

Mechanical seals

Types, dimensions, seal arrangements, designation
and material code**DIN**
24 960

Gleitringdichtungen; Einbaumaße Hauptmaße, Bezeichnung und Werkstoffschlüssel

See Explanatory notes for connection with International Standards ISO 3069 : 1974 and ISO 5199 : 1986 published by the International Organization for Standardization (ISO).

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Dimensions in mm

1 Scope and field of application

This standard specifies dimensions of internally mounted axial single and double mechanical seals with rotating (types N and K) or stationary (type C) spring assembly and dimensions of seal chambers, and deals with the different arrangements of such seals. It further specifies the designation of and the material code for mechanical seals, the aim being to facilitate enquiry, ordering and supply.

For the purposes of this standard, mechanical seals are sealing devices which serve to prevent fluid leakage where a shaft penetrates a component wall.

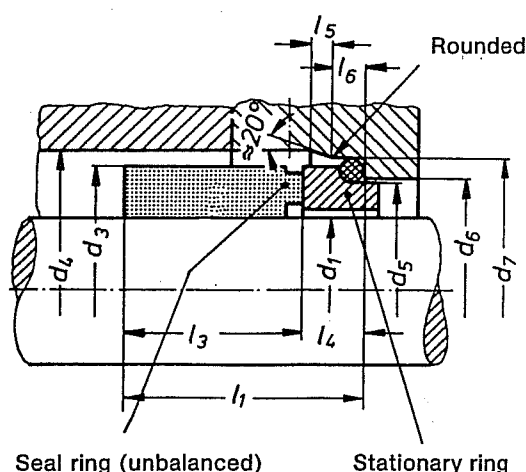
2 Dimensions

Mechanical seals and seal cavities are not expected to conform to the designs illustrated here; compliance is only required in the case of the dimensions specified. Auxiliary seals may be O-rings (as shown in the figure), use of other seal rings being permitted. The left-hand side of figures shows the pump side.

For general tolerances, accuracy grade m as specified in ISO 2768 shall apply.

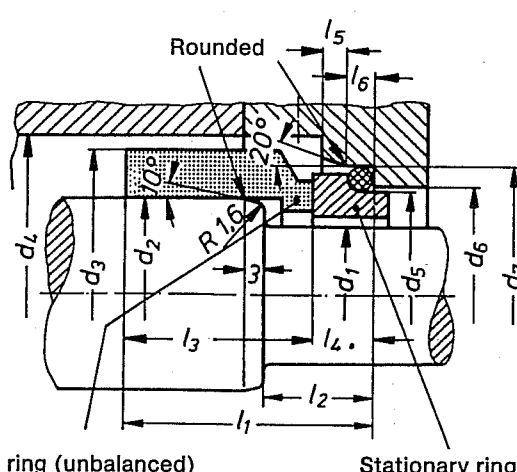
2.1 Mechanical seal with rotating spring assembly

Mechanical seals may be of standard length (type N) or short length (type K); see table 2.

2.1.1 Single mechanical seals, types N and KSeal arrangement U,
unbalanced

Seal ring (unbalanced)

Stationary ring

Seal arrangement B,
balanced

Seal ring (unbalanced)

Stationary ring

**Nur zur Information
-wird nicht aktualisiert-**

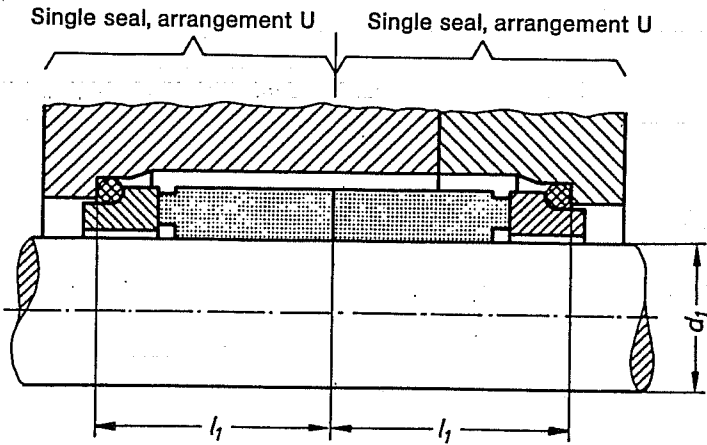
**For information only
-will not be updated-**

**Seulement pour information
-ne sera pas actualisé**

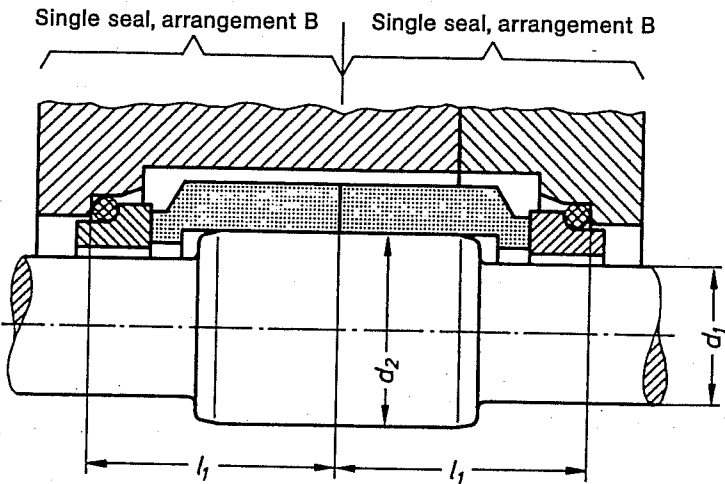
Continued on pages 2 to 12

2.1.2 Double mechanical seal (consisting of two single type K mechanical seals)

2.1.2.1 Single seal, arrangement UU



2.1.2.2 Single seal, arrangement BB



2.1.2.3 Single seal, arrangement UB

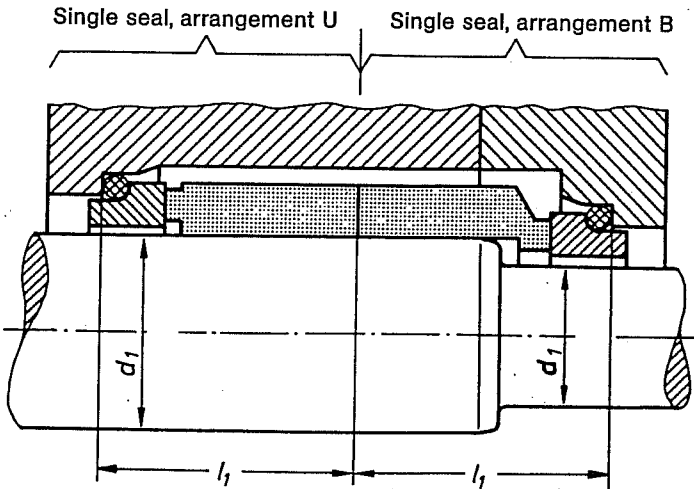


Table 1. Shaft diameters for seal arrangement UB

d ₁	S.a.*)	10	12	14	16	18	20	24	25	28	30	32	33	35	38	40	43	45	48	50	53	55	58	60	63	65	70	75	80	85	90	95
	B																															
	S.a.*)	14	16	18	20	22	24	28	30	33	35	38	38	40	43	45	48	50	53	55	58	60	63	65	68	70	75	80	85	90	95	100
	U																															

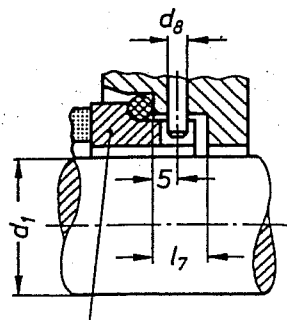
*) Seal arrangement.

2.1.3 Securing of stationary ring

2.1.3.1 Securing against rotation

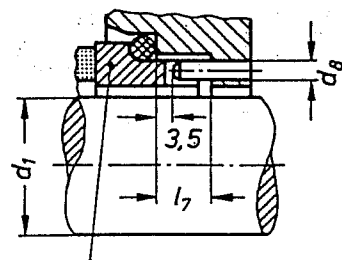
The stationary ring may be secured against rotation (at the manufacturer's discretion) by introducing a pin

either at right angles



Stationary ring

or parallel to the shaft axis.

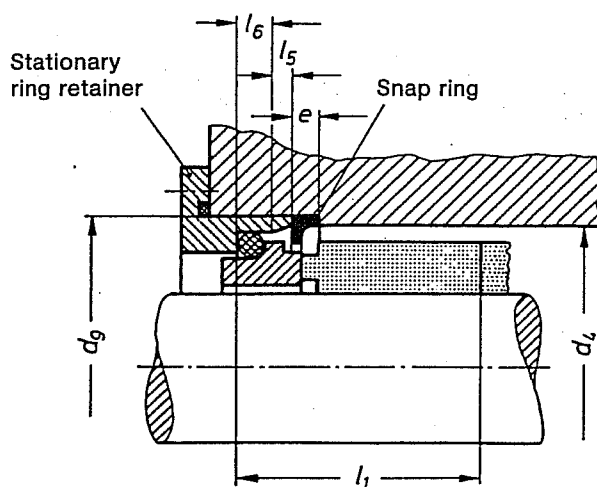


Stationary ring

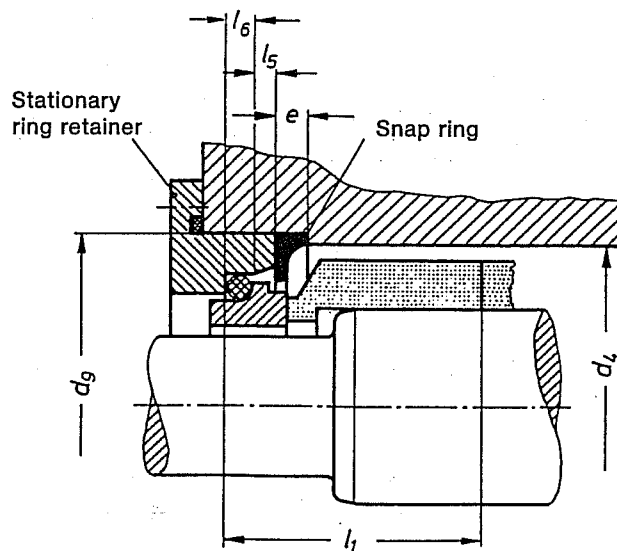
The above configurations can be used for both seal arrangements (U and B).

2.1.3.2 Securing against axial displacement by providing a stationary ring retainer and a snap ring (applies only to seal arrangements UU, BB and UB on the pump side)

Example of seal arrangement U



Example of seal arrangement B



Where the stationary ring on the pump side is to be secured against axial displacement, dimension d_4 shall be at least 2 mm smaller than dimension d_9 to ensure an adequate seating of the snap ring. The manufacturer shall supply the snap ring on request (cf. dimension e). d_9 is the diameter of the space required by the snap ring.

2.1.4 Dimensions of types N and K seals

Table 2.

d_1 Nominal diameter		d_2	$d_3^{1)}$ (maximum)		$d_4^{1)}$ (minimum)		d_5	d_6	d_7	d_8	d_9		e	l_1				l_2	l_3 l_4	l_5	l_6	l_7
S.a.*) U h6	S.a.*) B	S.a.*) B h6	S.a.*) U	S.a.*) B	S.a.*) U	S.a.*) B	h8	H11	H8		S.a.*) U H8	S.a.*) B H8		S.a.*) U $\pm 0,5$	S.a.*) B $\pm 0,5$	S.a.*) U $\pm 0,5$	S.a.*) B $\pm 0,5$	$\pm 0,5$				$+0,5$ 0
10		14	20	24	22	26		17	21		26	30			50	32,5	40			1,5	4	8,5
12		16	22	26	24	28		19	23		28	32		40				18				
14		18	24	32	26	34		21	25		30	38			55	35	42,5					
16		20	26	34	28	36		23	27		32	40		45								
18		22	32	36	34	38		27	33		38	42										
20		24	34	38	36	40		29	35		40	43		50				20				
22		26	36	40	38	42		31	37	3	42	46	4		60							
24		28	38	42	40	44		33	39		43	48				40	47,5					
25		30	39	44	41	46		34	40		46	50		55						5		
28		33	42	47	44	49		37	43		48	53										
30		35	44	49	46	51		39	45		50	60			65	42,5	50		2			
32		38	46	54	48	58		42	48		53	62										
33		38	47	54	49	58		42	48		53	62		55								
35		40	49	56	51	60		44	50		60	65										
38		43	54	59	58	63		49	56		62	67			75							
40		45	56	61	60	65		51	58		65	70				45	52,5	23				
43		48	59	64	63	68		54	61		67	72		60								
45		50	61	66	65	70		56	63		70	75										
48		53	64	69	68	73		59	66		72	77										
50		55	66	71	70	75		62	70		75	86										
53		58	69	78	73	83		65	73		77	88			85	47,5	57,5					
55		60	71	80	75	85		67	75		86	91										
58		63	78	83	83	88		70	78		88	93		70				25				
60		65	80	85	85	90		72	80	4	91	96	6									
63		68	83	88	88	93		75	83		93	98			95	52,5	62,5			2,5		
65		70	85	90	90	95		77	85		96	103										
68	—	88	—	93	—	—		81	90		98	—		80			—					
70		75	90	99	95	104		83	92		103	108										
75		80	99	104	104	109		88	97		108	120										
80		85	104	109	109	114		95	105		120	125				60	70					
85		90	109	114	114	119		100	110		125	130			105			28			7	
90		95	114	119	119	124		105	115		130	135		90						3		
95		100	119	124	124	129		110	120		135	140				65	75					
100		105	124	129	129	134		115	125		140	145										

*) Seal arrangement.

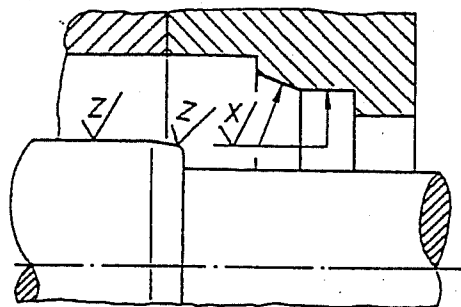
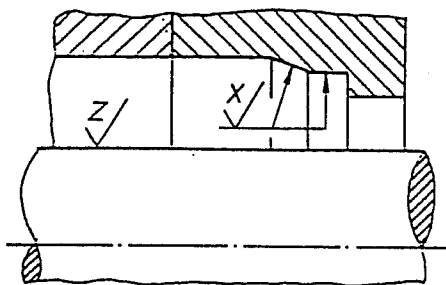
1) In order to provide an adequate distance between the rotating and the stationary parts of the assembly, it is recommended that dimension d_3 be taken as a maximum and dimension d_4 as a minimum.2) The manufacturer is permitted to supply a shorter seal (type N) than that seal corresponding to dimension l_1 . If he does so, the difference in length shall be compensated for by a spacer, also to be supplied by him (material as indicated in box 5 of material code; see clause 4).

2.1.5 Surface roughness of area where auxiliary seals are seated

Table 3.

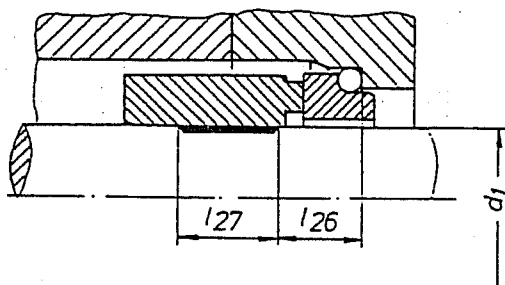
Auxiliary seal material	$\sqrt{z}/=$	$\sqrt{y}/=$
Rubber ¹⁾	$2,5\sqrt{}$	$1,0\sqrt{}$
Other materials (or cases where use of rubber is optional)	$1,6\sqrt{}$	$0,20\sqrt{}$

¹⁾ For concepts relating to rubber, see DIN 7724 and for symbols for rubber and latices, see ISO 1629.



2.1.6 Length of any coated area for seating of auxiliary seals

Seal arrangement U



Seal arrangement B

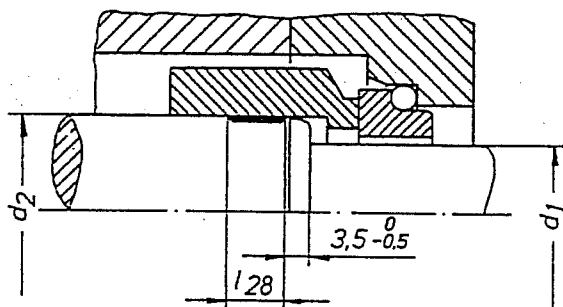


Table 4.

d_1	d_2	$l_{26}^{1)}$	$l_{27}^{\pm 0,5 2)}$	$l_{28}^{\pm 0,5 2)}$	d_1	d_2	$l_{26}^{1)}$	$l_{27}^{\pm 0,5 2)}$	$l_{28}^{\pm 0,5 2)}$	d_1	d_2	$l_{26}^{1)}$	$l_{27}^{\pm 0,5 2)}$	$l_{28}^{\pm 0,5 2)}$
10	14	10	12,5	10	33	38	10	18	14	63	68	14	22	20
12	16	10	12,5	10	35	40	10	18	14	65	70	14	22	19
14	18	10	12,5	11	38	43	13	17	14	68	—	14	24,5	—
16	20	10	12,5	11	40	45	13	17	14	70	75	14	26	20
18	22	10	15	12	43	48	13	17	15	75	80	14	27	20
20	24	10	15	12	45	50	13	17	15	80	85	14	27	20
22	26	10	15	11	48	53	13	19	15	85	90	14	27	23
24	28	10	16,5	14	50	55	13	20	15	90	95	14	30	23
25	30	10	16,5	14	53	58	13	20	16	95	100	14	30	23
28	33	10	18	14	55	60	13	20	16	100	105	14	30	23
30	35	10	18	14	58	63	14	20	18					
32	38	10	18	14	60	65	14	21	18					

¹⁾ Tolerance is included in l_1 (to within ± 5 mm).

²⁾ The coating material shall be selected as a function of the required surface roughness. No fixing bolts shall be provided in the coated area.

2.2 Mechanical seals with stationary spring assembly (type C)

The dimensions specified in table 5 permit the use of preassembled units consisting of axial single or double mechanical seals with sleeve and end plate, intended mainly for use with centrifugal pumps as specified in DIN 24 256 (cf. ISO 2858). For double mechanical seals, the atmospheric side of the seal may also be provided with a rotating spring assembly. The preassembled unit shall be supplied with an end plate gasket.

2.2.1 Dimensions of type C seals

Table 5.

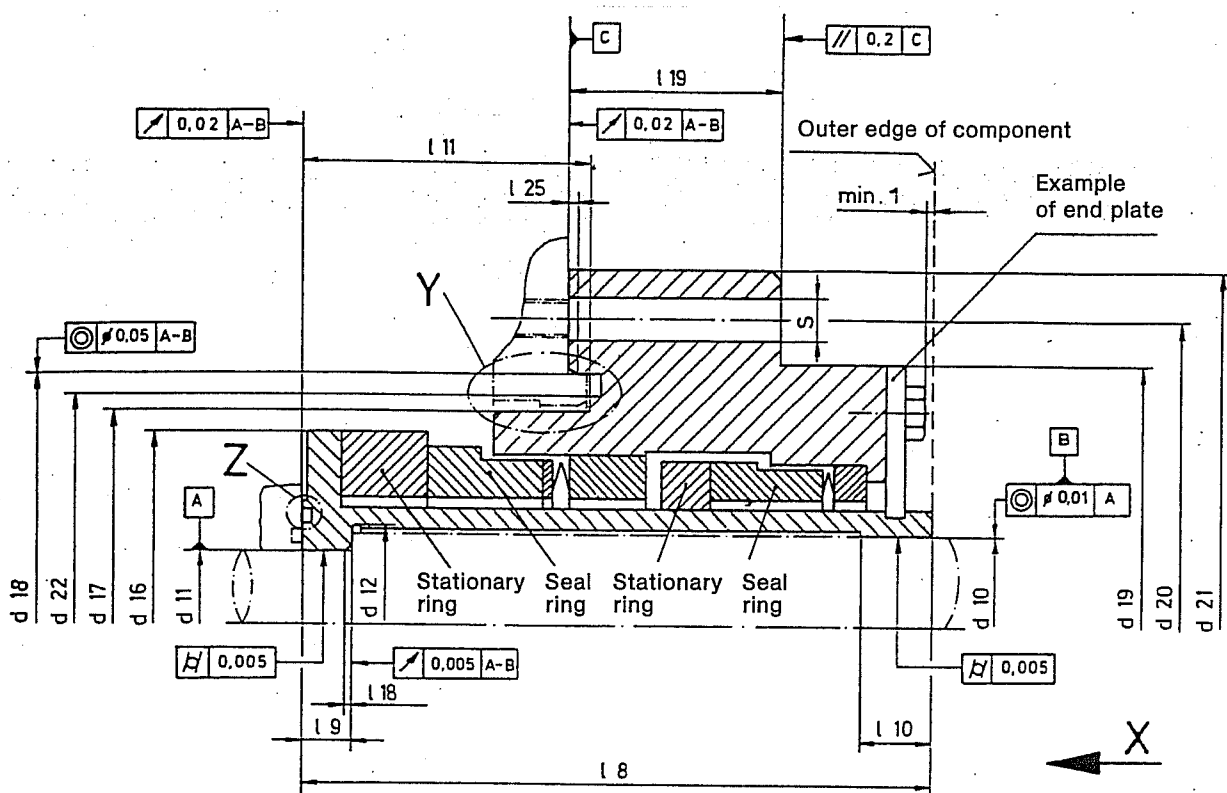
d_{10} (nominal diameter) H7	d_{11} H7	d_{12} +0,2 0	d_{13} 0 -0,2	d_{14} +0,2 0	d_{15} +0,5 0	d_{16} max.	d_{17} h8	d_{18} H7 f7	d_{19}	d_{20}	d_{21}	d_{22} min.	l_8 +0,1 0	l_9	l_{10}	l_{11} +0,2 +0,1	l_{12} +0,2 +0,1	l_{13} 0 -0,1
30	24	31	35	41	44	82	85	95	$d_{19} < d_{20}$	110	129	86	115	10	15	50	4	4
40	32	41	45	51	54	92	95	110		130	155	96	130	10	15	52	4	4
50	42	51	56	61	66	105	110	125		145	168	111	140	12	15	55	4	4
60	50	61	61	67	76	120	125	140		160	185	126	166	14	20	70	4	4

d_{10} (nominal diameter) H7	l_{14}	l_{15}/l_{16}	l_{17}	l_{18} x 45°	l_{19}	l_{20}	l_{21}	l_{22}	l_{23}	l_{24} ± 0,05	l_{25} x 45°	Hole 1) for bolt of size	Auxiliary connection: Tapped hole, type X, as in DIN 3852 Part 1, with thread as in ISO 228-1	
													In/Out	Outlet
30	20	1	16	0,5	55	39	35	35	39	2	0,5	M 10	G 3/8	G 1/8
40	22	1	18	0,5	60	44	40	40	44	2	0,5	M 12	G 3/8	G 1/8
50	25	1	21	0,5	60	44	45	45	44	2	0,5	M 12	G 3/8	G 1/8
60	30	1	26	0,5	60	44	50	50	44	2	0,5	M 12	G 3/8	G 1/8

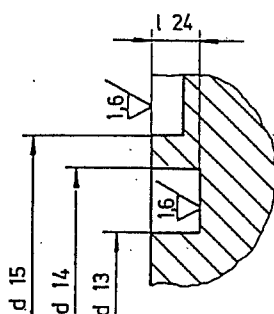
1) Clearance hole, medium series, as specified in ISO 273.

2.2.2 Mechanical seal with stationary spring assembly, type C

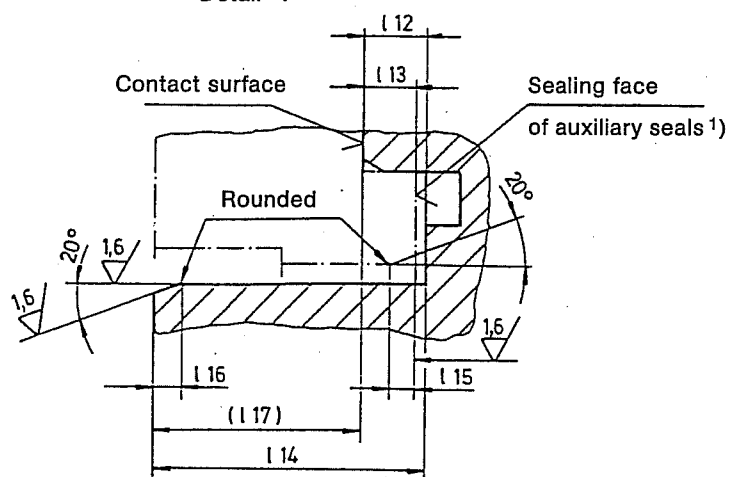
The figure shows a double mechanical seal.



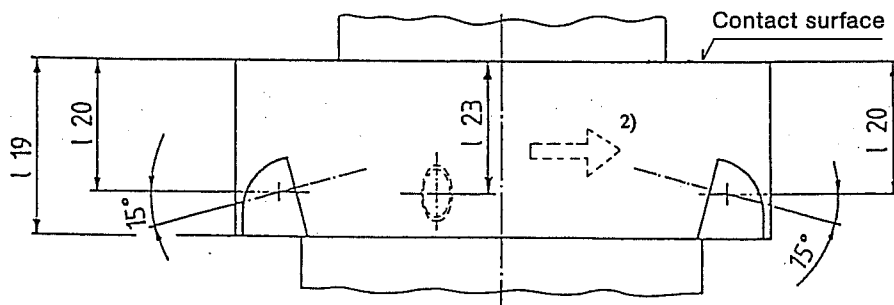
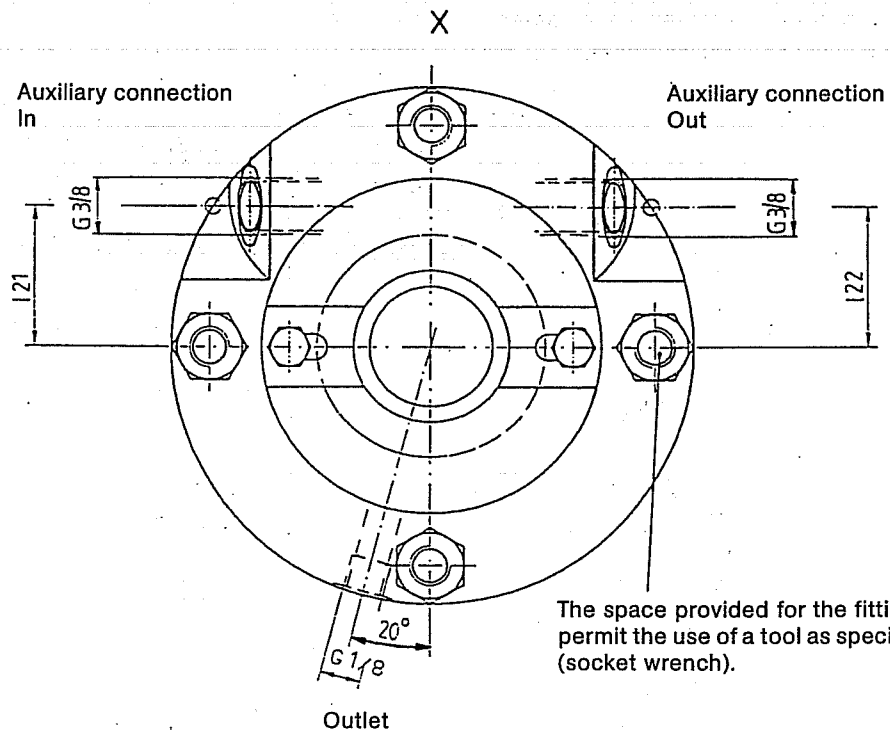
Detail Z



Detail Y



1) The relative axial position of the sealing face is determined by dimension l_{13} on the pump side.



2) The performance of type C seals is not a function of the direction of rotation, unless otherwise indicated by the manufacturer's marking this direction with an arrow on the seal end plate.

3 Standard designation

3.1 Designation of single mechanical seals

Designation		DIN number	Characteristics									
Mechanical seal		DIN 24 960	Symbol					Material code				
Type	N = N											
	K = K											
	C = C											(see clause 4)
Seal arrangement	U = U											
	B = B											
	C = 0											
Nominal diameter												
Nominal diameter, d_1 , of seal, or d_{10}												
(normally, with 3 digits; in the case of two-digit numbers for d_1 or d_{10} , precede the number with a zero).												
Direction of rotation of types N and K seals												
R — right-handed (as viewed from stationary ring when seal ring rotates clockwise)												
L — left-handed (as viewed from stationary ring when seal ring rotates counter-clockwise)												
S — seal stationary												
Direction of rotation of type C seals ²⁾												
R — right-handed (as viewed from the drive when shaft rotates clockwise)												
L — left-handed (as viewed from the drive when shaft rotates counterclockwise)												
S — seal stationary												
Securing of ring against rotation												
0 — not secured												
1 — secured												
2 — in accordance with the manufacturer's instructions (for type C)												

3.2 Designation of a single mechanical seal

Designation of a single mechanical seal, type N, seal arrangement U, with a nominal diameter, d_1 , of 43 mm (043), right-handed rotation (R), stationary ring secured against rotation (1), mechanical seal made of chromium steel, stationary ring made of carbon, resin-impregnated (B), auxiliary seal made of fluorocarbon synthetic rubber (V), spring made of CrNiMo steel (G), and other components made of CrNiMo steel (G):

Mechanical seal DIN 24 960 — NU043R1-SBVGG

Designation of a single mechanical seal, type C, seal arrangement C (0), with a nominal diameter, d_1 , of 30 mm (030), stationary (S), stationary ring secured against rotation (2), seal ring and stationary ring made of SiC-Si (Q2), auxiliary seals made of fluorocarbon synthetic rubber (V), spring made of CrNiMo steel (G), and other components made of CrNiMo steel (G):

Mechanical seal DIN 24 960 — C0030S2-Q2Q2VGG

For 2), see page 8.

3.3
Designation of double mechanical seals

Designation		DIN number	Characteristics									
Mechanical seal		DIN 24 960	Symbol					Material code				
			—	□	□	□	□	□	□	□	□	□
Seal arrangement (pump side)												
	U = U											
	B = B											
Type	C = C											
Seal arrangement (atmospheric side)												
	U = U											
	B = B											
Type	C = C											
Nominal diameter												
Nominal diameter, d_1 , of seal, or d_{10}												
(normally, with 3 digits; in the case of two-digit numbers for d_1 or d_{10} , precede the number with a zero).												
Direction of rotation of types N and K seals												
R — right-handed (as viewed from atmospheric side stationary ring when seal ring rotates clockwise)												
L — left-handed (as viewed from stationary ring when seal ring rotates counter-clockwise)												
S — seal stationary												
Direction of rotation of type C seals ²⁾												
R — right-handed (as viewed from drive when shaft rotates clockwise)												
L — left-handed (as viewed from drive when shaft rotates counterclockwise)												
S — seal stationary.												
Securing of atmospheric/pump-side stationary ring against rotation												
0 — not secured												
1 — atmospheric side stationary ring secured												
2 — pump-side stationary ring secured												
3 — atmospheric and pump-side stationary rings secured												
4 — in accordance with the manufacturer's instructions (for type C)												
Securing of pump-side stationary ring against axial displacement												
0 — not secured												
D — secured												
E — in accordance with the manufacturer's instructions (for type C)												

Box 1–5
(pump
side)
Box 1–3
(atmos-
pheric side)

(see clause 4)

3.4
Designation of a double mechanical seal

Designation of a double mechanical seal, seal arrangement UU (UU), with a nominal diameter, d_1 , of 43 mm (043), seal stationary (S), atmospheric side stationary ring secured against rotation (1), pump-side stationary ring secured against axial displacement (D), pump-side seal ring made of Al-oxide (V), pump-side stationary ring made of carbon, resin-impregnated (B), pump-side auxiliary seals made of fluorcarbon synthetic rubber (V), spring made of CrNiMo-steel (G), other components made of CrNiMo steel (G), atmospheric side seal ring made of chromium steel (S), atmospheric side stationary ring made of carbon, resin-impregnated (B) and atmospheric side auxiliary seals made of fluorcarbon synthetic rubber (V):

Mechanical seal DIN 24 960 — UU043S1D-VBVGGSBV

For ²⁾, see page 8.

4 Material code for mechanical seal components

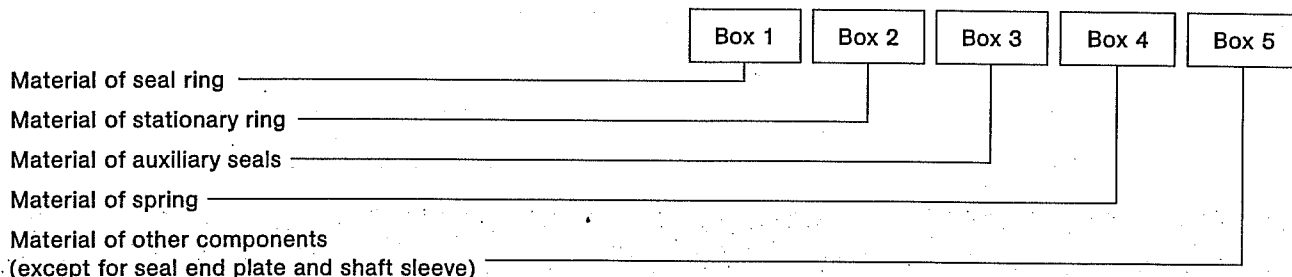


Table 6.

Boxes 1 and 2,	Box 3	Boxes 4 and 5
Material ¹⁾ of contact faces of seal ring and stationary ring	Material of auxiliary seals ³⁾	Material of other components (e.g. springs, bellows, except sealing cover and shaft sleeve); for type C, also seal end plate and shaft sleeve
Synthetic carbon A – carbon, metal-impregnated B – carbon, resin-impregnated C – other types of carbon Metal D – C steel E – Cr steel F – CrNi steel G – CrNiMo steel K – hard metal alloy coated M – nickel-based alloy N – copper tin alloy P – cast iron R – alloyed cast iron S – cast chromium steel T – other metals Q – silicon carbide U – tungsten carbide, U1 – tungsten carbide, cobalt-bound U2 – tungsten carbide, nickel-bound U3 – tungsten carbide, CrNiMo-bound Q1 – silicon carbide (without free silicon) Q2 – silicon carbide with free silicon Q3 – silicon carbide graphite Q4 – silicon-converted carbon J – other carbides Metal oxides V – Al-oxide W – Cr-oxide X – other metal oxides Synthetics Y1 – PFTE, glass fibre reinforced Y2 – PFTE, carbon reinforced Z – other synthetics	Elastomers, not jacketed ⁴⁾ B – butyl synthetic rubber E – EP synthetic rubber K – perfluorelastomer N – chloroprene P – nitrile synthetic rubber S – silicon synthetic rubber V – fluorcarbon synthetic rubber X – other elastomers Elastomers, jacketed M – elastomer, jacketed Non-elastomers G – graphite foil T – PTFE Y – other non-elastomers Special cases U – different materials	D – C steel E – Cr steel F – CrNi steel G – CrNiMo steel M – nickel-based alloys N – copper-tin alloy T – other materials

¹⁾ Further details can be obtained from the manufacturer's documentation.

²⁾ Seal ring, unbalanced.

³⁾ Auxiliary seals are sealing the rotating part to the shaft/shaft sleeve and stationary ring to the housing/end plate, including bellows, where applicable.

⁴⁾ See table 3, footnote 1.

⁵⁾ For bellows seals, missing components shall be marked '-'.

Standards referred to

DIN 3124	Square drive socket wrenches for hexagon bolts, hand-operated
DIN 3852 Part 1	Stud ends, tapped holes and screw plugs for compression couplings and valves, with metric fine pitch thread; dimensions
DIN 7724	Classification of polymer materials on the basis of the effect of temperature on their mechanical behaviour; principles and concepts
DIN 24 256	End suction centrifugal pumps (rating 16 bar), with bearing bracket; nominal power and main dimensions
ISO 228-1 : 1982	Pipe threads where pressure-tight joints are not made on the threads; designation, dimensions and tolerances
ISO 273 : 1979	Fasteners; clearance holes for bolts and screws
ISO 1629 : 1987	Rubbers and latices; nomenclature
ISO 2768-1 : 1989	Tolerances for linear and angular dimensions without individual tolerance indications
ISO 2858 : 1975	End suction centrifugal pumps (rating 16 bar); designation, nominal duty point and dimensions
ISO 3069 : 1974	End suction centrifugal pumps; dimensions of cavities for mechanical seals and for soft packing
ISO 5199 : 1986	Technical specifications for centrifugal pumps, class II

Previous editions

DIN 24 960 Part 1: 11.76; DIN 24 960 Part 2: 11.76; DIN 24 960: 06.80.

Amendments

The following amendments have been made to the June 1980 edition.

- The standard has been completely revised.
- The scope of the standard has been extended to include dimensions of mechanical seals with stationary spring assembly (type C), and dimensions of the coated zones in contact with auxiliary seals (see subclause 2.1.6).
- The specifications for the material code have been amended.

Explanatory notes

The seal chamber dimensions specified here largely comply with those specified in ISO 3069 : 1974. This particularly applies to nominal diameters, d_1 , from 18 mm to 68 mm, and the associated diameters d_2 and d_4 (for seal arrangements U and B). Supplementary to the specifications of ISO 3069, for seal arrangement B, d_2 has been specified at 75 mm and d_4 at 104 mm for $d_1 - 70$ mm.

In comparison with the June 1980 edition of this standard, the note has been omitted that nominal diameters, d_1 , of 25, 30, 32, 35, 40, 45, 50, 58, 63 and 68 mm were not recommended for new designs, since there still is a great demand for these sizes in practice.

In subclause 2.1.6, table 4, dimensions l_{26} , l_{27} and l_{28} have been substituted for dimensions l_8 , l_9 and l_{10} , which had been used in former editions of the standard, to avoid confusion.

The inclusion of dimensional specifications for mechanical seals with stationary spring assembly (type C) is intended as a basis for optimizing seal arrangements which meet the particular operational requirements.

Although this standard does not specify seal chamber materials, the dimensions specified are based on the assumption that these chambers are made of metallic materials. Where, for special applications, flexible plastics, ceramics, glass, graphite or silicon carbide are used, for type C seals in end suction centrifugal pumps, the properties of the material may require the dimensions in the zone of contact between the seal and the impeller or the seal end plate to deviate from the specifications given here.

International Patent Classification

F16J 15/34