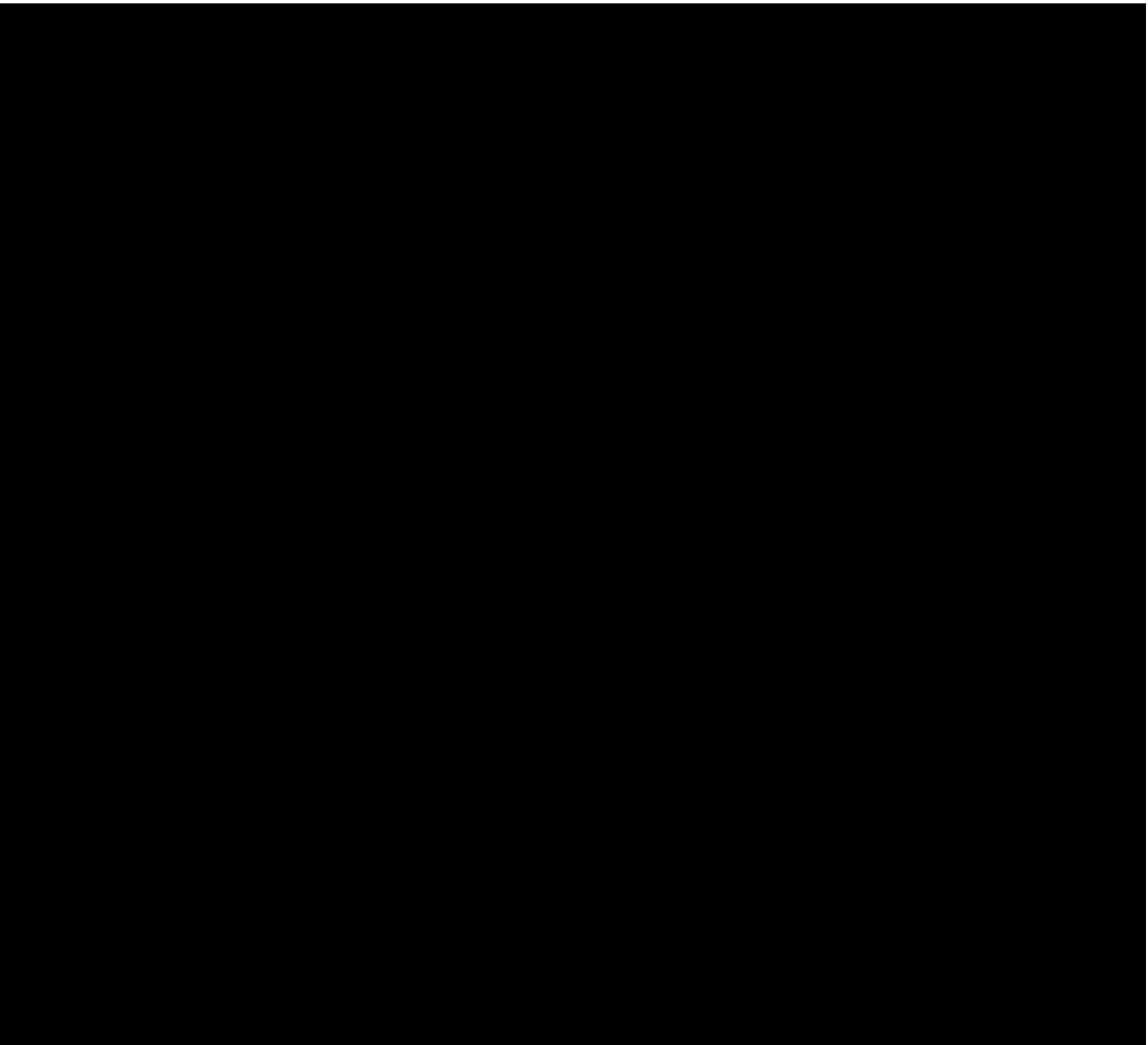
SIZING AND SELECTION



According to
DIN 740 part 2

SAFETY COUPLINGS

ST

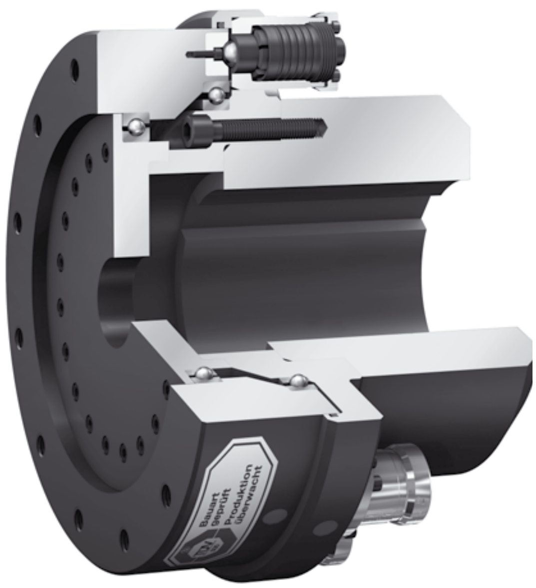
RELIABLE TORQUE OVERLOAD PROTECTION

ST series safety couplings are designed to decouple machine drives in the event of torque overload, preventing damage and downtime.

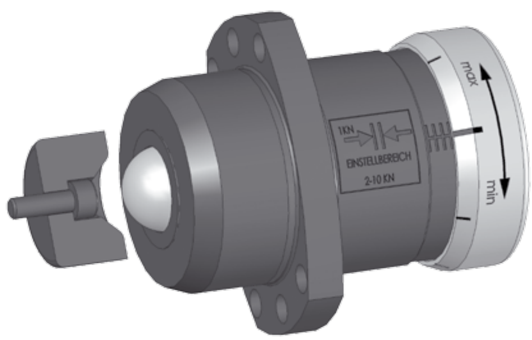
A series of ball bearings are spring loaded into detents on an otherwise freely spinning output plate. In the case of the ST series, these ball bearings are mounted onto plungers which are individually loaded in order to generate high clutching forces while maintaining a relatively small profile.

The transmittable torque is determined by the number and force setting of the safety elements and their distance from the center of the rotational axis. In the event of an overload, the force applied by the detents causes the plungers to overcome the spring loading and retract into the housings, resulting in a complete separation of the driving and driven hubs.

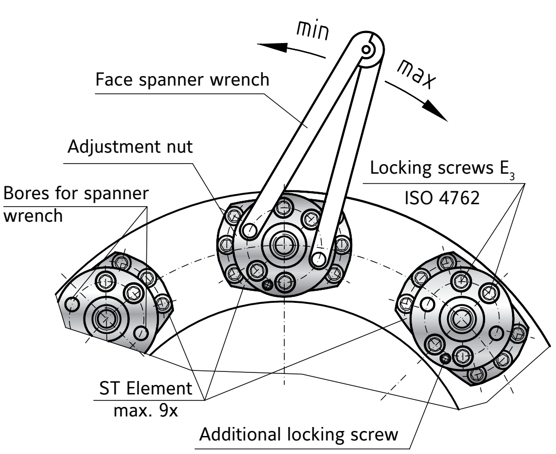
They will not re-engage automatically. After the overload condition has passed, an axial force must be applied in order to re-engage the safety elements into the detents of the output plate.

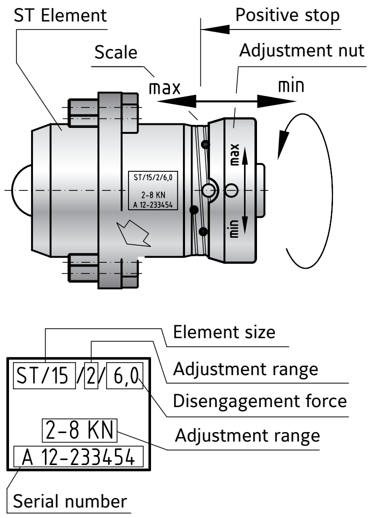


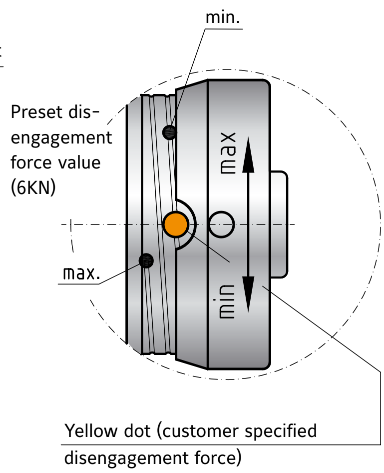
The safety elements consist of two components: the detent receptacle and the adjustable plunger mechanism.



TORQUE ADJUSTMENT







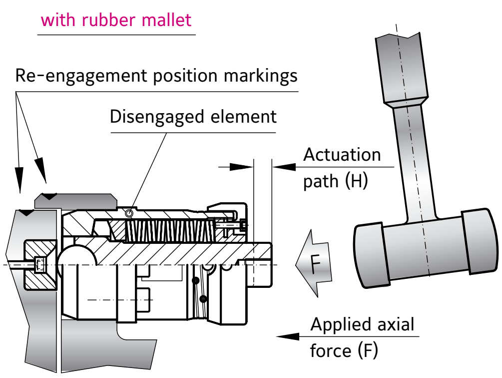
After loosening (approx. 1 rotation) the locking screws (E_3), the adjustment nut can be turned to adjust the disengagement setting. Minimum, maximum and preset values are marked on the adjustment scale. After adjustment, the torque setting is secured by tightening the locking screws (E_3).

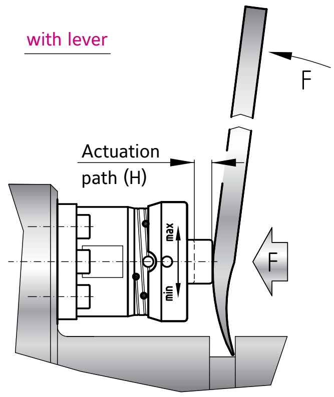
▶ **Note**

All safety elements must be set to the same value.

RE-ENGAGEMENT OF THE SAFETY ELEMENTS

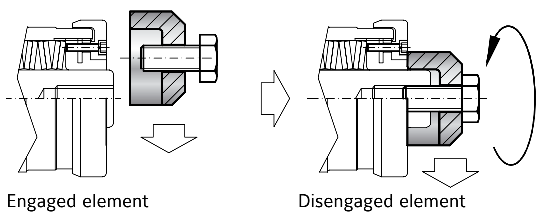
After the overload has been cleared, the drive or driven side must be rotated until the re-engagement position markings are lined up. The elements can only be re-engaged in this position. The element is re-engaged through applying an axial force to the plunger. Re-engagement is audible. Once this is complete, the torque limiter is ready for operation.





MANUAL DISENGAGEMENT OF ELEMENTS

Prior to machine start-up, the individual elements can be manually disengaged. A manual disengagement tool is available from R+W (see page 61).



SAFETY COUPLINGS

ST

SYMBOLS

T_{AR} = Disengagement torque of the coupling (Nm)
K = Service factor
T_{max} = Maximum torque of the drive system (Nm)
T_{AN} = Rated torque of the motor (Nm)
P_{Drive} = Drive power (kW)
n = Drive speed (min^{-1})
α = Angular acceleration (rad/s^2)
t = Acceleration time (s)
ω = Angular velocity (rad/s)
J_L = Moment of inertia of load (kgm^2)
J_A = Moment of inertia of drive (kgm^2)
T_{AS} = Peak motor torque (Nm)
S = Number of safety elements
F = Tangential force (kN)
r = Radius to element (m)
s = Spindle pitch (mm)
F_V = Feed force (N)
η = Spindle efficiency
d_0 = Pitch diameter (mm)
F_V = Feed force (N)
C_T = Torsional stiffness of coupling (Nm/rad)
$J_{Masch.}$ = Total load inertia (kgm^2)
(e.g. shaft + sprocket + chain + roller + 1/2 of coupling)
$J_{Mot.}$ = Total driving inertia (kgm^2)
(e.g. motor shaft + 1/2 of coupling)
f_e = Resonant frequency of the two mass system (Hz)

Shock or Load Factor S_A		
uniform load	non-uniform load	heavy shock load
1	2	3
For many crushing and shredding applications load factors are commonly S_A = 2-3		

ACCORDING TO DISENGAGEMENT TORQUE

Safety couplings are normally selected according to the required disengagement torque, which must be greater than the maximum torque required for start-up and operation.

Disengagement torque values are often determined from the drive data and are typically a multiple of the nominal torque at the operating drive speed (T_{AN}). In addition to a start-up torque ($T_{max.}$), the following values are used as further safety factors, depending on the load conditions:

K = 1.3 uniform harmonious load
K = 1.5 non-uniform load
K = 1.8 heavy shock load

$$T_{AR} \geqq K \cdot T_{max} \text{ (Nm)}$$

or

$$T_{AN} \geqq 9{,}550 \cdot \frac{P_{Drive}}{n} \text{ (Nm)}$$

ACCORDING TO ACCELERATION (START-UP WITH NO LOAD)

$$T_{AR} \geqq \frac{J_L}{J_A + J_L} \cdot T_{As} \cdot S_A \geqq \alpha \cdot J_L \text{ (Nm)}$$

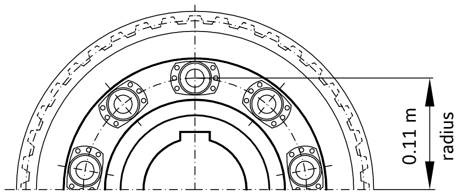
$$\alpha = \frac{\omega}{n} = \frac{\pi \cdot n}{t \cdot 30}$$

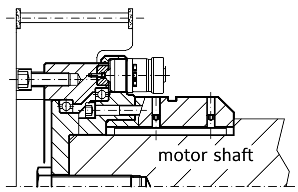
ACCORDING TO ACCELERATION (START-UP WITH LOAD)

$$T_{AR} \geqq \left[\frac{J_L}{J_A + J_L} \cdot (T_{AS} - T_{AN}) + T_{AN} \right] \cdot S_A \geqq \alpha \cdot J_L + T_{AN} \text{ (Nm)}$$

ACCORDING TO THE NUMBER OF SAFETY ELEMENTS

$$T_{AR} = S \cdot F \cdot r$$





ACCORDING TO LINEAR FEED FORCE

Screw drive

$$T_{AN} = \frac{s \cdot F_v}{2{,}000 \cdot \pi \cdot \eta} \text{ (Nm)}$$

Rack and pinion drive

$$T_{AN} = \frac{d_0 \cdot F_v}{2{,}000} \text{ (Nm)}$$

ACCORDING TO RESONANT FREQUENCY

The torsional natural frequency of the coupling must be significantly higher or lower than that of the equipment. For the mechanical substitution model the two mass system applies.

$$f_e = \frac{1}{2 \cdot \pi} \sqrt{C_T \cdot \frac{J_{Masch} + J_{Mot}}{J_{Masch} \cdot J_{Mot}}} \text{ (Hz)}$$

SAFETY COUPLINGS

ST

ELASTIC JAW COUPLING DESIGN ST2

Size	ST2 / 2	ST2 / 5	ST2 / 10	ST2 / 25	ST2 / 40	ST2 / 60	ST2 / 100	ST2 / 160
T_{KN} Rated Torque (Nm)	2,000	3,000	5,000	7,500	20,000	20,000	40,000	40,000
T_{Kmax} Maximum Torque (Nm)	4,800	7,500	18,000	25,000	48,000	48,000	120,000	120,000
Torsional Stiffness (10^3 Nm/rad)	58	92	145	230	500	580	850	1000
Relative Damping	1	1	1	1	1	1	1	1

LOAD FACTORS BY MACHINE TYPE

EXCAVATORS
S bucket chain excavators
S traveling gear (caterpillar)
M traveling gear (rails)
M suction pumps
S bucket wheels
M slewing gears

CONSTRUCTION MACHINERY
M concrete mixers
M road construction machinery

CHEMICAL INDUSTRY
M mixers
G agitators (light fluids)
M dryer drums
G centrifuges

FEEDERS AND CONVEYORS
S belt conveyors
G belt conveyors (bulk materials)
M belt bucket conveyors
M screw conveyors
M circular conveyors
M hoists

BLOWERS AND FANS[1]
G blowers (axial/radial) P:n ≤ 0.007
M blowers (axial/radial) P:n ≤ 0.07
S blowers (axial/radial) P:n > 0.07
G cooling tower fans P:n ≤ 0.007
M cooling tower fans P:n ≤ 0.07
S cooling tower fans P:n > 0.07

GENERATORS AND TRANSFORMERS
S generators

RUBBER MACHINERY
S extruders
S calendars
M mixers
S rolling millse

WOOD PROCESSING MACHINERY
G woodworking machines

CRANES
S traveling gears
S hoisting gears
M slewing gears

PLASTICS MACHINERY
M mixers
M shredders

METALWORKING MACHINERY
M sheet metal bending machines
S plate straightening machines
S presses
M shears
S punch presses
M machine tools, main drives

FOOD PROCESSING MACHINERY
G filling machines
M kneading machines
M cane crushers
M cane cutters
S cane mills
M sugar beet cutters
M sugar beet washers

PAPER MACHINERY
S wood cutters
S calendars
S wet presses
S suction presses
S suction rollers
S drying cylinders

PUMPS
S piston pumps
G centrifugal pumps (light fluids)
S reciprocating pumps

STONE AND CLAY MACHINES
S breakers
S rotary kilns
S hammer mills
S brick presses

TEXTILE MACHINERY
M tanning vats
M willows
M looms

COMPRESSORS
S reciprocating compressors
M centrifugal compressors

METAL ROLLING MILLS
M plate tilters
S ingot handling machinery
M winding machines (strip and wire)
S descaling machines
S cold rolling mills
M chain transfers
M cross transfers
M roller straighteners
S tube welding machines
S continuous casting plants
M roller adjustment drives

LAUNDRY MACHINES
M tumblers
M washing machines

WASTEWATER TREATMENT PLANTS
M aerators
G screw pumps

[1]) P = power of drive in kW
n = speed of drive in rpm

DESIGN FACTORS

Shock or Load Factor S_A

Drive type	Load characteristics of driven machine		
	G	M	S
electric motors, turbines, hydraulic motors	1.25	1.6	2.0
internal combustion engines ≥4 cylinder degree of uniformity ≥1:100	1.5	2.0	2.5

G = smooth uniform load | M = moderate load | S = heavy shock load

Temperature Factor S_υ

Ambient Temperature	-40 C° +30 C°	+40 C°	+60 C°	+80 C°	> +80 C°
S_υ	1.0	1.1	1.4	1.8	on request

Start Factor S_Z

Starts per Hour	30	60	120	240	>240
S_Z	1.0	1.1	1.2	1.3	on request

ACCORDING TO TORQUE

1. Calculate the drive torque T_{AN}.

$$T_{AN} \geqq 9{,}550 \cdot \frac{P_{Drive}}{n} \quad (Nm)$$

2. Base the coupling rated torque T_{KN} on the drive torque T_{AN} multiplied by the application factors.

$$T_{KN} \geq T_{AN} \cdot S_A \cdot S_\upsilon \cdot S_Z$$

Example:
Coupling between an electric motor (P = 450 kW and n = 980 rpm) and a gearbox driving a belt conveyor for bulk materials.

$$T_{AN} = 9{,}550 \cdot \frac{450\ kW}{980\ min.^{-1}} = 4{,}385.2\ Nm$$

smooth uniform load
= G : S_A = 1.25
ambient temperature
40°C : S_υ = 1.1
starts
30/h : S_Z = 1.0

$$T_{KN} \geq T_{AN} \cdot S_A \cdot S_\upsilon \cdot S_Z$$
$$T_{KN} \geq 4{,}385.2\ Nm \cdot 1.25 \cdot 1.1 \cdot 1.0 = 6{,}029.7\ Nm$$

Selected coupling: ST2 / 10 with elastomer coupling T_{KN} = 6,030 Nm

SAFETY COUPLINGS

ST

GEAR COUPLING DESIGN ST4

Size		ST4 / 2	ST4 / 5	ST4 / 10	ST4 / 25	ST4 / 40	ST4 / 60	ST4 / 100	ST4 / 160	ST4 / 250
T_{KN} Rated Torque	(Nm)	5,700	9,000	14,500	22,000	45,000	70,000	150,000	200,000	402,000
T_{Kmax} Maximum Torque	(Nm)	14,000	21,500	35,000	54,000	110,000	170,000	360,000	480,000	804,000
n Ref (max speed)	($min.^{-1}$)	4,000	3,900	3,700	3,550	2,750	2,420	1,950	1,730	990

ACCORDING TO TORQUE

1. Calculate the drive torque. T_{AN}.

$$T_{AN} \geqq 9{,}550 \cdot \frac{P_{Drive}}{n} \quad (Nm)$$

2. Base the coupling rated torque T_{KN} on the drive torque T_{AN} multiplied by the application factor. (see page 20 for shock or load factors S_A).

$$T_{KN} \geq T_{AN} \cdot S_A$$

Example:
Coupling between an electric motor (P = 800 kW and n = 980 rpm) and a gearbox driving a bucket chain excavator (S_A = 2).

$$T_{AN} = 9{,}550 \cdot \frac{800\ kW}{980\ min.^{-1}} = 7{,}796\ Nm$$

$$T_{KN} \geq T_{AN} \cdot S_A$$
$$T_{KN} \geq 7{,}796\ Nm \cdot 2 = 15{,}592\ Nm$$

Selected coupling: ST4 / 10 with gear coupling T_{KN} = 16,000 Nm

DISC PACK COUPLINGS

LP

SYMBOLS

T_{KN} = Rated torque of the coupling (Nm)

T_{AS} = Peak torque of the drive system

e.g. max. acceleration torque of drive (Nm)
or max. braking torque of load (Nm)

J_L = Total load inertia (e.g. shaft + sprocket + chain + roller + 1/2 of coupling) (kgm ^{2})

J_A = Total driving inertia (motor [including gear ratio] + 1/2 of coupling) (kgm ^{2})

Shock or Load Factor S_A		
uniform load	non-uniform load	highly dynamic load
1	2	3-4
Common factor for servo drives in machine tools: S_A = 2-3		

ACCORDING TO TORQUE

Couplings are normally sized for the highest torque to be regularly transmitted. The peak torque of the application should not exceed the rated torque of the coupling. The following calculation provides an approximation of the minimum required coupling size, and allows for the maximum rated speed and misalignment to exist in the application.

$$T_{KN} \geqq 1.5 \cdot T_{AS} \text{ (Nm)}$$

ACCORDING TO ACCELERATION TORQUE

A more detailed calculation takes acceleration and the driving and driven moments of inertia into account. A strong inertia ratio diminishes the effect of the load factor in the sizing calculation.

$$T_{KN} \geqq T_{AS} \cdot S_A \cdot \frac{J_L}{J_A + J_L} \text{ (Nm)}$$

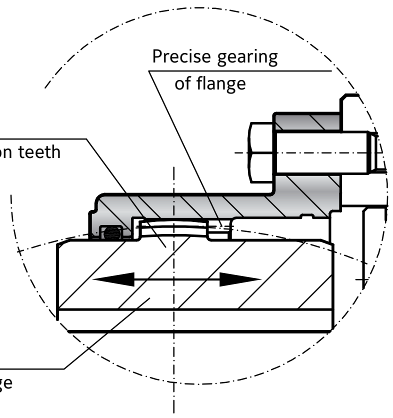
GEAR COUPLING

BZ

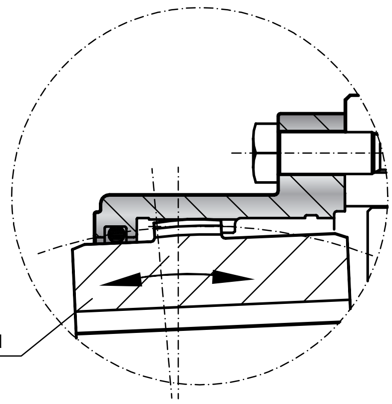
FUNCTION OF THE GEAR COUPLING

The high precision gearing of the coupling compensates for lateral, angular, and axial misalignment. The gearing transmits torque with minimal backlash and a high degree of torsional rigidity. The precise geometry of the gearing ensures the performance of the coupling.

Axial misalignment



Angular and lateral misalignment



MAINTENANCE AND LUBRICATION

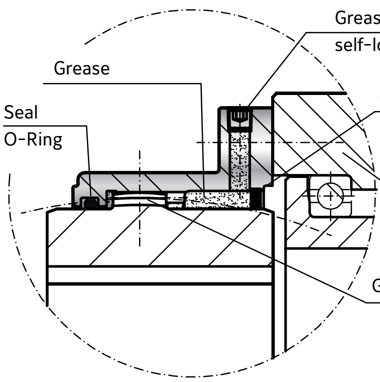
▶ **Note:** Lubrication of the gearing is very important to the service life of the coupling.
An additional seal (optional) ensures the lubrication of the gearing over a long period of time.

Use only high performance grease

RECOMMENDED LUBRICANTS

Normal speed		High speed	
Castrol	Impervia MDX	Caltex	Coupling Grease
Esso	Fibrax 370	Klüber	Klüberplex GE 11-680
Klüber	Klüberplex GE 11-680	Mobil	Mobilgrease XTC
Mobil	Mobilux EPO	Shell	Albida GC1
Shell	Alvania grease EP R-O or ER 1	Texaco	Coupling Grease
Total	Specis EPG		

For easier handling, the coupling will be shipped unassembled.



GEAR COUPLINGS

BZ

SYMBOLS

T_{KN} = Rated torque of the coupling (Nm)

T_{AN} = Rated torque of the drive (Nm)

S_A = Shock or load factor

P = Drive power (kW)

n = Rotational speed (rpm)

DESIGN FACTORS

Shock or Load Factor S_A

Drive type	Load characteristics of driven machine		
	G	M	S
electric motors, turbines, hydraulic motors	1.25	1.6	2.0
internal combustion engines ≥4 cylinder degree of uniformity ≥1:100	1.5	2.2	2.5

G = smooth uniform load | M = moderate load | S = heavy shock load

LOAD FACTORS BY MACHINE TYPE

EXCAVATORS
- S bucket chain excavators
- S traveling gear (caterpillar)
- M traveling gear (rails)
- M suction pumps
- S bucket wheels
- M slewing gears

CONSTRUCTION MACHINERY
- M concrete mixers
- M road construction machinery

CHEMICAL INDUSTRY
- M mixers
- G agitators (light fluids)
- M dryer drums
- G centrifuges

FEEDERS AND CONVEYORS
- S belt conveyors
- G belt conveyors (bulk materials)
- M belt bucket conveyors
- M screw conveyors
- M circular conveyors
- M hoists

BLOWERS AND FANS[1]
- G blowers (axial/radial) P:n ≤ 0.007
- M blowers (axial/radial) P:n ≤ 0.07
- S blowers (axial/radial) P:n > 0.07
- G cooling tower fans P:n ≤ 0.007
- M cooling tower fans P:n ≤ 0.07
- S cooling tower fans P:n > 0.07

GENERATORS AND TRANSFORMERS
- S generators

RUBBER MACHINERY
- S extruders
- S calendars
- M mixers
- S rolling millse

WOOD PROCESSING MACHINERY
- G woodworking machines

CRANES
- S traveling gears
- S hoisting gears
- M slewing gears

PLASTICS MACHINERY
- M mixers
- M shredders

METALWORKING MACHINERY
- M sheet metal bending machines
- S plate straightening machines
- S presses
- M shears
- S punch presses
- M machine tools, main drives

FOOD PROCESSING MACHINERY
- G filling machines
- M kneading machines
- M cane crushers
- M cane cutters
- S cane mills
- M sugar beet cutters
- M sugar beet washers

PAPER MACHINERY
- S wood cutters
- S calendars
- S wet presses
- S suction presses
- S suction rollers
- S drying cylinders

PUMPS
- S piston pumps
- G centrifugal pumps (light fluids)
- S reciprocating pumps

STONE AND CLAY MACHINES
- S breakers
- S rotary kilns
- S hammer mills
- S brick presses

TEXTILE MACHINERY
- M tanning vats
- M willows
- M looms

COMPRESSORS
- S reciprocating compressors
- M centrifugal compressors

METAL ROLLING MILLS
- M plate tilters
- S ingot handling machinery
- M winding machines (strip and wire)
- S descaling machines
- S cold rolling mills
- M chain transfers
- M cross transfers
- M roller straighteners
- S tube welding machines
- S continuous casting plants
- M roller adjustment drives

LAUNDRY MACHINES
- M tumblers
- M washing machines

WASTEWATER TREATMENT PLANTS
- M aerators
- G screw pumps

[1]) P = power of drive in kW
n = speed of drive in rpm

ACCORDING TO TORQUE

1. Calculate the drive torque at speed T_{AN}.

$$T_{AN} \geqq 9{,}550 \cdot \frac{P_{Drive}}{n} \text{ (Nm)}$$

2. Determine the required torque rating of the coupling T_{KN} based on the drive torque T_{AN} multiplied by the shock or load factor S_A (see page 20)

$$T_{KN} \geq T_{AN} \cdot S_A$$

Sample calculation:
Coupling between an electric motor (P = 800 kW at n = 980 rpm) and a transmission, driving a screw conveyor (S_A = 1.6).

$$T_{AN} = 9{,}550 \cdot \frac{800 \text{ kW}}{980 \text{ min.}^{-1}} = 7{,}796 \text{ Nm}$$

$$T_{KN} \geq T_{AN} \cdot S_A$$
$$T_{KN} \geq 7{,}796 \text{ Nm} \cdot 1.6 = 15{,}592 \text{ Nm}$$

BELLOWS COUPLINGS

BX

SYMBOLS

T_{KN} = Rated torque of coupling (Nm)

T_{AS} = Peak torque (Nm)

e.g. maximum acceleration peak torque or maximum braking torque from the load

J_L = Moment of inertia of the load (load + drive line components + half of coupling) (kgm^2)

J_A = Drive inertia (rotor of motor + drive line components + half of coupling) (kgm^2)

C_T = Torsional stiffness of coupling (Nm/rad)

f_e = Resonant frequency of the two mass system (Hz)

f_{er} = Exitation frequency of the drive (Hz)

φ = Angle of twist (degree)

Shock or Load Factor S_A		
uniform load	non-uniform load	heavy shock load
1	2	3-4
For many crushing and shredding applications load factors are commonly S_A = 2-3		

ACCORDING TO TORQUE

Couplings are normally sized for the highest torque to be regularly transmitted. The peak torque of the application should not exceed the rated torque of the coupling. The following calculation provides an approximation of the minimum required coupling size, and allows for the maximum rated speed and misalignment to exist in the application.

$$T_{KN} \geqq 1.5 \cdot T_{AS} \text{ (Nm)}$$

ACCORDING TO ACCELERATION TORQUE

A more detailed calculation takes acceleration and the driving and driven moments of inertia into account. A strong inertia ratio diminishes the effect of the load factor in the sizing calculation.

$$T_{KN} \geqq T_{AS} \cdot S_A \cdot \frac{J_L}{J_A + J_L} \text{ (Nm)}$$

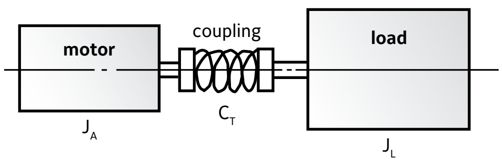
ACCORDING TO RESONANT FREQUENCY

The torsional natural frequency of the coupling must be significantly higher or lower than that of the equipment. For the mechanical substitution model the two mass system applies.

In practice the following applies: $f_e \geq 2 \cdot f_{er}$

$$f_e = \frac{1}{2 \cdot \pi} \sqrt{C_T \cdot \frac{J_A + J_L}{J_A \cdot J_L}} \text{ (Hz)}$$

Two Mass System



ACCORDING TO TORSIONAL DEFLECTION

To calculate transmission error as a result of torsional stress:

$$\varphi = \frac{180}{\pi} \cdot \frac{T_{AS}}{C_T} \text{ (degree)}$$

ELASTIC JAW COUPLINGS

EK

SYMBOLS

T_{KN} = Rated torque of the coupling (Nm)
T_{Kmax} = Maximum torque rating of coupling (Nm)
T_S = Peak torque applied to the coupling (Nm)
T_{AS} = Peak torque of the drive system (Nm)
T_{AN} = Nominal torque of the drive system (Nm)
T_{LN} = Nominal torque of the load (Nm)
P = Drive power (kW)
n = Rotational speed ($min.^{-1}$)
J_A = Total driving inertia (kgm^2)
(motor [including gear ratio] + 1/2 of coupling)
J_L = Total load inertia (kgm^2)
(load + drive line components + half of coupling)
J_1 = Moment of inertia of driving coupling half (kgm^2)
J_2 = Moment of inertia of driving coupling half (kgm^2)
m = Ratio of the moment of inertia of the drive to the load
υ = Temperature at the coupling (also consider radiant heat)
S_υ = Temperature factor
S_A = Load factor
S_Z = Start factor
(factor for the number of starts per hour)
Z_h = Number of starts per hour (1/h)

Temperature factor S_υ	A	B	E
Temperature (υ)	Sh 98 A	Sh 65 D	Sh 64 D
> -30°C to -10°C	1.5	1.3	1.2
> -10°C to +30°C	1.0	1.0	1.0
> +30°C to +40°C	1.2	1.1	1.0
> +40°C to +60°C	1.4	1.3	1.2
> +60°C to +80°C	1.7	1.5	1.3
> +80°C to +100°C	2.0	1.8	1.6
> +100°C to +120°C	–	2.4	2.0
> +120°C to +150°C	–	–	2.8

Start factor S_Z			
Z_h	up to 120	120 to 240	over 240
S_Z	1.0	1.3	on request

Shock / load factor S_A		
uniform load	non-uniform load	heavy shock load
1	1.8	2.5

COUPLING SELECTION FOR OPERATION WITHOUT SHOCK OR REVERSAL

The rated torque of the coupling (T_{KN}) must be greater than the rated torque of the load (T_{LN}), taking into account the temperature at the coupling (Temperature factor S_υ). Should T_{LN} be unknown, T_{AN} can be used as a substitute in the formula.

Calculation

$$T_{KN} > T_{AN} \cdot S_\upsilon$$

Supplemental Calculation

$$T_{AN} = \frac{9{,}550 \cdot P}{n}$$

Sample calculation: (without shock loads)

Coupling conditions
υ = 70° C
S_υ = 1.7 (for 70°/ Elastomer Type A)

Drive for centrifugal pump
T_{AN} = 850 Nm

Calculation: $T_{KN} > T_{AN} \times S_\upsilon$
$T_{KN} >$ 850 Nm · 1.7
$T_{KN} >$ 1445 Nm ⟶ **Result:** Coupling model EKH/2500/A (T_{KN} = 1950 Nm) is selected.

COUPLING SELECTION FOR OPERATION WITH SHOCK LOADS

Same basic conditions as above. In addition, the maximum torque rating of the coupling (T_{Kmax}) is dictated by peak torque (T_S) due to shock loads.

Calculation

$$T_{KN} > T_{AN} \cdot S_\upsilon$$

Supplemental Calculation

$$T_{AN} = \frac{9{,}550 \cdot P}{n}$$

Calculation

$$T_{Kmax} > T_S \cdot S_Z \cdot S_\upsilon$$

Supplemental Calculation

$$T_S = \frac{T_{AS} \cdot S_A}{m + 1}$$

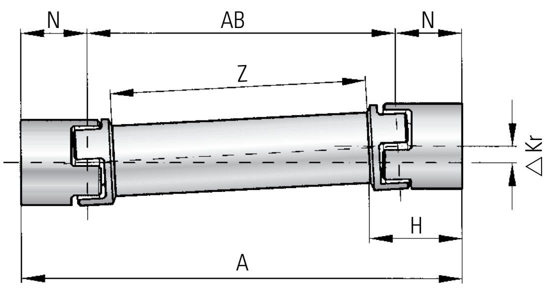
$$m = \frac{J_A \cdot J_1}{J_L \cdot J_2}$$

ELASTOMER-DRIVE SHAFT COUPLINGS

EZ

SYMBOLS

A	=	Overall length (mm)
AB	=	Distance between flextures (mm) AB = (A – 2xN)
Z	=	Tube length (mm) Z = (A – 2xH)
H	=	Length of coupling ends (mm)
N	=	Length to flexture (mm)
T_{AS}	=	Peak torque of the drive (Nm)
φ	=	Torsional deflection (degree)
C_T^B	=	Torsional stiffness of both flexible elements (Nm/rad)
C_T^{ZWR}	=	Torsional stiffness per 1m of tubing (Nm/rad)
C_T^{ZA}	=	Total torsional stiffness (Nm/rad)
n_k	=	Critical speed (1/min.)
C_{Tdyn}^E	=	Dynamic torsional stiffness of both elastomer inserts (Nm/rad)
C_{Tdyn}^{EZ}	=	Total torsional stiffness (Nm/rad)



MODEL EZ

Size	Torsional stiffness of both flexible elements		Torsional stiffness per 1m of tubing	Length of coupling ends EZ	Length to flexture	Max. axial misalignment
	Elastomer insert A C_T^B (Nm/rad)	Elastomer insert B C_T^B (Nm/rad)	C_T^{ZWR} (Nm/rad)	H (mm)	N (mm)	Δ Ka (mm)
2500	87,500	108,000	1,000,000	142	108	5
4500	168,500	371,500	2,500,000	181	137	5
9500	590,000	670,000	5,000,000	229	171	6

Table 2

MAXIMUM TRANSMITTABLE TORQUE BY BORE DIAMETER (Nm)

Size	Ø 35	Ø 45	Ø 50	Ø 55	Ø 60	Ø 65	Ø 70	Ø 75	Ø 80	Ø 90	Ø 120	Ø 140
2500	1900	2600	2900	3200	3500	3800	4000	4300	4600	5200		
4500		5300	5800	6300	7000	7600	8200	8800	9400	10600	14100	
9500			9200	10100	11100	11900	12800	13800	14800	16700	22000	25600

TEMPERATURE FACTOR S

	A	B
Temperature (φ)	Sh 98 A	Sh 64 D
> -30° to -10°	1.5	1.7
> -10° to +30°	1.0	1.0
> +30° to +40°	1.2	1.1
> +40° to +60°	1.4	1.3
> +60° to +80°	1.7	1.5
> +80° to +100°	2.0	1.8
> +100° to +120°	–	2.4

ACCORDING TO TORSIONAL STIFFNESS

Condition: Line shaft EZ2, Size 4500 T_{AS} = 5,000Nm
Wanted: Total torsional stiffness C_T^{ZA}

$$(C_T^{ZA}) = \frac{168{,}500 \text{ Nm/rad x } (2{,}500{,}000 \text{ Nm/rad} / 1.344 \text{ m})}{168{,}500 \text{ Nm/rad} + (2{,}500{,}000 \text{ Nm/rad} / 1.344 \text{ m})} = 154504 \text{ [Nm/rad]}$$

$$(C_T^{ZA}) = \frac{C_T^B \cdot (C_T^{ZWR}/Z)}{C_T^B + (C_T^{ZWR}/Z)} \text{ (Nm/rad)}$$

ACCORDING TO TORSIONAL DEFLECTION

Condition: Line shaft EZ2, size 4500 T_{AS} = 5,000 Nm
Wanted: Torsional deflection at maximum acceleration torque T_{AS}

Measurement (A) of line shaft = 1.706 m
Length (Z) of tubing = A-(2xH) = 1.344 m

$$\varphi = \frac{180 \cdot T_{AS}}{\pi \cdot C_T^{ZA}} \text{ (degree)}$$

$$\varphi = \frac{180 \text{ x } 5{,}000 \text{ Nm}}{\pi \text{ x } 154504 \text{ Nm/rad}} = 1{,}85°$$

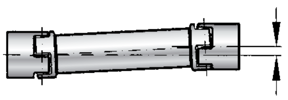
With a maximum torque of 5,000 Nm the torsional deflection is 1.85°

DRIVE SHAFT COUPLINGS

EZ

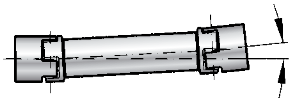
ACCORDING TO MAXIMUM MISALIGNMENT

Lateral misalignment $\triangle$ Kr



$$\Delta Kr_{max} = \tan \Delta \tfrac{Kw}{2} \cdot AB$$
$$AB = A - 2N$$

Angular misalignment $\triangle$ Kw



$\triangle Kw_{max.} = 2°$

Axial misalignment $\triangle$ Ka

$\triangle$ Ka See table
(Page 27)

R+W CALCULATION PROGRAM

Using proprietary software, R+W will calculate the specific mechanical details of exactly the model you plan to use. Overall length, tube materials (e.g. steel, aluminum, CFK), and other factors are used to determine a number of performance values unique to your line shaft coupling.

Critical speed	n_k	=	1/min.
Torsional stiffness of tubing	C_T^{ZWR}	=	Nm/rad
Overall stiffness	C_T^{ZA}	=	Nm/rad
Torsional deflection	φ	=	degree-min-sec
Total Weight	m	=	kg
Moment of inertia	J	=	kgm^2
Maximum misalignment	$\triangle$ Kr	=	mm

GENERAL INFORMATION
ELASTOMER SEGMENT ST2

ST2

ELASTIC SAFETY COUPLING

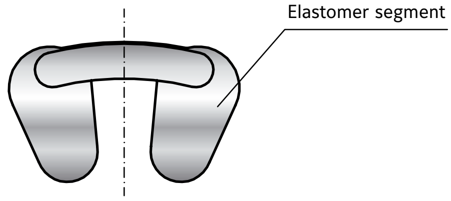
THE ELASTOMER SEGMENT

The compensating elements of the ST2 safety couplings are the elastomer segments. They transmit torque while damping vibration and compensating for lateral, axial and angular misalignment. Three different versions are available with version A being supplied unless otherwise specified.

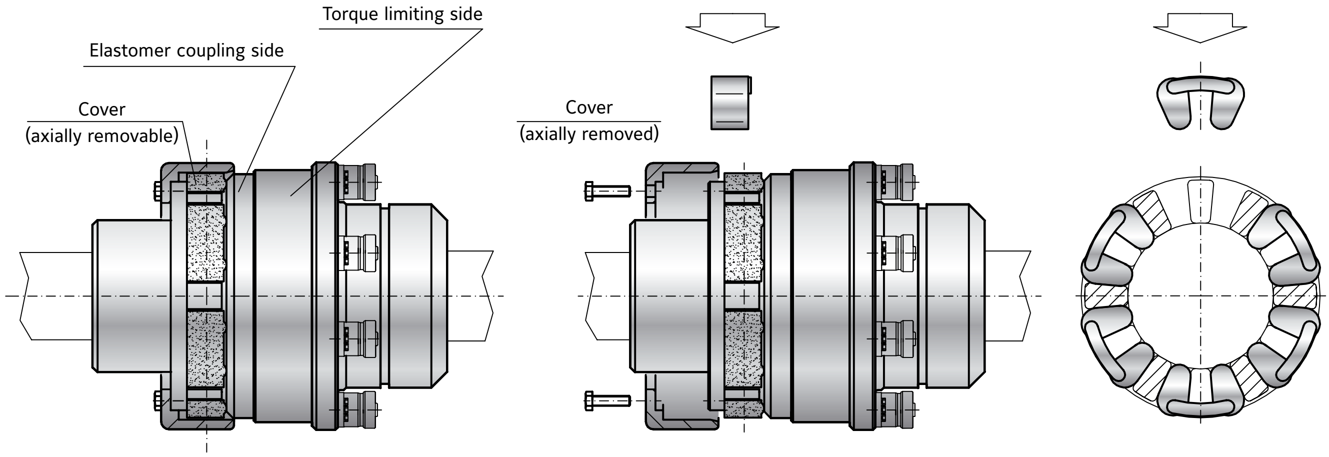
Type	Relative damping (ψ)	Temperature range constant	peak	Material	Shore hardness	Features
A (Standard)	1.0	-40°C to +80°C	+90°C	Natural and synthetic rubber	75-80 Shore A	Very high wear resistance
B	1.0	-40°C to +100°C	+120°C	Synthetic rubber	73-78 Shore A	Resistant to many oils and fuels
C	1.0	-70°C to +120°C	+140°C	Silicone rubber	70-75 Shore A	High temperature range

▶ Note

Elastomer segments can be easily changed after installation. Every coupling utilizes 6x elastomer segments. The elastomer segments do not need to be installed prior to coupling mounting.



CHANGING THE ELASTOMER SEGMENTS



For easier handling, the coupling will be shipped unassembled.