SPIETH Clamping Sleeves

Series DSK – DSL

Shaft-Hub-Connections
for tolerance fields h5/h6

Works Standard SN 01.01

SPIETH Clamping Sleeves Series DSK – DSL

To cope in the future with increasing levels of dynamic stress, higher quality shaft-hub connecting elements will be necessary.

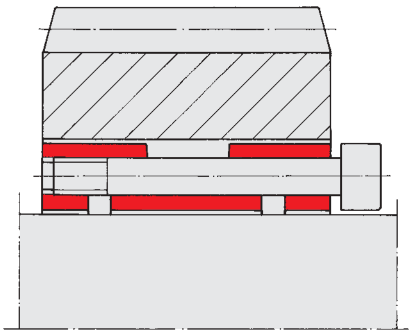
To avoid balancing problems, high-frequency rotating spindles must offer absolute concentricity together with a dynamically balanced structure.

Using a clamping sleeve, precisely oriented peripheral and/or axial positioning is easy to be realised.

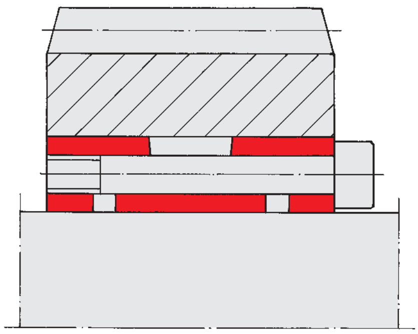
The combination of simply manufactured connecting components and a low-priced clamping sleeve with the advantage of easy assembly and dismantling, make this an outstanding cost-effective shaft-hub connecting element.

The amount of work for dismantling is often underestimated.
If demands for a machine service or the question of recycling capability are present, the importance of quick dismantling is fully realized.

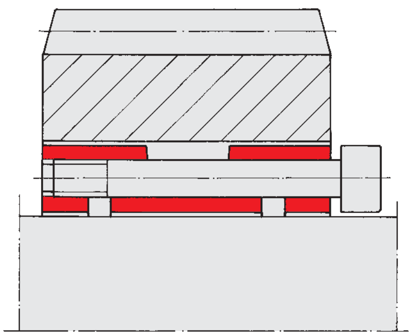
Functional principle:



Connecting with assembly play.



Clamping screws tightened, connection centred and capable of withstanding high levels of stress.



Clamping screws released, easy dismantling with disassembly play.

The principle is shown in a simplified diagram with enlarged play.

SPIETH clamping sleeve series DSK

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Fields of application:

„SPIETH design“ clamping sleeves are friction-locked connecting elements used in general mechanical engineering. Arranged between cylindrical shafts and hub bores, they are capable of transmitting high levels of torque and/or axial forces. Their high centring capability, dynamic symmetry and the ease of dismantling afforded by the use of spring hardened steel make them ideal for application wherever precise concentricity is required, where high rotational frequencies are involved, or where exchangeable components are connected. Typical application examples include the fixture of gears, connection to modern working spindles, the fixture of profile rollers and many more. However, this system is not reserved to this type of complex application and can be used at reasonable cost for all kinds of shaft-hub connections.

Benefits:

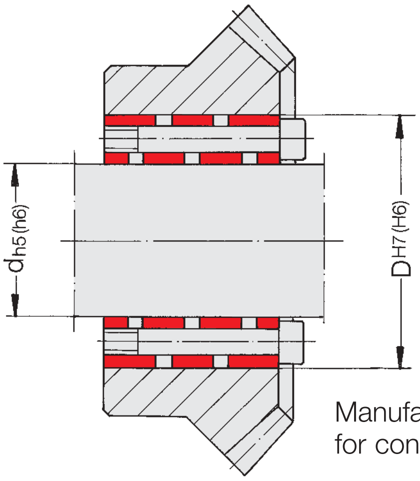
Simple execution of hub and shaft: Cylindrical hub boreholes without shoulders or a machined end face. Glazed cylindrical shaft without weakening grooves or toothing. No additional axial safeguards such as collars, retaining rings, distance rings etc. are required. The completely play-free connection is resistant to alternating torsion (→ transmittable forces). As the clamping forces engage evenly all round, no shaft distortion can occur. A highly accurate level of concentricity is achieved without any special effort. By tightening the clamping screws individually, it is possible to partially or completely compensate any eccentricity, still existing in the connecting elements due to the production process.

Execution:

The clamping sleeves are produced from spring-hardened steel. The outside diameter is machined to ISO tolerance h5, the central bore to ISO tolerance H6. The maximum bore/outside diameter concentricity error is 0.01 mm. The built-in clamping screws are cheese head screws in accordance with ISO 4762, and are actuated using an ISO 2936 screwdriver.

Connecting components:

The cylindrical bore and outside surfaces of the clamping sleeve must be completely covered by the connecting components.
The manufacturing tolerance of the hub bore is H7 (H6 for stringent concentricity requirements, e. g. in gears).
Manufacturing tolerance of the shaft: h5 (max. h6).
The shaft and bore must be cylindrically machined with a mean peak-to-valley height of Rz = 2.5-6.3 microns.



Manufacturing tolerances for connecting components

To ensure that the stress exerted on the hub remains within the elastic range, we recommend the following minimum hub wall thickness:

C 45 steel	$= 0{,}6\ (d_2 - d_1)$
Aluminium alloys Minimum strength F 38	$= 1{,}0\ (d_2 - d_1)$
Grey cast iron GG 22 shrinkage free cast	$= 1{,}0\ (d_2 - d_1)$

If smaller dimensions are requested, ask our technical consulting for possibilities.

Application:

The clamping screws built into the sleeve may only be actuated when the bore and outside surface of the clamping sleeve are covered by the connecting components.
Otherwise the clamping sleeve could be destroyed as a result of plastic deformation.

Assembly

1. Clean the clamping sleeve, shaft and hub bore and wet slightly using low-viscosity machine oil.

2. Push the clamping sleeve between the shaft and hub without using force.

3. Tighten the clamping screws evenly crosswise until the initial assembly play is eliminated. The play elimination phase is particularly important for ensuring good concentricity results.

4. Continue tightening evenly and gradually in diagonal sequence until you have achieved full torque.

5. Finally, check the tightening torque all round.

Dismantling

1. Release the clamping screws gradually in diagonal sequence. Never completely unscrew one screw after the other. This would cause the last screw to be subjected to the total spring back force exerted by the clamping sleeve and consequently to block. An attempt to release it can result in destruction of the hexagonal socket.

2. After releasing the clamping screws, all the components of the connection can once more be freely moved. After several assembly processes, an unfavourable alteration of the friction ratio between the screw head and the contact surface of the clamping sleeve can take place. When tightening, a stick-slip effect can occur which results in jerky movement of the clamping screw. In this case, the contact surface of the screw head must be relubricated using a standard machine oil without additives.

Explanations

Clamping screws:

Cheese head screws with hexagon socket in compliance with ISO 4762, strength class 12.9.
As the power transmission of the clamping sleeves depends on the exerted clamping force, the clamping screws should be tightened by using a torque wrench.
M_A: Tightening torque per clamping screw

Transmittable forces

The values in the table apply to following tolerance constellation: shaft h5, bore H7. For shaft h6, in the most unfavourable constellation a 10 % reduction of transmittable forces may be expected.

M: Transmittable torque at $F_a = 0$
The specified values were ascertained in a series of tests, in which the connecting components were made of C45 steel, produced with the stipulated surface quality.

F_a: Transmittable axial force at M = 0
F_a values are calculated according to the formula

$$F_a = 2000 \cdot \frac{M}{d_1} \text{ [N]}$$

Subjection of the clamped connection to steady, pulsating, alternating or sudden stress has no impact provided that the occurring peak forces do not exceed the catalogue values.

The risk of fretting corrosion is always a possibility in friction-locked connections subjected to alternating torsion or rotating bending stress.

This phenomenon can hamper dismantling, and can be prevented with the following instructions:

Adm. alternating torsion $\tilde{T}_{zul.} \leqq 0{,}6$ M

Adm. rotating bending stress $\tilde{M}_{b_{zul.}} \leqq 0{,}3$ M

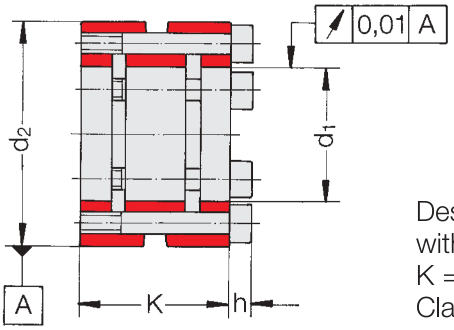
M und F_a: If torque and axial forces act on a clamping sleeve at the same time, check using the following formula whether the resulting torque Mr is transmittable.

$$M \geqq Mr = \sqrt{Me^2 + \left(\frac{Fae \cdot d_1}{2000}\right)^2} \text{ [Nm]}$$

M	= Transmittable torque (catalogue value) [Nm]
Mr	= Resulting torque [Nm]
d_1	= Shaft diameter [mm]
Fae	= Required axial force [N]
Me	= Required torque [Nm]

Note:

Other clamping sleeves conforming to our works standard are available:
SN 01.02 – series DSM for shaft tolerance k6/m6
SN 01.05 – series AK/AL and IK/IL for external exertion of tension

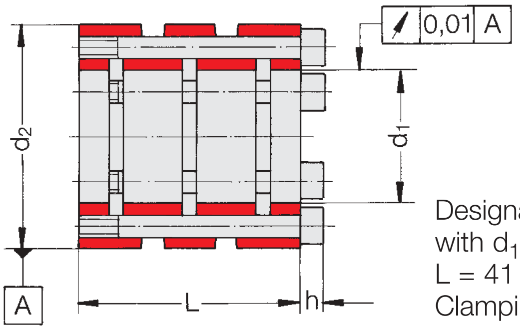


SPIETH clamping sleeve Series DSK

Designation of a clamping sleeve with d_1 = 20 mm, d_2 = 40 mm and K = 36 mm:
Clamping sleeve DSK 20 · 40

Subject to changes.
Special versions:
On request, by sending of an explanatory sketch.

Code	Dimensions in mm			Clamping screws				Transmittable forces		Mass moment of inertia J
DSK	d_1 H6	d_2 h5	K	ISO 4762	h mm	M_A Nm	No.	M or F_a Nm	M or F_a N	kg cm^2
14 · 26	14	26	21	M3	3	2	6	36	5100	0,045
15 · 28	15	28	21	M3	3	2	6	44	5900	0,059
16 · 28	16	28	21	M3	3	2	6	43	5400	0,058
16 · 32	16	32	31	M4	4	5	6	71	8900	0,161
18 · 30	18	30	21	M3	3	2	6	53	5900	0,074
18 · 35	18	35	31	M4	4	5	6	96	10700	0,227
20 · 32	20	32	21	M3	3	2	6	62	6200	0,093
20 · 37	20	37	31	M4	4	5	6	100	10000	0,278
20 · 40	20	40	36	M5	5	7	6	130	13000	0,434
22 · 35	22	35	21	M3	3	2	6	75	6800	0,131
22 · 38	22	38	31	M4	4	5	6	100	9100	0,302
22 · 42	22	42	36	M5	5	10	6	210	19100	0,519
25 · 37	25	37	21	M3	3	2	6	85	6800	0,155
25 · 42	25	42	31	M4	4	5	6	140	11200	0,439
25 · 45	25	45	36	M5	5	10	6	260	20800	0,666
28 · 40	28	40	21	M3	3	2	6	98	7000	0,203
28 · 45	28	45	31	M4	4	5	6	170	12100	0,562
28 · 48	28	48	36	M5	5	10	6	300	21400	0,840
30 · 42	30	42	21	M3	3	2	6	110	7300	0,240
30 · 47	30	47	31	M4	4	5	6	190	12700	0,655
30 · 50	30	50	36	M5	5	10	6	340	22700	0,973
30 · 55	30	55	41	M6	6	13	6	390	26000	1,594
32 · 48	32	48	31	M4	4	5	6	180	11300	0,690
32 · 52	32	52	36	M5	5	10	6	360	22500	1,117
32 · 56	32	56	41	M6	6	13	6	410	25600	1,687
35 · 52	35	52	31	M4	4	5	6	230	13100	0,936
35 · 55	35	55	36	M5	5	10	6	420	24000	1,362
35 · 60	35	60	41	M6	6	17	6	630	36000	2,180
40 · 56	40	56	31	M4	4	5	6	240	12000	1,174
40 · 62	40	62	36	M5	5	10	6	540	27000	2,142
40 · 65	40	65	41	M6	6	17	6	750	37500	2,898
40 · 70	40	70	52	M8	8	25	6	830	41500	5,298
45 · 68	45	68	36	M5	5	10	6	640	28400	3,007
45 · 70	45	70	41	M6	6	17	6	860	38200	3,761
45 · 75	45	75	52	M8	8	25	6	950	42200	6,778
50 · 72	50	72	36	M5	5	10	6	750	30000	3,602
50 · 75	50	75	41	M6	6	17	6	1040	40800	4,784
50 · 80	50	80	52	M8	8	40	6	1850	74000	8,518
55 · 80	55	80	41	M6	6	17	6	1100	40000	5,981
55 · 85	55	85	52	M8	8	40	6	2070	75400	10,538
60 · 85	60	85	41	M6	6	17	6	1320	44000	7,364
60 · 90	60	90	52	M8	8	40	6	2370	79000	12,860
65 · 90	65	90	41	M6	6	17	6	1450	44600	8,948
65 · 95	65	95	52	M8	8	40	6	2640	81400	15,505
70 · 100	70	100	52	M8	8	40	6	2990	85400	18,494
75 · 105	75	105	52	M8	8	40	6	3250	86700	21,850
80 · 110	80	110	52	M8	8	40	6	3520	88000	25,592
85 · 120	85	120	57	M8	8	40	6	3560	83800	40,255



SPIETH clamping sleeve Series DSL

Designation of a clamping sleeve with d_1 = 28 mm, d_2 = 45 mm and L = 41 mm:
Clamping sleeve DSL 28 · 45

Subject to changes.
Special versions:
On request, by sending of an explanatory sketch.

Code	Dimensions in mm			Clamping screws				Transmittable forces		Mass moment of inertia J
DSL	d_1 H6	d_2 h5	L	ISO 4762	h mm	M_A Nm	No.	M or F_a Nm	N	kg cm^2
14 · 26	14	26	31	M3	3	2	6	60	8600	0,059
15 · 28	15	28	31	M3	3	2	6	66	8800	0,078
16 · 28	16	28	31	M3	3	2	6	73	9100	0,077
16 · 32	16	32	41	M4	4	5	6	130	16300	0,179
18 · 30	18	30	31	M3	3	2	6	86	9600	0,099
18 · 35	18	35	41	M4	4	5	6	160	17800	0,250
20 · 32	20	32	31	M3	3	2	6	100	10000	0,124
20 · 37	20	37	41	M4	4	5	6	180	18000	0,307
20 · 40	20	40	52	M5	5	7	6	170	17000	0,547
22 · 35	22	35	31	M3	3	2	6	110	10000	0,173
22 · 38	22	38	41	M4	4	5	6	180	16400	0,334
22 · 42	22	42	52	M5	5	10	6	260	23600	0,653
25 · 37	25	37	31	M3	3	2	6	140	11200	0,206
25 · 42	25	42	41	M4	4	5	6	250	20000	0,484
25 · 45	25	45	52	M5	5	10	6	320	25600	0,839
28 · 40	28	40	31	M3	3	2	6	160	11400	0,269
28 · 45	28	45	41	M4	4	5	6	280	20000	0,619
28 · 48	28	48	52	M5	5	10	6	370	26400	1,059
30 · 42	30	42	31	M3	3	2	6	180	12000	0,318
30 · 47	30	47	41	M4	4	5	6	320	21300	0,722
30 · 50	30	50	52	M5	5	10	6	410	27300	1,225
30 · 55	30	55	62	M6	6	13	6	430	28700	2,130
32 · 48	32	48	41	M4	4	5	6	340	21200	0,764
32 · 52	32	52	52	M5	5	10	6	440	27500	1,408
32 · 56	32	56	62	M6	6	13	6	460	28700	2,258
35 · 52	35	52	41	M4	4	5	6	400	22900	1,029
35 · 55	35	55	52	M5	5	10	6	520	29700	1,716
35 · 60	35	60	62	M6	6	17	6	700	40000	2,913
40 · 56	40	56	41	M4	4	5	6	470	23500	1,299
40 · 62	40	62	52	M5	5	10	6	620	31000	2,686
40 · 65	40	65	62	M6	6	17	6	830	41500	3,873
40 · 70	40	70	77	M8	8	25	6	900	45000	6,888
45 · 68	45	68	52	M5	5	10	6	720	32000	3,765
45 · 70	45	70	62	M6	6	17	6	960	42600	5,029
45 · 75	45	75	77	M8	8	25	6	1100	48900	8,810
50 · 72	50	72	52	M5	5	10	6	850	34000	4,518
50 · 75	50	75	62	M6	6	17	6	1130	45200	6,398
50 · 80	50	80	77	M8	8	40	6	1980	79200	11,069
55 · 80	55	80	62	M6	6	17	6	1260	45900	8,001
55 · 85	55	85	77	M8	8	40	6	2240	81500	13,692
60 · 85	60	85	62	M6	6	17	6	1480	49400	9,853
60 · 90	60	90	77	M8	8	40	6	2600	86600	16,706
65 · 90	65	90	62	M6	6	17	6	1630	50100	11,976
65 · 95	65	95	77	M8	8	40	6	2900	89300	20,141
70 · 100	70	100	77	M8	8	40	6	3210	91800	24,022
75 · 105	75	105	77	M8	8	40	6	3560	95000	28,378
80 · 110	80	110	77	M8	8	40	6	3870	96800	33,237
85 · 120	85	120	92	M8	8	40	6	3900	91800	60,214

Assembly examples

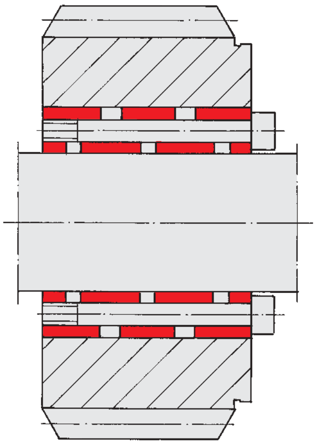


Fig. 1:
Gear fixture.
For highest concentricity requirements, we recommend mounting a control facility to proof the concentricity and adjust by tightening the screws with different levels of torque. This ensures precise assembly.

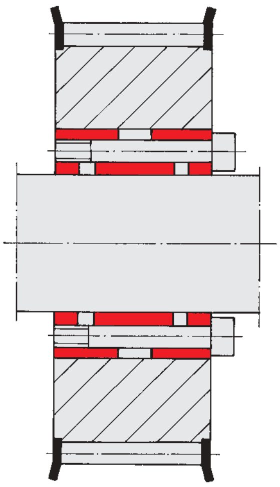


Fig. 2:
Pulley fixture.
The hub can be made of an aluminium alloy. Observe minimum strength. High temperatures can impair retention force!

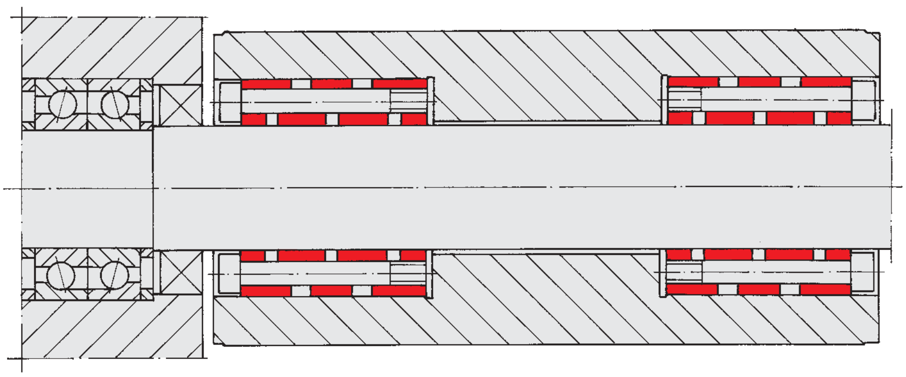


Fig. 3:
Pressure roller fixture.
Here, two long clamping sleeves are used to achieve high overall radial rigidity due to intensive tensioning of the shaft hub. The pressure roller is exchanged by pulling the shaft out of the bearings.

Assembly examples

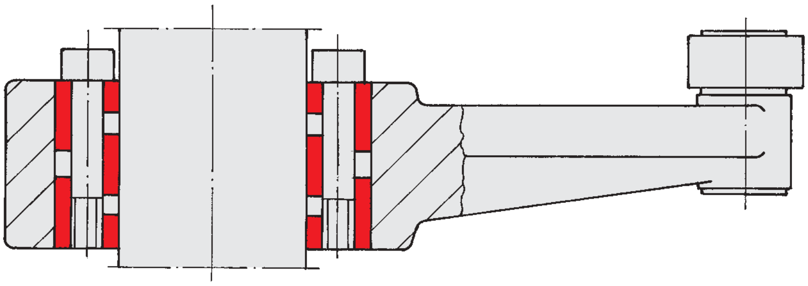


Fig. 4:
Rocker arm fixture.
The peripheral and axial position can be ideally adjusted during assembly.

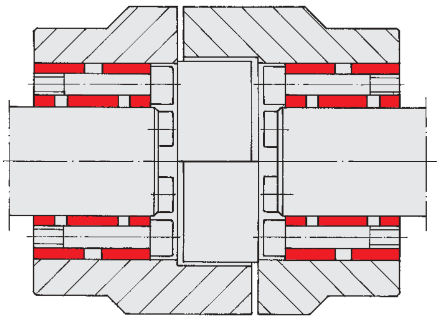


Fig. 5:
Jaw clutch fixture.
No grooves, shaft shoulders etc.
A reasonably priced but highly effective connection.

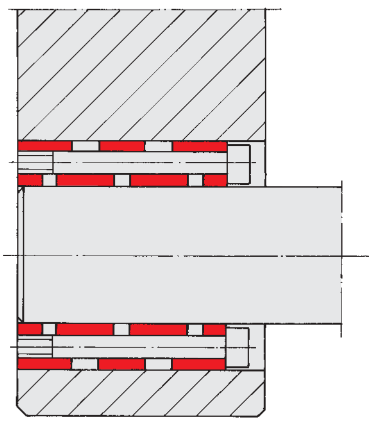


Fig. 6:
Fixture of a guide column in the machine body.

Assembly examples

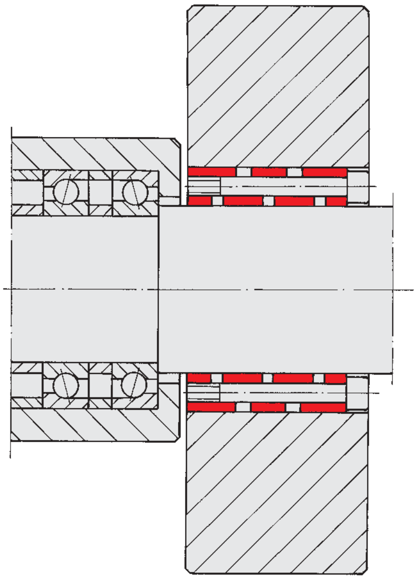


Fig. 7:
Flywheel fixture.
On a high-speed rotating working spindle, the arrangement of the precisely concentric flywheel can help reduce the installed drive output.

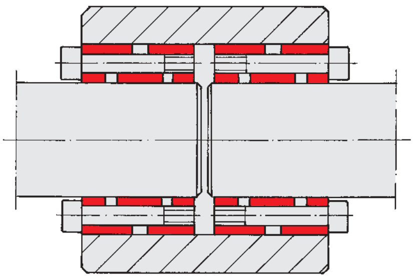


Fig. 8:
Two shafts with rigid coupling using clamping sleeves. Due to possible overdefinition, attention must be paid to the admissible rotating bending stress.

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