marking
12. Lubricant filler
13. Vent bore
14. Puller thread
15. Housing screws

Figure 1: Configuration and components of a barrel coupling

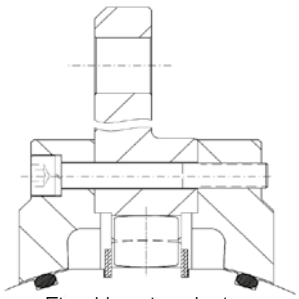
The torque that is induced via the gearbox output shaft is transfered over the hub and the barrel rollers into the housing. The housing transmits the torque into the drum over the bolting and two carrier faces provided on the rope drum.

The lip seal on the inside and the lip seal of the outer cover prevent foreign bodies from ingressing and lubricant from leaking out.

An indicator that is attached to the external cover (No. 5, Figure 1) allows to check the wear and the axial position (No. 10, Figure 1) of the coupling housing relative to the coupling hub. If the barrel coupling has to be dismounted, assembly markings ensure easy re-assembly at a later point of time.

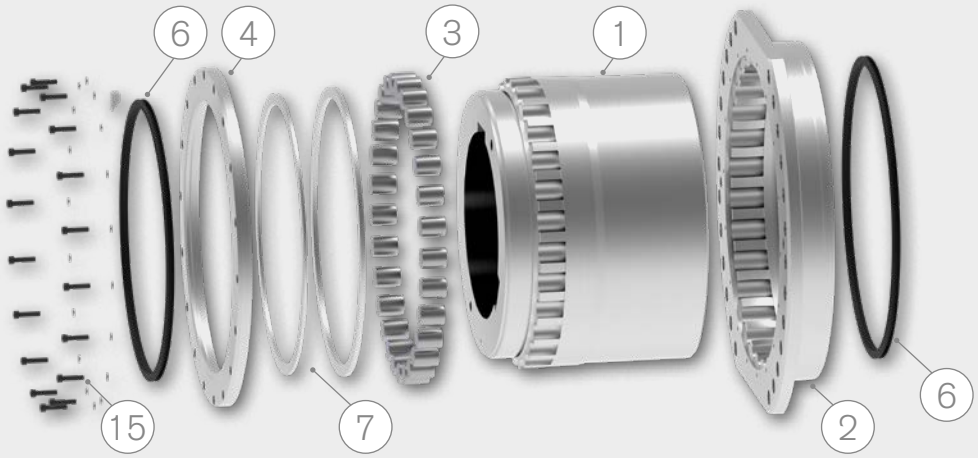


Non-locating bearing design with axial securing of the barrel bodies, internally by integration in the hub, externally with retaining ring and additional thrust ring



Fixed bearing design

1. Hub
2. Sleeve
3. Barrel roller
4. External cover
6. Sealing ring
7. Retaining ring
15. Housing screws



Coupling Size Selection

Considering the group classification according to FEM or DIN, the coupling size is determined on basis of:

1. the torque to be transmitted
2. the applied radial load
3. verification of the geometric dimension

1. Selection on basis of the torque to be transmitted

For the coupling size selection applies:

$$T_{Kmax} > T_K$$

T_{Kmax} = the type-dependent maximum torque of the barrel coupling (see Tables & Values)

It can be calculated on basis of:

a) maximum motor power or installed power
b) required motor power

a) Calculating the torque on basis of the maximum motor power Pi

In this approach, the power reserve of the motor is included in the calculation of the torque:

T_K	**=**	**9550 * Pi / n * k_1**	**[Nm]**
T_K	=	Coupling torque at the rope drum	[Nm]
Pi	=	Installed motor power	[kW]
n	=	Rotary speed of the rope drum	[rpm]
k_1	=	Service factor	[-]

Service factor k_1 to the group classification acc. to (*)

Class			Factor k_1
DIN 15020 (1974)	FEM (1970)	FEM 1.001 (1998) BS466 (1984)	
1 Bm	IB	M1, M2, M3	1,12
1 Am	IA	M4	1,25
2 m	II	M5	1,4
3 m	III	M6	1,6
4 m	IV	M7	1,8
5 m	V	M8	2
L4-T8-M8; L3-T9-M8; L4-T9-M8			2,2

(*) Service factor according to standardized calculation method, version (year)

b) Calculating the torque on basis of the required power P_N

In this approach, the torque required to lift the load is calculated taking into account the system-related additional forces:

P_N	=	$F_R * v_T / 60000$	[kW]
T_K	=	$9550 * P_N / n * k_1$	[Nm]
		or	
T_K	=	$F_R * D / 2 * k_1$	[Nm]
P_N	=	Required power	[kW]
F_R	=	Entire tackle at the drum, including the lifting gear paying regard to the efficiencies and drum bearings	[N]

(see 2. selection on basis of the radial load)

v_T	=	Rope velocity at the drum	[m/min]
D	=	Effective winding diameter at the drum	[m]

2. Selection on basis of the radial load acting on the barrel coupling

a) Determination of the radial load acting on the barrel coupling

The radial force F_S acting on the barrel coupling is composed of the pull on account of the working load and weight of the lifting device and of the impact of the rope sheave and the efficiency of the bearings.

F_S	=	$(Q + G) / (ir * \eta)$	[N]
Q	=	Max. force of the working load	[N]
G	=	Weight force of the lifting device and the rope (m *g)	[N]
m	=	Mass	[kg]
g	=	9.81 (gravity acceleration)	[m/s²]
η	=	Efficiency of the support bearing and lifting device bearing	[-]

The transmission ratio **ir** is determined as a function of rope fastening, number of pulley and tackles:

ir = Transmission ratio

$$= \frac{\text{Total number of rope lines in the lifting device}}{\text{Number of rope lines to the drum [-]}}$$

Efficiency η							
ir	2	3	4	5	6	7	8
η with plain bearings	0,92	0,9	0,88	0,86	0,84	0,83	0,81
η with ball bearings	0,97	0,96	0,95	0,94	0,93	0,92	0,91

Rope fastening both sides to drum

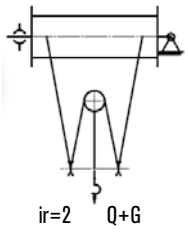


Fig. 2

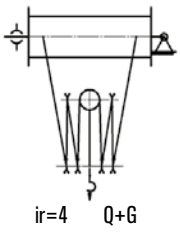


Fig. 3

Rope fastening one side with external fixed point

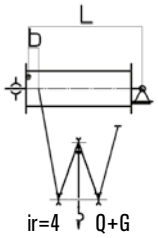


Fig. 4

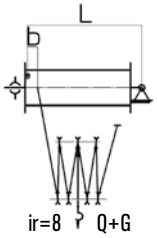


Fig. 5

The transmission ratio and the used bearings in the lifting device determine the efficiency η

b) Calculation of the radial load acting on the barrel coupling

In this approach, the impact of an inclined rope guide by the tackles and pulleys and the drum diameter is neglected because these effects, calculated by the equation below, reduce the radial force F_T acting on the barrel coupling.

For systems with two ropes at the drum, see fig. 2 & 3

$$F_T = F_S / 2 + W / 2$$

For systems with only one rope at the drum, see fig. 4 & 5

$$F_T = F_S (1 - b / L) + W / 2$$

W	=	Weight of the drum including rope and the connected parts of the barrel coupling	[N]
b	=	Minimal distance between rope and joint of the barrel coupling	[m]
L	=	Distance between the bearing locations of the rope drum	[m]

According to the design rules of FEM 1.001, version 1998 and BS466, version 1984, the safety factor k_2 has to be considered for the radial load:

Safety factor k_2				
Load spectrum	L1	L2	L3	L4
k_2	1,05	1,1	1,15	1,2

The value F_R which is to be calculated for the selected coupling must be lower than the permissible radial load F_{Rmax} indicated in the tables.

$$F_R = F_T \cdot k_2 < F_{Rmax} \qquad [Nm]$$

c) Size optimization on account of permissible correction of the calculation

The loads due to torque and radial force correlate, so that in case one of the maximum values is not fully used up, the other value can be corrected. This may in some cases allow the use of a smaller coupling size.

Case 1: Radial load correction -> F_C [Nm]
The torque capability of the selected size is not yet fully used and the calculated radial force FR is above the permissible value. It is:

$$F_C = F_{Rmax} + (T_{max} - T_K) \cdot C > F_R \text{ and } F_C < 1.5 \cdot F_{Rmax}$$

Case 2: Torque correction -> T_C [Nm]
The calculated torque is just above the permissible torque of the coupling, however, the permissible radial load FRmax is not yet fully used up. It is:

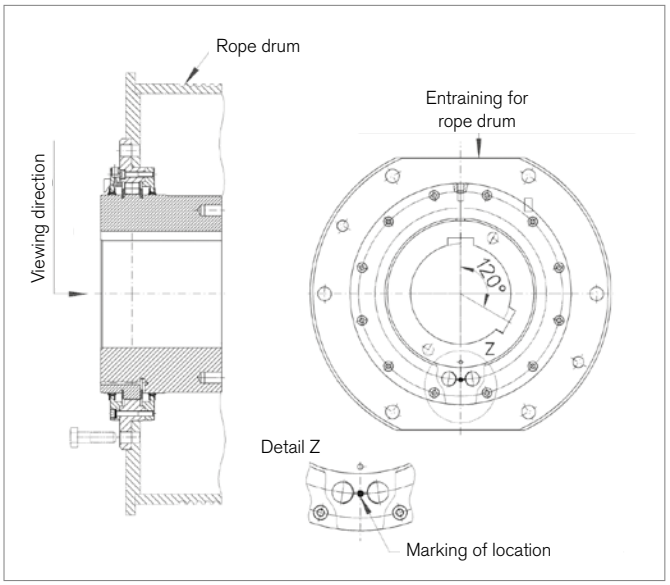
$$T_C = T_{max} + (F_{Rmax} - F_T) / (C \cdot k_1) \text{ and } T_C < 1.08 \cdot T_{max}$$

Correction factor C for T_{Kmax}/F_{Rmax}			
Coupling size	**C**	**Coupling size**	**C**
25	14,8	1000	4,4
50	13,7	1500	3,7
75	11,4	2100	3,6
100	10,8	2600	3,3
130	9,0	3400	3,3
160	8,7	4200	2,9
200	7,4	6200	2,6
300	7,2	8200	2,4
400	6,1	9200	2,2
500	5,3	10200	1,9
600	4,8	---	---

3. Checking the connection geometry

As a standard, the hubs of the barrel couplings are equipped with 2 keyways offset by 120° according to DIN 6885-1. The position of the keyways is always specified in viewing direction of the rope drum. Other hub-shaft connections can also be provided. The transmission capability of the hub-shaft connection has to be checked for each type of connection. If an interference fit is used as a hub-shaft connection, the influence of the interference on the functionally required clearance of the barrel coupling has to be checked by us.

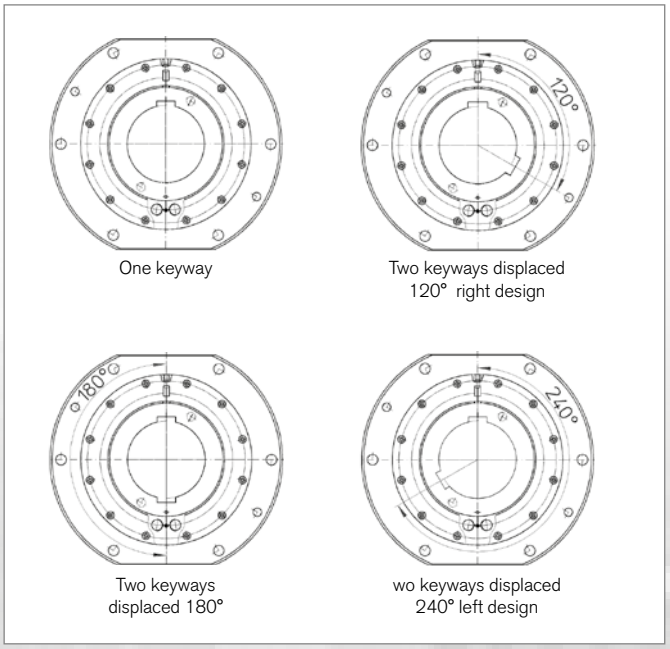
The installation of a hub with interference fit is often done in warm condition of the hub. This requires the prior removal of the barrel coupling. While assembling the individual components, the position marking must always be observed. This marking can be found on a tooth opposite to the wear marking.

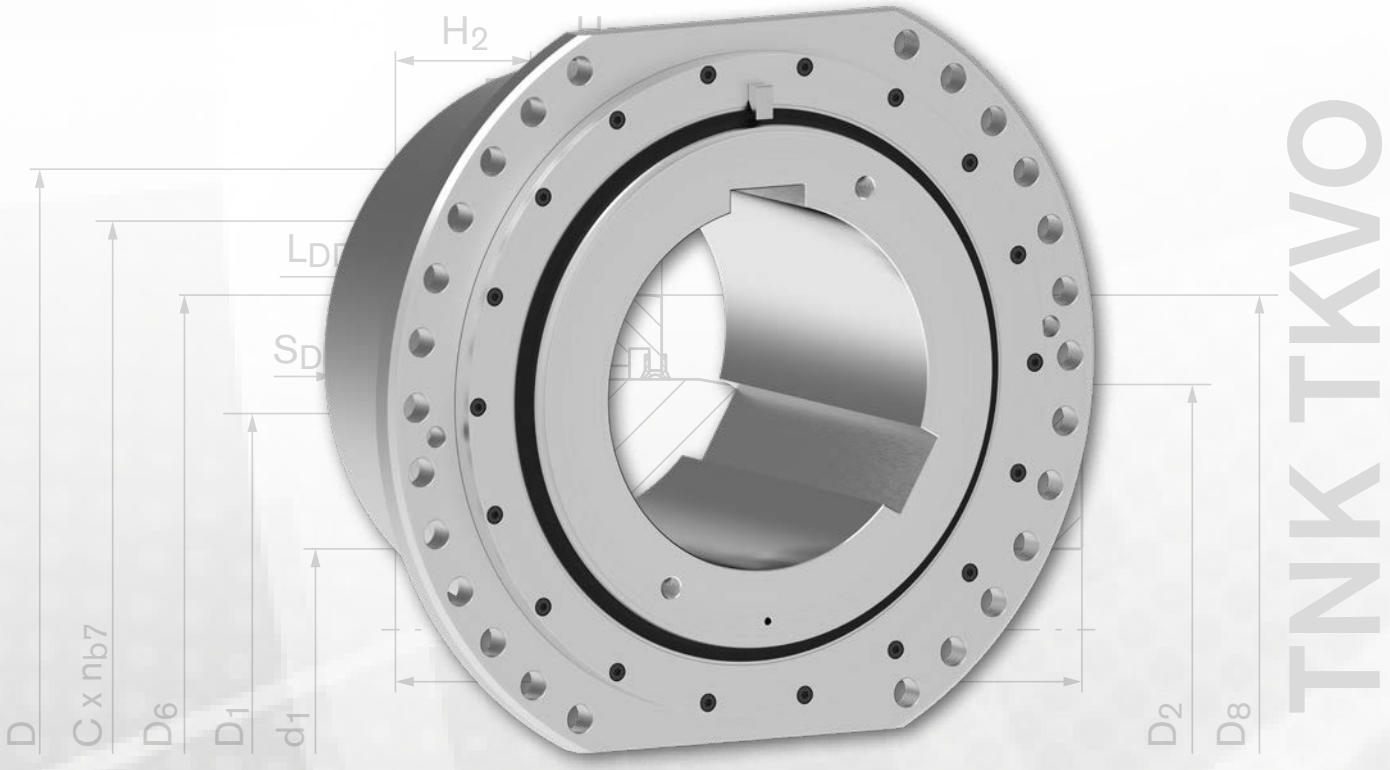


The position of the keyways is always defined in viewing direction of the rope drum.

The flange is included in the rope drum through the face S (h9/F8) to secure the torque transmission capacity, as is standard for rope drums. The connecting screws must have at least strength category 10.9.

The position of the keyways is always defined in viewing direction of the rope drum.



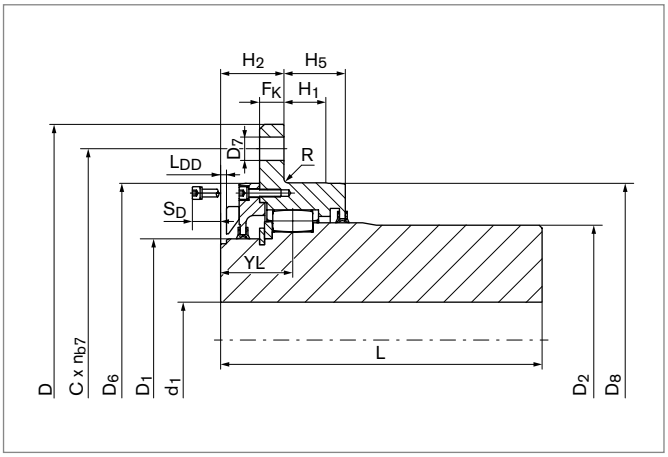


TNK TKVO

Further information on
RINGFEDER® TNK TKVO
on **www.ringfeder.com**

Performance and Application Optimized Type

The type **RINGFEDER® TNK TKVO** is a torsionally stiff barrel coupling with hub and housing made of high-strength material. The inner ring integrated in the housing enables quick and easy assembly with an extremely compact coupling design. The type incorporates construction according to the operation sheet of the German Steel Iron Industry SEB 666212 for rope drum hinge joints.



Characteristics

- Torsionally rigid, compensate for angular and axial shaft misalignment
- Torque transmission by steel rollers
- With standardized connection to rope drums in crane lifting gear
- Reduced assembly effort due to integrated inner ring as well as simplified insertion of the barrel coupling
- With wear indicator for easier condition monitoring
- Bore diameter d_1 up to 440 mm
- Outer diameter D up to 850 mm
- Transmissible torque T_{Kmax} up to 815,000 Nm
- Maximum radial load F_{rad} up to 490,000 N

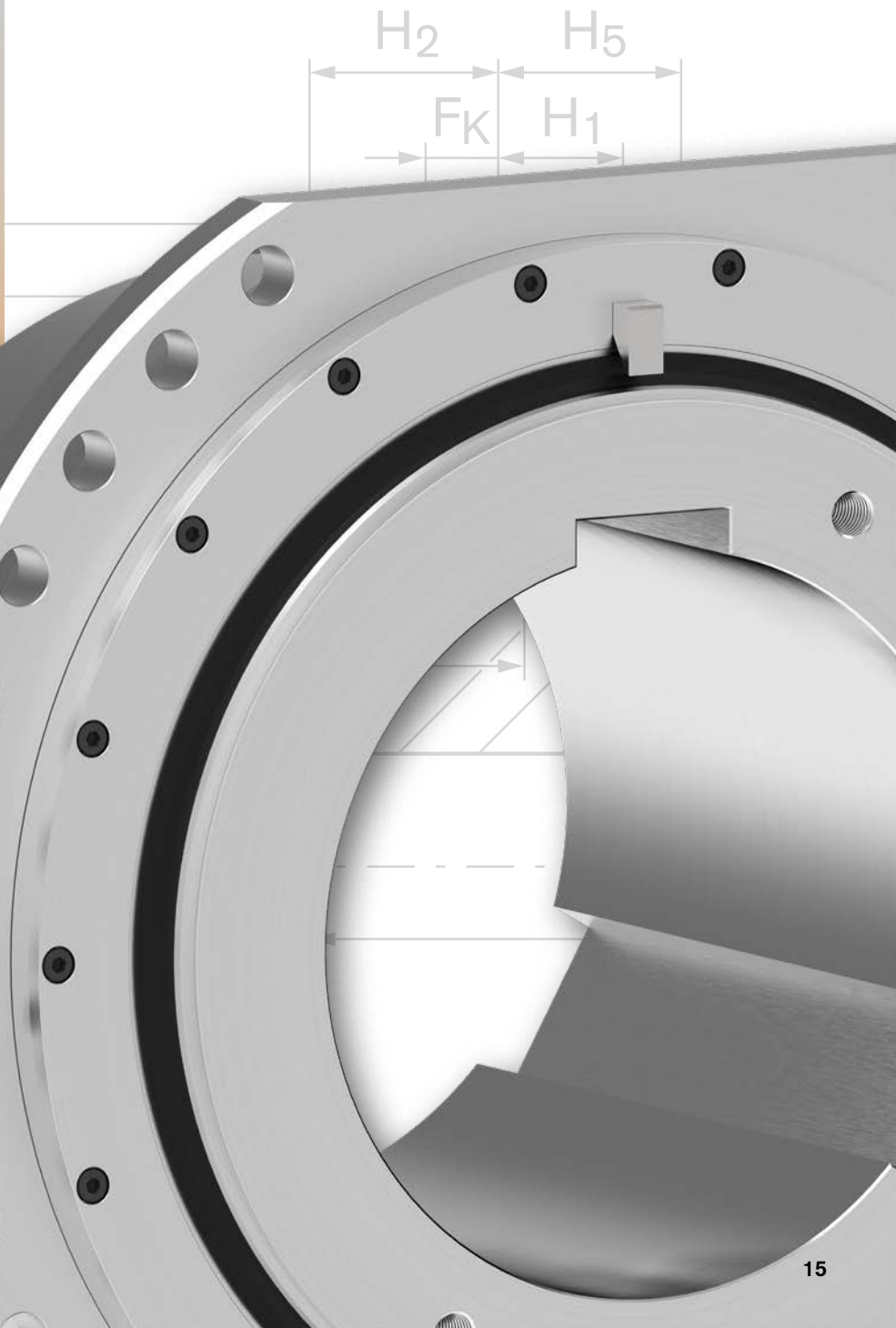
RINGFEDER

EN | Tech Paper | 12.2021

Barrel Couplings
RINGFEDER® TNK

Tables & Values

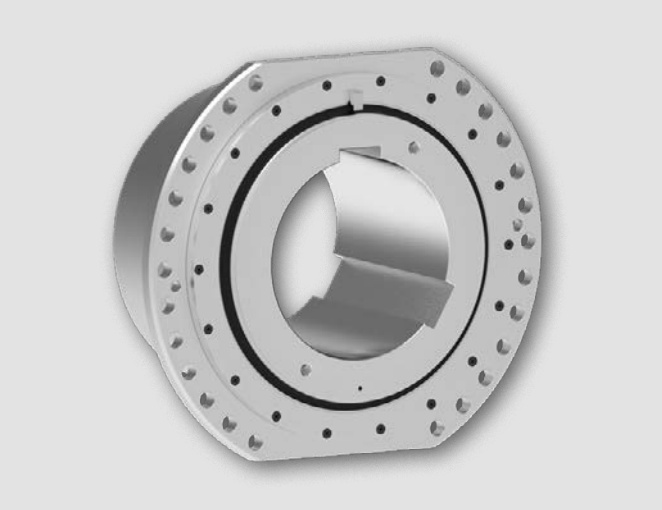
For the correct selection of a suitable coupling size, it is essential to observe the equations and recommendations in the chapter “Coupling Size Selection”.

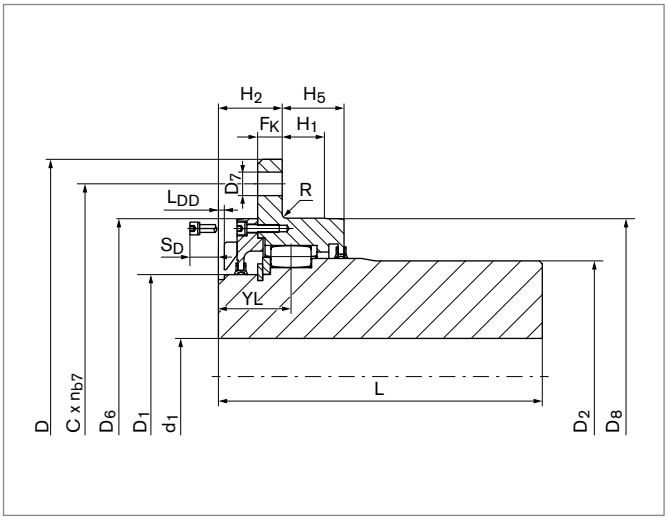


Barrel Couplings

RINGFEDER® TNK TKVO

Performance and Application Optimized Type





Identifier	SEB 666212	Size	T_{Kmax}	F_{rad}	d_{1kmin}	d_{1kmax}	D	D_2	L	L_{min}	D_1	D_6	D_8	H_1	R	H_2	F_K	H_5	YL
			Nm	N	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
WG3125	(*)	25	6500	17650	20	70	250	110	95	85	95	159	160	16	2,5	42	12	31	44,0
WG3128	(*)	50	8400	20000	20	80	280	127	100	85	110	179	180	16	2,5	42	12	33	45,0
WG3132	(*)	75	10500	21500	20	90	320	142	110	95	125	199	200	17	2,5	45	15	32	46,0
WG3134	(*)	100	16000	28000	20	100	340	155	125	95	140	219	220	19	2,5	45	15	34	47,0
WG3136	(*)	130	21500	37000	47	115	360	175	130	95	160	239	240	19	2,5	45	15	36	48,0
WG3138	(*)	160	27000	42500	47	130	380	194	145	95	180	259	260	21	2,5	45	15	35	48,0
WG3140	SG130	200	31500	48000	47	145	400	213	170	95	200	279	280	21	2,5	45	15	37	48,0
WG3142	(*)	300	39000	53000	47	160	420	234	175	95	220	309	310	25	2,5	45	15	40	50,0
WG3145	SG140	400	53500	75000	47	190	450	274	185	120	260	339	340	21	2,5	60	20	39	60,5
WG3151	(*)	500	91000	118000	77	215	510	314	220	125	295	399	400	29	2,5	60	20	49	64,5
WG3155	SG185	600	127000	132000	77	225	550	329	240	125	310	419	420	29	2,5	60	20	49	64,5
WG3158	SG200	1000	180000	145000	102	255	580	368	260	130	350	449	450	29,5	2,5	60	20	49,5	65,0
WG3165	SG240	1500	241000	184000	102	305	650	431	315	140	415	529	530	31,5	2,5	65	25	51,5	68,0
WG3166	(*)	2100	360000	283000	102	315	665	458	330	145	430	544	545	43	4,0	65	25	63	74,0
WG3168	SG270	2600	425000	330000	102	325	680	470	350	145	445	559	560	43	4,0	65	25	63	74,0
WG3171	SG315	3400	529000	366000	178	350	710	502	380	165	475	599	600	38	4,0	81	35	63	86,0
WG3178	SG355	4200	660000	420000	208	395	780	566	410	165	535	669	670	40	4,0	81	35	66	87,5
WG3185	SG400	6200	815000	490000	238	440	850	630	450	165	600	729	730	42	4,0	81	35	65	87,5

*Construction and design acc. to operation sheet of German Steel Iron Industry SEB 666212

To continue see next page

Barrel Couplings RINGFEDER® TNK TKVO

Identifier	SEB 666212	Size	C	n_{b7}	d_7	S (h9/F8)	S_D	G_G	L_{DD}	X_a	J_{sb}	Gw_{sb}
			mm		mm	mm	mm	inch	mm	mm	$10^{-3}kgm^2$	kg
WG3125	(*)	25	220	10	15	220	50	G1/8	5	+/-3	60	13
WG3128	(*)	50	250	10	15	250	50	G1/8	5	+/-3	90	17
WG3132	(*)	75	280	10	19	280	60	G1/8	5	+/-4	170	24
WG3134	(*)	100	300	10	19	300	60	G1/8	5	+/-4	240	32
WG3136	(*)	130	320	10	19	320	60	G1/8	5	+/-4	330	38
WG3138	(*)	160	340	10	19	340	60	G1/8	5	+/-4	450	48
WG3140	SG130	200	360	10	19	360	60	G1/8	5	+/-4	650	64
WG3142	(*)	300	380	10	19	380	60	G1/8	5	+/-4	910	79
WG3145	SG140	400	400	10	24	400	70	G1/4	9	+/-4	1520	108
WG3151	(*)	500	460	10	24	460	70	G1/4	7	+/-6	3090	163
WG3155	SG185	600	500	10	24	500	70	G1/4	7	+/-6	4060	195
WG3158	SG200	1000	530	14	24	530	70	G1/4	7	+/-6	5880	244
WG3165	SG240	1500	600	14	24	580	80	G1/4	7	+/-6	12630	404
WG3166	(*)	2100	615	26	24	590	90	G1/4	6	+/-6	15670	467
WG3168	SG270	2600	630	26	24	600	90	G1/4	6	+/-6	18150	520
WG3171	SG315	3400	660	26	28	640	90	G1/4	10	+/-8	25460	598
WG3178	SG355	4200	730	26	28	700	90	G1/4	10	+/-8	42020	795
WG3185	SG400	6200	800	26	28	760	90	G1/4	10	+/-8	67270	1049

*Construction and design acc. to operation sheet of German Steel Iron Industry SEB 666212

Explanations

T_{Kmax} = Max. transmissible torque of the coupling
F_{rad} = Admissible force radial
d_{1kmin} = Min. bore diameter d_1 with keyway acc. to DIN 6885-1
d_{1kmax} = Max. bore diameter d_1 with keyway acc. to DIN 6885-1
D = Outer diameter flange
D_2 = Outer diameter hub
L = Total length
L_{min} = Minimum length

D_1 = Outer diameter hub
D_6 = Outer diameter cover
D_8 = Centering diameter
H_1 = Length
R = Radius
H_2 = Distance
F_K = Flange thickness
H_5 = Distance
YL = Distance
C = Pitch circle diameter

n_{b7} = Quantity of bore d_7
d_7 = Bore diameter Flange
S (h9/F8) = Distance of the flattening
S_D = Disassembly Space
G_G = Whitworth thread
L_{DD} = Distance dimension
X_a = Axial gap max.
J_{sb} = Moment of inertia at smallest bore diameter
Gw_{sb} = Weight at smallest bore diameter

Ordering example

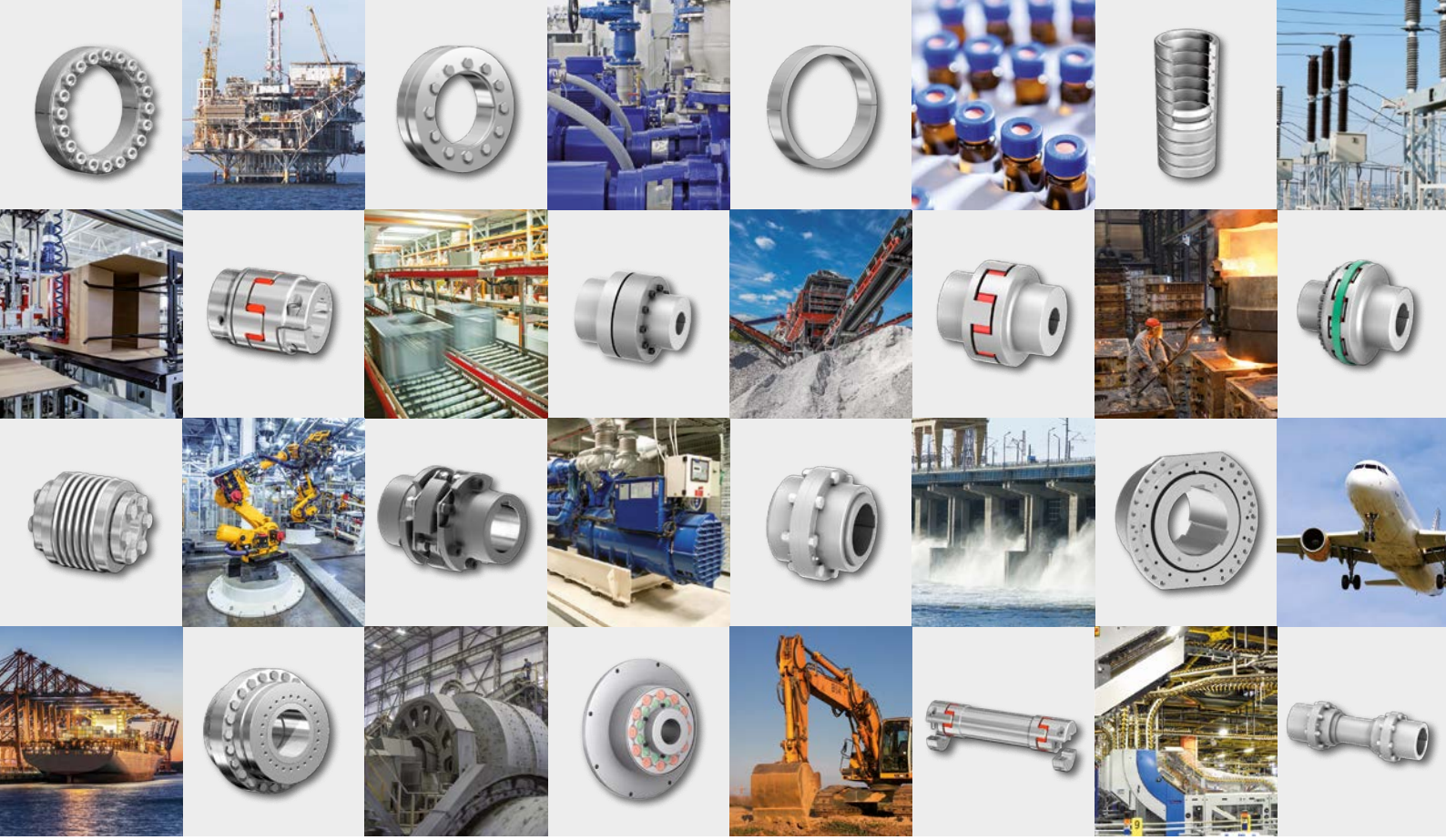
Identifier	Size	d_{1k}
WG3140	200	80

Technical Information

- Without further specifications, we deliver as standard: Bore tolerance H7; Keyway acc. to DIN 6885-1; Keyway width tolerance P9.

Further information on
RINGFEDER® TNK TKVO
on **www.ringfeder.com**

RINGFEDER POWER TRANSMISSION



RINGFEDER POWER TRANSMISSION GMBH
Werner-Heisenberg-Straße 18, 64823 Groß-Umstadt, Germany · Phone: +49 (0) 6078 9385-0 · Fax: +49 (0) 6078 9385-100
E-Mail: sales.international@ringfeder.com

RINGFEDER POWER TRANSMISSION USA CORP.
165 Carver Avenue, Westwood, NJ 07675, USA · Toll Free: +1 888 746-4333 · Phone: +1 201 666-3320 · Fax: +1 201 664-6053
E-Mail: sales.usa@ringfeder.com

CARLYLE JOHNSON MACHINE COMPANY, LLC.
291 Boston Turnpike, Bolton, CT 06043, USA · Phone: +1 860 643-1531 · Fax: +1 860 646-2645
E-Mail: info@cjmco.com

HENFEL INDÚSTRIA METALÚRGICA LTDA.
Av. Maj. Hilário Tavares Pinheiro 3447, Pq. Ind. Carlos Tonanni, CEP 14871-300, Jaboticabal, SP, Brazil · Phone: +55 (16) 3209-3422
E-Mail: vendas@henfel.com.br

RINGFEDER POWER TRANSMISSION INDIA PVT. LTD.
Plot No. 4, Door No. 220, Mount Poonamallee Road, Kattupakkam, Chennai – 600 056, India · Phone: +91 (0) 44 2679-1411
Fax: +91 (0) 44 2679-1422 · E-Mail: sales.india@ringfeder.com

KUNSHAN RINGFEDER POWER TRANSMISSION CO. LTD.
No. 406 Jiande Road, Zhangpu 215321, Kunshan, Jiangsu Province, China · Phone: +86 (0) 512 5745-3960
Fax: +86 (0) 512 5745-3961 · E-Mail: sales.china@ringfeder.com

Partner for Performance

www.ringfeder.com

RINGFEDER
POWER TRANSMISSION