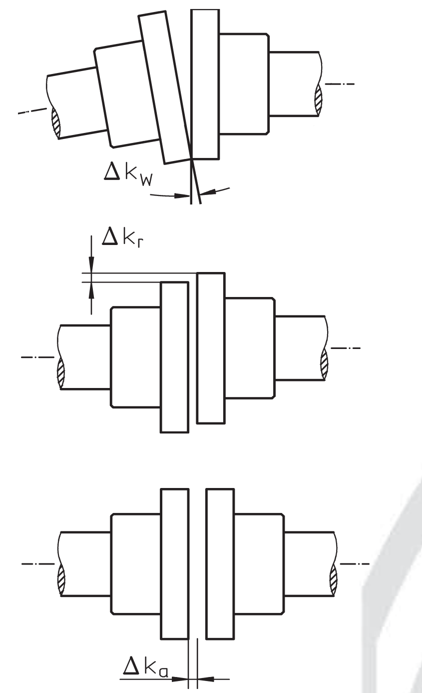
TSCHAN

Barrel - Coupling

Flexible couplings

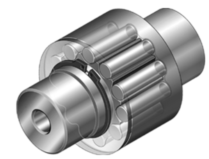


TSCHAN®- S

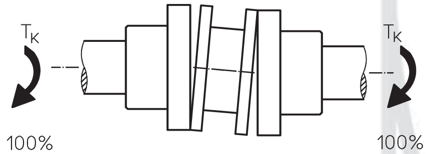
TSCHAN® - B

Nor-Mex®

ROLLASTIC®

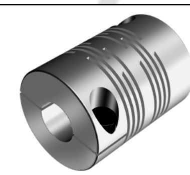


Torsionally rigid couplings



POSIMIN®(PHP)

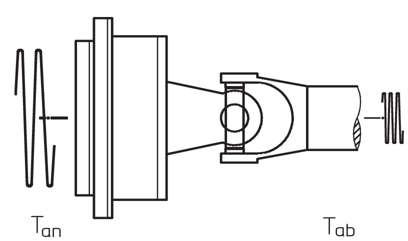
POSIMIN®-F



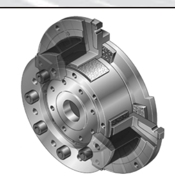
POSIFLEX®

BARREL-COUPLING

Highly flexible couplings

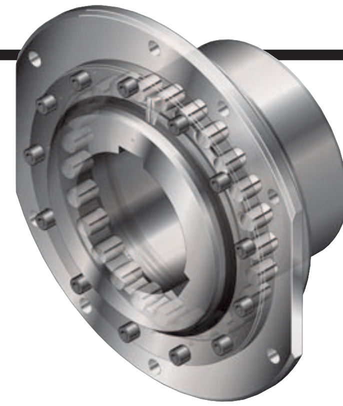


TORMAX®-VS



TORMAX®-DS

CONTENTS



General Description

Technical Specifications

1.0 FEATURES AND APPLICATIONS

TSCHAN TK barrel couplings are recommended for installation in crane lifting mechanisms, to connect the cable drum with the gearbox output shaft, as well as in winch conveyors and platform hoists.
By selecting the coupling size (Table 1a/1b), it is necessery to consider the radial load (S_T(N)), the dimension of the gearbox shaft (d min – d max) and especially the transmission torque (T) with the operating factor (K1) in Table 3.

Fig.1 Rigid Connection

When the gearbox output shaft is rigidly connected to the drum in a lifting mechanism, this results in three support points, which is statically indeterminate case (Fig. 1).
This type of mounting requires special care in alignment and levelling, which is difficult to achieve in practice.

Mounting inaccuracies, as well as deformation in structures and wear in moving parts, lead to enormous additional forces, above all in the gearbox output shaft. These forces occur in alternating bending loads and can lead to shaft breakage and severe damage to bearings and gears.

Fig.2 Barrel Coupling

In the recommended mounting Fig. 2, the barrel coupling, which is installed between the gearbox and cable drum, performs the function of an articulated joint, thus making the connection statically determinate and avoiding the occurrence of high bending moments.

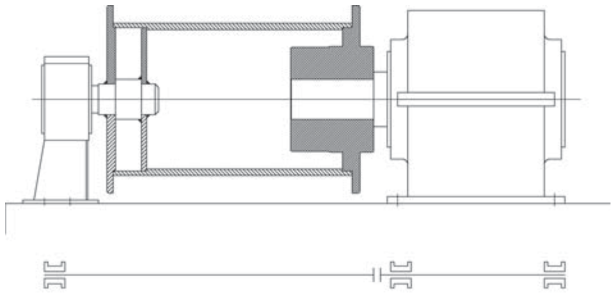


Fig.1
Rigid mounting of gearbox-drum connection
Support at three points – static uncertain/indeterminate

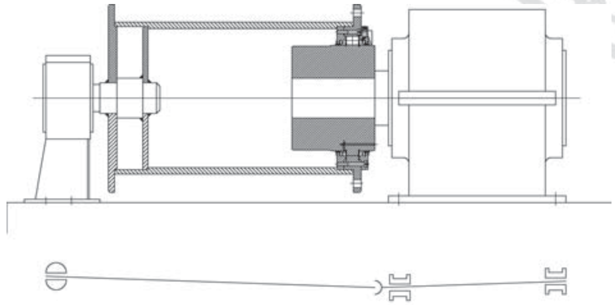


Fig.2
Mounting with barrel coupling – static certain/determinate

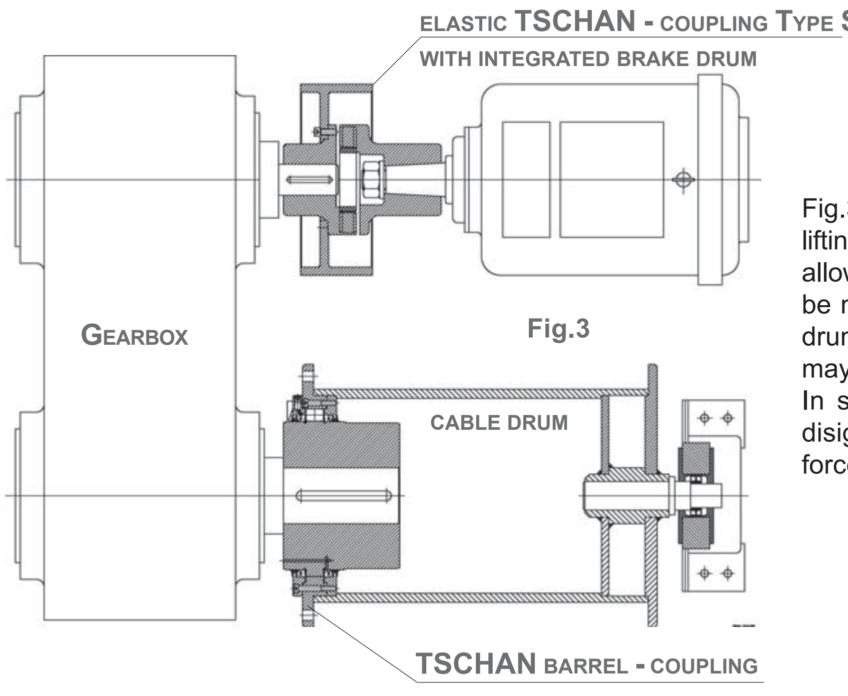


Fig.3

Fig.3 shows the mounting of the barrel coupling in a lifting mechanism. Considering the fact that this coupling allows axial displacement, a self-adjusting bearing must be mounted, fixed laterally, at the opposite end of the drum shaft in order to withstand the axial forces that may be genarated.
In special applications, the barrel coupling can be disigned as an articulated joint that withstands axial forces by itself.

2.0 Designs and Components

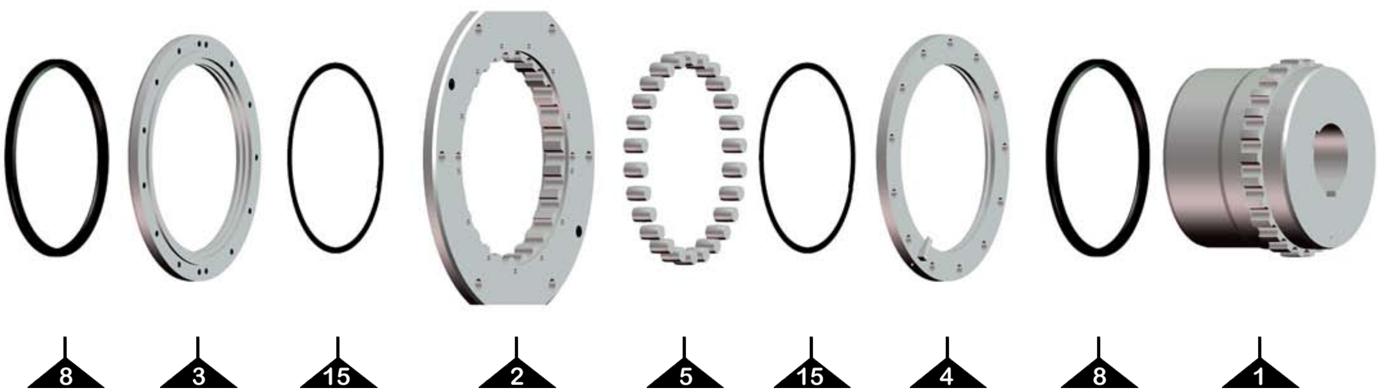
The barrel coupling consists of a sleeve flange (Pos.2, Fig.4) provided with semicircular toothing around its internal diameter and a hub (Pos.1, Fig.4) that is externally toothed in a similar way. A series of cylindrical barrels (Pos.5, Fig.4), of hardened steel, are inserted in the holes formed by this toothing to act as power transmission elements.

Covers and special seals (Pos.8, Fig.4) provide 100% sealing of the inner zone, preventing the penetration of dust and guaranteeing the integrity of the required lubrication. Two double-lamina elastic rings (Pos.15, Fig.4) mounted on the hub, one on each side of the toothing, limit the axial movement of the barrels.

Torque is transmitted to the drum's receiving flange, generally by two diametrically opposed flat driving surfaces, located at the periphery of the coupling sleeve flange (Pos.2, Fig.4), and also by means of bolts which, at the same time, serve as connection with the drum.

The discribed design is appropriate for large bearing radial loads, as these are distributed over large barrel support surface. In the same way, this design also minimizes the effect of alternating bending moments on the toothing, the latter being robust thanks to its low height and large root section. In addition to this, due to the effect of "crush polishing" of the hardened barrels on the tooth profiles, toothing wear resistance is appreciably improved.

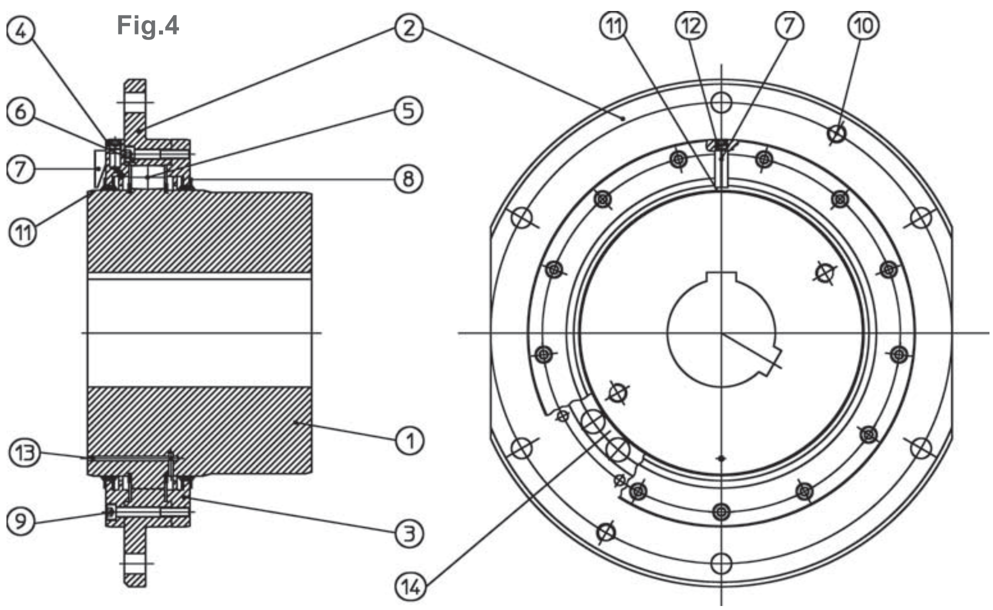
A pointer / indicator (Pos.7, Fig.4) located on the external cover (Pos.4, Fig.4) , permits monitoring of tooth wear without the need to disassemble any part of the coupling. This pointer moves relative to the marks on the hub as a function of wear. The same indicator also serves to monitor the axial position of the sleeve relative to the hub.



Component List

1 Hub
2 Sleeve flange
3 Internal cover
4 External cover
5 Barrel
6 Fixing screw
7 Pointer
8 Double-lip seal
9 Fixing screw
10 Removal threading
11 Wear notches
12 Lubricant supply
13 Overflow hole
14 Assembly marking
15 Retaining ring

Fig.4



3.0 DIMENSIONS AND PARAMETERS TK BARREL COUPLINGS

Table 1a (Metric)

Size	T(max) [Nm]	Allowable radial load Smax (N)	d (h7) max. Ø [mm]	d (h7) min.Ø [mm]	D Ø [mm]	L [mm]	L (min) [mm]	N Ø [mm]	A Ø [mm]	B(h6) Ø [mm]	S(h9) Ø [mm]	e [mm]	f [mm]	c [mm]	r [mm]	h [mm]	k [mm]	T Ø [mm]	b Ø [mm]	max.axial displacement [mm]	Weight [Kg]	Inertia [Kgm²]
25	4500	14500	65	38	250	95	85	95	159	160	220	42	44	12	2.5	16	34	220	15	3	12	0.06
50	6000	16500	75	48	280	100	85	110	179	180	250	42	44	12	2.5	16	34	250	15	3	19	0.13
75	7500	18500	85	58	320	110	95	125	199	200	280	45	46	15	2.5	17	34	280	19	4	23	0.17
100	9000	20000	95	58	340	125	95	140	219	220	300	45	46	15	2.5	17	34	300	19	4	27	0.28
130	15500	31000	105	78	360	130	95	160	239	240	320	45	47	15	2.5	19	34	320	19	4	33	0.36
160	19500	36000	120	78	380	145	95	180	259	260	340	45	47	15	2.5	19	34	340	19	4	42	0.48
200	24000	38500	135	98	400	170	95	200	279	280	360	45	47	15	2.5	19	34	360	19	4	59	0.66
300	28000	42000	145	98	420	175	95	220	309	310	380	45	47	15	2.5	19	34	380	19	4	70	0.93
400	38000	49000	175	98	450	185	120	260	339	340	400	60	61	20	2.5	22	40	400	24	4	95	1.45
600	70000	115000	205	118	550	240	125	310	419	420	500	60	61	20	2.5	22	42	500	24	6	162	3.93
1000	120000	125000	230	138	580	280	130	350	449	450	530	60	61	20	2.5	22	42	530	24	6	195	5.63
1500	180000	150000	280	158	650	315	140	415	529	530	580	65	68	25	2.5	27	47	600	24	6	305	11.0
2600	310000	250000	300	168	680	350	145	445	559	560	600	65	70	25	4.0	34	54	630	24	8	360	16.0
3400	400000	300000	315	198	710	380	165	475	599	600	640	81	85	35	4.0	34	56	660	28	8	408	20.0
4200	500000	340000	355	228	780	410	165	535	669	670	700	81	85	35	4.0	34	56	730	28	8	580	34.5
6200	685000	380000	400	258	850	450	165	600	729	730	760	81	85	35	4.0	34	59	800	28	8	715	52.0

The convex shape of the barrels and the internal spaces of the toothing allows the hub to swivel relative to the sleeve. This allows angular misalignments of ± 1.5° and an axial displacement that varies between ± 3 mm (± 0.118”) and ± 8 mm (± 0.315”) (see Table 1a/1b)

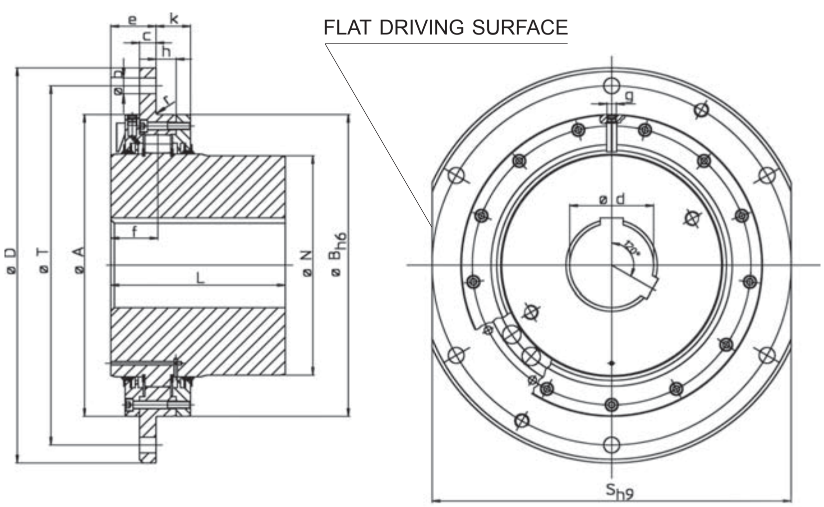


Table 1b (English)

Size	T(max) [ft-lb]	Allowable radial load S_{max} (lbf)	d (h7) max. Ø [inch]	d (h7) min.Ø [inch]	D Ø [inch]	L [inch]	L (min) [inch]	N Ø [inch]	A Ø [inch]	B(h6) Ø [inch]	S(h9) Ø [inch]	e [inch]	f [inch]	c [inch]	r [inch]	h [inch]	k [inch]	T Ø [inch]	b Ø [inch]	max.axial displacement [inch]	Weight [pound]	Inertia [pound x inch²]
25	3319	3263	2.559	1.496	9.843	3.740	3.346	3.740	6.260	6.299	8.661	1.654	1.732	0.472	0.098	0.630	1.339	8.661	0.591	0.118	26	0.0001
50	4425	3713	2.953	1.890	11.024	3.937	3.346	4.331	7.047	7.087	9.843	1.654	1.732	0.472	0.098	0.630	1.339	9.843	0.591	0.118	42	0.0002
75	5532	4163	3.346	2.283	12.598	4.331	3.740	4.921	7.835	7.874	11.024	1.772	1.811	0.591	0.098	0.669	1.339	11.024	0.748	0.157	51	0.0002
100	6638	4500	3.740	2.283	13.386	4.921	3.740	5.512	8.622	8.661	11.811	1.772	1.811	0.591	0.098	0.669	1.339	11.811	0.748	0.157	60	0.0004
130	11432	6975	4.134	3.071	14.173	5.118	3.740	6.299	9.409	9.449	12.598	1.772	1.850	0.591	0.098	0.748	1.339	12.598	0.748	0.157	73	0.0005
160	14382	8100	4.724	3.071	14.961	5.709	3.740	7.087	10.197	10.236	13.386	1.772	1.850	0.591	0.098	0.748	1.339	13.386	0.748	0.157	93	0.0007
200	17701	8663	5.315	3.858	15.748	6.693	3.740	7.874	10.984	11.024	14.173	1.772	1.850	0.591	0.098	0.748	1.339	14.173	0.748	0.157	130	0.0009
300	20652	9450	5.709	3.858	16.535	6.890	3.740	8.661	12.165	12.205	14.961	1.772	1.850	0.591	0.098	0.748	1.339	14.961	0.748	0.157	154	0.0013
400	28027	11025	6.890	3.858	17.717	7.283	4.724	10.236	13.346	13.386	15.748	2.362	2.402	0.787	0.098	0.866	1.575	15.748	0.945	0.157	209	0.0021
600	51629	25875	8.071	4.646	21.654	9.449	4.921	12.205	16.496	16.535	19.685	2.362	2.402	0.787	0.098	0.866	1.654	19.685	0.945	0.236	357	0.0056
1000	88507	28125	9.055	5.433	22.835	10.236	5.118	13.780	17.677	17.717	20.886	2.362	2.402	0.787	0.098	0.866	1.654	20.866	0.945	0.236	430	0.0080
1500	132761	33750	11.024	6.220	25.591	12.402	5.512	16.339	20.827	20.866	22.835	2.559	2.598	0.984	0.098	1.063	1.850	23.622	0.945	0.236	673	0.0156
2600	228644	56250	11.811	6.614	26.772	13.780	5.709	17.520	22.008	22.047	23.622	2.559	2.756	0.984	0.157	1.339	2.126	24.803	0.945	0.315	794	0.0228
3400	295025	67500	12.402	7.795	27.953	14.961	6.496	18.701	23.583	23.622	25.197	3.189	3.346	1.378	0.157	1.339	2.205	25.984	1.102	0.315	900	0.0285
4200	368781	76500	13.976	8.976	30.709	16.142	6.496	21.063	26.339	26.378	27.559	3.189	3.346	1.378	0.157	1.339	2.205	28.740	1.102	0.315	1279	0.0491
6200	505230	85500	15.748	10.157	33.465	17.717	6.496	23.622	28.701	28.740	29.921	3.189	3.346	1.378	0.157	1.339	2.323	31.496	1.102	0.315	1577	0.0740

Table 2a (Metric)

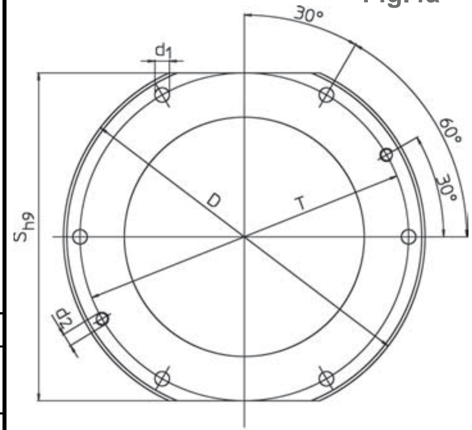
Size	D	T	S (F8)	a (min.)	d1	d2	d3 (F8)	P	n (min.)
	Ø	Ø			Ø	Thread	Ø		
	[mm]	[mm]	[mm]	[mm]	[mm]		[mm]	[mm]	[mm]
25	250	220	220	25	15	M 12	160	3.0	10
50	280	250	250				180		
75	320	280	280		19	M 16	200		
100	340	300	300				220		
130	360	320	320				240		
160	380	340	340				260		
200	400	360	360				280		
300	420	380	380				310		
400	450	400	400	30	24	M 20	340		
600	550	500	500				420		
1000	580	530	530	40			450		20
1500	650	600	580	50			530		25
2600	680	630	600				560	5.0	
3400	710	660	640	60	28	M 24	600		35
4200	780	730	700				670		
6200	850	800	760				730		

Flange holes

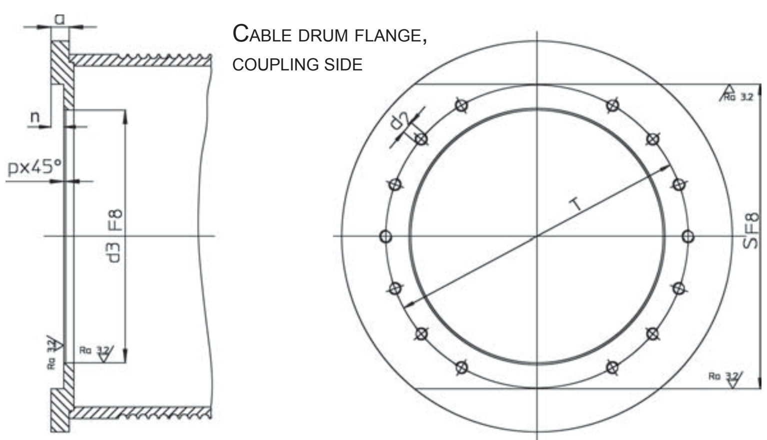
Couplings

(according to table 1a + 1b)

Fig.4a

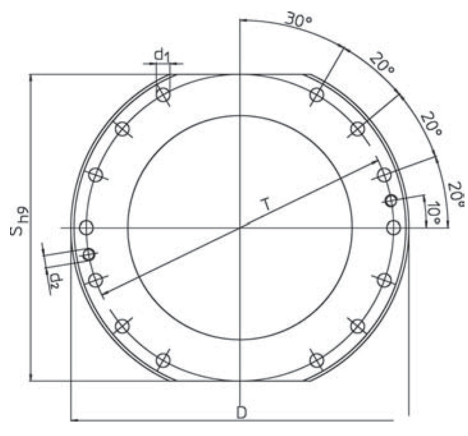


Sizes 25 - 600



The design of the cable drum flange must be according to fig. 4a to 4c and Table 2

Fig.4b

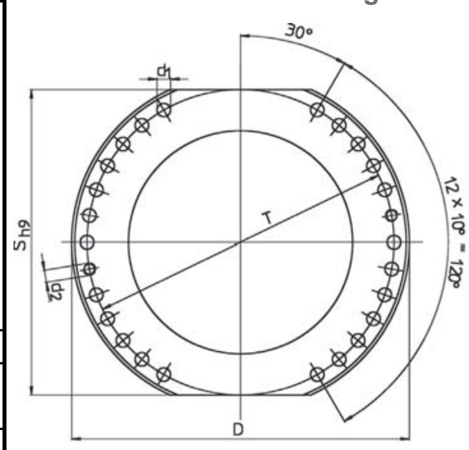


Sizes 1000 - 1500

Table 2b (English)

Size	D	T	S (F8)	a (min.)	d1	d2	d3 (F8)	P	n (min.)
	Ø	Ø			Ø	Thread	Ø		
	[inch]	[inch]	[inch]	[inch]	[inch]		[inch]	[inch]	[inch]
25	9.843	8.661	8.661	0.984	0.591	M 12	6.299	0.118	0.394
50	11.024	9.843	9.843				7.087		
75	12.598	11.024	11.024		0.748	M 16	7.874		
100	13.386	11.811	11.811				8.661		
130	14.173	12.598	12.598				9.449		
160	14.961	13.386	13.386				10.236		
200	15.748	14.173	14.173				11.024		
300	16.535	14.961	14.961				12.205		
400	17.717	15.748	15.748	1.181	0.945	M 20	13.386		
600	21.654	19.685	19.685				16.535		
1000	22.835	20.866	20.866	1.575			17.717		0.787
1500	25.591	23.622	22.835	1.969			20.866		0.984
2600	26.772	24.803	23.622				22.047	0.197	
3400	27.953	25.984	25.197	2.362	1.102	M 24	23.622		1.378
4200	30.709	28.740	27.559				26.378		
6200	33.465	31.496	29.921				28.740		

Fig.4c



Sizes 2600 - 6200

4.0 SELECTION OF COUPLING SIZE

The required coupling size depends on:

1. Transmission torque T (Nm)
2. Radial load by the coupling S_R (N)
3. Dimesions check of the gearbox shaft

4.1 Transmission torque T (Nm)

a) Based on installed power N_i (kW)

Eq 1
$$T(Nm) = (N_i / n) \times 9550 \times K_1$$

N_i = Max. installed power of the motor (kW)
n = Drum turning speed (rpm)
K_1 = Operating factor (Table 3) of the drive system

Table 3 (Operating Factor K_i)

Group DIN 15020	1 Bm	1 Am	2 m	3 m	4 m	5 m
Group FEM (1970)	IB	IA	II	III	IV	V
Group FEM (1987) Group BS 466 (1984)	M1,M2,M3	M4	M5	M6	M7	M8
Operating factor K_1	1.12	1.25	1.40	1.60	1.80	2.00

b) Based on consumed power N_c (kW)

Eq 2
$$N_c(kW) = (S_R \times V_T) / 60000$$

Eq 3
$$T(Nm) = ((N_c \times 9550) / n) \times K_1$$

or

Eq 4
$$T(Nm) = S_R \times (D/2) \times K_1$$

N_c = Max. consumed motor power (kW)
S_R = Drum static pull, incl. cable and pulley effciency in Newton (N) (see Eq 6)
V_T = Drum cable lifting rate (m/min)
n = Drum turning speed (rpm)
D = Drum pitch diameter (m)
K_1 = Operating factor (Table 3)

The resulting transmission torque T(Nm), based on the installed or consumed power, must be less than the transmission torque Tmax (Nm), shown in Table 1.
After this, it is necessary to confirm the selection on the basis of the radial load to be withstood.

4.2 Determination of the radial load S_R(N)

Radial load is understood to be the fraction of the load that must be withstood by the coupling due to the pull of the load and the hoisting tackle.

As the coupling constitutes one of the drum's two supports, it must withstand a fraction of the total load.

Prior to calculating the radial load S, it is necessary to obtain the static load S_R in the drum.

Determination of static load S_R in the drum

Eq 5
$$S_R(N) = (Q + G) / i_r$$

Q = Max. load on hook (N)
G = Weight of hoist tackle and cables (N)
i_r = (Total number lines)/(Number of lines leaving the drum)

The static load is modified if cable and pulley efficiency K_2 is taken into account according to Table 4

Eq 6
$$S_R(N) = (Q + G) / (i_r \times K_2)$$

K_2 = Operating factor for drum and hoist tackle efficiency (Table 4)

Table 4
Operating Factor K_2

i_r Hoist tackle reduction	2	3	4	5	6	7	8
K_2 with bronze bearings	0.92	0.90	0.88	0.86	0.84	0.83	0.81
K_2 with ball bearings	0.97	0.96	0.95	0.94	0.93	0.92	0.91

Figures 1 to 4 below, show different examples of hoist tackle configuration.

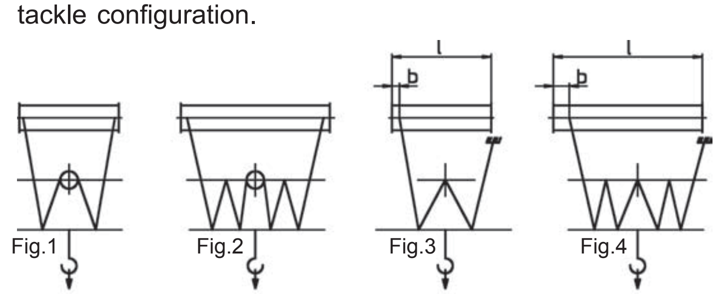


Fig.1	Fig.2	Fig.3	Fig.4
Twin hoist, 2 sheaves double line to drum	Twin hoist, 4 sheaves double line to drum	Hoist, 2 sheaves single line to drum	Twin hoist, 4 sheaves single line to drum
$i_r = 2$	$i_r = 4$	$i_r = 4$	$i_r = 8$
$S_R=(Q+G)/2$	$S_R=(Q+G)/4$	$S_R=(Q+G)/4$	$S_R=(Q+G)/8$

After obtaining the static load, it is necesarry to calculate the radial load S (N) by using the following equation:

For examples Fig. 1 & 2

Eq 7 $$S(N) = (S_R / 2) + (w / 2)$$

S_R	=	Drum static pull, incl. cable and pulley efficiency in Newton (see Eq 6)
l	=	Distance between drum supports (mm)
b	=	Shortest possible distance from cable in drum, to the geometric center axis of the barrels, into the coupling (mm)
w	=	Own weight of the drum with its cables and couplings parts linked to it (N)

For examples Fig. 3 & 4

Eq 8 $$S(N) = (S_R \times (1 - (b / l))) + (w / 2)$$

Once the radial load S is obtained, it is necessary to check that the allowable radial load S, of the selected coupling (see Table 1) is larger than Smax.
If the transmission torque T is lower than the nominal torque Tmax, of the preselected coupling, but the calculated radial load S is larger than the allowable catalog load Smax for this size of coupling, it may still be possible to use the selected coupling. Using the same data in the formular below, a new maximum allowable (compensated) radial load S_A can be caculated. If S is less than S_A the coupling size is correct.

S_A = S+((Tmax-T)xC) C= Compensation factor variable according to coupling size (Table 5)

Table 5 Compensation Factor

Coupling Size	25	50	75	100	130	160	200	300	400	600	1000	1500	2600	3400	4200	6200
Factor C	10.3	9.0	8.0	7.2	6.4	5.8	5.2	4.8	4.1	3.4	3.0	2.6	2.4	2.2	2.0	1.8

Compensation is only applicable to the radial load, not to the torque !

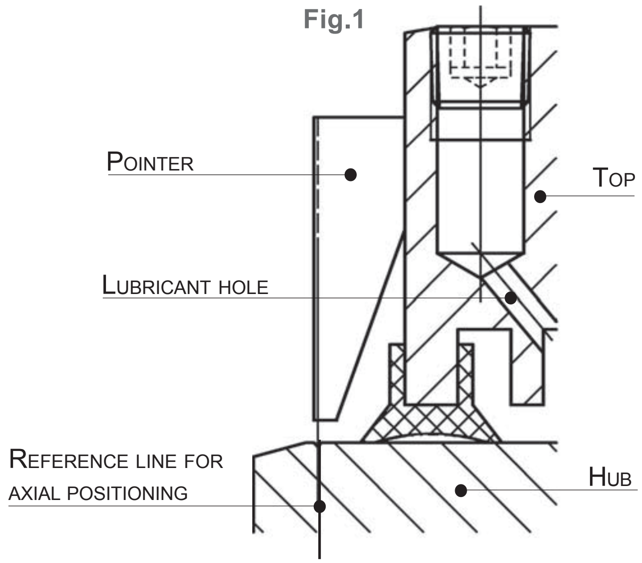
4.3 Dimension check of the gearbox shaft

Also, a check by the dimenson of the gearbox shaft must be done, if it is smaller , as the maximum admissible diameter dmax. for each coupling size, according to Table 1. These values are valid for shafts with keyways according to DIN 6885 / 1. Additionally, a check must be done, of the pressure to the keyways.
For other types of fixing, such as spline shafts according to DIN 5480, mounting with interference, etc. , please contact our technical department.

5.0 Assembly instructions

Prior to drilling the holes to fasten the support, axially fix the position of the drum with respect to the coupling's hub. In this case, the front edge of the pointer must line up with the mark on the hub (see Fig.1). During assembly, axial displacement must not exceed 10% of the maximum nominal value admitted by the coupling, according to Table1.

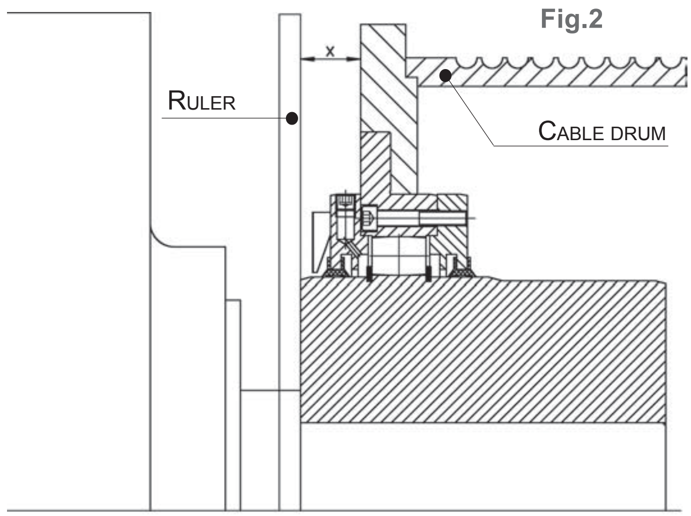
Fig.1



After this, the angle aligment is checked by measuring the gap "x" at four points with a separation of 90° by using a reference ruler (see Fig.2). The difference between the four measurements should not be higher as the following figures are shown:

0,30 mm (0.0118") for sizes = / < TK- 600
0,60 mm (0.0236") for sizes = / > TK-1000

Fig.2

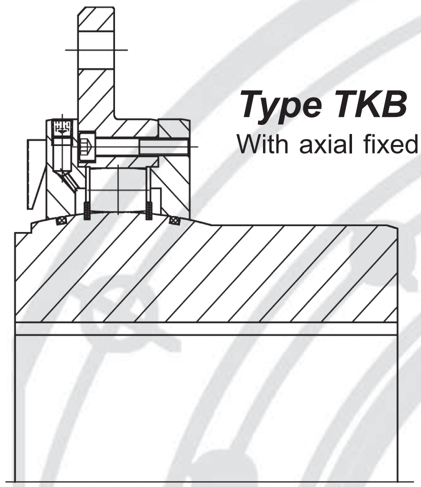


The TSCHAN TK barrel coupling is supplied as a complete unit, ready for installation, but without lubrication. Before it is put into service, it must be properly lubricated as indicated in the assembly and service manual.

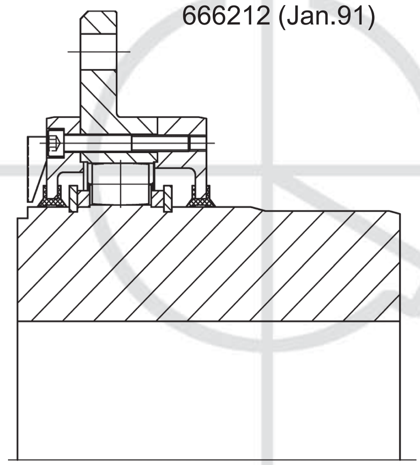
6.0 ALTERNATIVE DESIGNS

For alternative designs, see types below, please contact our technical department.

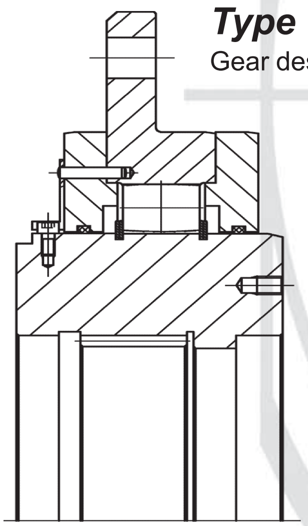
Type TKB
With axial fixed barrels



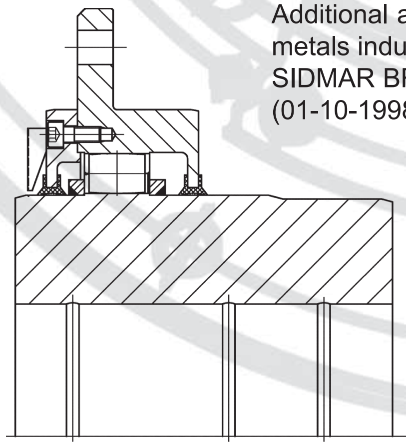
Type TKSG
Additional axial lock for metals industry, as per standard SEB 666212 (Jan.91)



Type TKN
Gear designed



Type TKSI
Additional axial lock for the French metals industry as per standard SIDMAR BR3-550 (01-10-1998 Rev.D)



TSCHAN

TSCHAN GmbH

Zweibrücker Strasse 104
D - 66538 Neunkirchen
Telefon: +49(0)6821/866-0
Telefax: +49(0)6821/88353
Internet: www.tschan.de
E-Mail: postmaster@tschan.de

Competent agencies throughout the world quarantee prompt information, delivery and service.
The full list of TSCHAN-agencies is available on request.

in North America:

euro-technologies,inc

EURO-TECHNOLOGIES, INC

325 Meadowlands Blvd., Suite 2
Washington, PA 15301 USA
Tel: (724) 743-2837
Fax: (724) 743-2838
etiusa@euro-technologies.com
www.euro-technologies.com