ETP Transmission AB

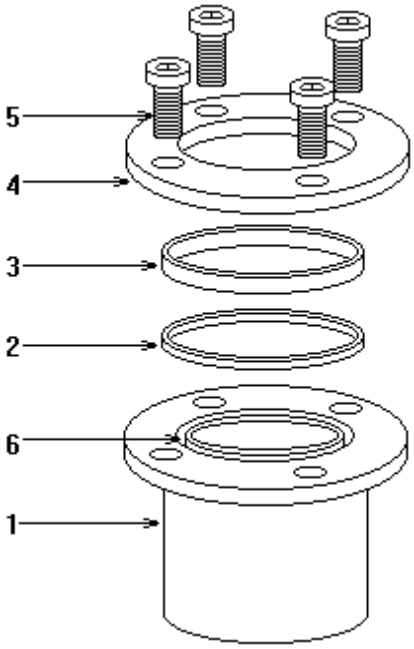
Technical Manual

ETP-CLASSIC incl type R

Content

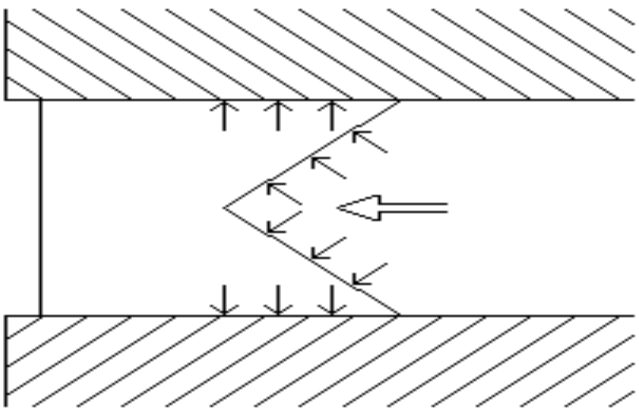
Technical parts description

1. Consists of two steel (for type R stainless) sleeves welded together in one end, the whole sleeve is heat treated, thus hardened all through to a hardness of approx. 300 Vickers (300 Brinell, 107 Rockwell B, 31 Rockwell C). The tolerances on the ID and the OD of the double walled sleeve are chosen in such a way that it is easy to mount and it loosens from the shaft and hub as soon as the screws are loosened.



2. Seal

A V-shaped extruded special plastic ring. The plastic is an acetal plastic (POM) which does not coldflow under high pressure. It has a pressfit between the two sleeves. The V-shape also makes sure there will be a tight fit so the pressure medium does not get out..



3. Circular piston

A non hardened steel piston which transforms the screw force into a pressure in the pressure medium and also acts as a support ring for the seal.
For type R in stainless.

4. Pressure flange

A hardened steel flange, hardness: the same as the double walled sleeve.
For type R in stainless.

5. Screws

DIN 912, of the highest tensile strength available 12.9 also named according to ISO standard: ISO 4762 (similar to ANSI B 18.3 but metric).
For the inch sizes the same screws (metric) are used.
For type R: Screws DIN 933 A4 plated for a low and even friction in the threads. Available from us as spare parts. Not available as standard on the market. Lubricated with food approved Klüberpaste UH1 84-201, also Molykote P-1900 food grade paste can be used.

6. Pressure medium

The pressure medium is a special mixture of different materials developed by ETP. It is not available to buy on the open market as a ready compound. We prefer to keep the content of it as a company secret. It is non-compressible with a minimized difference in volume expansion coefficient compared to steel. As it is hermetical enclosed no ageing occurs. Under the high pressure (1000 bar, 14.500 PSI) which is used, it acts like a fluid.

The ingredients have been judged after the N. Irving Sax: Dangerous properties of industrial materials. – The ingredients are in other cases used as additives to food or in other products which come in contact with food. From ETP-CLASSIC only small amounts can possibly come out, the pressure medium must be regarded as harmless

Mounting/dismantling tips

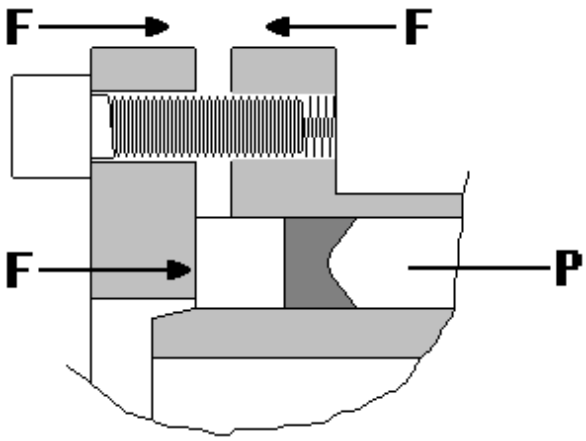
Comments to the instruction which is enclosed with each ETP-CLASSIC:

- For max. torque capacity all the contact surfaces should be cleaned with a solvent.
- A thin oil on the surfaces will reduce the torque capacity only slightly but make the mounting easier.
- Use a torque wrench if the full load capacity is going to be used.
- If the screws need to be changed make sure to get the right quality (DIN 912, 12,9 or ISO 4762)
- If the screws need to be changed for type R, make sure to get the right quality, only available from us.
- When mounting type R frequently we recommend you put grease on the threads of the screws before each mounting. See under Screws above for lubricants.
- As accessories screws with hexheads are also available.
- If there is a keyway in the shaft or hub it has to be filled in to avoid permanent deformation of the double-walled sleeve.
- If there is no clearance between the flanges when the screws are tightened the following could be the reason:

  Too wide tolerance on the shaft or in the bore of the hub.
  Too small wall thickness or too weak material in the hub.
  Something wrong with ETP-CLASSIC itself.

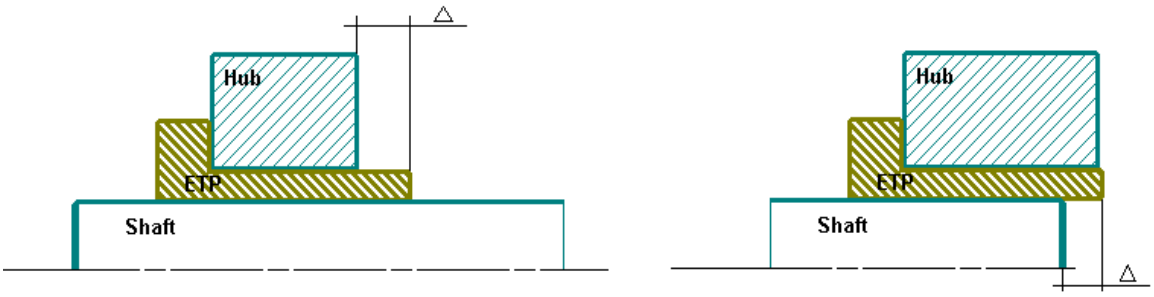
- If mounting is going to be done frequently put grease on the threads of the screws regularly.

- Because the hydraulic pressure, p, always makes sure that there is a "prestress-force" in the screws, there is no risk the screws will loosen because of vibration.



ETP Transmission AB

- ETP-CLASSIC can protrude at the end of the hub or shaft according to this list without getting permanently deformed or cause reduction in torque capacity.

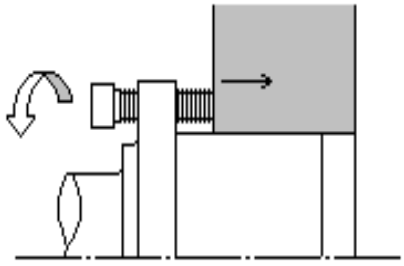


(mm)	Δ	(inch)	Δ
15	3	3/4"	3,5
19	3,5	7/8"	4
20	3,5	15/16"	4
22	4	1"	4
24	4	1 1/8"	4,5
25	3,6	1 3/16"	5
28	4,5	1 1/4"	5
30	5	1 5/15"	5
32	5	1 3/8"	5,5
35	5,5	1 7/16"	6
38	5,5	1 1/2"	6
40	6	1 5/8"	6
42	6	1 11/16"	6,5
45	6,5	1 3/4"	6,5
48	7	1 15/16"	7,5
50	7	2"	7,5
55	7,5	2 3/16"	8
60	8	2 7/16"	9
65	9	2 1/2"	9,5
70	9,5	2 15/16"	9,5
75	9,5	3"	10,5
80	9,5	3 7/16"	11,5
85	10,5	3 15/16"	12,5
90	10,5	4"	13,5
95	12,5		
100	12,5		

ETP Transmission AB

Dismantling

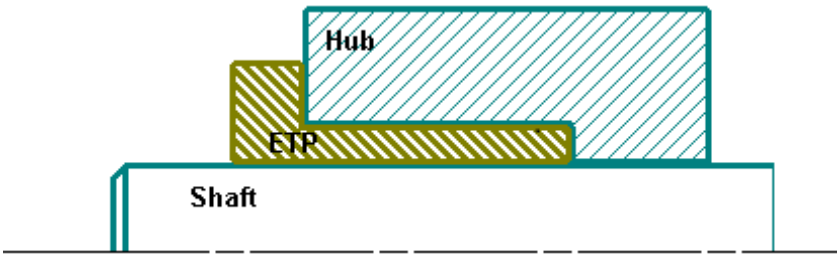
- Untighten the screws clockwise around the flange, about 1/2 revolution for each screw to start with.
- The screws do not need to be removed from the flange before the ETP-CLASSIC loosens.
- If the surface of the hub or ETP-CLASSIC has got damaged, ETP-CLASSIC can be pushed out of the hub like the picture shows. It may be necessary to use longer screws.



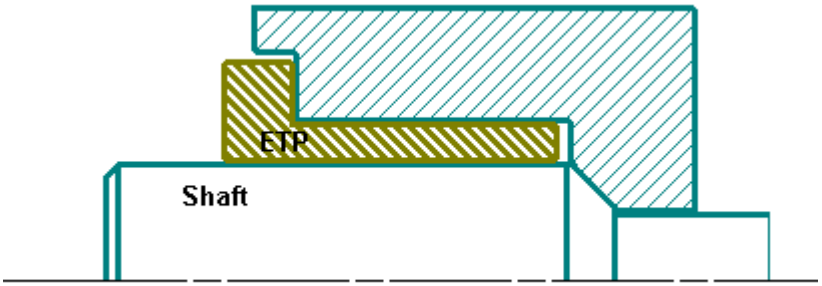
Never dismantle the seal.

Design suggestions

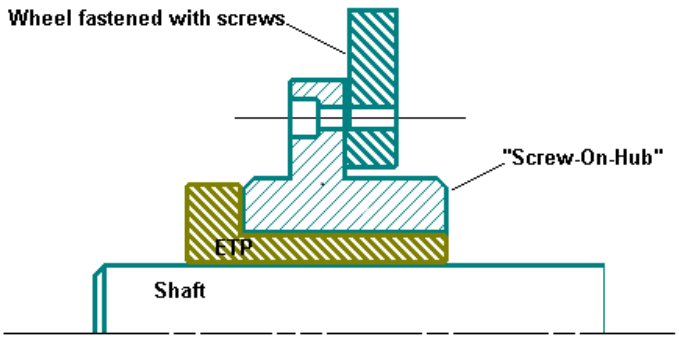
If there are an extremely high radial load or bending torque.



To mount a cylinder when the radial load is very high.

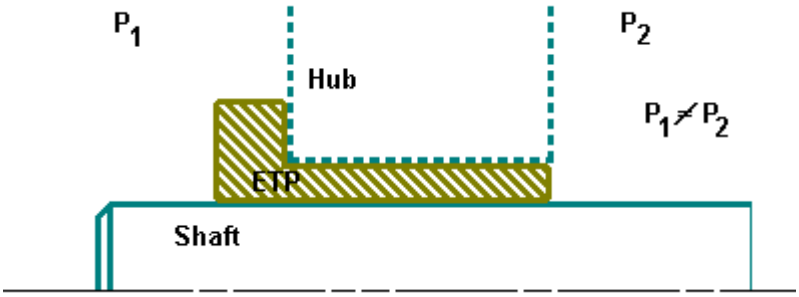


A "screw on hub"

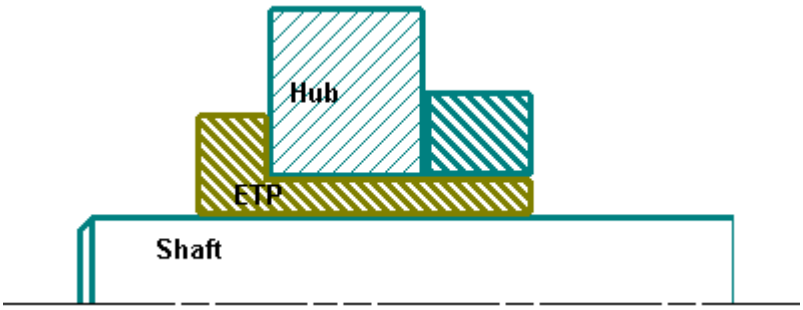


To use ETP-CLASSIC as a "seal”.

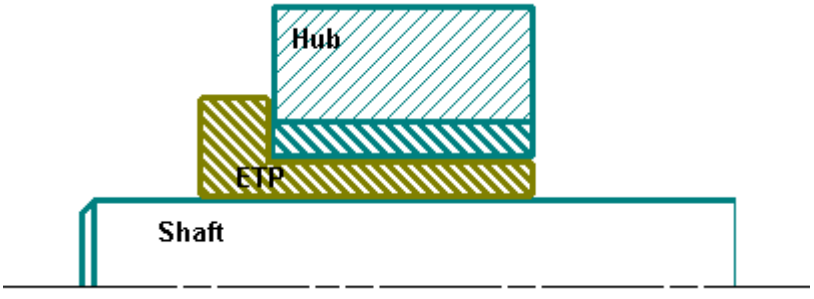
From one side of the hub to the other in the axial direction. This is possible because of the even surface pressure and the unslotted double walled sleeve.



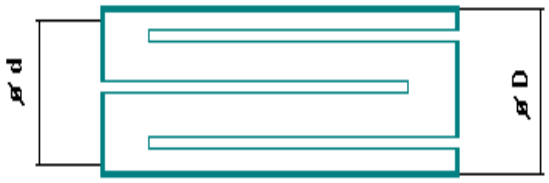
For short hubs use an extra hub to avoid deformation.



For plastic hubs use a steel sleeve between ETP-CLASSIC and the plastic hub.



If the correct size of ETP-CLASSIC is not available
A split sleeve can be used between the bore of ETP-CLASSIC and the shaft.



If h8 shaft tolerance:

D: tolerance js6

d: tolerance JS6

Transmittable torque = $\frac{d}{D}$

Times rated torque for ETP-CLASSIC.

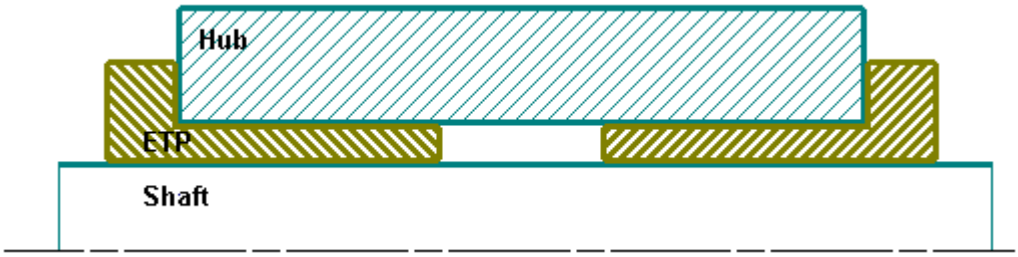
If an unslotted sleeve is used:

Transmittable torque $= \left(\frac{d}{D}\right)^2$

Times rated torque for ETP-CLASSIC.

To increase the torsional stiffness of the shaft.

A steel tube can be connected around the shaft with two ETP-CLASSIC.



ETP Transmission AB

Rigid coupling

Instead of using a flange coupling with keyways like in pic.1, (on the next page), two ETP-CLASSIC can be used to connect two shafts of same or different sizes, just by using a steel tube between the shafts (see pic. 2-3). This can be done when designing a new machine which give the following advantages:

- shorter shafts to handle when assembling and serving the machine
- a compact shaft to shaft coupling
- a rigid coupling
- the customer can make the steel sleeve himself

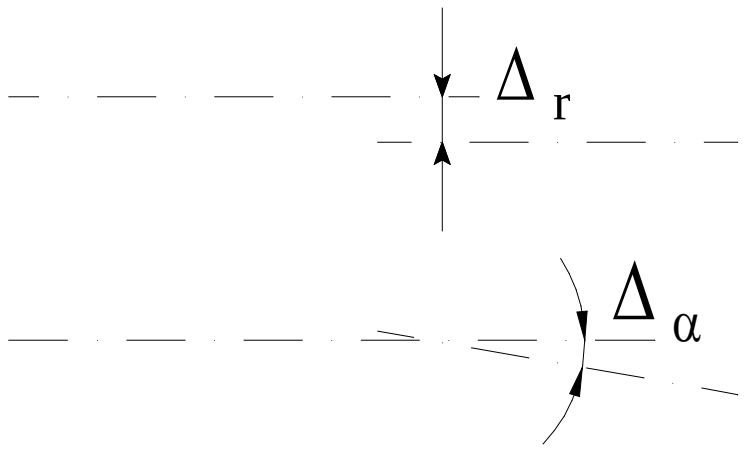
It can also be used to repair a broken shaft thus achieving the following:

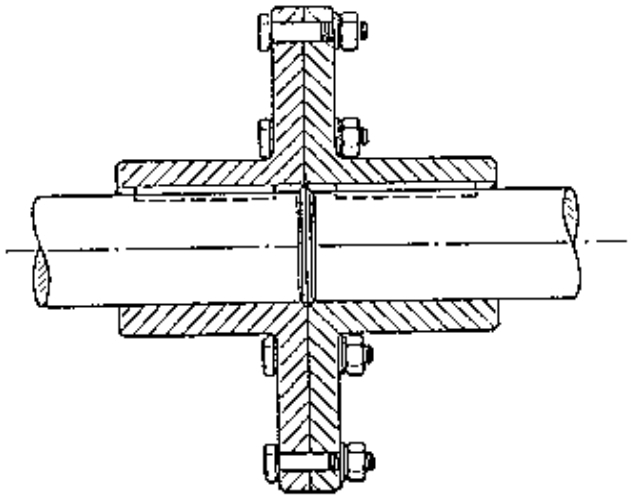
- easy to repair the broken shaft part with a steel tube
- the sleeve can be of practically any length

Thickness of the sleeve: same rules as when choosing the thickness of the hub. The radial bore in the sleeve makes the axial positioning of the coupling easier.

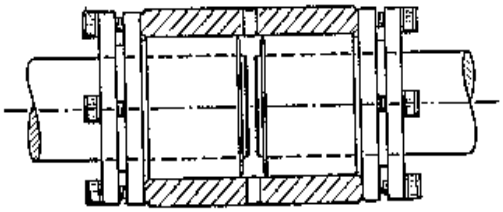
Alignment: Because of the rigid nature of the coupling the misalignment between the two shafts has limitations in order not to get fatigue of ETP-CLASSIC.

	Maximal radial Misalignment (mm) (Δ_r)	**Maximal angle misalignment (°)** (Δ_α)
ETP-20	0,04	0,1°
ETP-30	0,05	0,1°
ETP-40	0,06	0,1°
ETP-50	0,07	0,1°
ETP-60	0,08	0,1°
ETP-70	0,09	0,1°
ETP-80	0,10	0,1°
ETP-90	0,11	0,1°
ETP-100	0,12	0,1°

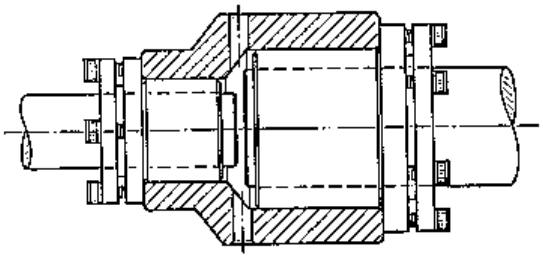




Picture 1.



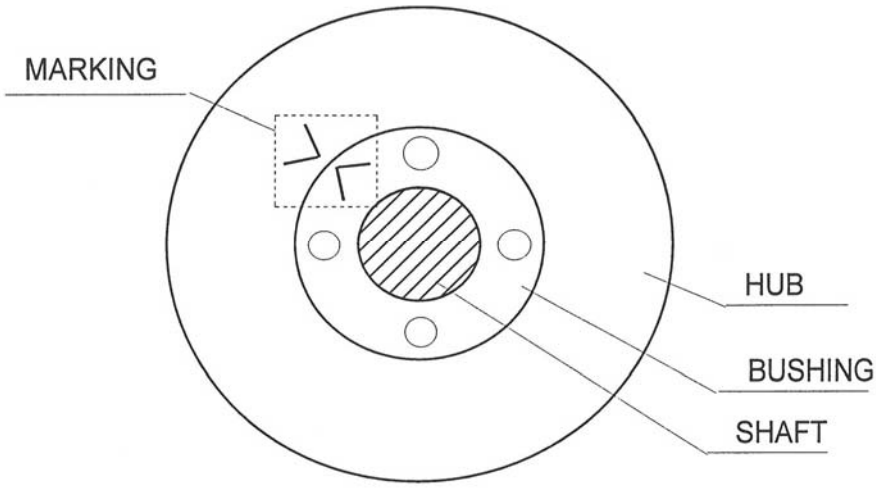
Picture 2.



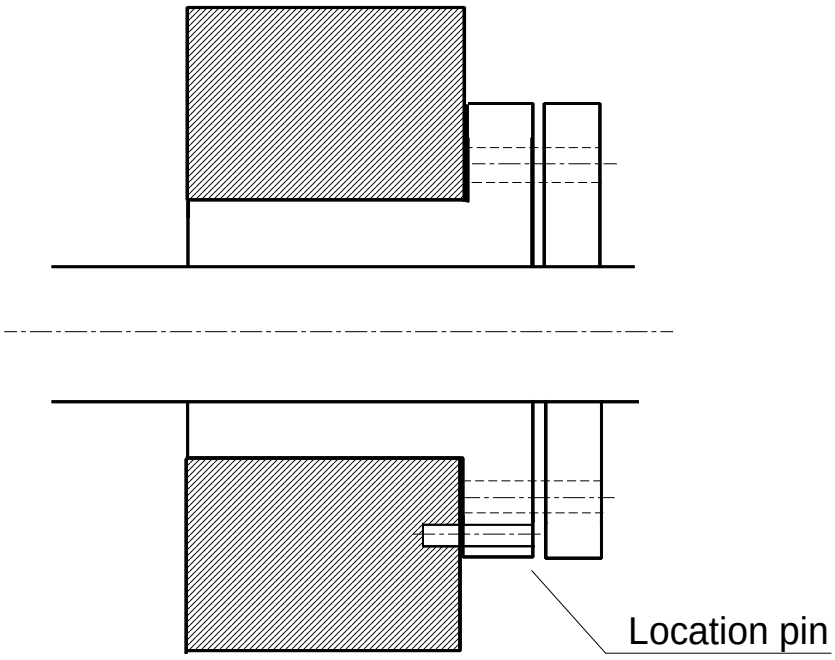
Picture 3.

Advices

If ETP-CLASSIC and hub are dynamically balanced as one unit and is mounted/ dismantled frequently, we suggest to try to position the hub at the same place on ETP-CLASSIC every time. This can be done by marking the hub and ETP-LASSIC,(example 1),or by having a small location pin in the flange,(example 2).



Example 1.

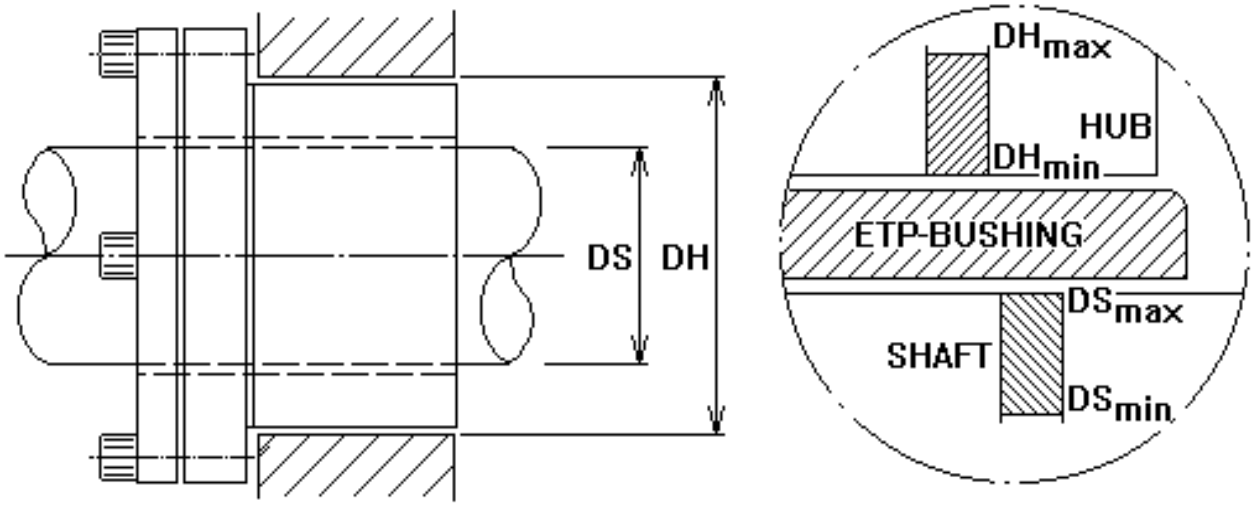


Example 2.

Tolerances

Recommended tolerances for ETP-CLASSIC is h8 - k6 which means that all tighter tolerances within this are included. ETP-CLASSIC can also be used on h9 shafts but then the transmittable torque will be reduced by 20%.

Note: For ETP-CLASSIC 15 the working span is only h7.



ETP (metric 15-100 mm), recommended tolerances in inch

	Shaft			Hub	
	from	to		from	to
15	0	-0,0007	15-20	0	0,0008
19-30	0,0006	-0,0013	22-38	0	0,0010
32-50	0,0007	-0,0015	40-60	0	0,0012
55-80	0,0009	-0,0018	65-95	0	0,0014
85-100	0,0010	-0,0021	100	0	0,0016
R-15	0	-0,0007	R 15-20	0	0,0008
R 20-30	0	-0,0013	R 25-35	0	0,0010
R 35-50	0	-0,0015	R 40-50	0	0,0012

ETP (inch 3/4”- 4”), recommended tolerances in inch

	Shaft			Hub	
	from	to		from	to
3/4"	0	-0,0015	3/4" – 1 15/16"	0	0,0010
7/8" – 1 1/2"	0	-0,0020	2" – 2 7/16"	0	0,0012
1 5/8" - 2 15/16"	0	-0,0030	2 1/2" - 4"	0	0,0014
3" - 3 7/16"	0	-0,0040			
3 15/16" - 4"	0	-0,0030			

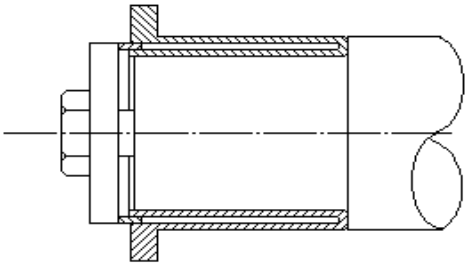
Central bolt

Not applicable for ETP-CLASSIC type R.

The following applies to the replacement of screws in ETP-CLASSIC by a single central screw, the pressure in the sleeve will be equal in both cases.

Shaft size	Existing Bolts				Central screw		
	Nbr of pcs	Pitch circle diam	Size	Total screw force kN	Size	T_{clamp} Nm	Strength class
15	3	28	M5	20,1	M8	28	12,9
19	3	35	M5	26,9	M8	38	12,9
20	3	35	M5	26,9	M8	38	12,9
22	4	40	M5	26,9	M8	38	12,9
24	4	40	M5	35,8	M10	65	10,9
25	4	40	M5	35,8	M10	65	10,9
28	4	46	M5	35,8	M10	65	10,9
30	4	47,5	M5	35,8	M10	65	10,9
32	4	50,5	M5	35,8	M10	65	10,9
35	6	53,5	M5	53,7	M12	113	10,9
38	6	56	M5	53,7	M12	113	10,9
40	6	60,5	M5	53,7	M12	113	10,9
42	6	60,5	M5	53,7	M12	113	10,9
45	6	66,5	M6	70,7	M14	175	10,9
48	6	69,5	M6	70,7	M14	175	10,9
50	6	72,5	M6	70,7	M14	175	10,9
55	8	78	M6	94,3	M16	260	10,9
60	8	84,5	M6	94,3	M16	260	10,9
65	8	91	M6	94,3	M16	260	10,9
70	6	99	M8	134,6	M20	465	10,9
75	6	104	M8	134,6	M20	465	10,9
80	6	109	M8	134,6	M20	465	10,9
85	6	115	M8	134,6	M20	465	10,9
90	8	121	M8	179,5	M20	620	12,9
95	8	129	M8	179,5	M20	620	12,9
100	8	134	M8	179,5	M20	620	12,9

The above information is taken from the bolt manufacturer's catalogue.

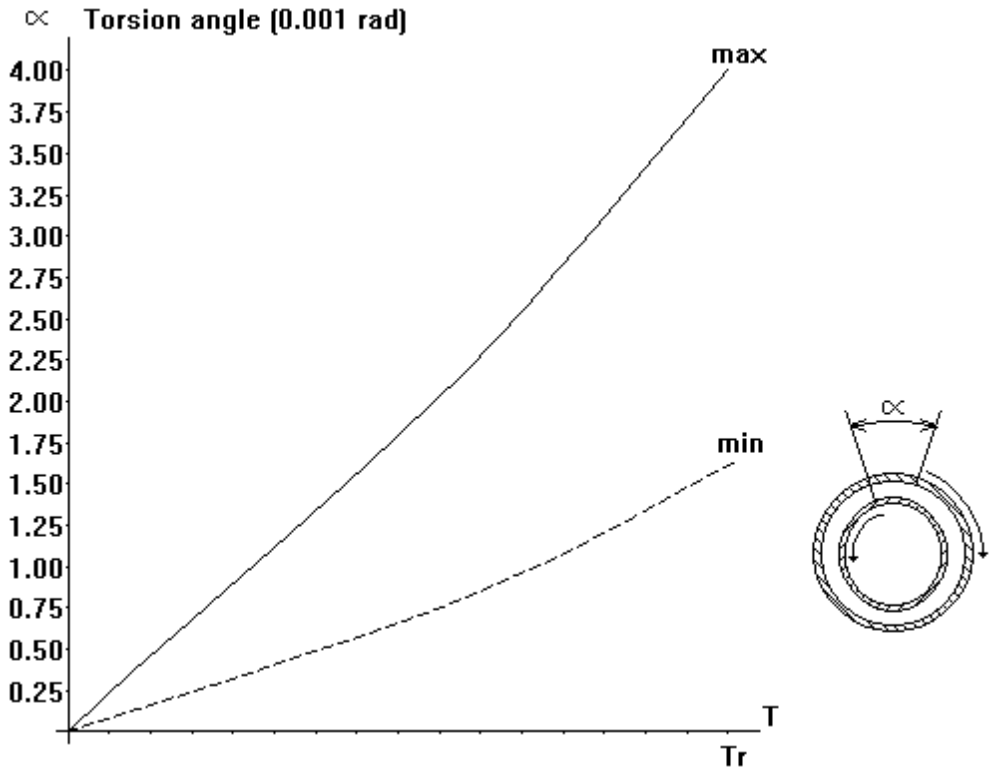


Torsional stiffness

When torque is applied to the double-walled sleeve there will be a for most applications neglectable torsion angle (α) between the two tubes the double-walled sleeve consists of.

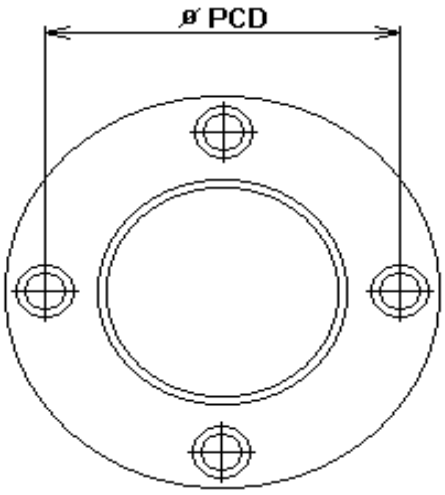
The torsion angle is practically the same for all sizes at the rated torque, see diagram. As a guide figure the torsion is less than 0,004 rad (approx. 0,25°).
The full curve shows the torsion angle when the hub and the shaft give maximum play within the recommended tolerance width.
The dotted curve is valid for the minimum play.

The torsion angle is of no interest unless the accuracy between the hub and the shaft is in the area of 0,004 rad.



Screw pitch circle diameter

The PCD for the screws are given in this table:

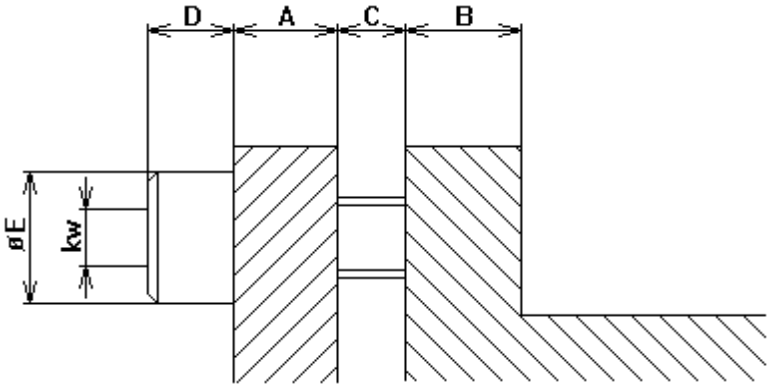


Shaft (mm)	**PCD** (mm)	**Shaft** (inch)	**PCD** (mm)
15	28	3/4"	35
19	35	7/8"	40
20	35	15/16"	40
22	40	1"	41,5
24	40	1 1/8"	46
25	40	1 3/16"	47,5
28	46	1 1/4"	50,5
30	47,5	1 5/16"	52
32	50,5	1 3/8"	53,5
35	53,5	1 7/16"	56
38	56	1 1/2"	59
40	60,5	1 5/8"	61
42	60,5	1 11/16"	65
45	66,5	1 3/4"	66,5
48	69,5	1 15/16"	72,5
50	72,5	2"	76
55	78	2 3/16"	81
60	84,5	2 7/16"	88
65	91	2 1/2"	93
70	99	2 5/16"	104
75	104	3"	107
80	109	3 7/16"	119
85	115	3 15/16"	134
90	121	4”	141
95	129		
100	134		

ETP Transmission AB

Flange dimensions, inch sizes

For ETP-CLASSIC R, the dimension D is different, see the broschure.



The figures for C are before mounting.
kw = key width for allen key

Shaft	D	A	C	B	ØE	Screw size	kw
3/4"	5	5,5	2,8	7	8,5	M5	4
7/8"	5	5,5	2,5	6,5	8,5	M5	4
15/16"	5	5,5	2,8	6,5	8,5	M5	4
1"	5	5,5	2,8	7	8,5	M5	4
1 1/8"	5	5,5	2,8	7	8,5	M5	4
1 3/16"	5	5,3	2,8	7	8,5	M5	4
1 1/4"	6	7	3,0	7,5	10	M6	5
1 5/16"	6	7	3,0	7,5	10	M6	5
1 3/8"	5	7	3,1	7,5	8,5	M5	4
1 7/16"	5	7	3,1	7,5	8,5	M5	4
1 1/2"	5	7	3,5	7,5	8,5	M5	4
1 5/8"	5	8	3,5	8	8,5	M5	4
1 11/16"	6	8	3,9	8	10	M6	5
1 3/4"	6	8	3,1	8,5	10	M6	5
1 15/16"	6	8,5	4,5	9,7	10	M6	5
2"	6	8,5	4,5	9,5	10	M6	5
2 3/16"	6	9,5	5,3	10,5	10	M6	5
2 7/16"	6	9,5	5,4	10,5	10	M6	5
2 1/2"	8	10	6,4	10	13	M8	6
2 15/16"	8	11	6,6	11	13	M8	6
3"	8	11	6,5	11	13	M8	6
3 7/16"	8	11	6,6	11	13	M8	6
3 15/16"	8	13,2	7,6	13,2	13	M8	6
4"	8	13	7,6	13	13	M8	6

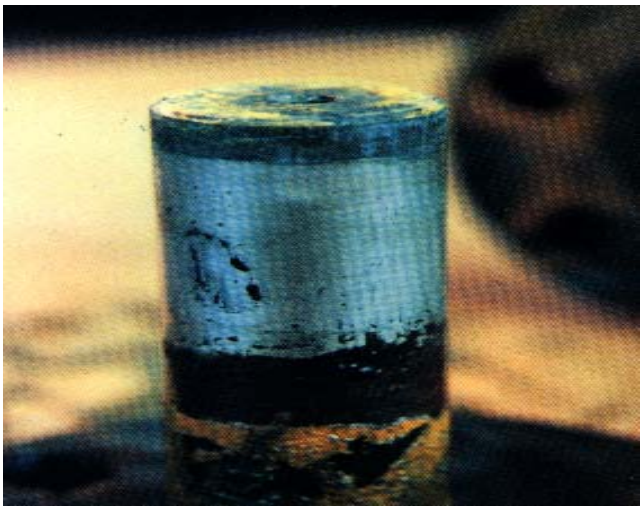
Corrosion test

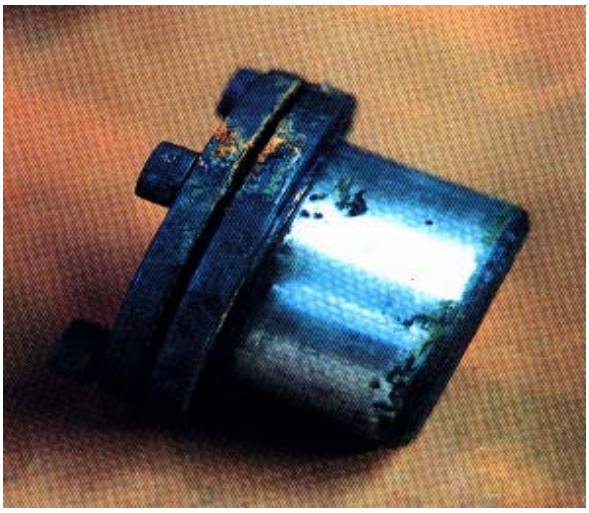
As ETP-CLASSIC (not type R) is made of steel it will corrode in a corrosive environment.
However, because of the following factors it will not corrode on the contact surfaces:

- The even surface pressure against bore of hub and shaft.

- The sleeve is not slotted.

The joint below was immersed for one year in a 3,5% salt solution.
It was easily dismantled. As soon as the screws were loosened the hub fell off by itself. As you also see in the pictures there is no corrosion on the contact surfaces because of the tight fit created by ETP-CLASSIC.





Screws

ETP-CLASSIC is delivered with cap head screws of quality 12.9 DIN 912. Type R with hex head screws DIN 933, A4 quality plated for low friction.
There screws for ETP-CLASSIC are available on the market.
We also keep them available for you to buy as spare parts. ETP-CLASSIC for inch shafts has metric screws also.

Because of the small number of screws which gives a lot of space around the flange it is also possible to use screws with hex heads. These are, however not available as standard items. Through purchase of large quantities we have had them made for us and can supply them to you. They are used for two reasons:

- because of limited space in the axial direction for mounting tools
- to avoid collecting dirt in the cap head, specially in the food industry

METRIC		**INCH**	
Shaft size	Screw size	Shaft size	Screw size
15	5x10	3/4" – 1 3/16”	5x12
19-30	5x12	1 1/4" - 1 5/16”	6x14
32-38	5x14	1 3/8" - 1 ½”	5x14
40-42	5x16	1 5/8"	5x16
45-48	6x16	1 11/16" – 1 ¾”	6x16
50-55	6x18	1 15/16" – 2”	6x18
60-65	6x20	2 3/16" – 2 7/16”	6x20
70	8x20	2 1/2"	8x20
75-85	8x22	2 15/16" – 3 7/16”	8x22
90-100	8x25	3 15/16" – 4”	8x25

FAQ

What happens if the rated torque is exceeded?

There is a certain safety margin for the rated torque. If that is also exceeded ETP-CLASSIC slips on the shaft or in the hub bore. If it is not immediately stopped ETP-CLASSIC will weld to the shaft when it cools and be difficult to dismantle.

If the rpm is very low and the machine is stopped directly just after a few revolutions, nothing serious will have happened to the surfaces and it can be dismantled and used again. Some of our customers use it in this way as an adjustable safety slip coupling. By varying the tightening torque for the screws the slip torque can be adjusted.

Can the screws be overtightened?

When mounting nothing will happen to ETP-CLASSIC itself or to the seal.
The tightening torque is chosen so that if the screws are tightened to the recommended torque at room temperature, they will also function at 85°C. If they are much overtightened at room temperature, some screws can break if the operating temperature is 85°C.

What happens if ETP-CLASSIC is fatigued?

If the reason for fatigue is alternating or pulsating torque the inner sleeve will break close to the welding. Pressure medium will come out and ETP-CLASSIC will slip.

If the reason is high radial load or bending torque the outer sleeve will break close to the welding.

How can the torque capacity be increased?

There are the following ways of doing this, however, you have to be aware of the restrictions which they imply. These are described elsewhere.

- increase the tightening torque on the screws
- closer tolerances for the shaft and hub
- use of ETP-FRICTION, ETP-INTERFIX or ETP-HFC

Can screws of quality 10.9 be used?

They can be used (not type R) and tightened to the tightening torque that we recommend in the
Brochure (for 12.9), but then the operating temperature may not exceed the mounting temperature.

Can the seal be destroyed?

The seal will only break if the max. temperature is exceeded for a longer time.
It will not loosen even if the piston is dismantled as it has a pressfit in the sleeve.

How are the double-walled sleeve made?

The double-walled sleeve consists of two sleeves which are welded together. The welding is done according to a special method with special tooling and material in an automatic electron beam welding machine adopted to our requirements. Because of this and the heat treatment, the welding zone is stronger than the sleeves themselves.

Why does ETP-CLASSIC R have a lower rated torque than ETP-CLASSIC?

Stainless screws are not available in such a high tensile strengths, 12.9, as for ETP-CLASSIC. The number of screws has been increased for type R but still the total force from the screws which creates the pressure in the double walled sleeve is not as high as for ETP-CLASSIC.

Why does ETP-CLASSIC R have hex head screws instead of cap heads like ETP-CLASSIC?

Hex head screws do not have any “pockets” where dirt and impurities could hide, thus they are easier to clean.