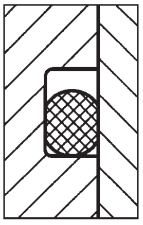
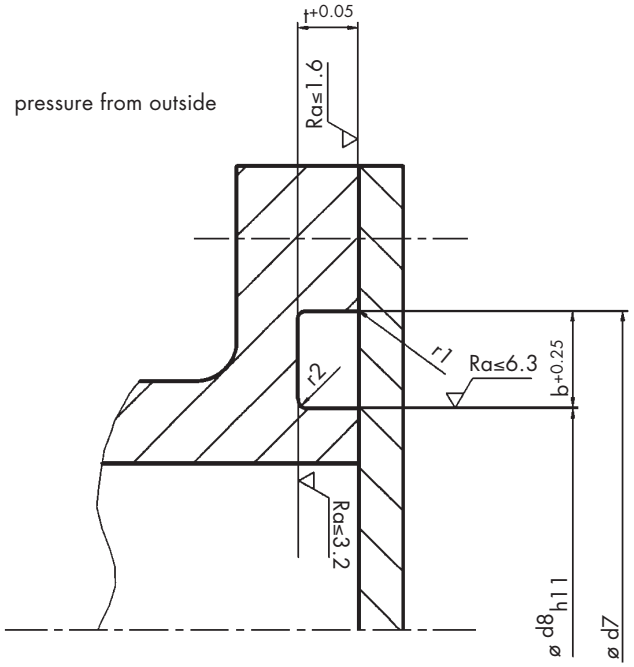
Groove dimensions

d2	Groove depth t +0.05	Groove width b +0.25	d2	Groove depth t +0.05	Groove width b +0.25
1	0.7	1.4	4	3.1	5.5
1.2	0.9	1.6	4.3	3.3	5.9
1.25	0.9	1.7	4.5	3.5	6.1
1.3	1	1.7	5	4	6.7
1.5	1.1	2.1	5.3	4.2	7.2
1.6	1.2	2.2	5.33	4.2	7.3
1.78	1.3	2.5	5.5	4.5	7.4
1.8	1.3	2.6	5.7	4.6	7.6
1.9	1.4	2.7	6	4.8	8.1
2	1.5	2.8	6.5	5.3	8.6
2.2	1.6	3.1	6.99	5.7	9.7
2.4	1.8	3.3	7	5.7	9.7
2.5	1.9	3.5	7.5	6.2	10.1
2.6	2	3.6	8	6.6	10.7
2.62	2	3.7	8.4	7.1	11.1
2.65	2	3.8	8.5	7.2	11.3
2.7	2.1	3.8	9	7.6	12
2.8	2.1	4	9.5	8.1	12.5
3	2.3	4.1	10	8.5	13.6
3.1	2.4	4.2	10.5	8.9	14
3.5	2.7	4.8	11	9.4	14.7
3.53	2.7	4.9	12	10.4	15.7
3.55	2.7	5	15	13.2	19.4
3.6	2.8	5.1			
3.7	2.9	5.2			

Static sealing, pressure from outside, rectangular groove by axial deformation



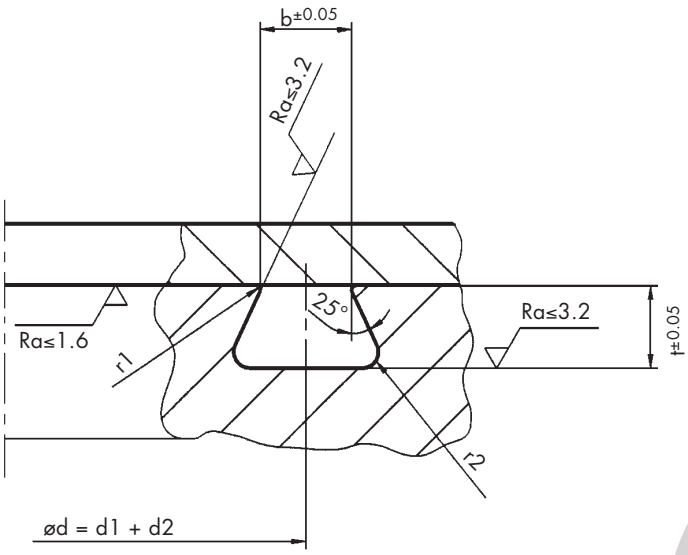


Trapezoidal groove

Trapezoidal grooves are difficult and expensive to manufacture. This groove geometry is only worthwhile if the O-ring needs to be held in the groove during assembly, for the application and removal of compression moulding tools, or for overhead installations.

A trapezoidal groove is really only advisable for cross sections of 2 mm and more. The average groove diameter equates to the inner diameter plus the cord thickness of the O-ring.

Static sealing, trapezoidal groove



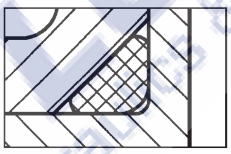
Groove dimensions

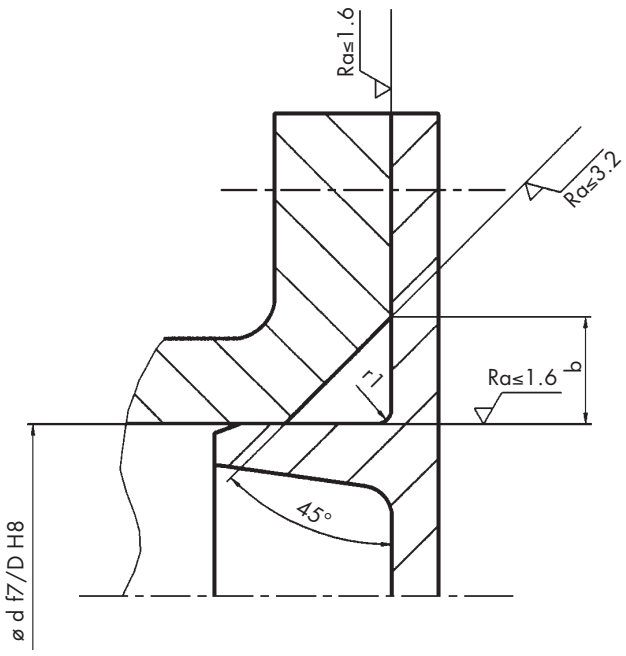
d2	Groove depth $t^{\pm 0.05}$	Groove width $b^{\pm 0.05}$	r2	r1
2	1.5	1.6	0.4	0.25
2.2	1.6	1.7	0.4	0.25
2.4	1.8	1.9	0.4	0.25
2.5	2	2	0.4	0.25
2.6	2.1	2.1	0.4	0.25
2.62	2.1	2.1	0.4	0.25
2.65	2.1	2.1	0.4	0.25
2.7	2.2	2.1	0.4	0.25
2.8	2.3	2.2	0.4	0.25
3	2.4	2.4	0.4	0.25
3.1	2.5	2.5	0.4	0.25
3.5	2.8	2.9	0.8	0.25
3.53	2.8	2.9	0.8	0.25
3.55	2.8	2.9	0.8	0.25
3.6	2.9	3	0.8	0.25
3.7	3	3.1	0.8	0.25
4	3.2	3.3	0.8	0.25
4.3	3.3	3.6	0.8	0.25
4.5	3.7	3.7	0.8	0.25
5	4.2	4	0.8	0.25
5.3	4.6	4.2	0.8	0.4
5.33	4.6	4.2	0.8	0.4
5.5	4.7	4.4	0.8	0.4
5.7	4.9	4.5	0.8	0.4
6	5.1	4.7	0.8	0.4
6.5	5.6	5.1	0.8	0.4
6.99	6	5.6	1.6	0.4
7	6	5.6	1.6	0.4
7.5	6.4	6.1	1.6	0.4
8	6.9	6.3	1.6	0.4
8.4	7.3	6.7	1.6	0.5
8.5	7.4	6.8	1.6	0.5
9	7.8	7.2	1.6	0.5
9.5	8.2	7.7	1.6	0.5
10	8.7	8	1.6	0.5

Conical groove

In individual cases involving screwed flange and cover sealing design, requirements may call for a conical groove. However, with this particular groove geometry it can be difficult to ensure a defined deformation of the O-ring. Furthermore, the restricted space of a conical groove can be disadvantageous if the surrounding media then cause the O-ring to swell.

Static sealing, conical groove





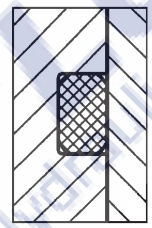
Groove dimensions	d2	Side length b	Tolerance (+)	r1
	1	1.45	0.1	0.25
	1.2	1.7	0.1	0.25
	1.25	1.75	0.1	0.25
	1.3	1.8	0.1	0.3
	1.5	2.1	0.1	0.3
	1.6	2.15	0.1	0.3
	1.78	2.4	0.1	0.3
	1.8	2.45	0.1	0.3
	1.9	2.6	0.1	0.4
	2	2.75	0.1	0.4
	2.2	3	0.1	0.4
	2.4	3.25	0.15	0.4
	2.5	3.4	0.15	0.5
	2.6	3.55	0.15	0.5
	2.62	3.6	0.15	0.5
	2.65	3.6	0.15	0.5
	2.7	3.7	0.15	0.6
	2.8	3.8	0.15	0.6
	3	4.1	0.2	0.6
	3.1	4.25	0.2	0.6
	3.5	4.8	0.2	0.8
	3.53	4.8	0.2	0.8
	3.55	4.85	0.2	0.8
	3.6	4.9	0.2	0.9
	3.7	5.05	0.2	0.9
	4	5.5	0.2	1.2
	4.3	5.9	0.2	1.2
	4.5	6.15	0.2	1.2
	5	6.85	0.25	1.2
	5.3	7.25	0.25	1.4
	5.33	7.3	0.25	1.4
	5.5	7.55	0.25	1.5
	5.7	7.8	0.25	1.5
	6	8.2	0.3	1.5
	6.5	8.9	0.3	1.7
	6.99	9.6	0.3	2
	7	9.6	0.3	2
	7.5	10.3	0.3	2
	8	11	0.4	2
	8.4	11.55	0.4	2
	8.5	11.7	0.4	2
	9	12.4	0.4	2.5
	9.5	13.05	0.4	2.5
	10	13.7	0.4	2.5
	10.5	14.4	0.4	2.5
	10	15.1	0.4	2.5
	12	16.5	0.5	3
	15	20.6	0.5	3

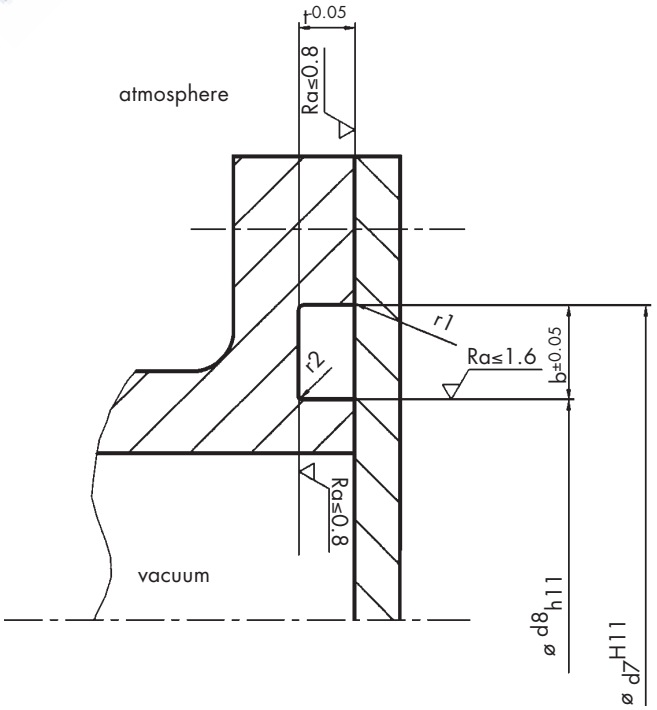
Vacuum sealing
Vacuum sealing is a special kind of static O-ring sealing. In this type, the system pressure that is to be sealed is less than the atmospheric pressure (p_{atm}= 1.01325 bar).

Contrary to the general installation guidelines for static O-ring sealing, the following recommendations apply for vacuum sealing:

- The groove should be almost 100% filled by the deformed O-ring. This creates greater contact surfaces and increases the diffusion time through the elastomer material.
- The deformation of the O-ring section should be about 30%.
- A vacuum grease should be used (reduces leakage).
- The surface quality (roughness depth) of the groove and sealed surfaces should be considerably better than of standard static sealing, and the percentage contact area should be t_p > 50%.
- The chosen elastomer should be gas compatible, have low permeability and a low compression set. We recommend fluoro rubber for standard applications.

Static sealing, vacuum sealing





Groove dimensions

d2	Groove depth $t^{-0.05}$	Groove width $b^{\pm 0.05}$	r1	r2
1.5	1.05	1.8	0.1	0.2
1.78	1.25	2.1	0.1	0.2
1.8	1.25	2.1	0.1	0.2
2	1.4	2.3	0.1	0.3
2.5	1.75	2.9	0.1	0.3
2.6	1.8	3	0.1	0.4
2.62	1.85	3.1	0.1	0.4
2.65	1.85	3.1	0.1	0.4
2.7	1.9	3.15	0.1	0.4
2.8	1.95	3.2	0.1	0.4
3	2.1	3.5	0.1	0.6
3.1	2.2	3.6	0.1	0.6
3.5	2.45	4.1	0.2	0.6
3.53	2.5	4.1	0.2	0.6
3.55	2.5	4.15	0.2	0.6
3.6	2.5	4.2	0.2	0.6
3.7	2.6	4.3	0.2	0.6
4	2.8	4.7	0.2	0.6
4.5	3.15	5.3	0.2	0.8
5	3.5	5.9	0.2	0.8
5.3	3.7	6.3	0.2	1
5.33	3.7	6.3	0.2	1
5.5	3.8	6.6	0.2	1
5.7	4	6.7	0.2	1
6	4.2	7.1	0.2	1
6.5	4.6	7.6	0.2	1
6.99	4.9	8.2	0.3	1
7	4.9	8.2	0.3	1
7.5	5.3	8.7	0.3	1
8	5.6	9.4	0.3	1
8.4	5.9	9.9	0.3	1
8.5	6	10	0.3	1
9	6.4	10.5	0.3	1
9.5	6.7	11.2	0.3	1
10	7.1	11.7	0.3	1

Dynamic sealing

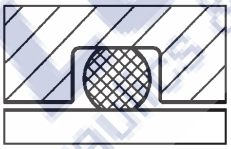
O-rings are used successfully as sealing elements in dynamic applications. However, their use is limited to lower pressures and speeds, or to use in small installation housings.

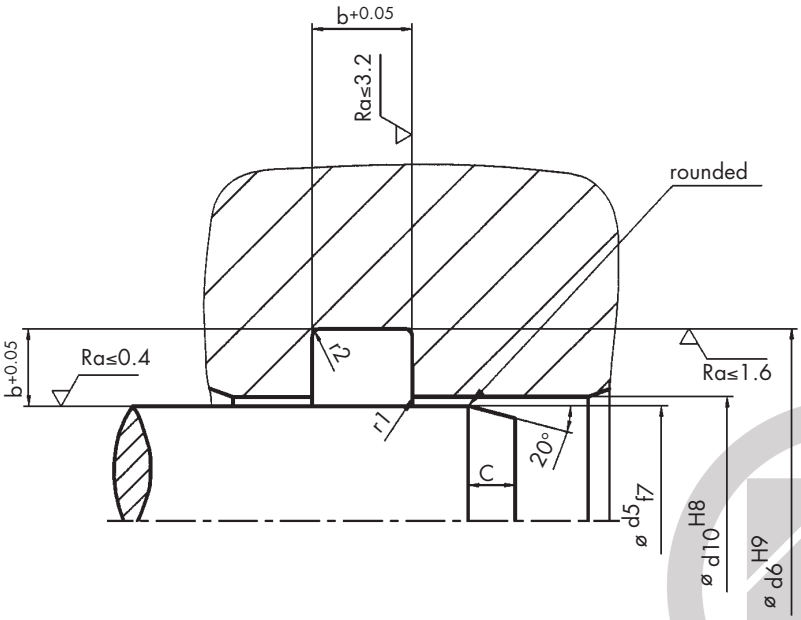
Because of the friction resistance in movement, e.g. in hydraulic or pneumatic components, a smaller O-ring deformation is chosen than for static sealing. The item should always be well lubricated in order to prevent a loss of power due to friction and premature wear of the O-ring if it runs dry.

The installation housings are the same for the reciprocating movement, and for the movement with simultaneous rotating (helical) movement. There are differences between the housings of hydraulic and pneumatic applications, because of the differences in pressure and lubrication.

Hydraulics
O-rings should only be used to seal hydraulic pistons and rods if there is little space for the installation, or if the rod stroke is relatively short with a low frequency, and the seal does not have to be completely leak-proof. In fact, a tiny amount of leakage is desirable as it provides a lubricant film that reduces friction and wear.

Dynamic sealing, internal sealing, rectangular groove by radial deformation

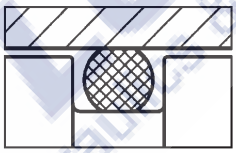


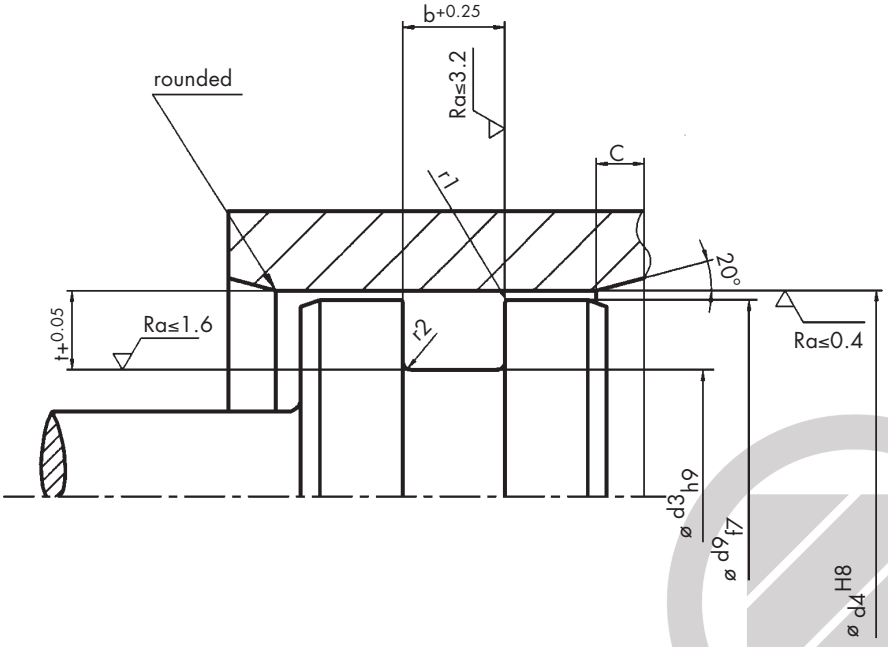


Groove dimensions

d2	Groove depth $t^{+0.05}$	Groove width $b^{+0.25}$	Lead-in chamfer C	d2	Groove depth $t^{+0.05}$	Groove width $b^{+0.25}$	Lead-in chamfer C
1	0.9	1.3	1	3.7	3.2	4.8	2
1.2	1	1.6	1	4	3.5	5.1	2
1.25	1.1	1.6	1	4.3	3.8	5.5	2.5
1.3	1.1	1.7	1.2	4.5	4	5.7	2.5
1.5	1.3	1.9	1.2	5	4.4	6.4	2.7
1.6	1.4	2	1.2	5.3	4.7	6.8	2.9
1.78	1.5	2.3	1.3	5.33	4.7	6.9	2.9
1.8	1.5	2.4	1.3	5.5	4.9	7.1	3
1.9	1.6	2.5	1.3	5.7	5.1	7.2	3
2	1.7	2.6	1.3	6	5.4	7.5	3.6
2.2	1.9	2.8	1.3	6.5	5.8	8.1	3.6
2.4	2.1	3	1.4	6.99	6.2	8.8	3.6
2.5	2.2	3.1	1.4	7	6.2	8.9	3.6
2.6	2.2	3.3	1.5	7.5	6.7	9.4	3.8
2.62	2.2	3.4	1.5	8	7.1	10.2	4
2.65	2.3	3.4	1.5	8.4	7.5	10.6	4.2
2.7	2.4	3.4	1.5	8.5	7.6	10.8	4.2
2.8	2.4	3.6	1.6	9	8.1	11.4	4.5
3	2.6	3.8	1.8	9.5	8.5	12	4.5
				10	9	12.6	4.5
3.1	2.7	3.9	1.8				
3.5	3.1	4.4	2	10.5	9.5	13.2	5
3.53	3.1	4.5	2	11	9.9	13.9	5
3.55	3.1	4.5	2	12	10.9	15.1	5
3.6	3.1	4.6	2	15	13.7	18.8	5

Dynamic sealing, external sealing, rectangular groove by radial deformation

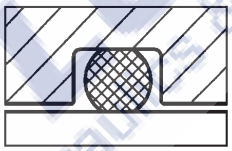


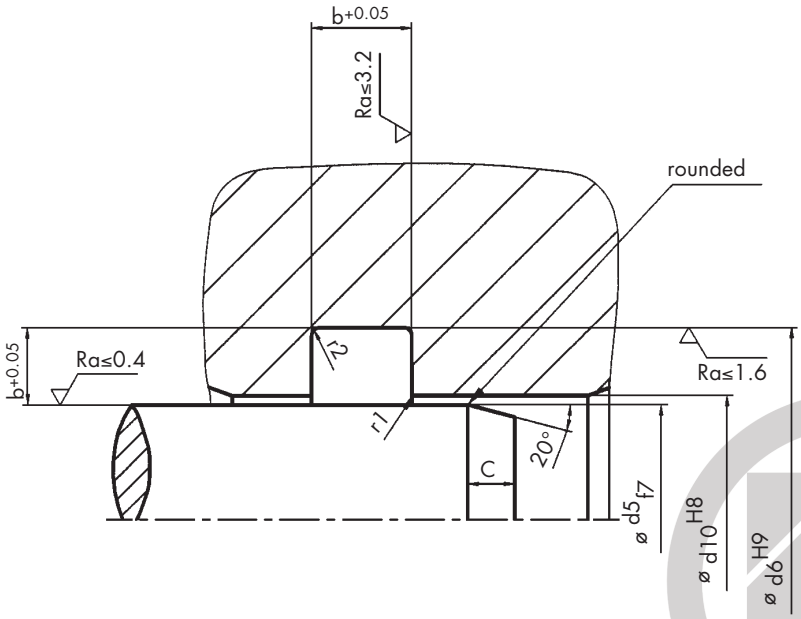


Pneumatics

In pneumatics, O-rings are used primarily to seal reciprocating movements. The deformation of the O-ring should be less than in hydraulic applications in order to keep the loss of power due to friction down, even with inadequate lubrication, in order to achieve the maximum possible lifetimes.

Dynamic sealing, internal sealing, rectangular groove by radial deformation





Groove dimensions

d2	Groove depth $t^{+0.05}$	Groove width $b^{+0.25}$	Lead-in chamfer C	d2	Groove depth $t^{+0.05}$	Groove width $b^{+0.25}$	Lead-in chamfer C
1	0.95	1.2	0.9	4	3.7	4.8	2
1.2	1.05	1.5	1	4.3	4	5.1	2
1.25	1.15	1.5	1	4.5	4.2	5.4	2.3
1.3	1.15	1.6	1.1	5	4.65	5.9	2.3
1.5	1.35	1.8	1.1	5.3	4.95	6.4	2.7
1.6	1.45	1.9	1.2	5.33	4.95	6.4	2.7
1.78	1.55	2.2	1.2	5.5	5.15	6.5	2.8
1.8	1.55	2.3	1.2	5.7	5.35	6.8	3
1.9	1.7	2.3	1.2	6	5.6	7.2	3.1
2	1.8	2.4	1.2	6.5	6.1	7.8	3.3
2.2	2	2.6	1.4	6.99	6.55	8.4	3.6
2.4	2.15	2.9	1.4	7	6.6	8.4	3.6
2.5	2.25	3	1.4	7.5	7.1	8.9	3.8
2.6	2.35	3.1	1.4	8	7.6	9.5	4
2.62	2.35	3.1	1.5	8.4	7.9	10.1	4.2
2.65	2.35	3.2	1.5	8.5	8	10.2	4.2
2.7	2.45	3.3	1.5	9	8.5	10.8	4.3
2.8	2.55	3.4	1.5	9.5	9	11.4	4.3
3	2.7	3.6	1.5	10	9.5	12	4.5
3.1	2.8	3.7	1.5				
3.5	3.15	4.2	1.8				
3.53	3.2	4.3	1.8				
3.55	3.2	4.3	1.8				
3.6	3.3	4.3	1.8				
3.7	3.4	4.4	1.8				

Dynamic sealing, external sealing, rectangular groove by radial deformation