



**HECKER®**  
**GSM®**  
**SEALS FOR**  
**HYDRAULIC &**  
**PNEUMATIC SYSTEMS**



*Alwin Hecker*

*Wendelinchen*

*Herrmann*

*Werner Hecker*



*Heck*

*Wendelinchen*



**MORE THAN  
A HUNDRED  
YEARS OF  
KNOWLEDGE  
IN SEALING  
BUSINESS**

## HECKER® GSM®-DICHTUNGEN UND FORMTEILE

- Pneumatik- und Hydraulikdichtungen
- Stangen- und Zylinderdichtungen
- Nutringe und Lippenringe
- Kompaktdichtringe
- Kegelformdichtsätze
- PTFE-Euroset/Duonet-Dichtsätze
- Abstreifringe
- Präzisions-O-Ringe nach DIN 3771
- Sonderdichtungen
- Formteile
- Gummi-Metallverbindungen

### Werkstoffe:

Sämtliche gängigen Elastomerwerkstoffe aus eigener Entwicklung wie NBR, EPDM, FKM, HNBR, VMQ, ACM und CR oder nach Ihren Rezepturen

Für eine Reihe von Werkstoffen liegen Freigaben vor z. B. nach KTW, FDA und BGA

Gummi-Gewebewerkstoffe  
Bitte Einzelprospekt anfordern

## HECKER® GSM®-SEALS AND MOULDINGS

- pneumatic and hydraulic seals
- piston and rod seals
- U-ring and lip seals
- compact sealing rings
- V-packings sealing sets
- PTFE-Euroset/Duroset- sealing sets
- scrapers
- precision o-rings according to DIN 3771
- special seals
- mouldings
- rubber-metal-connections

### Materials:

All generally available elastomers, self-developed elastomers as NBR, EPDM, FKM, HNBR,

KTW, FDA and BGA certificates available for several materials

Rubber-coated fabrics

## HECKER® JOINTS GSM® ET PIECES MOULÉES

- joints pneumatiques et hydrauliques
- joints pour pistons et tiges de piston
- joints en U à lèvres
- joints compacts
- jeux de joints coniques
- joints PTFE-Euroset/Duonet
- racleurs
- joints toriques de précision selon DIN 3771
- joints spéciaux, pièces moulées
- jointures métal-caoutchouc

### Matériaux:

Tous les Elastomères les plus utilisés, des ainsi que ceux de notre recherche comme NBR, EPDM, FKM, HNBR, VMQ, ACM et CR ou selon votre formule

Certifications FDA, KTW, BGA et autres disponibles pour plusieurs matériaux

Tissu caoutchoutés

## HECKER® GUARNIZIONI GSM® E PEZZI SAGOMATI

- guarnizioni pneumatiche e idrauliche
- guarnizioni per pistoni e aste
- guarnizioni a U e guarnizioni a labbro
- guarnizioni compatte
- guarnizioni coniche
- guarnizioni PTFE-Euroset/Duonet
- raschiatori
- anelli OR di precisione secondo DIN 3771
- guarnizioni speciali
- pezzi sagomati
- guarnizioni gomma-metallo

### Materiali:

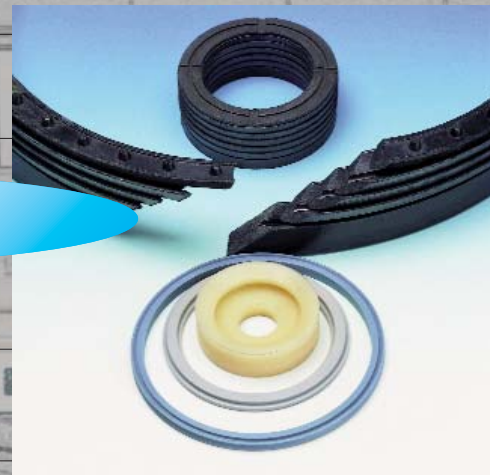
Tutti gli elastomeri, elastomeri di proprio sviluppo come NBR, EPDM, FKM, HNBR, VMQ, ACM e CR o degli elastomeri secondo Vostra ricetta

Certificati FDA, KTW, BGA ed altri disponibili per differenti materiali

Tessuto gommato



**GSM®  
PRODUCTS**



**SEALING  
QUESTIONS?  
ASK  
HECKER!**

The data indicated in our catalogue are based on experimental values concerning fabrication, bench performance and application of the sealing elements. In view of the large number of parameters and boundary conditions, the generally valid application limits can vary greatly so that the suitability for a particular application must be confirmed by practical tests in the user's works. No guarantee or liability can be assumed for the validity of our recommendation in individual cases.



# CONTENTS AND INTRODUCTION

The choice of seals for the hydraulic and pneumatic systems results from the consideration of a series of factors which on a simplified basis can be divided into three main groups.

## 1. CONSTRUCTION DETAILS

Here is to be considered, among others, the size and arrangement of the installation dimensions.

## 2. OPERATING CONDITIONS

respective seals are to be used. Here is to be considered: The comprehensive stress, the type of operating medium, the expected temperatures, running speed etc.

## 3. BUSINESS CONSIDERATIONS

These include the cost situation, questions concerning dates, that is, the availability, also in the future, as well as the guarantee of constant high quality for materials and performance.

Many of these factors mentioned above could contradict one another; also in many cases, the optimum solution can only be found through a compromise. Therefore, the enormous choice of types and materials of the seals in this catalogue must be seen from this perspective. The following tables contain profiles which have proven to be reliable in practice and thus represent our standard program. We have included the ratings, installation notes and examples of application of every type of seal in order to aid the design engineer in the right choice. For problem cases, the many years of experience which our technical consultation service has, should be made use of.

## ROD AND CYLINDER SEALS FOR HYDRAULIC AND PNEUMATIC SYSTEMS

### FORMS

U-Rings  
lip seals  
compact rod seals  
V-packings  
PTFE slide rings with O-Ring clamping element  
seals for pneumatic systems

### MATERIALS

Elastomers  
Elastomer-impregnated fabrics  
Polyurethane  
PTFE-Elastomer combinations

### GENERAL TABLE

Page 5

## SCRAPERS

### FORMS

oil wiper rings  
flat-type scrapers

### MATERIALS

Elastomer  
Polyurethane

### GENERAL TABLE

Page 117

## GUIDE ELEMENTS

### FORMS

rod and cylinder guide elements  
ready for installation  
sealing strip (yard ware)

### MATERIALS

modified Euraflon® PTFE

### GENERAL TABLE

Page 121

## O-RINGS, STARRINGS, RECTANGULAR PROFILE RINGS

### FORMS

O-rings  
starrings  
rectangular profile rings

### MATERIALS

Elastomer  
Polyurethane

### GENERAL TABLE

Page 124

## SPECIAL SEALS

- fitting seals for ball valves, valves, slide gates, double seat valves
- seals for butterfly valves
- seals for fittings, spindles and shafts
- rod seals for gas springs and shock absorbers
- standstill seals for pumps and agitators
- rectangular and oval packings
- OR frames for rotary pistons
- seals for rotary systems
- special seals for the car industry

## ELASTOMER AND POLYURETHANE / METAL COMPOUNDS MOULDINGS OF ELASTOMER AND POLYURETHANE

Furthermore we can produce seals according to your drawings and samples to develop the appropriate seal for your special field of application made from elastomers, elastomer-impregnated fabrics and polyurethane materials. Elastomer seals are also applicable in the field of food processing.

Linings for wheels and rollers, transport and scraper gibs, delivery plungers for concrete and sludge pumps, counter punching, counter punching pallets for paper and cardboard cutting machines, buffers etc.  
Spring and buffer elements, mouldings according to samples, drawings and constructions of our customers in collaboration with our technical department.

## SEMI-FINISHED PRODUCTS

### FORMS

Pipes, round and square bars  
sheets

### MATERIALS

Polyurethane  
Polyurethane

### GENERAL TABLE

up to 1000 mm in length  
thickn. 1-10, 500 x 1000  
thickn. 15-30, 500 x 1000

## LUBRICANTS

### HECKER GSM PASTE M No. 1049





















A mineral oil-based lubricant with an additive of molybdenum disulfide which has been proven in practice over many years. It can be well recommended for the application as installation and starting auxiliary for our GSM hydraulic and pneumatic seals. d Einlaufhilfe für unsere GSM-Hydraulik- und Pneumatikdichtungen

### HECKER GRAFIT PASTE K No. 1048

Manhole, flange and screw lubricant. Avoids the burning together of flange seals and thus enables a quick and easy loosening of worn seals. Prevents seizing of screws and nuts. This paste can also be recommended as lubricant for rubber/fabric seals. Available in cans of 1 kg or in buckets of 15 kg.






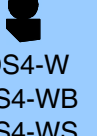
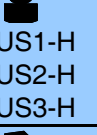
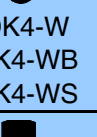
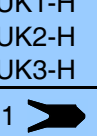





# CONTENTS AND INTRODUCTION

type group	seal profile	material	rod seal	cylinder seal	recommended values for application						page
					hydraulic systems			pneumatic systems			
					p (bar)	t (°C)	v (m/s)	p (bar)	t (°C)	v (m/s)	
<b>LIP SEALS</b>	 UG1	rubber (Gi) Gi-fabric (Gew) polyurethane (PU)			< 160 < 315 < 400	-30 upto 110 -30 upto 120 -25 upto 80	< 0,5 < 0,5 < 0,3	< 16	-20 up to +80	< 1	8
	 UG2	Gi PU			< 160 < 400	-30 upto 110 -25 upto 80	< 0,5 < 0,5				20
	 UR 1 + 2	Gi Gew			< 160 < 315	-30 upto 110 -30 upto 120	< 0,5 < 0,5				23
	 UNX7	Gew			< 400	-30 upto 120	< 0,5				25
	 UNI1	Gi Gew PU			< 160 < 315 < 400	-30 upto 110 -30 upto 120 -25 upto 80	< 0,5 < 0,5 < 0,3	< 16	-20 up to +80	< 1	26
	 UNI2	Gew			< 400	-30 upto 120	< 0,5				29
	 UNI3	Gi PU			< 160 < 400	-30 upto 110 -25 upto 80	< 0,5 < 0,5	< 16	-20 up to +80	< 1	32
	 UNA1	Gi Gew PU			< 160 < 315 < 400	-30 upto 110 -30 upto 120 -25 upto 80	< 0,5 < 0,5 < 0,3	< 16	-20 up to +80	< 1	32
	 UNA2	Gew			< 400	-30 upto 120	< 0,5				36
	 UNA3	Gi PU			< 160 < 400	-30 upto 110 -25 upto 80	< 0,5 < 0,5	< 16	-20 up to +80	< 1	32
	 UNX1	Gi			< 80	-30 upto 110	< 0,5				37
	 UNX2	Gi			< 25		< 0,5				
	 MN1	Gi			< 160	-30 upto 110	< 0,5				52
	 MA1-4	Gi Gew PU			< 40 < 100 < 40	-30 upto 110 -30 upto 120 -25 upto 80	< 0,25 < 0,5 < 0,25				54
	 ST1-4	Gi Gew PU			< 40 < 100 < 40	-30 upto 110 -30 upto 120 -25 upto 80	< 0,25 < 0,5 < 0,25				61
<b>COMPACT SEALS</b>	 UGA1	Gi-Gew.- combination			< 250	-30 upto 110	< 0,5				64
	 UGA3										
	 UGA2	Gi			< 160	-30 upto 110	< 0,5				64
 UGA4											
 UGA5	Gi-Gew.- combination			< 250	-30 upto 110	< 0,5				68	


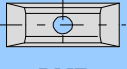










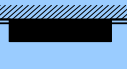


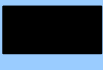


# CONTENTS AND INTRODUCTION

type group	seal profile	material	rod seal	cylinder seal	recommended values for application						page
					hydraulic systems			pneumatic systems			
					p (bar)	t (°C)	v (m/s)	p (bar)	t (°C)	v (m/s)	
<b>SEALING SETS</b>	 NK1-Sets	Gew.			< 400	-30 up to +120	< 0,5				69
		Gew/Gi			< 250	-30 up to +120	< 0,5				69
	 UK1-Sets	Gew.			< 400	-30 up to +120	< 0,5				77
	 UD1-Sets	Gew.			< 600	-30 up to +120	< 0,5				82
	 NOI1-Sets	Gew.			< 400	-30 up to +120	< 1				85
		Gew/Gi			< 250	-30 up to +120	< 0,5				85
 NOA1-Sets	Gew.			< 400	-30 up to +120	< 1				94	
<b>EURAFLOM® (PTFE) ELASTOMER SEALING SETS</b>	 DS4-W DS4-WB DS4-WS	PTFE + Gi			< 500	-30 up to +110	< 5	< 16	-20 bis +120	< 5	97
	 EUS1-H EUS2-H EUS3-H	PTFE + Gi			< 500	-30 up to +110	< 5	< 16	-20 bis +120	< 5	99
	 DK4-W DK4-WB DK4-WS	PTFE + Gi			< 500	-30 up to +110	< 5	< 16	-20 bis +120	< 5	101
	 EUK1-H EUK2-H EUK3-H	PTFE + Gi			< 500	-30 up to +110	< 5	< 16	-20 bis +120	< 5	104
<b>SEALS FOR PNEUMATIC SYSTEMS</b>	PKS1 PKK1 	Gi						< 16	-30 bis +80	< 1	106
	EUK1-P EUS1-P 	PTFE + Gi						< 25	-30 bis +120	< 5	108
	UNA-P UNI-P 	Gi PU						< 16	-30 bis +80	< 1	112



# CONTENTS AND INTRODUCTION

type group	seal profile	material	operating temperature (°C)	speed (m/s)	application	page
<b>ARMATUR E SEALS</b>	 <b>ASD</b>	rubber (Gi)	- 30 up to + 200		Valve- and gate valve stems, switching axles, cocks	113
	 <b>AKD</b>	Gi	- 30 up to + 200		butterfly valves for the food industry, chemical industry, water treatment, hydraulic oil supply etc.	
<b>SCRAPERS</b>	 <b>ABR1</b>	rubber (Gi) Polyurethane (PU)	- 20 up to + 110 - 25 up to + 80	ca. 1	Wiper seals for rods and plungers in hydraulic and pneumatic systems and for die sets	114
	 <b>ABR2</b>	PU	-25 up to + 80			115
	 <b>ABR3</b>	Gi	-20 up to +100			115
	 <b>ABF1</b>	PU	-25 up to + 80		Flat belt scrapers for flat belt guides, e.g. on machine tools, wood treating and textile machines etc.	119
	 <b>ABF2</b>	PU	-25 up to + 80			
	 <b>ABP1</b>	PU	-25 up to + 80		Prismatic belt scraper for prismatic belt guides e.g. on machine tools, automatic machines etc.	auf Anfrage
	 <b>ABP2</b>	PU	-25 up to + 80			
	 <b>ABP3</b>	PU	-25 up to + 80			
	 <b>AB</b>	PU	-25 up to + 80			
	<b>GUIDE BELT RINGS</b>	 <b>KF1-S</b>	PTFE-Bronze- Compound		-100 up to +200	ca. 2,5
 <b>KF1-K</b>		PTFE-Bronze- Compound	-100 up to +200	ca. 2,5	for pistons (ready for installation)	121
<b>O- RINGS</b>	 <b>OR</b>				dimensions according to DIN 3771, ISO 3601, ARP 568, BS 4518, SMS 1586	122
<b>STAR RINGS</b>	 <b>SR1</b>	Gi PU			SR1 = Standard design for universal application.	
<b>RECTAN GULAR PROFILE RING</b>	 <b>RE1</b>				Rectangular profile rings with different basic forms (rectangular, square, with deviations etc.)	





## APPLICATION

GSM-U-Rings UG can be used in hydraulic and pneumatic systems on the basis of its symmetrical profile as cylinder or rod-seal.

In addition, they proved themselves at dosage and filling plants and rotating and pivoting cylinders. Under most circumstances they should not be used where impeded business-conditions like pressure-pushes, vibrations, etc., are to expect.

## MATERIALS

materials	Operating medium	Hydraulics			Pneumatics		
		p(bar)	t(°C)	v(m/s)	p(bar)	t(°C)	v(m/s)
858	Petroleum, oil-water-emulsion,	<=160	-20 up to +110	<=0,5	<=16	-20 up to +80	<=1
900	compressed air	<=400	-25	<=0,3			
071 072		<=315	-30 up to +120	<=0,5			

U-Rings UG1 are delivered in following standard-materials:

WS 858: a NBR-material with approximately 86 ShA

WS 900: a Polyurethane-material with approximately 94 ShA

WS 071, 072: NBR-fabric materials, that differ in the fabric-structure. These materials are delivered standardly graphitated.

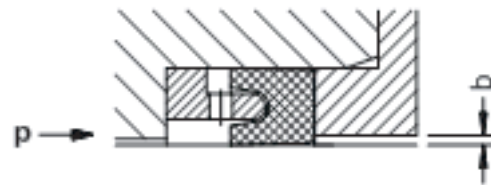
A particular tool is required for each of these three material-types.

UG1-Rings can be manufactured on customer-wish in each material. If the following tables show no suitable tool for the relevant measurements please ask us.

However, it must be taken into account that different rubber-kinds can differ in the production-sizes especially when using the same tool for different materials.

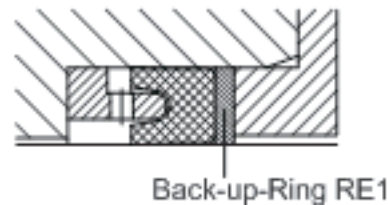
## CLEARANCE BEHIND THE SEAL

Too much clearance behind the seal leads to a premature failure of the seal. The admissible clearance behind the seal is calculated as follows:



WS 858  $B_{adm} = 0,3 - 0,001p$   
(for p up to 160 bar)

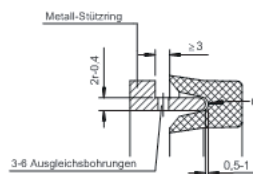
WS 900 and WS 072  $B_{adm} = 0,4 - 0,008p$   
(for p up to 400 bar)



If „ $b_{adm}$ “ is exceeded, the additional installation of back-up rings of suitable plastic materials (PTFE, POM) must be provided behind the seal.

## SUPPORT

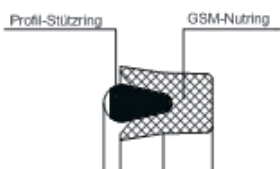
For UG 1-Rings, the additional installation of supporting elements is recommended



a) The metallic support ring: Has to be made by the customer. The sketch informs about the dimensions of the parts.

b) The profiled rubber support ring: In contrast to the metallic support element this support of observance of the mounting-measurement „L“ a (see table of dimensions) causes an additional radial pressure on the lips, that has an effect positively particularly with fabric-seals, since these parts show less elastic behavior as a pure Elastomer-sealing. Get along only a restricted number of tools for defined support rings is on disposal.

In many cases the use of a cutted profile-string is possible. It must be checked by our technical department.

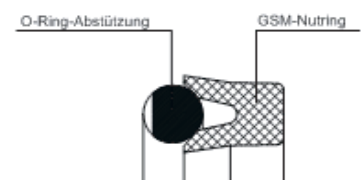


## c) Support by means of O-rings

It offers herself as alternative for the use-cases where no defined support by means of o-rings stands by the disposal, for which is striven mode of action of the same, however. Also here, the suitable O-Ring-dimensions must be determined by us.

Our technical service department informs and advises you on:

- Further dimensions available
- Further materials please refer to the general table „Materials“
- Installation dimensions
- Extreme conditions



Tell us about your sealing problems, we will develop a solution to meet your requirements.

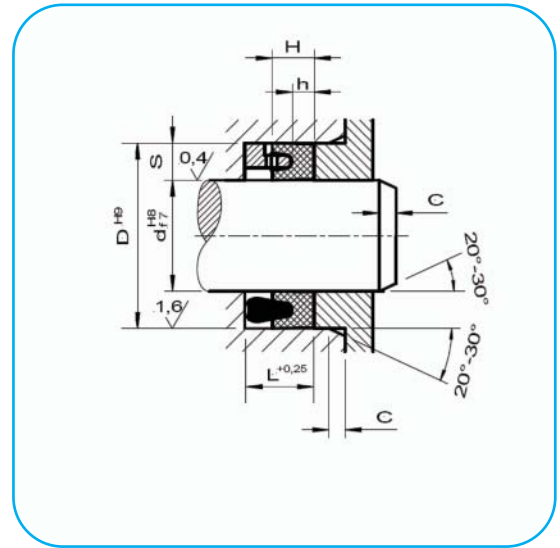




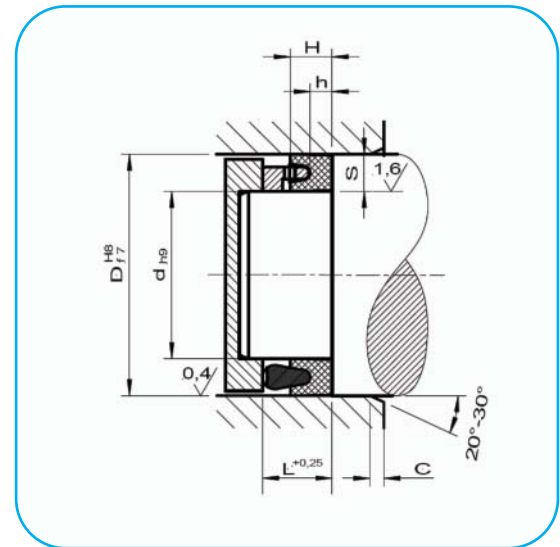


nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
1,2	10	5	2	2-08117		
2	10	3,8	1,8	2-05650		
2,5	10	3,8	1,8	2-08683		
2,7	6,8	5	3	2-05710		
3	10	5	2	2-07548		
3	10	5	2	2-00496		
3	15	9	3	2-02060		
3	7	5	3,5	2-04521		
3	8,5	4,2	2	2-02521		
3,5	7,5	3	1	2-07206		
3,9	7,5	3	1,5	2-02501		
4	10	4	2	2-01016	2-04884	
4	10	5	2,5	2-01262		
4	11	8	4,5			V-427
4	12,5	4	2	2-01825		
4	16	9	3	2-02061		
4,9	8	2,2	1,2	2-05023		
5	10	5	2,5	2-07810		
5	11	5	2,5			V-1855
5	11	6,5	4			V-2437
5	11,5	4	1,6	2-01295		
5	12	5	2,5	2-01185		
5	12	8	4,5			V-0426
5	12	5	3		2-06078	
5	12	8	4,2	2-06461		
5	13	6	3,8	2-09318	2-04882	
5	14	4,5	2	2-01261		
5	14	4,5	2,3	2-06428		
5	14	4,5	2,3			V-2537
5	14	7,5	3,2	2-03737		
5	15	5	2,5		2-00848	
5	17	9	3	2-09012		
5	17	9	4,5	2-05508		
5	17	9	4,5	2-02062		
5	18	8	3,6	2-03304		
5,5	11	3,5	1,7	2-11392		
5,5	11	4	2	2-02475		
5,5	18	7,5	4,2			V-1704
6	10,8	3	1,5		2-04449	
6	10,8	3	1,8	2-06451		
6	11,5	6	4			V-2356
6	12	4	1,8		2-01066	V-0329
6	12	4	2	2-03931		
6	12	4	2	2-07090		
6	12	4	2			V-2519
6	12	4	2	2-11869		
6	12	4	2	2-00744		
6	12	6	3			V-1145
6	12	8	4	2-05033		
6	15	7	3			V-3168
6	15	8	4	2-02010		
6	15	8	4	2-06427		
6	16	5	2,5	2-01870		
6	16	6	3	2-01322		
6	16	8	4,5		2-06079	
6	17	6	2,8	2-03424		
6	18	7,5	4,2			V-1882
6	18	9	3	2-02265		
6	18	10	3,5			V-1021
6	19	10	4	2-04901		
6	22	8	3	2-02173		
6	22	8	4			V-1703
6	24	12	6	2-05428		
6	25	10	5		2-06589	
6,35	16	6	3	2-13005		
7	11	3	1,2			V-2922
7	12,5	3,5	1,7	2-02214		
7	14	3	1,75	2-08337		
7	15	5	2,5	2-09586		
7	15	7	5			V-3941
7	17	9	3	2-02063		
7	18	6	3	2-00778		
7	18	10	7			V-1575
7,8	15	3,5	1,8	2-02890		
8	12	2,5	1,1	2-08891		
8	13	4	1,5	2-03911		
8	14	4	1,5			V-0971

## SEALING OF A PISTON ROD



## SEALING OF A CYLINDER



## INSERTION CHAMFER

S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10



# UG 1 U-RINGS ROD- AND CYLINDER SEALS



nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
8	14	6	3			V-0934
8	15	6	3			V-0398
8	14	4	2	2-00300	2-04885	
8	15	6	3,8	2-00262		
8	15	6	3,8	2-02447		
8	16	6	2,5	2-00139		
8	16	6	3,5			V-0143
8	17	6,5	3	2-00081		
8	18	8	3		2-08025	
8	18	8	3,5			V-1236
8	18	8	4	2-00754		
8	19	6	2,7		2-04875	
8	19	6	3	2-00578		
8	20	6	2			V-1037
8	20	6	2,7		2-02450	
8	20	9	3	2-01990		V-2256
8	22	8	3,5		2-00313	
8	22	8	4,5			V-0111
8	22	8	3,7	2-03370		
8	24	10	3,2		2-00182	
8	24	10	5,5			V-0295
8	25	6	3		2-00894	V-2678
8	25	10	4,5		2-05512	
8	30	10	4		2-04866	V-1458
8	30	12	5,5		2-05369	
9	15	3	1	2-02572		
9	19	6	2,5	2-09684	2-06232	
9	20	4	2,4	2-03308		
9	23	9	4,5	2-04541		
9,4	16,7	4	2,2	2-06452		V-3187
10	15	5	2,2	2-04609		
10	15	5	2,5	2-09661		
10	16	4	2	2-04320		
10	16	4	2			V-1436
10	16	5	2,2	2-04293		
10	16	5	2,3	2-05107		
10	16	6	4			V-2169
10	16,8	4	2	2-02436		
10	18	4	2		2-02449	
10	18	5	2,2	2-03430		
10	18	6	2,8	2-02187		
10	18	7	3		2-02617	
10	18	7	3,3	2-09323		V-0390
10	19	8	4	2-06935		
10	20	8	2,3			V-0717
10	20	8	3,7		2-02274	
10	20	8	5	2-09619		
10	20	10	5,5			V-0577
10	22	6	3	2-01845		V-0200
10	22	8	3,5		2-00525	
10	22	9	3			V-2203
10	24	9	5,5			V-2632
10	25	6	2,8	2-02074		
10	26	8	3			V-0933
10	28	8	3	2-05597		
10	28	8,5	3,8			V-0632
10	28	9	4		2-08340	
10	28	12	5,5		2-01083	
10	30	8	4			V-0216
10	30	10	4,5	2-00757		
10	32	10	4,5		2-00272	
10,5	16	3	1,5	2-09618		
11	21	7,5	3,3	2-00127		
11	25	8	3			V-0973
11	25	8	3,5	2-04850		
11	27	8	4			V-2446
11	28	8	3	2-01539		
11,3	15,5	2,5	1,4	2-08871		
12	18	4	1,8	2-00246		
12	18	4	2	2-09496		
12	18	4,5	1,5			V-0773
12	18	6	3	2-08866		V-1375
12	18	6	4	2-04420		
12	20	5,5	3	2-08090		
12	20	8	3,5	2-11366		
12	20	8	5		2-07324	V-0531
12	20	8	5	2-08947		

nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
12	22	8	4			V-0386
12	23	12	6,5	2-00503		
12	24	6	2,7	2-03251		
12	24	6	3		2-12406	V-1588
12	24	8	4	2-01359		
12	24	9	3	2-01991	2-09324	V-0982
12	25	8	3,5	2-01609	2-00101	
12	25	8	4			V-0101
12	25	10	3,5			V-1099
12	26	7	3,5	2-00679		V-1772
12	26	9	5,5			V-2634
12	28	8	3,5	2-04028		
12	28	8	3,6			V-1237
12	28	10	4,5	2-03626		
12	28	12	5		2-00373	
12	30	10	4		2-00457	
12,5	21,7	7,5	3,5		2-01454	
12,5	24	7	3,5			V-2018
12,7	25	6,5	2,5		2-00436	
13	23,5	12	6	2-05711		
13	24	6	2,8	2-01577		
13	25	10	5	2-05993		
13	25	10	5,1		2-06985	
13	25	10	6,3			V-0215
13	27	10	5,5	2-09341		
13	27	10	6,5			V-2633
13	30	10	5	2-04736		
13,2	30,4	10,5	5		2-04734	
13,5	30	12	5,5		2-09367	
14	20	4	2	2-09493		
14	20	4	2	2-03408		
14	22	4	1,8	2-00558		
14	22	6	3	2-04365		V-1856
14	22	6	3	2-00053		
14	23,5	12	6		2-08020	
14	24	12	6,5	2-00392		
14	25	5,5	2,4	2-05889		
14	24	8	4			V-1776
14	30	8	3,2		2-00152	
14	30	8	3,5	2-01096		V-0542
14	32	10	4,5		2-00290	
14	40	12	6			V-3629
15	21	5	2,5	2-08183		
15	23	14,5	4,5	2-02777		
15	24	6	3,7			V-2114
15	24	7,5	3,8	2-06200		
15	24	12	6,5	2-00870		
15	24	12	8,4		2-06521	
15	25	5	2,3		2-00386	
15	25	15	6,9	2-03309		
15	25	5,3	2,2			V-1028
15	25	7,5	3,9	2-03324		
15	25	7,5	4			V-0109
15	25	8	5			V-1970
15	28	8	2,5	2-01124		
15	28	8	3,5	2-04029		
15	30	7,5	3,5	2-07504		
15	30	7,5	3,7		2-09238	
15	30	7,5	4	2-02522		
15	30	8	3,7	2-03391		
15	30	8	4			V-1003
15	30	9	3,9		2-00102	
15	35	10	4,9	2-03152		
15	30	10	6,2			V-2849
15	35	10	5,2			V-0120
15	38	15	6	2-01923		
15	40	10	3,5	2-00269		
15,9	25,4	6,35	2,85		2-03394	
16	22	6	2,8		2-04990	
16	22	6	3	2-00140		
16	24	6	2,5	2-02578		
16	24	8	3,5	2-09849		V-2644
16	24	8	5			V-2628
16	24	12	9	2-04025		
16	25	5	2,2		2-00377	
16	25	5	2,2	2-08783		
16	25	8	4			V-1818





nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
16	26	5	2			V-0777
16	26	5	2,2	2-03789		
16	26	8	4	2-06067		
16	26	9	5	2-07400		
16	28	6	2,7	2-05890		
16	28	6	3			V-1774
16	28	9	3	2-01992	2-09325	V-1100
16	28	9	5,3			V-0128
16	28	11	5,5	2-04030		
16	30	6	3	2-05006		V-1292
16	31	11	5,5		2-05012	
16	31	11	5,5	2-01397		
16	32	8	4			V-1605
16	32	10	4,5	2-04392	2-02494	
16	32	10	5,8			V-0122
16	35	9	4,5			V-0762
16	35	7	3	2-00480		
16	36	10	4,5	2-04125		
16	36	9	4		2-00576	
16	36	15	7		2-06845	
16	36	15	8,5			V-0159
16	40	18,5	7		2-02785	
17	22	5	2,2	2-03377		
17	33	15	6,5		2-00362	
17	33	15	6	2-04500		
17	34	9	4,5	2-04629		
17	35	10	5	2-05955		
17	40	10	4			V-0126
17	40	10	4,5		2-01077	
18	24	4	1,9	2-01088		
18	24	4	2			V-1692
18	24	10	8,5			V-2149
18	25	4	1,5			V-0874
18	25	4	1,8	2-00087		
18	25	4	2	2-07379		
18	25	6	3,5			V-2281
18	26	6	3	2-02095		
18	28	5	2			V-0780
18	28	7,5	3,5	2-04079		
18	28	8	4,5			V-0203
18	28	8	5,2	2-07020		V-1689
18	28	9	5	2-07401		
18	29	7	3,8	2-04390		
18	29	7	4	2-01248		
18	30	6	3	2-09735		
18	30	12	5,4	2-03639		
18	30,3	12	4,5		2-01623	
18	31	7	3,5			V-1975
18	32	10,5	5	2-06024		
18	32	12	8,3			V-0132
18	34	8	3,5	2-02497		
18	34	12	5,5		2-00543	
18	35	8	3			V-1499
18	35	8,5	4,3			V-1998
18	35	12,7	3,8			V-0130
18	38	10	4,5		2-06504	
18	38	10	4,7			V-0108
18	38	10	5	2-06991		
18	40	10	4,5	2-02779		
18	40	10	5	2-02876		V-0278
18	40	10	4,7		2-04843	
18	40	11	5,5			V-3628
18	58	20	10	2-09520		
19	31	9	4,2		2-03600	
19	32	6,5	3	2-01103		
19	35	14	6		2-00455	
19,5	31,5	6,3	3,3	2-09595		
20	26	6	3			V-1348
20	26	8,5	4,5		2-09119	
20	27	6	3	2-08788		
20	28	4	1,8	2-06437		
20	28	4,5	2	2-02371		
20	28	4	2,2	2-12749		
20	28	8	3	2-11367		
20	28	8	3,5			V-2645
20	28	8	5			V-1713
20	28	8	5,3	2-07981		

nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
20	28	8	5,3	2-06302		
20	30	8	4		2-09123	
20	30	9	5	2-07402		
20	32	6	1,5			V-0709
20	32	6	3	2-01260		
20	32	7,5	3			V-1238
20	32	7,5	3,7	2-03347		
20	32	7,5	3,7	2-06892		
20	32	7,5	4			V-1674
20	32	9	3	2-02267		V-2200
20	32	9	4,2		2-03602	
20	32	12	4		2-01113	
20	32,5	6	3	2-09207		
20	32,5	8	5			V-0335
20	33	13	5		2-04555	
20	34	9	4,5			V-2019
20	34	12	7,5			V-2695
20	35	6	2,5	2-04315		
20	36	8	3,7	2-03348		V-0547
20	36	8	4		2-04667	V-4124
20	36	10	4,5			V-0484
20	36	12	5		2-04448	
20	36	15	8	2-02153		
20	39	10	5			V-1691
20	40	6	2,3	2-03497		
20	40	8	4	2-06568		
20	40	10	4,9	2-03153		
20	40	10	4,5		2-00151	
20	40	10	5	2-03369		V-0277
20	40	15	5			V-1102
20	40	15	9,5			V-0118
20	40	15	7	2-04914		
20	43	10	4,7	2-03920		
20	45	18,7	9,3	2-07052		
20	50	10	5	2-06569		
21	35	10,5	4,5		2-01817	
21	37	10	6			V-2697
22	28	4,5	2,7			V-2807
22	28	5	2,8		2-04900	
22	28	11,5	8	2-04767		
22	28	8	5			V-2548
22	30	3,8	2		2-09043	
22	30	6	2,8			V-0385
22	30	6	3	2-02748		
22	30	6	2,6		2-00103	
22	30	14	9,5	2-09627		
22	32	5	1,7			V-0781
22	32	5	2,2	2-03790		
22	34	6	2			V-0771
22	34	7,5 EW			2-00104	
22	34	10	7			V-2095
22	35	5	2,5			V-1778
22	36	10	5			V-0347
22	36	10,5	5,5	2-04080		
22	38	14	9,2			V-2635
22	40	10	4,5		2-00973	
22	40	10	4,5	2-03554		
22	40	10	5			V-0375
22	40	10	5			V-1678
22	42	10	4		2-00458	
22	45	15	8		2-06457	V-0163
22	45	15	9	2-07881		
22	46	12	5,5	2-02064		
23	32	5	2,5	2-09274		
23	35,3	12	4,5		2-01624	
23	40	10	5,7			V-2850
24	31	5	2,5	2-06650		
24	32	7	4,5			V-1572
24	38	21,5	10			V-3709
24	39	10	5			V-2020
24	40	8	3,8			V-0104
24	40	8	3,6	2-04002		
24	40	10	5	2-09108		
24	44	12	5,6		2-03649	
24	48	12	5,5	2-01744		
24	50	12	6			V-0664
24	50	12	5,5	2-01073		



# UG 1 U-RINGS ROD- AND CYLINDER SEALS



nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
24	60	15	7,5	2-09489		
25,4	30,4	3	1,7	2-11315		
25	33	8	3,5	2-09569		V-2646
25	34	7,5	3,5		2-04887	
25	35	5	2,5	2-08984	2-00211	V-1736
25	35	7,5	3	2-02052		
25	35	8	3,8		2-06500	
25	35	8	5			V-1293
25	35	8	5			V-1748
25	37	6	3			V-1503
25	37	9	3	2-01872		V-2198
25	37	9	4,2		2-03601	
25	38	8	4	2-06570		
25	38	8	4		2-07124	
25	40	6	2,5	2-03483		V-0430
25	40	8	3,5		2-02415	
25	40	8	4			V-1789
25	40	10	5		2-11815	
25	40	11	5			V-0595
25	40	11	7,5			V-1726
25	40	12	4	2-05986		
25	40	12	6		2-09120	
25	41	12	5,6		2-03504	
25	41	20	11			V-1343
25	42	13	8,5			V-2636
25	43	7	3		2-00378	
25	43	10	4,5			V-1342
25	43	15	9			V-0214
25	45	6	3			V-1773
25	45	10	4,5			V-0623
25	45	10	5	2-00758	2-00641	V-1721
25	45	12	7,6			V-1512
25	45	15	5			V-1104
25	45	15	6,5		2-00254	
25	45	15	8,7	2-07808		V-0102
25	47	15	4		2-03555	V-0367
25	50	15	6,5		2-00459	
25	50	18	11,5			V-0105
26	34	4	2	2-04473		
26	35	10	7			V-2806
26	35	10	7			V-2549
26	36	10	5		2-12437	
26	36	8	3,5	2-03927		
26	38	6	3	2-06508		
26	42	8	3,7	2-03349		
26	45	10	4,5	2-02884		V-0313
26	45	10	4,7	2-02423		
26	46	10,5	4,7	2-03736		
26	47	12	6			V-1900
26	50	12	5		2-09785	
26	57	32	15	2-00059		
26	70	18	4		2-03088	
27	33	10	5		2-04888	
27	33	10	6,7	2-04303		
27	36	6	3	2-06412		
27	48	12	6,8			V-2638
28	34	7	3,2	2-05319		
28	36	5	2,5	2-03970		
28	38	6	2,7	2-03560		
28	38	6	3			V-3681
28	38	7	3,5	2-08184		
28	38	8	4			V-1797
28	40	10	6,5			V-2717
28	40,3	12	4,5		2-01625	
28	44	8	3,5		2-02445	
28	44	8	4	2-00861		
28	45	10	5	2-03630		V-0362
28	45	15	9,5			V-0239
28	48	10	5	2-02230		
28	50	12	6,5	2-09391		
28	50	16,5	10			V-0164
28	52	15	9	2-08496		
28	70	15	7,5	2-09308		
28	73,5	18	4	2-04307		
28,5	35	8	4	2-01578		
30	37	8	4		2-04991	
30	37	8	5			V-1573

nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
30	37	11,5	6		2-09121	
30	38	6	3			V-1534
30	38	6	3,5	2-09861		
30	38	7	2		2-04297	
30	38	7	4	2-07309		
30	38	8	3,5			V-2647
30	38	12	6			V-0337
30	38	12	7,8	2-04014		
30	40	10	7,5			V-2246
30	40	10,3	6,5	2-09558		
30	40	5	2,4	2-01947		
30	40	9	5	2-07403		
30	42	9	3	2-02268		V-0698
30	44	7	3,5	2-05583		
30	45	10	4,5		2-02991	
30	45	15	5		2-01294	
30	45	7,5	3		2-12404	
30	46	6,5	2,5	2-01291		
30	46	11	5,5			V-1976
30	47	10	4,5		2-01203	
30	48	15	9			V-1206
30	50	9	3,5			V-1200
30	50	10	4		2-06458	
30	50	10	4		2-00207	
30	50	10	4,9	2-03042		
30	50	10	5	2-02408		
30	50	10	5,5			V-0121
30	50	10,5	5			V-1241
30	50	12	6,5		2-00799	
30	50	12	7	2-08826		
30	50	15	5			V-1106
30	52	11	5			V-0624
30	52	15	10			V-1508
30	54	13	6,5			V-1978
30	55	12	6,5	2-03350		
30	55	15	7			V-0506
30	55	18,7	9		2-01068	
31	50	12	7			V-2696
31,75	56,2	18	8,4		2-08465	
31,8	40	4,2	2	2-05791		
32	40	4	2	2-02500		
32	40	5	2,5			V-1088
32	40	6	2,8	2-01125		
32	40	8	5	2-07364		
32	42	10	5		2-12441	
32	42	5	2,5			V-2081
32	42	10	7			V-2550
32	44	6	3	2-05963		
32	44	10	5			V-3315
32	44	10	6	2-04658		
32	45	10	5,5			V-2042
32	48	8	4	2-04725		
32	50	10	5	2-04657		
32	50	15	7,5			V-0374
32	52	10	4,5	2-03125		
32	52	10	5		2-04121	V-1354
32	52	15	7		2-06318	
32	52	15	7,7	2-03984		
32	52	15	9			V-0160
32	60	15	7,5			V-2538
32,8	53	15	10			V-0879
33	43	6	3			V-1577
33	45	12	4,5		2-01626	
33	45	12	4		2-01112	
33	45	6	3	2-06094		
33	50	12	6			V-0218
33	50	15	7		2-03051	
33	53	15	8,5			V-0140
33	68	15	7			V-0342
33	68	18	6		2-02718	
34	42	5	3	2-06117		
34	45	7	3,5			V-0993
34	53,5	14	6,5	2-01680		
34	60	12	6	2-01926		
34	63,5	14	8		2-07984	
34	64	30	13		2-00304	
34	65	20	8		2-02616	



# UG 1 U-RINGS ROD- AND CYLINDER SEALS



nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
35	42	8	3	2-06962		
35	42	8	4			V-1982
35	43	4	2	2-09593		
35	44,5	5	2,5	2-09755		
35	45	6	2			V-0627
35	45	6	2,5	2-04149		
35	45	6	3		2-00212	V-1773
35	45	7,5	3,5	2-04081		
35	45	8	5			V-1853
35	45	9	5	2-07404		
35	47	6	2,5			V-2012
35	48	10	6			V-1638
35	50	8	3,7	2-04158		
35	50	8	3,8		2-03521	
35	50	8	4	2-05861		V-1506
35	50	9	6	2-05987		
35	50	10	5,5	2-06186		
35	50	15	7		2-09452	
35	51	9	4	2-04353		
35	53	10	4,5	2-04142		
35	53	10	5		2-07186	
35	54	10	4,8	2-05379		
35	55	9	3,5			V-1201
35	55	10	4,5	2-02647		V-0112
35	55	15	7		2-04266	
35	55	15	5			V-1108
35	55	15	7,5			V-0372
35	57	10	5	2-00801		
35	57	10	5	2-06071		
35	60	12	6			V-0745
35	60	18,7	8,7		2-06846	
35	60	18,7	11,5			V-0161
36	43	10,5	5,5		2-09122	
36	44	8	3,5	2-09774		V-2648
36	46	6	3		2-00570	
36	46	9	5	2-07405		
36	46	10	5		2-12438	
36	46	10	7			V-2551
36	48	6	3	2-03999		
36	48	6,5	3	2-02713		
36	48	9	3	2-02269		V-2901
36	48	9	5			V-1724
36	50	10	6,5			V-2637
36	55	10	4,5	2-02332		
36	56	10	4,5			V-0652
36	56	14	5,5			V-2994
36	56	15	7		2-02336	
37	46	5	2	2-05352		
37	53	9	5			V-2639
37	57	10	4,5	2-05593		
37	57	10	4,5		2-05594	
37	65	15	7			V-0373
37	65	15	8	2-08917		
38	46	4	2,3	2-02218		
38	46	11,5	5,5			V-0349
38	46	12	7	2-04117		
38	50	6	2,8	2-01391		
38	50	7	3		2-03200	
38	50	9	4			V-0739
38	50	9	6			V-1170
38	54	11	5		2-01552	
38	57	11	6		2-12403	
38	58	10	4		2-02673	
38	58	10	4,5			V-0388
38	58	10	5	2-05276		
38	72	18	8			V-0371
38,5	50	9	5			V-1795
38,9	56,8	8,5	2,7		2-07456	
39	48	8	4			V-2552
39,7	55,5	11	5,5		2-07125	
40	48	4	2			V-0358
40	50	5	2,2 V		2-07874	
40	50	5	2,3	2-03568		
40	50	5	2,5	2-09499		
40	50	5	2,5	2-12000		
40	50	6	2,5		2-07660	V-2001
40	50	10	5	2-01846		

nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
40	50	10	6			V-1747
40	50	10,5	5		2-04886	
40	52	7	3			V-0405
40	55	10	4		2-04503	V-0331
40	55	10	4,5	2-04314		
40	55	10	5			V-1722
40	55	10	5			V-1819
40	55	15 EW			2-09400	
40	56	8	3,5	2-02006		
40	56	10	4,5		2-01440	
40	56	10	6			V-1556
40	56	12	5,5		2-02490	
40	56	15	7,5			V-0318
40	57	8,5	4		2-02344	
40	58	10	5,5	2-09377		
40	60	8	4		2-01007	
40	60	10	3,5			V-0599
40	60	10	5	2-02887		V-1368
40	60	10	5			V-2466
40	60	15	7	2-07180		
40	60	18	12			V-0807
40	63	12	5	2-04092		
40	64	15	5	2-03696		
40	65	10	5			V-0806
40	65	12	6	2-00840		V-0763
40	65	12	6		2-00129	
40	65	18	8		2-02319	
40	65	18,7	11,5			V-0162
40	65,5	12	6			V-0799
40	70	15	6,9	2-03373		
40	70	15	8			V-0217
40	70	22,5	10,5		2-00416	V-0131
40	80	22	8		2-04583	
40	85	22	8		2-04584	
41,5	62	10	5	2-07060		
42	50	5	3			V-2395
42	50	6	2,8	2-04631		
42	55	6,5	2,5		2-00387	
42	55	6,5	2,9	2-04305		
42	58	15	10			V-2544
42	62	12	7	2-09743		
42	65	12	5,5	2-00260		
42	66	12	5,4	2-04143		
43	58	12	6,5		2-00794	
43	63	10	5		2-11243	V-2038
43,8	55	11	2,5		2-03738	
44	50	7	3,5			V-1718
44	52	8	3,5	2-09539		V-2649
44	55	6	3	2-09502		
44	55	10	4			V-0834
44	56	6	3	2-00796		
44	56	9	3	2-02270		V-1893
44	60	10	5	2-06571		
44	62	8	3		2-02977	
44	64	10	5		2-09537	
45	51	15	10		2-01170	
45	52	8	4,5	2-08874		
45	52	13,5	11,5			V-0209
45	53	12	7	2-04015		V-0338
45	53	8	3,5		2-01204	
45	55	10	6,5	2-08779		
45	57	6	3	2-02345		
45	57	10,5	7			V-1465
45	58	6,5	2,9	2-03406		
45	58,4	12	4,5		2-01627	
45	60	7,5	3,3		2-03939	
45	60	7,5	3,3	2-09134		
45	60	10	6			V-1957
45	63	10	5	2-03318		V-1752
45	65	10	4,5	2-00228		
45	65	10	4,5		2-00510	
45	65	10	5		2-11061	V-0273
45	65	12	5		2-04445	
45	65	12	5,5			V-0330
45	70	10	5	2-06573		
45	70	12	6			V-1843
45	70	18,7	8,7		2-05626	



# UG 1 U-RINGS ROD- AND CYLINDER SEALS



nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
45	70	18,7	9,4	2-04754		
45	70	18,7	11,2			V-2335
45	75	15	7			V-1408
45	75	15	7,5			V-1413
45	75	21	10		2-07531	
45	85	15	7	2-00372		
46	56	10	4,5		2-01769	
46	58	12	4		2-01111	
46	58	9	4,2	2-03113		
46	59	6,5	3,2		2-00571	
46	68	18	8		2-02292	
47,5	65	10	5	2-06262		
47,6	58	9	5,5			V-1025
48	56	11,5	8			V-1464
48	59	6	3	2-09498		
48	60	6	2,8	2-02246		
48	60	6	3			V-1473
48	60	8	5			V-1578
48	60	10	6			V-1796
48	65	10	5	2-03867		V-1554
48	68	12	5		2-00114	V-137
48	68	12	5,4	2-03852		
48	68	13	6		2-01924	
48	68	18	8			V-0431
48	72	12	5,5	2-11501		V-0321
48	72	12	6			V-1351
50	58	8	5			V-1626
50	58	10	3	2-06963		
50	60	8	4		2-07661	
50	60	10	5	2-04632		
50	60	10	6			V-1985
50	60	10	7,5			V-2076
50	61	15	7,5		2-01078	
50	62	9	6			V-1194
50	62	10	5		2-09124	
50	62	10	7			V-1807
50	62	15	5			V-0978
50	62	15	7		2-01833	
50	62	16	8	2-02611		
50	63	6,5	2,5		2-08358	V-1048
50	64	10	5		2-12439	
50	65	10	6			V-1639
50	65	12	5		2-07174	
50	65	12	6	2-06367		
50	65	15	7,5			V-1631
50	65	20	4	2-00049		
50	70	10	4,1	2-03195		
50	70	10	4,5		2-04188	V-0687
50	70	10	4,5		2-06503	
50	70	10	5		2-06310	V-1164
50	70	12	6		2-11791	
50	70	12	7,6			V-1491
50	70	15	5			V-1110
50	70	15	7		2-02922	
50	70	18	12		2-06201	V-1023
50	71	12	6			V-2161
50	72	13	7,5			V-2640
50	75	12,5	4			V-0945
50	75	12,5	5,5		2-01784	
50	75	12,5	6	2-01660		V-1337
50	75	14	7			V-1974
50	78	21	9		2-00257	
50	80	10	5			V-0729
50	95	15	6		2-00183	
50,8	76	12,7	3,3		2-07055	
51	62	6	3	2-09501		
51	63	6	3	2-04968		
51,6	75,9	12,7	3,3		2-07457	
52	64	9	3		2-02065	V-2036
52	70	8	4	2-06687		
52	70	9	4,5	2-09309		V-2468
52	72	10	5			V-1888
52	75	17,2	7,4		2-00307	
52	90	12	6	2-11255		
53	65	6	2,5			V-1338
53	65	6	3,5	2-06753		
53	65	7	3	2-03455		

nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
53	65	7	3	2-03455		
53	65	7	3			2-03933
53	76	18	3			2-00797
53	80	13	5,8			2-05884
53,98	74,61	9,8	4,2	2-09729		
54	60	8	4,5	2-04750		
54	64	5	2,5	2-09592		
54	66	18	11,5			2-06812
54	73	10,5	5,4			V-0158
54	80	13	5,8			2-05885
54	80	18	8,2			2-06733
54,5	65,5	11,2	5,5			2-01746
55	63	5	2,5	2-11489		
55	63	6	3			2-08942
55	63	11,5	5,5			V-0350
55	63	12	7,8	2-04016		
55	65	5	2,5	2-08872		V-2416
55	65	9,5	6,5	2-06934		
55	68	6,5	2,9	2-04633		
55	70	10	5	2-03952		V-0690
55	70	7,5	3			2-00388
55	71	16	6,5			2-04285
55	75	10	4,9	2-03154		
55	75	10	5	2-00748		V-0268
55	75	15	8,5			V-0274
55	75	18	12			V-1412
55	76	10	5			V-1275
55	78	12	5			2-00243
55	80	12	5,5	2-03442		
55	80	12	6			V-1524
55	80	13	4			2-01115
55	80	15	7			V-0258
55	80	18	12			V-0805
55	85	12	7,5			V-0346
56	80	12	6	2-06371		
57	72	8	4,2			V-1915
57	73	12,5	5			V-1086
57	73	12,5	6			2-04174
57	75	10	5			V-1256
57	76,5	9,5	4			2-08088
57	100	15	5			2-05362
57,8	66,5	4,7	2	2-12125		
58	70	12	4,5			2-01628
58	70	6	3	2-03971		V-2531
58	71	6	3	2-09074		
58	74	12	4,6			V-2553
58	75	10	3,6	2-03786		
58	78	12	5			2-00244
59	67	11,5	7,5	2-04577		
60	68	12	6			V-0339
60	68	12,5	8	2-04116		
60	68	8	3,7			2-01150
60	68	15,5	7,5			2-06292
60	68	25	16			2-02586
60	68	13,5	11			V-0211
60	70	7,5	5	2-05360		
60	72	6	2,7	2-00137		
60	72	6	3			V-1835
60	72	9	3	2-02066		V-2148
60	75	10	4,8	2-05907		
60	75	10	5			2-12513
60	75	12	8			V-1640
60	76	7,5	3,5			2-00572
60	76	14	10			V-1728
60	80	10	4,5			2-02446
60	80	10	5			V-1611
60	80	10	5			V-2490
60	80	10	5			V-1140
60	80	10	5	2-00967		V-0324
60	80	12	7			V-1926
60	80	12,5	6,2	2-06572		
60	80	14	5			2-03682
60	80	14	6			V-1016
60	80	15	7			2-02491
60	80	18	12			2-04740
60	80	18	12			V-1165
60	80	18	9,5			2-04859





nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
60	81	18	10		2-07184	
60	84	10	5			V-1997
60	85	10	5			V-1487
60	85	12,6	6,25		2-04741	
60	85	12	6,5	2-09206		V-0190
60	85	13	6	2-00535		
60	85	17	8			V-0317
60	90	15	7,5	2-07435		
60	90	15	7,5		2-04694	V-0345
61	83	18	10		2-07185	
62	78	8	3,8		2-02206	
62	78	8	4	2-04000		
62	82	14	4		2-00711	
62	92	15	7,5		2-06960	
62,5	74,7	7,5	4,5	2-09643		
63	90	22,5	9		2-02786	
63,5	88,9	12,7	3,3		2-08037	
64	74	7	3	2-06263		
64	80	8	4			V-1391
64	80	8	3,6	2-03532		
65	73	11,5			2-08553	
65	75	7,5	4			V-1715
65	75	12	7			V-2007
65	75	15	7		2-01438	
65	76	12	6	2-05873		
65	80	7,5	3	2-02124		
65	80	7,5	3	2-08552		
65	80	7,5	4		2-07172	
65	80	8	4,5			V-2025
65	80	11	7			V-1570
65	80	11,3	4,3	2-02734		
65	80	11,3	6,5		2-00813	
65	80	13	3,7		2-04630	
65	81	16	6,5		2-04284	
65	84	15	8		2-04677	
65	85	10	4,5		2-04987	
65	85	10	5	2-02888		V-2470
65	85	10	5			V-1838
65	85	15	8	2-02441		V-0228
65	85	15	7		2-02623	V-3211
65	85	18	11			V-2450
65	90	12	5,4	2-03569		
65	90	12	5,9			V-0142
65	90	18	12			V-0876
65	90	18,7	8		2-00359	
65	95	15	7		2-04502	V-0332
65	95	17,5	12			V-1288
65	95	17,5	9			V-1409
65	100	18	9	2-05769		
66	76	10	5	2-02541		
66	82	14	4		2-00712	
67	74	8	5		2-11168	
67	75	25	17		2-00862	
68	80	10	6,5			V-2721
68	80	12	8	2-06417		
68	83	10	6,2			V-2848
68	85	15	6		2-01832	
68	85	15	8	2-02612		
68	88	12	5,5		2-01922	
68	92	12	6	2-07707		
68	98	15	7,5		2-06959	
68	100	15	7		2-07576	
68,5	84,5	12	5		2-04447	
68,6	78,6	5,6	2,5	2-12129		
69	100	15	7		2-07577	
70	77	12	10,2			V-2260
70	78	5,5	3		2-00280	
70	78	13,5	5		2-01132	
70	80	30	19		2-02583	
70	80	10	6,5			V-2447
70	81	15	7,5		2-01305	
70	81	15	9,5	2-08873		
70	85	7,5	3,5		2-04988	
70	85	7,5	3,5	2-07928		
70	85	10 EW			2-12667	
70	85	12	7,5			V-1889
70	85	13	6	2-04229		V-0525

nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
70	85	13	7			V-2074
70	86	12,5	6			V-1265
70	86	13	6	2-05509		
70	86	10	4,5			V-0543
70	90	10	4,5	2-03422		
70	90	10	5			V-2160
70	90	12	5		2-00190	V-0686
70	90	12	5		2-04465	
70	90	12	7			V-0225
70	90	15	7			V-3207
70	90	18	12		2-06205	V-0915
70	95	10	5			V-2343
70	95	10	5			V-1536
70	95	12	5,5	2-03371		
70	95	12	6		2-06202	V-1340
70	95	12	6			V-1684
70	95	14	6		2-04470	V-1356
70	95	14	6			V-0320
70	95	19	6			V-1112
70	100	15	7,5		2-04742	V-1414
70	100	15	7	2-03264		
70	105	18,7	9		2-05391	
72	84	9	6			V-0463
72	86	12	5			V-2995
72	90	6,5	3			V-3525
72	90	12	5			V-2996
72	92	12	6	2-04522		
72	96	12	5,4		2-03034	
72	96	12	6	2-00860		
72	96,8	18,5	8			V-1219
73	81	12	7	2-08309		
74,8	100	12,5	4			V-0905
75	83	11,5	9			V-1463
75	87	18	11,5		2-06813	
75	90	7,5	2,5			V-1029
75	90	7,5	3,7		2-06204	V-1374
75	90	7,5	3,8	2-01173		
75	90	12	8,2			V-2088
75	90	15	6,5	2-03056		
75	95	10	5	2-01174		
75	95	12	4,7			V-0138
75	95	12	5		2-00115	
75	95	16	8			V-1587
75	95	16	8,5		2-00786	
75	95	18	12		2-04538	
75	100	15	7,5	2-08949		
75	100	22	15			V-2671
75	105	15	7,5			V-2951
75	105	17	8		2-04466	
75	105	19	7,5			V-3232
76	101	12,5	5,5		2-04410	
76	110	17	12			V-1522
77	85	11,5	7,5		2-04578	
77	101,3	12	6		2-07607	
78	86	11	6,9	2-06244		
78	86	12,5	8	2-04017		
78	86	8	4		2-01564	
78	90	12	6		2-02273	
78	94	16	5,3		2-04027	
78	95	10	2,5			V-3118
78	190	16	4	2-02466		
78,2	103,6	13	7			V-1991
78,5	110	15	7,5			V-2142
80	88	12,5	4,5			V-1031
80	88	12,5	8	2-04302		
80	88	15,5	5			V-0997
80	90	15	9			V-0483
80	90	15	9,5		2-00887	
80	92	10	6,5			V-2374
80	94	10	5		2-12440	
80	95	12	7			V-1817
80	95	12	7			V-1916
80	95	7,5	3,5		2-04184	
80	100	10	4,5		2-01618	V-0325
80	100	10	4,5	2-03155		
80	100	10	5			V-1139
80	100	12	7	2-09099		





nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
80	100	12	7,6			V-1490
80	100	14	4,5		2-03679	
80	100	15	7		2-09407	V-3122
80	100	18	12		2-04539	V-1380
80	101,5	12	7,5			V-2404
80	105	12	6			V-2952
80	105	12,5	6,2	2-08186		
80	105	15,5	8,5			V-0804
80	105	18,7	9,5		2-00765	
80	105	22	15			V-0914
80	108	15	10			V-1645
80	110	15	3,5			V-0731
80	110	15	6,9	2-03372		
80	110	15	7,5		2-04743	
80	110	22,5	7			V-1113
80	120	20	10	2-06829		
80	125	30	14			V-1353
82	92	10	6,5	2-06936		
82	101	9,5	5,5			V-2009
82,55	101,6	9	2,5		2-06885	
85	93	11,5	7	2-04173		
85	93	25	16		2-02587	
85	95	12	8,2	2-09149		
85	97	9	3	2-02067		V-2084
85	100	11,3	5	2-02735		
85	100	11,3	6,5		2-00815	
85	100	12	7			V-1749
85	104	12	5,5		2-11685	
85	105	10	5		2-11263	V-2030
85	105	12	5,5	2-02886		
85	105	12	6			V-1820
85	105	18	12		2-06203	V-1379
85	110	12	4			V-0758
85	110	12	5		2-00509	
85	110	15	7,5			V-1223
85	110	22	10			V-1251
85	120	17	8		2-04501	
85	177	20	5	2-03697		
85,5	104,5	10	4		2-02693	
88	110	10	4,5		2-08021	
88	96	13,5	11			V-0210
88	96	25	16		2-02506	
88	96	25	17		2-00863	
88	118	15	7,5			V-2067
88,9	107,95	10	4		2-08654	
89	110	10	4,5		2-08022	
90	98	12	7,5	2-04411		
90	100	10	6	2-08827		
90	100	12	8			V-2444
90	101	15	7		2-01396	
90	105	12	6		2-11391	
90	108	13	3			V-3117
90	110	10	4,5	2-03035		
90	110	10	5	2-08217		V-0255
90	110	12	7	2-04647		V-1417
90	110	16	6,8		2-03199	
90	110	16	10,7			V-2641
90	110	18	10		2-07678	
90	110	18	12			V-1120
90	114	8	3	2-09959		
90	115	12,5	5,5	2-00245		
90	115	15	8			V-2572
90	115	18	12			V-1895
90	115	22	15		2-07051	V-0913
90	120	15	6		2-00508	
90	120	15	7			V-0326
90	120	15	7,5		2-08115	
90	120	17	6		2-03839	
90	120	22,5	10,5			V-0500
90	125	18	9			V-0406
91	100	8,5	4,5			V-1716
93	104	12	9,5	2-08310		
94	104	30	19		2-02584	
95	115	10	5		2-12001	V-2082
95	115	12	6			V-2376
95	115	15	7		2-03613	

nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
95	115	15	9,5			V-0227
95	115	18	12			V-1610
95	120	12	6	2-11194		
95	120	13	6		2-12401	
95	120	22	9			V-0365
95	120	22	10		2-02175	
95	125	15	3,5			V-0732
95	125	15	7		2-05095	
95	125	15	7,5	2-08187		V-3186
96	104	11,5	7,5		2-04579	
96	108	18	11,5		2-06814	
97	105	11,5	5,7		2-06293	
97	105	11,5	7,3	2-06243		
97	105	12,5	4,5			V-1030
97	105	12,5	8	2-04018		
97	105	25	18	2-07179		
99	115	12	5		2-04454	
100	108	12,5	4,5			V-1158
100	110	5	2,2	2-03017		
100	112	9	3			V-2155
100	112	9	3,5	2-01757		
100	114	16,5	4		2-03854	
100	115	12	7,9			V-2252
100	115	12	8,2			V-2258
100	120	10	4,5			V-0559
100	120	10	5	2-01117		
100	120	13	6,5	2-00536		V-0530
100	120	18	6			V-0986
100	120	18	9,5		2-05908	
100	120	18	12			V-1156
100	125	12	6			V-0960
100	125	15	7	2-09444		V-0565
100	125	15	8		2-08051	
100	125	15	9			V-1870
100	125	22	9,5			V-3748
100	125	22	10		2-08576	
100	125	22	15			V-1157
100	130	15	5			V-0759
100	130	15	7	2-03274		
100	130	15	7,5		2-07917	
100	130	22,5	10,5			V-0501
100	135	15	7			V-0259
100	140	17	8			V-0316
100	140	30	17			V-0174
101	121	10	5	2-04294		
104,3	114,3	7,5	3,3	2-03378		
105	120	15	6		2-01831	
105	120	15	7	2-02613		
105	120	15	9			V-1627
105	130	12	6	2-11195		
107	130	20	10		2-07718	
107	140	18	7		2-09648	
108	127	12,7	6,7	2-06444		
110	118	15	10,5		2-07998	V-1546
110	118	25	16		2-02588	
110	125	10,5	3,5		2-08943	
110	125	12	7			V-1134
110	125	15	10			V-2445
110	130	10	3,5			V-0936
110	130	10	5		2-12398	
110	130	10	4,8	2-03280		
110	130	12	7	2-04661		V-1415
110	130	18	6			V-1063
110	130	18	8,4		2-03612	
110	130	18	12			V-0912
110	130	18	12			V-1331
110	135	12	6		2-00798	
110	140	15	7,5		2-04744	
110	140	15	8			V-0286
112	142	15	7		2-00594	
115	125	15	10			V-1783
115	126	15	9,5		2-06948	
115	133	15	10,5			V-2259
115	134	10,5	4,8	2-09704		
115	140	12	5,9	2-03325		
115	145	15	7,5	2-08188		
116	130	9,5	5			V-1717





# UG 1 U-RINGS ROD- AND CYLINDER SEALS



nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
118	126	11,5	7,3	2-06245		
118	130	18	11,5		2-06815	
118	150	15	10			V-1460
118	158	20	7			V-1052
120	128	12,5	4,5			V-1122
120	128	12,5	8,5			V-1207
120	132	9	3	2-08680		V-1821
120	139	10	5	2-09500		
120	140	10	5	2-08899		V-1751
120	140	15	7,5		2-07719	
120	140	15	5			V-1311
120	140	15	8,5			V-0173
120	145	18	11			V-2485
120	150	15	6,7	2-03457		
120	150	15	7,5			V-1983
120	150	18	10,5	2-09334		
120	150	18	13			V-1486
120	150	26	17,5		2-08114	
120	150	26	9		2-03123	
120	160	20	10			V-0307
123	150	20	5	2-03695		
124	134	30	19		2-02585	
125	135	14	10		2-04695	
125	145	10	4,5	2-04357		
125	145	10	5		2-12008	
125	145	15	5			V-0853
125	145	15	7,3	2-02995		
125	145	18	8		2-00707	
125	145	25	11	2-05065		
125	147	22	5		2-11745	
125	148	16	8		2-05612	
125	150	12	6			V-1403
125	150	12,5	6		2-07495	
125	150	22	9,5			V-3110
125	150	22	10		2-08469	
125	155	23,5	6,5			V-0711
126	150	12	6	2-04649		
127,5	244	14	6,35	2-08492		
130	145	11,3	4,3	2-02736		
130	145	11,3	6,5		2-00814	
130	150	10	4,8	2-03326		
130	150	10	5		2-07354	
130	155	20	8,8	2-03940		
130	160	15	7		2-02374	
130	160	15	7,5	2-01975		V-0992
130	160	15	7,5			V-1644
131	152	11	5,5	2-06443		
132	150	20	3		2-03053	
132,5	140,5	14	8,5		2-07016	
133	167	18	8,5		2-07307	
134	160	15	7,5	2-09615		
135	155	15	7	2-02817		
135	160	13	5	2-07253		
135	165	15	6,3	2-03351		
135	165	20	10		2-07027	
136,5	152,4	19	12	2-11856		
140	152	9	3	2-11231		V-2488
140	160	10	3,5			V-0887
140	160	15	9,5			V-2251
140	163	20	9		2-00451	
140	165	14	6		2-08511	
140	165	18	11			V-1965
140	165	22	9,5			V-2999
140	165	22	10		2-09471	
140	170	15	7		2-00717	
140	170	15	7	2-09628		
140	170	16,5	8	2-09445		V-1240
140	170	20	7,5		2-11407	
140	170	25	11			V-0438
140	180	20	10			V-0284
140	180	30	10			V-0902
143	151	11,5	7,3	2-06246		
143	155	12,5	7,7	2-06952		
145	165	15	7,5			V-2166
145	175	15	7,5			V-0271
146	160	9,5	5			V-1719
145	170	15	6		2-07591	

nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
150	170	15	7,5			V-2277
150	170	18	8		2-00705	
150	170	24	8	2-03976		
150	175	15	5			V-0809
150	175	15	7,5		2-07918	
150	180	15	7		2-12397	
150	180	15	6,5	2-01698		
150	180	15	7,5			V-0238
150	180	15	7,5			V-1137
150	180	22	9,5			V-3307
150	180	22,5	10		2-02281	
150	190	20	10			V-0237
153	183	22,5	10,4		2-03509	
155	180	22	11,5	2-05716		
155	185	15	7,5	2-03978		
160	180	14	7	2-01976	2-02875	V-1407
160	180	15	7			V-1746
160	185	15	7,5	2-05109		
160	190	15	6,7	2-04504		
160	190	15	7,5	2-06838	2-07920	V-1555
160	190	15	7,5			V-0253
160	190	22	9,5			V-3100
160	190	22,5	10		2-07952	
160	190	25	17			V-0570
160	190,5	22,5	14			V-0134
160	195	36	15		2-00317	
160	196	25	14	2-02354		
160	200	20	10	2-05606	2-02994	V-0252
165	190	15	5			V-0810
165	195	15	7	2-03273		
165	201	25	8	2-01095		
170	200	15 EW			2-12395	
170	200	15	7,5	2-09446		V-2482
170	200	16	4,5	2-08290		V-736
170	200	25	8		2-09461	
170	200	26	17,5			V-0800
175	191	15	8	2-09739		
175	200	16	8	2-08681		V-2486
175	205	15	7	2-01977		
175	205	20	8		2-12461	
175	205	26	10			V-1176
176	200	12	6		2-05617	
180	200	14	7		2-05041	
180	200	15	9,5			V-2250
180	210	15	7,5	2-09155		V-0280
180	210	22	9,5			V-3111
180	210	25	10		2-03500	
180	212	24	11		2-00460	
180	220	20	10	2-11196	2-05997	V-0249
180	220	28	10		2-04191	
183	223	20	9		2-06467	
185	200	12	7,5			V-3467
185	205	20	5		2-04134	
185	210	15	5			V-0811
185	215	15	7		2-00716	
185	215	15	7,5	2-06891		
185	220	26	7			V-0770
185	220	30	10			V-0903
185	225	20	6			V-0526
190	206	12	8	2-06104		
190	220	15	6,7	2-04781		
190	220	20	9			V-0477
190	220	22,5	11		2-02492	
190	220	26	17,4			V-0683
190	225	20	9			V-0476
190	230	20	9			V-0370
192,5	200	14	11		2-04679	
195	220	18,7	8		2-01494	
195	220	18,7	9,2		2-01186	
195	225	15	7		2-00715	
195	225	22,5	10,4		2-03508	
195	235	20	10			V-0283
200	225	18	11	2-08682		V-2487
200	230	22	9,5			V-3114
200	230	22	14			V-1754
200	230	25	10		2-08326	
200	230	26	17,5			V-1770





nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
200	230	30	13			V-0382
200	230	35	11		2-03201	
200	235	35	16		2-01460	
200	240	20	10		2-05996	V-0236
200	240	20	9	2-03436		
202	222	14	9			V-2847
205	230	15	7	2-01978		
205	245	20	10			V-0270
210	230	20	5		2-04197	
210	234	20	10		2-07926	
210	235	15	5			V-0812
210	235	15	6	2-02811		
210	235	28	10			V-1186
210	240	15	7,5			V-0666
210	240	15	8		2-12006	
210	250	20	5,5			V-0563
210	250	20	9		2-05062	
210	250	20	9	2-03437		
210	250	24	6			V-0734
210	250	34	23		2-07198	
210	250	40	12		2-03644	
211	247	30	18	2-00408		
215	235	25	12			V-3778
217	252	28	14,5	2-09546		
218	230	15	6			V-3144
220	250	15	7,5			V-2483
220	250	22	9,5			V-3371
220	250	22,5	11		2-02493	
220	250	26	17,5		2-06895	V-1420
220	250	29	13			V-0560
220	255	36	15		2-00318	
220	260	20	10		2-07758	V-0235
222,2	254	25,4	14,4		2-09132	
222,3	254	28,58	12			V-2989
223	265	25	8			V-0032
224	260	30	18			V-2913
225	255	15	7,5			V-0254
225	255	26	17,5			V-2650
225	255	22	9,5			V-3814
230	270	20	9	2-03438		
230	270	20	10			V-0234
235	255	20	5		2-03917	
235	260	15	5			V-0813
235	260	18	10		2-05437	
235	260	28	10			V-1187
235	275	20	10	2-00376		
235	275	30	10			V-0045
236	258	22	5		2-03510	
240	270	22	9,5			V-3838
240	272	26	12			V-1255
240	272	26	17,5			V-1810
240	290	38	8	2-02170		
245	275	22	11		2-05089	
245	280	36,5	22,5		2-07786	
247	280	26	17,5			V-2754
249	282	22,2	9,5			V-3686
250	270	13,5	6			V-3134
250	270	25	12			V-3779
250	280	14	4,5		2-09297	
250	280	15	7,5	2-06576	2-12537	
250	280	22	9,5			V-3177
250	280	25	11		2-01576	
250	280	26	17		2-04680	
250	280	30	10			V-0033
250	280	35	17		2-00361	
250	285	36	15		2-00422	
250	290	20	9	2-03439		
250	290	20	10			V-0250
260	280	20	5		2-04196	
260	285	15	5			V-0814
260	290	22	9,5			V-3113
260	290	22,5	10		2-06835	
260	296	35	18	2-00548		
260	300	20	5,5			V-0256
260	300	20	10			V-0256/1
260	300	20	9	2-05521		
260	300	29	9			V-0046

nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
260	300	30	10		2-07511	
260	300	34	23			V-1771
260	300	35	19		2-06590	
260	305	34	23			V-2556
261	283	22	5		2-03796	
265	295	25	12		2-08513	
266,7	304,8	22,2	7,9			2-06653
268	292	20	5			V-0742
270	310	20	9	2-03855		
270	310	20	10			V-0269
275	307	25	12			2-08359
275	315	20	10		2-05995	V-0275
275	315	34	23			V-1884
278	312	22	9,5			V-3537
280	310	15	7,5		2-07231	
280	310	22	9,5			V-3246
280	310	22,5	8		2-02620	
280	310	30	18	2-09283		
280	320	20	10			V-0282
280	320	30	14			2-07194
284	320	30	13	2-00312		
285	315	22,5	9		2-01583	
285	325	25	7			V-0724
290	310	15	7		2-05975	
290	330	20	9		2-00714	
290	340	36	28			V-2339
299,5	340	45	15		2-04611	
300	320	25	12			V-3780
300	330	18	8,5			V-3904
300	340	20	10			V-0233
300	340	30	10			V-0746
300	340	30	12,2			V-3165
300	340	30	13		2-07195	
300	345	30	12,2			V-3201
305	331	15	6		2-05765	
310	330	15	7,5	2-06575		
310	330	15	7,5		2-06888	
310	330	20	5		2-04232	
310	335	15	8	2-05672		
310	340	26	10		2-04155	
310	346	35	19	2-01154		
310	350	20	5,5			V-0251
310	350	20	10			V-0251/1
310	350	30	14		2-02894	
310	355	38	29			V-1885
310	360	25	12,5			V-2530
311	333	22	5		2-04381	
314,5	344,5	25	10		2-08921	
317	365	30	12,2			V-3689
320	350	22,5	12		2-11347	
320	350	26	7			V-0802
320	350	26	8			V-0034
320	350	27	17			V-1886
320	350	38	18	2-08597		
320	355	30	23			V-1881
320	355	36	12			V-0051
320	355	36	15		2-00423	
320	360	30	12,2			V-3217
320	360	30	13		2-08379	
320	360	34	23		2-04681	
325	354	30	12,2			V-3443
325	357	25	8		2-08691	
325	385	20	5	2-08784		
329,5	370	25	11		2-04126	
330	360	22,5	10,5		2-08006	
335	357	22	5		2-11747	
335	360	15	5			V-0816
340	380	20	9			V-1316
340	380	20	10		2-07353	
340	380	30	12,2			V-3160
340	380	30	13		2-07169	
340	380	30	15		2-09596	V-2017
340	390	25	17,7			V-1571
350	370	15	7		2-04977	
350	380	25	17,5			V-2340
350	381,5	22,5	7,5			V-0042
350	385	27	7		2-07829	



# UG 1 U-RINGS ROD- AND CYLINDER SEALS



nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
350	390	20	10			V-0119
350	410	30	15	2-07752		
350	440	40	20		2-07505	
352	380	21	10		2-08005	
357	402	30	12,2			V-3152
358	400	38	15		2-11183	
360	380	20	5		2-04233	
360	395	36	15		2-00424	
360	396	35	23	2-01700		
360	400	15	7,5	2-06574		
360	400	30	12,2			V-3212
360	400	30	14		2-07325	
360	400	30	16	2-00650		
360	400	35	15			V-0035
360	410	30	14		2-09383	
360	410	30	19		2-07553	
370	400	26	7			V-0801
370	400	26	10		2-04154	
370	402	32	14		2-02340	
375	410	30	19	2-00409		
378	423	30	12,2			V-3687
380	410	22,5	10,5		2-08008	
380	420	20	10			V-0232
380	420	30	12,2			V-3137
380	420	30	13		2-02282	
385	425	46	20		2-04163	
388	418	22,5	6		2-01492	
390	430	20	8,5		2-04812	
397,5	440	30	12,2			V-3783
399	443	30	12,2			V-3695
400	430	24,5	17,5			V-1301
400	440	29	12		2-07362	
400	440	30	12,2			V-3112
400	445	35	16			V-2611
405	440	35	9		2-04912	
410	432	22	5		2-11746	
410	450	20	5,5			V-0281
410	450	20	9	2-03237		
410	450	20	10		2-08009	
410	450	28	19,5		2-06823	
420	460	30	12,2			V-2998
420	460	30	14		2-03968	
422	468	32	16		2-08030	
425	450	22	11		2-04176	
425	465	34	18	2-07753		
435	475	30	15		2-07450	
435	475	40	25		2-08291	
440	470	25	13,5		2-05200	
440	480	25	10			V-0248
440	480	30	12,2			V-3395
440	480	30	13		2-02283	
448	480	24	11		2-08007	
448	492	30	12,2			V-3351
450	490	30	12,2			V-2895
450	490	34	23			V-2557
455	475	13,5	6			V-3674
460	500	30	12,2			V-3242
463	498	30	15			V-2966
465	495	25	16,5			V-1574
470	510	28	23		2-06824	
474	516	28,6	17			V-3239
475	515	30	12,5		2-08137	
480	520	20	10			V-0110
480	520	30	12,2			V-3196
496	520	20	10	2-06947		
500	540	29	13		2-08301	
500	540	30	12,2			V-3161
500	540	34	23			V-0609
500	542	30	12,2			V-3108
520	560	30	12,2			V-3275
525	570	25	12	2-02398		
528	572	30	12,2			V-3536
540	580	20	10			V-0231
540	580	30	12,2			V-3197
550	583	15,5	7,4	2-05553		
550	590	35	15		2-08509	
550	590	35	17,2			V-3453

nominal seal dimensions				Tool-number		
d	D	H	h	rubber	rubber /fabric	Polyurethane
560	600	30	12,5		2-07951	
560	610	30	12,2			V-3385
560	610	37,5	17		2-09222	
568	600	20	12	2-07444		
570	610	35	12,4			V-0036
578	622	28,6	10,8			V-3499
580	620	25	13			V-0230
580	620	30	12,2			V-3263
580	620	35	19		2-08461	
598	642	30	12,2			V-3280
600	632	25	10	2-09246		
600	640	30	12,2			V-3123
600	640	34	16,3			V-0037
608	640	20	10	2-06949		
630	670	30	12,2			V-3569
650	680	32	22		2-06953	
650	690	30	12,2			V-3322
660	700	35	17,2			V-3454
670	710	30	14		2-03747	
674	694	10	5	2-09244		
730	780	30	12,2			V-4159
700	740	35	12,4			V-0038
700	740	35	12,4			V-3402
710	750	32	14		2-04203	
710	760	30	12,2			V-3430
747	795	32,2	15		2-06429	
750	800	30	12,2			V-3271
750	790	35	17,2			V-3505
760	810	30	12,2			V-3741
800	840	34	23			V-2684
880	930	30	12,2			V-3799
1000	1040	35	16,4			V-0040





## APPLICATION

- rod and cylinder seal
- mobile hydraulic systems
- injection machines and machine tools
- standard cylinders

Groove dimensions and ranges of diameter as per DIN ISO 5597/1 or DIN ISO 3320

materials	Operating medium	p(bar)	Hydraulics	
			t(°C)	v(m/s)
858	Mineral oil, oil-water-emulsion	<=160	-20 up to +110	<=0,5
900		<=400	-25 up to +80	<=0,3

## MATERIALS

U-rings UG2 are delivered in following standard materials::

WS 858: a NBR-material with approx. 86 Shore A

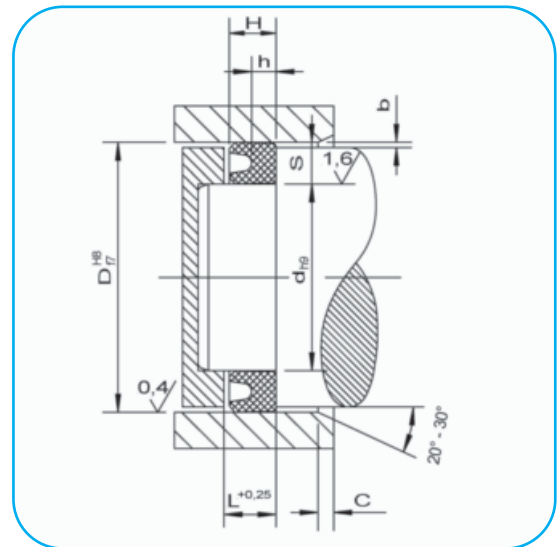
WS 900: a polyurethane-material with approx. 94 Shore A

## SUPPORT

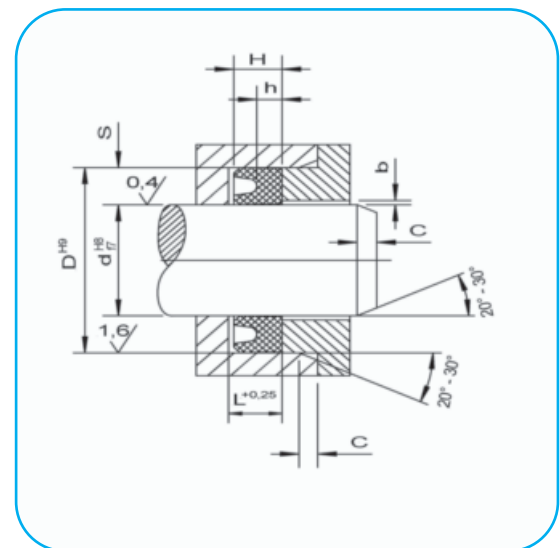
Supporting elements are superfluous at the mounting of UG2 rings.

Montage-helps, insertion chamfer and split of the seal: For the allowable split "b<sub>(zul)</sub>" behind the seal and for the insertion chamfer is with the same implementations like for profile UG1.

## SEALING OF A PISTON ROD



## SEALING OF A CYLINDER



## INSERTION CHAMFER

S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10





NOMINAL SEAL DIMENSIONS				TOOL-NUMBER		INSERTION CHAMFER
d	D	H	h	RUBBER	POLYURETHAN	L
7	16	6,5	3,7	2-11201		7,5
8	16	8	4,5	2-06456		9
10	16	4	2,3	2-09630		5
10	20	8	4,5	2-05144		9
11	27	8	4		V-2446	9
12	20	6,5	3,5	2-12005		7,5
12	22	8	4	2-07197		9
12	24	10	6	2-05145		11
14	24	8	5,6		V-3171	9
15	25	10	8	2-08876		11
15	28	10	6	2-05146		11
15	30	10	6	2-05754		11
16	32	10	4,5	2-08883		11
18	28	5	2,5		V-3295	6
18	34	12	7	2-09638		12,5
20	30	8	3,5	2-00153		9
20	35	10	5,5	2-10048		11
20	35	10	6	2-05147		11
22	30	6	2,6	2-00103		7
22	32	8	5,2		V-2619	9
22	32	10	6	2-09251		11
22	35	10	6		V-2464	11
22	38	10	5,5	2-10049		11
24	50	12	5,5	2-08859		12,5
25	32	7	3,5	2-08924		8
25	35	8	5		V-1748	9
25	35	10	6		V-2534	11
25	35	10	6,5	2-08867		11
25	38	10	6,4	2-09253		11
25	40	10	5,5	2-10050		11
25	40	10	6	2-05148		11
26	36	6	3,3		V-2545	7
28	41	6	3,5	2-09706		7
30	38	12	7	2-08592		12,5
30	40	10	5,5	2-08790		11
30	40	10	7,5		V-2246	11
30	45	10	6	2-05149	V-2618	11
32	42	10	7		V-3273	11
32	50	10	5,5	2-10053		11
35	45	10	6	2-09212		11
35	48	10	6		V-1638	11
35	50	10	5,5	2-10054		11
35	50	10	6	2-05150		11
36	52	10	5,5	2-10055		11
40	50	10	5		V-2560	11
40	50	10	6		V-1747	11
40	55	10	5		V-1722	11
40	56	10	5	2-07694		11
40	60	12	7	2-10056		12,5
40	60	12	7	2-05170	V-2312	12,5
41,3	54	6,35	3,5	2-09296		7,35
42	54	7,8	4,5		V-2899	8,8
42	62	15	9,5		V-2800	16
45	53	12	7	2-08593		13
45	55	10	6		V-2467	11
45	60	10	6		V-1957	11
45	65	12	7	2-05151		12,5

NOMINAL SEAL DIMENSIONS				TOOL-NUMBER		INSERTION CHAMFER
d	D	H	h	RUBBER	POLYURETHAN	L
45	65	12	7	2-10057		12,5
45	70	12	6	2-09172		12,5
46,7	58,7	10	6,7		V-3225	11
48	63	9	5	2-11145		10
50,8	69,8	11	5,7	2-08059		12
50	60	10	5	2-08882		11
50	60	10	6		V-2469	11
50	65	10	6		V-1639	11
50	70	12	7	2-05152		12,5
50	70	12	7	2-10058		12,5
50	70	12	7,6		V-1491	12,5
50	70	18	12		V-2587	20
52	72	10	5	2-09173		11
55	63	12	7	2-08590		12,5
55	65	12	7	2-08906		12,5
55	70	12	8	2-08875		12,5
55	75	12	7	2-05153		12,5
55	75	12	7	2-10059		12,5
55	75	12	7,5		V-3146	12,5
56	76,3	12	6	2-06323		12,5
56	76	12	7	2-10060		12,5
60	68	12,5	7,5	2-08594		13,5
60	70	12	7,8	2-11666		12,5
60	70	12	8		V-2492	12,5
60	70	12	8,4	2-08877		12,5
60	75	12	8		V-1640	12,5
60	80	12	7	2-05154	V-1811	12,5
60	80	12	7	2-10061		12,5
60	90	15	6,7	2-08661		16
62	72	12	8		V-2506	12,5
62	77	12	6,8	2-08948		12,5
63	78	12	8		V-3277	12,5
63	83	12	7	2-10062		12,5
65	75	12	7		V-2007	12,5
65	80	12	7,9		V-2600	12,5
65	85	10	4,5	2-08662		11
65	85	12	8		V-2471	12,5
65	90	15	8	2-05312		16
66	76	10	5	2-09599		11
66	76	5,5	2,5	2-12213		6,5
68	83	12	8		V-3278	12,5
68	92	15	9,8		V-3484	16
70	80	10	6,5		V-2447	11
70	80	12	8		V-2472	12,5
70	80	12	8		V-2504	12,5
70	80	13	8	2-08762		14
70	85	12	5,5		V-2585	12,5
70	85	12	7,5		V-1889	12,5
70	85	13	7		V-2074	14
70	90	12	6,5		V-2558	12,5
70	90	12	7	2-05155		12,5
70	90	12	7	2-10063		12,5
72	90	12	7	2-09298		12,5
73	81	12	7	2-08591		12,5
73	89	8	4,5		V-3526	9
75	85	10	5,5	2-08764		11
75	90	12	7,8		V-3924	12,5





NOMINAL SEAL DIMENSIONS				TOOL-NUMBER		INSERTION CHAMFER
d	D	H	h	RUBBER	POLYURETHAN	L
75	91	8	4,5		V-3526	9
78	86	11	6	2-08595		12
80	90	10	6		V-2473	11
80	92	10	6,5		V-2374	11
80	95	12	7		V-1916	12,5
80	100	12	6,5		V-2566	12,5
80	100	15	9	2-10064		16
80	101,5	12	7,5		V-2404	12,5
80	112,8	15	7,5	2-06354		16
85	100	12	7		V-1749	12,5
85	105	12	7,5		V-3147	12,5
85	110	12	5,1	2-08663		12,5
85	110	15	8,1	2-08664		16
88	118	15	7,5	2-07153	V-2067	16
90	100	12	8		V-2474	12,5
90	100	12	8		V-2444	12,5
90	110	15	9	2-05157		16
90	110	15	9	2-10065		16
90	115	15	7		V-3409	16
90	120	15	7,5	2-12362		16
93	123	15	7,5		V-2883	16
95	110	12	7		V-3773	12,5
95	110	12	7,9	2-09221		12,5
95	115	12	6		V-2376	12,5
100	114	10	5,5	2-06941		11
100	115	12	6,2	2-08763		12,5
100	115	12	7,9		V-2252	12,5
100	125	15	8,5	2-05158		16
100	125	15	9		V-1870	16
100	125	18	10	2-10066		20
102	130	15	7,3	2-11922	V-3488	16
105	120	15	9		V-1627	16
105	125	15	10	2-09150	V-1641	16
108	128	15	8	2-08776		16
110	125	15	9	2-09156		16
110	125	15	10		V-2445	16
110	130	15	8	2-07251		16
110	135	18	11	2-05159		20
110	140	15	6,8	2-08665		16
115	125	15	10		V-1783	16
115	135	15	9,5		V-2889	16
115	135	20	5	2-03996		21
120	140	15	8,5		V-0173	16
120	145	18	11	2-05160		20
125	140	15	10		V-2541	16
125	145	12	6,5		V-2910	12,5
125	145	15	8	2-07252		16
125	145	15	9,5		V-2602	16
128	158	18	9,7	2-08190		20
130	150	14	7	2-08807		15
130	150	15	9,5		V-3107	16
130	155	19	12,1	2-08922		20
135	160	18	11	2-05161		20
140	160	15	9,5		V-2251	16
140	165	18	11	2-05162	V-1965	20
145	165	15	9,5		V-2603	16
149	179	18	11	2-09106		20

NOMINAL SEAL DIMENSIONS				TOOL-NUMBER		INSERTION CHAMFER
d	D	H	h	RUBBER	POLYURETHAN	L
150	170	15	7,5		V-2277	16
150	180	18	11	2-05163		20
160	195	32	20		V-2915	34
166	188	22	5	2-03635		23
170	200	22	14	2-05164		23
175	205	18	9,7	2-09491		20
180	200	25	19,5		V-3821	26
180	200	15	9,5		V-2250	16
180	200	16	8,5	2-08808		17
180	210	22	14	2-05165		23
200	230	22	14	2-05166		23
211	233	22	5	2-03643		23
220	250	22	13,7	2-08768		23
225	250	18	11	2-05167		20
230	240	15	10		V-3202	16
235	260	15	10		V-3892	16
236	249,5	12	7,5	2-06390		13
250	270	15	9,5	2-09945		16
250	280	22	13,7		V-2561	23
290	320	15	7,5		V-3105	16
290	340	36	28		V-2339	38
340	380	20	10	2-12382		21
345	395	36	27,5		V-2667	38
470	500	18,5	11	2-11146		19,5
540	570	15	7,5		V-3106	16





## APPLICATION

U-Rings UR1 and UR2 correspond to our sealing type UG1 in profile and operating usability. Originally developed as a substitute for leather-sealings, they therefore are rounded at the back.

The substitution for leather sealing applies particularly to hydraulic walter and sub-piston-presses of older construction. rod and cylinder seal

## RECOMMENDED VALUES FOR APPLICATION

materials	Operating medium	p(bar)	Hydraulics	
			t(°C)	v(m/s)
858	Mineral oil, oil-water-emulsion	<=160	-20 up to +110	<=0,5
071 072			-30 up to +120	

## MATERIALS

UR-Rings are delivered in following standard materials:

**WS 858:** a NBR-material with approx. 86 Shore A  
**WS 071/072:** NBR cotton fabric materials which differ in the structure of the fabric. Standard is a graphitaded surface.

For further materials take a look in the chapter „materials“.

## SUPPORT

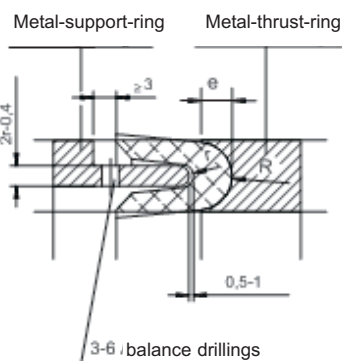
Supporting elements are superfluous at the mounting of UG2 rings.

Montage-helps, insertion chamfer and split of the seal: For the allowable split "b<sub>(zul)</sub>" behind the seal and for the insertion chamfer is worth the same implementations like for profile UG1.

## MOUNTING AREA AND INSTALLATION

The thrust-ring lying flat on the sealing-ground must be fitted exactly on the radius of the corresponding rounding of the sealing-ring.

It must be made out of metal or out of suitable plastics like POM or PA.

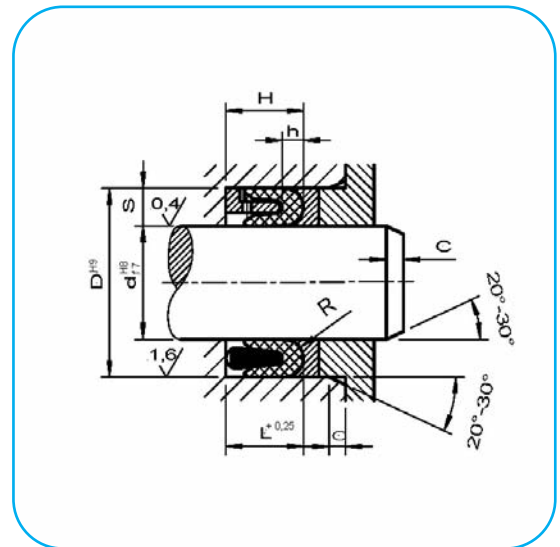


The dimensions „R“, „r“ und „e“ are listed in the following tables or on inquiry.

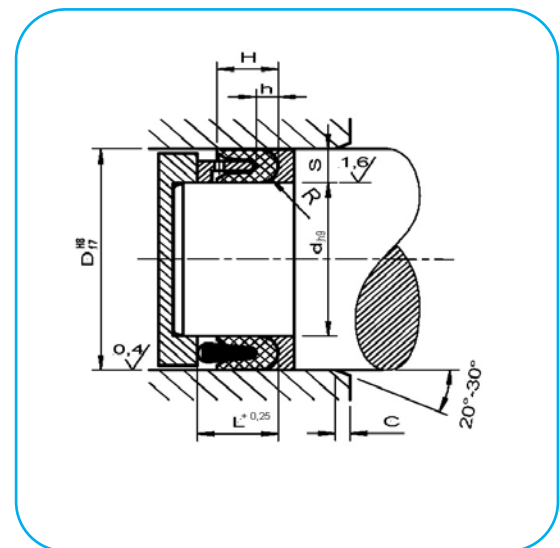
## SUPPORT AND TOOLS FOR INSTALLATION

UR-Rings have to be supported. For the 3 mentioned supporting alternatives and for the types of the installation tools look at chapter UG 1.

## SEALING OF A PISTON ROD



## SEALING OF A CYLINDER



## INSERTION CHAMFER

S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10





NOMINAL SEAL DIMENSIONS				TOOL-NUMBER			UR- No
d	D	H	h	RUBBER-FABRIC	RUBBER	R	
5	14	8	2,5	2-01347		2,3	1
6	20	8	3	2-00858		3,5	1
8	20	6	2,5	2-00511		3,0	1
10	30	12	4	2-00846		5,0	1
10	30	15	4	2-07387		5,3	2
10	32	12	4	2-00544		5,5	1
11	28	12	4	2-01954		4,3	1
12	20,5	5	2		2-03536	2,1	1
12	28	10	3,5	2-01126		4,0	1
14	32	10	3,5	2-02183		4,5	1
14	36	15	5	2-05871		5,5	1
15	27	12	4	2-02674		3,0	1
18	28	7	2,5	2-03469		2,5	1
18	35	10	2,5	2-04971		4,3	1
18	35	10	3,5	2-05920		4,3	1
18	50	14	4	2-01782		8,0	1
19	44,4	15,9	3,5	2-02816		6,4	1
20	30	8	2		2-01092	2,5	1
20	36	11	4	2-01848		4,0	1
20	40	15	5	2-00632		5,0	1
20	45	18,7	6,2	2-00080		6,3	1
23	50	20	6,6	2-00633		6,8	1
24	44	16	5	2-01333		5,0	1
25	50	17	5	2-00540		6,3	1
26	60	15	5	2-02622		8,5	1
26	70	18	6	2-00531		11,0	2
27	60	24,5	8	2-02514		8,3	1
30	46	13	5	2-05679		4,0	1
30	55	17	5	2-01608		7,5	2
32	50	12		2-00643		4,5	1
33	50	12	4,3	2-00590		4,3	1
34	42	6	2	2-09008		2,0	1
34	54	12	3		2-03150	5,0	1
34	54	16	5	2-01334		5,0	1
35	60	18,7	6,3	2-00805		6,3	1
35	63	12	4		2-01094	7,5	2
38	46	4,5	1,4		2-06285	2,0	9
40	56	10	4	2-00266		4,0	1
40	60	15	5	2-00219		5,0	1
40	65	18	6,2	2-00644		6,3	1
45	72	19	6,7	2-03069		6,8	1
46	68	18	5,5	2-00355		5,5	1
48	66	12	4		2-01807	4,5	1
49	72	18	7	2-00545		5,8	1
50	70	15	5	2-00154		5,0	1
50	80	21	5	2-01486		9,0	2
52	60	4,5	2		2-06286	2,0	9
52	72	15	5	2-00217		5,0	1
55	85	21	5	2-01483		9,0	2
60	80	20	9		2-00350	5,0	1
60	85	15	5	2-02014		6,3	1
60	90	21	5	2-01925		9,0	2
65	95	21	5	2-01484		9,0	2
69,8	107,9	19	4,7	2-02815		9,5	1
70	98	14	4,1		2-04671	7,0	1
70	100	21	5	2-01876		9,0	2
73	89	7,5	2,3		2-09477	4,0	1
75	100	25	6	2-07501		7,0	2
75	105	21	5	2-01487		9,0	2

NOMINAL SEAL DIMENSIONS				TOOL-NUMBER			UR- No
d	D	H	h	RUBBER-FABRIC	RUBBER	R	
76	100	14	3,5		2-01093	6,0	1
80	105	18,7	5,7	2-01994		6,3	1
80	110	22	8		2-00695	7,5	1
80	115	24	6	2-01485		10,5	2
85	120	24	6	2-01264		10,5	2
90	120	15	7,5	2-04712		7,5	1
90	120	22	8,5	2-11499		7,5	1
90	125	18	7	2-00709		8,8	1
92	130	26	8	2-11514		9,5	1
95	120	19	6	2-02515		6,3	1
95	130	24	6	2-01764		10,0	2
100	125	24	6	2-01516		6,3	2
100	135	24	6	2-01779		10,0	2
101,5	123,7	22	7,5	2-07414		5,6	1
102	126	24	8	2-06038		6,0	1
105	140	24	6	2-01348		10,5	2
106	126	24	8	2-06039		5,0	1
110	145	24	6	2-02160		10,5	2
110	140	22,5	7,5	2-00067		7,5	1
112	137	18,7	6	2-00094		6,3	1
120	150	20	6	2-02013		7,5	1
120	155	24	6	2-01948		10,5	2
125	150	24	6	2-01517		7,5	2
125	160	24	6	2-01555		10,4	2
126	161	24	9	2-00427		8,8	1
127	160	25,5	8,3	2-03192		8,3	1
130	160	22,5	7,5	2-03071		7,5	1
132	150	13,5	4,5	2-02176		4,5	1
135	170	24	6	2-01718		10,5	2
140	184	33	11	2-02235		11,0	1
144	180	24	8	2-03194		9,0	1
145	175	24	6,5	2-03193		7,5	1
150	175	23	4		2-02832	6,3	1
150	185	30	9	2-02455		8,8	1
160	185	20	5	2-01557		7,5	2
160	192	24	8	2-00095		8,0	1
175	205	25	9	2-11310		7,5	1
175	215	28	7	2-01349		12,0	2
188	225	28	9	2-00356		9,3	1
190	226,3	27	9	2-04926		9,1	1
202	260	40	10	2-00812		15,5	2
205	242	28	9	2-04925		9,3	1
210	240	28	7	2-01001		9,0	2
220	260	28	7	2-01643		12,0	2
230	275	30	5	2-12460		11,3	1
250	290	28	7	2-01350		12,0	2
256	300	30	10	2-07452		11,0	1
280	314	26	8,7	2-05565		8,5	1
310	360	28	5	2-07072		12,5	1
320	350	22,5	7,5	2-00225		7,5	1
320	360	30	12	2-08468		10,0	1
360	405	32	8,5	2-06525		13,5	2
380	420	28	8	2-07449		12,0	2
425	455	25	7,5	2-00490		7,5	1







## APPLICATION

- cylinder seal for double acting pistons
- mobile hydraulic systems
- mining industry
- stamping machines

## RECOMMENDED VALUES FOR APPLICATION

materials	Operating medium	p(bar)		t(°C)		v(m/s)
Sealing-ring 071/072 Back-up-ring POM/PA 090	Mineral oils, oil-water-emulsion	<400		-25 up to +110		<0,5

## MATERIALS

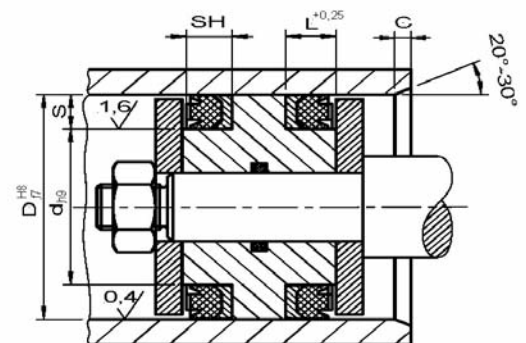
Standard and on stock are U-rings in NBR-impregnated cottonfabric. Surface covered with graphite. The Back-up-rings are in hard-fabric or in POM/PA. For more materials see chapter "materials".

## CHARACTERISTICS OF THE SEAL

Two-piece sealing-set, existing from a fabric-U-Ring with powerful lips, pressed support-part and a separated one, defined back-up-ring. Installation dimensions are as per ISO 3320.

## AVAILABLE TOOLS

Dichtungsnennmasse			Werkzeug-Nr.	L	C min
D	d	SH			
40	25	9,5	2-10164	9,5	4
50	35	9,5	2-10165	9,5	4
63	48	9,5	2-10166	9,5	4
80	60	12,5	2-10167	12,5	5
90	70	12,5	2-09812	12,5	5
100	80	12,5	2-10168	12,5	5
115	90	15,5	2-08699	16	7,5
125	100	15,5	2-10169	16	7,5
160	130	19	2-10170	20	7,5
200	170	19	2-10171	20	7,5
250	220	19	2-10172	20	7,5
500	470	19	2-10203	20	7,5





## APPLICATION

- rod seal for hydraulic systems
- standard cylinders
- mobile hydraulic systems
- injection machines and machine tools
- spindle seal fittings
- rotary and pivoting cylinders for low pressures and low speeds

## RECOMMENDED VALUES FOR APPLICATION

materials	Operating medium	Hydraulics			Pneumatics		
		p(bar)	t(°C)	v(m/s)	p(bar)	t(°C)	v(m/s)
858	Mineral oil, oil-water-emulsion compressed air	<=160	-20 up to +110	<=0,5	<=16	-20 up to + 80	<= 1
900		<=400	-25 up to +80	<=0,3			
071/072		<=315	-30 up to +120	<=0,5			

## MATERIALS

Standard production and stockage is effected in a NBR quality with approx. 86 ShoreA (WS 858) and a PU quality with approx. 94 ShoreA (WS 900).

WS 071, 072: NBR-fabric materials with different fabric structures (standard is carbon surface)

(WS 071, 072 recommended only for UNI1)

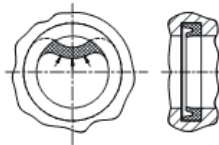
Deliveries with other hardness and made of special materials like FKM, EPDM, CR etc. are also possible, please refer to the general material table.

## AVAILABILITY

For the dimensions available, please contact us.

## MOUNTING AREA AND INSTALLATION

UNI-Rings are mounted without a separate support ring. UNI1- and UNI3-Rings are more flexible and can be mounted also in forehead closed mounting rooms. This kind of mounting is not possible in every mounting area, every material and every dimension of the ring.



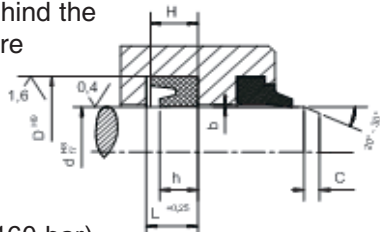
## CLEARANCE BEHIND THE SEAL

Too much clearance behind the seal leads to a premature failure of the seal. The admissible clearance behind the seal is calculated as follows:

WS 858:

$$b_{zul} = 0,3 - 0,001p \quad (p_{max}: 160 \text{ bar})$$

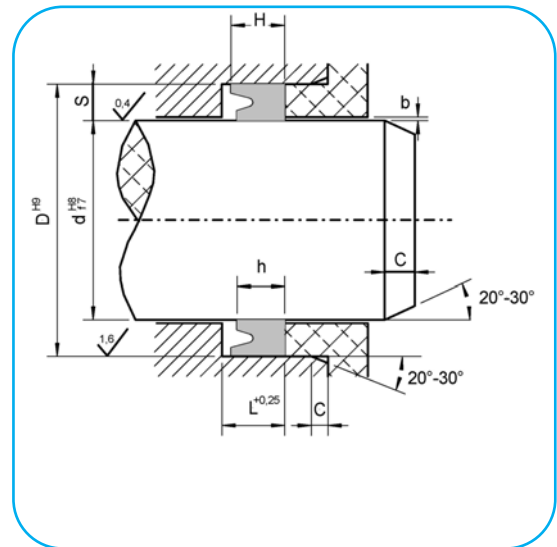
and for the other materials:  $0,4 - 0,0008p \quad (p_{max}: 400 \text{ bar})$



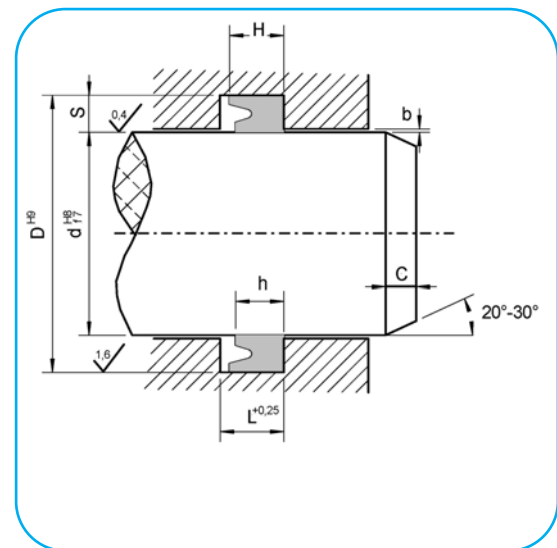
## TOOLS FOR INSTALLATION

Look for useful tools for installations and the right insertion chamfer that you don't damage the thin edges of the lips.

## SEALING OF A PISTON ROD (GROOVE WITH LID)



## SEALING OF A CYLINDER (RECESSED GROOVE)



## INSERTION CHAMFER

S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10



# UNI 1, UNI 3 LIP SEAL, ROD SEAL



NOMINAL SEAL DIMENSIONS				TOOL-NUMBER				UNI- No.
d	D	H	h	RUBBER	RUBBER FABRIC	POLYURET HANE	L	
3,175	9,5	9,5	7,5	2-04604			10,5	1
4,5	10	2,5	2,4	2-12424			3	3
4,7	9,5	3,6	3,2	2-12962			4,1	1
5	9	3,5	3	2-01598			4	1
5	10	4	2,8	2-08653			4,5	3
6	10	3	2,4	2-09202			3,5	3
6	10	4	2,8	2-12893			4,5	3
6	12	4	3,5	2-08700			4,5	1
6	12,7	5	4	2-03905			5,5	1
6	17	5,5	5	2-08520			6	1
8	14	4	3,2	2-09557			4,5	3
8	16	5,5	4	2-05720			6	3
8	16	5,5	3,7	2-10085			6	3
8	16	6	5,5	2-01774			6,5	1
8	17	11,5	10,5			V-1995	12,5	1
8	23	7	6,5	2-05525			8	1
9	28	13,5	11	2-04566			14,5	1
10	15	6	5			V-1565	6,5	1
10	16	4,5		2-11963			5	3
10	16,5	4	3,4	2-03890			4,5	1
10	18	5,5	3,7	2-10086			6	3
10	18	5,5	3,8			V-3200	6	3
10	18	8	7	2-01209			9	1
10	22	5,5	5	2-08521			6	1
10	22	9	7,5	2-00039			10	1
10	28	13,5	11	2-02564			14,5	1
11	16	3	2,7	2-08881			3,5	1
12	20	5,5	4,9	2-05595			6	3
12	20	5,5	3,7	2-10087			6	3
12	20	5,5	3,8			V-3199	6	3
12	22	5	4,5	2-02547			5,5	1
12	22	5	4,2	2-05621			5,5	1
12	22	7,5	6	2-03512			8,5	1
12,5	20,5	5,2	4,5	2-04391			5,7	1
12,65	22	7	5,6	2-03393			8	1
12,7	21	5	4,5	2-07812			5,5	1
12,7	28	11	10	2-03845			12	1
13	18	3	2,7	2-09273			3,5	1
13	22	7	5,6	2-03851			8	1
13	25	8	7	2-06756			9	1
13	25	9	7,2	2-03547			10	1
13	35	16,5	13,2	2-05188			17,5	1
14	22	5	4	2-03314			5,5	1
14	22	5,3	5	2-11967			5,8	1
14	22	5,5	3,7	2-10088			6	3
14	24	5	4,5	2-02548			5,5	1
14	26	8	6,4	2-03831			9	1
15	22	5	3,4	2-12262			5,5	3
15	22	10	8,5	2-05848			11	3
15	26	9	7,2	2-04814			10	1
15	27	9	7,2	2-00405			10	1
15	27	9	7,5	2-02375			10	1
15	27	12	10	2-04753		V-0568	13	1
15	30	7,5	7	2-08522			8,5	1
15	30	9	7		2-05527		10	1
15,9	22,2	4,8	3,5	2-06174			5,3	1
16	22	10	9		V-2666		11	1
16	23	5	4	2-03582			5,5	1
16	24	4,6	4		2-11684		5,1	1
16	24	5	4,5		V-1951		5,5	3
16	24	5,5	4	2-05229			6	3
16	24	5,5	3,7	2-10089			6	3
16	26	5	4,5	2-02549			5,5	1
16	26	7	6	2-09250			8	1
16	26	14	13,2	2-08504			15	1
16	27	9	7,5	2-01102			10	1
16	33	8,5	7,7	2-09048			9,5	1
17	25	10	9,4		V-2255		11	3
17	27	9	7,2	2-03830			10	1
17,9	28	9	8	2-05454			10	1
18	25	5	4,3	2-11457			5,5	1
18	25	5	4,5		V-1816		5,5	3
18	25	5,5	4,1	2-08962			6	3
18	25	8	7	2-08241		V-1437	9	3
18	26	5,5	3,7	2-10090			6	3
18	30	9	7,5	2-01229			10	1
18	30	10	8,5		V-0616		11	1
18	32	12	9,5		V-0720		13	1
18	33,5	8	6,4	2-12874			9	3
18	38	15	13,5	2-07560			16	3
19,6	30	8	7,5	2-02946			9	1
20	28	5,5	3,8	2-09694			6	3
20	28	5,5	3,7	2-10091			6	3
20	28	5,5	4,5		2-11397		6	1
20	28	6	4,8	2-03198			6,5	1
20	28	6	5	2-05570		V-1274	6,5	1
20	28	6	5		2-08637		6,5	1
20	28	8	7,5		V-2334		9	3
20	28	13,5	12		2-01974		14,5	1
20	32	6	5,5	2-02550			6,5	1
20	34	10	8	2-01087			11	1

NOMINAL SEAL DIMENSIONS				TOOL-NUMBER				UNI- No.
d	D	H	h	RUBBER	RUBBER FABRIC	POLYURET HANE	L	
20	35	11,2	9	2-00404			12,2	1
20	40	20	16	2-05519			21	1
20	40	20	18			V-1334	21	1
20	41	14	13		2-08345		15	1
20,3	38,5	16,5	12	2-09313			17,5	1
22	28	6	5	2-01041			6,5	1
22	28	6	5,3			V-0675	6,5	1
22	29	8	7	2-07757		V-1547	9	1
22	30	5,5	3,7	2-10092			6	3
22	30	7	5,8	2-09322		V-0984	8	1
22	30	13,5	12	2-07588		V-2121	14,5	3
22	32	6	5,5		2-12700		6,5	1
22	32	14	13,2	2-08369			15	3
22	34	9	7,5	2-02168			10	1
22	35	10	8			V-0719	11	1
23	40	18	16			V-1335	19	1
23,1	32,9	8	7			V-1397	9	1
24	34	7,5	6	2-03703			8,5	1
24	36	6	5,5	2-04730			6,5	1
24	38	10,5	9	2-01995			11,5	1
24	40	11,2	9,5	2-03930			12,2	1
25	30	7	6,5	2-09511		V-2349	8	1
25	31,5	12	10			V-0970	13	1
25	31,5	12	11	2-06852			13	1
25	31,5	12	11	2-07685			13	3
25	33	4,5	4		2-12698		5	1
25	33	8	7			V-2302	9	1
25	33	10	8,5	2-07662			11	1
25	33	10	9			V-1307	11	1
25	33	10	9	2-07941			11	3
25	35	7	4,7	2-09666			8	3
25	35	7	4,7	2-10093			8	3
25	35	7,5	6,5	2-04022			8,5	1
25	36	11	9,5	2-04423			12	1
25	37	6	5,5	2-02551			6,5	1
25	37,5	12	10			V-1287	13	1
25	40	8	6			V-2452	9	1
25	40	11,2	9	2-01887			12,2	1
25	45	15	13		2-07114		16	1
25,4	38,1	6,2	5	2-06175			7,2	1
26	40	12	11	2-07601		V-2192	13	1
27	45	15	12			V-1592	16	1
28	40	16	12		2-08638		17	1
28	40	16	13			V-0778	17	1
28	42	10,5	9	2-07526			11,5	1
28	42	14	12,5			V-0628	15	1
28	42	14	13	2-08686			15	1
28	48	18	15,5	2-05395			19	1
28	48	18	16			V-0846	19	1
30	36	3,8	3,2			V-4058	4,3	1
30	37	9	8,5		2-00964		10	1
30	37	13,5	12		2-07137	V-1259	14,5	1
30	38	7	4,5	2-04960			8	1
30	38	13,5	12		2-04277		14,5	1
30	38,5	6,5	5,8	2-11993			7,5	1
30	40	7	4,7	2-10095			8	3
30	40	7,5	6,5	2-03680			8,5	1
30	40	7,5	6,8			V-1952	8,5	3
30	40	10,3	9	2-06424			11,3	1
30	42	8	7,5	2-02943			9	1
30	45	10	8	2-04520			11	1
30	47	12,5	10,5			V-0546	13,5	1
30	47	12,7	10	2-00403			13,7	1
30	50	15	12	2-00402			16	1
31,7	39,7	6,3	5,5	2-04603			7,3	1
32	38	6	5	2-01040			6,5	1
32	40	6	5			V-3300	6,5	1
32	40	8	6			V-1286	9	1
32	40	8	7,5	2-06910			9	1
32	40	10	9			V-1544	11	1
32	40	12,5	11		2-04582		13,5	1
32	42	7	6	2-07468			8	1
32	42	7	4,7	2-10096			8	3
32	44	8	7	2-07069			9	1
32	48	8	6,4	2-02552			9	1
32	48	14	11			V-0782	15	1
32	50	13,5	10,5			V-0156	14,5	1
32	50	13,5	12	2-07588			14,5	1
32	52	15	12	2-05625			16	1
34	42	5,8	5			V-2656	6,3	1
34	46	9	7,5	2-04085			10	1
35	43	8	7	2-09320	2-08640	V-0988	9	1
35	43	9	8	2-03759			10	1
35	43	10	11	2-03761			11	1
35	43	11	10			V-2348	12	1
35	44	12	9,5			V-0722	13	1
35	44	12	10	2-01357			13	1
35	44	12	10		2-04218		13	1

# UNI 1, UNI 3 LIP SEAL, ROD SEAL



NOMINAL SEAL DIMENSIONS				TOOL-NUMBER				UNI- No.
d	D	H	h	RUBBER	RUBBER FABRIC	POLYURET HANE	L	
55	65	13.5	11	2-04280			14.5	1
55	67	6	5	2-05918			6.5	1
55	70	10	8.5		2-08643	V-0651	11	1
55	75	18	16			V-0615	19	1
56	66	7	4.7	2-10101			8	3
56	76	15	12	2-00955			16	1
57,15	69,85	8	7	2-06176			9	1
58	66	12.5	11		2-06872		13.5	1
58	77.5	11	9.5	2-07397			12	3
60	67.8	15.5	14.5	2-02349			16.5	1
60	68	10	8			V-0825	11	1
60	68	10	8.5	2-12500			11	1
60	68	11.5	10		2-05015		12.5	1
60	68	11.5	10		2-07491		12.5	1
60	68	12.5	11		2-00924		13.5	1
60	68	12.5	11		2-04726		13.5	1
60	68	13	11.5		2-06418		14	1
60	68	13	11.5		2-11692		14	1
60	68	13.5	12		2-00851	V-0626	14.5	1
60	68	13.5	12			V-1130	14.5	1
60	70	12.5	11.5		2-03926		13.5	1
60	70	13.5	12.5	2-08900		V-2330	14.5	1
60	71.5	8	7.5		2-11041		9	1
60	72	8.5	5.7	2-10102			9.5	3
60	72	9	7.5	2-02279			10	1
60	74	12	11			V-2271	13	1
60	76	8	7	2-07264			9	1
60	80	11.5	10	2-06180			12.5	3
60	80	15	12	2-03511			16	1
60	80	18	16			V-1270	19	1
60	80	18	16.5		2-08258		19	1
60	85	19	16			V-0198	20	1
60,33	76.2	8	7	2-06177			9	1
60.5	76.5	8	7.5	2-04813			9	1
62	75	16	14			V-0829	17	1
63	71	11.5	10		2-07135		12.5	1
63	71	12.5	11		2-02467		13.5	1
63	75	8.5	5.7	2-10103			9.5	3
63	83	15	13	2-09733			16	1
65	71.5	8	7.5	2-09294		2-11009	9	1
65	73	11.5	10		2-02960		12.5	1
65	73	11.5	10			V-3292	12.5	3
65	73	13.5	12		2-08647	V-1289	14.5	1
65	75	8	7	2-01216			9	1
65	75	13.5	12	2-08766			14.5	3
66	76	12	9.5	2-01043			13	1
70	78	11.5	10		2-01270		12.5	1
70	78	12.5	11		2-02689		13.5	1
70	78	12.5	11.5		2-09885		13.5	1
70	78	13.5	12			V-0516	14.5	1
70	80	12	11			V-2407	13	1
70	80	12	10.5		2-04856		13	1
70	82	8.5	5.7	2-10104			9.5	3
70	85	12	10			V-2286	13	3
70	85	25	22	2-00090			26	1
70	90	15	12	2-02084			16	1
70	90	18	16	2-04493	2-04102	V-0612	19	1
70	95	18.7	14.9	2-03878			19.7	1
70	95	18.7	15			V-0141	19.7	1
71	79	12.5	11		2-01157		13.5	1
72	80	6	4.8	2-05809			6.5	1
72	80	13.5	11	2-00298			14.5	1
72	92	15	12	2-03685			16	1
73	82.55	9.5	7.5	2-06178			10.5	1
73	84	13.5	12		2-04281		14.5	1
75	83	11.5	10		2-02957		12.5	1
75	83	13.5	12	2-04388			14.5	1
75	90	12	10.5			V-1793	13	3
75	90	12	11		2-11785		13	1
75	95	25	22	2-00130			26	1
75	105	22.5	18			V-0179	24.5	1
75	107	12.5	11	2-09897			13.5	1
75	110	22	19.4	2-07985			24	1
76	89	9.5	8	2-07241			10.5	1
78	86	11.5	10		2-01271		12.5	1
78	86	11.5	10		2-04727		12.5	1
78	86	12	10.5		2-03972		13	1
78	86	12	11.3	2-06803			13	1
78	86	12.5	11		2-07477	V-1246	13.5	1
78	86	13	11.5		2-11899		14	1
78	86	13.5	12		2-00852	V-0116	14.5	1
78	88	15.5	14.5		2-02350		16.5	1
78	90	10	8			V-0817	11	1
80	88	11.5	10		2-07009		12.5	1
80	88	12	10.5			V-1475	13	1
80	88	12.5	11		2-05040		13.5	1
80	90	10	9	2-05389			11	1
80	92	8.5	5.7	2-10105			9.5	3
80	92	9	7.5	2-02280			10	1
80	92	9	8.7			V-2630	10	1
80	93	20	18.5		2-01665		22	1

NOMINAL SEAL DIMENSIONS				TOOL-NUMBER				UNI- No.
d	D	H	h	RUBBER	RUBBER FABRIC	POLYURET HANE	L	
80	95	12	10.5	2-09371			13	1
80	95	12	11			V-1531	13	1
80	100	16	14	2-08624			17	1
81	89	11.5	10		2-08317		12.5	1
82,55	95,25	8	7	2-06179			9	1
85	93	11.5	10			V-2991	12.5	3
85	93	11.5	10		2-02963		12.5	1
85	93	12.5	11		2-01670		13.5	1
85	105	18	16			V-0607	19	1
87	95	11.5	10		2-08271		12.5	1
87.3	100	11	9.5	2-05096			12	1
90	98	11.5	10		2-09162		12.5	1
90	98	12.5	11		2-01158		13.5	1
90	98	13.5	12	2-08911		V-1273	14.5	1
90	100	12	11.5	2-07357			13	1
90	100	12	11.3	2-09295			13	1
90	102	8.5	5.7	2-10106			9.5	3
90	120	22.5	18	2-04512			24.5	1
93	104	13.5	12		2-04282		14.5	1
95	103	11.5	10		2-00222		12.5	1
95	103	11.5	10		2-01272		12.5	1
95	115	25	22	2-00091			27	1
95	120	20	18			V-2310	22	1
97	105	11.5	10		2-07765		12.5	1
97	105	12.5	11		2-02688		13.5	1
97	105	12.5	11		2-07478		13.5	1
97	105	13	11.5		2-11900		14	1
97	105	13.5	12	2-00299	2-00853	V-0117	14.5	1
98	110	9	7.5	2-03161			10	1
99	120	15	12			V-1857	16	1
100	108	11.5	10		2-07980		12.5	1
100	108	12.5	11		2-00922		13.5	1
100	108	12.5	11		2-03934		13.5	1
100	108	12.5	11		2-05039		13.5	1
100	110	15	13.5			V-3119	16	1
100	112	16	14			V-2916	17	1
100	115	10	6.7	2-10107			11	3
100	120	15	12	2-03007		V-1613	16	1
100	140	18	14	2-03937			19	1
100	140	18	16			V-0199	19	1
101	112	15.5	14.5		2-02351		16.5	1
104	112	11.5	10		2-08312		12.5	1
105	113	11.5	10		2-00532		12.5	1
105	113	11.5	10		2-01273		12.5	1
105	113	11.5	10			V-3293	12.5	3
105	113	13.5	12		2-01853	V-1131	14.5	1
105	120	10.5	9	2-06056			11.5	1
105	125	15	13			V-2287	16	3
108	116	11.5	10		2-02962		12.5	1
108	116	13.5	12		2-01805		14.5	1
109	130	14	12	2-12818			15	3
110	118	11.5	10		2-11984		12.5	1
110	122	9	8	2-08061			10	1
110	135	18.7	16			V-1128	19.7	1
110	135	19	17			V-2311	20	1
110	150	28	24	2-09697			30	1
112	120	13.5	12		2-02086		14.5	1
112	120	14	12.5		2-03214		15	1
113	121	12.5	11		2-01159		13.5	1
115	125	9.5	8.5	2-07961			10.5	1
115	135	15	12	2-03417			16	1
115	140	20	16	2-05766		V-0752	22	1
116	124	12.5	11		2-05034		13.5	1
118	126	11.5	10		2-05016		12.5	1
118	126	12.5	11	2-03973			13.5	1
118	126	12.5	11		2-07479		13.5	1
118	126	13.5	12		2-00993		14.5	1
120	128	12.5	11		2-00921		13.5	1
120	128	12.5	11		2-03935		13.5	1
120	130	14	13.5	2-07358			15	1
120	140	15	12.5	2-01719			16	1
120	145	21	17		2-00189		23	1
120	160	30	24	2-04513			33	1
123	131	12.5	11	2-03275			13.5	1
124	132	12.5	11		2-05038		13.5	1
125	133	11.5	10		2-01649	V-2945	12.5	1
125	133	12.5	11		2-01669		13.5	1
125	135	13	11.5		2-05337		14	1
125	145	25	22	2-00092			27	1
125	160	26	22.5	2-09929			28	1
126	136	7.5	6	2-00873			8.5	1



## APPLICATION

- bottom-ram press
- High-pressure-plunger-pumps
- Steam-hammers

For these applications it is possible to use single rings or sets of rings. Sets of rings are recommended particularly in the cases, where open rings must be used. The number of the elements combined to the sets follows the respective operating-conditions on that occasion and in the case of doubt our technical advice should be asked.

## RECOMMENDED VALUES FOR APPLICATION

sealing material	operating systems	hydraulic systems		
		p(bar)	t(°C)	v(m/s)
071	mineral	<400	-30	<0,5
072	oil, oil-water-emulsions compressed air		up to +120	

## MATERIALS

### WS 071:

NBR-impregnated cotton fabric with a fine structure.

### WS 072:

NBR-impregnated cotton fabric with a coarse structure.

In addition, our cotton and Aramide fabrics can be equipped also with other impregnations on wish. Standard, UNI-2-rings are delivered with a surface in graphite. Further materials see in chapter "materials".

## MOUNTING AREA AND INSTALLATION

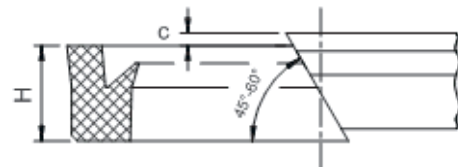
2-Lip-rings are delivered normally as closed rings. With demand (badly accessible sealing-areas), however also the delivery of open rings with diagonally cut seal-ends is possible.

Open UNI 2-seals, immediately whether cut out from the next bigger measurement or manufactured from so-called length-tools, can be used only set by set. The cutting of these rings delivered with excess takes place the best like follows.

a) Decide the correct scope-length through putting on the sealing-ring about the Plunger.

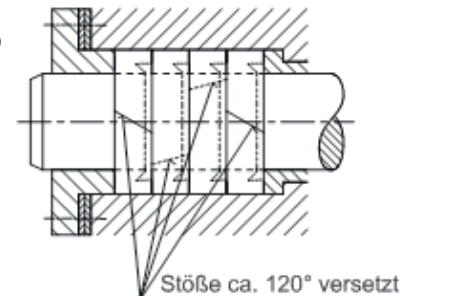
b) The push-places of the cutted ring something must be a bit larger at good installation at the Plunger in order to cause a small pressure in scope-direction after the mounting in the stuffing-box-area.

$$c = 0,1 \times H$$



c) The push-places of the individual set-elements are to be moved from ring to ring by approximately 120°. It is

recommended to begin at the exactly matched push-places with the montage of open sealing-rings in the stuffing-box-room.



d) Difficult and heaviest business-conditions, like for example high press and speeds, possibly make the mounting of two UNI2-rings necessary, as is represented in following picture.



## TOOLS FOR INSTALLATION

In order to protect the sensitive lips with the montage, suitable montage-helps and insertion chamfers are to be intended.

## ADJUSTING OF THE SEALING PRESSURE

Before the first operating use, the stuffing-box-room can be attracted only easily. Only after some lifting, insufficient sealing-effect can perhaps be improved by well-measured after-spans. In any case the span of the room must be chosen in a way that an axial fixation of the sealing set in the stuffing-box-room is guaranteed.

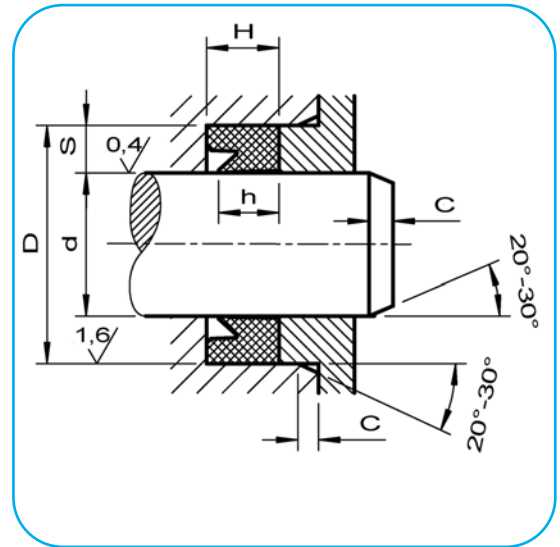




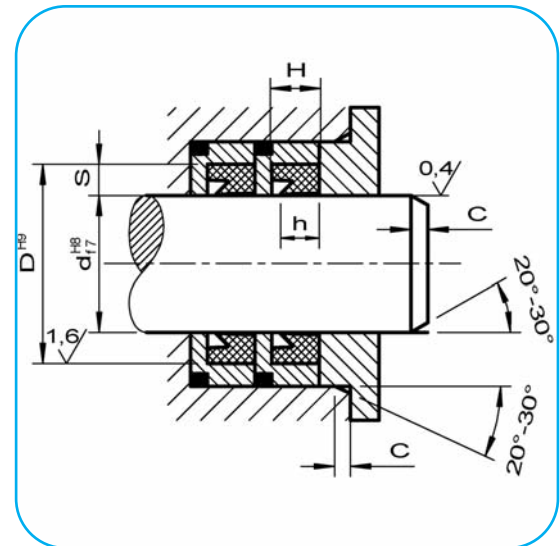
## NOMINAL SEAL DIMENSIONS

d	D	H	h	TOOL-NUMBER
6	22	12,7	11,8	2-04820
7	11	5	4,5	2-07593
12	24	10	8	2-09187
12	24	14	12	2-05445
14	26	8	6,5	2-00974
14	26	14	12	2-03574
14	30	14	12	2-05059
15	40	20	16	2-03002
16	26	14	12	2-03573
16	36	18	16	2-05866
16	38	18	16	2-09188
18	28	8	6,5	2-00294
18	30	10	8	2-06434
18	30	15	12	2-01788
18	32	14	11,5	2-01128
18	38	15	12	2-04790
18	38	15	12	2-05247
19	40	18	14	2-01750
20	32	14	12	2-03572
20	32	26		2-03163
20	33	14	11,5	2-02657
20	35	14	11,5	2-02621
20	36	10	10	2-04313
20	40	14	12	2-06757
20	40	16	13	2-00477
20	40	16	13	2-09657
21	32	14	12	2-03323
22	32	14	12,5	2-00453
22	35	11,5	10,5	2-03892
22	36	10	8,5	2-01413
22	36	14	12	2-03576
22	40	14	12	2-01919
22	42	14	11	2-05494
23	40	14	12	2-02775
24	39	14	11,5	2-01327
24	40	14	12	2-09483
25	37	10	8	2-06139
25	40	14	12	2-01340
25	41	10	9	2-00297
25	45	14	12	2-01920
25	50	20	16	2-09189
26	36	14	12	2-04499
26	40	14	12	2-03594
26	42	14	11,5	2-00626
26	44	14	12	2-03571
28	38	10	8	2-07564
28	44	14	12	2-03575
28	48	16	13	2-04927
28	50	15	12	2-00323
28	52	24	20	2-09190
30	40	14	12	2-05796
30	45	14	12	2-03670
30	50	14	12	2-01339
32	42	15	13,5	2-06593
32	48	14	11,5	2-00625
32	49	14	11,5	2-01863
32	50	14	11,5	2-00816
32	52	16	13	2-02368
32	54	16,5	13,5	2-01258
32	55	18	15	2-09832
34	50	14	12	2-08055
35	50	12	10	2-06769
35	52	14	12	2-06747
35	55	14	12	2-01338
36	52	13	10,5	2-00295
36	52	14	12	2-03570
36	54	11	9	2-01414

## SEALING OF A PISTON ROD



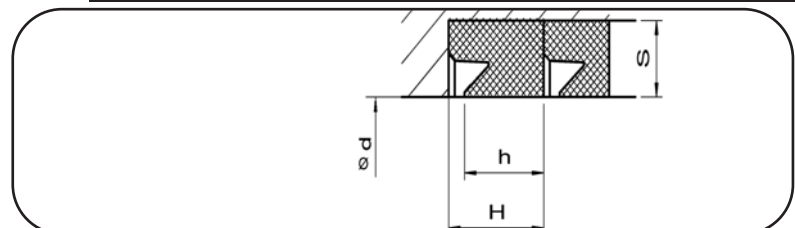
## SEALING OF A PISTON ROD



## INSERTION CHAMFER

S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10

## OPEN SEALING RINGS UNI2



Plunger - Ød	S	H	h	Tool-No.
500 - 1500	20	32	26	2-03163
500 - 1500	25	40	32	2-03162
500 - 1500	29	40	34	2-03596
500 - 1500	30	40	35	2-05173
700 - 1500	35	40	32	2-05028
700 - 1500	40	50	34	2-05174





## NOMINAL SEAL DIMENSIONS

d	D	H	h	TOOL-NUMBER
38	54	12	10	2-11748
38	58	16	13	2-07430
38	62	16	13	2-04928
38	65	20	16	2-04207
38	70	25	21	2-05328
38	79	18	15	2-08154
38,5	60	14	11,5	2-09369
39	55	14	11,5	2-00817
40	55	12	10	2-06238
40	55	13,5	11,5	2-07250
40	55	18	15,5	2-00507
40	60	16	13	2-04670
40	65	24	20	2-00433
40	70	25	21	2-04908
42	57	14	11,5	2-00279
42	57	18	15	2-00579
45	60	12	10	2-06269
45	60	18	16	2-09427
45	65	10	8,5	2-01386
45	75	18	13,5	2-05965
46	66	15	13	2-08056
48	63	14	11,5	2-01299
48	68	13	11	2-01850
50	65	12	10	2-06270
50	69	18	14,5	2-09423
50	70	14	12	2-06311
50	70	15	12,5	2-02130
50	70	18	15	2-00278
50	75	25	21	2-12364
50	80	25	20	2-00749
51	79	18	15	2-08155
52	72	15	12	2-07939
52	82	25	20	2-00755
54	75	18	14,5	2-00521
55	75	18	14,5	2-00522
55	80	20	16,5	2-01147
56	76	18	15	2-01959
56	81	20	17	2-01179
56	86	18	14,5	2-03585
56	86	25	20	2-01075
56	88	31	25	2-02287
56	96,6	32	26	2-01425
56	100	32	26	2-04641
56,5	79	18	14,5	2-02018
57	79	18	15	2-08156
58	90	25	20	2-01491
60	80	18	14	2-01166
60	85	23	19	2-01064
60	90	28	23	2-00678
60	92	31	26	2-01916
60	94	27	23	2-06016
60	100	33	26,5	2-00379
62	92	22,5	18	2-00585
62	92	27	22	2-01024
63	83	18	15	2-01534
63	96	25	21	2-05852
63	102	28	25	2-01193
63,5	104,8	26	22	2-05129
64	84	16	13	2-12774
64	95	27	22	2-02499
65	85	18	15	2-01673
65	90	23	19	2-00170
65	92	27	22	2-00584
65	95	27	22	2-03166
65	100	16	14	2-01202
68	90	16	13	2-07008
70	95	16,5	15,5	2-05530

## NOMINAL SEAL DIMENSIONS

d	D	H	h	TOOL-NUMBER
70	95	20	16	2-00358
70	100	27	22	2-01029
70	100	33	27	2-01473
70	102	25	20	2-01194
71	90	18	14,5	2-03586
72	92	16	13	2-07788
72	100	25	21	2-07902
72	120	36	30	2-05009
75	95	20	17	2-00730
75	100	20	16	2-01074
75	105	20	17	2-01469
75	108	31	25	2-01532
75	115	25	21	2-01470
75	115	33	27	2-00255
75	120	36	29	2-01658
78	104	24	19	2-01381
79	104	24	19,5	2-00518
80	100	16	13	2-00992
80	100	18	14	2-06284
80	104	24	19,5	2-00519
80	110	25	21	2-01676
80	120	33	28	2-05192
80	120	33	28	2-05772
81	104	24	19,5	2-00520
85	105	18	15	2-01533
85	105	20	16	2-01165
85	110	24	20	2-00595
85	115	27	22	2-05951
85	115	33	27	2-01474
90	115	24	20	2-01783
90	120	25	20	2-01195
90	122	25	20	2-05441
90	122	31	27	2-05584
95	120	20	16	2-04427
100	130	25	21	2-01677
100	130	27	22	2-05193
100	140	33	28	2-05344
100	160	45	38	2-05773
102	132	25	21	2-02656
104,5	140	31	25	2-02019
105	165	45	36	2-01207
108	140	25	16	2-06440
110	135	19	16	2-06834
110	140	27	22	2-00681
115	140	20	17	2-03766
115	150	27	22	2-01080
119	149	25	21	2-04535
120	140	18	14,5	2-02181
120	145	21	17	2-00189
120	150	27	22	2-00682
120	160	33	26	2-01038
120	170	40	32	2-00756
121	167	37	30	2-01424
126	190	40	34	2-01172
126	195	40	34	2-01171
130	160	27	22	2-00683
135	170	26,2	23	2-02291
140	170	27	22	2-00684
142	170	20	16	2-03587
150	180	33	28	2-01037
153	180	25	20	2-05227
155	185	25	20	2-00742
160	185	24	20	2-01548
160	188	20	16	2-01477
160	190	27	22	2-01246
160	200	33	26	2-01036
163	195	32	26	2-03588

## NOMINAL SEAL DIMENSIONS

d	D	H	h	TOOL-NUMBER
165	200	27	22	2-01081
167	210	33	20	2-01035
170	200	25	20,5	2-01201
170	200	27	22	2-01854
170	200	33	28	2-00685
175	220	36	30	2-09889
175	254	50	42	2-05004
180	204	24	20	2-02589
180	220	32	26	2-01659
187	240	35	30	2-03607
190	241	40	32	2-01599
190	250	35	29	2-00918
190	268	48	44	2-02321
198	251	35	28	2-01105
200	230	25	21	2-00731
200	230	27	22	2-03678
207	251	35	28	2-01104
210	240	27	22	2-00822
210	250	33	26	2-03268
212	240	24	21	2-03589
215	245	25	21	2-06134
215	255	32	26	2-01811
218	270	40	32	2-03379
220	250	25	20	2-00302
222	250	24	20	2-01380
225	255	25	21	2-00884
230	270	33	26,5	2-03590
240	280	33	27	2-00617
250	290	33	27	2-02000
250	314	45	36	2-02250
260	300	33	27	2-00686
265	305	33	26	2-01034
280	310	27	22,5	2-03807
280	325	36	30	2-02229
280	328	35	28	2-01106
280	330	40	33	2-01370
292	350	45	37	2-00960
295	350	40	33	2-07872
296,5	350	40	33	2-05943
300	340	33	27	2-00673
300	350	40	33	2-00823
308	340	27	23	2-03650
310	350	33	27	2-00687
320	350	28	23	2-01681
320	390	50	42	2-01461
330	358	27	22	2-01773
340	380	32	26	2-00876
340	406	40	32	2-06465
340	420	60	50	2-02251
350	410	50	40	2-01462
360	410	40	32	2-01553
375	415	33	27	2-01743
380	409	21,7	18	2-08010
396	440	33	27	2-01220
400	430	27	22	2-01332
400	450	40	32	2-06135
400	460	40	35	2-05364
405	440	27	23	2-04707
410	460	40	32	2-03250
440	480	32	26	2-01047
465	510	33	27	2-01033
470	534	45	38	2-01463
500	560	50	42	2-06745





## APPLICATION

- cylinder seal for hydraulic systems
- standard cylinders
- mobile hydraulic systems
- injection machines and machine tools
- rotary and pivoting cylinders for low pressures and low speeds.

## RECOMMENDED VALUES FOR APPLICATION

Material	operating medium	Hydraulic system			Pneumatic system		
		p(bar)	t(°C)	v(m/s)	p(bar)	t(°C)	v(m/s)
858	mineral oil oil-water-emulsions, compressed air	< 160	-20 up to 110	< 0,5	< 16	-20 up to 80	< 1
900		< 400	-25 up to 80	< 0,3			
071 072		< 315	-30 up to 120	< 0,5			

other materials see chapter "materials"

## MATERIALS

Standard production and stockage is effected in a NBR-quality with approx. 86 ShoreA (858). Deliveries with other hardness and made of special materials like FKM, EPDM, CR etc. are also possible, please refer to the general table.

WS 858: a NBR-material with approx. 86 Shore A

WS 900: a Polyurethane material with approx. 94 ShA

WS 071,072:

NBR-fabric-materials which differ in the structure of the fabric. Standard is a surface in graphite. (WS 071, 072 is recommended only for UNA1)

## TOOLS FOR INSTALLATION

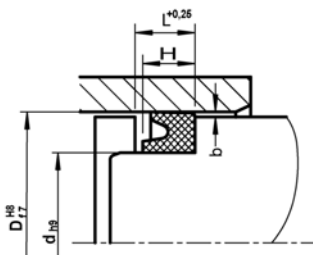
In order to protect the sensitive lips with the montage, suitable montage-helps and insertion chamfers are to be intended. For the dimensions available, please contact us.

## CLEARANCE BEHIND THE SEAL

Too much clearance behind the seal leads to a premature failure of the seal. The admissible clearance behind the seal is calculated as follows:

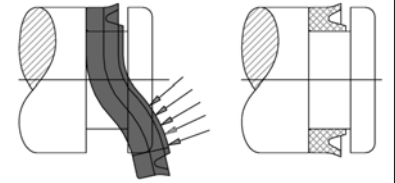
WS 858:  $b_{zul} = 0,3 - 0,001p$  (for p up to 160 bar)

WS 900, 071, 072:  $b_{zul} = 0,4 - 0,008p$  (for p up to 400 bar)

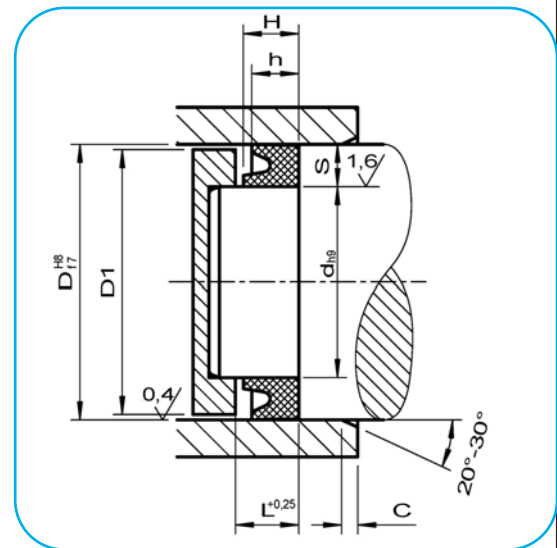


## MOUNTING AREA AND INSTALLATION

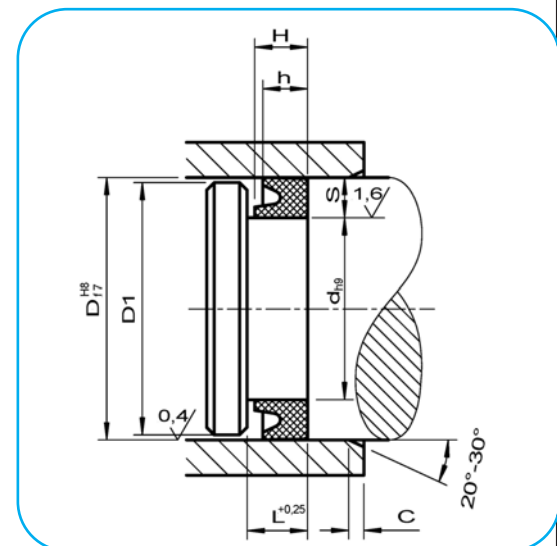
UNA-rings are mounted without an extra support ring. UNA1-Seals in WS 858 and WS 900 are more flexible and it is possible to snap them in closed mounting areas. For  $D > 25$ , we recommend installation into open groove with lid. UNA rings in WS 071 and 072 can only be mounted in a open mounting area.



## SEALING OF A CYLINDER GROOVE WITH LID



## SEALING OF A CYLINDER RECESSED GROOVE



## INSERTION CHAMFER

S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10





# UNA 1, UNA 3 LIP SEAL, CYLINDER SEAL



NOMINAL SEAL DIMENSIONS				TOOL-NUMBER			[mm]	[mm]	
D	d	H	h	RUBBER	RUBBER FABRIC	POLYURETHANE	L	D1	UNA-No.
8,7	3,4	3,8	3	2-04366			4,8	7,7	1
9	5	3,5	2,8	2-08348			4,5	8	1
9	5	3,5	2,8	2-11262			4,5	8	1
9,5	3,175	6,35	4,5			V-1402	7,35	8,5	1
10	6,5	2,1	2	2-09948			3,1	9	3
11	4	3,8	3,2	2-07101			4,8	10	1
11	4	6	4,8	2-03706			7	10	1
12	4	6	5	2-03707			7	11	1
12	5,67	6,35	4,5			V-2731	7,35	11	
12	6	4	3,5	2-01674			5	11	1
12	6	6	5	2-06241			7	11	3
12	6	8	7	2-04147			9	11	1
13,5	7,5	4,7	3,8	2-04204			5,7	12,5	1
14	8	4	3,5	2-05950			5	13	1
14	9	4	3,5	2-09508			5	13	1
15	7	5,7	4	2-05524			6,7	14	3
15	7	5,5	4	2-05722			6,5	14	3
15	9	12	10	2-06230			13	14	1
15,5	8	5,4	4,5	2-04367			6,4	14,5	1
15,5	10	4,8	4,65	2-08380			5,8	14,5	1
15,8	9,5	3,6	3	2-13030			4,2	14,3	1
16	8	6	4,9			V-0699	7	15	1
16	8	6	5	2-03146			7	15	1
16	9	5	4,4	2-09691			6	15	1
16	10	4	3,5	2-09598			5	15	1
16	10	4	2,6	2-10116			5	15	3
16	10	5	4,5	2-01028			6	15	1
16	11	4,2	3,5	2-08670			5,2	15	1
16,4	9,5	5	4,5	2-09161			6	15,4	1
17	9	8	7			V-2740	9	16	3
18	10	5	4,1	2-11690			6	17	3
18	10	10	9	2-03966			11	17	1
18	12	4	3,3	2-09494			5	17	1
18,5	12,5	3,8	3,5	2-04369			4,8	17,5	1
19	13	4	3,4	2-12385			5	18	1
19	14	8	7	2-09469			9	18	1
20	6	12	11	2-06265			13	19	3
20	10	7,5	6,5	2-01642		V-1346	8,5	19	1
20	12	5,5	3,7	2-10117			6,5	19	3
20	12	10	9,2	2-03992			11	19	1
20	14	5	4,2	2-11456			6	19	1
20	14	6,3	4,8	2-05507			7,3	19	1
20	14	6,5	6		2-00966		7,5	19	1
20,6	12,4	5,8	5,2	2-05021			6,8	19,6	1
21	9	9,7	7	2-07395			10,7	20	3
22	7	6,5	6	2-05523			7,5	21	1
22	10	9	8	2-00948			10	21	1
22	10	9,7	7	2-06463			10,7	21	3
22	12	6	4,5	2-04511			7	21	1
22	12	7,5	6,3	2-07748			8,5	21	3
22	12	12	11,2	2-03993			13	21	1
22	14	5,5	4	2-05721			6,5	21	3
22	14	6	4,8	2-05613			7	21	1
22	14	6	4,8	2-11796			7	21	1
22	16	5	4,5	2-01328			6	21	1
23	15	5	4,4	2-07127			6	22	1
23,5	14,5	6,2	5,2	2-04368			7,2	22,5	1
24	10	10,5	8,4	2-02868			11,5	23	1
24	14	7,5	6,7	2-00780			8,5	23	1
24	16	5,5	5	2-07217			6,5	23	1
25	12	9,7	9	2-02435			10,7	24	1
25	15	7,5	6	2-04437			8,5	24	1
25	17	5,5	4	2-06853			6,5	24	3
25	17	5,5	3,7	2-10118			6,5	24	3
25	17	6	4,8	2-06023			7	24	1
25	17	8	7	2-09178			9	24	3
25	17	10	9			V-1698	11	24	1
26	12	7	6,5	2-08248			8	25	3
26	12	10,5	9	2-00949			11,5	25	1
26	16	7,5	6,5	2-08575			8,5	25	3
27,7	20	8	6,5	2-00696			9	26,7	1
28	12,7	11	10	2-03673			12	27	1
28	16	7	5,5	2-05925			8	27	3

NOMINAL SEAL DIMENSIONS				TOOL-NUMBER			[mm]	[mm]	
D	d	H	h	RUBBER	RUBBER FABRIC	POLYURETHANE	L	D1	UNA-No.
28	16	9	8,1	2-06530			10	27	1
28	16	9	7,5			V-0352	10	27	1
28	16	9	7,7	2-11390			10	27	3
28	20	5	4,4	2-08529			6	27	1
29,5	18	6	5	2-04371			7	28,5	1
30	15	10,2	8	2-00450			11,2	29	1
30	21,7	8	7,5			V-2307	9	29	1
30	22	6	5			V-0839	7	29	1
30	22	6	5,4	2-04228			7	29	1
30	22	10	8,5	2-09219		V-1349	11	29	1
30	22,5	4,9	4,3	2-11458			5,9	29	1
30	23	6	5,5	2-06982			7	29	1
30	24	6,5	6		2-00965		7,5	29	1
31,5	24,5	8	7			V-2642	9	30,5	1
31,5	24,5	8	7	2-09275			9	30,5	3
32	16	12	10,5	2-02738			13	31	1
32	18	12	9,5			V-0721	13	31	1
32	18	12	10,5	2-02442			13	31	1
32	20,2	7,5	7			V-2118	8,5	31	1
32	22	8	7	2-08570			9	31	3
32	24	5,5	3,7	2-10119			6,5	31	3
32	24	6	5	2-03986			7	31	1
32	25	6	4,8	2-09321		V-0983	7	31	1
32	25	8	7			V-1441	9	31	1
32,3	20	5	4,2	2-07790			6	31,3	1
32,5	24,5	8	7	2-04124			9	31,5	1
34	20	9	8	2-08249			10	33	3
34	27,3	3,5	3			V-2903	4,5	33	1
35	19	9	8	2-08574			10	34	3
35	19	12	9,6	2-00950			13	34	1
35	19	12	10,2	2-07656			13	34	1
35	25	6,5	5,4	2-02978			7,5	34	1
35	25	6,5	5,2	2-08039			7,5	34	3
35	27	10	8,5			V-2257	11	34	1
36	24	6	5,5	2-02553			7	35	1
36	24	6	5,5	2-04877			7	35	1
36	26	7	4,7			V-3423	8	35	3
36	29	6,2	5,2	2-04370			7,2	35	1
37	21	12	10	2-01245			13	36	1
37	21	12	10,5			V-1323	13	36	1
37	21	12	11,9			V-2230	13	36	1
38	26	10	8			V-1190	11	37	1
38	28	8	7	2-08569			9	37	3
38,1	25,4	6,5	5,5	2-06889			7,5	37,1	1
40	22	10	9			V-2518	11	39	1
40	24	14	11,2	2-03561			15	39	1
40	24	14	11,2	2-06012			15	39	1
40	28	6	4,8	2-03313			7	39	1
40	28	9	7,5	2-01234		V-0696	10	39	1
40	28	10	8	2-05891			11	39	1
40	29,5	10	8,5			V-2441	11	39	1
40	30	7	4,7	2-10120			8	39	3
40	32	10	9	2-07756		V-1549	11	39	1
40	33	6	5,5	2-06983			7	39	1
40	33	8	7,5			V-1398	9	39	1
40,5	28	9	7,5	2-05808			10	39,5	1
41,1	25,4	9,2	7,8	2-07017			10,2	40,1	1
42	34	4,5	3,7	2-12980			5,5	41	3
43	32	9	6,5	2-09744			10	42	1
43	32	12	10	2-07839			13	42	1
43	33	8	7	2-08581			9	42	3
44	28	12	10	2-08315		V-1290	13	43	1
45	29	9	6	2-06111			10	44	3
45	29	12	10	2-00882		V-0674	13	44	1
45	32	10	8	2-05892			11	44	1
45	34	10	8,5			V-2522	11	44	1
45	35	7	4,3	2-09667			8	44	3
45	37	6	5	2-01060			7	44	1
45	37	6	5,1	2-08062			7	44	3
45	37	10	9	2-08888		V-2539	11	44	1
46	30	11	10	2-08246			12	45	3
47	31	12	10	2-00951		V-0897	13	46	1
47	31	12	10	2-08703			13	46	3





NOMINAL SEAL DIMENSIONS				TOOL-NUMBER			[mm]	[mm]	
D	d	H	h	RUBBER	RUBBER FABRIC	POLYURETHANE	L	D1	UNA-No.
48	32	13,8	12	2-04343			14,8	47	1
50	30	15	12	2-02155			16	49	1
50	32	10	9,4	2-06163		V-1743	11	49	1
50	32,4	9	8			V-1740	10	49	1
50	34	12	10,8	2-02871			13	49	1
50	36	10	8	2-03296			11	49	1
50	36	10,5	8,5			V-1041	11,5	49	1
50	37	8,5	7,5	2-05348			9,5	49	1
50	38	6	5,5	2-02554			7	49	1
50	38	6	5,5	2-04878			7	49	1
50	38	6	5,3	2-11484			7	49	1
50	38	10	8,5			V-2270	11	49	1
50	40	7	5,6	2-07795			8	49	3
50	40	7	4,7	2-10121			8	49	3
50	42	8	7	2-02603		V-0614	9	49	1
50	42	10	9	2-04462		V-1569	11	49	1
50	42	10	9			V-1283	11	49	1
50	42	10	8		2-08636		11	49	1
50	44	8	7	2-09623			9	49	3
50	42	10	9	2-08298			11	49	3
50,8	34,9	8	6,8	2-06848			9	49,8	1
52	36	9	6	2-05888			10	51	3
52	36	12	9,6	2-00952			13	51	1
52	36	12	11	2-05550			13	51	1
52	36	12	10			V-1097	13	51	1
52	36	12	10	2-08707			13	51	3
52	44	4,5	3,7	2-12981			5,5	51	3
53	40	9,5	8			V-0873	10,5	52	1
53,5	41	6,2	5,2	2-04372			7,2	52,5	1
54	38	12	10	2-04702			13	53	1
55	39	12	10	2-00567			13	54	1
55	40	12	10	2-02988		V-0192	13	54	1
55	40	12	11	2-07508			13	54	3
55	45	7	4,7	2-12778			8	54	3
55	47	10	9			V-2509	11	54	1
55	47	8	7	2-12052			9	54	1
56	46	10	9		2-00438	V-0175	11	55	1
57	41	12	10	2-00883			13	56	1
57	49	6	5	2-01061			7	56	1
57,15	44,95	9,5	8	2-05098			10,5	56,15	1
57,2	44,2	7,2	6	2-12173			8,2	56,2	1
60	40	15	12	2-00788			16	59	1
60	42	13,5	11			V-0205	14,5	59	1
60	44	12	10	2-00828			13	59	1
60	46	12	11			V-2379	13	59	1
60	48	7,5	6	2-02979			8,5	59	1
60	50	7	4,7	2-10201			8	59	3
60	50	10,3	9	2-06422			11,3	59	1
60	52	9	7			V-2385	10	59	1
62	45	12	10	2-03746			13	61	1
62	46	12	9,6	2-03327			13	61	1
62	50	8	7	2-04083			9	61	1
62	52	10	8,5			V-0606	11	61	1
62	52	10	9	2-02604			11	61	1
63	49	10	8	2-03297			11	62	1
63	49	12	9,5			V-2739	13	62	1
63	49	12	9,5	2-12499			13	62	1
63	51	6	4,8	2-03312			7	62	1
63	53	7	5	2-06855			8	62	3
63	53	7	4,7	2-10122			8	62	3
63	53	11	10	2-09487			12	62	3
63	57	8	7	2-09622			9	62	3
63,5	47,6	8	6,8	2-06847			9	62,5	1
64	39	13	11	2-06018			14	63	1
65	40,8	13	12	2-08247			14	64	3
65	49	9	6	2-06112			10	64	3
65	49	12	9,6	2-00953			13	64	1
65	49	12	9,6	2-04334			13	64	1
65	49	12	10			V-1098	13	64	1
65	49	12	11	2-05549			13	64	1
65	55	8	7			V-2958	9	64	3
65	57	10	9			V-1548	11	64	1
65	57	10	9			V-2359	11	64	1

NOMINAL SEAL DIMENSIONS				TOOL-NUMBER			[mm]	[mm]	
D	d	H	h	RUBBER	RUBBER FABRIC	POLYURETHANE	L	D1	UNA-No.
65	57	10	9,4	2-06984			11	64	1
67	52	11,2	9,4	2-05562			12,2	66	1
67,5	50	11	9,5	2-05097			12	66,5	1
70	40	22,5	18	2-03149			24,5	69	1
70	50	11,5	7,5	2-06113			12,5	69	3
70	50	15	12	2-00954			16	69	1
70	50	15	12	2-04335			16	69	1
70	50	15	12,5			V-0618	16	69	1
70	54	8	7,5	2-02555			9	69	1
70	54	12	11	2-08573			13	69	3
70	60	8	7	2-06462			9	69	1
70	60	12	10,5		2-04851		13	69	1
70	62	6	5	2-01062			7	69	1
70	62	6	5	2-06020			7	69	1
70	62	9	7			V-2565	10	69	1
70	62	9	8	2-04929			10	69	1
72	58	10,5	9,5	2-04758			11,5	71	1
72	58	12	10,5			V-1026	13	71	1
74	58	12	10,5			V-4036	13	73	1
75	50	14	13	2-08250			15	74	3
75	59	12	9,8			V-1119	13	74	1
75	59	12	10	2-01123			13	74	1
75	59	12	10	2-08800			13	74	3
75	65	12	10,5	2-08765			13	74	3
75	65	13,5	12			V-1910	14,5	74	1
77	69	13,5	12			V-2054	14,5	76	1
80	60	14	11,5	2-01437			15	79	1
80	60	15	12			V-0204	16	79	1
80	60	15	13	2-09319			16	79	1
80	60	15	13,5			V-2128	16	79	1
80	60	18	15,7			V-2355	19	79	3
80	62	12,5	11,5	2-02367			13,5	79	1
80	64	8	7,5	2-12703			9	79	3
80	64	12	10	2-01181			13	79	1
80	64	12	10,8		2-08235		13	79	1
80	66	12	10			V-2422	13	79	1
80	68	8,5	6	2-09441			9,5	79	3
80	68	8,5	5,5	2-10123			9,5	79	3
80	68	12	11,1	2-02967			13	79	1
80	70	5	4,5	2-11508			6	79	1
80	70	8	7			V-2959	9	79	3
80	70	11,6	10,6	2-05232			12,6	79	1
80	70	12	10,5		2-04853		13	79	1
80	70	12	11			V-1308	13	79	1
80	70	12	11,1	2-08297			13	79	1
80	70	13	12			V-1679	14	79	1
80	70,5	7,5	6,8	2-04407			8,5	79	1
80	71,8	8,3	7,5			V-2366	9,3	79	3
80	71,8	12	10			V-2106	13	79	3
80	72	10	9,5		2-08919		11	79	1
80	72	12	10			V-2228	13	79	1
80	72	12	10,5	2-09049			13	79	3
82	57	13	12	2-02980			14	81	1
82,6	63,5	9,5	8,1	2-06849			10,5	81,6	1
85	75	7,5	6	2-03211			8,5	84	1
86	76	6	6			V-3158	7	85	1
86	76	10	9		2-00439	V-0176	11	85	1
86,3	65,9	9,2	7,5	2-12172			10,2	85,3	1
87	72	12	10			V-2055	13	86	1
90	70	15	12	2-00638			16	89	1
90	70	22	17,5			V-1002	24	89	1
90	75	9,3	7,2			V-2954	10,3	89	1
90	80	10	9	2-09148			11	89	3
90	80	13,5	12	2-08901			14,5	89	1
91	70	11	9,5	2-05099			12	90	1
93	73	13,5	12	2-04387			14,5	92	1
95	70	12	10			V-2360	13	94	1
95	70	15,5	13			V-0201	16,5	94	1
95	70	18	14,5			V-0290	19	94	1
95	80	12	10,5	2-04854			13	94	1
95	85	5	4,5	2-11678			6	94	1
95	85	13,5	12	2-08538		V-1908	14,5	94	1
98	86	9	7	2-03889			10	97	1



# UNA 1, UNA 3 LIP SEAL, CYLINDER SEAL



NOMINAL SEAL DIMENSIONS				TOOL-NUMBER			[mm]	[mm]	
D	d	H	h	RUBBER	RUBBER FABRIC	POLYURETHANE	L	D1	UNA-No.
100	80	15	11			V-0670	16	99	1
100	80	15	12,5	2-00624			16	99	1
100	80	15	13	2-07129			16	99	3
100	82	12,5	10	2-01798		V-0648	13,5	99	1
100	82	12,5	10,5	2-04101			13,5	99	1
100	84	8	7,5	2-02556			9	99	1
100	84	8	7,2	2-03205			9	99	1
100	85	13,1	12			V-2517	14,1	99	1
100	88	8,5	6	2-07138			9,5	99	3
100	88	8,5	5,7	2-10124			9,5	99	3
100	90	8	7			V-2960	9	99	3
100	90	10,5	8,5	2-04494			11,5	99	1
100	90	10,5	9	2-08902		V-2168	11,5	99	3
100	90	12	11			V-1440	13	99	1
100	90	14	12,5		2-08639	V-1298	15	99	1
101,6	82,5	9,5	8,5	2-07003			10,5	100,6	1
102	84	12	10			V-2344	13	101	1
102	93	13	11			V-1589	14	101	1
102	94	10	9			V-1590	11	101	1
105	75	22	17			V-0202	24	104	1
105	75	22,5	18	2-03995			24,5	104	1
105	85	12	10	2-03493			13	104	1
105	85	12	10,5			V-2282	13	104	3
105	98	8	7			V-2432	9	104	1
110	80	18,5	16	2-04937			19,5	109	1
110	90	15	12	2-06028			16	109	1
110	90	15	13			V-2724	16	109	1
110	93	16	14			V-1285	17	109	1
110	95	11,2	9	2-03414			12,2	109	1
110	100	8	6,6	2-03472			9	109	1
110	100	14	13,5	2-07359			15	109	1
110,2	101	5,5	4,5	2-13015			6,5	109	1
112,5	93	16	14			V-2290	17	111,5	1
115	95	15	12,5	2-01243			16	114	1
115	95	15	12,5	2-08928			16	114	1
115	103	12	10	2-03849			13	114	1
115	105	13,5	12	2-09019			14,5	114	3
120	96	16	13	2-01436		V-1566	17	119	1
120	105	10	8,5	2-07596			11	119	1
120	105	12,5	11			V-2961	13,5	119	3
120	105	15	13	2-04855			16	119	1
120	106	14	12	2-02959			15	119	1
120	110	12	10	2-08093			13	119	1
124	100	18	15	2-08189			19	123	1
125	103	16	14		2-08641	V-0642	17	124	1
125	107	12	11			V-2380	13	124	1
125	107	12,5	10	2-03769			13,5	124	1
125	110	10	9	2-07469			11	124	1
125	110	10	6,7	2-10125			11	124	3
125	113	13,6	12,6	2-09151			14,6	124	1
125	113	14	13			V-1282	15	124	1
125	117	12,5	11,5	2-04580			13,5	124	1
126	116	10	9	2-00440		V-0177	11	125	1
127	107,9	9,5	8	2-06957			10,5	126	1
130	110	15	13,5	2-02462			16	129	1
130	110	15	12	2-05061			16	129	3
130	110	15	13			V-1167	16	129	1
132	112	15	12	2-06972			16	131	1
135	100	16,5	15			V-2037	17,5	134	1
135	120	11,2	9	2-03415			12,2	134	1
140	120	10	9	2-02557			11	139	1
140	120	15	13	2-02543			16	139	1
140	120	15	13,5			V-2283	16	139	3
140	120	20	18			V-1146	22	139	1
140	125	10	8,5	2-11264			11	139	3
140	128	17,5	16,5	2-04980			18,5	139	1
146	124	16	14,5	2-08865		V-2314	17	145	1
150	130	15	12	2-00621			16	148	1
150	130	15	13			V-0928	16	148	1
150	132	12,5	10	2-03773			13,5	148	1
150	135	10	6,5	2-12503			11	148	3
150	140	14	12,5	2-09561			15	148	1
151	118	21	18	2-08857			23	149	1

NOMINAL SEAL DIMENSIONS				TOOL-NUMBER			[mm]	[mm]	
D	d	H	h	RUBBER	RUBBER FABRIC	POLYURETHANE	L	D1	UNA-No.
151	122	11	10	2-08856			12	149	1
152,4	130	11	9,5	2-06890			12	150,4	1
160	138	16	14,5			V-2305	17	158	1
160	140	10	8,5	2-08216			11	158	1
160	144	16	14	2-02965			17	158	1
160	145	15	12,5	2-04137		V-0613	16	158	1
160	148	14	13			V-1281	15	158	1
160	148	15,5	14	2-08903			16,5	158	3
165	140	18	16	2-08306		V-2284	19	163	3
170	150	16,1	14,6			V-2497	17,1	168	1
170	155	15	12,5	2-07543			16	168	1
178	158,8	11,2	9	2-06647			12,2	176	1
180	140	30	24			V-1761	32	178	1
180	150	18	16			V-2304	19	178	3
180	160	15	12	2-03009			16	178	1
180	165	11,2	9	2-03416			12,2	178	1
190	174	12	10,8	2-07824			13	188	3
190	182	10	9,1	2-11207			11	188	3
195	175	15	12,5	2-01720			16	193	1
200	172	20	18			V-2306	22	198	1
200	176	12	11	2-02558			13	198	1
200	180	14	9,3	2-10127			15	198	3
200	180	15	12	2-03730			16	198	1
200	180	15	12,5			V-4177	16	198	1
200	185	15	12,5	2-08644		V-0605	16	198	1
200	185	15	13,5	2-09562			16	198	1
200	186	15,5	13	2-06419			16,5	198	1
203,2	177,8	12,7	10	2-07011			13,7	201,2	1
220	199,5	15	12			V-1961	16	218	3
220	200	12,5	11,5	2-08058			13,5	218	1
220	200	15	12		2-08645		16	218	1
220	205	15	12			V-0700	16	218	1
220	208	11	10	2-07962			12	218	1
222,3	200,65	12,7	11	2-08698			13,7	220,3	1
225	195	15	12	2-06420			16	223	1
230	215	11,2	9	2-06887			12,2	228	1
240	226	15	13,5		2-08646		16	238	1
250	226	16	13	2-03010			17	248	1
250	238	14	12,5	2-09560			15	248	1
254	228,6	15,8	13,8	2-07013			16,8	252	1
263	213	37,5	33,7	2-06896			40,5	261	1
270	250	15	12	2-04396			16	268	1
275	245	22,5	18	2-06421			24,5	273	1
300	280	15	12	2-04397			16	298	1
305	279,4	15,8	14	2-07012			16,8	303	1
330	310	15	12,5			V-0637	16	328	1
340	310	30	25			V-0634	33	338	1
340	310	30	27		2-03850		33	338	1
355	317	19	16,1	2-06850			20	353	1
370	350	15	12,5	2-05282			16	368	1
400	370	22,5	18	2-05559			24,5	397	1
400	370	30	26			V-0066	33	397	1
410	390	15	12,5			V-0638	16	407	1
420	390	24	20			V-2077	26	417	1
450	420	22,5	18	2-05801			24,5	447	1
450	420	30	25			V-1671	33	447	1
471,5	445	20	17	2-06499			22	468,5	1
510	480	15	12,5	2-03537			16	507	1
530	500	24	20			V-2268	26	527	1
533	520	12	12	2-03651			13	530	1
594	566	20	17,2	2-09011			22	591	1
685	670	9,5	8,5	2-07814			10,5	682	1
690	675	9,5	8,5	2-07815			10,5	687	1





## APPLICATION

UNA 2-Lip-rings in fabric materials are used as cylinder seals in heavy hydraulic presses.

## RECOMMENDED VALUES FOR APPLICATION

sealing material	operating medium	hydraulic system		
		p (bar)	t (°C)	v (m/s)
071 072	mineral oil, oil-water-emulsions, compressed air	< 400	-30 up to 120	< 0,5

(other materials see chapter "materials")

## MATERIALS

### WS 071:

NBR-impregnated cotton-fabric material with a thin structure.

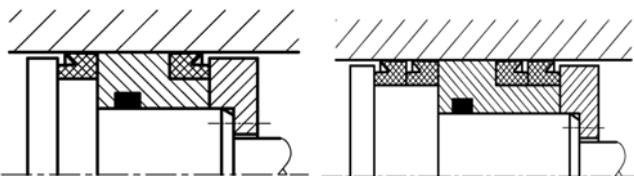
### WS 072:

NBR-impregnated cotton-fabric material with a more rough structure.

Other cotton and aramide fabric materials can be made also with other impregnations. Standard impregnation is a surface in graphite.

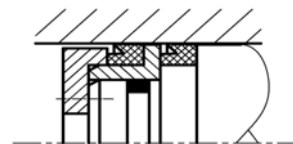
## MOUNTING AREA AND INSTALLATION

UNA2-cylinder seals should be used only as closed rings in order to avoid difficulties with the montage of the seal. They can be used as single seals or in sealing-sets



## TOOLS FOR INSTALLATION

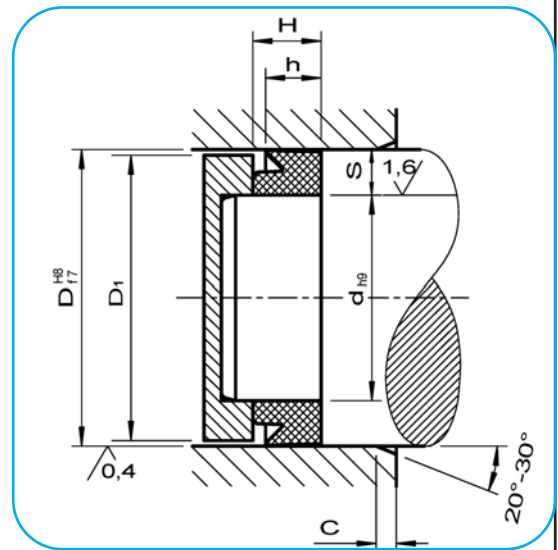
In order to protect the sensitive lips with the montage, suitable montage-helps and insertion chamfers are to be intended.



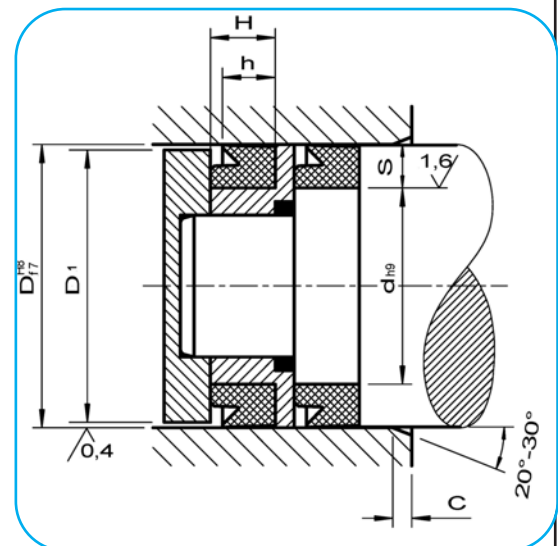
## INSERTION CHAMFER

S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10

## CYLINDER SEAL



## CYLINDER SEAL



Installation length  $L = H$

D	d	H	h	TOOL NUMBER
34	6	18	14	2-11476
38	63	11	9,5	2-05865
48	32	14	12	2-00857
80	60	16	13	2-01225
95	70	15,5	13,5	2-05529
108	80	20	16	2-06083
120	96	16	13	2-03686
130	100	23	20,5	2-06886
140	110	27	22	2-02258
150	122	21	17,5	2-03381
170	130	27	22	2-01797
181	151	27	22	2-00990
185	150	27	22	2-01082
192	162	27	22	2-00989
270	230	32	26	2-01489
275	245	22,5	18	2-08512
315	275	33	27	2-02001
320	280	33	26	2-01682
400	370	25	21	2-02691
450	410	32	26	2-00991
560	500	50	42	2-08577





## APPLICATION

The difference between UNX1 and UNX2 is a wiper under the bottom of the seal. Because of the pretty good friction behavior the use is recommended where the reserve power is limited e.g. in hydraulic-lifting-systems. (car lifters, load-elevators, hydraulic ramps)

## RECOMMENDED VALUES FOR APPLICATION

sealing material	operating medium	hydraulic system		
		p (bar)	t (°C)	v (m/s)
858	mineral oil, oil-water-emulsion,	UNX1 < 80 UNX2 < 25	-20 up to 110	< 0,5

UNX1-rings can be produced in a harder material and therefore can be used for pressures up to 160 bar.

## MATERIALS

UNX-Rings are produced in a NBR-material (WS 858) with a hardness of 85 ShoreA. Further materials upon request.

## MOUNTING AREA AND INSTALLATION

For the shape and the dimensions of the mounting area look in the table. Split leakage and with it the destroying of the UNX2 seal is, because of the wiper under the bottom of the seal only to fear if the recommended values for the application are crossed.

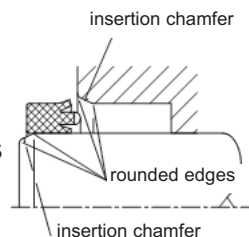
## CLEARANCE BEHIND THE SEAL UNX1

Too much clearance behind the seal leads to a premature outage of the sealing properties. The admissible clearance behind the seal is calculated as follows:

WS 858:  $b_{zul} = 0,3 - 0,001p$  (for p up to 160 bar)

## TOOLS FOR MOUNTING

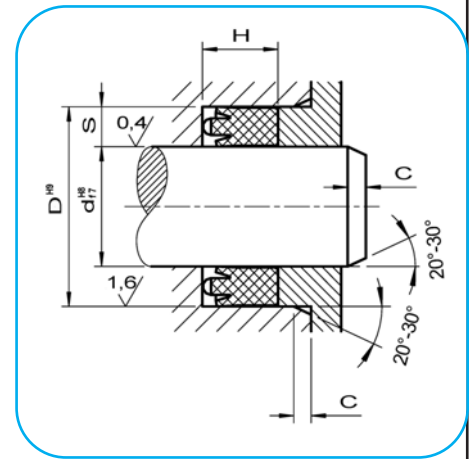
- no sharp edges, please do not use sharp installation tools
- look for insertion chamfers



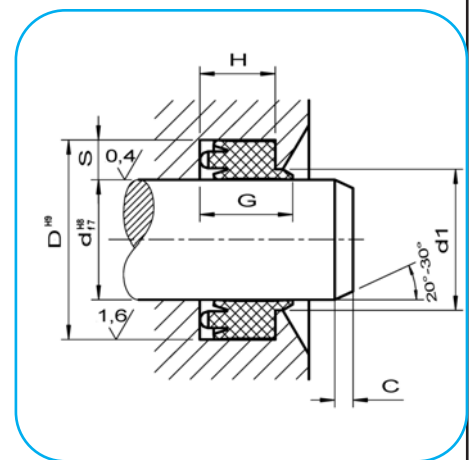
## INSERTION CHAMFER

S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10

## ROD SEAL UNX 1



## ROD SEAL UNX 2



NOMINAL SEAL DIMENSIONS					
d	D	H	G	TOOL-No.	UNX-No.
10	21	9	11	2-07121	UNX2
30	45	10,5	9,5	2-03640	UNX1
32	47	6		2-06564	UNX1
40	60	12	16	2-07903	UNX2
128	150	18	23	2-06250	UNX2
165	189	23	18	2-06158	UNX2
166	186	18	23	2-05538	UNX2
185	205	29		2-05329	UNX1
188	210	18	23	2-07181	UNX2
210	235	27	21	2-05108	UNX2
210	230	29		2-05363	UNX1
210	233	21	27	2-05588	UNX2
210	230	29		2-08318	UNX1
211	233	21		2-05644	UNX1
211	247	31		2-06950	UNX1
214	240	21	27	2-07453	UNX2
214	250	31		2-07820	UNX1
236	258	27	21	2-05453	UNX2
236	258	21		2-05645	UNX1
236	258	31		2-06290	UNX1
236	272	31		2-07126	UNX1
238	272	31		2-08711	UNX1
238	272	31		2-09409	UNX1
239	275	31		2-07819	UNX1
260	283	27	21	2-05643	UNX2
260	280	29		2-06291	UNX1
310	333	25	19	2-05285	UNX2
310	330	29		2-06600	UNX1
311	347	31		2-07499	UNX1
348	373	25	19	2-05317	UNX2
349	385	31		2-07500	UNX1
360	384	19	25	2-09152	UNX2





## APPLICATION

- hydraulic brake systems
- hand pumps
- car lifters

MN-rings are hanged cylinder seals, developed especially for pistons under pressure from only one side. In the profile of the lips and the mode of action they are identically with our outer lip seal UNA1 the sealing is recommended in those cases where a complete coverage of the metallic piston head side is desired.

## RECOMMENDED VALUES FOR APPLICATION

SEALING MATERIAL	OPERATING MEDIUM	HYDRAULIC SYSTEM		
		p (bar)	t(°C)	v(m/s)
858	mineral oil, oil-water-emulsions water	< 160	-20 up to + 110	< 0,5

## MATERIALS

MN-sealing rings are produced preferably in our NBR-material WS 858 (86 ShoreA). Further materials on inquiry.

## MOUNTING AREA AND INSTALLATION

MN-sealing rings are mounted hanged in accordance to the shape of the piston body.

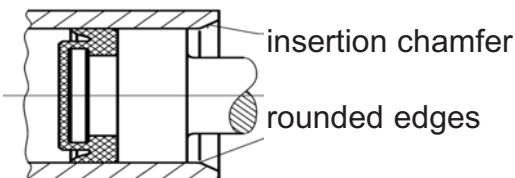
## CLEARANCE BEHIND THE SEAL

Too much clearance behind the seal leads to a premature failure of the seal. The admissible clearance behind the seal is calculated as follows (WS 858):

$$b_{zul} = 0,3 - 0,001p \text{ (for } p \text{ up to 160 bar)}$$

## TOOLS FOR INSTALLATION

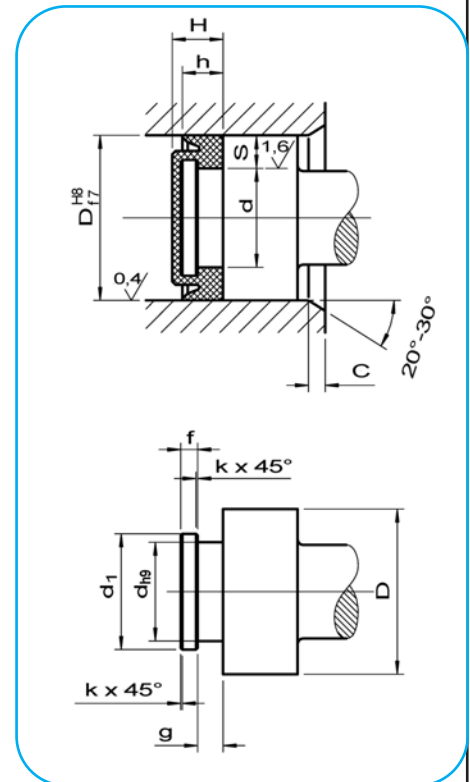
Lok for useful tools for installation and the right insertion chamfer that you don't damage the thin edges of the lips.



## INSERTION CHAMFER

S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10

## CYLINDER SEAL



SEAL DIMENSIONS				TOOL-				
D	d	H	h	NUMBER	d <sub>1</sub>	g	f	k
10	3	8	7,5	2-07159	4,7	3,8	3,2	0,2
11	4	8	7,5	2-01307	5,9	4,1	2,6	0,2
12	4	6	5	2-00512	5,9	3	2	0,2
12	4	8	7,8	2-00980	6	4	2,6	0,2
14	6	6	5	2-01006	8	3	2	0,2
14	6	8	7,5	2-01190	8	4	2,5	0,2
14	6	8	7,5	2-06711	8	4	2,6	0,2
15	7	8	7,5	2-02320	9	4,2	2,6	0,2
16	8	8	7,5	2-01259	10	4	2,6	0,2
18	10	8	7,5	2-01218	12	4,1	2,6	0,2
20	12	6	5	2-00415	14	3	2	0,2
22	14	6	5,5	2-02742	16	3	2	0,2
24	16	8	7,5	2-01638	18	4,1	2,6	0,2
25	17	6	5,5	2-02905	19,2	3	2	0,2
26	18	8	7,5	2-01217	20	4	2,6	0,2
28	18	7,5	6,3	2-03963	20,5	3,8	2,5	0,25
32	22	7,5	7	2-02759	25	3,8	2,5	0,25
35	24,5	8	6,8	2-03638	27,5	4	2,5	0,25
36	26	7,5	6,3	2-03080	28,5	3,8	2,5	0,25
38	28	7,5	7	2-02640	30,5	3,8	2,5	0,25
50	38	9	7,5	2-02517	41	4,5	3	0,3
50	38	9	7,5	2-07366	41	4,5	3	0,3
60	48	9	7,5	2-04227	51	4,3	3	0,3
70	55	11,5	9,7	2-03206	58,5	5,6	4	0,4
80	65	11,5	10	2-02322	68,5	6	3,6	0,4
100	85	11,5	9,6	2-03242	89	5,3	4,3	0,4
140	120	15	12,5	2-03243	125	7,2	5,5	0,5
150	130	15	12,5	2-03015	134,3	7,5	5	0,5





## APPLICATION

U-shaped seals MA are suitable as piston-seals and walking movements into hydraulic and pneumatic systems. For use-cases, where pressure-loose work-phases frequently occur, the use of our MA3 and MA4 with feather-backed tension of the lip is recommended.

## RECOMMENDED VALUES FOR APPLICATION

SEALING MATERIALS	OPERATING MEDIUM	HYDRAULIC SYSTEM			PNEUMATIC SYSTEM		
		p(bar)	t(°C)	v(m/s)	p(bar)	t(°C)	v(m/s)
858	mineral oil water water-emulsions compressed air	< 40	-20 up to +110	< 0,25	< 16	-20 up to + 80	< 1
900		< 40	25 up to + 80	< 0,25			
071 072		< 100	-30 up to +120	< 0,25			

## SEAL PROPERTIES

All U-shaped-seals MA1-4 are equipped with relatively long sealing-lips and flat shaped flange-looking sealing-grounds, that show central-drillings with most measurements. Partially, considerable differences are in the relationship of pre-tension, lips and ground-strength, centralisation e.g. given and declares itself from the difference of the in each case first need.

The lips of our types MA3 and MA4 find out an additional pressure through interior-lying pressure-feathers at the cylinder-wall.

The sealing-types MA2 and MA4 are approximately looking round at the lip-back, MA1 and MA3 at this place have a twisty transition to the ground.

## MATERIALS

The MA-seals are delivered normally in the following standard materials:

WS 858: a NBR- material with approx. 86 ShA

WS 900: a polyurethane-material with approx. 94 ShA

WS 071; 072: NBR-cotton-fabric materials which differ in the structure of the fabric. Standard is a surface with graphite (not possible for MA3 and MA4)

Further materials on inquiry.

The feathers for MA3 and MA4 are in standard-implementation out of unalloyed feather-steel-wire. These can also be delivered in material 1.4310.

## INSTALLATION AREA AND MOUNTING

MA-seals (with central-drilling) are installed into open mounting-areas in principle, i.e. the necessary sealing-compression at the flange-ground must take place by means of a stretchable stationary-ring. A border for pressing through attack should be intended. For the seals MA2 and MA4, the metallic surface of the piston must show the same radius as at the outer diameter how it is to be found for the corresponding seal under the table-measurement "R." This recommendation is applicable to all R bigger than 3 mm.

## CLEARANCE BEHIND THE SEAL

The maximum clearance (b) behind the seal is:

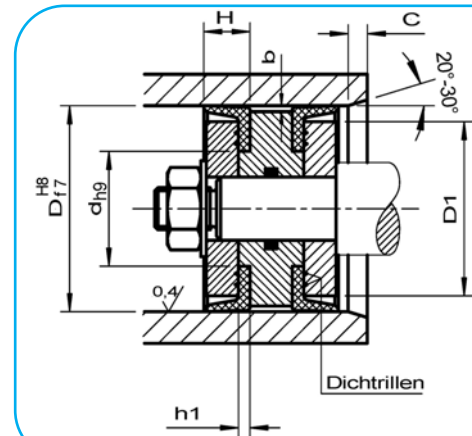
WS 858  $b_{zul} = 0,2 \text{ mm}$

WS 900, 071 and 072:  $b_{zul} = 0,3 \text{ mm}$

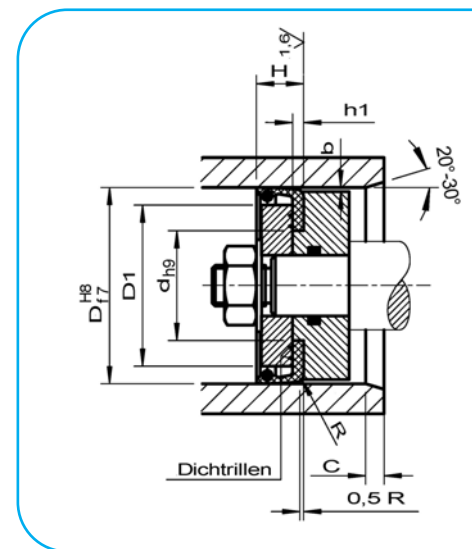
## TOOLS FOR INSTALLATION

Look for useful installation tools and the right insertion chamfer (C=0,3H) that you don't damage the thin edges of the lips.

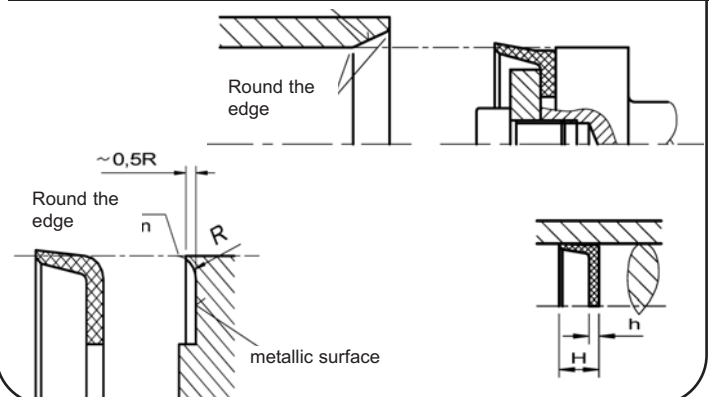
## CYLINDER SEAL MA 1



## CYLINDER SEAL MA 4



## INSERTION CHAMFER



# MA U-SHAPED SEAL, CYLINDER SEAL



NOMINAL SEALING DIMENSIONS				TOOL-NUMBER			D1	R	MA No.
D	d	H	h	RUBBER	FABRIC	PU			
6	0	6	3,5	2-01789			0,5	2	
6	0	6	4			V-0792	1,4	1	
6	0	6	2,7			V-0629	0	1	
6,6	4,3	5	1,5	2-08136			4,7	1,5	2
8	2,5	5	1,5	2-01263			5	0,7	2
8	2,5	5	1,3			V-0909	4,7	1	
9	2,5	5	1			V-0644	5,5	1	
9	2,5	5	1,3			V-0154	5,4	1	
10	0	7	1,5	2-02049			6,2	0	2
10	0	7	4,7	2-04804			4	1	
10	0	7	5			V-0513	5	1	
10	0	10	8	2-01097			1	2	
10	4	6	3		2-01148		6	1	
10,5	5	6	1,5	2-09821			8	0,5	2
11	0	8,5	3,5			V-1551	4,5	1	
11	4	7	2			V-1540	5,8	1	
12	3,5	7	2,5	2-02424			5,9	1	
12	4	4	1,5	2-08631			8	1	
12	4	6	2	2-09503			7	2	
12	4	7	1,5	2-00940			0,1	2	
12	4	8	2		2-00044		7,4	1	
12	5,5	7	2,5	2-09237			8	1	
12,2	5,5	6	2	2-01376			7,9	1	
13	4	8	3,5			V-2460	7,8	1	
13	5	7	2,5		2-00223		7,8	1	
13	5	7	2,5			V-0741	8,6	1	
13	5	8	3,3			V-1642		1	
13	5	8	3,5			V-0768		1	
13	5	8	3,5			V-1971		1	
13	6,5	6	1,5	2-09553				2	
14	0	8	3	2-05198				1	
14	5	7,5	1,5		2-06409			1	
14	5	8	4		2-01107			1	
14	5	8	4			V-1541		1	
14	5	9	2	2-00939				2	
14	6,5	7,5	2,5	2-02904				1	
14	7	7	1,5		2-01138			1	
15	0	7,5	5	2-04751				1	
15	0	7,5	5,5			V-0622		1	
15	0	8	6	2-01714				2	
15	6	5	1,5	2-01795				1	
15	6	7	3	2-04655				2	
15	7,5	7	2,5	2-00586				1	
15	9	5	1,5	2-04379				1	
16	0	7	5	2-04805				1	
16	0	7	5			V-0514		1	
16	0	8	1,5	2-02417				1	
16	0	8	2,5		2-04145			2	
16	6	10	5			V-1582		1	
16	7	6	1,5	2-11258				1	
16	7	6,5	2	2-09552				2	
16	8	8	2		2-01989			1	
16	8	8	2			V-4113		2	
16	10	4	2	2-08701				1	
17	8	6	1,5	2-05347				2	
17	8	6	3	2-11054				1	
17	10,2	5,5	1,5		2-04943			1	
18	0	8	6	2-01806				2	
18	0	10	5	2-08767				1	
18	5	14	4		2-02156			1	
18	5	14	4			V-0842		1	
18	8	7	2	2-04181				1	
18	10	11	5,5			V-1297		1	
18,5	6,5	5	2	2-09412				1	
19	0	8	2,5	2-04109				1	
19	11,5	9	4,5			V-1669		1	
19,2	5,1	7	1,2	2-05373				1	
20	0	10	6			V-1175		1	
20	6	10	3		2-03032			1	
20	6	10	3	2-04404				1	
20	8	7	2	2-00128				1	
20	9,3	6	3	2-07230				2	
20	10	5	2	2-09396				1	
20	10	6	2			V-4109		2	
21	0	7	2,3	2-11744				1	

NOMINAL SEALING DIMENSIONS				TOOL-NUMBER			D1	R	MA No.
D	d	H	h	RUBBER	FABRIC	PU			
21	0	8	6	2-01807					2
21	11,5	7	3			V-0301			1
22	0	6	2	2-08889					1
22	0	6	2			V-1123			1
22	0	10	6	2-04637					1
22	0	10	6			V-1248			1
22	5	6	2	2-12066					1
22	8	7	2	2-00821					1
22	9	7	2,5	2-00587					1
22	10	11	3			V-0532			1
23	8	7	2,5	2-07842					1
23	8	11	2	2-00997					2
24	8	7	3	2-05339					2
24	10	10	2	2-01526					1
24,2	5,1	7	1,2	2-05374					1
25	0	5	3			V-1457			1
25	0	5,5	2,5	2-07464					1
25	0	8	2,5		2-04412				1
25	0	10	5			V-1196			2
25	4,5	7	1,3	2-05292					1
25	7	10	2,5	2-05287					1
25	8	7	1,7	2-01137					1
25	8	8	2	2-11273					1
25	8	8	2,5			V-2728			1
25	10	10	3			V-1790			1
25	12	10	2	2-00383					1
25	16	5	1,7		2-00333				1
25,5	0	5,5	2,5	2-09394					1
26	0	12	8	2-01713					2
26	0	12	8			V-0854			1
26	6	10	2,5			V-2884			2
26,5	0	7	1,5			V-1434			1
26,5	12	7	2			V-1381			1
27	0	7	1,5			V-2871			1
27	8	7	3	2-07841					1
27,2	5	7	1,5	2-05375					1
28	8	10	3			V-2309			2
28	8,5	10	3,5	2-09433					1
28	10	10	2,5	2-00588					2
28	10	10	2,5		2-04975				2
28	15	9	2	2-02121					2
28	18	10	2	2-12180					2
30	0	12	3		2-07247				2
30	8	10	4	2-01149					1
30	8	12	6	2-03788					1
30	10	6	2,5	2-07111					1
30	10	8	4		2-00615				1
30	11	11	5		2-02300				1
30	12	13	3		2-03121				1
30	14	6	2	2-07218					2
30	16,5	8	2,5		2-08615				2
30	18	10	2,5			V-2163			1
30,5	8	10	2,5	2-00996					2
31	0	8	2,5	2-08862					2
31,75	0	10	2,5	2-06716					2
31,75	6	10	2,5	2-06717					2
32	0	10	2	2-00987					2
32	0	13	4			V-1962			1
32	10	10	2	2-06841					2
32	16	10	2		2-03168				2
32	22	6	3			V-2285			1
33	14	12	3	2-06816					1
33	20	8	3		2-01176				1
34	24	10	2	2-06775					1
34,2	11	7	2	2-05482					1
35	0	8	3,5	2-12114					1
35	0	9	2,5			V-0567			1
35	0	10	3		2-00464				1
35	10	20	4		2-02104				2
35	16,5	10	2	2-01236					1
36	10	8	2,5		2-01865				1
36	10	13	3	2-00995					2
36	10	13	3			V-2811			2
36	12	10	3	2-11876					2
38	0	15	5		2-00077				1





# MA U-SHAPED SEAL, CYLINDER SEAL



NOMINAL SEALING DIMENSIONS				TOOL-NUMBER			MA		
D	d	H	h	RUBBER	FABRIC	PU	D1	R	No.
38	10	14	4		2-00982				2
38	10	14	4		2-03704				2
38	14	11	4	2-02440					2
39,5	18	18	4		2-00205				2
39,5	18	18	4		2-08510				2
40	0	5	2			V-1260			1
40	8,5	12	3	2-03563					1
40	8,5	12	3			V-0538			2
40	12	8	2	2-04355					1
40	14	13	3	2-01600					1
40	15	12	4		2-02342				1
40	15	20	4		2-02105				2
40	16	15	4		2-04325				1
40	16,5	13	4		2-08094				2
40	18	6	2			V-0518			1
40	18	12,5	3		2-02301				1
40	20	8,5	2,5			V-2919			1
40	20	10	3		2-02263				2
40	20	12,5	3,5		2-02874				2
40	20	16	4			V-0308			1
40	21	10	3		2-01134				1
40	23,5	13	4	2-01535					2
40	24	15	3			V-0304			1
40	25	10	3		2-06540				1
40	25	15	4		2-02812				2
40	26	8	2		2-03079				1
40	26	8	3		2-03562				1
40	26	10	2,5	2-05899					1
40	27	9	3	2-05999					2
41	24	9	3	2-09642					2
42	0	12	3		2-03559				2
42	8,5	12	3			V-0544			2
42	10,5	14	4		2-04491				1
42	11,9	9	2	2-01478					1
42	18	11	3	2-06366					1
43	12	14	4			V-2140			1
43	25	6,5	2		2-00334				1
45	5	12	2,5	2-00988					2
45	12	12	2,5		2-02769				1
45	14	15	3	2-00947					2
45	15	15	3		2-00800				1
45	15	15	4		2-01734				1
45	15	20	4		2-02106				2
45	16	12	4	2-11877					2
45	16,5	10	2	2-01235					1
45	18	20	4		2-06004				1
45	19,5	12,5	2,5		2-03883				2
45	20	10	3		2-00144				2
45	20	15	3		2-00613				2
45	20	17	4		2-01323				2
45	24	10	3	2-01027					1
45	24	10	3			V-0305			1
45	25	18	4		2-01457				2
45	26	10	3		2-01792				2
45	30	8	3		2-03291				1
45	30	18	4		2-00469				2
45,5	0	6	3	2-07242					1
46	15	15	3		2-00501				1
48	10,5	14	4		2-04492				1
48	18	14	4		2-02703				1
50	0	15	4		2-03541				1
50	10	20	4		2-03476				1
50	10	25	4	2-06320					1
50	12	8	2	2-04356					1
50	15	20	4		2-02107				2
50	16	10	3		2-01733				1
50	16	10	3	2-05283					2
50	18	14	4			V-0397			1
50	20	10	4		2-03167				1
50	20	12	3		2-00968				1
50	20	20	4	2-00537					2
50	20	25	5	2-01900					2
50	22	20	4	2-01826					1
50	25	10	3			V-4021			1
50	25	11	5		2-00476				1

NOMINAL SEALING DIMENSIONS				TOOL-NUMBER			MA		
D	d	H	h	RUBBER	FABRIC	PU	D1	R	No.
50	25	12	3		2-07070				1
50	25	15	4	2-00589					2
50	25	15	3			V-0303			1
50	27	10	3		2-04956				1
50	27	14	4		2-01254				1
50	27	14	4			V-0354			1
50	30	10	3		2-06541				1
50	30	10	3	2-08798					1
50	30	14	4,5		2-08616				2
50	34	15	3			V-1394			1
50,8	12	12	3		2-06076				1
51	34	18	4		2-00390				1
51,5	24	10	2,3			V-0441			1
52	0	15	2,5	2-00616					1
52	24	18	5	2-00811					1
52	32	12	5			V-0297			1
55	8	15	4			V-1750			1
55	9	12,5	3,3	2-04567					1
55	12	15	3		2-00344				1
55	14	15	3		2-04222				1
55	16	10	3	2-08464					1
55	20	20	4	2-00656					2
55	20	20	4		2-01902				2
55	25	10	2			V-3148			1
55	25	10	2,5			V-2956			1
55	25	10	3			V-2929			1
55	28	12	3,5	2-01119					2
55	28	20	4	2-02222					2
55	30	12	4	2-01495					2
55	30	12	4	2-05250					1
55	32	15	4		2-08617				2
55	36	10	3			V-2595			1
56,5	14,5	15	3		2-04359				1
56,5	39,5	19,5	4,5		2-02879				1
57	8	8	2,5	2-07950					1
57	15	18	4	2-06817					1
57	16	12	3,5			2-03515			1
57	24	15	2,3			V-1663			1
58	8	15	4		2-03033				1
60	0	18	3		2-01986				2
60	0	18	3,5		2-02716				2
60	0	20	5	2-02877					1
60	14	15	4		2-00470				1
60	20	20	4	2-00538					2
60	20	20	4		2-01893				2
60	20	25	5		2-01901				2
60	24	12	3	2-06506					1
60	30	12	3	2-09270					1
60	30	15	3		2-02422				1
60	30	16	4	2-00942					2
60	30	20	5	2-00179					1
60	30	20	4,5		2-02526				2
60	32	15	4		2-01837				1
60	35	15	4		2-07734				1
60	35	15	5		2-08618				2
60	36	15	3		2-07118				1
60	40	10	2,5	2-06583					1
60	40	15	2,3			V-1649			1
63	25	16	5	2-11878					2
63,5	25,6	13	3,4		2-12506				2
65	10	15	3,3		2-00465				1
65	14	15	3,3		2-04221				1
65	30	16	4	2-03864					1
65	35	16	5		2-07598				1
65	35	16	4		2-08619				2
65	41	15	3,3		2-00180				1
65	41	15	3,3	2-04112					1
65	44	13	4		2-02893				1
65	45	12	3	2-04650					3
65	45	12	3	2-04794					1
68	15	15	3		2-00502				1
68	51	10	3		2-01114				1
69	25,5	16	4			V-1056			2
69	45	18	3		2-02942				2
69,5	12	17	5		2-01108				1



# MA U-SHAPED SEAL, CYLINDER SEAL



NOMINAL SEALING DIMENSIONS				TOOL-NUMBER						MA
D	d	H	h	RUBBER	FABRIC	PU	D1	R	No.	
69,5	42	10	2,5		2-08954				2	
69,6	50,7	22,2	5		2-07416				2	
69,7	12	17	5		2-01317				1	
70	12	17	5		2-00704				1	
70	15	9	1,5	2-06731					1	
70	20	20	4	2-00539					2	
70	20	22	4		2-01932				2	
70	20	25	5		2-01899				2	
70	25	10	3			V-3318			1	
70	25	16,5	5	2-09417					1	
70	26	15	4		2-03884				2	
70	26	18	4		2-02720				1	
70	27	20	4			V-0591			1	
70	28	12	3,5	2-01121					2	
70	28	20	4	2-02221					2	
70	30	10	3			V-2941			1	
70	38	17	5		2-07781				1	
70	40	12,5	2,5	2-04762					2	
70	40	16	4		2-02807				2	
70	40	20	4		2-02766				2	
70	41	15	3		2-04957				2	
70	42	25	5			V-0755			1	
70	45	16	4		2-02070				2	
70	45	16	4			V-2318			1	
70	45	20	4,5		2-02096				2	
70	45	20	4		2-06089				1	
70	52	24	4		2-02261				2	
71	16	12	3,5	2-07113					2	
71	38	13,5	3,5	2-12420					2	
72	12	15	4	2-02682					1	
72	12	17	5		2-00703				1	
72	40	12	3	2-01136					1	
73	50	10	3	2-02901					2	
73	50	18	4		2-02125				1	
74	28	16	4		2-02337				2	
74	52	15	5			V-0517			1	
75	12	15	3,3		2-03101				1	
75	16	15	3,3		2-00143				1	
75	16	15	4	2-03593					1	
75	27	15	4		2-01244				2	
75	35	25	5		2-02776				2	
75	38	15	4		2-07735				1	
75	38	21	5		2-06763				1	
75	40	12	4	2-01496					2	
75	45	20	5	2-11425					2	
75	53	15	3,3		2-00042				1	
76	54	11	4,5		2-04625				2	
76	55	11	4,5		2-00750				2	
76,2	19	15	3	2-09050					2	
77	51	18	5	2-04844					4	
77	54	11	4,5		2-05380				1	
80	0	20	4		2-02717				2	
80	0	20	4	2-06255					1	
80	0	25	5		2-01983				2	
80	20	18	4	2-01427					1	
80	20	18	4		2-02194				2	
80	20	20	4		2-02098				2	
80	20	25	5		2-02108				2	
80	25	15	4		2-00213				1	
80	30	20	6			V-0302			1	
80	40	16	4		2-05235				2	
80	48	22	4	2-00943					2	
80	50	10	2,5	2-11648					1	
80	55	20	4			V-2319			1	
80	58	25	4	2-02260					2	
84	50	18	4			V-2520			2	
85	14	17	4,5		2-00471				1	
85	14	17	4,5	2-08123					3	
85	19	15	5		2-00037				1	
85	20	25	5		2-02109				2	
85	40	17	4,5		2-07736				1	
85	52	30	15		2-02993				1	
85	55	16	5		2-00036				1	
86	28	20	4	2-08144					1	
88,9	25,4	19	4,8		2-08200				2	

NOMINAL SEALING DIMENSIONS				TOOL-NUMBER						MA
D	d	H	h	RUBBER	FABRIC	PU	D1	R	No.	
89	22	22	4	2-04377					1	
89	25	25	4		2-02973				1	
89	54	15	3,8		2-12468				1	
90	0	20	3	2-06580					1	
90	16	17,5	4		2-03030				1	
90	18	20	5		2-04698				1	
90	25	25	4		2-01324				2	
90	25	25	5			V-1981			1	
90	40	11	5		2-03517				1	
90	40	20	3		2-02743				1	
90	62	17,5	4		2-00218				1	
91	61	22	5		2-03822				2	
92	61	22	5			V-0334			1	
94	60	22	5		2-06761				1	
95	29	18	4		2-05536				2	
97	12	19	5		2-04544				1	
98	60	15	3,5		2-11395				1	
98	68	25	4		2-01964				2	
98	68	30	3,5		2-03598				1	
100	0	25	5	2-02727					2	
100	20	16	4	2-11649					4	
100	30	15	5	2-03865					1	
100	30	20	5	2-00941					2	
100	30	20	6			V-0395			1	
100	30	25	5		2-02110				2	
100	40	24	5	2-01256					2	
100	42	20	4		2-06207				1	
100	44	18	4	2-07597					1	
100	46	20	4		2-03885				2	
100	50	20	4		2-02771				2	
100	55	20	5		2-02166				2	
100	60	10	2,5	2-09079					1	
100	60	10	3			V-1036			1	
100	60	18	4		2-00043				1	
100	60	20	5	2-06584					1	
100	61	25	5		2-07081				1	
100	62	22	4			V-1358			1	
101	70,5	22	5		2-02913				2	
101,6	50,8	19			2-12017				1	
102	0	18	5		2-06607				1	
102	40	24	5	2-01715					1	
102	64	37	5			V-2046			1	
102	77	10	2,5	2-01076					2	
103	30	25	5		2-02111				2	
105	20	20	4		2-02097				2	
105	55	20	5		2-02615				2	
105	70	17	3,5	2-01135					1	
106	78	30	6		2-01385				2	
108	25	25	5			V-1980			1	
110	19	18	4		2-00122				1	
110	27	30	5		2-01728				2	
110	28	30	4	2-02328					2	
110	30	25	5		2-03151				1	
110	42	22	5	2-01704					1	
110	46	16	3	2-02223					3	
110	50	25	5		2-02527				2	
110	65	15	4	2-01497					2	
110	70	15	3	2-06030					1	
110	70	15	3			V-1558			1	
110	80	20	4		2-03356				1	
114	103	6	3			V-3375			1	
115	75	25	5		2-02112				2	
115	76	25	5		2-02144				2	
115	76	25	4		2-03306				2	
115	85,5	23	6		2-02912				2	
116	45	30	5		2-04899				2	
116	49	30	5		2-05376				2	
116	50	20	3		2-01985				2	
117	57	20	6		2-06764				1	
119	95	15	4		2-08955				2	
120	30	20	3	2-04846					2	
120	30	20	3	2-04940					2	
120	30	25	5		2-02113				2	
120	48	25	5		2-01987				2	
120	50	20	4		2-02728				2	





NOMINAL SEALING DIMENSIONS				TOOL-NUMBER						MA
D	d	H	h	RUBBER	FABRIC	PU	D1	R	No.	
120	60	18	4		2-02192				2	
120	60	35	7	2-04815					2	
120	70	20	5		2-07739				1	
120	75	25	5			V-0328			1	
120	75	30	5		2-01300				2	
120	76	25	5		2-07082				1	
120	80	20	4		2-02002				2	
120	80	20	4	2-05275					2	
120	98	15	3	2-03171					2	
124	30	25	5	2-04318					2	
125	0	25	5	2-03023					1	
125	30	25	5		2-02114				2	
125	34,3	18	5		2-00917				2	
125	60	18	5		2-02193				2	
125	60	20	6	2-11879					2	
125	65	25	5		2-02099				2	
125	80	20	4	2-01498					2	
125	80	25	5		2-02100				2	
125	81	25	4		2-02116				2	
125	85	20	5		2-00276				1	
125	95	25	5		2-02262				2	
126	18	20	5		2-04699				1	
127	100	15	6	2-00603					1	
130	20	18	4		2-01004				1	
130	60	21,5	5	2-03776					2	
130	80	18	4		2-06527				1	
130	85,5	32	6		2-03823				2	
130,5	86	15	5		2-03246				2	
132	73	20	4,5			V-1054			1	
132	80	20	4	2-02830					1	
132	85	20	4		2-00919				1	
135	85	12	3		2-01808				1	
135	90	20	4		2-02813				2	
135	105	25	5		2-02722				2	
136	90	24	4		2-02685				1	
136	108	12	3		2-01891				1	
136	108	18	3		2-03223				1	
140	30	20	4	2-04469					2	
140	50	20	5		2-01966				2	
140	50	25	5		2-02162				2	
140	50	30	4		2-01982				2	
140	75	25	5		2-02528				2	
140	91	30	6		2-07083				1	
145	35	30	5		2-01360				1	
145	85,5	32	6		2-03824				2	
146	91,5	20	3,5	2-03577					1	
150	30	25	5		2-02115				2	
150	50	26	5		2-03886				2	
150	52	19	4	2-11160					2	
150	60	25	5		2-01765				1	
150	100	20	10		2-11766				2	
150	105,5	30	5		2-00612				2	
150	110	28	5		2-02498				2	
150	120	15	4	2-09626					1	
150	126	12	3	2-02900					2	
155	120	25	5		2-03355				2	
155	132	10	3		2-01951				1	
159	92	32	8		2-08086				2	
160	50	25	5		2-01984				2	
160	80	20	5		2-01931				2	
160	80	24	5	2-01182					1	
160	100	24	5	2-03866					1	
160	110	20	5	2-01499					2	
160	111	30	6		2-07084				1	
160	120	18	3,5	2-01141					1	
164,5	60	20	4	2-04001					1	
165	0	22	6		2-06608				1	
165	35	30	5		2-01361				1	
170	120	27	5		2-01894				2	
172	122	20	5	2-01953					1	
175	125	16	6		2-01745				2	
175	135	23	6		2-00238				1	
178	76	19	5		2-05197				2	
180	110,5	18	3	2-06032					2	
180	120	30	5		2-04122				2	

NOMINAL SEALING DIMENSIONS				TOOL-NUMBER						MA
D	d	H	h	RUBBER	FABRIC	PU	D1	R	No.	
180	130	12	3		2-01433				1	
180,6	18	20	5		2-04700				1	
190	57	17,8	5		2-05787				2	
190	130	27	5		2-01895				2	
190	145	21,5	6,5	2-00604					1	
200	0	30	6		2-02726				2	
200	0	30	5		2-12598				2	
200	100	13	5	2-11565					1	
200	130	32	7			V-2713			1	
200	150	20	5	2-01500					2	
200	150	30	5		2-01729				2	
200	150	30	4	2-02326					2	
200	150	30	5	2-02329					2	
200	165	22,8	6,5	2-03775					2	
203,2	157,1	20,6	4	2-09111					2	
205	35	25	5		2-03026				1	
205	100	25	5		2-02386				2	
216	176	25	6		2-00764				1	
218	230	5	8			V-4185			1	
220	80	25	5	2-05076					2	
220	172	15	3		2-00126				2	
223	0	22	8		2-06604				1	
228,5	88,9	28,5	6,4	2-02228					2	
235	32	37	6	2-07891					1	
245	191	30	5		2-08012				1	
249	175	30	5		2-08011				1	
250	100	40	6		2-01897				2	
250	125	25	5		2-02387				2	
250	175	30	5		2-01896				2	
250	180	25	5	2-01501					2	
250	180	30	5		2-01721				2	
250	180	30	4	2-02325					2	
250	190	30	5			V-2694			2	
250	210	20	5	2-04376					1	
250	210	25	8		2-00237				1	
251	18	20	6		2-04746				1	
260	240	22	5	2-03366					2	
270	230	20	5		2-06037				1	
280	200	28	5	2-06581					1	
281	180	25	5		2-09281				2	
285	205	25	5		2-11119				2	
287	171	25	5		2-09280				2	
288	236	22	4		2-00938				2	
300	150	40	6		2-01898				2	
300	261	24	6		2-00239				1	
301	18	20	6		2-04747				1	
303	250	22,5	5		2-00252				1	
304	245	25	5	2-08113					1	
304,8	231,8	15,9	4	2-09154					1	
315	215	40	5		2-02808				2	
317	210	25	5		2-01766				1	
329	270,1	19	4		2-01223				2	
350	125	25	5		2-02388				2	
350	290	30	6	2-05874					2	
355	315	25	5	2-04591					3	
360	300	25	4	2-07308					3	
369	308,2	22	4		2-00622				2	
371	0	20	6		2-06063				1	
380	329	24	4	2-07617					2	
400	360	20	5		2-06388				1	
420	365	25	5	2-01787					3	
420	375	25	5	2-04972					3	
440	377	30	5		2-05690				1	
450	410	27	5	2-06585					1	
470	430	25	5	2-03000					3	
500	450	24	5	2-07112					3	
500	481	24	5	2-06582					1	
520	480	25	5	2-01631					3	
520	482	25	5	2-04981					3	
560	500	25	5	2-07445					3	
572	542	8	5			V-0520			1	
630	570	24	5	2-06938					3	
700	640	24	5	2-06939					3	





## APPLICATION

Cap-seals ST are suitable as rod-seals for walking movements into hydraulic and pneumatic systems. They proved themselves as radial-sealing-elements, where slow trick, and swing-movements from interior pressure-burden take place, e.g. in mixer shafts - put - and rule-elements in the turbine-construction and at spindles für armatures. For use-cases, where pressure-loose work-phases frequently occur, recommends the use of our ST3 and ST4 with feather-backed pre-tension of the lips.

## SEALING SPECIFICATIONS

All cap-seals ST1-4 have relatively long sealing lips and even flange-grounds.

From dimension to dimension, partially considerable differences are given in the relationship of pre-tension, lips and ground-strength, that let itself explain mainly from the difference of the in each case first need. The lips of the sealings ST3 and ST4 become an additional pressing by a circular pull-spring. The cap seal types ST2 and ST4 are round on the back of the lip whereas the types ST1 and ST3 have an angled passage to the ground.

## RECOMMENDED VALUES FOR APPLICATION

SEALING MATERIALS	OPERATING MEDIUM	HYDRAULIC SYSTEM			PNEUMATIC SYSTEM		
		p(bar)	t(°C)	v(m/s)	p(bar)	t(°C)	v(m/s)
858	mineral oil water water-emulsions compressed air	< 40	-20 up to +110	< 0,25	< 16	-20 up to + 80	< 1
900		< 40	25 up to + 80	< 0,25			
071 072		< 100	-30 up to +120	< 0,25			

## MATERIALS

The cap-seals ST are delivered normally in the following standard-materials:  
WS 858: a NBR-material with 86 ShA  
WS 900: a polyurethane material with 94 ShA  
WS 071, 072:  
 NBR-cotton-fabric-materials which differ only in the structure of the fabric.

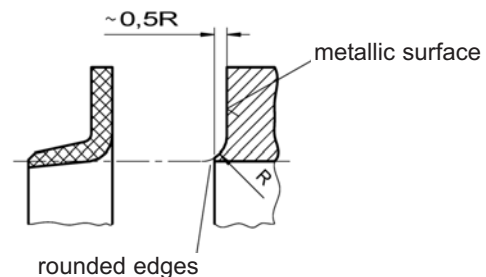
Standardly the material is delivered with a graphite covered surface (not possible for ST3 and ST4). For further materials see chapter „materials“. The springs for ST3 and ST4 are standardly out of non alloyed feather-steel wires. These can be delivered in material 1.4310.

## CLEARANCE BEHIND THE SEAL

The maximum clearance (b) behind the seal is: 0,2mm for WS 858 and 0,3mm for WS 900, 071 and 072.

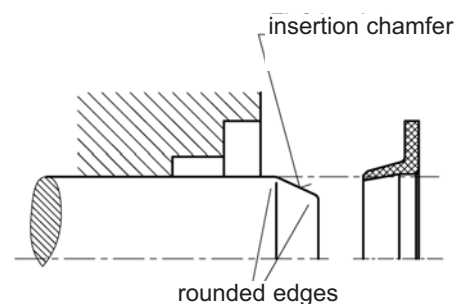
## MOUNTING AREA AND INSTALLATION

ST seals are installed into open mounting areas. That means the necessary sealing compression at the flange-ground must take place by means of a stretchable stuffing-box-glass. A border for maximum pressure through attack or supplement-disks should be intended. For the cap seals ST2 and ST4, the metallic installation surface must show the same radius at the piston at the inner diameter how it is to be found for the corresponding seal under the table-measurement R. This recommendation is applicable to all  $R > 3\text{mm}$ .



## TOOLS FOR INSTALLATION

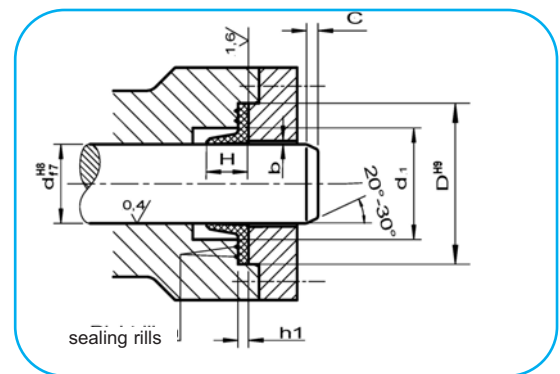
Look for useful tools for installation and the right insertion chamfer that you don't damage the thin edges of the lips.



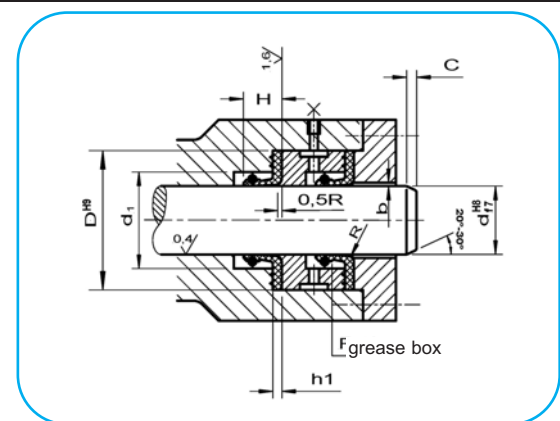


SEAL DIMENSIONS				TOOL NUMBER			d1	R	ST
D	d	H	h	RUBBER	FABRIC	PU			
3	8,5	5	2,3	2-02334			6,4		1
3	16	5	2	2-04380			7,5		1
3	16	5	2	2-08905			6,8	1	2
3	16	5	2			V-0265	8,4		1
3,8	8,5	4	1,5	2-00025	2-07680		6,8		1
4,76	11,1	3,2	1,7	2-07657			8		1
5	20	6	1,5	2-07721			9	2	2
6	15	4,5	1,5	2-02648			10,2		1
6	18	15	3	2-03204			12,9		1
6	22	8	2	2-07722			11	1,5	4
6,35	18	15	3	2-04811			14,2		1
6,7	21	11	2		V-1004		12,1		1
7	18	15	3	2-05957			15,4		1
7,6	13,9	5,5	2	2-00668			11,5		1
8	14	6	1,5	2-01030			12		1
8	14	8	1,5	2-03127			12		1
8	18	5	1,5	2-07658			12		1
8	18	9	2	2-01240			14,5		1
8	20	6	1,2	2-07723			12		1
8	20	9	2	2-01238			14,5		1
8	23	10	3		2-02077		16	1,9	2
8	23	12	4		2-03684		16		1
8,5	16	5	1,5	2-08951			11,8		1
8,5	16	5		2-12049			12		1
8,5	20	7	2		2-04164		14		1
9	16	5	1,2	2-00442			13		1
9	16	5,5	2,5	2-03353			12,5		1
10	16	5	2		2-01031		13,8		1
10	18	5	1,5	2-01404			14		1
10	20	10	2	2-01002			16	2	2
10	23	10	3		2-02078		16,8	3	2
10	24	5,5	2,8	2-07724			14,5	1,5	2
10	24	6	2		2-03057		14		1
10	28	10	2	2-00999			16	2	2
11	20	7	2		2-01988		16,8		1
12	28	11	2,5	2-01003			18,7	2,5	2
12	38	15	3,5	2-00825			21		1
12,7	68,3	12,7	5,5		2-02822		27,7	5	2
13	24	10	2	2-00944			19	2	2
13	45	15	4	2-03058			20,5		1
14	24	10	2	2-00946			20	2	2
14	30	8	2,5		2-00443		20,9		1
14	30	14	4	2-06321			23		1
15	32	10	3,5	2-05323			23,5	0,5	4
15,5	25	7,5	2,2	2-06554			20,8		1
16	28	11	3	2-02576			23,4		1
16	28	11	3,2	2-04916	2-04171		25,4		1
16	30	10	2	2-00945			21,7	2	2
16	38	12	4	2-01561			26,6	4	2
16	38	12	4		2-05820		24,8		1
16	42	18	6		2-03001		27	3	2
17	38	20	5		2-00691		30		1
18	34	10	3		2-05554		26	1	2
18	38	10	2,5	2-08751			24		1
18	54	15	4	2-01841			38		1
19	50,8	19	4,8		2-02823		35	6	2
20	27	6	3	2-02365			24,5		1
20	28	7	2	2-07312			24,3		1
20	35	15	2	2-01296			27,8		1
20	35	15	4		2-02272		30	5	2
20	36	15	3		2-01079		29		1
20	36	15	3	2-06707			29,3	4	2
20	38	13	4		2-06309		31,2		1
20	38	15	4		2-01904		31,2	4,5	2
20	38	15	4		2-02508		31	4	2
20	38	21	5	2-11285	V-0361		30,5		1
20	40	9	2	2-05504			27	1,2	4
20	40	10	3	2-11670			28	2,5	2
20	40	14	3		2-01325		29		1
21	43	21	7	2-03122			31		1
22	28	8	3		2-00331		26,8		1
22	38	21	5	2-12026			33		1
22	38	21	5		V-0584		32,5		1
23	38	21	5	2-01012			35,6	2,5	2
23	38	21	5		V-0300		36		1
24	42	11	3		V-2662		31,5		1
25	45	15	3		2-00500		34,7		1
25	45	15	3	2-04917			34		1
25	46	8	2,5		2-00444		13,5		1

## ROD SEAL ST1



## ROD SEAL ST4



## INSERTION CHAMFER

$$c = 0,3 \times H$$





SEAL DIMENSIONS				TOOL NUMBER			d1	R	ST No
D	d	H	h	RUBBER	FABRIC	PU			
25	46	8	2.5	2-12372			31.5		1
25	50	10	2.5	2-07380			31.5	2.5	4
25	50	12	4	2-01502			35.5	4	2
25	50	12	4		2-04872		34		1
25	53	15	5		2-00692		34.7		1
25	54	20	5		2-00693		38.1		1
26	56.3	11.3	3.5	2-05719			37.5	5	2
27	45	14	3		2-03038		35		1
28	42	9.5	3	2-05338			36		1
28	42	9.5	3		2-07220		36		1
28	46	6	2.3	2-06271			36	1.5	4
30	40	9	2.5			V-3337	36		1
30	45	10	3.5			V-2003	36.5		1
30	48	8	2.5		2-00568		36.5		1
30	50	30	6	2-01011			43.9	6	2
30	50	30	6			V-0299	43.3		1
30	55	20	4		2-02401		44	6	2
30	58	12	4	2-01503			40.5	4	2
30	60	14	4		2-00233		39.1		1
30	60	14	4	2-04918			41		1
30	77	15	3.5	2-00482			38.5		3
32	56	10	3		2-03031		38.6		1
35	48	7	2.5	2-05854			40		1
35	56	8.5	2.5		2-01970		47.5	3	2
35	60	25	5		2-03444		45		1
35	62	12	4	2-01504			45.5	2	2
35	70	20	4		2-02402		39.5	6	2
35	74	25	5		2-01965		51	8	2
35	80	20	4	2-02147			47.5	5	2
36	55	8	3	2-07266			43.2		1
36	55	20	5		2-00694		49		1
36	55	20	5	2-04919			50		1
37	60	12	3	2-05184			47	1	4
38	52	8	2.5		2-00671		44.9		1
38	54	10	2.3			V-1648	47		1
38	63	20	5		2-06762		52		1
40	52	7.5	3	2-03475			46.6	1	2
40	58	8	2.5		2-00147		46.6		1
40	60	15	3		2-05902		48.6		1
40	60	30	4		2-03599		50		1
40	65	9.5	3	2-05186			50		1
40	65	14	4		2-00236		49.1		1
40	65	14	3.5		2-06579		59.8		1
40	67	15	5	2-05705			49		1
40	68	12	4	2-01505			50.5	4	2
40	70	25	4		2-03474		50		1
42	62	10	3		2-01890		50		1
42	70	16	4		2-02684		54		1
42	72	15	4		2-00425		51.5		1
42	74	15	4	2-12823			56		2
42	83	18	4		2-03261		51.8	5	2
42	85	15	4		2-01575		65	9.5	2
43	65	12	3	2-05183			53	1	4
45	65	15	3.3		2-00079		54.8		1
45	70	20	4		2-02778		58.6	5	2
45	73	12	4	2-01506			55.5	4	2
45	74	25	5		2-01905		63	9	2
45	80	25	5		2-02145		63.5	6	2
49	63	7	2.5	2-03821			54		2
49.3	61.3	12	3	2-02687			56.3	1	4
50	63	7	2.5	2-03819			55.8	1.2	2
50	64	10	3		2-07527		57		1
50	64	12	3	2-05555			60.5	1	4
50	65	10	5	2-02395			60	1	2
50	65	10	5	2-07321			59		1
50	70	10	3		2-00018	V-0107	57		1
50	70	20	4.5		2-02523		63	8	2
50	70	20	4.5	2-04507			63.5	5	2
50	75	15	4.5		2-03248		60.4	4.5	2
50	75	30	5		2-02264		66	8	2
50	76	10	3	2-04375			57.5		1
50	80	22	4	2-03397			62		3
50	81	20	4	2-01703			64		1
50	82	16	5	2-01507			63	5	2
50	84	25	4			V-0697	62	3	2
50	85	25	5		2-02146		66	6	2
50	85	30	4		2-03361		60	5	2
50	88	12	4	2-11826			59	5	2
50	90	10	3	2-00559			62	5	1

SEAL DIMENSIONS				TOOL NUMBER			d1	R	ST No	
D	d	H	h	RUBBER	FABRIC	PU				
50	90	15.8	4.5			2-01445		60		3
50	118	22	4					59.5		1
55	88	24	4	2-05236				66		2
55	90	15	4					63.5		3
57.15	76.2	12.7	3	2-02655				68		2
58	89	30	6	2-12890				76.5		2
60	90	9.5	3.6	2-07255				67.2	2.4	2
60	90	15	4			2-01519		70		1
60	90	22	4	2-03629				72		3
60	92	16	5	2-01508				72	5	2
60	95	25	5			2-02372		78	8	2
60	105	15	3	2-09303				70	1	4
63	86	10	4	2-01344				72	2	2
64	83	9.5	2.5	2-03820				70		2
64	92	15	3.3	2-00739				78	1	2
65	83	9.5	2.5	2-03156				73	1.5	2
65	94	25	5			2-01903		83	9	2
65	100	30	5			2-03584		79		1
70	99	30	5			2-00614		84	7	2
70	100	30	5			2-02814		85	5	2
70	100	30	4				V-1768	82		1
70	104	20	5	2-01257				82.8	5	2
70	110	30	4			2-07880		82		1
70	115	10	3			2-00593		77		1
73	98.4	9.5	3.2	2-07240				80.8		1
75	100	15	3.5	2-02719				86.5	1	2
75	100	25	5			2-05901		90		1
75	135	25	5	2-03365				88	5	2
80	100	13	4	2-06408				92		1
80	100	20	5			2-02614		93	6	2
80	110	15	4			2-00224		90		1
80	120	15	3	2-05703				89		1
80	150	25	5			2-02101		96	6	2
85	95	7	2.5	2-08755				89.6		1
85	125	22	4			2-01847		99	6	2
90	120	13.5	3.5	2-11122				100		3
90	129	25	6			2-02370		109	8	2
95	124	25	5			2-01908		115	9	2
95	125	35	5			2-04592		109		1
100	125	17	4			2-00235		110		1
100	125	30	5			2-05990		114		1
100	126	18	6			2-00234		110		1
100	126	18	6	2-03906				116		1
100	129	25	5			2-01907		120	9	2
100	130	13	3	2-00654				110		3
100	130	14	3.5	2-11123				110		3
100	135	30	5			2-01722		120	9	2
100	140	20	4			2-03247		110	4	2
100	142	20	4	2-06386				113		1
120	160	20	5	2-01509				133	5	2
125	145	18	3			2-01048		137	6	2
125	150	16	5.5	2-09523				137	2.5	4
125	172	20	5	2-12031				144	2	4
150	190	20	5	2-05336				163	1.5	4
160	200	20	5	2-01510				173	5	2
160	200	20	5			2-02996		172		1
165	200	20	5	2-03245				180	3	3
168	220	18	5			2-00659		178.5	8	2
185	220	20	5	2-03082				200		3
200	240	18	4.5	2-01446				211		3
210	245	20	5	2-03083				225		3
220	254	15	3	2-06577				230		1
223	275	16	5	2-05082				248	3	4
235	270	20	5	2-02592				250	3	4
240	275	20	5			2-07992		250		1
250	300	20	5	2-09765				263		1
260	295	20	5	2-03084				276		3
320	355	15	3	2-06578				331		1
335	370	20	5	2-03085				352		3
360	422	20	5	2-12116				378	2	4
380	440	20	5	2-09934				393		1
420	470	18	4	2-08112				430	0.8	4
430	470	20	5			2-11645		446		1
470	570	30	8	2-04721				490		3
487	517	8	5				V-0519	500		1
735	850	28	7	2-07021				790	5	2



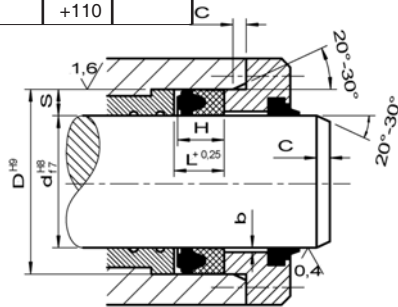


## APPLICATION

Hydraulic cylinder, lightweight to medium/heavy operating conditions, small installation areas, rod seal and cylinder seal for pressure on one side, hinges, rotary transmission leadthroughs at low speed.

## RECOMMENDED VALUES FOR APPLICATION

SEALING MATERIAL	OPERATING MEDIUM	HYDRAULIC SYSTEM		
		p(bar)	t(°C)	v(m/s)
951 969	mineral oil oil-water- -emulsions water	< 250	-20 up to +110	< 0,5
858		< 160	25 up to +110	< 0,5



## MATERIALS

UGA1, 3 and 5 rings are delivered in the following standard material combinations: WS 951 and WS 969. They consist of NBR impregnated cotton-fabric material with a different structure just as an attached vulcanized rubber-part out of NBR.

Delivery is also possible in material combinations with FPM and aramide.

Standard are rings with graphite on the surface. UGA2 and 4 Rings are delivered - if ordered not differently - in our NBR-material WS 858 with 86 ShA. Further materials see chapter "materials".

## CHARACTERISTICS

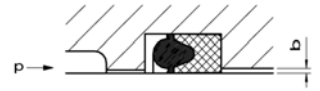
UGA-Rings are compact packings. The pre-tension comes through the distortion of a massive elastomer-block. This block causes a high sealing pressure for a long time also in low pressure areas or in areas with no pressure.

In contrast to the profiles UGA2 and UGA4, which consist only of rubber, the types UGA1, 3 and 5 have an additional onvulcanized fabric part. This increases the distortion-stability, reduces the inclination to the extrusion in

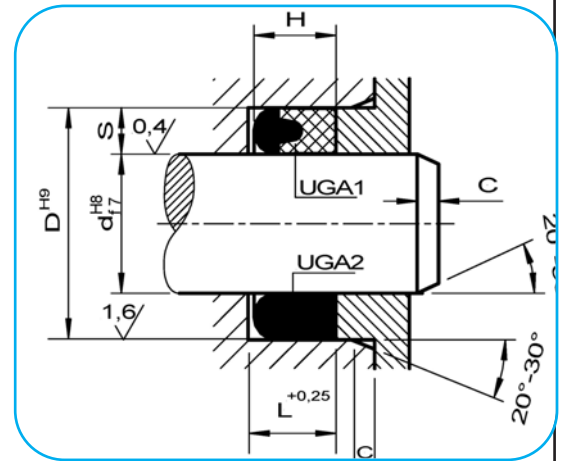
the split and improves - particularly in the higher pressure-areas - the rubbing behaviour of the seal through lubricant-storage in the fabric-surface-structure.

## CLEARANCE BEHIND THE SEAL

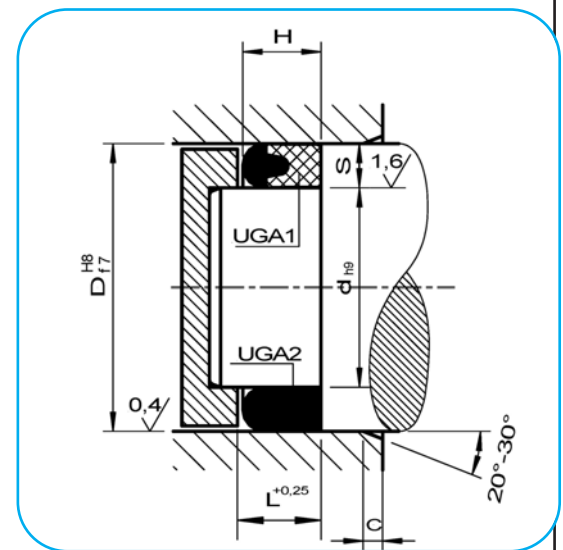
Too much clearance behind the seal leads to a premature outage of the sealing properties. The admissible clearance behind the seal  $b$  is calculated as follows:  
 WS951, 969:  $b=0,4-0,008p$  for  $p$  up to 250bar  
 WS858:  $b=0,3-0,001p$  for  $p$  up to 160bar



## ROD SEAL



## CYLINDER SEAL



## INSERTION CHAMFER

S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10





d	D	H	TOOL No.	L	UGA Nr.
3,5	7,5	4	2-08063	4,5	2
4	7,5	3	2-08969	3,5	2
4	10	5	2-08064	5,5	2
5	13	8	2-04890	8,5	1
6	14	6	2-05353	6,5	
8	16	6	2-05354	6,5	
8	16	10	2-06480	11	3
10	16	5,5	2-05591	6	2
10	18	6	2-05355	6,5	1
10	18	8	2-08952	8,5	1
12	20	6	2-05356	6,5	
12	26	10	2-06481	11	3
13	24	5	2-11132	5,5	2
13	25	12	2-05635	13	1
14	20	5	2-06413	5,5	2
15	22	5	2-07415	5,5	2
15	22	5,5	2-06994	6	1
16	24	10	2-04626	11	1
16	32	10	2-06482	11	3
17	23	12	2-07554	13	2
18	24	6	2-05443	6,5	2
19	30	6,5	2-11889	7	1
20	26	5,5	2-06995	6	1
20	27	6	2-04713	6,5	1
20	27	6	2-04860	6,5	2
25	32	6	2-04862	6,5	1
25	33	6,5	2-04889	7	1
25	33	7	2-09013	7,5	3
25	34	7	2-06996	7,5	1
25	50	15	2-08772	16	1
26	34	6	2-06211	6,5	2
27	35	8	2-07552	8,5	1
27,5	36	7	2-08687	7,5	3
28	35	5,5	2-06997	6	1
28	35	12	2-07555	13	2
28	36	7	2-07794	7,5	3
28	40	9	2-06483	9,5	3
30	37	13,4	2-07583	14,4	1
30	38	6	2-07584	6,5	1
30	38	7	2-09165	7,5	3
30	38	8	2-08720	8,5	3
30	38	8	2-04581	8,5	1
30	38	8	2-07714	8,5	4
30	38	13,5	2-06546	14,5	3
30,1	42,8	8	2-12881	8,5	1
32	40	5	2-05546	5,5	1
32	40	12	2-09907	13	4
32	42	8,5	2-06998	9	1
32	44	11,5	2-07351	12,5	1
33	39,5	6	2-07550	6,5	1
34	50	12	2-06484	13	3
35	43	6	2-07585	6,5	1
35	43	6,5	2-06999	7	1
35	43	7	2-09003	7,5	3
35	44	9	2-04732	9,5	1
36	44	8,5	2-06937	9	1
38	46	8	2-04782	8,5	1
38	46	8,5	2-11779	9	3
38	46	13,5	2-06547	14,5	3
38	50	9	2-06695	9,5	3
40	47	12	2-07556	13	2
40	48	8	2-04902	8,5	1
40	48	8	2-07642	8,5	4
40	48	8	2-09851	8,5	4
40	48	8	2-09109	8,5	3
40	48	10	2-04907	11	1
40	48	10	2-04974	11	2
40	50	6	2-07586	6,5	1
40	50	8,5	2-07000	9	1
40	50	10	2-08555	11	3
40	60	12	2-08292	13	3
40	60	12,5	2-07606	13,5	1
40	60	15	2-06485	16	3
40	70	25	2-05982	26	1
42	50	7	2-08105	7,5	1
42	50	7	2-06871	7,5	3
44	55	10	2-09166	11	3
45	52	13,4	2-07587	14,4	1
45	53	8	2-04783	8,5	1
45	53	8	2-07715	8,5	4
45	55	10	2-07619	11	1
45	55	10	2-08524	11	3
45	60	11	2-07994	12	3
45	60	11	2-09181	12	3
45	60	12	2-08103	13	3
48	60	10	2-09174	11	3
49	55,6	6	2-07549	6,5	1
50	58	8	2-07071	8,5	1
50	60	10	2-07432	11	3
50	62	9,5	2-07001	10	1
50	62	10	2-08525	11	3

d	D	H	TOOL No.	L	UGA Nr.
50	65	10	2-04857	11	1
50	65	12	2-07834	13	1
50	65	12	2-08293	13	3
51	64	9,5	2-08133	10	1
54,5	62,5	11	2-09041	12	1
55	63	8	2-04784	8,5	1
55	63	8	2-09591	8,5	3
55	63	8	2-07643	8,5	4
55	63	8	2-08126	8,5	3
55	65	8,5	2-07609	9	1
55	67	10	2-05947	11	1
55	67	10	2-09171	11	3
59,5	67,5	8	2-09025	8,5	1
59,5	67,5	11	2-09024	12	4
60	68	8	2-04785	8,5	1
60	68	10	2-07716	11	4
60	72	9,5	2-07610	10	1
60	75	12	2-09136	13	3
60	80	16	2-08214	17	3
60	80	20	2-06324	21	2
68	80	10	2-09175	11	3
69,5	77,5	11	2-09040	12	1
70	79,6	8	2-07659	8,5	2
70	82	9,5	2-07611	10	1
70	85	12	2-09160	13	3
70	85	12	2-07888	13	4
75	88	10	2-09176	11	3
75	90	12	2-09835	13	4
77,5	85,5	8	2-09026	8,5	1
78	86	8	2-04786	8,5	1
78	86	8	2-09938	8,5	3
80	89,5	6,2	2-06903	6,7	1
80	95	11,3	2-09096	12,3	1
80	95	12	2-08019	13	2
80	95	12	2-09201	13	3
80	100	15,5	2-07352	16,5	1
85	97	9,5	2-07612	10	1
85	100	12	2-06770	13	1
85	100	12	2-09177	13	3
88	97,5	5,5	2-06914	6	1
90	102	12	2-07982	13	2
90	105	12	2-09180	13	3
95,5	105,5	10	2-04719	11	1
97	105	5,4	2-07431	5,9	2
97	105	8	2-04787	8,5	1
100	115	12	2-08944	13	3
105	130	22	2-07350	23	1
107	124	16,5	2-08134	17,5	1
117	137	20	2-08368	21	2
124	134	6	2-07484	6,5	2
126	138,2	7,8	2-06915	8,3	1
129	140	6,5	2-07272	7	1
130	145	10,5	2-07929	11,5	1
135	155	20	2-05974	21	2
160	180	20	2-05972	21	2
165	185	20	2-06777	21	2
170	190	20	2-05827	21	2
173	183	7,2	2-06987	7,7	1
174	182	6	2-07043	6,5	1
175	183	6	2-06986	6,5	1
175	195	20	2-09680	21	1
178	188	7,2	2-06988	7,7	1
180	200	20	2-09226	21	2
198	218	20	2-08294	21	2
205	225	20	2-09679	21	1
220	240	20	2-05828	21	2
225	245	20	2-06900	21	2
240	260	20	2-09404	21	1
245	265	20	2-09231	21	2
270	290	20	2-07802	21	1
300	320	20	2-09403	21	1
340	360	20	2-09521	21	2







## MATERIALS

UGA 5 Rings are delivered in the standard-material-combinations WS 951 and WS 969. They consist of a NBR impregnated cottonfabric material with different structure and a onvulcanized rubber-block of NBR. Delivery in a FKM-Aramide-fabric combination is possible. Standardly the rings have graphite on the surface.

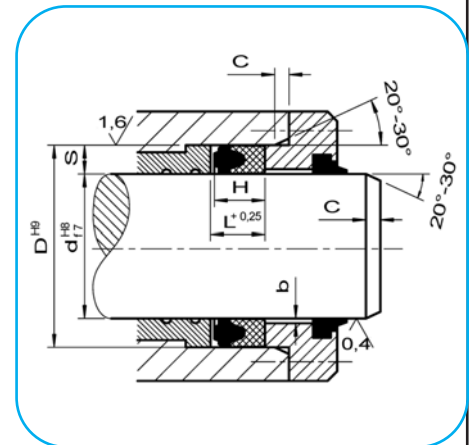
## RECOMMENDED VALUES FOR APPLICATION

OPERATING MEDIUM	p(bar)	t(°C)	v(m/s)
mineral oil oil-water- -emulsions	< 250	-20 up to +110	< 0,5

## INSERTION CHAMFER

S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10

## CYLINDER SEAL



$$b_{zul} = 0,4 - 0,0008 p \quad (\text{for } p \text{ up to } 250 \text{ bar})$$

## NOMINAL SEAL DIMENSIONS

d	D	H	TOOL No.	L
10	17	6	2-10134	6,3
12	19	6	2-10135	6,3
19	28,4	6,5	2-11139	7
20	28	6	2-10139	6,3
22	30	6	2-10140	6,3
25	33	6	2-10141	6,3
30	42,8	7	2-11174	7,5
30	45	8,5	2-09135	9
32	40	6	2-10143	6,3
36	44	6	2-10144	6,3
40	48	6	2-10145	6,3
40	48	8	2-09109	8,5
40	55	10	2-11003	11
45	55	7,5	2-10146	8
47	55	6	2-12702	6,3
50	60	7,5	2-10147	8
55	63	8	2-08126	8,5
63	75	9	2-10149	9,5
71	79	8	2-08171	8,5
80	92	9	2-10151	9,5
85	110	20	2-11004	21
100	115	11,5	2-10153	12,5
125	140	11,5	2-10155	12,5
320	350	24	2-09941	25
420	460	30	2-09940	31





## STANDARD V-PACKINGS

- multipart seal with 1-7 sealing rings, 1 male adapter ring and 1 female adapter ring
- to be retensioned by means of spreading lips, resulting in a longer lifetime
- closed design up to a max. diameter of 800 mm
- possibility for an open design for min. 3 sealing rings
- open design available up to a max. diameter of 1500 mm
- design with studded male adapter ring for installation areas without retensioning possibility.

## RECOMMENDED VALUES FOR APPLICATION

For further materials please refer to the general table

SEALING MATERIAL	OPERATING MEDIUM	HYDRAULIC SYSTEMS		
		p(bar)	t(°C)	v(m/s)
071	mineral oil	< 400	-25	< 0,5
072	oil-water-emulsions water		up to +120	

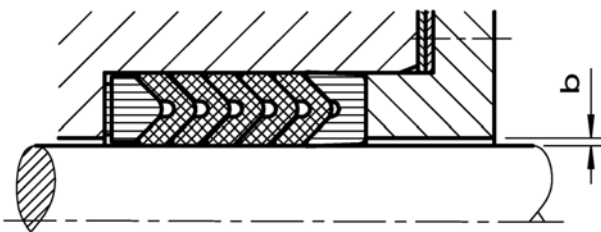
## APPLICATION

- plungers and piston rods for presses
- mobile hydraulic systems
- working cylinders for medium up to heavy operating conditions
- frequent change of pressure
- for new design series NK-N, NK-K, NK-H

## CLEARANCE BEHIND THE SEAL

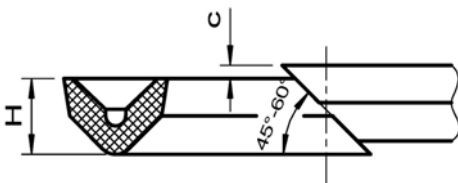
Too much clearance behind the seal leads to a premature failure of the seal. The admissible clearance behind the seal is calculated as follows:

- b = clearance behind the seal
- p = operating pressure (bar)
- $b_{adm} = 0,4 - 0,0007 p$



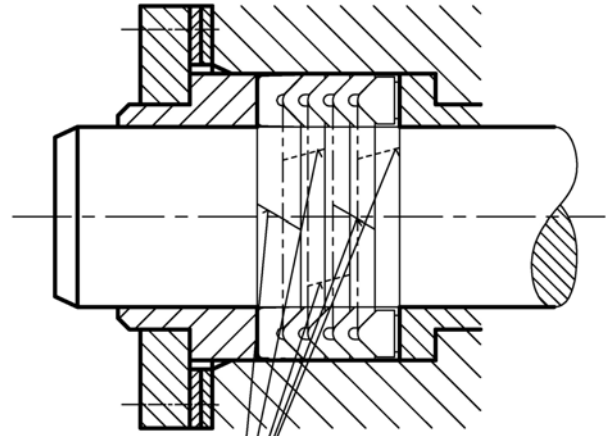
## RIGHT CUTTING FOR INSTALLATION OF OPEN SEALING SETS

$$c = 0,1H$$



## INSTALLATION OF OPEN SEALING SETS

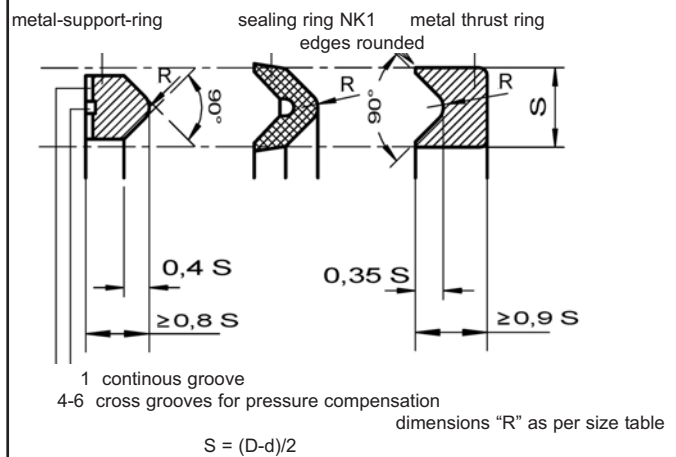
- cutting to length by HECKER or contact us for further information
- first position the gaps
- prior to the first stroke, slightly tighten the collar
- retighten until an optimum sealing efficiency is achieved
- Note: In the case of media causing swelling of the seal, please retighten after the initiation phase



gaps offset by approx. 120°

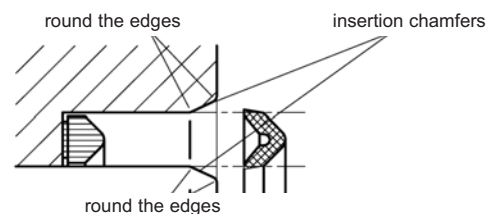
## SUPPORT

If there are no fitting tools for adapter rings, the customer will be able to fabricate them from a piece of metal. The following illustration serves for a correct dimensioning, or you may contact us for more detailed information.



## TOOLS FOR INSTALLATION

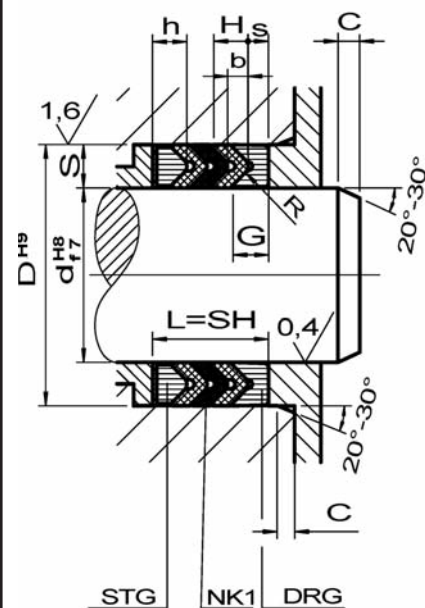
To protect the thin sealing lips please use the right tools and look for insertion chamfers.





## PISTON ROD SEAL

NOMINAL SEAL DIM.				TOOL NO.		MALE AD.RING		FEMALE AD.RING		
d	D	H	b	FABRIC	RUBBER	h	ToolNo	G	s	ToolNo
3	11	3,4	1,6		2-04432					
4,7	14,3	4,5	2,5		2-04310					
5	15	4,2	2,4	2-05930		3,2	2-05930	3,6	1,8	2-05930
6	12	4,2	3,3	2-05230		2,5	2-05230	2,5	1,5	2-05230
6	14	3,4	2	2-05753		5,9	2-05753	6	4,6	2-05753
6	14,5	4,5	2,8	2-05533						
6	16	4	2,2	2-09229						
6	16	4	2,2	2-09830						
6	19	5,5	3,2	2-05649						
8	16	4	2,5	2-05968						
8	16	4	2,6	2-05331		5	2-05331	5,5	4,2	2-05331
8	18	4	2,15	2-08319						
8	18	4,2	3,2	2-04969		4,5	2-04969	4,2	2,7	2-04969
8	20	5,1	2,7	2-05812		4,8	2-05812	5,7	3,6	2-05812
8	20	5,8	4	2-07922						
8	24	6,8	3,5	2-05676		4,1	2-05676	4,8	2	2-05676
9,5	22,2	4,5	2,3	2-05681		4,5	2-05681	6,5	4,5	2-05681
10	19,5	4,5	2,9	2-00434						
10	20	4	2,15	2-08320		4,5	2-08324	4,2	2,7	2-08325
10	20	4,2	2,5	2-02964						
10	22	5,1	2,9	2-07028		7,2	2-07028	7,5	5,5	2-07028
10	31	10	5,5	2-00546						
11	20	4	2,1	2-08957						
12	22	4	2,2	2-08933	2-08934	4,5	2-08933	5,7	4	2-08933
12	25	5,5	3	2-04967						
12	26	5,9	1,5	2-04594						
12	27	6	3,1	2-02672		8	2-02672	8	5,3	2-02672
12,7	22,2	4,5	2,5	2-01013						
12,7	25	6	3,7	2-00435		4,8	2-00435	4,7	3,6	2-00435
12,7	25,4	4,5	2,4	2-05682		4,5	2-05682	6,5	4,5	2-05682
13	32	7,6	4,4	2-11380						
14	24	4	2,2	2-09397	2-09398	4,5	2-09397	4,7	3	2-09397
14	30	6,8	3,7	2-05132						
14,3	28	5,3	2,5	2-08956						
15	25	4	2,15	2-08666	2-08672	4,5	2-08666			
15	25	5,5	3,7	2-05069		5,2	2-05069	6	4,1	2-05069
15	25	5,5	3,7	2-06750				4,7	3	2-06751
15	36	10	5,5	2-00547						
16	24	3,4	1,9	2-05836		9,6	2-05838	9,1	7,8	2-05837
16	26	7,5	5,6	2-03185		7,5	2-03185	7,5	5,5	
16	28	5,8	3,6	2-02772		5,8	2-02772	7	4,7	2-02772
16	30	5,9	4,2	2-05007		5,6	2-05007	6,5	4,6	2-05007
16	31	6,4	3,4	2-07705		4,1	2-07705	5,1	2,5	2-07705
17	30	5,2	2,9	2-09137						
17	30	5,5	3	2-09301						
18	26	3,2	1,8	2-09435		2,4	2-09435	3	2	2-09435
18	26	5	4	2-11404						
18	26	5,1	4	2-12972						
18	28	4,2	2	2-07046	2-07047	4,5	2-07046	5	3,5	2-07046
						5,5	2-08157			
18	28	5,8	4	2-09609						
18	30	5	2,8	2-02419		7	2-02419	7	5	2-02419
18	31	5,5	3	2-09365						
18	32	5,9		2-05169						
19	38	7,6	4,4	2-09089						
19,3	28,6	4,5	2,7	2-11321						
20	28	5,2	4	2-12973						
20	30	4,3	2,2	2-05544	2-05545	5,7	2-05544	6	4,4	2-05544
						4,5	2-08259	4,7	3	2-08260
20	31,5	4,7	2,4	2-06697		5,5	2-06697	7,2	5,2	2-06697
20	32	4,8	2,6	2-08667		6	2-08667	5	3	2-08667
20	33	5,2	2,8	2-08499	2-08500					



L = installation length

SH = height of set

x = number of NK1-Rings

$$L = SH = x \cdot b + h + s$$

The height of sealing set or installation length which can be calculated according to the above formula is a recommended value. Depending on the respective width of profile, number of rings, material shrinkage etc., deviations up to +2 and -1 mm are possible.

## INSERTION CHAMFER

S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10





NOMINAL SEAL DIM.				TOOL NO.		MALE AD.RING		FEMALE AD.RING		
d	D	H	b	FABRIC	RUBBER	h	ToolNo	G	s	ToolNo
20	34	5.3	3	2-09574						
20	34	5.3	3		2-12115					
20	34	5.9	3.3	2-03902		5.6	2-03902	6.6	4.2	2-03902
20	35	6.4	3.4	2-06473		4.5	2-06473	5	2.4	2-06473
20	42	9		2-02605						
22	32	4	2.2	2-08556	2-08557	4.5	2-08556	4.7	3	2-08556
22	33	4.7	2.7	2-03362				7	5.3	2-11136
22	38	6.8	3.4	2-05864						
22	40	7.6	4.4	2-04459		8.8	2-04459	10	7	2-04459
22	42	8.5	4.8	2-05877						
22.2	34.9	5.4	3	2-06869	2-06870					
23.5	33	4.1	2.1	2-08959						
23.5	35	4.5	2.1	2-08958						
24	36	5.1	2.8	2-05201		4.8	2-05201	5.7	3.6	2-05201
25	35	4.3	2.3	2-05542	2-05543	6.5	2-0542	6.6	5	2-05542
25	36	4	2.2	2-11468						
25	37	4.8	2.6		2-08321	6	2-08322	5	3	2-08323
25	37	5.1	2.7	2-06696		4.6	2-06696	7.2	5.2	2-06696
25	40	6	3.2	2-08668		4	2-08668	4.5	2	2-08668
						4.5	2-07225	4.8	2.3	2-07226
25	40	6.4	3.5	2-03844		8.5	2-03844	8.3	5.5	2-03844
25.4	38.1	5	2.7	2-02359	2-06928	4.5	2-02359	4.5	2.3	2-02359
								7.8	5.8	2-06929
25.4	41.3	6.8	3.6	2-06797		6	2-06797	8	6.4	2-06797
26	40	5.5	3	2-12504	2-12504					
26	42	5	2.8	2-11257						
26	42	6.4	3.6	2-09652		6	2-09652	6.8	4	2-09652
28	38	5.5	4	2-12974						
28	40	5.1	2.7	2-05839	2-07911	5.5	2-05839	6	4	2-05839
						6	2-08158			
28	42	6	3.5	2-05044		7	2-05044	9.5	7	2-05044
28	44	5.5	3	2-12864						
28	44	6.8	5.4	2-05011						
28	44	6.8	4.7		2-09763					
28	48	8.5	5.9	2-07162						
28.6	41.3	6	3.8	2-09969				6.5	5.4	2-09969
28.8	39	4.2	2.4	2-03260		5	2-03260	5	2.45	
30	38	5	4	2-12975						
30	40	4.2	2.3	2-01820		5.5	2-09125	4.7	3	2-09126
30	42	4.8	2.6	2-08353	2-08354					
30	42	5.1	2.9	2-12467		6	2-08353	5	3	2-08353
30	42	5.8	3.9	2-08091						
30	43	5.5	2.9	2-05492		6.8	2-05492	7.2	4.9	2-05492
30	45	6	3.2	2-08497		5	2-08497	4.5	2	2-08497
30	46	6.8	3.7	2-03505	2-03505	10.3	2-03505	8.2	4.3	2-03505
30	48	9	5.8	2-05620						
30	50	8.5	4.3	2-03451		7.5	2-03451	11.4	7.5	2-03451
31.5	44.5	5.5	3.2	2-02030		5.5	2-02030	6.5	4.5	2-02030
31.75	50.8	8.1	4.5	2-06901		6.3	2-06901	8	4.7	2-06901
31.75	44.45	5.4	3.1	2-06909		5.7	2-06909	7.2	5	2-06909
32	44	4.8	2.6	2-08131	2-08132	6	2-08131	5	3	2-08131
32	45.3	5.3	3.2	2-04483	2-04484	4.2	2-04483	8	6.4	2-0483
32	47	5.4	3	2-12408						
32	49	7.2	4	2-05066		6.8	2-05066	8	5.1	2-05066
32	50	7.6	4.4	2-05209		7.2	2-05209	8.5	5.3	2-05209
32	52	8.5	4.9	2-07063		8.3	2-07063	11.5	8	2-07063
33.34	52.39	8.1	4.65	2-07407		7.8	2-07407	7.5	4.2	2-07407
34.93	53.98	8.1	4.5	2-03907		7.8	2-03907	8	4.25	2-03907
35	47	5.1	2.9	2-07909	2-07910	6	2-07909	5	3	2-07909
35	48	5.5	3.2	2-07228		5.2	2-07228	6.8	4.6	2-07228
35	50	6	3.2	2-08559		4	2-08559	4.7	2.1	2-05934
						5	2-07931			

NOMINAL SEAL DIM.				TOOL NO.		MALE AD.RING		FEMALE AD.RING		
d	D	H	b	FABRIC	RUBBER	h	ToolNo	G	s	ToolNo
						4.4	2-07224			
35	50	6.4	3.7	2-04108	2-04108	5.8	2-04108	6	3.3	2-04108
						5	2-07931	9.8	6.8	2-05478
						4.4	2-07224	4	2.1	2-05934
35	51	6.8	3.9	2-07873				7.8	5	2-07873
35	55	8.5	4.6	2-03241		7	2-03421	8.5	3.7	2-03241
36	48	4.8	2.7	2-08964	2-08965	6	2-08964	5	3	2-08964
36	48	6	4	2-07237						
36	51	5.5	3	2-12409						
36	52	6.8	3.7	2-03157						
37	53	6.8	3.9	2-07973	2-07972	7.5	2-07973	7	4.5	2-07973
37	55	7.3	3.5	2-08960						
37.9	50.8	5	2.9	2-01906						
38	52	5	2.1	2-08961						
38	54	8	4.5	2-00961						
38	58	8.5	4.6	2-03677		12.5	2-03677	12	8.7	2-03677
38.1	50.8	5.5	2.9	2-06532	2-06526	6.3	2-06532	6.6	3.9	2-06532
39	51	4.8	2.6	2-08099	2-08100	6	2-08099	5	3	2-08099
40	51	4.7	2.7	2-07717		6.4	2-07717	6.5	4.8	2-07717
40	51	4.7	2.7		2-11581					
40	52	5.1	2.9	2-07648	2-07649	5	2-07648	5	3	2-07648
						6	2-08159			
40	55	6	3	2-08232	2-06075	4	2-08232	4.5	2	2-08232
40	55	6.4	3.5	2-03891		5	2-03891	5.5	2.5	2-03891
40	55	7	3.2	2-06665		9.5	2-06665	9	5.2	2-06665
40	56	6.8	3.6	2-06118		7.5	2-06118	8.5	5.8	2-06118
40	58	8	4.9	2-11121				7.5	4.7	2-11121
40	60	8.5	4.6	2-04546		9	2-04546	11.5	8	2-04546
40	62	8.8	4.9	2-09653		8	2-09653	9.8	6	2-09653
40	65	8.5	4	2-04809		7	2-04809	8.5	4	2-04809
40	65	10.5	5.7	2-02712		10	2-02712	10	6	2-02712
40.48	64.7	11.2	6.8	2-07442						
41.3	57.1	6.7	3.9	2-07467						
42	54	5.1	3	2-05318	2-07991	4.8	2-05318	5.1	3	2-05318
						6	2-08160			
						5	2-08578			
42	58	6.5	3.7	2-08578						
44	56	5	2.8	2-05497	2-05498			6.4	5.7	2-05497
44	56	5	2.8		2-11662					
44	70	10.7	6.7	2-08652		9.5	2-08652	12.5	8	2-08652
44.45	63.5	8.1	4.5	2-03908		7.8	2-03908	8	4.25	2-03908
44.5	57.5	5	2.9	2-02360		5.5	2-02360	5.5	3.5	2-02360
44.5	60.3	6.3	3.4	2-08035	2-08036	6	2-08035	6.8	3.5	2-09157
45	57	4.5	2.5	2-09114	2-09115	4	2-09114	4.5	2.3	2-09114
45	60	6.4	3.1	2-07229	2-07921	5	2-07229	4.5	2.3	2-07229
						5.5	2-08677			
45	61	6.4	3.5	2-08135		kontrolliert				
45	65	7.2	3	2-08231		5.9	2-08231	8	4.5	2-08231
45	65	7.2	3.5		2-08628					
45	65	8.5	4.5	2-02474		7.5	2-02474	7.5	5.5	2-02474
45	65	8.5	4.5		2-05964					
45	69	12	6.3	2-00976						
47	65	7.6	4.3	2-07347		8	2-07347	8.3	6.2	2-07347
48	60	4.5	2.5	2-09116	2-09117	4	2-09116	4.5	2.3	2-09116
48	63	6.4	3.7	2-07908		6	2-07908	5.3	2.8	2-07908
48	65	8.5	4.4	2-05063		8.5	2-05063	9.5	6.5	2-05063
48	68	6	3.5	2-05105						
48	68	8.5	4.9	2-09922						
48	72	10.2	5.9	2-06904	2-06905					
48	85	14.8	7	2-08582		12	2-08582	14	7	2-08582
50	60	4.2	2	2-11043						
50	61	4.7	3	2-08692		5.1	2-08692	6.3	4.5	2-08692
50	61	4.7	2.4		2-08693					





NOMINAL SEAL DIM.				TOOL NO.		MALE AD.RING		FEMALE AD.RING		
d	D	H	b	FABRIC	RUBBER	h	ToolNo	G	s	ToolNo
50	62.6	5.5	3.1	2-11673	2-11674	6.8	2-11673	7.6	5.4	2-11673
50	65	6	3	2-07986	2-07987	5	2-07986	6	3.5	2-07986
50	65	6.4	3.5	2-04107	2-04107	6.6	2-04107	6	3	2-04107
						3.5	2-07630			
50	65	6.4	3.3	2-05495	2-05496			8.8	6.2	2-05495
								11.5	9	2-09094
50	65	6.4			2-05496					
50	70	8	4.3	2-08245		5.5	2-08245	6	2.5	2-08245
								8	4.5	2-08864
50	70	8.5	5		2-08343					
50	70	9	5.1	2-06670		9.5	2-06670	10	6	2-06670
50	70	10	6.4	2-05618						
50	75	10.5	5.7	2-02795		7	2-02795	7	3	2-02795
50	78	12	6.5	2-02606						
50	80	14	8.4	2-04669						
50.3	63.5	5.5	2.95	2-06798		3.6	2-06798	6.2	3.9	2-06798
50.3	76.5	11.9	7	2-04262		9.4	2-04262	12.5	7.6	2-04262
50.8	63.5	5	2.5	2-06676		4	2-06676	7	4.9	2-06676
50.8	63.5	5.4	3.1	2-06867	2-06868	3.8	2-06867	5.3	3.3	2-06867
50.8	66.7	6.4	3.6	2-08655		7	2-08655	7.5	5	2-08655
50.8	69.8	9	5.5	2-03189	2-03190	5.5	2-03189	9	4.6	2-03189
50.8	70.8	10.5	6.5	2-06669		10.5	2-06669	11.3	7	2-06669
50.8	76.2	10.6	6	2-06652		9.5	2-06652	11	6	2-06652
52	71.5	8.3	4.8	2-07123		7	2-07123	7.3	2.9	2-07123
52	72	8	4.4	2-09727		5	2-09727	6.5	3	2-09727
52	76	10	4.9	2-02624		9.5	2-02624	9.5	5.5	2-02624
53.98	73.03	8	3.8	2-07406		7.8	2-07406	8	4.2	2-07406
54	69.8	6.7	3.9	2-07762	2-07761	5	2-07762	6.4	3.5	2-07762
54	74	8.5	5.3	2-04788		10.5	2-04788	9	5.7	2-04788
54	79.2	10.9	6.4	2-12844						
54	80	11	6.3	2-08004						
55	70	5.9	2.9	2-06374	2-06373	4.2	2-06374	5.5	2.7	2-06374
						4.5	2-08161	9	6.7	2-08540
55	75	8	4.3	2-08669		5.5	2-08669	6.5	3	2-08669
55	75	8	4.5		2-11461					
55	75	8.5	4.9	2-03518						
55	75	10.2	6	2-06666		12.8	2-06666	12	7.5	2-06666
55	75	11.5	7.5		2-06513					
55	79	10.2	5.6	2-03024		11	2-03024	11	6.1	2-03024
55.5	68.3	5.4	2.4	2-11322						
56	65	4	2	2-02714						
56	71	6	3.2	2-11296	2-11297	4	2-11296	4.5	2	2-11296
57.1	76.5	8.5	5.2	2-02033	2-02034	6.5	2-02033	8	3.5	2-02033
57.15	76.2	8	4.1	2-06414		6.3	2-06414	7.5	4	2-06414
60	75	5	2		2-08225					
60	75	6	3.3	2-05513	2-05514	5	2-05513	5.5	3	2-05513
60	75	5	2		2-08225	6	2-08162			
60	76	20	17.3	2-03758						
60	80	6.2	2.3	2-03095		5	2-07473	5.5	2.7	2-07274
60	80	7	2.8		2-03096	5.5	2-07273	10	7	2-08167
60	80	7	3.6	2-08737						
60	80	8.5	4.3	2-02473		7.5	2-02473	7.5	4.5	2-02473
60	80	8.5	4.9		2-08656					
60	80	20	16.7	2-03757						
60	85	10	5.4	2-08732		17	2-08732	14.5	10	2-08732
60	90	12.5	6.2	2-02706		12	2-02706	12	7	2-02706
60	96	15.3	7.6	2-05484		14.4	2-05484	17.1	10.8	2-05484
60.1	68	3.8	2.3	2-03064		3.8	2-03064	5.2	3.3	2-03064
62	77	6.4	3.4	2-05932	2-05933	8	2-05932	9.5	7	2-05932
63	78	6	3.2	2-08236	2-08237	4	2-08236	4.5	2	2-08236
63.5	76.2	5.4	3.1	2-07002		5	2-07002	5	3	2-07002
63.5	76.2	5.5	2.3	2-01520						

NOMINAL SEAL DIM.				TOOL NO.		MALE AD.RING		FEMALE AD.RING		
d	D	H	b	FABRIC	RUBBER	h	ToolNo	G	s	ToolNo
63.5	79.3	6.8	3.6	2-06802		10.5	2-06802	8	5.1	2-06802
63.5	79.3	6.8	3.9		2-08833	5.5	2-01281			
						10	2-06940			
63.5	79.4	6.5	3.5	2-01283						
63.5	79.4	7	4	2-01282						
63.5	82.55	8.1	4.5	2-06863		6.3	2-06863	8.3	5	2-06863
63.5	83.1	8.5	4.9	2-03311	2-03311	6	2-03311	6	1.9	2-03311
63.5	85.7	9.3	4.8	2-06795						
63.5	95.3	13.6	7.1	2-06796		7.6	2-06796	10.8	5.2	2-06796
65	77	4.8	2.5	2-08273	2-08274	6.2	2-08273	5.5	3.5	2-08273
65	80	6	3	2-07647	2-08101	5	2-07647	5.5	3	2-07647
65	85	8.5	4.5	2-02715		7	2-02715	7.5	4.2	2-02715
								6.9	3.6	2-09687
65	95	12.8	7.3	2-07100		10	2-07100	10	4.5	2-07100
65	95	14	7.2		2-02755					
66.7	82.5	6.3	3.4	2-08106	2-08107	5.9	2-08106	7.3	4.5	2-08106
								6	3.2	2-08914
68.26	87.31	8.1	4.7	2-08050		7.8	2-08050	15.2	10.6	2-08050
69.8	79.4	4	2.4	2-03183		6	2-03183	6	3.7	2-03183
69.8	88.9	9	5.2	2-06059		4.7	2-06059	5.5	2.5	2-06059
69.85	88.9	8.1	4.1	2-06862		6	2-08108	6	2.5	2-08915
69.9	88.8	8.6	5.3	2-07571	2-07572	11.6	2-07571	11.7	7.7	2-07571
69.9	88.9	8.1	4	2-06213	2-06214					
70	85	6	3.2	2-05499	2-05500	4.6	2-05499	4.5	1.9	2-05499
						10	2-09038	11.5	9	2-09039
								14	12	2-09056
70	86	7	4.1	2-09814		13	2-09814	13	10	2-09814
70	89	6	3.3	2-06605		7.5	2-06605	6.2	4	2-06605
70	89	7.5	3.7		2-06606					
70	90	8.5	4.9	2-04156		8.2	2-04156	7.7	4	2-04156
70	90	8.5	4.3		2-05624	10	2-05624	10.5	7.2	2-05624
70	90	8.5	5	2-06014		10	2-05624	10.5	7.2	2-05624
70	90	8.5	4.9		2-08733					
70	90	9	5	2-06671		9.5	2-06671	9	4.9	2-06671
70	90	8.5	4.3	2-04156		8.2	2-04156	7.7	4	2-04156
70	95	10	5.6	2-09805		10	2-09805	11.5	7	2-09805
70	96	10.4	5.8	2-08149		6.8	2-08149	11.5	7	2-08149
73.02	86	5.1	2.8	2-09583						
74.6	87.3	5.4	2.9	2-11323						
74.6	88.9	5.9	3	2-06127						
75	87	5.1	2.7	2-06097	2-06098	4.1	2-06097	3.8	1.5	2-06097
75	90	6	3.3	2-07646		4	2-07646			
75	90	6	3.2	2-08219	2-08220	4	2-08219	5	2	2-08219
75	90	6.4	3.8	2-05501		7.6	2-05501	7.3	4.7	2-05501
75	95	8	4.3	2-08329		10	2-08329	11.5	8	2-08329
75	95	8	4.5	2-08857						
75	105	13	7	2-01967		17	2-01967	14.5	8.8	2-01967
76.2	101.6	10.6	6.2	2-06654		14	2-06654	11.2	6.2	2-06654
78	86	3.4	1.6	2-03055		4.8	2-03055	5.2	3.6	2-03055
78	100	9	5	2-02654		7.5	2-02654	7.5	4	2-02654
79.4	98.4	8	4.7	2-07764	2-07763	5	2-07764	6.4	3.4	2-07764
80	95	5	2		2-05516	6	2-08163			
80	95	6	3	2-05515		5	2-05515	5.5	3	2-05515
								12	9.5	2-08953
80	100	8.5	4.8		2-08658					
80	100	8.5	4.6	2-05020		8	2-05020	9.5	6	2-05020
80	100	8.5	5.3	2-06015				11.3	7.8	2-07923
80	100	9.5	5.5	2-07318						
80	104	10.2	5.9	2-07673		11	2-07673	14	10	2-07673
80	105	13	7.5	2-06667		14	2-06667	14.5	10	2-06667
80	110	12.5	6.7	2-02707		16.5	2-02707	12.2	7.2	2-02707
80	110	12.5	6		2-06976					





NOMINAL SEAL DIM.				TOOL NO.		MALE AD.RING		FEMALE AD.RING		
d	D	H	b	FABRIC	RUBBER	h	ToolNo	G	s	ToolNo
80	110	15	8.3	2-05619						
80	112	13.6	7.5	2-03305		14	2-03305	14	6	2-03305
81.8	107.9	11.2	5.5	2-07766		13	2-07766	15.2	10.6	2-0766
82.5	101.6	8	4.4	2-02530		7	2-02530	8	5	2-02530
82.5	101.6	8	4.5		2-06924					
82.55	107.9	11.2	6.3	2-08049		13	2-08049	15.2	10.6	2-08049
85	100	6	3.2	2-08222	2-08222	3.8	2-08221	5	2.2	2-08221
85	100	6.4	3.7	2-07629		5	2-07629	6	3.5	2-07629
85	105	8	4.3	2-08671		10	2-08671	11.5	8	2-08671
88.9	114.3	9.8	4.7	2-06060		10	2-06060	10	5	2-06060
90	102	5.1	3.2	2-04589						
90	105	6	3.2	2-08284	2-08285	4	2-08284	4.5	2	2-08284
90	110	8.5	4.5	2-07227		8	2-07227	10.5	7	2-07227
						10	2-08165			
90	114	10.2	5.7	2-05142	2-05143	9.6	2-05142	11.4	7.2	2-05142
92.08	104.78	5.4	2.7	2-06859	2-06860	3.1	2-06859	6	3.9	2-06859
95	110	6	3.2	2-08052	2-08053	4	2-08052	4.5	2	2-08052
95	120	10.6	6	2-11125						
95	130	12	4	2-05253						
95.25	114.3	7.6	3.9	2-08895				7.3	4.5	2-08034
95.25	114.3	8.1	4.7	2-06464	2-08033	6.5	2-06464	9	5.7	2-06464
97	120	7.6	3.2	2-03097						
97	120	8.5	3.9		2-03098					
97	120	9.5	5	2-02471		8	2-02471	8	4	2-02471
98.4	114.3	7	4.3	2-07573	2-07574	6.35	2-07573	6.35	3.75	2-07573
100	112	5.8	3.9	2-09268						
100	115	6	3.2		2-08316	6	2-08316			
100	115	6.4	3.2	2-05532		9.5	2-05532	10	7.5	2-05532
100	116	7.8	5	2-05438		12.7	2-05438	9.7	6.9	2-05438
100	120	8.5	4.5	2-04287		9	2-04287	9.5	5.8	2-04287
100	120	9	4.9	2-06672		8	2-06672	9	5.4	2-06672
100	125	10.6	5.8	2-05931		11.3	2-05931	13.5	9	2-05931
						10	2-08713	12	7.5	2-09058
100	130	12.8	7	2-03018		16	2-03018	16	8.6	2-03018
101.6	127	10.8	6.2	2-06990		10.4	2-06990	7.8	3	2-06990
101.6	127.8	11	6.9	2-03227		10	2-03227	10	3.5	2-03227
102	127	10.5	5.8	2-02044		6	2-02044	13	9	2-02044
104	130	11.8	6	2-06668		10	2-06668	12.5	6.5	2-06668
104.77	123.8	7.6	4.3	2-09584						
105	125	7.9	4.5	2-09055		10	2-09055	10.5	7	2-09055
105	130	10.6	5.2	2-11693						
107.9	127	8.1	4.2	2-06091	2-06092	7.5	2-06091	8.7	5.4	2-06091
110	125	6.4	3.2	2-06927	2-06926	8	2-06927	5.7	3	2-06927
						11	2-08168			
110	130	8	4.3	2-08366		10	2-08366	13.5	10	2-08366
110	135	10.6	5.2	2-06698		10	2-06698	10	5.5	2-06698
110	135	10.6	6.1		2-07056					
112	144	13.6	7.5	2-04735		11	2-04735	12.5	6.5	2-04735
112	152	17	9.2	2-05439						
113	126.2	4.5	2.3	2-01927						
113	127	6	3.2	2-02820	2-07038	5	2-02820	6	3.2	2-02820
114	140	10.4	5.8	2-01814		8	2-01814	14	8	2-01814
114.3	127	5.4	2.8	2-06857	2-06858	5.3	2-06857			
114.3	133.4	7.6	4.3	2-09585						
114.3	136.5	9.4	5.4	2-07760	2-07759	5.1	2-07760	9.8	5.9	2-07760
114.3	137.7	11	6.3	2-07355		10	2-07355	14	8	2-07355
114.8	145.6	13.2	7.3	2-04717		12.4	2-04717	14.7	8.8	2-04717
115	130	6	3.2	2-08244	2-08243	6	2-08244	10	7.5	2-08244
								7.5	5	2-09052
115	140	10.5	6	2-03240		14.8	2-03240	10	5.3	2-03240
						10.5	2-08166	13.5	8.8	2-08716
115	145	12.8	7.4	2-07482				12	7	2-07482

NOMINAL SEAL DIM.				TOOL NO.		MALE AD.RING		FEMALE AD.RING		
d	D	H	b	FABRIC	RUBBER	h	ToolNo	G	s	ToolNo
117.5	136.5	7.6	4.3	2-09603						
118	140	9	4.4	2-02652		7.5	2-02652	7.5	4	2-02652
118	140	9	4.9		2-07057					
118	144	11	6.4	2-07023						
120	136	6.2	4.3	2-04283		6	2-04283	8	6	2-04283
120	140	8.5	4.6	2-07632		7.5	2-07632	7	3.5	2-07632
121	151	14	8.4	2-05168						
125	140	6	3.2	2-08526	2-08527					
125	150	10	5.4	2-08374		10	2-08526	10	7.5	2-08526
125	150	10	5.3	2-11477						
125.7	139.7	6	3.4	2-02026	2-02027	5	2-02026			
127	152.4	9.8	5	2-06061		8.4	2-06061	10	5.5	2-06061
						10	2-07361	12	7.5	2-07361
130	145	6	3.4	2-09103	2-09104	9.3	2-09103	9.7	7.2	2-09103
130	160	12	6.5	2-08712		12	2-08712	14.2	9.5	2-08712
130.1	152.4	9.3	4.8	2-06085	2-06086	8.8	2-06085	10.4	6.6	2-06085
133.35	152.4	8	4.7	2-09710						
135	157	9.4	5.7	2-06053		7.8	2-06053	9.5	5.6	2-06053
135	165	12.8	7.4	2-07171						
138.3	165.1	10.7	6.1	2-09989						
139.7	165.1	10.6	6.2	2-06794		10.3	2-06794	12	7.7	2-06794
140	155	6	3.2	2-08598	2-08599	10	2-08598	10	7.5	2-08598
140	160	9	4.8	2-06673		7.6	2-06673	9	5.2	2-06673
140	165	10	5.5	2-08630		10.5	2-08630	12.5	8	2-08630
140	172	13.5	7.5	2-03239		12	2-03239	12	5	2-03239
142.9	184.15	17.6	9.6	2-04299		21	2-04299	18.6	11.4	2-04299
145	170	10.5	5.7	2-07319				12.5	7.5	2-07319
146	161.9	6.3	3.4	2-08047	2-08048	6	2-08047	6.7	3.8	2-08047
150	170	8	4.3	2-08454	2-08455	10	2-08454	11.5	8	2-08454
150	175.5	10	5.7	2-09354		14.3	2-09354	14.5	10	2-09354
150	180	12	6.5	2-08124		15	2-08124	18	12.5	2-08124
150	180	12.8	7.5	2-06662		20	2-06662	22.5	17.3	2-06662
								14.5	9	2-08714
150	182	13.6	7	2-06831						
152.4	177.8	9.8	5	2-06062		8	2-01284	11.5	6	2-01287
152.4	177.8	12	5.6	2-01286						
155.6	196.85	17.6	9.5	2-04300						
158.75	196.85	16.1	9.7	2-04263		20.4	2-04263	19	11.7	2-04263
160	180	8.5	4.7	2-05567		8.5	2-05567	11.5	7.9	2-05567
160	183	9.5	5.2	2-02651		8	2-02651	8	4.5	2-02651
160	190	12	6.5	2-08338		15	2-08338	17	11.5	2-08339
160	190	12.8	7.4	2-07670						
163	183	8	4.5	2-09249						
164	178	6	3.9	2-01770		7.5	2-01770			
						4	2-06923			
165	195	13	7.3	2-03364		12	2-03364	11	3.6	2-03364
170	200	12	6.8	2-11394						
170.2	184.2	6	3.5	2-06922		3.3	2-06921			
170.2	184.2	6	3.1	2-02678	2-02679	8.5	2-02678			
175	205	12	6.5	2-08966		15	2-08966	17	11.5	2-08966
177.8	203.2	10.5	5.3	2-06818						
180	200	8	4.3	2-08600	2-08601	10	Feb 00	11.5	8	2-08600
180	210	12	6.5	2-08226		15	2-08626	17	11.5	2-08626
199.15	230	12.4	6.9	2-08758		10	2-08758	12.5	7.3	2-08758
200	220	8.5	5	2-05520	2-05551	8.5	2-05520	10	6.5	2-05520
200	220	8.5	4.5	2-06171						
200	230	12	6.5	2-08735		15	2-08735	17	12	2-08735
200	240	17	9	2-04685		15.5	2-04685	15	8.5	2-04685
210	230	8.5	4.8	2-09337				7	3.4	2-02990
220	250	12	6.7	2-09217		17	2-09217	18.5	13	2-09217
222.25	247.65	10.5	6.4	2-06908						
240	272	13.6	7.3	2-04666		9.5	2-04666	12	6	2-04666

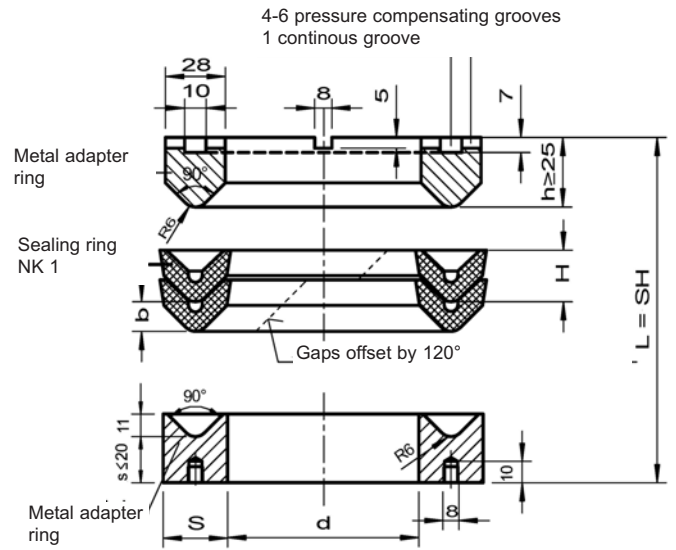




## NOMINAL SEAL DIM. TOOL NO. MALE AD.RING FEMALE AD.RING

d	D	H	b	FABRIC	RUBBER	h	ToolNo	G	s	ToolNo
250	280	12.8	7	2-11578						
265	305	17	9.4	2-06370		10	2-06370	11.5	4.3	2-06370
270	301	12.8	7	2-04286		10.5	2-04286	11	5.2	2-04286
280	310	12.5	6.5	2-02399		12	2-02399	12	7	2-02399
								18	12.5	2-09051
280	320	16	9	2-09910	2-09911			26	19	2-09910
285	315	12.8	6.9	2-05740		13	2-05740	10	4.8	2-05740
288	339	22	12.5	2-07816						
290	320	12	7.3	2-09233						
300	330	12.9	7	2-04837		12	2-04837	12.5	7	2-04837
315	355	17	9	2-04686		15.5	2-04686	15	8.5	2-04686
320	360	17	9.4	2-03221		16.5	2-03221	10.5	8.6	2-03221
320	390	30	15.5	2-05688						
330	360	12	6.8	2-09021		16	2-09021	19	15	2-09021
330	380	21.2	11.3	2-08967		20	2-08967	19	10.5	2-08967
340	380	15.8	8.8	2-08981		15	2-08981	17.5	10.5	2-08981
350	390	16	8	2-12660				18	11	2-12660
355	405	21.2	11.3	2-04687		20	2-04687	19	10.5	2-04687
356	395	16	8.4	2-05446						
360	390	12	7.3	2-09234						
370	400	12.5	6.7	2-02400		12	2-02400	12	7	2-02400
370	410	17	9.4	2-03222		16.5	2-03222	16.5	8.6	2-03222
370	412	17.8	10.9	2-04179						
388	418	12.8	7.1	2-03507		18.5	2-03507	11.5	5	2-03507
400	460	25.6	14.3	2-05760						
410	445	15	8.6	2-07413		14.2	2-07413	14	8	2-07413
420	450	12	7.3	2-09235						
450	490	15.8	8.8	2-09211				20	13	2-09211
455	495	16	8.6	2-08623		13	2-08623			
470	500	12.8	7.3	2-05803		12	2-05803	12	7	2-05803
474	515	16	8.4	2-12696						
480	520	15.8	8.8	2-12661				17	11	2-12661
500	530	13.2	8	2-09432		9	2-09432	12.2	7	2-09432
500	532	13.6	7	2-04408		12	2-04408	13	6.8	2-04408
500	540	15.8	8.8	2-09224				22	15	2-09224
500	550	21.2	11.2	2-04688		20	2-04688	19	10.5	2-04688
510	550	17	10.7	2-02764		17	2-02764	15	9	2-02764
512	557	19.2	10.6	2-04915		23	2-04915	27.1	19.2	2-04915
530	570	16	9	2-09210				16.5	9	2-09210
530	600	30	16.5	2-05689						
600	640	15.8	8.8	2-09209		16	2-09209	22	15	2-09209
600	650	21.2	12.3	2-03220						
626	666	17	8.6	2-11823						
630	670	16	9.9	2-09236						
630	680	21.2	12	2-04689		17	2-04689	19	10.5	2-04689
650	690	18	11.3	2-12662		23	2-12662			
700	738.5	16.1	8.2	2-06708		25	2-06708	27.5	20.5	2-06708
720	770	21.2	11.7	2-05810		17	2-05810	19	10	2-05810
800	850	21.2	12.2	2-06992		13.5	2-06992	19	10	2-06992

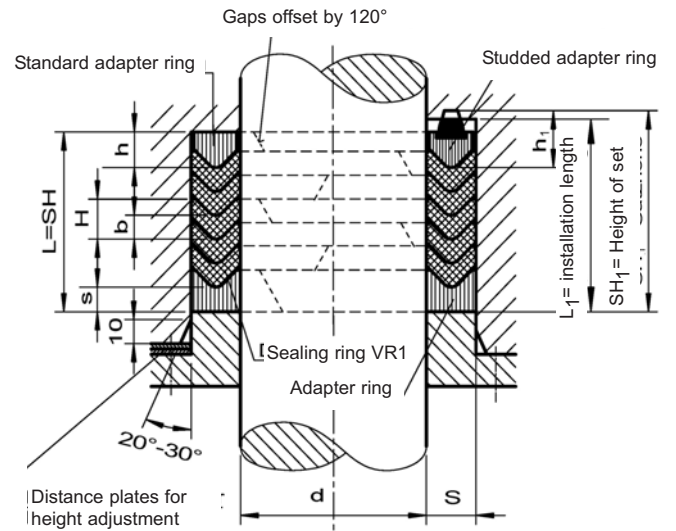
## NK 1



$L = SH = x \cdot b + h + s$   
 L = installation length  
 SH = height of sealing set  
 X = number of x-rings (at least 3 NK)

d 700-1500 / S 30 / H 25,6 / b 13,5 -> Ordern no. 2-5763  
 Adapter rings must be fabricated by the customer as per the above mentioned dimensions. Diameters from 700 up to 1500mm are available.

## VR 1



d 700-1500 / S 20 / H 17 / b 8 -> Ordern no. 2-6001  
 male AR: h 13 -> Order no. 2-6001  
 female AR: s 9 -> order no. 2-6001  
 studded male AR: h1 23 -> order no. 2-9209

Heights of sealing set and installation heights:

number of the rings	with stand.male adapter ring	with studded male adapter ring	
	Height of set=height of inst. S = L	height of set SH1	install. length L1
3	46	56	54
4	54	64	62
5	62	72	70
6	70	80	78
7	78	88	86





## TABLE (WITH STUDED SUPPORT RING)

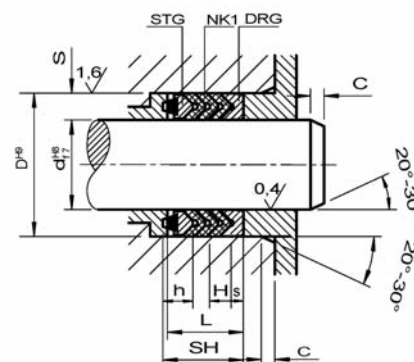
Dichtungsinnenmasse				Werkz.-Nr.	Nop.-Stützring		Druckring		SH		L		Bem
d	D	H	S		h	WZ-Nr.	s	WZ-Nr.	bei 3 NK	bei 5 NK	bei 3 NK	bei 5 NK	
50	70	8	10	2-08245	10,8	2-09070	3	2-08245	25,5	24,5	34	33	•
55	75	8	10	2-08669	10,8	2-09070	3	2-08669	25,5	24,5	34	33	•
60	80	8,5	10	2-02473	10,8	2-09070	2,7	2-07274	25,5	24,5	34	33	•
65	85	8,5	10	2-02715	10,8	2-09070	3,6	2-09087	27	26	36	35	•
70	90	8,5	10	2-05624	12,5	2-09073	7,5	2-05624	29,5	28	39,5	38	•
75	95	8	10	2-08329	12,5	2-09073	8	2-08373	33,5	32	42,5	41	•
80	100	8,5	10	2-05020	12,5	2-09073	7,8	2-07923	33,5	32	42,5	41	•
100	125	10,6	12,5	2-05931	8,5	2-09007	9	2-05931	35	34	46	45	•
150	170	8	10	2-08454	12	2-09066	8	2-08454	32	31	40	39	•
160	180	8,5	10	2-05567	12	2-09066	8	2-05567	33,5	32,5	42,5	41,5	•
180	200	8	10	2-08600	12	2-09066	8	2-08600	32,5	31,5	41	40	•
315	355	17	20	2-04686	26,5	2-09065	8,5	2-04686	63	61,5	81,5	80	•
320	360	17	20	2-03221	26,5	2-09065	8,5	2-03221	63	61,5	81,5	80	•
370	410	17	20	2-03222	23	2-09211	8,5	2-03222	59,5	58	78	76,5	•
450	490	15,8	20	2-09211	23	2-09211	13	2-09211	63,5	62	81,5	80	•
500	540	15,8	20	2-09224	23	2-09224	15	2-09224	64	62,5	82	80,5	•
530	570	16	20	2-09210	26	2-09210	9	2-09210	64	62,5	82	80,5	•
600	640	15,8	20	2-09209	23	2-09209	15	2-09209	65	63	82	80,5	•
650	690	18	20	2-12662	23	2-12662	9	2-06001	66	64	88,5	86,5	••
720	770	21,2	25	2-05810	23	2-12710	10	2-05810	68	66	91,5	89,5	•
800	850	21,2	25	2-06992	23	2-12710	10	2-06992	69,5	67,5	94	92	•

The studded male adapter rings listed in this table can also be applied for V-packings on the following table.

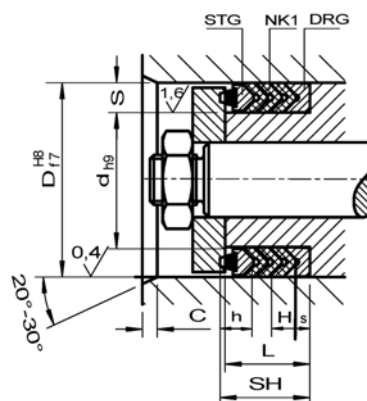
The elastic studs of the adapter ring enable an axial pre-tensioning of the sealing set within a solid installation area.

- = male adapter ring available in open design only
- = female adapter ring available in open design only

## PISTON ROD SEAL



## CYLINDER SEAL



L = installation length  
SH = height of set

## INSERTION CHAMFER

S	10	12,5	20
C	5	6,5	10







GSM-UK U-ring-sets are sturdy multisectional sealing-elements. They consist of adapter rings and several UK-Rings. The UK-Rings are conical at the back. If you put several UK-Rings to a set together, they touch itself only at the powerful back of the profile (back-radius). The sealing lips even lie exposed on that occasion and are spread by oncoming pressure. Therefore an axial after-tension is not possible.

If no tools for supports and thrust-ring are presented in our measurement-table, these must be manufactured out of metal of the customer.

## APPLICATION

UK-sets are suitable for the insulation of plunger pumps, piston-rods and pistons with high demand. The lying exposed lips guarantee a comparatively low friction opposite after-ductile set-types here, for example what with free-fall-plungers at sub-piston-presses of advantage is. Also the use proved itself at high-speed plunger pumps, that work with very high pressing and pure water without lubricant-addition as pressure-medium. If good insulation is necessary in the low-pressure-area, our after-ductile NK-sets should be preferred.

## RECOMMENDED VALUES FOR APPLICATION

SEALING MATERIAL	OPERATING MEDIUM	HYDRAULIC SYSTEMS		
		p(bar)	t(°C)	v(m/s)
071	mineral oil	< 400	-30	< 0,5
072	oil-water-emulsions water		up to +120	

## MATERIALS

Standard design and stockage is effected in materials 071 and 072. For some of the dimensions exist tools for polyurethan or pure rubber materials. In this cases a NBR-material (WS 858 / 86 ShoreA) or a polyurethane-material (WS 900 / 92 ShoreA) are recommended. For further materials, please refer to the general table. Thrust- and female adapter rings are made of hard compounds (WS 090).

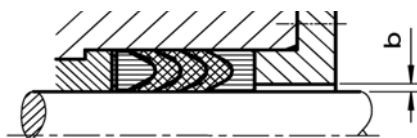
## CLEARANCE BEHIND THE SEAL

In case of the use of fabric female adapters the recommended clearance behind the seal ("b") is calculated as follows:

b = clearance behind the seal

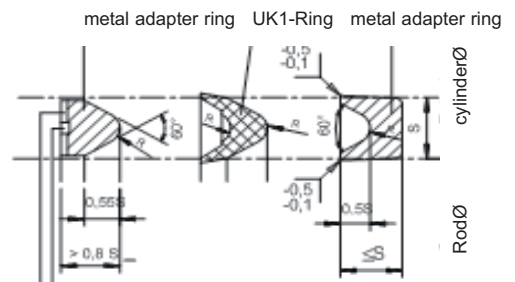
p = operating pressure (bar)

$$b_{zul} = 0,4 - 0,0007p \text{ (for } p \text{ up to 400 bar)}$$



## SUPPORT

For adapter rings in metal versions the following graphic is useful to fix the dimensions:



1 = continuous groove

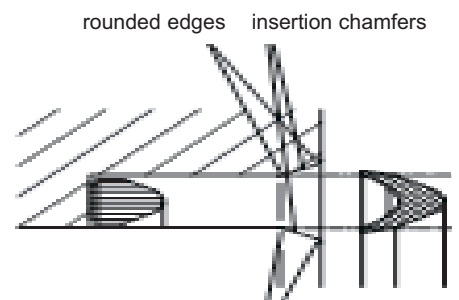
4-6 = cross grooves for pressure compensation

dimension "R" corresponding to dimension table

$$S = (D-d) / 2$$

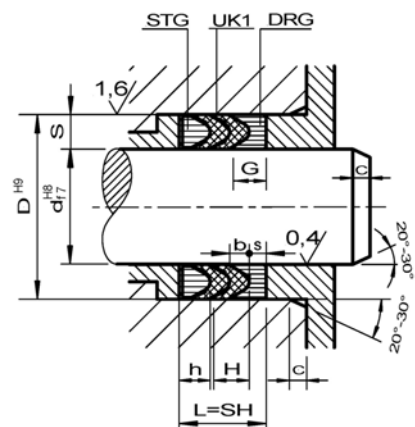
## INSTALLATION TOOLS

To save the thin sealing edges use correct tools and insertion chamfers.



round the edges

## PISTON ROD SEAL



## INSERTION CHAMFER

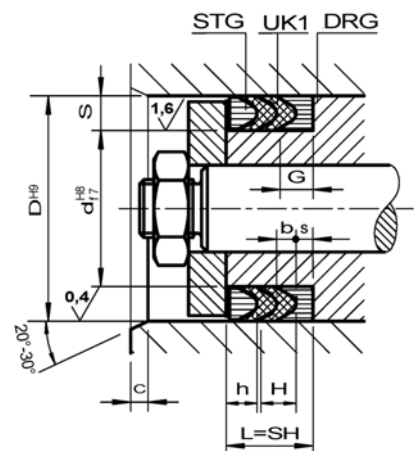
S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10



Nominal seal dimensions				Tool No.			male ad.ring		female ad.ring		
d	D	H	b	fabric	rubber	polyurethane	h	tool-no.	G	s	tool-no.
6	20	7	3.9	2-02504							
6	22	10	5	2-04789							
8	18	5	2.8	2-00148							
8	16	4.5	2.7		2-01417						
8	20	6	3.4	2-02094							
8	15.2	5	3	2-04161							
8	25	8.5	5	2-05981							
8	18	5.9	4	2-06771							
10	30	10	5.6	2-00983							
10	20	5	2.8	2-01422							
10	37	13.5	7.5	2-04938							
10	22	8	3.5	2-06958							
12	24	8	5.5	2-00663							
12	30	9	5.2	2-00900							
12	25	7	3.5	2-01205			9.5	2-00900	10	5	2-00900
12	18	4.5	3.2	2-01753							
12	34	11	6.2	2-01839							
12	32	10.2	6	2-03542							
12	22	5	2.8	2-07677							
12	26	7.7	4.6	2-12862							
13	40	13.5	7.8	2-00903							
13	37	12	6.7	2-04939							
13	36	11.5	6.4	2-04942							
13	25	6	3.3	2-06768							
14	34	10	5.6	2-01840							
14	26	6	3.4	2-02082							
14	26	6	3.5	2-05199							
14	28	7.2	5	2-12847							
15	30	7.5	4.3	2-00901							
15	32	8	4.5	2-01053							
15	40	13	9.5	2-01372							
15	35	10	5.5	2-01842							
15	25	5	2.7	2-02212							
16	40	12	7		V - 293						
16	40	12	7.2	2-00445							
16	42	13	8	2-00809							
16	30	7	4	2-00902							
16	37	11	5.8	2-01067							
16	36	10	5.6	2-02220							
16	25	4.5	2.5	2-02503							
16	28	6	3.3	2-12825							
18	30	6	3.4	2-01420							
18	27	4.5	2.5	2-02505							
18	35	8.5	4.8	2-02598							
18	40	11	6.2	2-02976							
18	26	4	2.1	2-06013							
18	28	5.5	4	2-09395							
18	28	6	4	2-11074							
18	28	6	4	2-12410							
19	30	5.5	3.2	2-02150							
19	36	8.5	4.8	2-04941							
19	35	8	4.5	2-04979							
22	45	11.6	6.3	2-12715							
24	39	7.5	4.2	2-03418							
24	38	7.4	4.5	2-12865							
24	34	6.4	4.5	2-12863							
25	45	10.5	6	2-01153							
25	50	12.5	7	2-01057							
26	46	10	5.6	2-02509							
29.5	40.5	5.5	3.1	2-04861			7	2-04861	7	4.3	2-04861
28	40	6	3.4	2-03301							
28	45	8.5	5	2-02596							
30	48	9	5.1	2-01009							
30	40	5	2.8	2-01145							
30	55	12.5	7	2-01980							
30	47	8.5	5	2-02288							
30	46	8	4.5	2-02582							
30	52	10	5.6	2-02829							

Nominal seal dimensions				Tool No.			male ad.ring		female ad.ring		
d	D	H	b	fabric	rubber	polyurethane	h	tool-no.	G	s	tool-no.
30	45	7.5	4.2	2-03331							
30	45	5	3	2-05712							
30	48	9	5	2-06411							
30.2	42.9	6.5	3.6	2-05218							
31	51	10	5.6	2-06410							
32	52	11	6	2-01021			10	2-01021	11.4	6	2-01021
32	44	6	3.4	2-06391							
32	46	7	3.8	2-08797							
32.6	58	12.5	6.8	2-06108							
33	56	11.5	6.5	2-01008							
33	58	17.5	10	2-02295							
33	50	8.5	4.8	2-03334							
34	65	15	9	2-00561							
34	54	10	6	2-00746							
35	55	11	6	2-01022							
35	49	7	3.9	2-01416							
35	60	12.5	7	2-02594							
35	45	5	2.8	2-02745							
35	59	12	7	2-04903							
35	52	8.5	4.8	2-05110							
35	65	15	8.4	2-06315							
35	68	16.5	9.2	2-06362							
35	50	7.5	4.5	2-08572							
36	55	10	6	2-00701							
36	58	11	6	2-06587							
36	60	12.2	7	2-09393							
38	62	12	6.8	2-02207							
38	58	10	6	2-07498							
39	70	15	9	2-00562							
40	50	5	2.8	2-01146							
40	55	8	4.5	2-01169			8	2-01169	9	5	2-01169
40	70	15	8.4	2-01661							
40	67	13.5	7.5	2-02294							
40	60	10	5.6	2-02302							
40	65	12.5	7	2-02373							
40	56	8.5	5	2-08620							
40	55	8	5	2-12407							
44	56	6.7	4.1	2-03332							
44	60	8	4.5	2-03333							
44	75	15	9.7	2-05666							
45	60	7.5	4.5	2-00172							
45	85	20	12	2-00842							
45	65	10	5.5	2-01099							
45	75	15	8.5	2-01129							
45	69	12	5	2-02632							
45	70	12.5	7	2-03103							
46	59	6.5	3.6	2-05019							
46	66	10	5.5	2-08180							
47	75	14	7.8	2-01367							
48	68	10	6	2-00700							
48	70	11	6.2	2-01219							
48	72	12	6.5	2-04954							
48	71	10	5.5	2-07147							
49	61	6.7	3.5	2-03335							
50	90	20	12	2-00306							
50	80	15	9	2-00803							
50	65	7.5	4.2	2-01187							
50	70	10	5.6	2-01206							
50	60	5	2.8	2-01415							
50	95	22.5	12.5	2-01793							
50	66	8	4.5	2-02391							
50	85	17.5	9.7	2-02705							
50	75	12.5	7	2-03303							
54	66	6.7	4.1	2-03336			7	2-03336	6.7	4.5	2-03336
55	80	12.5	7	2-01693							
55	75	10	5.6	2-01776							
55	70	7.5	4.2	2-02213			8	2-02213	8	4.3	2-02213
55	79	12	6.7	2-04792							
56	90	17	9.5	2-01762							

## CYLINDER SEAL



L = installation length  
 SH = height of sealing set  
 x = number of UK-1 rings  
 $L = SH = x * b + h + s$





Nominal seal dimensions				Tool No.			male ad.ring		female ad.ring		
d	D	H	b	fabric	rubber	polyurethane	h	tool-no.	G	s	tool-no.
56	75	10	6	2-04128							
56	76	10	5.5	2-07045			7	2-07045	14.5	10	2-07045
58	90	16	9.6	2-00841							
58	75	8.5	4.8	2-03964							
58	82	12	6.7	2-04793							
59	71	6	3.4	2-03337					6.7	4.5	2-03374
60	78	9	5.4	2-00133							
60	80	10	6	2-00421			10.5	2-00421	11	6	2-00421
60	90	15	9	2-00646							
60	76	8	4.5	2-01869							
60	85	12.5	7.5	2-05759							
62	92	15	8	2-08633							
62	82	10	5.6	2-09807							
65	95	15	8.4	2-02704							
65	85	10	5.6	2-03072							
65	90	12.5	7	2-04337							
65	97	16	8.9	2-05664							
69	81	6	3.4	2-03302					6.7	4.5	2-03402
69.65	100	15	8.7	2-05667							
70	100	15	9	2-00395							
70	90	10	5.6	2-01086							
70	102	16	9	2-01511							
70	94	10	5.6	2-03988							
70	110	20	11	2-04711							
70	94	12	6.7	2-04791							
70	96	13	7.3	2-05203							
71	90	10	6	2-04129							
74	90	8	4.4	2-06954							
75	100	12.5	7.5	2-00396							
75	105	15	9	2-00647							
75	95	10	5.5	2-02899							
76	90	7	4	2-02303							
76	96	10	5.6	2-05127							
78	98	10	5.6	2-05384							
80	110	15	8.5	2-00935			16.5	2-00935	15	9	2-00935
80	100	10	5.6	2-01180			10.8	2-01180	11	6	2-01180
85	110	12.5	7	2-01241							
85	115	15	8.5	2-01772							
85	102	8.5	4.8	2-03441							
85	125	20	11.2	2-04904							
85	105	10	5.6	2-06470							
85.5	105.5	10	5.6	2-04471							
88	110	11	6.2	2-03143							
88.9	108	10	5.5	2-05945							
89	101	6	3.4	2-03338					6.7	4.5	2-03405
90	120	15	8.4	2-00363			15	2-00363	8	3.9	2-00363
90	110	10	5.6	2-01421							
90	115	12.5	7.2	2-01830							
90	215	12.5	7	2-02239							
95	125	15	9	2-00648							
95	120	15	8.5	2-02906							
95	115	10	5.6	2-03279			9.5	2-03279	12.5	7.5	2-03279
96	132	18	10	2-05385							
100	130	15	9	2-00397			16	2-00397	16	9	2-00397
100	120	10	6	2-00441			9	2-00441	9	5.4	2-00441
100	135	17.5	9.8	2-04905							
107.9	127	10	5.5	2-05946							
110	140	15	8.4	2-01242							
110	135	12.5	7	2-04869							
114	150	18	10	2-05714							
115	145	15	8.4	2-03172							
125	155	15	8.5		V - 564						
115	135	10	5.5	2-06586							
120	146	13	7.3	2-01419							
120	150	15	8.3	2-01651							
120	137	8.5	4.8	2-03392							
122	147	13	7.4	2-05607							
125	145	10	5.6	2-03368							
125	155	15	8.5	2-03750							

Nominal seal dimensions				Tool No.			male ad.ring		female ad.ring		
d	D	H	b	fabric	rubber	polyurethane	h	tool-no.	G	s	tool-no.
125	150	14	10	2-04130							
128	160	16	9	2-01949							
130	160	15	8.5			V - 1079					
130	160	15	8.5	2-00401							
130	150	10	5.6	2-01778							
130	170	20	11.2	2-04891							
130	155	12.5	6.9	2-08561							
133	159	13	7.2	2-09248							
139	180	20.5	11.5	2-03104							
140	170	15	9	2-00871							
140	160	10	5.5	2-09053							
145	175	15	8.4	2-01472							
150	180	17	11	2-00879							
150	170	10	5.6	2-01556							
150	180	15	8.5	2-03698							
155	185	15	8.3			V - 1932					
160	190	15	9	2-00488							
161	191	15	8.4	2-04552							
165	195	15	9	2-03111							
165	195	15	8.4	2-03184							
170	200	15	9	2-02954			18	2-02954	18	10	2-02954
175	215	20	12	2-00804							
180	210	15	9	2-00489							
180	200	10	5.6	2-01051							
186	222	18	10	2-05386							
190	240	25	15	2-00824							
195	230	17.5	10	2-01652							
195	230	17	9.5	2-01763							
195	225	15	9.5	2-02806							
195	230	17.5	10.5			V - 1078					
200	230	15	8.5	2-01052							
200	225	12.5	7	2-02580							
210	240	15	9	2-00872							
220	250	15	8.4	2-04892							
230	260	15	9	2-07563							
240	280	20	11.2	2-04893							
245	285	24	14	2-01319							
265	300	17.5	9.8	2-03960							
275	310	17.5	9.8	2-02626							
285	315	15	8.4	2-01479							
290	330	20	12	2-00452							
290	320	15	8.2	2-07773			15	2-07773	17	9	2-07773
295	340	22.5	12.5	2-02314							
330	360	15	8.5	2-05608							
350	382	16	8.5	2-02629							
380	420	20	11.2	2-01343							
385	425	20	11.2	2-04841			21	2-04841	22	11	2-04841
390	430	20	11.2	2-02628							
430	478	24	13.5	2-02397							
449	495	23	13.8	2-00690							
470	510	20	11	2-01685							
475	505	15	8.5	2-05609							
530	570	20	11	2-01667							
640	680	20	11.2	2-04824							





GSM-U-Ring sealing sets UD1 are multisectional sealing-elements in robust implementation. They consist from ever one support-ring and a thrust-ring and several UD1-U-rings, whose special profile-formation a radial spreading of the lips causes with oncoming pressure and axial glasses-tightening. This after-tightening allows a cost-lowering extension of the sealings stand-time beside the attitude of a optimal sealing-effect. UD1-sets, for which are tools according to following table existing, can be delivered as open or closed rings. Inter-sizes, for which no matching tools are available, however are available only in open implementation. They are cut out from the next-bigger, unending dimensions.

## APPLICATION

UD1-U-ring-sealing sets are suitable because of their sturdiness to the insulation at plungers and piston-rods in the heavy-hydraulics, how for example at cutting-presses, rope-presses etc.. Their use as rod seals restricts itself to special cases. However, their application is recommended everywhere there, where are through exceptional operating-conditions, like lateral pushes or strong disruptions, high requests for the sealing-elements. The friction-strengths are with UD1-sealing sets somewhat more highly in general. They are less been suitable for this reason in cases where only restricted friction-strengths are (for example plungers, that should fall back into their exit-situation through their net weight) allowable.

## RECOMMENDED VALUES FOR APPLICATION

SEALING MATERIAL	OPERATING MEDIUM	HYDRAULIC SYSTEMS		
		p(bar)	t(°C)	v(m/s)
072	mineral oil oil-water-emulsions water	< 600	-30 up to +120	< 0,5

## MATERIALS

UD1-sets are delivered only in wear resistant fabric materials. Standard design is WS 072 = NBR-fabric-cotton material with a rough surface structure.

For special operating conditions, e.g. higher temperatures, difficult inflammable operating mediums their exist special materials (refer to the gernal table for materials).

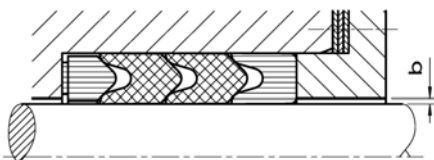
## CLEARANCE BEHIND THE SEAL

The admissible clearance behind the seal is calculated as follows:

b = clearance behind the seal

p = operating pressure

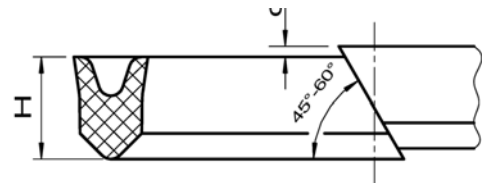
$b_{zul} = 0,6 - 0,0005p$  (for p up to 630 bar)



The right cutting at the mounting of open set-elements and mounting-hints:

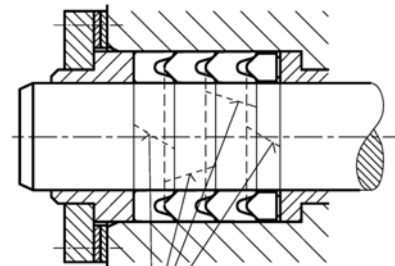
The cutting of open delivered rings should be used like follows: The exact seal-length is determined by putting on about the plunger. The stick parts of this of ready cutted rings must be a bit longer at good installation around the Plunger in order to cause a small jolt of the ring in scope-direction after the mounting in the stuffing-box-room.

$$c = 0,1 * H$$



The stick-places of the individual set-elements are to be moved from ring to ring by approximately 120°.

It is recommended to begin the mounting with exactly matched stick-places when bringing in open sealing rings in the stuffing-box-room.



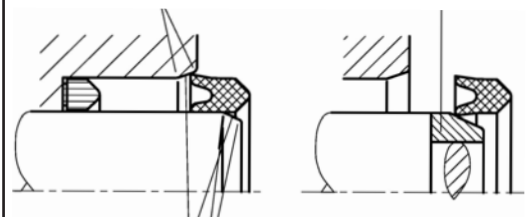
120°

## TOOLS FOR INSTALLATION

To save the sensitive sealing lips at the mounting procedure use proper installation tools and insertion chamfers.

rounded edges

installation case



insertion chamfers  
/ rounded edges



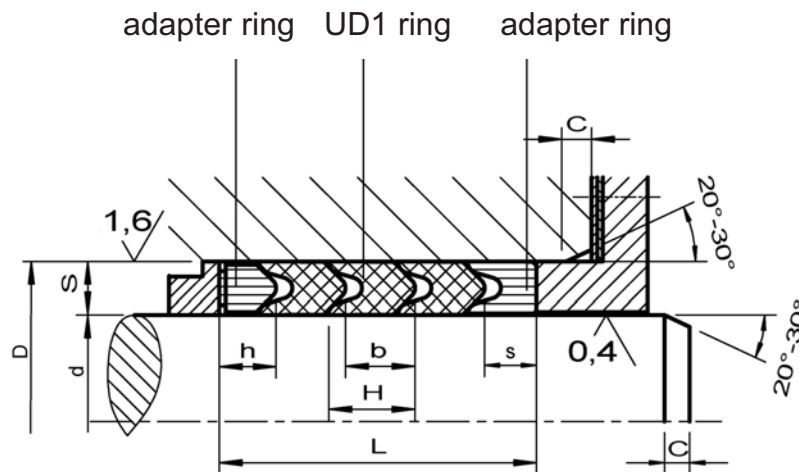


## ADJUSTMENT OF THE SEALING PRESSURE

Before the first installation, the stuffing-box-glass can be attracted only easily. Only after some lifts of the plunger, insufficient sealing effect can perhaps be improved by well-measured after-spans.

With operating-media with elevated swelling-effect on the sealing-material, the most favorable sealing-effect is reached through relaxation and later after-stretching of the stuffing-box-glass after a finish-phase to put in.

## DIMENSION TABLE UD1



## INSERTION CHAMFER

S	20	25
C	10	12,5

open rings	closed rings											
	U-Ring UD1						adapter ring		thrust ring		2 UD1	3 UD1
d	d	D	S	H	b	Tool no.	h	Tool no.	s	Tool no.	height of install.L	
120 up to 150	150	190	20	38	31	2-09193	34	2-09193	28	2-09193	124	155
150 up to 190	190	230	20	38	31	2-09194	20	2-09194	28	2-09194	110	141
190 up to 210	210	250	20	38	31	2-09195	20	2-09195	28	2-09195	110	141
210 up to 245	245	285	20	38	31	2-09196	20	2-09196	28	2-09196	110	141
245 up to 280	280	320	20	38	31	2-09199	20	2-09199	28	2-09199	110	141
320 up to 380	380	420	20	38	31	2-09200	21	2-09200	28	2-09200	111	142
450 up to 630	630	680	25	47,5	40	2-04455	17	2-04689	10,5	2-04689	107,5	147,5





## APPLICATION

Normally, NOI1-Rings are combined with support-rings and pressure-rings to sealing sets, whose construction follows the constructive and operational realities. If no tools for support-rings and pressure-rings are presented in our dimension-table, they finally must be manufactured by the customer of metal.

NOI1-sets are been suitable as sealing-element for rods and plungers particularly there where the maximum pressure becomes effective with long lifting and relatively high lifting-speed only over one relatively short work-area. The long lips favor a comparatively good friction-behaviour on this occasion and are able to equalize certain leadership-imprecisions through their flexibility.

The use of NOI1-sets spreads from the spindle-insulation in the armature-industry over the use as press-insulation in the hydraulics until to the approved sealing-elements at smithy-presses and steam-hammers.

## RECOMMENDED VALUES FOR APPLICATION

SEALING MATERIAL	OPERATING MEDIUM	HYDRAULIC SYSTEMS		
		p(bar)	t(°C)	v(m/s)
071 072	mineral oil oil-water-emulsions water	< 400	-30 up to +120	< 1,0
858		< 250	-20 up to +110	< 0,5

## MATERIALS

NOI1-rings are delivered to 071 and WS 072 as standard-implementation in NBR-cotton-fabric-materials. For the use of steam, we deliver these rings in WS 054 (CR-impregnated aramide fabric). When dimensions for the rubber-tools exist, we manufacture support rings and pressure-rings in our NBR-standard-material WS 858 with approximately 86 Shore A. For some dimensions we can produce rings in our especially wear-solid hard-fabric-quality WS 090.

If special operating-conditions make it necessary, like for example higher temperatures, heavy-inflammable liquids) NOI-sets can be delivered also in for this suitable materials. (for further materials please refer to the general table for materials)

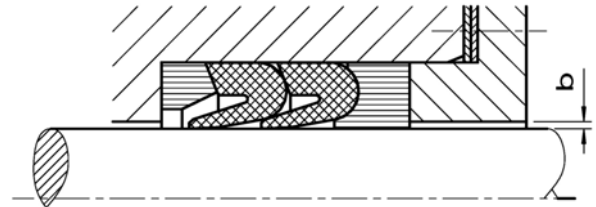
## CLEARANCE BEHIND THE SEAL

With application of fabric-pressure-rings, the allowable clearance behind the seal „b<sub>zul</sub>“ is calculated as follows:

b = clearance behind the seal

p = operating pressure (bar)

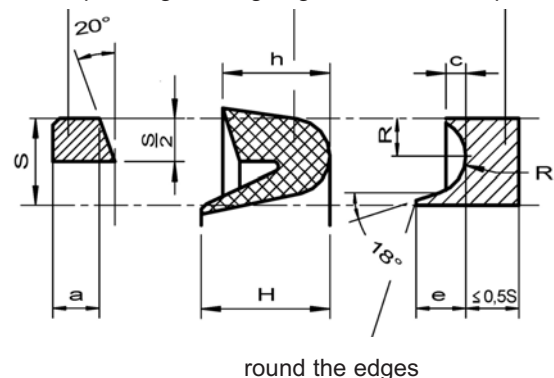
$b_{zul} = 0,5 - 0,0005p$  (for p up to 400 bar)



## SUPPORT

If the adapter rings must be manufactured of metal, following drawing of the measurement-establishing serves:

metal adapter ring sealing ring NOI1 metal adapter ring



$$a = H - h + 0,3S$$

$$R = 0,44S$$

$$C = 0,25S$$

$$e = 0,6S$$

$$S = (D-d)/2$$

In difference from the usual set-construction a series of proved set-combinations is used in the practice. Instead of a metallic adapter ring an exactly dimensioned O-Ring can cause additional pressure of the neighboring NOI1-lips one and can improve the sealing-function with it in the low-pressure-area.

adapter ring (o-ring)

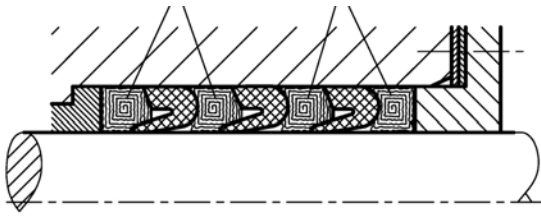


The combination of NOI1-sealing rings with special soft-stuffing-box-rings causes an essential reduction of the friction through their high lubricant-share.

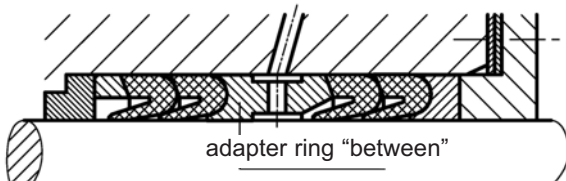




soft stuffing box ring



An adapter ring installed in the set can serve the leakage-drainage, bring additional lubricants against the seal or with armatures and agitator gearings of suitable locking medias.

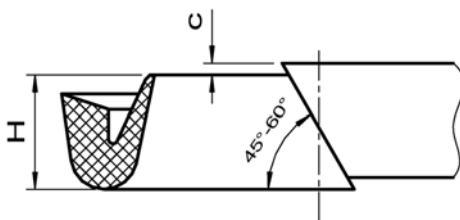


adapter ring "between"

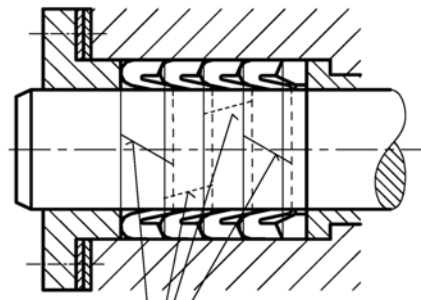
## CORRECT CUTTING FOR INSTALLATION OF OPEN RINGS AND INSTALLATION INSTRUCTIONS

Open NOI1-rings can cut out been delivered from so-called length-tools and cutted out from bigger tools.. The cutting should be done like follows: the exact seal-length is determined by putting on around the plunger. The push-places of this ready cutted rings must be a bit longer at good installation at the plunger in order to cause an easy accumulation in scope-direction after the mounting in the stuffing-box-room.

$$C = 01 * H$$



The push-places of the individual set-elements are to be moved from ring to ring by approximately 120°.

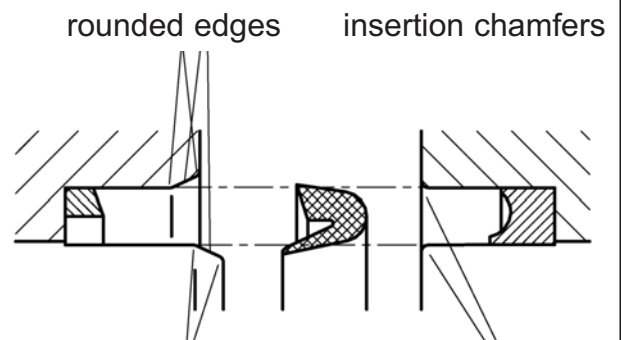


push places moved by 120°

When mounting the sealing-rings in the stuffing-box-room, it is advisable to begin with the exactly matched push-places.

## TOOLS FOR INSTALLATION

To save the thin lips at the installation use correct mounting tools and insertion chamfers.



rounded edges

rounded edges

## ADJUSTMENT OF THE SEALING PRESSURE

Before the first use, the stuffing-box-glass can be attracted only easily. Only after some lifts of the plunger, insufficient sealing-effect can perhaps be improved by well-measured after-spans.

With operating-media with elevated swelling-effect on the sealing-material, the most favorable sealing-effect is reached through relaxation and later after-stretching of the stuffing-box-glass.





Nominal seal dimensions					Tool No.		male ad.ring		female ad.ring		
d	D	H	h	s	fabric	rubber	a	tool-no.	G	b	tool-no.
3	11	6	5	4,5	2-04456						
4	12	6	5	4,5		2-05309					
5	17	9	7,5	6,7		2-06705	6,2	2-06705			
6	16	7,5	6,3	5,4	2-00560						
6	16	7,5	6,3	5,7		2-05310					
6	25	14,2	11,9	10,7	2-00639						
8	14	8	4	3,6	2-00315						
8	18	7,5	6	5,4		2-05311					
8	18	7,5	6,3	5,7	2-05736		7,7	2-05736			
8	18	8	6	5,3	2-01178						
8	20	9	7,5	6,7	2-00577						
8	20	9	7,5	6,8		2-04828					
8	20	10	8	7,2	2-06308						
8	25	12,7	10,7	9,6	2-00640					4,2	2-00719
10	17	6	5	4,6	2-06357						
10	18	6	5	4,5	2-00719		3,4	2-00719	6,5		
10	18	6	5	4,5		2-06305					
10	18	7,5	5,5	5	2-01851						
10	20	7,5	6,3	5,7	2-03105						
10	20	9	7,5	6,9		2-04829					
10	22	9	7,5	6,8	2-05675						
10	25	11,2	9,4	8,4	2-00513						
10	26	12	10	8,9	2-00371					4,2	2-05905
11	25	8	7	6	2-04205					4,2	2-00013
12	20	6	5	4,5	2-05905		3,5	2-05905	6		
							3,3	2-00013	6,5		
12	20	6	5	4,5		2-06306					
12	22	7,5	6,3	5,7	2-00258		7,5	2-00258		3,9	2-00774
12	22	7,5	6,3	5,7		2-05429					
12	24	9	7,5	6,8	2-00774		4,9	2-00774	7		
12	24	9	7,5	6,7		2-04835					
12	24	10,4	7,8	7,8	2-02356						
12	26	10,5	8,8	7,8	2-01547						
12	28	12	10	8,9	2-02076						
12,72	24,72	9	7,5	6,7		2-06706					
13	20	6	5	4,5	2-01120						
13	21	6	5	4,5	2-00329						
13	22	6,7	5,7	5,2	2-01378						
13	25	9	7,5	6,7	2-00752						
13	28	12	9	8,2	2-12591					3,8	2-00775
14	22	6	5	4,5	2-01118						
14	24	7,5	6,3	5,7	2-00775				6,5		
14	26	9	7,5	6,8	2-02179						
14	28	10,5	8,8	7,9	2-03169						
14	34	15	12,5	11,2	2-07959						
15	24	8,3	5,9	5,4	2-05002						
15	25	7,5	6,3	5,7	2-00291						
15	28	11,4	8,5	7,7	2-05101						
15	30	12,8	9,8	8,8	2-02178						
15	35	15	12,5	11,2	2-00491						
15	36	15,7	13,2	11,9	2-01017						
15,5	24	6,7	5,7	5,1	2-01232						
16	24	6	5	4,5	2-01790						
16	24	6	5	4,5		2-06307					
16	24	8	6	5,5	2-01852					4	2-05910
16	25	6,7	5,7	5,1	2-01885					4	2-0078
16	26	7,5	6,3	5,7	2-05910		4	2-05910	6		
16	26	7,5	6,3	5,7	2-00078		4	2-0078	6,5		
16	28	9	7,5	6,7	2-00093						
16	28	9	7,5	6,8		2-04830					
16	28	11	9	8,3	2-01999						
16	29	9,7	8,2	7,3	2-03904					5	2-00305
16	30	12,2	9,1	8,1	2-02483						
16	32	12	10	8,9	2-00305				9,5		
16	32	13,8	10,4	9,3	2-04429						
17	25	6	5	4,5	2-01791					4	2-00026
17	28	8,2	6,9	6,2	2-00608	2-05430	7,9	2-05430		4	2-05958
18	27	6,7	5,7	5,2	2-00026		3,1	2-00026	6,7		
18	27	6,7	5,7	5,2	2-05958		3,1	2-05958	6		
18	28	7,5	6,3	5,7	2-00216						
18	28,5	7,5	6,3	5,6	2-00293						
18	30	9	7,5	6,8	2-00229					4	2-06964

Nominal seal dimensions					Tool No.		male ad.ring		female ad.ring		
d	D	H	h	s	fabric	rubber	a	tool-no.	G	b	tool-no.
18	32	10,5	8,8	7,9	2-00185						
18	34	12	10	8,9	2-06964		5,8	2-06964	6,5		
18	35	12,7	10,7	9,7	2-00335						
18	35	14	10,5	9,4	2-03690						
18	38	15	12,5	11,2	2-00495						
19	29	7,5	6,3	5,7	2-00468						
19	32	9,7	8,2	7,3	2-00308						
19	35	12	10	9	2-05409						
19	37	13,5	11,3	10,2	2-00309					2,9	2-00215
20	28	6	5	4,5	2-00060						
20	32	9	7,5	6,7	2-00215		6	2-00215	6,5		
20	32	9	7,5	6,8		2-04831					
20	33	9,7	8,2	7,3	2-04166					4,9	2-01582
20	35	11,2	9,4	8,4	2-00106						
20	36	12	10	9	2-01582		6,5	2-01582	9,5		
20	37	12,7	10,7	9,6	2-02453						
20	38	13,5	11,3	9,4	2-00027						
20	40	15	12,5	11,2	2-00263						
20	40	17,3	13	11,7	2-01559		8,7	2-01559			
20	44	21	15,6	14,1	2-02384						
21	31	7,5	6,3	5,7	2-05652	2-05431	7,7	2-05652		3	2-06854
22	32	7,5	6,3	5,6	2-00142					7,5	2-05779
22	32	7,5	6,3	5,6	2-06854		4	2-06854	5,5		
										10	
22	32,5	7,5	6,3		2-12067					2,3	2-05750
22	34	11,2	8,5	7,8	2-04585						
22	34	16,2	8,5	7,8		2-05750	5	2-05750	6,5		
22	35	9,7	8,2	7,3	2-00057					5,5	2-00336
22	36	12,2	9,1	8,1	2-02195						
22	38	12	10	8,9	2-00336		6,5	2-00336	10		
22	38	13,8	10,4	9,2	2-03671						
22	40	13,5	11,3	10,2	2-01054						
22	42	15	12,5	11,3	2-03177						
22	42	17,3	13	11,6	2-03745						
23	35	9	7,5	6,7	2-05653	2-05432					
24	34	7,5	6,3	5,6	2-02873						
24	36	11	7,5	6,8	2-04327					5,5	2-00364
24	37	9,7	8,2	7,4	2-00888						
24	40	12	10	8,9	2-00364		6,5	2-00364	10		
24	42	13,5	11,3	10,2	2-02252					3,8	2-07990
25	35	8,8	6,5	5,8	2-02630						
25	35	8,8	6,5	5,8	2-07990		4	2-07990	6,5		
25	36	8,2	6,9	6,2	2-00201						
25	37	9	7,5	6,8		2-04836				3,5	2-01224
25	37	11	9	8,3	2-09730						
25	38	9,7	8,2	7,3	2-01224		4,7	2-01224	7	5,5	2-00083
25	39	10,5	8,8	7,2	2-00474						
25	40	11,2	9,4	8,3	2-00083		5,5	2-00083	9,5		
25	41	14	10	9		2-01584					
25	42	12,7	10,7	9,5	2-02955						
25	45	15	12,5	11,2	2-00084						
25	45	17,3	13	11,6	2-03694						
25	48	17,2	14,4	12,9	2-00058						
25	50	18,7	15,7	14	2-00916		9,8	2-00916			
25,4	36,5	9	7,5	6,8	2-07102		3,4	2-07102			
26	39	9,7	8,2	7,4	2-01189					5,5	2-00337
26	41	12,8	9,8	8,8	2-07600						
26	42	12	10	8,9	2-00337				10		
26	43	12	10,7	9,7	2-02872						
26	44	13,5	11,3	10,2	2-02253						
26	46	15	12,5	11,2	2-01018						
26	48	16,5	13,8	12,4	2-00666						
26	50	18	15	13,4	2-00665						
27	45	13	11,3	10,2	2-05410						
28	41	9,7	8,2	7,3	2-00015					5,5	2-00184
28	42	12,2	9,1	8,1	2-04906						
28	44	12	10	8,9	2-00184		6,5	2-00184	10		
28	45	12,7	10,7	9,6	2-00667						
28	48	15	12,5	10,7	2-00029						
28	50	16,5	13,8	12,3	2-00351						
28	52	18	15	13,5	2-01405						
28,5	44,5	12	10	8,9	2-00136						





Nominal seal dimensions					Tool No.		male ad.ring		female ad.ring		
d	D	H	h	s	fabric	rubber	a	tool-no.	G	b	tool-no.
29	44	14	11	10	2-04950					4,1	2-00072
29	48	14,2	11,9	10,7	2-00277						
30	42	9	7,5	6,7	2-00072		6	2-00072	7		
30	42	9	7,5	6,9		2-04832					
30	42	9	7,5	6,7		2-05440					
30	42	9	7,5	6,9	2-05952						
30	42	11	9	8,3	2-09731					5	2-00028
30	43	9,7	8,2	7,4	2-00199						
30	45	11,2	9,4	8,5	2-00028	2-05642	3,7	2-00028	10	10	2-00790
30	45	12,8	9,8	8,8		2-05749	6	2-05749		16,3	2-05302
30	46	12	10	9	2-01306					12	
30	50	17,3	13	11,6	2-04430					20,3	
30	53	18	15	13,5	2-03466						
30	55	18,7	15,7	14,1	2-00759						
30	60	22,5	18,8	16,8	2-03501						
30,5	46	12	10	8,9	2-00524						
30,5	65	31	24	22,2	2-05133						
32	40	7,3	5,2	4,7	2-06718					3,8	2-03534
32	40	8	6,5	6	2-06894						
32	44	9	7,5	6,7	2-03534		5	2-03534	7	12	2-01311
32	45	9,7	8,2	7,3	2-07326						
32	48	13,8	10,4	9,3	2-01311		5,5	2-01311	14		
32	50	13,5	11,3	10,2	2-01020						
32	52	15	12,5	11,3	2-00264						
32	52	17,5	13	11,6	2-04298						
32	55	17,2	14,4	12,3	2-05060		8,3	2-05060			
32	57	18,7	15,7	14,2	2-04309						
32	60	21	17,5	15,7	2-00504						
33	52	14,7	11,9	10,8	2-00492						
33	55	16,5	13,8	12,3	2-04701						
33,5	45,5	9	7,5	6,8	2-00728						
34	54	15	12,5	11,2	2-01775						
34	58	18	15	13,6	2-01019						
34	66	24	20	17,9	2-00962					7,8	2-05031
35	45	7,5	6,3	5,7	2-00729						
35	47	10,4	7,8	7,1	2-02299				10,4	4,8	2-06773
35	50	11,2	9,4	8,5	2-00007						
35	50	12	9,8	8,9	2-06773				9		
35	51	12	10	8,9	2-00210						
35	54	14,2	11,9	10,6	2-02236						
35	55	15	12,5	11,2	2-00006						
35	55	17,3	13	11,6	2-03781						
35	60	18,7	15,7	14	2-00085						
35	65	22,5	18,8	16,8	2-05411						
36	48	9	7,5	6,8		2-04833					
36	50	10,5	8,8	7,9	2-00912						
36	54	13,5	11,3	10,1	2-09864						
36	56	16	13	11,6		2-06684					
36	58	16,5	13,8	12,4	2-00289						
36	60	18	15	13,5	2-02452						
36	60	21	15,6	13,9	2-04406						
36	70	25,5	21,3	19,1	2-00569						
36,51	50,8	11,11	9,5	8,7	2-08910						
37	52	11,2	9,4	8,4	2-00061						
38	53	11,2	9,4	8,4	2-01756						
38	58	15	12,5	11,2	2-00301						
38	60	16,5	13,8	12,4	2-00844						
38	78	30	25	22,4	2-05412						
38,1	57,1	17	13	11,8	2-07103		5,8	2-07103			
39	55	12	10	8,9	2-00636						
39	56	15	12,5	11,2	2-00478						
39,69	57,15	14,29	11,11	10	2-08909						
40	48	6	5		2-00618						
40	50	7,5	6,3	5,7	2-00426					11	2-00160
40	50	8,8	6,5	5,8	2-06702						
40	52	9	7,5	6,7	2-00010				12,3	4,8	2-00086
40	52	11	9	8,3	2-09732					4,8	2-01629
40	55	11,2	9,4	8,5	2-00086	2-08774			9		
40	55	12,8	9,8	8,8	2-01629		6,5	2-01629	9		
40	56	12	10	8,9	2-00369						
40	58	15,7	11,7	10,5	2-01873					4,5	2-03257
40	60	15	12,5	11,2	2-00004						

Nominal seal dimensions					Tool No.		male ad.ring		female ad.ring		
d	D	H	h	s	fabric	rubber	a	tool-no.	G	b	tool-no.
40	60	17	13,5	12,3	2-03257		8,4	2-03257	11		
40	60	17,3	13	11,7	2-01439						
40	65	21,5	16,3	14,7	2-04394						
40	68	21	17,5	15,7	2-01432						
40	70	22,5	18,8	16,9	2-00017						
41,3	57	13,5	10,7	9,9	2-05788						
42	54	9	7,5	6,9		2-04834					
42	55	9,7	8,2	7,3	2-02366						
42	58	13,8	10,4	9,3	2-04477						
42	62	15	12,5	11,2	2-00097					12,5	2-01098
42	62	16	13	11,7		2-06685					
42	62	18	12,5	11,2	2-02821					18	
43	62	16	12,5	11,2		2-04421					
44	56	9	7,5	6,8	2-01192						
44	56	9	7,5	6,7		2-06622					
44	60	12	10	8,9	2-01175						
44	70	19,5	16,3	14,5	2-01042					9	2-00330
45	58	11,2	9,4	8,5	2-03829						
45	60	11,2	9,4	8,4	2-00330					14,5	
45	60	12,8	9,8	8,9	2-05001						
45	60	13	9,8	8,7	2-12054					6,2	2-00071
45	64	14,2	11,9	10,6	2-01044						
45	65	15	12,5	11,2	2-00071		8,2	2-00071	12		
45	65	17,3	13	11,8	2-05000						
45	68	17,2	14,4	12,9	2-00410						
45	70	18,7	15,7	13,6	2-00107						
45	73	21	17,5	15,7	2-01116						
45	75	22,5	18,8	17	2-03181						
46	66	15	12,5	11,2	2-02448						
46	66	16	13	11,7		2-06686					
47	61	10,5	8,5	7,9	2-05120						
47	62	11,2	9,4	8,2	2-03074		5,7	2-03074			
47	65	13,5	11,3	10,2	2-03073		6,8	2-03073			
47	67	17,3	13	11,8	2-09047						
47	68	15,7	13,2	10,8	2-00986						
47,5	79,4	24	20	17,9	2-09528						
47,7	67,7	15	12,5	11,3	2-00886					6,2	2-00718
48	67	14,2	11,9	10,6	2-01045						
48	68	15	12,5	1,3	2-00718					12	
48	70	16,5	13,8	12,4	2-00708						
48	75	24,5	18,4	16,5	2-03516						
48,5	69,5	15,7	13,2	11,8	2-02670						
50	62	9	7,5	6,7	2-00466						
50	62	11	9,5	8,8	2-05894					6	2-02324
50	64	12,2	9,4	8,2	2-01864						
50	65	12,8	9,8	9	2-02324					11	
50	65	13	10	9,1	2-09057						
50	66	12	10	8,9	2-02671		4,4	2-02671		6	2-00041
50	68	13,5	11,3	10,2	2-00202						
50	70	15	12,5	11,3	2-00041		8,5	2-00041	12		
50	75	18,7	15,7	14	2-00012						
50	76	19,5	16,3	14,6	2-00751						
50	80	22,5	18,8	16,8	2-01089		12,3	2-01089			
50	85	26,2	21,9	19	2-05414						
52	62	7,5	6,3	5,7	2-00407						
52	63	8,2	6,9	6,2	2-03107						
52	64	9	7,5	6,8	2-06005						
52	70	13,5	11,3	10,2	2-00391						
53	75	16,5	13,8	12,3	2-00011						
54	74	15	12,5	11,3	2-00727						
55	65	7,5	6,3	5,7	2-00769					6	2-00032
55	66	8,2	6,9	6,2	2-00374						
55	75	15	12,5	11,3	2-00032		8,2	2-00032	12		
55	75	15	12,5	11,3		2-05304					
55	80	22	16	14,4	2-07483						
56	76	17,3	13	11,89	2-08925						
57	68	9	7,5	7,1	2-00697						
57	75	13,5	11,3	10,2	2-00745						
57	89	24	20	17,8	2-04321						
57,2	70	10,7	8,2	7,6	2-05789						
58	83	21,5	16,5	15	2-06077						



Nominal seal dimensions					Tool No.		male ad.ring		female ad.ring		
d	D	H	h	s	fabric	rubber	a	tool-no.	G	b	tool-no.
60	75	11,2	9,4	8,4	2-00063						
60	75	12,8	9,8	8,8	2-01320						
60	76	13,8	11,5	10,4	2-03631						
60	78	13,5	11,3	10,1	2-01605						
60	80	15	12,5	11,3	2-00054					6	2-07022
60	80	15	12,5	11,3	2-08752					6,2	2-05725
60	80	16	13	10,7	2-07022					11	
60	80	17,3	13	11,7	2-01645		6,3	2-05724	10,5		
60	82	16,5	13,8	12,4	2-00250					8	2-00741
60	85	18,7	15,7	14	2-00479						
60	90	22,5	18,8	16,9	2-00741		12,3	2-00741	17		
60	90	26,5	19,5	15,9	2-03425						
60	95	26,2	21,9	19,7	2-02910						
62	82	17,3	13	11,5	2-08908						
64	78	10,5	8,8	7,9	2-03106						
64	84	15	12,5	11,3		2-05305					
64	94	22,5	18,8	16,9	2-00353						
65	78	11,4	8,5	7,6	2-01480						
65	79	12,2	9,1	8,1	2-02569						
65	80	11,2	9,4	8,4	2-02392						
65	81	13,8	10,4	9,3	2-05822					6,2	2-00069
65	84	14,2	11,9	10,7	2-00056						
65	85	15	12,5	11,3	2-00069				11		
65	86	15,7	13,2	11,9	2-00889						
65	89	18	15	13,4	2-00389						
65	90	21,5	16,3	14,6	2-01392						
65	95	22,5	18,8	16,8	2-01813						
65	97	24	20	18	2-05415						
65	100	26,6	21,9	19,6	2-00281						
65	110	33,7	28,2	25,3	2-05416					7,5	2-03092
66	96	26	19,5	17,2	2-12775						
67	79	9	7,5	6,7	2-03092				9,5		
67	90	20,1	15	13,5	2-07219						
68	88	15	12,5	11,2	2-00267						
68	88	17,3	13	11,8	2-08998						
68	92	18	15	13,5	2-02289						
68	98	22,5	18,8	16,9	2-01754						
70	81	8,2	6,9	6,3	2-00008						
70	81	9,7	7,2	6,5	2-05692						
70	85	11,2	9,4	8,4	2-00327					10,2	2-00082
70	85	12,8	9,8	8,8	2-05677						
70	90	15	12,5	11,2	2-00082		4,2	2-00082	16		
70	90	15	12,5	11	2-08775					7,5	2-00273
70	90	17,3	13	11,6	2-04476						
70	95	18,7	15,7	14	2-00273				14,5		
70	100	22,5	18,8	16	2-00850						
70	110	34,5	26	23,3	2-04959						
72	92	17,3	13	11,7	2-01363						
72	92	17,3	13	11,9		2-05306					
73	86	9,7	8,2	7,4	2-00066						
74	117	32,2	26,9	24,1	2-02889						
75	90	12,7	10,2	9		2-11388					
75	91	13,8	10,4	9,4	2-08253						
75	95	15	12,5	11,3	2-00591						
75	95	17,3	13	11,8	2-08938						
75	95	17,5	13	11,6	2-03903						
75	99	18	15	13,5	2-05826						
75	100	18,7	15,7	14	2-02520						
75	115	30	25	22,4	2-01877						
75	120	33,7	28,2	25,1	2-02929						
76,5	110	25,5	21,3	19,1	2-03432						
77	88	9	7,5	7,1	2-00698						
78	100	16,5	13,8	12,4	2-00523						
78	100	20	15	13,7	2-03255						
79	105	20,1	16,9	15,2	2-01531						
80	92	9	7,5	6,8	2-00156						
80	95	12	9,8	8,7	2-12123					15	2-00565
80	96	13,8	10	8,7	2-12384					6	2-03108
80	100	15	12,5	11,3	2-00565	2-08913	8,2	2-00565	18	9,5	2-08282
							8,2	2-03108	12		
									15,5	7	2-00326
80	102	16,5	13,6	12,2	2-00771						

Nominal seal dimensions					Tool No.		male ad.ring		female ad.ring		
d	D	H	h	s	fabric	rubber	a	tool-no.	G	b	tool-no.
80	105	18,7	15,7	14	2-00326		9,7	2-00326	13,5		
80	110	22,5	18,8	16,9	2-00020						
80	110	25,7	19,5	17,7	2-01429						
80	115	30,2	23	20,6	2-03467		10,7	2-03467			
80	118	28,5	23,8	21,3	2-02936						
80	120	30	25	22,4	2-02937						
80	130	37,5	31,3	27,9	2-02933						
82	102	15	12,5	11,4	2-05307						
82	102	17,3	13	11,5	2-08907					7,5	2-03093
82	105	17,2	14,4	12,9	2-00314						
85	97	9	7,5	6,8	2-03093					9	
85	105	17,3	13	11,8	2-02346					8,3	2-06851
85	110	13	11	9,3	2-03898						
85	115	22,5	18,8	16,9	2-00178					17,2	
85	123	25	20	17,5	2-02209						
90	102	9	7,5	6,8	2-00075						
90	105	11,2	9,4	8,4	2-02163					6	2-07141
90	110	15	12,5	11,3	2-00688		8,2	2-0688			
90	110	17,3	13	11,7	2-08138					12	
90	115	21,5	16,3	14,6	2-02566					9	2-06611
90	120	22,5	18,8	16,9	2-01656						
90	120	24	19,5	17,5	2-06611					15,5	
90	130	30	25	22,4	2-00248						
90	140	37,5	31,3	28,1	2-05392						
92	108	12	10	8,9	2-01678						
92	115	20,1	15	13,5	2-02434						
95	115	12,7	10,2	9		2-11389					
95	125	22,5	18,8	17	2-02925					11	2-00163
99,6	135,3	27	22,5	20,2	2-05483						
100	112	9	7,5	6,8	2-00157					12,3	
100	112	9	7,5	6,8		2-06282					
100	113	9,7	8,2	7,3	2-01946						
100	120	15	12,5	11,4	2-05308						
100	120	17,3	13	11,8	2-08926					7,7	2-01304
100	125	18,7	15,7	14,1	2-00620						
100	125	21,5	16,3	14,6	2-01304		10,8	2-01304	15,5		
100	130	22,5	18,8	16,9	2-00209						
100	135	26,2	21,9	19,6	2-00259						
100	140	33	25	22,5	2-05578		16,4	2-05578			
100	150	37,5	31,3	28	2-02208						
108	130	19,3	14	12,5	2-12056					5	2-02381
110	130	15	12,5	11,3	2-00869						
110	130	17,3	13	11,7	2-02381					10,8	7,5 2-01430
110	134	21,1	15,6	14,1	2-02172					17,3	2-06046
110	135	21,5	16,3	14,6	2-01430						
									9,8	2-01430	14,5
									14	2-06047	21
110	140	22,5	18,8	16,3	2-00483						
110	140	27	20	18,2	2-03091						
110	150	30	25	22,4	2-03322						
110	168	51	37,7	33,8	2-06907						
115	135	15	12,5	11,2	2-00675						
115	140	21,5	16,3	14,6	2-02382						
115	150	26,2	21,9	14,5	2-01481					11	2-00164
115	158	32,2	26,9	24,2	2-02546						
120	132	9	7,5	6,7	2-00158					12,3	
120	132	9	7,5	6,8		2-06283				9,5	2-00772
120	136	12	10	8,9	2-00517						
120	140	15	12,5	11,3	2-00772	2-09077				15,5	9 2-02068
120	142	16,5	13,8	12,3	2-04737					10,4	2-03191
120	150	25	20	17,8	2-12416		12,3	2-02068	17		
120	150	26,2	21,9	19,7	2-03191					20,5	
120	165	33,7	28,2	25,3	2-00761						
120	190	52,5	43,8	41,3	2-04643						
125	145	15	12,5	11,3	2-00937						
125	145	17,3	13	11,5	2-08973						
125	150	18,7	15,7	14,1	2-00787						
125	150	21,5	16,3	14,8	2-01330						
125	157	27,6	20,8	18,7	2-01303						
125	160	26,2	21,								

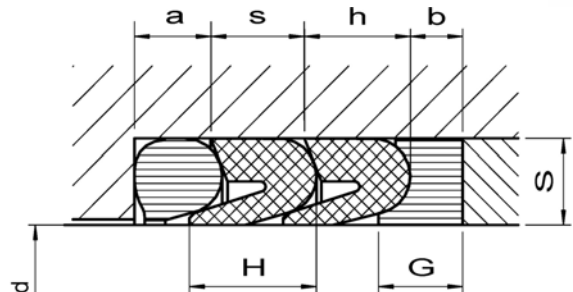


Nominal seal dimensions					Tool No.		male ad.ring		female ad.ring		
d	D	H	h	s	fabric	rubber	a	tool-no.	G	b	tool-no.
128	140	10,5	8,8	8	2-00699						
130	150	17	13	11,5	2-12396						
130	154	21,1	15,6	14	2-02565						
130	160	22,5	18,8	16,8	2-01032						
130	160	25,7	19,5	17,7	2-03224						
130	170	30	25	22,4	2-01884						
134	160	19,5	16,3	14,6	2-00498						
135	147	9	7,5	6,8	2-00411						
135	175	34,5	26	23,8	2-05361					11	2-00165
138	195	42,7	35,7	32	2-00726						
140	152	9	7,5	6,8	2-00159				12,3		
140	170	22,5	18,8	16,9	2-00282						
140	170	25,7	19,5	17,5	2-01163						
140	185	33,7	28,2	25,2	2-01247						
140	190	37,5	31,3	27,7	2-09925						
140	193	39,7	33,2	29,7	2-02972						
140	200	45	37,5	33,7	2-03748						
142	195	39,7	33,2	29,8	2-00724						
144	195	38,2	31,9	28,8	2-01228					9	2-02275
145	175	22,5	18,8	16,8	2-01058						
145	175	25,7	19,5	17,5	2-02275					13	
148	162	13,5	11,3	10,4	2-00516					8,4	2-01434
150	170	15	12,5	11,3	2-00505						
150	180	25,7	19,5	17,6	2-01434		12,5	2-01434	17		
150	190	30	25	22,5	2-01883						
150	200	37,5	31,3	28	2-01880						
152	190	28,5	23,8	21,2	2-02376					9	2-0497
152	215	47,2	39,4	35,2	2-01878						
155	185	22,5	18,8	16,9	2-00497		12,3	2-00497	17		
158	201	32,2	26,5	24,1	2-00393						
158	205	35,2	29,4	16,4	2-01838						
160	185	21,5	16,3	14,6	2-01435						
160	188	21	17,5	15,6	2-01133						
160	190	25,7	19,5	17,6	2-02177						
160	200	30	25	22,4	2-00110						
160	210	37,5	31,3	28	2-06552		26	2-06552			
160	215	41,2	34,4	30,8	2-02122						
163	200	27,7	23,2	20,7	2-02050						
164	220	42	35	31,3	2-01109						
165	195	22,5	18,8	16,9	2-00399						
165	215	37,5	31,3	28,1	2-01879						
170	182	9	7,5	6,7	2-04720						
170	194	21,1	15,6	14	2-01633						
170	210	30	25	22,4	2-00605						
170	210	35	26	22,9	2-12090						
170	225	41,2	34,4	30,8	2-02123						
175	205	25,7	19,5	17,6	2-01768						
175	215	30	25	22,4	2-02378						
180	200	17,3	13	11,6	2-03427						
180	204	18	15	13,6	2-01070					9	2-01366
180	204	21,1	15,6	14,2	2-01369						
180	210	25,7	19,5	17,7	2-01366		12,3	2-01366	17		
180	220	34,5	26	23,5	2-01318						
180	230	37,5	31,3	28,1	2-01152						
180	240	45	37,6	33,9	2-01326						
180	245	45	37,6	34	2-06264						
185	215	22,5	18,8	17	2-05576						
185	235	39	32,5	29,3	2-05067						
185	237	39	32,5	29,2	2-00856						
190	220	22,5	18,8	17	2-05577		12,3	2-05577	9	2-07641	
193	245	39	32,5	29,3	2-01400						
195	225	22,5	18,8	16,9	2-07641		12,4	2-07641	17		
195	230	26,2	21,9	19,6	2-01856						
195	245	37,5	31,3	28	2-00394						
198	230	24	20	17,9	2-01662						
200	220	17,5	13,2	12	2-07271						
200	230	25,7	19,5	17,5	2-01331						
200	240	34,5	26	23,4	2-01558						
200	250	37,5	31,3	28,1	2-00782						
203	255	39	32,5	29,2	2-01482						
220	240	17,8	13	11,7	2-03384						
220	242	16,5	13,8	12,5	2-03998					9,5	2-05418

Nominal seal dimensions					Tool No.		male ad.ring		female ad.ring		
d	D	H	h	s	fabric	rubber	a	tool-no.	G	b	tool-no.
220	250	22,5	18,8	17	2-03052						
220	252	24	20	18	2-05418		13,3	2-05418	18		
220	260	34,5	26	23,4	2-01644						
225	270	39,3	29,2	26,3	2-01961						
228,6	266,7	33	23,8	21	2-08736						
230	275	33,7	28,2	25,3	2-00089						
233	283	37,5	31,3	28,1	2-01398						
240	270	25,7	19,5	17,4	2-01428						
240	285	33,7	28,2	25,4	2-00977					9	2-00485
250	270	17,3	13	11,8	2-05225						
250	280	22,5	18,8	16,9	2-00485		12,4	2-00485	17		
250	280	22,5	18,8	16,2	2-01857					9	2-05419
250	290	34,5	26	23,6	2-02510						
260	290	22,5	18,8	16,9	2-05419				17		
265	297	27,6	20,8	18,7	2-05742						
270	298	27	20	18,4	2-09245						
275	315	34,5	26	23,4	2-01767						
278	310	24	20	17,9	2-04618						
280	310	22,5	18,8	16,8	2-01858		12	2-08929		11	2-06387
280	315	26,2	21,9	19,7	2-00292						
290	330	32	26	23	2-06387					22,5	
300	328	24,3	18,2	16,3	2-01712						
300	330	25,7	19,5	17,7	2-05245						
300	340	30	25	22	2-11279					10	2-01554
320	360	30	25	22,4	2-00723						
320	360	34,5	26	23,9	2-01554		20	2-01554	22,9		
325	365	30	25	22,5	2-01312						
325	370	39,3	29,2	26,2	2-03808						
345	385	30	25	22,5	2-01431						
350	381	23,2	19,4	17,3	2-04708						
358	398	30	25	22,5	2-01749					10	2-05743
375	415	30	25	22,6	2-01455						
380	420	34,5	26	23,2	2-05743		16,4	2-05743	20		
406	432	19,5	16,3	14,6	2-04709						
415	467	45,3	33,8	30,3	2-03383		22	2-09035			
420	472	39	32,5	29,2	2-00672						
440	480	30	25	22,5	2-02185					10	2-05741
448	488	30	25	22,5	2-08042					10	2-05853
450	490	34,5	26	23,2	2-05741		16	2-05741	20		
452	493	26	22	19,1	2-05853					18	
494	540	30	25	22,5	2-11904	EW					
495	545	37,5	31,3	27,9	2-02919						
500	535	26,2	21,9	19,6	2-05900						
500	552	45,3	33,8	30,4	2-00203					13	2-06833
521	568	35,2	29,4	26,5	2-01546						
550	600	43,3	32,5	28,9	2-06833					29	
570	602	24	20	18	2-00428						
580	620	30	25	22,5	2-11526						
756	812	42	35	31,4	2-01280						

## OPEN SEALING RINGS NOI1 LENGTH - TOOL

diameter d from 600 up to 1500 mm



					male ad.ring		female ad.ring		
S	H	h	s	Tool No.	a	Tool No.	G	b	Tool No.
25,5	43,5	32,5	29,3	2-03164	22	2-08937	31,5	16,2	2-03165
26	45,3	33,8	30,4	2-08930	22	2-08937	31,5	16,2	2-03165
27	39	32,5	29,2	2-00204					





## APPLICATION

Normally, NOA1 rings are combined with support-rings and pressure-rings t sealing sets, whose construction follows the constructive and operational realities.

NOA1-sets are been suitable as sealing elements for rods particularly there where the maximum pressure becomes effective with long lifting and relatively high lifting-speed only over a relatively short working area. The long lips favor a comparatively good friction-behaviour on this occasion and are able to equalize certain leadership-imprescions through their flexibility.

## RECOMMENDED VALUES FOR APPLICATION

SEALING MATERIAL	OPERATING MEDIUM	Hydraulic system		
		p(bar)	t(°C)	v(m/s)
071	Mineral oil	≤ 400	-30	≤ 1,0
072	oil-water-emulsions water		up to +120	

## MATERIALS

NOA1-rings are delivered in WS 071 and WS 072 as standard-implementation in NBR-cotton-fabric-materials. Male- and female adapter rings are - if the special tools are in stock - produced in our especially wear-solid hard-fabric-material WS 090. If special operating-conditions make it necessary, like for example higher temperatures, heavy-inflammable liquids) NOA-sets can be delivered also in for this case suitable materials. (refer to our general table for materials).

## INSTALLATION TOOLS

To save the thin lips do not use sharp installation tools and look for insertion chamfers.

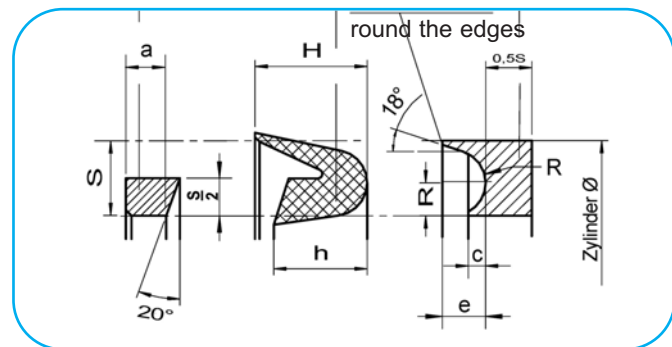
## INSERTION CHAMFER

S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10

## SUPPORT

If the adapter rings must be manufactured of metal, following drawing of the measurement establishing servers:

metal adapter ring sealing ring NOI1 metal adapter ring



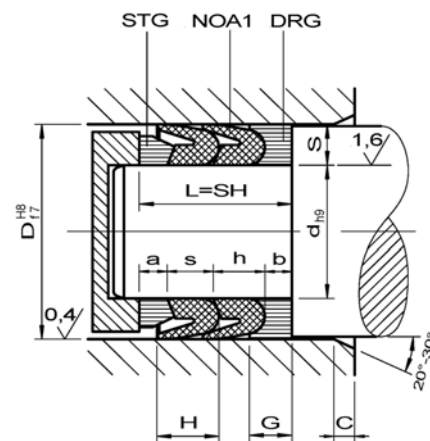
$$a = H - h + 0,3 S$$

$$R = 0,44 S$$

$$c = 0,25 S$$

$$e = 0,6 S$$

## CYLINDER SEAL



L = installation length

SH = height of the set

x = number of NOI1-rings

$$L = SH = a+h+ (x-1) s+b$$

The result is only a clue.

According to profile-width, ring-numbers, material-shrinkage etc. can deviations until +2 and .1 mm appear.





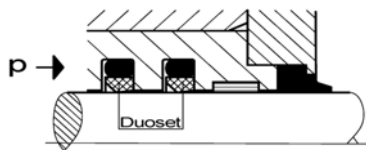
Nominal seal dimensions					Tool-no.		adapt.ring		Female adapt.ring		
D	d	H	h	s	rubber fabric	rubber	a	Tool-no.	G	b	Tool-no.
20	8	8	6,8	6,2	2-06084						
24	13	10,4	7,8	7,2	2-05093						
25	13	10,4	7,8	7	2-02036						
32	24	6	5	4,5	2-00610						
36	23	9,7	8,2	7,4	2-04012						
38	30	6	5	4,5	2-00611						
40	20	17,3	13	11,8	2-01368						
40	28	9	7,5	6,8	2-04840						
43	26	12,7	10,7	9,6	2-00420						
44	25	15	12,5	11,2	2-01122						
45	25	15	12,5	11,3	2-00649						
45	29	12	10	9	2-01679						
48	28	17,3	13	11,8	2-01290						
48	36	10,4	7,8	7,1	2-09069						
50	26	18	15	13,4	2-00253						
55	35	17,3	13	11,8	2-01921						
55	39	12	10	8,9	2-00328						
55	40	11,2	9,4	8,4	2-02312						
60	30	22,5	18,8	16,9	2-06314						
60	42	13,5	11,3	10,2	2-01329						
62	46	12	10	8,9	2-00875						
63,5	44,5	14,2	11,9	10,7	2-07132	2-07131					
65	45	17,3	13	11,6	2-06239						
65	50	12,8	9,8	8,5	2-04867						
70	50	15	12,5	11,2	2-00100						
70	54	12	10	8,9	2-00467						
75	55	17,3	13	11,8	2-04999				17,3	11,5	2-05032
80	60	17,3	13	12,2	2-01310						
80	64	12	10	8,8	2-00360						
85	61	18	15	13,5	2-00909						
86	66	17,5	13,1	11,7	2-03468		8	2-03468			
90	60	22,5	18,8	17	2-00984						
90	70	15	12,5	11,3	2-01801						
90	70	17,3	13	11,8	2-04998						
92	72	15	12,5	11,3	2-01293						
95	75	15	12,5	11,2	2-00533						
100	76	18	15	13,5	2-01292						
100	76	21,1	15,6	14,2	2-01362						
100	84	12	10	8,9	2-00514						
105	89	12	10	8,9	2-00534						
110	90	15	12,5	11,1	2-01056						
110	90	17,3	13	11,8	2-04997						
114	82	24	20	18	2-00256						
120	90	22	16	14	2-04351						
120	96	21,1	15,6	13,7	2-11771						
125	90	22	16	13,7	2-04352						
125	95	25,7	19,5	17,5	2-02431						
125	100	21,5	16,3	14,6	2-04150						
126	86	30	25	22,4	2-01000						
130	102	24,3	18,2	16,3	2-02433						
130	110	17,3	13	11,8	2-02380						
135	115	15	12,5	11,1	2-01471						
140	110	22,5	18,8	16,5	2-00506						
140	110	25,7	19,5	17,2	2-05463						
140	116	18	15	13,5	2-00674						
140	120	15	12,5	11,2	2-05420						
150	122	21	17,5	15,7	2-03389						
155	125	28	20	18	2-03616				25,5	18	2-08139
160	130	22,5	18,8	17	2-01394						
160	140	17	13	11,3	2-12007						
175	135	30	25	22,5	2-01574						
175	150	18,7	15,7	14	2-03833						
180	150	22,5	18,8	17	2-01337						
190	170	15	12,5	11,2	2-00810						
210	176	28	21	19	2-03094						
210	176	28	21	19	2-11455						
220	190	22,5	18,8	17	2-05022						
230	200	22,5	18,8	16,9	2-00484						
250	225	18,7	15,7	14,2	2-02335						
254	230	22	18	16,4	2-01071						
255	225	25,7	19,5	17,7	2-02784						
260	230	22,5	18,8	16,4	2-00725						
315	275	34,5	26	23,4	2-02432						
320	270	45	35	31,1	2-12089						
320	284	31,4	23,5	21,2	2-02174						
326	286	30	25	22,3	2-01748						
380	350	22,5	18,8	17	2-01819						
455	420	30	25	22,5	2-01747						
537	487	37,5	31,3	28	2-00737						





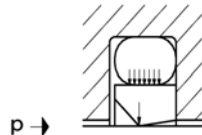
## SEAL PROPERTIES

- PTFE slide ring with elastic clamping element
- high sealing effect at low friction
- no stick slip
- very long service lives
- less space requirement and easy installation areas
- for pressure admission on one side
- high specific surface pressure
- a good sealing pressure is achieved with the application of the operating pressure and by pretensioning
- single or tandem arrangement



## APPLICATION

- rod seal in hydraulic systems
- shaft seal
- hinges and rotary transmission leadthrough at low speed.

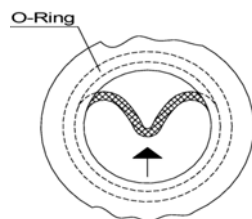


## MATERIAL

EURAFLO<sup>®</sup> (PTFE) compound with elastic elastomer clamping element. For further materials, please refer to the general table.

## INSTALLATION

To be latched into the closed groove by reniform deformation. For diameter < 35 mm, an open groove is necessary.



In standard dimensions or as per your specifications.

Please do not hesitate to contact our service department.

## EXAMPLE FOR ORDER

DuoSet sealing sets DS4-W for a rod diameter for 100 mm: *DUSOET DSs 4-W 100*

## RECOMMENDED VALUES FOR APPLICATION:

(other temperature ranges upon request)

p (bar)	t(°C)	v (m/s)
≤ 500	- 20 up to + 120	≤ 5

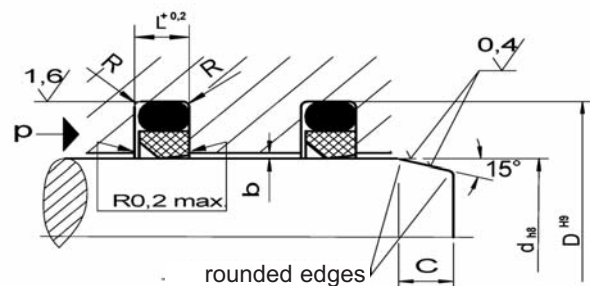
admissible clearance b;

up to p = 350 bar: C = L

D = 10 - 40 b<sub>(zul)</sub> = 0,3 - 0,0006p

D = 41 - 360 b<sub>(zul)</sub> = 0,4 - 0,0007p,

For p > 350 bar we recommend fit H8/f7





DS4-W (standard series)				
d	D	L	Order No.	R
10	17,3	3,2	DS4-W 10	0,2
12	19,3		DS4-W 12	
14	21,3		DS4-W 14	
16	23,3		DS4-W 16	
18	25,3		DS4-W 18	
20	30,7	4,2	DS4-W 20	0,3
22	32,7		DS4-W 22	
25	35,7		DS4-W 25	
28	38,7		DS4-W 28	
30	40,7		DS4-W 30	
32	42,7		DS4-W 32	
35	45,7		DS4-W 35	
36	46,7		DS4-W 36	
40	55,1		DS4-W 40	
45	60,1		DS4-W 45	
50	65,1	DS4-W 50		
56	71,1	DS4-W 56		
60	75,1	DS4-W 60		
63	78,1	DS4-W 63		
70	85,1	DS4-W 70		
75	90,1	DS4-W 75		
80	95,1	DS4-W 80		
85	100,1	DS4-W 85		
90	105,1	DS4-W 90		
100	115,1	DS4-W 100		
110	125,1	DS4-W 110		
120	135,1	DS4-W 120		
125	140,1	DS4-W 125		
140	155,1	DS4-W 140		
160	175,1	DS4-W 160		
180	195,1	DS4-W 180		
200	220,5	8,1	DS4-W 200	0,6
220	240,5		DS4-W 220	
250	270,5		DS4-W 250	
280	304		DS4-W 280	
320	344		DS4-W 320	
360	384		DS4-W 360	

DS4-WB ( wide series )				
d	D	L	Order No.	R
10	20,7	4,2	DS4-WB 10	0,3
12	22,7		DS4-WB 12	
14	24,7		DS4-WB 14	
16	26,7		DS4-WB 16	
18	28,7		DS4-WB 18	
20	35,1	6,3	DS4-WB 20	0,5
22	37,1		DS4-WB 22	
25	40,1		DS4-WB 25	
28	43,1		DS4-WB 28	
30	45,1		DS4-WB 30	
32	47,1		DS4-WB 32	
35	50,1		DS4-WB 35	
36	51,1		DS4-WB 36	
40	60,5		DS4-WB 40	
45	65,5		DS4-WB 45	
50	70,5	DS4-WB 50		
56	76,5	DS4-WB 56		
60	80,5	DS4-WB 60		
63	83,5	DS4-WB 63		
70	90,5	DS4-WB 70		
75	95,5	DS4-WB 75		
80	100,5	DS4-WB 80		
85	105,5	DS4-WB 85		
90	110,5	DS4-WB 90		
100	120,5	DS4-WB 100		
110	130,5	DS4-WB 110		
120	140,5	DS4-WB 120		
125	145,5	DS4-WB 125		
140	160,5	DS4-WB 140		
160	180,5	DS4-WB 160		
180	200,5	DS4-WB 180		
200	224	9,5	DS4-WB 200	0,8
220	244		DS4-WB 220	
250	274		DS4-WB 250	
280	307,3		DS4-WB 280	
320	347,3		DS4-WB 320	
360	387,3		DS4-WB 360	

DS4-WS ( narrow series )				
d	D	L	Order No.	R
10	14,9	2,2	DS4-WS 10	0,1
12	16,9		DS4-WS 12	
14	18,9		DS4-WS 14	
16	20,9		DS4-WS 16	
18	22,9		DS4-WS 18	
20	27,3	3,2	DS4-WS 20	0,2
22	29,3		DS4-WS 22	
25	32,3		DS4-WS 25	
28	35,3		DS4-WS 28	
30	37,3		DS4-WS 30	
32	39,3		DS4-WS 32	
35	42,3		DS4-WS 35	
36	43,3		DS4-WS 36	
40	50,7		DS4-WS 40	
45	55,7		DS4-WS 45	
50	60,7	DS4-WS 50		
56	66,7	DS4-WS 56		
60	70,7	DS4-WS 60		
63	73,7	DS4-WS 63		
70	80,7	DS4-WS 70		
75	85,7	DS4-WS 75		
80	90,7	DS4-WS 80		
85	95,7	DS4-WS 85		
90	100,7	DS4-WS 90		
100	110,7	DS4-WS 100		
110	120,7	DS4-WS 110		
120	130,7	DS4-WS 120		
125	135,7	DS4-WS 125		
140	150,7	DS4-WS 140		
160	170,7	DS4-WS 160		
180	190,7	DS4-WS 180		
200	215,1	6,3	DS4-WS 200	0,5
220	235,1		DS4-WS 220	
250	265,1		DS4-WS 250	
280	300,5	8,1	DS4-WS 280	0,6
320	340,5		DS4-WS 320	
360	380,5		DS4-WS 360	



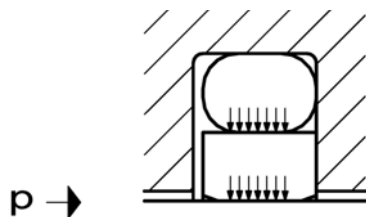


## SEAL PROPERTIES

- PTFE slide ring: clamping element (O-ring)
- high sealing effect at low friction
- no stick slip
- very long service lives also in the case of poor lubrication conditions
- less space required and easy installation areas
- for pressure admission on one or on both sides
- a good sealing pressure is achieved with the application of the operating pressure and by pretensioning

## APPLICATION

- rod seal in hydraulic systems
- shaft seal
- hinges and rotary transmission leadthrough at low speed

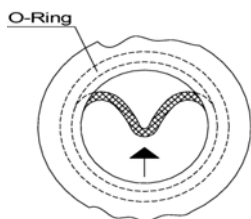


## MATERIAL

EURAFLO<sup>®</sup> (PTFE) compound clamping element (O-ring) made of elastomer. For further materials, please refer to the general table.

## INSTALLATION

To be latched into the closed groove by reniform deformation. For diameter  $d < 35$  mm, an open groove is necessary.



## AVAILABILITY

in standard dimensions or as per your specifications. Please do not hesitate to contact us.







## HECKER EUROSET-SEALING SET SERIES EUS1-HN, EUS2-HN AND EUS3-HN

### EXAMPLE FOR ORDER:

Euroset-sealing set EUS1-HN for a rod diameter of 100 mm: *EUROSET EUS1-H 100*

### RECOMMENDED VALUES FOR APPLICATION

other temperature ranges upon request

Hydraulic systems:  $p$  (bar)  $\leq 500$   
 $t$  (°C) -30 up to +120  
 $v$  (m/s)  $\leq 5$

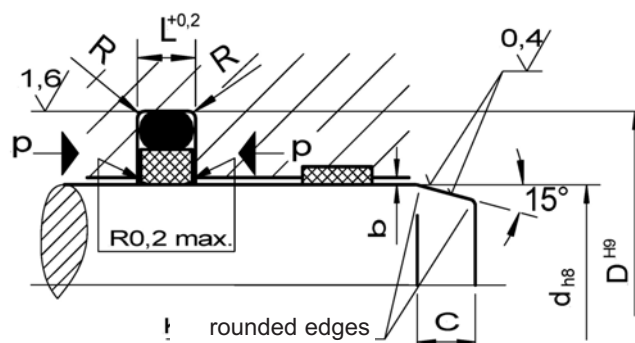
Pneumatic systems:  $p$  (bar)  $\leq 16$   
 $t$  (°C) -30 up to +120  
 $v$  (m/s)  $\leq 5$

admissible clearance  $b$ ; up to  $p = 350$  bar:  $C = L$

$D = 10 - 40$   $b$ (zul) = 0,3 - 0,0006 $p$

$D = 41 - 360$   $b$ (zul) = 0,4 - 0,0007 $p$ ,

for  $p > 350$  bar we recommend fit H8/f7



EUS1-H ( standard series )				
d	D	L	Order-No.	R
10	17,3	3,2	EUS1-H 10	0,2
12	19,3		EUS1-H 12	
14	21,3		EUS1-H 14	
16	23,3		EUS1-H 16	
18	25,3		EUS1-H 18	
20	30,7	4,2	EUS1-H 20	0,3
22	32,7		EUS1-H 22	
25	35,7		EUS1-H 25	
28	38,7		EUS1-H 28	
30	40,7		EUS1-H 30	
32	42,7		EUS1-H 32	
35	45,7		EUS1-H 35	
36	46,7	EUS1-H 36	6,3	0,5
40	55,1	EUS1-H 40		
45	60,1	EUS1-H 45		
50	65,1	EUS1-H 50		
56	71,1	EUS1-H 56		
60	75,1	EUS1-H 60		
63	78,1	EUS1-H 63		
70	85,1	EUS1-H 70		
75	90,1	EUS1-H 75		
80	95,1	EUS1-H 80		
85	100,1	EUS1-H 85	8,1	0,6
90	105,1	EUS1-H 90		
100	115,1	EUS1-H 100		
110	125,1	EUS1-H 110		
120	135,1	EUS1-H 120		
125	140,1	EUS1-H 125		
140	155,1	EUS1-H 140		
160	175,1	EUS1-H 160		
180	195,1	EUS1-H 180		
200	220,5	9,5	EUS1-H 200	0,8
220	240,5		EUS1-H 220	
250	270,5		EUS1-H 250	
280	304		EUS1-H 280	
320	344		EUS1-H 320	
360	384		EUS1-H 360	

EUS2-H ( wide series )				
d	D	L	Order-No.	R
10	20,7	4,2	EUS2-H 10	0,3
12	22,7		EUS2-H 12	
14	24,7		EUS2-H 14	
16	26,7		EUS2-H 16	
18	28,7		EUS2-H 18	
20	35,1	6,3	EUS2-H 20	0,5
22	37,1		EUS2-H 22	
25	40,1		EUS2-H 25	
28	43,1		EUS2-H 28	
30	45,1		EUS2-H 30	
32	47,1		EUS2-H 32	
35	50,1		EUS2-H 35	
36	51,1	EUS2-H 36	8,1	0,6
40	60,5	EUS2-H 40		
45	65,5	EUS2-H 45		
50	70,5	EUS2-H 50		
56	76,5	EUS2-H 56		
60	80,5	EUS2-H 60		
63	83,5	EUS2-H 63		
70	90,5	EUS2-H 70		
75	95,5	EUS2-H 75		
80	100,5	EUS2-H 80		
85	105,5	EUS2-H 85	9,5	0,8
90	110,5	EUS2-H 90		
100	120,5	EUS2-H 100		
110	130,5	EUS2-H 110		
120	140,5	EUS2-H 120		
125	145,5	EUS2-H 125		
140	160,5	EUS2-H 140		
160	180,5	EUS2-H 160		
180	200,5	EUS2-H 180		
200	224	9,5	EUS2-H 200	0,8
220	244		EUS2-H 220	
250	274		EUS2-H 250	
280	307,3		EUS2-H 280	
320	347,3		EUS2-H 320	
360	387,3		EUS2-H 360	

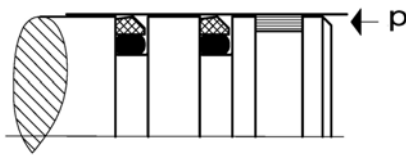
EUS3-H ( narrow series )				
d	D	L	Order-No.	R
10	14,9	2,2	EUS3-H 10	0,1
12	16,9		EUS3-H 12	
14	18,9		EUS3-H 14	
16	20,9		EUS3-H 16	
18	22,9		EUS3-H 18	
20	27,3	3,2	EUS3-H 20	0,2
22	29,3		EUS3-H 22	
25	32,3		EUS3-H 25	
28	35,3		EUS3-H 28	
30	37,3		EUS3-H 30	
32	39,3		EUS3-H 32	
35	42,3		EUS3-H 35	
36	43,3	EUS3-H 36	4,2	0,3
40	50,7	EUS3-H 40		
45	55,7	EUS3-H 45		
50	60,7	EUS3-H 50		
56	66,7	EUS3-H 56		
60	70,7	EUS3-H 60		
63	73,7	EUS3-H 63		
70	80,7	EUS3-H 70		
75	85,7	EUS3-H 75		
80	90,7	EUS3-H 80		
85	95,7	EUS3-H 85	6,3	0,5
90	100,7	EUS3-H 90		
100	110,7	EUS3-H 100		
110	120,7	EUS3-H 110		
120	130,7	EUS3-H 120		
125	135,7	EUS3-H 125		
140	150,7	EUS3-H 140		
160	170,7	EUS3-H 160		
180	190,7	EUS3-H 180		
200	215,1	8,1	EUS3-H 200	0,6
220	235,1		EUS3-H 220	
250	265,1		EUS3-H 250	
280	300,5		EUS3-H 280	
320	340,5		EUS3-H 320	
360	380,5		EUS3-H 360	





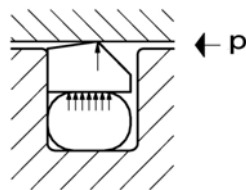
## SEAL PROPERTIES

- PTFE slide ring: clamping element (O-ring)
- high sealing effect at low friction
- no stick slip
- very long service lives
- less space required and easy installation areas
- high specific surface pressure
- a good sealing pressure is achieved with the application of the operating pressure and by pretensioning
- single or tandem arrangement



## APPLICATION

Piston seal in hydraulic systems, pressure admission on one side.

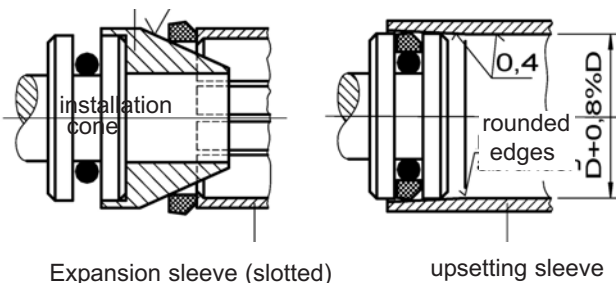


## MATERIAL

EURAFLO<sup>®</sup> (PTFE) compound with clamping element (O-ring) made of elastomer. For further materials, please refer to the general table.

## INSTALLATION

- With installation tools as per attached drawing
- Heating of the slide ring to approx. 100°C facilitates the installation procedure



## AVAILABILITY

In standard dimensions or as per your specifications. Please do not hesitate to contact our service department.





## SEAL PROPERTIES

- PTFE slide ring: elastic clamping element (O-ring)
- high sealing effect at low friction
- no stick-slip
- very long service lives also in the case of poor lubrication conditions
- less space required and easy installation areas
- a good sealing pressure is achieved with the application of the operating pressure and by pretensioning
- if necessary with pressure compensating grooves.

## APPLICATION

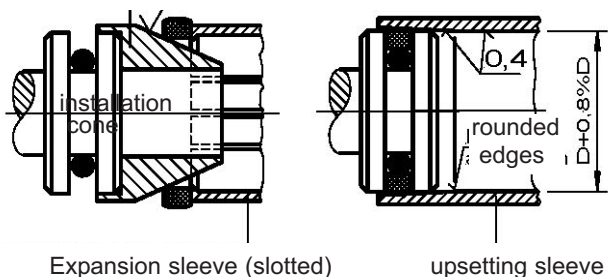
- piston seal in hydraulic systems pressure admission on both sides.

## MATERIAL

EURAFLOX (PTFE) compound with clamping element (O-ring) made of elastomer. For further materials, please refer to the general table.

## INSTALLATION

- with installation tools as per attached drawing
- heating of the slide ring to approx. 100°C facilitates the installation procedure.



## AVAILABILITY

In standard dimensions or as per your specifications. Please do not hesitate to contact our service department.





## HECKER EUROSET-SEALING SET SERIES EUK1-H, EUK2-H AND EUK3-H

### EXAMPLE FOR ORDER

Euroset-sealing set EUK1-H for a cylinder diameter of 100 mm: *Euroset EUK1-H 100*

### RECOMMENDED VALUES FOR APPLICATION

other temperature ranges upon request

Hydraulic systems:  $p$  (bar)  $\leq 500$   
 $t$  (°C) -30 up to +120  
 $v$  (m/s)  $\leq 5$

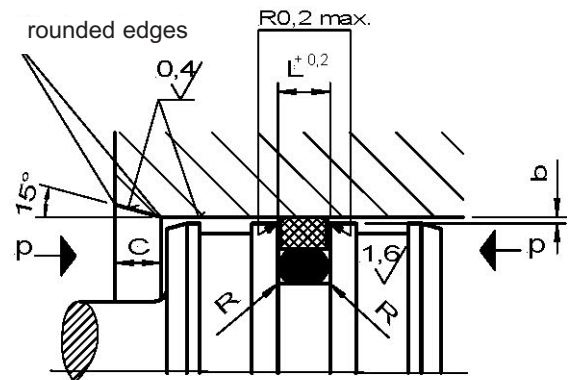
Pneumatic systems:  $p$  (bar)  $\leq 16$   
 $t$  (°C) -30 up to +120  
 $v$  (m/s)  $\leq 5$

admissible clearance  $b$ ; up to  $p = 350$  bar:  $C = L$

$D = 20-80$ ,  $b_{zul} = 0,3 - 0,0006 p$

$D = 81-400$ ,  $b_{zul} = 0,4 - 0,0007 p$

For  $p > 350$  bar we recommend fit H8/f7



EUK1-H ( Standard series )				
D	d	L	Order-No.	R
16	8,5	3,2	EUK1-H 16	0,2
20	12,5		EUK1-H 20	
22	14,5		EUK1-H 22	
25	17,5		EUK1-H 25	
28	20,5		EUK1-H 28	
30	22,5		EUK1-H 30	
32	24,5		EUK1-H 32	
35	27,5		EUK1-H 35	
40	29	4,2	EUK1-H 40	0,3
45	34		EUK1-H 45	
50	39		EUK1-H 50	
60	49		EUK1-H 60	
63	52		EUK1-H 63	
70	59		EUK1-H 70	
80	64,5	6,3	EUK1-H 80	0,5
100	84,5		EUK1-H 100	
125	109,5		EUK1-H 125	
140	119	8,1	EUK1-H 140	0,6
160	139		EUK1-H 160	
180	159		EUK1-H 180	
200	179		EUK1-H 200	
220	199		EUK1-H 220	
250	229		EUK1-H 250	
280	259		EUK1-H 280	
300	279		EUK1-H 300	
320	299		EUK1-H 320	
400	375,5		EUK1-H 400	

EUK2-H ( standard series )				
D	d	L	Order-No.	R
16	5	4,2	EUK2-H 16	0,3
20	9		EUK2-H 20	
22	11		EUK2-H 22	
25	14		EUK2-H 25	
28	17		EUK2-H 28	
30	19		EUK2-H 30	
32	21		EUK2-H 32	
35	24		EUK2-H 35	
40	24,5	6,3	EUK2-H 40	0,5
45	29,5		EUK2-H 45	
50	34,5		EUK2-H 50	
60	44,5		EUK2-H 60	
63	47,5		EUK2-H 63	
70	54,5		EUK2-H 70	
80	59	8,1	EUK2-H 80	0,6
100	79		EUK2-H 100	
125	104		EUK2-H 125	
140	115,5		EUK2-H 140	
160	135,5		EUK2-H 160	
180	155,5		EUK2-H 180	
200	175,5		EUK2-H 200	
220	195,5		EUK2-H 220	
250	225,5	EUK2-H 250		
280	255,5	EUK2-H 280		
300	275,5	EUK2-H 300		
320	295,5	EUK2-H 320		
400	372	9,5	EUK2-H 400	0,8

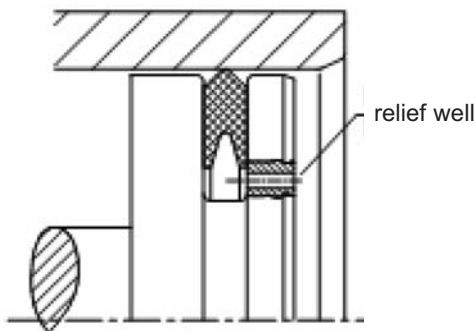
EUK3-H ( Standard series )						
D	d	L	Order-No.	R		
16	11,1	2,2	EUK3-H 16	0,1		
20	15,1		EUK3-H 20			
22	17,1		EUK3-H 22			
25	20,1		EUK3-H 25			
28	23,1		EUK3-H 28			
30	25,1		EUK3-H 30			
32	27,1	EUK3-H 32				
35	30,1	EUK3-H 35				
40	32,5	3,2	EUK3-H 40	0,2		
45	37,5		EUK3-H 45			
50	42,5		EUK3-H 50			
60	52,5		EUK3-H 60			
63	55,5		EUK3-H 63			
70	62,5		EUK3-H 70			
80	69	4,2	EUK3-H 80	0,3		
100	89		EUK3-H 100			
125	114		EUK3-H 125			
140	124,5	6,3	EUK3-H 140	0,5		
160	144,5		EUK3-H 160			
180	164,5		EUK3-H 180			
200	184,5		EUK3-H 200			
220	204,5		EUK3-H 220			
250	234,5		EUK3-H 250			
280	264,5		EUK3-H 280			
300	284,5		EUK3-H 300			
320	304,5		EUK3-H 320			
400	379		8,1		EUK3-H 400	0,6





## SEAL PROPERTIES AND APPLICATION

- rod and cylinder seal for pneumatic systems
- low friction
- lubricating film by optimum profile arrangement
- very long service lives
- symmetrical profile, easy installation
- pressure admission on one side or on both sides

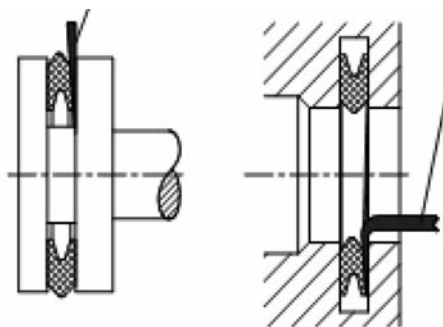


## RECOMMENDED VALUES FOR APPLICATION

SEALING MATERIAL	OPERATING MEDIUM	HYDRAULIC SYSTEMS		
		p(bar)	t(°C)	v(m/s)
413 707	compressed air	≤ 16	-35 up to +80	≤ 1

For further materials, please refer to the general table.

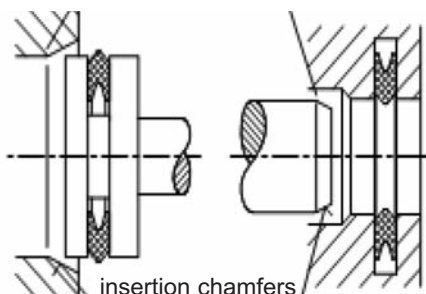
Fitting auxiliary / burrfree rounded



## INSTALLATION

- to be latched
- no sharp edges, please do not use sharp installation tools

rounded edges

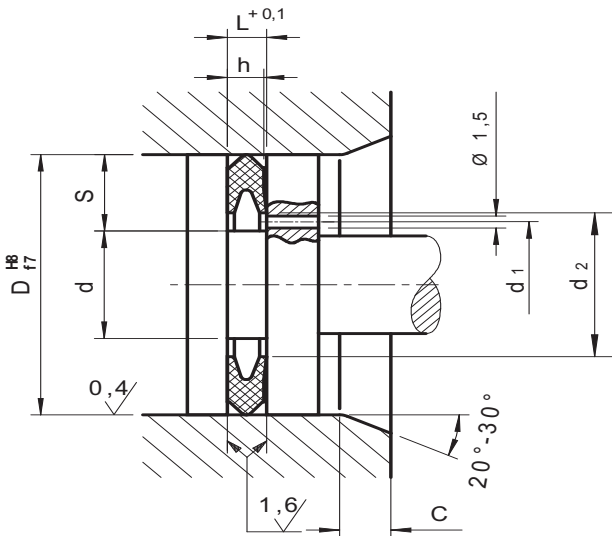


insertion chamfers  
fitting auxiliary / burrfree rounded

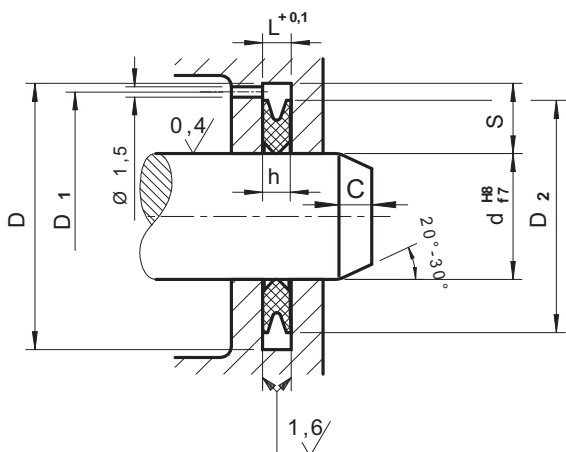




## SEALING OF A CYLINDER PKK1



Bore  $\varnothing$  1,5mm diam. pitch circle diameter  $\varnothing$ d1 or D1 only possible for pressure admission on one side (arrangement on pressure side).



## SEALING OF A PISTON ROD

S	4	5	7,5	10	12,5	15	20
C	2	2,5	4	5	6,5	7,5	10

## SEALING OF A CYLINDER PKK1

nominal dimensions order no. dimension of grooves

D	d <sub>2</sub>	h		d	L	d <sub>1</sub>
12	7,2	1,5	2-09826	5,2	1,7	6,8
14,7	7,1	2	2-12954	5,2	2,3	6,8
15	7,4	2	2-09963	5,2	2,3	6,8
18	10,4	2	2-11072	7,5	2,3	11,2
20	12,4	2	2-11871	9,5	2,3	11,2
25	17,4	2	2-12877	14,5	2,3	16,2
30	22,4	2	2-09571	19,5	2,3	21,2
30	24,2	1,5	2-09473	21	1,7	22,7
32	24,4	2	2-11518	21,5	2,3	23,2
35	25	2,5	2-11718	21,5	3	23,2
40	30	2,5	2-09475	26,5	3	28,2
45	35	2,5	2-09466	31,5	3	33,2
50	39	2,5	2-11184	36,5	3	37,2
50	40	2,5	2-12510	36,5	3	39,2
60	46	3	2-09572	42,5	3,5	44,2
63	49	3	2-11235	45,5	3,5	47,2
70	58	3	2-09701	54,5	3,5	56,2
74	62	3	2-12728	58,5	3,5	60,2
80	63,4	3,5	2-11313	60	4,1	61,7
82	65,4	3,5	2-09846	62	4,1	63,7
100	83,8	4	2-11519	80	4,6	81,7
102	85,4	4	2-09931	82	4,6	83,7
110	93,4	4	2-12729	90	4,6	91,7
118	99	4,5	2-11010	95	5,1	96,7
125	104,4	4,5	2-09476	100	5,1	101,7
127	106,4	4,5	2-09806	102	5,1	103,7
150	126,4	5,5	2-09932	122,5	6,2	124
160	135,6	5,5	2-09995	132	6,2	134
175	151	6	2-11335	148	6,7	150
180	156	6	2-09799	152	6,7	154
222	190	8	2-11044	186	8,8	188
255	223	8	2-11045	219	8,8	221

## SEALING OF A PISTON ROD

nominal dimensions order no. dimension of grooves

d	D <sub>2</sub>	h		D	L	D <sub>1</sub>
16	21,4	1,5	2-09478	24	1,8	22,3
16	25	2	2-09472	27	2,3	25,4
20	27,6	2	2-09479	30	2,3	28,4
22	29,6	2	2-12421	32	2,3	30,4
30	39	2	2-11762	41	2,3	39,5
36	46	2,5	2-11763	48	3	46,4
45	57	2,5	2-11764	59	3	57,4
60	74	3	2-11240	77	3,5	75,4
90	106,6	3,5	2-11241	110	4,1	108,4

**HECKER® GSM®**  
**EUK-P**  
**EUROSET-PACKING**  
**CYLINDER SEAL**  
**PNEUMATIC**  
**SYSTEMS**



**SEAL PROPERTIES**

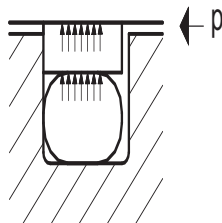
- PTFE slide ring, clamping element (O-ring)
- high sealing effect at low friction
- no stick-slip
- very long service lives also in the case of poor lubrication conditions
- less space required and easy installation areas
- a good sealing pressure is achieved with the application of the operating pressure and by pre-tensioning.

**APPLICATION**

piston seal in pneumatic systems

**MATERIAL**

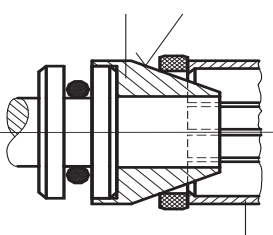
EURAFLO<sup>®</sup> (PTFE)-compound with clamping element (O-ring) made of elastomer. For further materials, please refer to the general table.



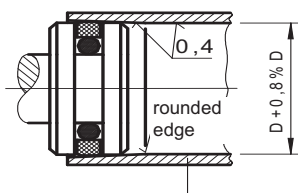
**INSTALLATION**

- with installation tools as per attached drawing
- heating of the slide ring to approx. 100°C facilitates the installation procedure

installation cone 0,4



expansion sleeve (slotted)



upsetting sleeve

**AVAILABILITY**

As to the dimensions available, please contact our service department.



# HECKER® GSM® EUK-P EUROSET-PACKING CYLINDER SEAL PNEUMATIC SYSTEMS

## HECKER EUROSET SEALING SET

Series EUK1-P

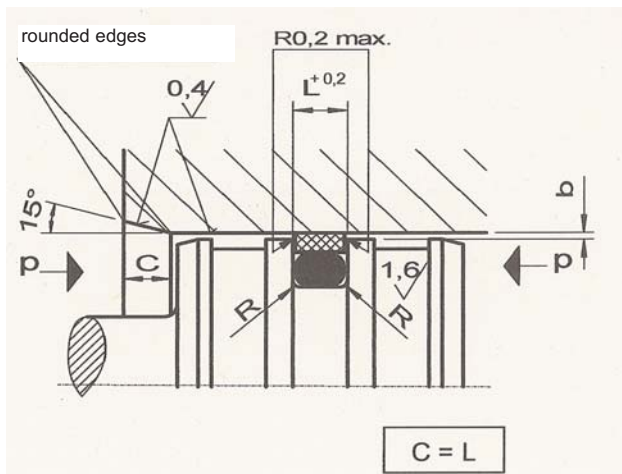
### EXAMPLE FOR ORDER

Euroset-sealing set EUK1-P for a cylinder diameter of 100 mm:

Euroset EUK1-P 100

### RECOMMENDED VALUES FOR APPLICATION

p (bar)	t (°C)	v (m/s)	
≤ 25	- 30 up to +120	≤ 5	Pneumatic systems



other temperature ranges upon request

nominal dimensions			(Order no.)	R
D	d	L		
8	3,6	2,2	EUK1-P 8	0,1
10	5,6	2,2	EUK1-P 10	0,1
12	7,6	2,2	EUK1-P 12	0,1
16	11,6	2,2	EUK1-P 16	0,1
20	15,6	2,2	EUK1-P 20	0,1
25	20,6	2,2	EUK1-P 25	0,1
32	25,6	3,2	EUK1-P 32	0,2
40	33,6	3,2	EUK1-P 40	0,2
50	43,6	3,2	EUK1-P 50	0,2
63	54,2	4,2	EUK1-P 63	0,3
80	71,2	4,2	EUK1-P 80	0,3
100	91,2	4,2	EUK1-P 100	0,3
125	116,2	4,2	EUK1-P 125	0,3
160	151,2	4,2	EUK1-P 160	0,3
200	187,2	6,3	EUK1-P 200	0,5
250	237,2	6,3	EUK1-P 250	0,5



**HECKER® GSM®**  
**EUS-P**  
**EUROSET-PACKING**  
**ROD SEAL**  
**PNEUMATIC**  
**SYSTEMS**



**SEAL PROPERTIES**

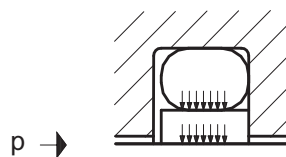
- PTFE slide ring: clamping element (O-ring)
- high sealing effect at low friction
- no stick slip
- very long service lives also in the case of poor lubrication conditions
- less space required and easy installation areas
- a good sealing pressure is achieved with the application of the operating pressure and by pre-tensioning

**APPLICATION**

- rod seal in pneumatic systems
- shaft seal
- shaft seal for slow rotating and pivoting motion

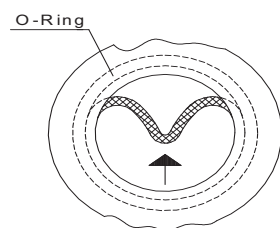
**MATERIAL**

EURAFロン® (PTFE)-compound with clamping element (O-ring) made of elastomer. For further materials, please refer to the general table.



**INSTALLATION**

To be latched into the closed groove by reniform deformation. For diameter  $d < 30$  mm, an open groove is necessary.



**AVAILABILITY**

As to the dimensions available, please contact our service department.



# HECKER® GSM® EUS-P EUROSET-PACKING ROD SEAL PNEUMATIC SYSTEMS

## HECKER EUROSET SEALING SET SERIES EUS1-P

### EXAMPLE FOR ORDER

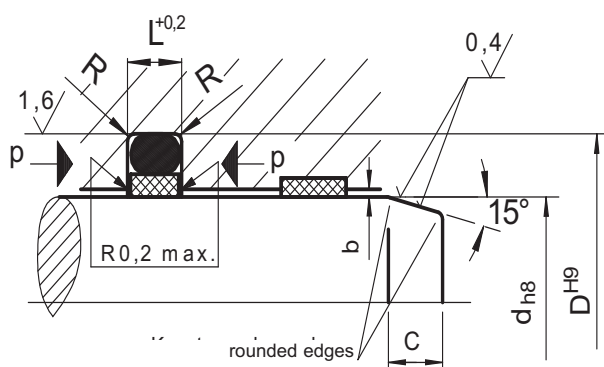
Euroset sealing set EUS1-P for a rod diameter of 100 mm:

Euroset EUS1-P 100

### RECOMMENDED VALUES FOR APPLICATION

p (bar)	t (°C)	v (m/s)	
≤ 25	- 30 up to +120	≤ 5	Pneumatic systems

other temperature ranges upon request



$$C = L$$

nominal dimensions			(Order no.)	R
6	10,4	2,2	EUS1-P 6	0,1
8	12,4	2,2	EUS1-P 8	0,1
10	14,4	2,2	EUS1-P 10	0,1
12	16,4	2,2	EUS1-P 12	0,1
14	18,4	2,2	EUS1-P 14	0,1
16	20,4	2,2	EUS1-P 16	0,1
18	22,4	2,2	EUS1-P 18	0,1
20	24,4	2,2	EUS1-P 20	0,1
22	26,4	2,2	EUS1-P 22	0,1
25	29,4	2,2	EUS1-P 25	0,1
28	34,4	3,2	EUS1-P 28	0,2
30	36,4	3,2	EUS1-P 30	0,2
32	38,4	3,2	EUS1-P 32	0,2
36	42,4	3,2	EUS1-P 36	0,2
40	46,4	3,2	EUS1-P 40	0,2
45	51,4	3,2	EUS1-P 45	0,2
50	56,4	3,2	EUS1-P 50	0,2
56	64,8	4,2	EUS1-P 56	0,3
60	68,8	4,2	EUS1-P 60	0,3
63	71,8	4,2	EUS1-P 63	0,3
70	78,8	4,2	EUS1-P 70	0,3
80	88,8	4,2	EUS1-P 80	0,3
90	98,8	4,2	EUS1-P 90	0,3
100	108,8	4,2	EUS1-P 100	0,3
110	118,8	4,2	EUS1-P 110	0,3
125	133,8	4,2	EUS1-P 125	0,3
140	148,8	4,2	EUS1-P 140	0,3
160	168,8	4,2	EUS1-P 160	0,3
180	192,8	6,3	EUS1-P 180	0,5
200	212,8	6,3	EUS1-P 200	0,5

# HECKER® GSM® UNA-P & UNI-P U-RING PNEUMATIC SYSTEMS CYLINDER & ROD SEAL



## APPLICATION

- cylinder seal for pneumatic systems (UNA-P) & rod seal for pneumatic systems (UNI-P)
- low friction by means of an optimum profile design
- application in the case of dry, oilfree compressed air
- lubrication only one time during installation
- small installation areas
- installation within closed grooves

## RECOMMENDED VALUES FOR APPLICATION

For further materials please refer to the general table

## EXAMPLE FOR ORDER

Sealing material	Operating medium	Pneumatic systems		
		p (bar)	t (°C)	v (m/s)
707	Compressed air	≤ 16	-30 up to +80	≤ 1

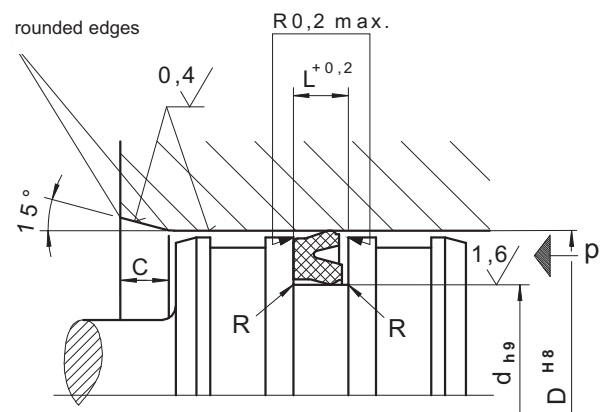
U-Ring UNA-P for a cylinder diameter of 63 mm:  
UNA-P 63x53x4,2

## TOOLS UNA-P (UNI-P TOOLS ON ENQUIRY)

NOMINAL DIMENSION TOOL-NO. WIDTH OF GROOVE L

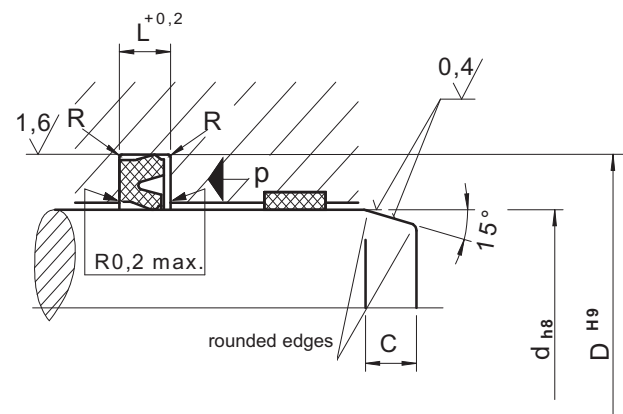
D	d	H	TOOL-NO.	WIDTH OF GROOVE L
20	14	2,5	2-11910	3
25	19	3,2	2-12021	3,5
26	20	3,25	2-12883	3,5
30	22	3,2	2-12010	3,5
35	27	3,25	2-12248	3,5
44	36	3,2	2-12656	3,5
50	42	3,2	2-12374	3,5
63	53	4,2	2-12375	4,5
69	60	7,5	2-12246	8,5
70	60	4,25	2-12265	5,2
80	64	8	2-12789	9
200	170	16	2-12326	18

## CYLINDER SEAL UNA-P



$$C = L$$

## ROD SEAL UNI-P



$$C = L$$

**HECKER® GSM®**

## **ASD 1 ARMATURE SHAFT SEAL**

An elastomer sealing element which fits into already existing stuffing box areas without any changes in construction.

Depending on the respective service conditions (media, temperature, pressure) we are able to deliver materials based on silicone, perbunane, EPDM and fluororubber.

The advantage of these seals is a completely self-acting and maintenance-free functioning.

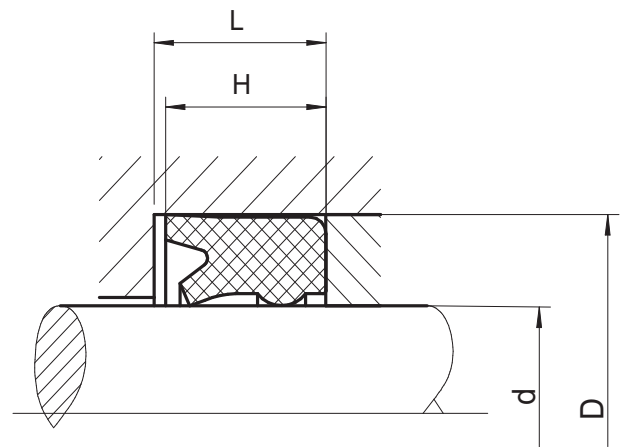
A mechanical retightening of the seal by connecting bushings or screw nuts is not required. Furthermore, a constructively unavoidable excentric mismatch of the shafts relative to their housings is equalized to a certain rate. Due to the geometrical design of the inside structure a closed gap is produced which can be filled with a suitable lubricant ensuring an extremely high easy-running of these soft elastomer seals.

### **AVAILABILITY**

For the dimensions available, please contact us.

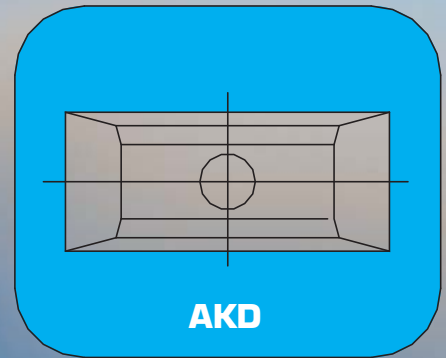


nominal dimensions			(Order no.)	installation length L
d	D	H		
8	18	10	2-11104	10,5
10	20	10	2-11069	10,5
12	22	10	2-11106	10,5
12	24	10	2-11735	10,5
16	26	10	2-11107	10,5
18	28	10	2-11401	10,5
20	30	10	2-11402	10,5
22	32	10	2-11403	10,5



**HECKER® GSM®**

## **AKD BUTTERFLY VALVE SEAL**



### **APPLICATION IN**

- butterfly valves for the food industry
- chemical industry
- water treatment
- hydraulic oil supply etc.

### **MATERIALS BASED ON**

- VMQ
- NBR
- EPDM
- FPM
- HNBR

Concerning approval certificates for FDA-, KTW-, DVGW- and BAM, please refer to section “materials”

### **DESIGN**

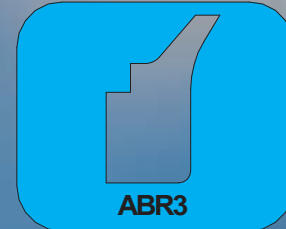
Due to the great constructional variety of butterfly valves the arrangement of the gasket will be fixed in cooperation with the customer, i.e. according to his special requirements.

Please contact our experienced technical service department.

**HECKER® GSM®**

**ABR**

**SCRAPER  
ROD SCRAPER**



### PROFILE PROPERTIES

- staple wiping lip, rigid element
- ABR1 to be latched into the groove
- ABR2 same function as ABR1, with additional supporting and sealing collar
- ABR3 same function as ABR1, flush mounted with the housing.

### APPLICATION

- scraper for rods in hydraulic and pneumatic systems
- removing solid and liquid contaminants

### INSTALLATION

- latched into the groove starting from  $d > 30\text{mm}$
- open groove for  $d < 30\text{ mm}$

### AVAILABILITY

For the dimensions available please contact us. In the case of new constructions, we recommend the use of series ABR3. Further dimensions upon request.

### MATERIALS

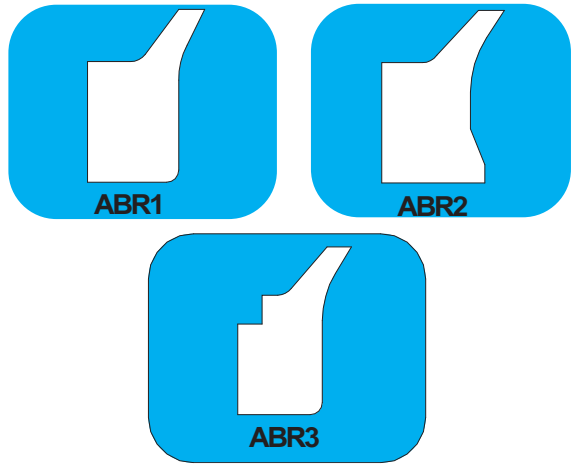
Standard materials WS 859 NBR 90Sha. For further materials please refer to the general table.

### EXAMPLE FOR ORDER

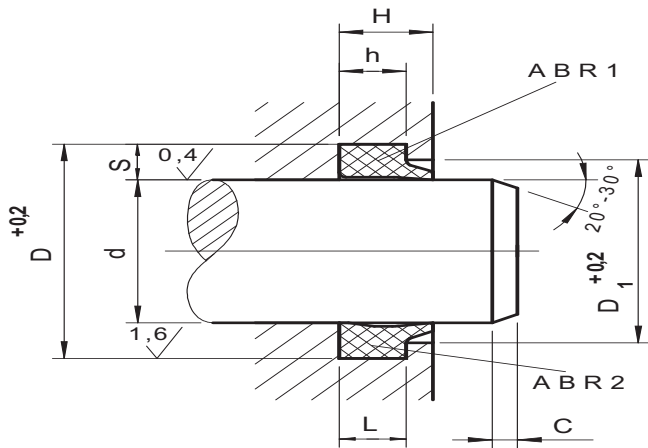
Scraper ABR3 for a rod diameter of 63 mm:  
ABR 3 - 63

### RECOMMENDED VALUES FOR APPLICATION

Seal Material	Operating media	t (°C)	v (m/s)
859	Mineral oil, oil-water- emulsions, air	-20 up to +110	≤ 1
900		-25 up to + 80	

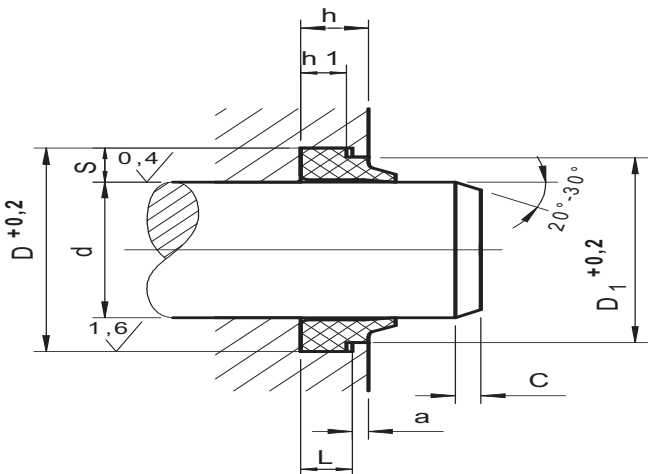


### ROD SCRAPER ABR1 AND ABR2



Width of groove:  $L = h +0,1$  up to  $+0,3$

### ROD SCRAPER ABR3



### INSERTION CHAMFER

S	3	4	5	6	7,5	10	12,5
C	1,5	2	2,5	3	4	5	6

nominal dimensions					tool-no.		Polyur ethan	D <sub>1</sub>	a	ABR- Typ
d	D	H	h	h <sub>1</sub>	tool-no.					
4	8	3	2		2-08842		6,2		1	
5	9	3	2		2-08843		7,2		1	
6	10	3	2		2-08844		8,2		1	
7	11	3	2		2-08849		9,2		1	
8	12	3	2		2-08845		10,2		1	
8	14	5	3		2-08974		12,5		1	
8	16	7	5	4	2-10001		14	1	3	
9,3	14	5	3,4	2,4	2-11210		12,5	1	3	
10	14	3	2		2-08846		12,2		1	
10	18	7	5	4	2-05737		16	1	3	
10	18	7	5	4	2-10002		16	1	3	
10	18	7	5			V-1424	14		1	
11	19	7	5	4	2-07836		17	1	3	
11,8	20	7	4,2			V-2655	16		1	
12	20	7	5		2-04178		15		1	
12	20	7	5		2-08759		16		1	
12	20	7	5	4	2-10003		18	1	3	
12	20	7	5			V-1425	15,5		1	
12	20	7	5			V-1271	15		1	
12	20	7	5			V-2461	16		2	
12,7	20	7	5	4	2-11211		18	1	3	
14	22	7	5	4	2-10004		20	1	3	
14,2	22	7	5	4	2-11212		20	1	3	
15	23	7	5		2-09338		19,6		1	
15	23	7	5			V-1426	19		1	
15,8	25	7	5			V-1660	21		1	
16	24	7	5		2-13041		19		1	
16	24	7	5	4	2-08332		22	1	3	
16	24	7	5	4	2-10005		22	1	3	
16	32	7	5			V-2059	21		1	
18	26	7	5	4	2-10006		24	1	3	
18	26	7	5			V-0964	21		1	
19	25	7	5	4	2-11213		23	1	3	
20	26	7	4		2-08724		25		1	
20	26	7	5			V-2801	24		1	
20	28	5	3,5			V-1371	24		1	
20	28	7	5	4	2-08333		26	1	3	
20	28	7	5	4	2-10007		26	1	3	
20	28	7	5			V-2266	24		1	
20	30	9	6			V-1485	27		1	
22	30	7	5		2-08726		25		1	
22	30	7	5	4	2-08334		28	1	3	
22	30	7	5	4	2-10008		28	1	3	
22	30	7	5			V-1427	25		1	
22,3	30	7	5			V-1606	26		1	
24	32	7	5		2-11682		28		2	
24	32	7	5			V-1433	28		1	
24	32,4	5,6	3,5		2-11902		27,5		1	
25	33	5	3,5		2-06856		29		1	
25	33	5	3,5			V-1372	29		1	
25	33	7	5	4	2-09439		31	1	3	
25	33	7	5	4	2-10009		31	1	3	
25	33	7	5		2-13042		28		1	
25	33	7	5			V-1744	30		1	
25	36	8,2	6			V-1887	31		1	
26	34	7	5		2-07783		30		1	
26	34	7	5	4	2-10202		32	1	3	
26	34	7	5			V-2253	30		1	
28	36	7	5	4	2-07098		34	1	3	
28	36	7	5	4	2-10010		34	1	3	

nominal dimensions					tool-no.		D <sub>1</sub>	a	ABR- Typ
d	D	H	h	h <sub>1</sub>	tool-no.	Polyur ethan			
28	36	7	5			V-2064	32		1
29	37	7	5			V-1070	33		1
29,6	37	7	5			V-1553	34		1
29,6	37	7	5			V-2034	34		2
30	38	7	5	4	2-08335		36	1	3
30	38	7	5	4	2-10011		36	1	3
30	38	7	5			V-0862	34		1
30	40	6,5	4			V-1253	35		2
30	40	10	7	5,5	2-05935		37	1,5	3
30	42	10	7			V-2317	36		1
30,9	40	7	5			V-2212	35		2
31,5	40	7	5			V-1614	36		1
31,75	41,28	7,14	4,8		2-09760		36		1
32	40	7	5		2-09440				3
32	40	7	5	3,7	2-09668		37,5	1,3	3
32	40	7	5	4	2-10012		38	1,2	3
32	40	7	5			V-2292	36		1
32	47	7	5		2-11683		37		1
32	47	7	5			V-2072	36		1
33	41	8	5	4	2-07459		39	1	3
35	43	7	5		2-06288		39		1
35	43	7	5	4	2-10013		41	1	3
35	43	7	4,8			V-2002	39,5		1
35	43	7	5			V-0863	39		1
35	45	8	4,5			V-1462	41		1
36	44	7	5	4	2-10014		42	1	3
36	44	7	5			V-1943	41		1
37,85	50	6,5	4			V-2213	44		2
38	46	7	5			V-1488	42		2
38	46	11,5	9			V-1989	42		1
38	48	7	5			V-1607	43		1
38	48	10	7			V-1936	43		1
38	50	6,5	4			V-2041	43		2
39	47	7	5		2-08098		43		1
40	48	7			2-05231				3
40	48	7	5	4	2-10015		46	1	3
40	48	7	5			V-2066	44		1
40	48	7	5			V-0864	44		2
40	50	6,5	4			V-1229	45		2
40	50	8	5			V-1450	45		2
42	50	7	5			V-0865	46		2
42	52	10	7			V-2039	47		1
44	58	6	3			V-0866	49		2
45	53	7	5	4	2-06520		51	1	3
45	53	7	5	4	2-10016		51	1	3
45	53	7	5			V-0999	49		1
45	57	10,5	6			V-1466	53		1
45	57,2	12	7,5			V-1017	52		1
48	56	7	5			V-1709	53		1
48,86	60	7	5			V-2056	53		2
49	57	7	5			V-0852	52		1
50	58	7	5		2-06289	V-0867	55		1
50	58	7	5	4	2-05830		56	1	3
50	58	7	5	4	2-10017		56	1	3
50	60	7	5		2-13043		53		1
50	62	8	5			V-1242	56		2
50	62	8	4,8			V-1228	55		2
50	62	10	7		2-05936		59	1,5	3
50	62	12	7		2-07178		58		1
50	65	13	7			V-1461	60		1

nominal dimensions					tool-no.		D <sub>1</sub>	a	ABR- Typ
d	D	H	h	h <sub>1</sub>	tool-no.	Polyur ethan			
50,8	63,5	10	6,35		2-07654		56,3		1
51	59	7	5	4	2-08741		57	1,2	3
52	60	7	5	4	2-07792		58	1	3
54	62	7	5			V-0868	58		1
55	63	7	5	4	2-05673		61	1	3
55	63	7	5	4	2-10018		61	1	3
55	63	7	5			V-1495	60		1
55	63	10	7			V-1650	60		1
55	67	8	4,8			V-1249	60		2
56	64	7	5	4	2-10019		62	1	3
56	64	7	5			V-2065	60		1
56	65	7	5		2-11955		60,8		1
56	66,6	7	5		2-13075		61		1
58	66	7	5		2-08588		63		1
58	66	7	5		2-07793		64		3
58	66	7	5	4		V-1966	64	1	3
59	67	7	5			V-0869	63		2
60	68	7	5		2-07119		64		1
60	68	7	5	4	2-08215		66	1	3
60	68	7	5	4	2-10020		66	1	3
60	68	7	5			V-0962	64		1
60	72	8	4,8			V-1163	65		2
60	72	10	7	5,5	2-05715		69	1,5	3
60	72,2	12	7,5			V-1018	66		1
60	75	8	5			V-3739	67		2
60	75	12	8			V-2345	68		1
60	80	7	5		2-06709		68		1
62	72	8	6			V-1513	67		1
62	72	10	7	5,5	2-05937		69	1,5	3
63	71	7	5	4	2-10021		69	1	3
64	73	7	5			V-1364	69		2
65	73	7	5		2-08097		69		1
65	73	7	5			V-1315	69		1
65	73	7	5			V-1369	69		1
65	77	8	4,8			V-2975	70		2
68	76	7	5	4	2-08621		74	1	3
68	80	12	7		2-06989		75		1
69	77	7	5			V-0851	72		2
69,1	80	8	5			V-2061	74		2
70	78	7	5	4	2-07791		76	1	3
70	78	7	5	4	2-10022		76	1	3
70	78	7	5			V-2494	75		1
70	80	7	5		2-13044		73		1
70	82	8	4,8		2-09886		75		2
70	82	8	4,8			V-0843	75		2
70	85	10	6			V-1489	76		2
70	85	13	9			V-2346	76		1
70,5	80	7	5			V-1538	75		2
72	80,6	7	5,2			V-3665	77,1		2
74	86	8	4,8			V-2365	79		2
75	83	7	5			V-1769	79		1
75	87	8	4,8		2-08972		80		1
75	87	8	4,8			V-1153	80		2
76,2	88,9	8	6,35		2-08038		81		1
78	86	7	5		2-11290		82		1
78	86	7	5			V-0963	82		1
78	90	8	4,8			V-1069	82		2
80	88	7	5			V-1000	84		1
80	88	7	5	4	2-05490		86	1	3
80	88	7	5	4	2-10023		86	1	3

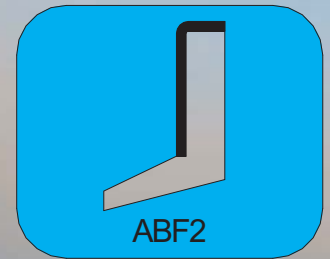
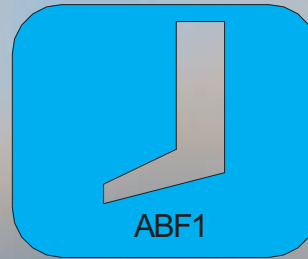


nominal dimensions					tool-no.		D <sub>1</sub>	a	ABR-Typ	
d	D	H	h	h <sub>1</sub>	tool-no.	Polyur ethan				
80	88	7	4		2-09884	V-3516	84		1	
80	92	8	4,8				85		2	
80	92	8	4,8				V-1162	85		2
80	95	10	6				V-3143	86		1
80	96	10	7				V-1523	88		1
82,5	95,5	8,35	6,35		2-08983	V-2199	86		1	
85	93	7	5				V-0980	88		1
85	97	8	4,8					90,4		1
85	97	8	4,8				V-1154	91		2
89	97	7	5				V-0870	93		2
90	98	7	5	3,8	2-09078		96	1,2	3	
90	98	7	5	4	2-10024		96	1	3	
90	98	7	5			V-1065	94		1	
90	102	8	4,8			V-0908	94		2	
90	102	12	7		2-13045		96		1	
92,1	111,1	18,5	15,5		2-11153		105		1	
95	107	8	4,8		2-11291	V-1172	100		2	
97	105	7	5				101		1	
97	105	7	5				V-0871	101		2
97	109,2	12	7,5			V-1019	103		1	
97,7	112	8	4,8		2-09239	V-2060	102		2	
98,3	114,3	10	6,35				V-1964	106		1
99	107	7	5				V-1370	103		1
100	108	7	5	3,8				106	1,2	3
100	108	7	5	4		2-10025		106	1	3
100	108	7	5		2-09447	V-1057	104		1	
100	112	8	4,8				105,5		2	
100	112	8	4,8				V-1155	104		2
100	112	8	4,8				V-3291	105,7		1
100	120	18	8			2-11866		110,5		1
102	110	7	5		2-09335	V-1001	105		1	
105	115	10	7				V-1528	110		1
105	117	8	4,8				V-1171	109		2
110	118	7	5					114		1
110	118	7	5				V-1008	113		1
110	118	7	5	4	2-10026		116	1	3	
110	122	8	4,8		2-13076	V-1051	114		2	
110	122,2	12	7					117,4		1
117,5	136,5	18,5	15,5			2-11154		130		1
118	126	7	5		2-11292		121,5		1	
118	126	7	5		2-0872	V-0872	121,5		1	
120	132	10	6				V-1735	126		1
120	135	10	6				V-1217	127		2
122,2	132	7	5				V-1646	128		1
124	132	7	5				V-1967	127		1
125	133	7	5		2-11857		129,2		1	
125	135	7	5		2-05343	V-2298	129		1	
125	135	12	8					132		1
125	137	10	7	5,5		2-10027		134	1,5	3
125	140	16	10			2-11952		133,2		1
126	134	7	5			2-11156	V-1076	130		1
127	146	18,5	15					140		1
130	138	7	5				V-1284	134		1
133,8	150	10	6				V-2134	140		1
135	150	10	6				V-1753	143		1
139	154	10	6		2-10029	V-2448	145		1	
140	152	10	7	5,5				149	1,5	3
140	155	10	6			2-09448		146		2
140	155	10	6				V-1059	146		2
140	155	10	6				V-3283	147		1

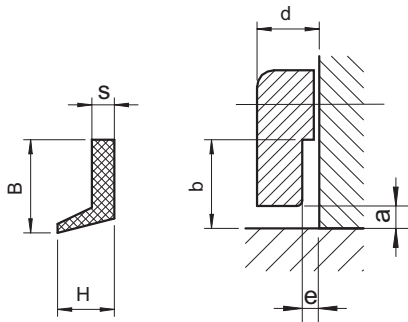
nominal dimensions					tool-no.		D <sub>1</sub>	a	ABR-Typ	
d	D	H	h	h <sub>1</sub>	tool-no.	Polyur ethan				
143	151	7	5		2-11293		147		1	
150	160	8	6				V-1116	154		1
154,5	165	8	6				V-2393	159		1
155	167	10,5	7	5,5		2-11363		164	2	3
160	170	8	6				V-1306	163		1
160	172	10	7	5,5	2-05569		169	1,5	3	
160	175	10	7		2-08054		166		2	
160	175	10	6		V-0835		167		2	
170	185	12	7				2-09449	176,5		2
171	179	7	5				2-11294	175		1
175	185	8	6			2-09067	V-1117	181		1
180	195	10	8					V-1492	189	
180	200	18	10					191		1
180	220	10	7,5				V-0065	189		2
185	205	14,5	12				2-07058	195		3
200	212	10	8	6	2-05522		208	2	3	
200	212	10	7	5,5	2-06836		209	1,5	3	
200	215	10	6		V-0836		206		2	
210	230	14,5	12	10			2-07039	220	2	3
211	227	12	8				2-06951	218		1
213	227	14,5	9,5	6,5		2-06488		222	3	3
214	230,5	13	10	8		2-11365		221,5	2	3
225	255	15	7,5		V-2654		235		2	
236	256	15,5	12	10			2-07059	246	2	3
240	254	14,5	9,5	6,5			2-06486	249	3	3
250	260	8	5			2-08498		255		1
250	270	12	8			2-07246	V-0783	258		2
260	280	12	8					268		1
260	280	12	8				V-1483	268		1
260	280	14,5	12	10	2-07130			270	2	3
280	300	18	10		2-09913			290		1
285	305	18	13	10	2-08523		295	3	3	
300	320	12	8		V-1667		311		1	
310	330	12	8				V-0837	317		2
310	330	14,5	12	10		2-07558		320	2	3
320	340	12	8			2-09068	V-0838	327		2
320	340	18	10						332	
340	360	12	8				V-2240	348		1
349	369	14,5	12	10	2-08182			359	2	3
360	380	10	8				V-1763	370		1
360	380	14,5	12	10	2-07559		370	2	3	
400	420	12	8		2-09822	V-1602	412		2	
400	425	16	11,5				V-1877	412		1
430	455	15	10					440		1
455	470	13	8,5	6,2		2-08622		466	2	3
480	505	23	11,5			2-12663		490		1
500	512,2	12	7		2-12654		505,5		1	
500	520	12	8		2-11705	V-1878	510		1	
500	525	23	19	11,5				512	7,5	3
600	625	20	12,5				V-2511	612		1
680	699,6	10	5,5			2-11163		688,5		1
700	740	25	12,5				V-3403	719		1

**HECKER® GSM®**

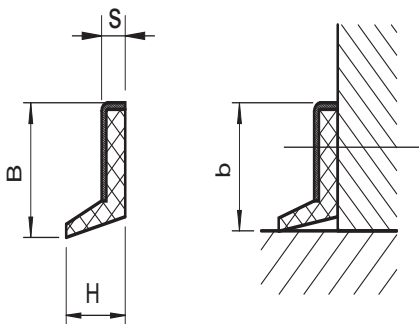
**ABF  
SCRAPER  
FLAT BELT SCRAPER**



**PROFILE AND  
INSTALLATION**



**ABF1  
ABF2**



**(WITH METAL RAIL)  
APPLICATION**

- sliding surfaces
- guide belts
- machine tools

**MATERIALS**

Polyurethane PU 94 Shore A,  
preferably WS 900 (Vulkollan)

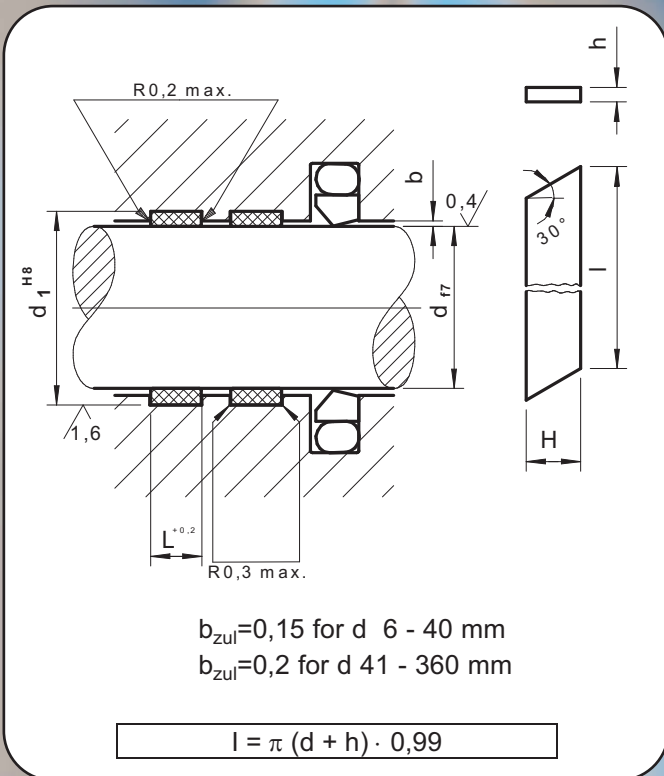
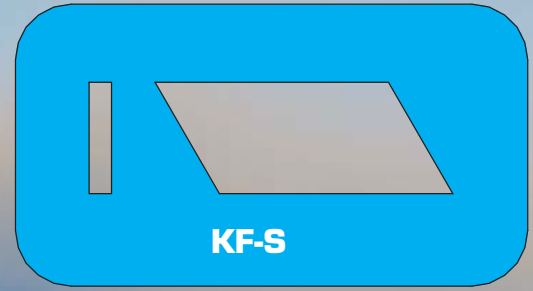
nominal dimensions			max. length to be deli- vered	Tool-no.	installation dimensions				
H	B	s			a	b	d	e	R
10	10	3	800	V-0830	3,5	9,6	11	2,9	1
	11								
	12								
	•13								
	14								
	15								
	•16								
	17								
	18								
	19								
	20								
						14,5			
						15,5			
						16,5			
						17,5			
						18,4			
						19,4			

• = preferably for new constructions

nominal dimensions			max. length to be deli- vered	Tool-no.	installation dimensions b
H	B	S			
10	15	4	250	V-1733	14,5
	17		500	V-2006	15

**HECKER® GSM®**

**KF-S  
EURAFLON®-(PTFE)  
GUIDE RING  
ROD GUIDE  
SERIES**



$b_{zul} = 0,15$  for  $d$  6 - 40 mm  
 $b_{zul} = 0,2$  for  $d$  41 - 360 mm

**STANDARD VALUES FOR APPLICATION**

$p$  (N/mm<sup>2</sup>)       $t$  (°C)       $v$  (m/s)  
 $< 2,5$        $-100$  up to  $+200$        $< 5$

$P = F/A$  (proj) = surface pressure (N/mm<sup>2</sup>)  
 $F$  = transverse action force (N)  
 $A$ (proj) = proj. surface ( $d1 * H$  (mm<sup>2</sup>))

**MATERIAL**

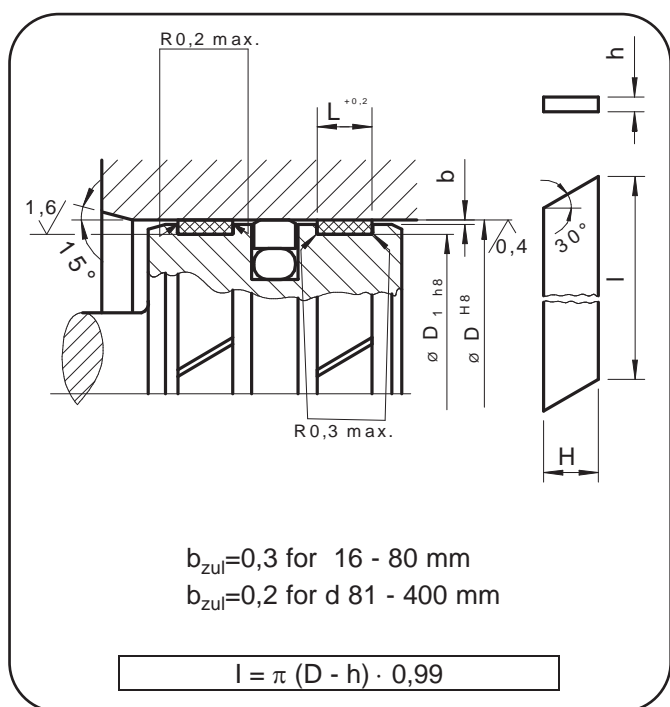
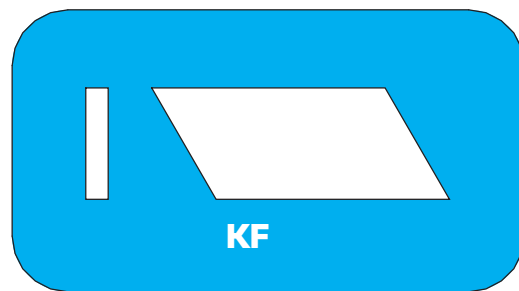
Standard design WS 7280 available from stock - a PTFE-bronze compound.

**EXAMPLE FOR ORDERS**

Rod guide KF1-S for a rod diameter of 63 mm:  
**KF1-S 63**

installation dimensions			order number		ring dimensions	
d	d <sub>1</sub>	L			h	H
6	9,1	4	KF1-S	6	1,55 <sup>+0,02</sup> -0,03	3,9 <sub>-0,1</sub>
8	11,1		KF1-S	8		
10	13,1		KF1-S	10		
12	15,1		KF1-S	12		
14	17,1		KF1-S	14		
16	19,1		KF1-S	16		
18	21,1		KF1-S	18		
20	25		5,6	KF1-S		
22	27	KF1-S		22		
25	30	KF1-S		25		
28	33	KF1-S		28		
30	35	KF1-S		30		
32	37	KF1-S		32		
35	40	KF1-S		35		
36	41	9,7		KF1-S	36	9,5 <sub>-0,2</sub>
40	45		KF1-S	40		
45	50		KF1-S	45		
50	55		KF1-S	50		
55	60		KF1-S	55		
60	65		KF1-S	60		
63	68		KF1-S	63		
70	75		KF1-S	70		
80	85	15	KF1-S	80	2,5 <sup>+0,02</sup> -0,03	15 <sub>-0,2</sub> -0,4
90	95		KF1-S	90		
100	105		KF1-S	100		
110	115		KF1-S	110		
120	125		KF1-S	120		
125	130		KF1-S	125		
135	140		KF1-S	135		
140	145		KF1-S	140		
150	155	25	KF1-S	150	25 <sub>-0,2</sub> -0,4	
160	165		KF1-S	160		
170	175		KF1-S	170		
180	185		KF1-S	180		
190	195		KF1-S	190		
200	205		KF1-S	200		
220	225		KF1-S	220		
250	255		KF1-S	250		
270	275	KF1-S	270			
280	285	KF1-S	280			
320	325	25	KF1-S	320	25 <sub>-0,2</sub> -0,4	
360	365		KF1-S	360		

## KF-K EURAFLON®-(PTFE) GUIDE RING PISTON GUIDE SERIES



installation dimensions			order number	ring dimensions	
D	D <sub>1</sub>	L		h	H
16	12,9	4	KF1-K 16	1,55 <sup>+0,02</sup> <sub>-0,03</sub>	3,9 <sub>-0,1</sub>
20	16,9		KF1-K 20		
22	18,9		KF1-K 22		
25	21,9		KF1-K 25		
28	23	5,6	KF1-K 28		5,5 <sub>-0,1</sub>
30	25		KF1-K 30		
32	27		KF1-K 32		
35	30		KF1-K 35		
40	35		KF1-K 40		
45	40	9,7	KF1-K 45		9,5 <sub>-0,2</sub>
50	45		KF1-K 50		
60	55		KF1-K 60		
63	58		KF1-K 63		
70	65		KF1-K 70		
80	75		KF1-K 80		
100	95		KF1-K 100		
125	120	KF1-K 125	2,5 <sup>+0,02</sup> <sub>-0,03</sub>		
140	135	KF1-K 140			
150	145	KF1-K 150			
160	155	KF1-K 160			
180	175	KF1-K 180			
200	195	15	KF1-K 200		15 <sub>-0,2</sub>
220	215		KF1-K 220		
250	245		KF1-K 250		
280	275		KF1-K 280		
300	295		KF1-K 300		
320	315	25	KF1-K 320		25 <sub>-0,2</sub> -0,4
400	395		KF1-K 400		

### STANDARD VALUES FOR APPLICATION

$p$  (N/mm<sup>2</sup>)       $t$  (°C)       $v$  (m/s)  
 $< 2,5$        $-100$  up to  $+200$        $< 5$

$P = F/A$  (proj) = surface pressure (N/mm<sup>2</sup>)

$F$  = transverse action force (N)

$A$ (proj) = proj. surface ( $D_1 \cdot H$  (mm<sup>2</sup>))

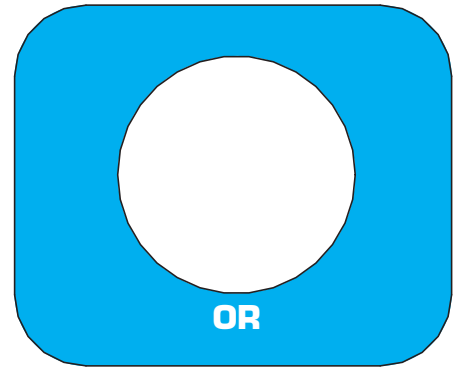
### MATERIAL

Standard design WS 7280 available from stock - a PTFE-bronze compound

### EXAMPLE FOR ORDERS

Piston guide KF1-K for a piston diameter of 100 mm: **KF1-K 100**

## SUPPORT RINGS FOR O-RINGS & O-RINGS



### SEAL PROPERTIES

O-Ring with circular cross section

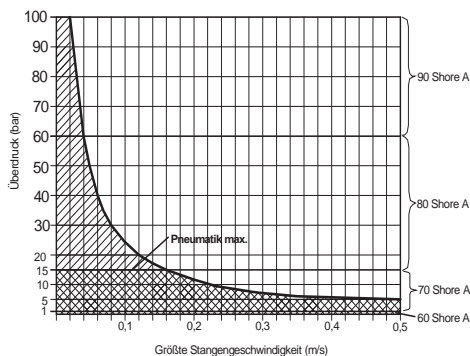
### STATIC SEALING

On static parts, for example covers, housings, flanges, bolts

### DYNAMIC SEALING (AXIAL)

- rod and cylinder seals in hydraulic and pneumatic systems
- application limits, see diagram for  $d_1 > 10 \text{ mm}$

### PRESSURE-SPEED DIAGRAM



### DYNAMIC SEALING (ROTATING)

- peripheral speed under optimum conditions, (with appropriate lubrication and heat dissipation) up to max.  $5 \text{ ms}^{-1}$
- armature shaft, hinges
- for small installation areas

### MATERIALS

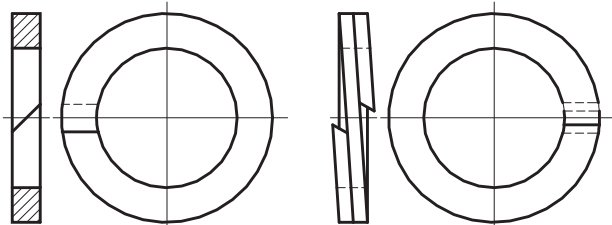
Using the same tools, different shrinkage of the materials can result in displacement of the field of tolerances.

Maximum clearance in relation to pressure, material hardness and O-ring cross section

hardness (ShoreA)	pressure (bar)	O-Ring-cross section diameter -Ø				
		1,8	2,65	3,55	5,3	7
60	20	0,18	0,23	0,28	0,3	0,35
	40	0,13	0,18	0,23	0,25	0,3
	63	0,1	0,13	0,15	0,18	0,2
	100	0,05	0,08	0,1	0,13	0,15
70	40	0,2	0,25	0,3	0,35	0,4
	63	0,15	0,18	0,23	0,25	0,3
	100	0,1	0,13	0,15	0,18	0,2
	160	0,05	0,08	0,1	0,12	0,15
	180	0,025	0,04	0,05	0,06	0,08
80	40	0,25	0,3	0,4	0,45	0,5
	63	0,2	0,25	0,3	0,35	0,4
	100	0,13	0,18	0,2	0,25	0,3
	160	0,1	0,13	0,15	0,18	0,2
	180	0,08	0,1	0,13	0,15	0,18
	250	0,05	0,08	0,1	0,12	0,15
90	40	0,35	0,4	0,45	0,5	0,5
	63	0,3	0,35	0,4	0,45	0,5
	100	0,25	0,3	0,35	0,38	0,45
	160	0,2	0,23	0,25	0,3	0,35
	180	0,15	0,18	0,2	0,25	0,3
	250	0,13	0,15	0,17	0,2	0,25
	355	0,08	0,1	0,13	0,15	0,2

### BACK-UP RINGS

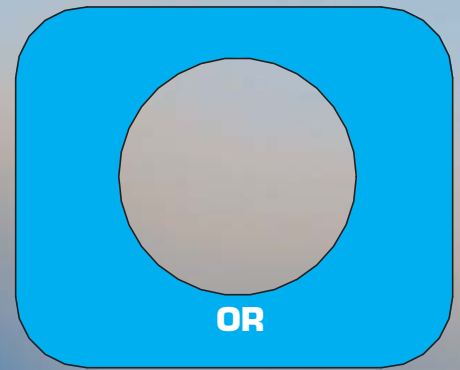
Back-up rings for compensating the clearance when the admissible clearance is exceeded



Back-up ring RE9  
Material PTFE  
or polyamide

Back-up-ring SP1  
Material PTFE

# HECKER® GSM® PRECISION O-RING (ROUND SEAL) BACK UP RINGS FOR O-RINGS



## INSTALLATION OF BACK-UP RINGS

The back-up rings are not standardized. The respective dimensions and widths of grooves are determined individually for each application. For correct dimensioning of the back-up rings required, we kindly ask you to fill in the following table:

### OUTSIDE SEALING

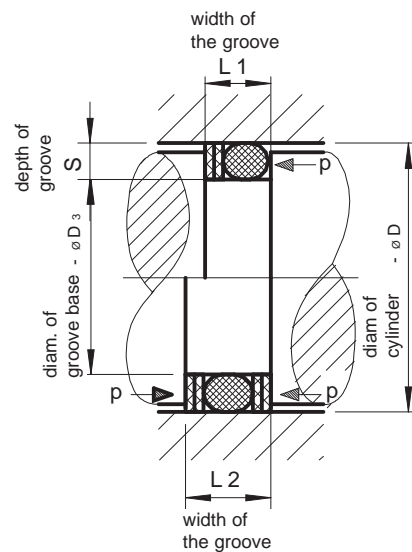
1. cylinder- $\emptyset D$
2. diam. of root of groove- $\emptyset D_3$  or depth of groove  $S$
3. width of groove  $L_1$  oder  $L_2$
4. O-Ring cross section- $\emptyset d_2$
5. sealing dynamic or static

### INSIDE SEALING

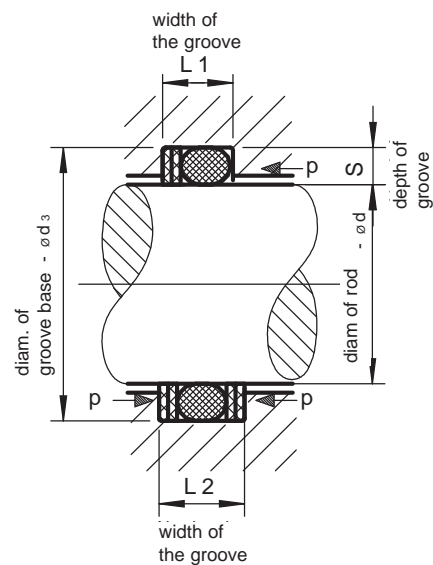
1. diameter of rod  $\emptyset d$
2. diam. of root of groove  $\emptyset d_3$  or depth of groove  $S$
3. width of groove  $L_1$  oder  $L_2$
4. O-Ring cross section- $\emptyset d_2$
5. sealing: dynamic or static

If the dimensions of the groove are selected according to our table, points 2,3 and 4 can be omitted.

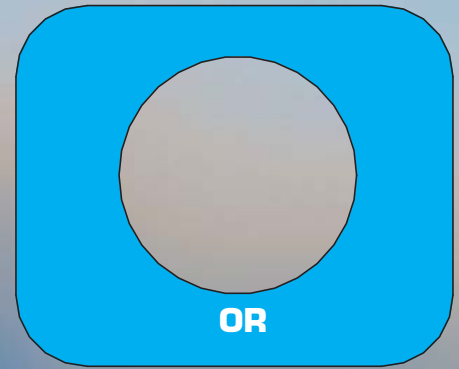
## OUTSIDE SEALING



## INSIDE SEALING

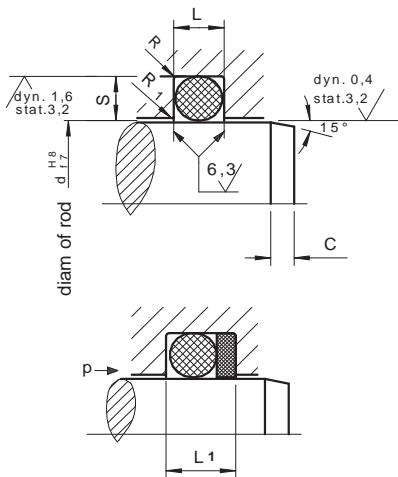


# HECKER® GSM® OR PRECISION O-RING (ROUND SEAL)



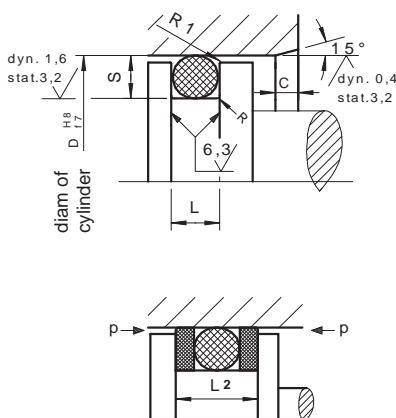
## INSIDE SEALING

e.g. chambered on one side with plastic Back-up ring.



## OUTSIDE SEALING

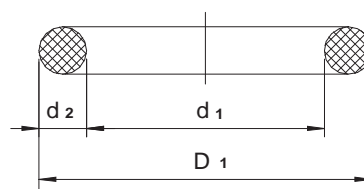
e.g. chambered on both sides with plastic Back-up rings.



## HYDRAULIC AND PNEUMATIC SYSTEMS SEALING: dynamic (axial movement)

diam. of cross section: $\varnothing d_2$	$r$ depth of groove S		width of groove			R	$R_1$	C
	$c$ dynamic		$L^{+0,2}$	$L_1^{+0,2}$	$L_2^{+0,2}$			
	hydraulic syst.	pneumatic syst.						
1	0,88	-	0,88	-	-	0,1	0,1	1,2
1,2	1,07	-	1,07	-	-			
1,25	1,1	-	1,1	-	-			
1,5	1,3	-	1,35	2,9	4,1			
1,6	1,4	-	1,45	3,1	4,3			
1,8 (1,78)	1,55	0,02	1,6	3,3	4,5	0,2	0,2	1,5
2	1,77	-	1,8	3,5	4,7			
2,4	2,12	-	2,15	4,4	6			
2,5	2,2	-	2,25	4,5	6,1			
2,65 (2,62)	2,35	-	2,35	3	4,6 6,2			
3	2,65	-	2,75	3,4	5 6,6	0,3	0,3	2
3,15	2,8	-	2,9	3,6	5,6 7,6			
3,5 (3,53)	3,2	-	3,25	4	6 8			
4	3,6	-	3,7	4,5	6,5 8,5			
4,5	4,1	-	4,2	5	7,5 10			
5	4,55	0,03	4,65	5,5	8 10,5	0,4	0,4	2,5
5,3 (5,33)	4,82	-	5	5,9	8,4 10,9			
5,5	5	-	5,15	6,1	8,6 11,1			
5,7	5,18	-	5,35	6,3	8,8 11,3			
6	5,45	-	5,65	6,7	9,2 11,7			
6,3	5,73	-	5,9	7	10 13	0,5	0,5	3,5
6,5	5,91	-	6,1	7,2	10,2 13,2			
7 (6,99)	6,35	-	6,6	7,7	10,7 13,7			
8	7,28	0,05	7,6	8,7	11,7 14,7			
8,4	7,65	-	7,9	9,1	12,6 16,1			
9	8,2	-	8,5	9,7	13,2 16,7	0,6	0,6	4,5
10	9,1	-	9,5	10,7	14,2 17,7			

Selection of the correct O-ring outside or inside diameters for the sealing of cylinders or rods.



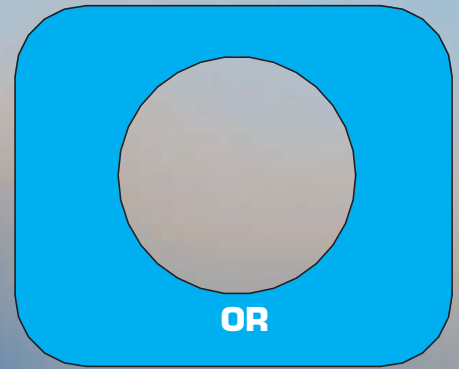
### Outside sealing:

Outside diam. of O-ring  $D_1$  equal or up to 6% smaller than cylinder diam.  $D$

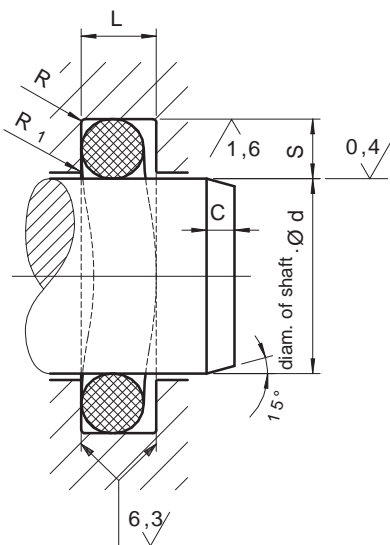
### Inside sealing:

Inside diam. of O-ring  $d_1$  equal or up to 2% larger than rod diam.  $d$

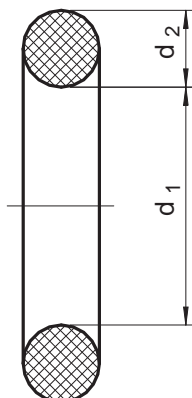
# HECKER® GSM® OR PRECISION O-RING (ROUND SEAL)



## INSIDE SEALING



## OUTSIDE SEALING



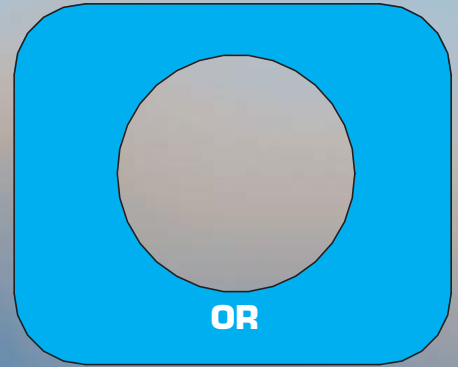
d1 ca. = 1,02d

## SEALING: ROTATING MOTION (FOR PRESSURELESS LIQUIDS)

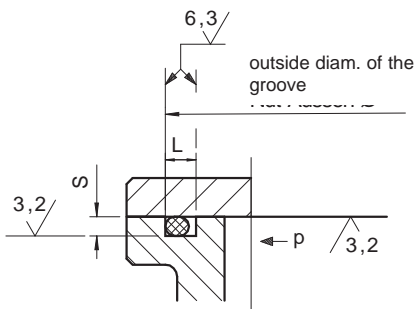
Ø d <sub>2</sub>	diam. of cross section:		depth of the groove:		width of the groove:		
	S	Tol.	L	Tol.	R	R <sub>1</sub>	C
1	0,9	- 0,02	1,1	+0,1	0,1	0,1	1,2
1,2	1,1		1,35				
1,25	1,15		1,4				
1,5	1,4		1,65				
1,6	1,5		1,75				
1,8 (1,78)	1,7		2		0,2	0,2	1,5
2	1,85		2,2				
2,4	2,25		2,65				
2,5	2,35		2,75				
2,65 (2,62)	2,5		2,9				
3	2,85	3,3	0,3	0,2	2		
3,15	3	3,45					
3,5 (3,53)	3,3	3,85					
4	3,8	4,4					
4,5	4,3	5					
5	4,75	- 0,03	5,5	0,4	0,2	2,5	
5,3 (5,33)	5,05	5,8					
5,5	5,25	6,1					
5,7	5,4	6,3					
6	5,7	6,6					
6,3	6	6,9	0,5	0,2	3,5		
6,5	6,2	7,2					
7 (6,99)	6,65	7,					
8	7,6	8,8					
8,4	8	9,3					
9	8,55	- 0,05	9,9	0,6	0,2	4,5	
10	9,5	11					



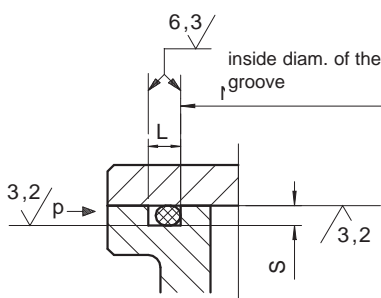
# HECKER® GSM® OR PRECISION O-RING (ROUND SEAL)



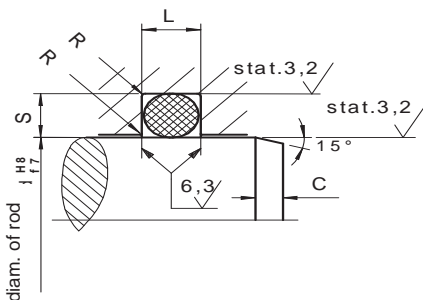
## RECTANGULAR GROOVE



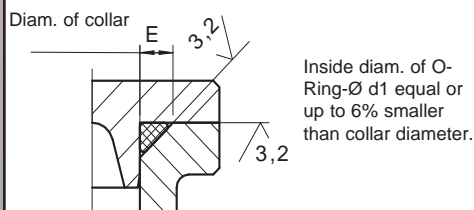
Outside diam. of O-ring  $\varnothing D_1$  equal or up to 1% larger than outside  $\varnothing$  diam. of the groove.-Ring



Inside diam. of O-Ring- $\varnothing d_1$  equal or up to 6% smaller than inside diam. of the groove.



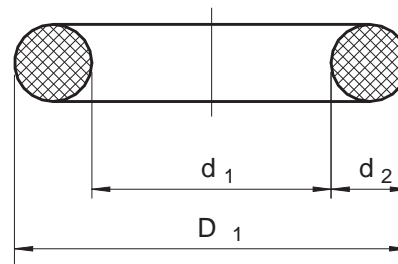
## TRIANGULAR GROOVE



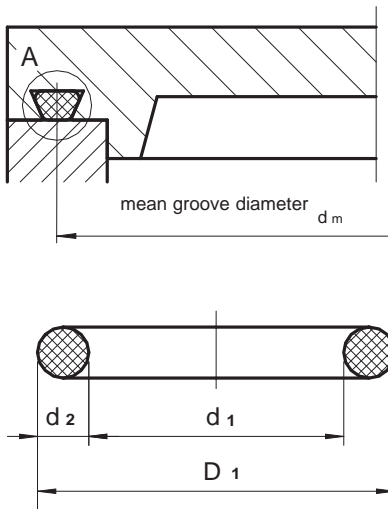
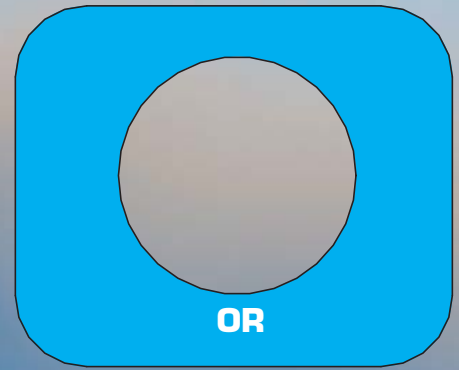
Inside diam. of O-Ring- $\varnothing d_1$  equal or up to 6% smaller than collar diameter.

## RECTANGULAR GROOVE AND TRIANGULAR GROOVE SEALING: STATIC

$\varnothing d_2$	S	Tol.	width of the groove:		triangular groove Dimension of edge	
			L <sup>+0,2</sup>	E	Tol.	
1	0,8	-0,05	1,3	1,4	+0,1	
1,2	0,95		1,55	1,6		
1,25	1		1,6	1,7		
1,5	1,2		1,95	2		
1,6	1,3	+/-0,1	2,1	2,1		
1,8 (1,78)	1,45		2,35	2,4		
2	1,6		2,6	2,7		
2,4	1,9		3,1	3,2		
2,5	2		3,25	3,4		
2,65 (2,62)	2,1		3,45	3,5		
3	2,4	+/-0,15	3,9	4	+0,2	
3,15	2,5		4,1	4,25		
3,5 (3,53)	2,8		4,55	4,8		
4	3,2		5,2	5,4		
4,5	3,6		5,85	6,1		
5	4		6,5	6,8		
5,3 (5,33)	4,2		6,9	7,2		
5,5	4,4		7,15	7,5		
5,7	4,6		7,4	7,8		
6	4,8		7,8	8,2		
6,3	5,05	+/-0,15	8,2	8,5		
6,5	5,2	8,45	8,8			
7 (6,99)	5,8	9,1	9,5			
8	6,65	10,4	10,8			
8,4	6,95	10,9	11,4			
9	7,45	11,7	12,2			
10	8,5	12,5	13,6			

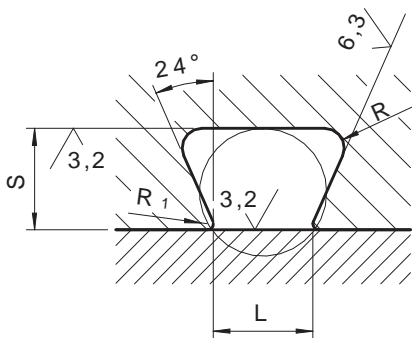


# HECKER® GSM® OR PRECISION O-RING (ROUND SEAL)



For installation reasons, we recommend calculation of the inside diameter of O-ring according to formula:

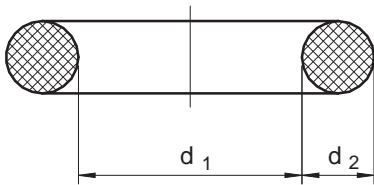
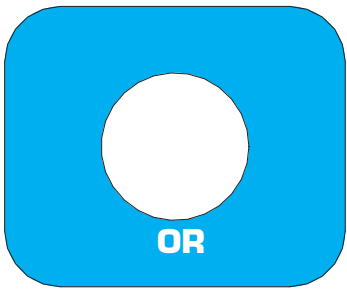
$$D1 = dm - 2 * d2$$



**DETAIL "A"**

## TRAPEZOIDAL GROOVE SEALING: STATIC

diam. of cross section: $\varnothing d_2$	depth of the groove: $S_{-0,05}$	width of the groove: $L^{+0,1}$	R	$R_1$
3	2,4	2,65	0,5	0,15
3,5 (3,53)	2,8	3,05	0,8	0,25
4	3,2	3,4		
4,5	3,65	3,75		
5	4,15	4,1		
5,3 (5,33)	4,4	4,35		
5,5	4,5	4,6	1,5	0,4
5,7	4,8	4,7		
6	5,05	4,95		
6,3	5,35	5,15		
6,5	5,5	5,3		
7	5,95	5,65	1,5	0,5
8	6,85	6,5		
8,4	7,25	6,8		
9	7,8	7,25		
10	8,7	7,55		
12	10,3	9,4		



### INSIDE DIAMETERS

#### $d_1$ TOLERANCE

over 2 up to 10	+/-0,13 +/-0,17
over 10 up to 20	+/-0,18 +/-0,22
over 20 up to 40	+/-0,23 +/-0,32
over 40 up to 60	+/-0,39 +/-0,54
over 60 up to 120	+/- 0,55 +/-0,97
over 120 up to 150	+/-1,0 +/-1,2
over 150 up to 200	+/-1,24 +/-1,55
over 200 up to 250	+/- 1,59 +/-1,88
over 250 up to 300	+/-1,93 +/-2,21
over 300 up to 400	+/-2,25 +/-2,84
over 400 up to 500	+/-2,91 +/-3,45
over 500 up to 630	+/-3,54 +/-4,22
over 630 up to 800	+/-4,38 +/-6,3

### CROSS SECTION DIAMETERS

#### $d_2$ TOLERANCE

up to 1,78	+/-0,08
over 1,78 up to 2,65	+/-0,09
over 2,65 up to 3,55	+/-0,10
over 3,55 up to 5,3	+/-0,13
over 5,3 up to 7	+/-0,15
over 7 up to 10	+/-0,18
over 10 up to 20	+/-0,20

### TYPE FEATURES

(displacement, burr, notch, flow marks, pores etc.). In general we deliver as per DIN 3771 type feature "N"; type feature "S" can also be delivered upon request.

d1	x	d2	Tool-no.:
0,6	x	1,4	2-09306
0,7	x	1	2-06515
0,8	x	2	2-04913
0,85	x	0,5	2-08471
1	x	0,6	2-07738
1	x	1	2-09833
1	x	1,25	2-08802
1	x	2	2-07742
1,15	x	1	2-06735
1,2	x	0,6	2-11415
1,2	x	0,7	2-08299
1,2	x	1	2-04444
1,2	x	1,15	2-12284
1,2	x	1,25	2-08071
1,4	x	1	2-09307
1,45	x	2,4	2-06122
1,5	x	0,6	2-11944
1,5	x	0,75	2-08350
1,5	x	0,78	2-12880
1,5	x	0,85	2-08300
1,5	x	1	2-03938
1,5	x	1,05	2-08835
1,5	x	1,5	2-08541
1,78	x	1,78	2-05816
1,8	x	0,5	2-11114
1,8	x	0,6	2-11551
1,8	x	1	2-02573
1,9	x	1	2-08745
2	x	1	2-08072
2	x	1,5	2-06778
2	x	1,7	2-08074
2,04	x	1,78	2-08750
2,2	x	0,8	2-12369
2,2	x	1	2-02464
2,2	x	1,5	2-08073
2,2	x	1,6	2-06736
2,3	x	0,8	2-07822
2,3	x	0,85	2-08351
2,3	x	1,5	2-05627
2,3	x	1,6	2-05628
2,35	x	1	2-03755
2,4	x	1,9	2-06737
2,44	x	1,78	2-04183
2,5	x	0,65	2-05973
2,5	x	1	2-06319
2,5	x	1,2	2-08742
2,5	x	1,3	2-05775
2,5	x	2,4	2-09456
2,54	x	1,78	2-05969
2,6	x	1	2-09023
2,6	x	1,2	2-02126
2,6	x	1,9	2-00849
2,7	x	1,5	2-02570
2,8	x	0,6	2-11906
2,8	x	0,7	2-09946
2,8	x	1,1	2-08065
2,84	x	1,78	2-08743
2,9	x	0,85	2-06678
2,9	x	1,78	2-02355

3	x	1	2-02773
3	x	1,8	2-03975
3	x	2,7	2-02186
3	x	3,9	2-03284
3,2	x	1,8	2-01727
3,3	x	1	2-07708
3,3	x	2,4	2-05435
3,3	x	2,5	2-06328
3,4	x	1,3	2-08076
3,4	x	1,9	2-05254
3,5	x	0,9	2-08805
3,5	x	1,2	2-06256
3,5	x	1,5	2-02487
3,6	x	1,8	2-08075
3,6	x	2	2-05505
3,69	x	1,78	2-05895
3,7	x	0,5	2-12202
3,7	x	1,78	2-05670
3,8	x	1,5	2-05668
3,8	x	1,6	2-08077
3,8	x	2,2	2-11434
3,9	x	1,7	2-08963
3,9	x	1,78	2-05774
4	x	0,6	2-05084
4	x	1	2-03213
4	x	1,2	2-08560
4	x	1,5	2-01996
4	x	1,75	2-05085
4	x	2	2-05086
4	x	2,2	2-03740
4	x	2,5	2-05087
4	x	2,65	2-12971
4	x	3	2-05368
4,2	x	1,9	2-01313
4,3	x	2,4	2-04842
4,4	x	1,8	2-08080
4,48	x	1,78	2-03713
4,5	x	1	2-04773
4,5	x	1,5	2-01650
4,5	x	2,4	2-08079
4,6	x	1,8	2-08739
4,6	x	2	2-02297
4,7	x	3	2-08747
4,9	x	1,9	2-05255
5	x	1	2-01800
5	x	1,2	2-08545
5	x	1,25	2-04533
5	x	1,45	2-07927
5	x	1,5	2-02577
5	x	1,6	2-07314
5	x	1,75	2-02051
5	x	2	2-03551
5	x	2,5	2-02643
5	x	3	2-06252
5	x	3,5	2-01998
5	x	5	2-07392
5,2	x	0,8	2-13001
5,28	x	1,78	2-05346

5,3	x	0,4	2-09747
5,3	x	1,85	2-08738
5,3	x	2,2	2-07628
5,3	x	2,4	2-04664
5,4	x	1,45	2-08286
5,4	x	1,5	2-08684
5,5	x	1,03	2-11996
5,5	x	1,5	2-06603
5,5	x	1,8	2-08749
5,5	x	3	2-05798
5,6	x	2	2-09442
5,65	x	0,8	2-08528
5,7	x	0,6	2-06313
5,7	x	1,9	2-05256
5,8	x	1,6	2-08744
6	x	0,75	2-05581
6	x	1	2-04488
6	x	1,25	2-08078
6	x	1,48	2-07797
6	x	1,5	2-00628
6	x	1,8	2-03946
6	x	2	2-01161
6	x	2,3	2-05450
6	x	2,5	2-04193
6	x	3	2-04189
6	x	3,75	2-08142
6	x	4,8	2-08069
6	x	5,5	2-06779
6,07	x	1,78	2-04965
6,1	x	1,6	2-06102
6,1	x	1,7	2-01871
6,2	x	1	2-04745
6,2	x	1,8	2-08748
6,3	x	0,6	2-05637
6,3	x	1,6	2-01742
6,3	x	2,4	2-04665
6,35	x	1,587	2-06399
6,36	x	0,82	2-08629
6,4	x	1,9	2-05257
6,5	x	0,6	2-06069
6,5	x	0,8	2-07625
6,5	x	1,5	2-09277
6,5	x	1,6	2-05334
6,5	x	2,8	2-09158
6,5	x	3	2-05119
6,5	x	5,25	2-07036
6,6	x	1,5	2-02571
6,7	x	0,45	2-11555
6,75	x	1,78	2-04441
7	x	0,5	2-12843
7	x	0,8	2-07626
7	x	1	2-03354
7	x	1,5	2-00629
7	x	1,6	2-07465
7	x	1,8	2-03947
7	x	2	2-00865
7	x	2,5	2-03762
7	x	3	2-01090
7	x	5	2-04472
7,2	x	0,7	2-06703

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
7,2	x	1,9	2-05258
7,3	x	2,4	2-03293
7,4	x	0,8	2-09573
7,5	x	1,5	2-05709
7,5	x	1,85	2-08081
7,5	x	2	2-04474
7,5	x	2,2	2-06516
7,5	x	2,5	2-08507
7,5	x	5	2-08181
7,6	x	1,78	2-01794
7,6	x	4	2-05764
7,8	x	1,78	2-13078
7,8	x	1,8	2-08746
7,9	x	1,6	2-03797
7,9	x	2,1	2-03286
7,9	x	2,3	2-03382
8	x	0,6	2-11113
8	x	0,7	2-11554
8	x	1	2-04616
8	x	1,3	2-09305
8	x	1,5	2-01617
8	x	1,6	2-02217
8	x	2	2-00580
8	x	2,325	2-04020
8	x	2,4	2-07168
8	x	2,5	2-05088
8	x	3	2-03897
8	x	3,75	2-03494
8	x	4	2-01390
8	x	10	2-01844
8,1	x	2	2-08082
8,13	x	1,78	2-09772
8,2	x	0,72	2-12570
8,2	x	2	2-00499
8,25	x	1,78	2-05671
8,3	x	2,4	2-04558
8,4	x	0,7	2-09646
8,4	x	2,2	2-04948
8,5	x	1	2-06096
8,5	x	1,5	2-06828
8,5	x	1,8	2-12849
8,5	x	2	2-04400
8,5	x	2,5	2-08228
8,5	x	3,5	2-04505
8,6	x	3	2-06261
8,73	x	1,78	2-06617
8,9	x	1,9	2-01314
8,9	x	2,7	2-05259
9	x	0,75	2-12816
9	x	1	2-07018
9	x	1,2	2-06068
9	x	1,5	2-03447
9	x	2	2-00795
9	x	2,25	2-01597
9	x	2,5	2-01708
9	x	2,7	2-07644
9	x	3	2-00631
9	x	3,5	2-03283
9	x	4	2-03550
9,1	x	1,6	2-08887

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
9,1	x	7,95	2-12371
9,12	x	1,7	2-02944
9,12	x	3,53	2-13060
9,2	x	1,78	2-03565
9,2	x	2,65	2-03564
9,2	x	2,9	2-03288
9,2	x	3,5	2-06406
9,3	x	2,4	2-02420
9,5	x	0,9	2-12363
9,5	x	1,6	2-04871
9,5	x	1,8	2-00472
9,5	x	2,4	2-01476
9,5	x	2,5	2-05117
9,5	x	3	2-06074
9,5	x	6	2-07536
9,5	x	8	2-12336
9,6	x	0,8	2-11480
9,6	x	3,4	2-01456
9,6	x	3,6	2-06045
9,92	x	1,78	2-09110
9,92	x	2,62	2-05693
10	x	0,5	2-12866
10	x	0,6	2-08771
10	x	1	2-04617
10	x	1,3	2-04506
10	x	1,5	2-04570
10	x	2	2-01731
10	x	2,2	2-03654
10	x	2,5	2-01184
10	x	3	2-00652
10	x	3,2	2-08754
10	x	4	2-01453
10	x	8	2-09878
10,2	x	2,5	2-04597
10,3	x	0,8	2-07417
10,3	x	1,2	2-08648
10,3	x	2,4	2-04644
10,5	x	1,5	2-04551
10,5	x	1,75	2-04807
10,5	x	2	2-13170
10,5	x	2,7	2-01315
10,82	x	1,78	2-05843
11	x	0,5	2-08143
11	x	1	2-02438
11	x	1,5	2-04752
11	x	2	2-04273
11	x	2,5	2-00913
11	x	3	2-02457
11	x	4,5	2-05651
11	x	5,5	2-06811
11	x	6	2-04226
11,11	x	1,59	2-06051
11,11	x	1,78	2-06101
11,11	x	2,38	2-06517
11,11	x	3,96	2-06400
11,2	x	2,75	2-00227
11,3	x	2,4	2-02132
11,5	x	1	2-11481
11,5	x	1,5	2-06259
11,5	x	2,5	2-02539

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
11,5	x	3	2-05561
11,5	x	4	2-04718
11,6	x	1,2	2-06433
11,91	x	2,62	2-06531
12	x	0,7	2-12892
12	x	0,8	2-12432
12	x	1	2-04576
12	x	1,5	2-03681
12	x	1,7	2-03767
12	x	1,9	2-04319
12	x	2	2-01384
12	x	2,5	2-03329
12	x	3	2-00630
12	x	3,5	2-12779
12	x	5	2-05116
12,3	x	1,9	2-07256
12,3	x	2,4	2-03664
12,4	x	2,65	2-01736
12,42	x	1,78	2-09771
12,5	x	1,8	2-04858
12,5	x	2,1	2-08722
12,5	x	2,75	2-05046
13	x	0,7	2-12805
13	x	1	2-03454
13	x	1,3	2-08252
13	x	1,5	2-04526
13	x	1,6	2-05240
13	x	2	2-00802
13	x	2,5	2-02676
13	x	3	2-02878
13	x	3,5	2-04921
13	x	4	2-03409
13	x	4,5	2-04004
13	x	8	2-03597
13,1	x	0,8	2-11478
13,1	x	2,65	2-06619
13,2	x	1,2	2-11479
13,2	x	1,78	2-11320
13,3	x	2,4	2-02133
13,4	x	1,6	2-07733
13,5	x	0,8	2-07418
13,5	x	1,5	2-08276
13,5	x	2,5	2-03950
13,5	x	5	2-04821
13,6	x	2,65	2-04434
13,6	x	3	2-03345
13,7	x	5,5	2-06661
13,8	x	2,54	2-02945
14	x	1	2-05506
14	x	1,5	2-02479
14	x	1,6	2-04487
14	x	1,78	2-04132
14	x	2	2-01821
14	x	2,5	2-01637
14	x	2,6	2-03262
14	x	3	2-00895
14	x	3,5	2-05548
14	x	4	2-02826
14	x	5	2-04920
14,2	x	2,8	2-01636

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
14,28	x	1,59	2-06052
14,4	x	1,6	2-11524
14,55	x	0,99	2-06329
14,6	x	2,3	2-02732
14,9	x	0,7	2-11643
15	x	1	2-05371
15	x	1,5	2-03901
15	x	2	2-01266
15	x	2,4	2-04605
15	x	2,5	2-02478
15	x	2,75	2-05047
15	x	3	2-03066
15	x	3,2	2-03298
15	x	3,5	2-05239
15	x	4	2-02331
15	x	5	2-03652
15	x	5,5	2-06210
15	x	6	2-04005
15	x	7	2-03307
15	x	10	2-03523
15,08	x	2,62	2-06567
15,1	x	2,7	2-05260
15,3	x	2,4	2-01738
15,36	x	2,62	2-06726
15,5	x	0,6	2-02680
15,5	x	2,5	2-04292
15,5	x	3	2-05452
15,5	x	3,8	2-00963
15,5	x	4,2	2-08546
15,55	x	2,65	2-04274
15,6	x	1,78	2-07871
15,6	x	2,6	2-04414
15,8	x	1,6	2-07727
15,8	x	4,1	2-03828
16	x	1	2-02437
16	x	2	2-00600
16	x	2,5	2-01616
16	x	2,6	2-07335
16	x	3	2-00864
16	x	3,5	2-03744
16	x	4	2-01026
16	x	5	2-05102
16	x	5,5	2-04424
16	x	8	2-01143
16	x	12	2-03997
16,2	x	2,5	2-04951
16,3	x	0,8	2-07419
16,3	x	2,4	2-03980
16,4	x	1	2-06739
16,4	x	2,6	2-04438
16,5	x	1,25	2-07838
16,5	x	1,5	2-06042
16,55	x	2,15	2-03835
16,8	x	1	2-08564
16,8	x	2,2	2-07238
16,9	x	2,7	2-05261
17	x	0,6	2-02593
17	x	1,5	2-03951
17	x	2	2-00454
17	x	2,5	2-01569

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
17	x	3	2-03739
17	x	4	2-05212
17	x	4,5	2-05134
17	x	5	2-04383
17	x	8	2-07618
17,12	x	2,65	2-04275
17,2	x	1,78	2-06294
17,3	x	2,4	2-02134
17,4	x	1,6	2-03591
17,4	x	2,8	2-11912
17,462	x	2,381	2-06398
17,5	x	2,4	2-03900
17,5	x	2,65	2-04435
17,5	x	3,5	2-04606
17,5	x	4,2	2-08547
18	x	1	2-09576
18	x	1,15	2-05855
18	x	1,3	2-07779
18	x	1,5	2-04349
18	x	2	2-01796
18	x	2,2	2-01917
18	x	2,5	2-01100
18	x	2,75	2-05929
18	x	3	2-00885
18	x	3,15	2-09293
18	x	3,5	2-02364
18	x	4	2-04485
18	x	5	2-02330
18	x	7	2-06006
18	x	8	2-07618
18	x	8,5	2-04186
18	x	10	2-07067
18	x	12,5	2-04007
18,3	x	2,4	2-03624
18,3	x	3,6	2-05263
18,4	x	2,7	2-05262
18,5	x	2,5	2-04215
18,5	x	3,5	2-04509
18,6	x	0,75	2-05202
18,6	x	2,6	2-02733
18,6	x	3,53	2-05655
18,7	x	1,9	2-02642
18,75	x	2,65	2-03567
18,77	x	1,78	2-06882
18,8	x	1,85	2-08084
18,8	x	3,5	2-06058
19	x	1,6	2-12646
19	x	2	2-05660
19	x	2,5	2-01918
19	x	3	2-00890
19	x	3,18	2-01707
19	x	3,5	2-01389
19	x	4	2-05135
19	x	5	2-09286
19	x	8	2-09722
19	x	16	2-03124
19,04	x	2,38	2-06048
19,2	x	1,65	2-05303
19,2	x	1,8	2-01025
19,2	x	3	2-03967

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
19,3	x	2,4	2-04358
19,5	x	1	2-02602
19,6	x	0,6	2-09538
19,6	x	2,8	2-07672
19,6	x	3,53	2-05655
19,8	x	2,9	2-09203
19,8	x	3,6	2-04267
20	x	1,3	2-04527
20	x	1,4	2-05349
20	x	1,5	2-08066
20	x	2	2-01183
20	x	2,5	2-01809
20	x	3	2-00896
20	x	3,3	2-09506
20	x	3,5	2-02747
20	x	4	2-01162
20	x	5	2-01451
20	x	6	2-04838
20	x	6,5	2-07190
20	x	7,5	2-06774
20	x	10	2-03734
20,2	x	0,6	2-02987
20,2	x	3,5	2-02545
20,24	x	2,62	2-06394
20,29	x	2,62	2-11304
20,3	x	2	2-03179
20,3	x	2,05	2-09006
20,3	x	5,85	2-03667
20,35	x	1,725	2-04133
20,5	x	3	2-02599
20,5	x	5,5	2-04120
20,5	x	5,75	2-03756
20,5	x	6,5	2-02240
20,6	x	1,5	2-11525
20,63	x	2,63	2-06675
20,8	x	2,7	2-05125
21	x	1	2-03287
21	x	1,5	2-03210
21	x	2	2-05659
21	x	2,4	2-03722
21	x	2,5	2-00892
21	x	3	2-03675
21	x	3,5	2-03942
21	x	4	2-09032
21	x	9,5	2-03869
21	x	10	2-09285
21,2	x	3	2-05733
21,3	x	3,6	2-05264
21,5	x	2,75	2-08085
21,5	x	3,5	2-01963
21,8	x	3	2-06100
21,8	x	3,53	2-03924
21,8	x	5,33	2-04553
21,89	x	2,65	2-06544
22	x	1	2-12340
22	x	1,4	2-04802
22	x	1,5	2-04276
22	x	2	2-02511
22	x	2,5	2-00936
22	x	2,8	2-06710

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
22	x	3	2-01346
22	x	3,5	2-01570
22	x	4	2-01641
22	x	5	2-03289
22	x	7	2-11810
22	x	10	2-03543
22	x	10,5	2-03524
22,2	x	3	2-04223
22,3	x	2,4	2-04627
22,5	x	2	2-07384
22,5	x	2,6	2-07336
22,5	x	4	2-05897
23	x	1,5	2-09036
23	x	2	2-01691
23	x	2,2	2-07257
23	x	2,5	2-00972
23	x	2,9	2-01710
23	x	3	2-01822
23	x	3,25	2-05580
23	x	3,5	2-03342
23	x	3,6	2-05265
23	x	3,75	2-05928
23	x	4	2-05137
23	x	5	2-05136
23	x	6	2-04839
23,3	x	2,4	2-07232
23,4	x	2,65	2-04993
23,4	x	3,53	2-04332
23,5	x	1,2	2-08140
23,5	x	1,78	2-05708
23,5	x	3	2-05800
23,8	x	2,62	2-06660
23,8	x	3,2	2-06942
24	x	1	2-08067
24	x	1,5	2-03395
24	x	2	2-00957
24	x	2,5	2-05345
24	x	3	2-00928
24	x	3,5	2-02696
24	x	3,75	2-06651
24	x	4	2-03049
24	x	5	2-03712
24	x	8	2-09721
24,2	x	3	2-04224
24,5	x	1	2-11112
24,5	x	3	2-11928
24,6	x	3,6	2-05266
25	x	0,8	2-07422
25	x	1,5	2-04338
25	x	2	2-01050
25	x	2,5	2-00866
25	x	2,65	2-06727
25	x	3	2-00958
25	x	3,5	2-01571
25	x	3,53	2-06534
25	x	4	2-00417
25	x	5	2-03115
25	x	6	2-01449
25	x	8	2-07650
25	x	8,5	2-09357

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
25	x	10	2-03733
25	x	12	2-04261
25,07	x	2,62	2-06674
25,12	x	1,78	2-04510
25,2	x	1,8	2-04528
25,2	x	3	2-03662
25,3	x	2,4	2-06919
25,5	x	2,5	2-07258
25,5	x	3,2	2-06930
26	x	1	2-06093
26	x	2	2-02561
26	x	3	2-00934
26	x	3,5	2-03945
26	x	3,75	2-04460
26	x	4	2-03922
26	x	5	2-03506
26	x	6	2-05799
26	x	8	2-08356
26,2	x	3	2-03742
26,2	x	3,6	2-05267
26,5	x	1	2-11111
26,58	x	3,53	2-05729
26,64	x	2,65	2-06728
26,7	x	1,78	2-05916
27	x	1,5	2-03502
27	x	2	2-03840
27	x	2,5	2-01941
27	x	3	2-03813
27	x	3,2	2-01459
27	x	3,5	2-02940
27	x	4	2-05752
27	x	4,5	2-05141
27	x	5	2-02631
27	x	5,5	2-05139
27	x	9	2-04010
27,3	x	2,4	2-03623
27,4	x	3,53	2-04436
27,5	x	1	2-02465
27,5	x	1,2	2-11110
27,5	x	1,5	2-05960
27,5	x	2	2-04823
27,6	x	2,2	2-03077
27,8	x	3,6	2-05268
27,8	x	5	2-03764
28	x	1	2-06136
28	x	1,5	2-04339
28	x	2	2-01354
28	x	2,5	2-01467
28	x	3	2-00897
28	x	3,5	2-01572
28	x	3,65	2-05124
28	x	3,75	2-06657
28	x	4	2-02197
28	x	4,5	2-09170
28	x	5	2-03453
28	x	6	2-03299
28,1	x	0,8	2-07423
28,15	x	3,53	2-04331
28,2	x	1	2-02601
28,2	x	3	2-06744

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
28,24	x	2,62	2-13129
28,3	x	1,8	2-05064
28,5	x	1,8	2-07964
28,5	x	3,5	2-01356
28,5	x	10	2-01144
28,7	x	2,95	2-04439
28,8	x	2,7	2-06917
28,9	x	1	2-08514
29	x	2	2-08212
29	x	2,5	2-02488
29	x	3	2-01227
29	x	3,5	2-02749
29,1	x	2,55	2-06551
29,2	x	3	2-03724
29,3	x	3,6	2-05269
29,5	x	3	2-05859
29,5	x	4,5	2-03048
29,8	x	1	2-02683
29,82	x	2,62	2-09522
30	x	2	2-02196
30	x	2,55	2-03498
30	x	3	2-00910
30	x	3,5	2-01573
30	x	4	2-00994
30	x	4,5	2-03538
30	x	5	2-02752
30	x	6	2-02241
30	x	7	2-04879
30	x	8	2-00791
30	x	10	2-03735
30,3	x	2,4	2-03625
30,4	x	3,9	2-06478
30,5	x	1,2	2-08264
30,5	x	3,5	2-13083
30,6	x	3,7	2-05491
30,6	x	3,8	2-06116
30,8	x	3,1	2-04440
30,8	x	3,6	2-05270
31	x	2	2-03637
31	x	2,5	2-04019
31	x	3,5	2-13084
31	x	8	2-06281
31	x	14	2-04202
31	x	18,5	2-08283
31,1	x	3,5	2-01962
31,35	x	3,53	2-04330
31,4	x	2,7	2-05466
31,42	x	2,62	2-07340
31,47	x	1,78	2-11926
31,5	x	1,78	2-08015
31,5	x	2,5	2-11798
31,5	x	3	2-02169
31,5	x	3,65	2-05121
31,5	x	4,5	2-08175
31,8	x	1	2-02681
31,8	x	2,65	2-09413
32	x	1,5	2-08148
32	x	2	2-04323
32	x	2,5	2-04340
32	x	3	2-02135

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
32	x	3,5	2-05531
32	x	3,75	2-06658
32	x	4	2-00911
32	x	5	2-01621
32	x	8	2-02607
32	x	10	2-04011
32,2	x	3	2-02015
32,5	x	2,65	2-11931
32,5	x	2,85	2-02686
32,5	x	3,6	2-05271
32,6	x	1,2	2-08104
32,6	x	1,5	2-08869
32,75	x	1,57	2-06126
32,9	x	3,5	2-04413
32,99	x	2,62	2-09770
33	x	1,8	2-05707
33	x	2	2-05325
33	x	2,5	2-01252
33	x	3	2-00792
33	x	3,5	2-01565
33	x	4	2-05138
33	x	5	2-03346
33	x	5,5	2-13085
33	x	6	2-03450
33,2	x	7,5	2-07066
33,25	x	3,5	2-13086
33,3	x	2,4	2-04628
33,33	x	3,175	2-06401
33,5	x	5	2-06160
33,6	x	3	2-12653
33,7	x	2,2	2-02119
33,75	x	3,25	2-05370
34	x	1,5	2-08068
34	x	2	2-01675
34	x	2,5	2-06301
34	x	3	2-01942
34	x	3,75	2-05372
34	x	4	2-01301
34	x	5	2-02451
34	x	5,5	2-02286
34	x	12	2-03544
34,1	x	3,6	2-05272
34,29	x	5,33	2-13087
34,5	x	3,5	2-03982
34,5	x	4	2-11816
34,59	x	2,62	2-13088
34,8	x	5	2-03991
35	x	1,5	2-06300
35	x	2	2-02198
35	x	2,5	2-00736
35	x	3	2-00929
35	x	3,2	2-01464
35	x	3,5	2-01566
35	x	3,6	2-06713
35	x	4	2-02131
35	x	4,5	2-11083
35	x	5,3	2-02409
35	x	6	2-09984
35	x	11	2-04304
35,2	x	1	2-11986

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
35,2	x	1,78	2-09853
35,5	x	8	2-03465
35,5	x	16,5	2-02059
35,6	x	1,5	2-11562
35,6	x	3,6	2-05273
35,8	x	1	2-08239
36	x	1,2	2-09685
36	x	2	2-04317
36	x	2,5	2-04624
36	x	3	2-00898
36	x	3,5	2-04775
36	x	4	2-01725
36	x	5	2-03254
36	x	7	2-08046
36	x	10	2-04211
36,2	x	3	2-03660
36,3	x	2,5	2-04023
36,5	x	3,2	2-01706
36,5	x	3,5	2-02136
36,5	x	4,5	2-04722
36,9	x	1,2	2-07425
37	x	2	2-02413
37	x	2,5	2-04803
37	x	3	2-02333
37	x	3,5	2-07393
37	x	4	2-07787
37	x	5	2-08000
37	x	5,5	2-01979
37	x	6	2-01151
37	x	8	2-02425
37,2	x	3	2-11504
37,3	x	3,6	2-05274
37,5	x	1	2-11130
37,5	x	3	2-04534
37,5	x	4	2-09644
37,5	x	5,33	2-06141
37,75	x	4,125	2-03780
37,77	x	2,62	2-13089
37,82	x	1,78	2-11299
38	x	2	2-05674
38	x	2,5	2-07385
38	x	3	2-01823
38	x	3,5	2-02103
38	x	4	2-13090
38	x	4,5	2-01868
38	x	5	2-03688
38	x	7	2-07651
38,1	x	1	2-07859
38,1	x	3,2	2-02639
38,5	x	3	2-08179
39	x	2	2-01265
39	x	2,2	2-03606
39	x	2,5	2-01177
39	x	3	2-01816
39	x	3,5	2-04214
39	x	4	2-04131
39	x	6	2-04536
39	x	8	2-02803
39	x	10	2-00619
39,2	x	5,7	2-04264

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
39,34	x	2,65	2-06884
39,34	x	2,8	2-09545
39,67	x	2,39	2-06049
40	x	1,5	2-03285
40	x	1,7	2-06594
40	x	2	2-04324
40	x	2,5	2-01488
40	x	3	2-00959
40	x	3,5	2-05959
40	x	4	2-00738
40	x	5	2-07679
40	x	5,5	2-12368
40	x	8	2-02805
40	x	10	2-04209
40,2	x	3,25	2-11760
40,5	x	4	2-04652
40,5	x	6	2-05911
40,6	x	5,33	2-06142
40,87	x	3,53	2-06899
40,94	x	2,62	2-13130
41	x	1,5	2-05237
41	x	2	2-04946
41	x	3	2-03557
41	x	4	2-05858
41	x	5	2-02641
41	x	7,5	2-01441
41	x	9,5	2-03870
41	x	10	2-02574
41	x	12	2-09548
41,1	x	3,65	2-05123
41,5	x	5,5	2-01936
42	x	1	2-04557
42	x	1,1	2-07690
42	x	2	2-04021
42	x	2,5	2-04451
42	x	3	2-02203
42	x	3,5	2-02284
42	x	4,5	2-02009
42	x	5	2-01657
42	x	5,5	2-05140
42	x	6	2-08176
42	x	8	2-07183
42	x	10	2-01780
42	x	13	2-02426
42,2	x	3	2-03622
42,5	x	3	2-13091
42,52	x	2,65	2-06883
43	x	2	2-02439
43	x	3	2-01399
43	x	3,5	2-03949
43	x	5	2-02480
43	x	5,25	2-06659
43	x	5,5	2-01910
43	x	6	2-03477
43,4	x	3	2-06435
43,5	x	3	2-05857
43,5	x	5,25	2-05048
43,5	x	9	2-02304
43,8	x	5,33	2-12851
44	x	1,78	2-06980

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
44	x	2	2-05398
44	x	2,5	2-04894
44	x	3	2-00930
44	x	3,5	2-01567
44	x	4	2-01233
44	x	4,5	2-04442
44	x	5	2-01824
44	x	5,25	2-09880
44	x	6	2-08001
44	x	8	2-07034
44	x	9	2-00927
44,12	x	2,62	2-13048
44,2	x	2,5	2-01889
44,2	x	5,7	2-02137
44,45	x	3,175	2-06402
44,45	x	3,53	2-06925
44,5	x	1,5	2-04180
44,5	x	2	2-01635
44,5	x	3,15	2-01705
44,6	x	9	2-12186
45	x	2	2-06029
45	x	3	2-02293
45	x	4	2-03981
45	x	4,5	2-06748
45	x	5	2-02753
45	x	7	2-02537
45	x	8	2-09933
45	x	12	2-05051
45,5	x	1,5	2-03076
45,5	x	5,5	2-05824
45,69	x	2,66	2-13062
45,7	x	2,62	2-12442
46	x	2	2-02741
46	x	2,5	2-03674
46	x	3	2-01127
46	x	3,5	2-01648
46	x	4,5	2-03040
46	x	5	2-03863
46,2	x	3	2-05731
46,4	x	5,4	2-03636
47	x	2	2-05214
47	x	2,52	2-02540
47	x	3	2-03484
47	x	3,5	2-05241
47	x	4	2-01640
47	x	5	2-05070
47	x	5,33	2-05806
47	x	5,5	2-02353
47,2	x	5,7	2-03990
47,5	x	1,5	2-05738
47,5	x	10	2-02427
47,6	x	2,6	2-05464
47,63	x	3,53	2-06566
48	x	1	2-07320
48	x	1,2	2-07427
48	x	1,8	2-08536
48	x	2	2-04760
48	x	2,5	2-11400
48	x	3	2-01543
48	x	3,5	2-01684

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
48	x	4	2-01874
48	x	5	2-01939
48	x	5,5	2-05867
48	x	6	2-02481
48	x	7	2-07068
48	x	8	2-07493
48	x	22	2-05393
48,5	x	3,5	2-13092
48,9	x	2,65	2-07014
49	x	1,5	2-03548
49	x	2	2-06595
49	x	2,5	2-03925
49	x	3	2-01458
49	x	3,6	2-03203
49	x	9	2-04777
49	x	15	2-09549
49,2	x	3	2-05638
49,2	x	5,7	2-03665
49,2	x	6,2	2-03495
49,21	x	3,53	2-06612
49,5	x	2,5	2-04554
50	x	2	2-01450
50	x	2,5	2-04705
50	x	3	2-00867
50	x	3,5	2-04826
50	x	4	2-02047
50	x	4,5	2-03047
50	x	5	2-00338
50	x	5,5	2-01815
50	x	6	2-00826
50	x	10	2-05332
50	x	12	2-03732
50,2	x	3	2-04936
50,2	x	5,33	2-04923
50,4	x	3,53	2-06609
50,47	x	2,65	2-06898
50,5	x	7	2-02560
51	x	2	2-07906
51	x	2,5	2-04595
51	x	3	2-03928
51	x	4,5	2-01937
51	x	9,5	2-03868
51,2	x	5,7	2-07134
52	x	1,5	2-07905
52	x	2,5	2-06322
52	x	3,5	2-01671
52	x	4	2-04765
52	x	5	2-02092
52	x	6	2-07887
52	x	8	2-12063
52	x	9	2-04638
52,07	x	2,62	2-13102
52,2	x	5,7	2-02138
52,5	x	4,5	2-03595
52,5	x	5	2-04288
52,7	x	0,85	2-08129
53	x	1,5	2-07313
53	x	2	2-04684
53	x	2,5	2-00925
53	x	3	2-03090



d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
53	x	4	2-09740
53	x	5,25	2-06649
53	x	7	2-08177
53	x	10	2-11067
53,35	x	5,33	2-04419
53,5	x	9	2-02305
53,57	x	3,53	2-13061
53,64	x	2,65	2-06956
53,7	x	1,78	2-13131
53,98	x	2,5	2-03782
54	x	3	2-01518
54	x	3,5	2-00931
54	x	4	2-01663
54	x	5	2-02744
54	x	5,5	2-02161
54	x	6	2-02073
54	x	8	2-12681
54,2	x	3	2-03658
54,2	x	5,7	2-02139
55	x	1,5	2-12718
55	x	2	2-13127
55	x	2,5	2-05790
55	x	3	2-01403
55	x	3,5	2-05242
55	x	5	2-03116
55	x	5,5	2-07692
55	x	6	2-05425
55,2	x	3	2-09437
55,25	x	2,62	2-06865
55,56	x	3,53	2-06396
56	x	0,6	2-07594
56	x	1	2-09534
56	x	2	2-05208
56	x	3	2-01563
56	x	3,5	2-03954
56	x	4	2-01664
56,2	x	3	2-04895
56,5	x	5,33	2-04416
56,7	x	1,2	2-08803
56,82	x	2,62	2-13063
57	x	2	2-03827
57	x	2,2	2-09567
57	x	2,5	2-03604
57	x	3	2-01741
57	x	3,5	2-01274
57	x	4	2-01943
57	x	5	2-02093
57,2	x	3	2-11405
57,5	x	10	2-02428
58	x	2	2-03089
58	x	2,5	2-07989
58	x	3	2-01653
58	x	3,5	2-01647
58	x	4	2-02048
58	x	5	2-05768
58,4	x	1,3	2-03277
58,42	x	2,62	2-13103
58,5	x	3,5	2-13104
59	x	2,5	2-06945
59	x	3	2-03526

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
59	x	3,53	2-04530
59	x	5	2-05856
59,2	x	5,7	2-03962
59,4	x	2,8	2-04924
59,7	x	5,33	2-05802
59,99	x	2,62	2-13133
60	x	1,5	2-09703
60	x	2	2-07398
60	x	2,5	2-04185
60	x	3	2-03294
60	x	3,5	2-00932
60	x	4	2-01606
60	x	4,5	2-09682
60	x	5	2-00339
60	x	5,3	2-13132
60	x	6	2-04384
60	x	8	2-04144
60	x	9	2-03873
60	x	16	2-03545
60,3	x	3,175	2-06403
60,3	x	4,8	2-01014
61	x	2	2-04849
61	x	3,2	2-08193
61	x	5	2-13105
61	x	6	2-08002
61	x	10	2-11888
61,2	x	5,7	2-09748
61,5	x	4	2-05042
62	x	1	2-09847
62	x	1,5	2-07823
62	x	2	2-06596
62	x	2,5	2-05365
62	x	3	2-00926
62	x	4	2-00651
62	x	4,5	2-13106
62	x	5	2-01781
62	x	6,5	2-02007
62	x	9	2-02188
62	x	14	2-01881
62	x	16,5	2-02054
62,2	x	5,7	2-05805
62,4	x	5,3	2-07565
62,5	x	10	2-02429
62,9	x	5,33	2-06143
63	x	2	2-03894
63	x	3	2-01596
63	x	3,5	2-06002
63	x	4,5	2-09726
63	x	5	2-06003
63	x	5,5	2-06842
63	x	6	2-12898
63	x	7	2-02783
63	x	10	2-04896
63,17	x	2,62	2-13047
63,5	x	2	2-03848
63,5	x	3,53	2-04532
64	x	1,4	2-07004
64	x	2,5	2-09482
64	x	3	2-01278
64	x	3,5	2-01059

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
64	x	4	2-04619
64	x	4,5	2-13094
64	x	5	2-02697
64	x	11	2-02306
64	x	12,5	2-03265
64,2	x	5,7	2-02927
64,9	x	2,6	2-05465
64,9	x	3,55	2-05921
65	x	2	2-03774
65	x	2,5	2-04450
65	x	3	2-03396
65	x	3,5	2-03953
65	x	4	2-02754
65	x	4,5	2-09612
65	x	4,6	2-12360
65	x	5	2-01387
65	x	5,7	2-06316
65	x	6	2-04103
65	x	6,5	2-03068
65	x	7,5	2-03862
65,5	x	2,3	2-07856
66	x	5	2-04141
66	x	5,33	2-06144
66,27	x	3,53	2-12854
66,34	x	2,62	2-13134
66,5	x	3,5	2-04291
67	x	2	2-05590
67	x	2,5	2-04714
67	x	3	2-03815
67	x	4	2-01944
67	x	6,5	2-06755
67	x	7	2-06251
67	x	8	2-05503
67,2	x	5,7	2-03661
67,8	x	2,3	2-07858
68	x	3	2-05211
68	x	3,5	2-05647
68	x	4	2-01353
68	x	4,5	2-11754
68	x	5	2-04764
68	x	5,5	2-01739
68	x	6	2-07637
68	x	18	2-06776
68,7	x	5,3	2-05949
69	x	2,5	2-12078
69	x	3	2-01410
69	x	4	2-05600
69	x	5	2-02600
69	x	5,5	2-13107
69	x	7,5	2-05610
69,2	x	5,33	2-06145
69,2	x	5,7	2-02140
69,3	x	4	2-06772
69,4	x	2,8	2-06070
69,44	x	3,53	2-13116
69,52	x	2,62	2-13108
69,7	x	2	2-09102
69,75	x	1,78	2-07789
70	x	1,4	2-06966
70	x	2	2-02762

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
70	x	3	2-00914
70	x	3,5	2-00734
70	x	4	2-03470
70	x	4,5	2-09664
70	x	5	2-00340
70	x	5,5	2-02698
70	x	7	2-13126
70	x	8	2-06714
70,5	x	2,4	2-07948
71	x	2	2-05220
71	x	2,5	2-03659
71	x	3	2-02390
71,1	x	2,65	2-02237
71,5	x	1,5	2-05876
71,5	x	1,7	2-07988
71,5	x	2,5	2-04208
71,5	x	3,5	2-13125
72	x	2	2-04961
72	x	3	2-02414
72	x	3,5	2-03955
72	x	4	2-03249
72	x	5	2-02165
73	x	2	2-00915
73	x	2,5	2-04105
73	x	3,5	2-00789
73	x	7	2-08178
73,5	x	2	2-03357
73,5	x	2,4	2-05189
74	x	2	2-05471
74	x	3	2-01940
74	x	4	2-05451
74	x	6	2-03669
74	x	7	2-04819
74	x	8	2-03726
74	x	11	2-02307
74,2	x	5,7	2-02443
75	x	2	2-06137
75	x	2,5	2-04600
75	x	3	2-01475
75	x	3,5	2-01634
75	x	4	2-00971
75	x	4,5	2-09613
75	x	5	2-02998
75	x	5,5	2-02737
75	x	7,5	2-02941
75,5	x	2,4	2-07946
75,6	x	5,33	2-04418
75,8	x	3,8	2-11531
75,87	x	2,62	2-13135
76	x	2	2-02233
76	x	2,5	2-00429
76	x	3	2-05351
76	x	3,5	2-08014
76	x	3,75	2-11579
76	x	4	2-00320
76	x	7	2-04863
76	x	8	2-07712
76,5	x	3	2-04672
76,62	x	3,53	2-13109
77	x	2,5	2-01818

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
77	x	5	2-04598
77,2	x	5,7	2-03611
77,5	x	5,2	2-06943
78	x	1,2	2-03282
78	x	2	2-04479
78	x	2,5	2-11875
78	x	3	2-02983
78	x	4	2-03728
78	x	5	2-04139
78	x	5,5	2-08278
78	x	6	2-07485
78	x	7	2-09714
78	x	15	2-03281
78,8	x	5,3	2-02005
78,97	x	3,53	2-04992
79	x	1,5	2-11862
79	x	2	2-06597
79	x	2,5	2-09481
79	x	3,65	2-07337
79	x	6	2-05994
79,2	x	5,7	2-03043
79,4	x	4,75	2-02637
79,5	x	2,5	2-11303
80	x	2	2-02232
80	x	2,5	2-03592
80	x	3	2-01345
80	x	3,5	2-03932
80	x	4	2-00735
80	x	5	2-00341
80	x	5,5	2-01859
80	x	6	2-02516
80	x	8	2-03144
80	x	10	2-09764
80	x	15	2-03817
80,8	x	2,3	2-07857
81	x	3	2-03421
81	x	5,5	2-13124
81	x	7	2-01938
81,9	x	5,33	2-04415
82	x	2,5	2-08016
82	x	3,5	2-04590
82	x	4	2-02407
82	x	5,5	2-05388
82	x	6	2-05758
82	x	8	2-03300
82,22	x	2,62	2-12852
82,27	x	1,78	2-13110
82,5	x	3,65	2-05122
82,6	x	1,6	2-06027
83	x	3	2-02482
83	x	5	2-03196
84	x	2	2-04962
84	x	3,5	2-05648
84	x	4	2-07144
84	x	5,33	2-05010
84	x	5,7	2-05601
84	x	11	2-02308
84,9	x	3,6	2-05922
85	x	2	2-02761
85	x	2,5	2-03657

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
85	x	3	2-01875
85	x	3,5	2-01358
85	x	4	2-02661
85	x	4,5	2-05883
85	x	5	2-05405
85	x	5,5	2-01860
85	x	7	2-06784
85,1	x	5,33	2-06148
85,32	x	3,53	2-12856
85,5	x	2,4	2-07944
85,5	x	2,5	2-02575
86	x	3	2-05036
86	x	3,7	2-11311
86	x	4	2-01945
86	x	6	2-02141
86	x	8	2-07518
87	x	2	2-05213
87	x	4	2-05300
87	x	5	2-08032
87,2	x	5,7	2-01888
88	x	3	2-02128
88	x	5	2-00807
88	x	8	2-13123
88	x	12	2-06132
88,3	x	5,33	2-06149
88,5	x	3,53	2-08583
89	x	4	2-07199
89	x	5,5	2-05286
89,2	x	5,7	2-02142
89,5	x	3,5	2-04290
90	x	1	2-07087
90	x	2	2-03258
90	x	2,5	2-05977
90	x	3	2-03020
90	x	3,5	2-05517
90	x	4	2-00933
90	x	5	2-03380
90	x	5,5	2-13122
90	x	6	2-03793
90	x	7	2-09302
90	x	10	2-04168
90	x	10,5	2-02610
91	x	4	2-03478
91	x	6	2-11563
91,44	x	5,33	2-12586
92	x	3	2-03778
92	x	3,5	2-06236
92	x	4	2-03229
92	x	5	2-02702
92,1	x	4,75	2-02802
92,2	x	5,7	2-07893
93	x	4	2-05734
93	x	5	2-07104
94	x	2	2-06591
94	x	2,5	2-03895
94	x	3	2-00623
94	x	4	2-07538
94	x	5	2-09005
94,2	x	5,7	2-02897
94,5	x	3	2-11498

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
94,6	x	3,5	2-12127
94,6	x	5,33	2-06151
95	x	3	2-01406
95	x	3,5	2-03791
95	x	4	2-03481
95	x	4,5	2-05811
95	x	5	2-02257
95	x	5,5	2-01861
95	x	7,5	2-06754
95	x	8	2-02536
95,2	x	3,5	2-03792
95,2	x	5,7	2-07976
95,5	x	2,4	2-07943
96	x	0,6	2-07595
96	x	2	2-07782
96	x	3	2-01411
96	x	4	2-00321
97	x	2,5	2-06598
97	x	4	2-03230
97	x	5	2-05992
97,8	x	5,33	2-06152
98	x	1,5	2-04673
98	x	3	2-05396
98	x	3,5	2-12853
98	x	4	2-06688
98	x	5	2-06237
98	x	6	2-07693
98	x	7	2-04360
98,4	x	5,33	2-06588
98,5	x	3,5	2-07389
98,5	x	5,3	2-07259
99	x	3	2-03316
99	x	5	2-01834
99	x	5,1	2-07688
99,2	x	5,7	2-04086
100	x	1,5	2-08890
100	x	2	2-05399
100	x	2,5	2-04909
100	x	3	2-02341
100	x	3,5	2-04571
100	x	3,65	2-07338
100	x	4	2-02242
100	x	5	2-01886
100	x	5,5	2-01601
100	x	6	2-04763
100	x	7	2-11672
100	x	10	2-01867
100	x	15	2-02804
101	x	5	2-09687
101	x	5,33	2-04529
101	x	6	2-02699
101,19	x	3,53	2-11305
101,27	x	2,62	2-11070
101,32	x	1,78	2-09746
102	x	1,5	2-08675
102	x	2,5	2-12211
102	x	3,5	2-05761
102	x	4	2-00642
102	x	5	2-13111
102	x	7	2-12606

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
102	x	8	2-03751
103	x	4	2-09875
103	x	5	2-02700
103	x	6	2-03267
104	x	2	2-11473
104	x	3	2-07200
104,1	x	5,33	2-06153
104,1	x	5,7	2-02444
104,37	x	3,53	2-13112
105	x	2	2-05219
105	x	3	2-01717
105	x	3,5	2-02389
105	x	4	2-03448
105	x	5,2	2-08194
105	x	5,5	2-11881
105	x	6	2-09715
105	x	6,4	2-02023
105	x	8	2-06715
105	x	15	2-02309
105,6	x	2,2	2-05094
106	x	1	2-04897
106	x	2	2-05243
106	x	3	2-04910
106	x	4	2-08706
106	x	4,5	2-07341
107	x	2	2-04898
107	x	4,5	2-04704
107	x	5	2-02143
107,2	x	5,2	2-12128
107,3	x	3,53	2-07999
107,3	x	5,33	2-06154
108	x	3	2-03731
108	x	4	2-05299
108	x	5	2-02902
108	x	5,2	2-07486
108	x	6	2-01602
108	x	8	2-04428
108,8	x	6	2-02721
109	x	2	2-03109
109	x	4	2-11854
109,2	x	5,7	2-03961
110	x	1,5	2-11465
110	x	3	2-04774
110	x	3,5	2-04615
110	x	4	2-01412
110	x	5	2-01226
110	x	5,5	2-09773
110	x	6	2-04883
110	x	9	2-11552
110,5	x	2,4	2-07947
110,5	x	5	2-06946
110,5	x	5,34	2-05407
110,72	x	3,53	2-04333
112	x	2,5	2-06881
112	x	3	2-05244
112	x	3,5	2-05762
112	x	4	2-03231
112	x	5,3	2-07260
112	x	6	2-07383
113	x	1,5	2-07191

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
113	x	3,5	2-01751
113	x	4	2-03858
113	x	6	2-02701
113	x	11	2-05978
113,2	x	3,5	2-04769
113,67	x	5,3	2-12857
113,7	x	5,33	2-06156
113,7	x	7	2-06166
113,9	x	3,53	2-11352
114	x	5,5	2-04344
114	x	6	2-02296
114,5	x	3	2-11905
114,6	x	2,2	2-03410
115	x	2	2-08544
115	x	3	2-05629
115	x	3,5	2-05927
115	x	4,5	2-02377
115	x	5	2-03238
115	x	6	2-12900
115	x	9	2-09716
115	x	12,5	2-03719
116	x	2	2-02750
116	x	3	2-05474
116	x	4	2-00322
116,8	x	7	2-06167
117	x	3,5	2-06880
117	x	4	2-01740
117,07	x	3,53	2-12855
117,5	x	5,33	2-06623
118	x	3	2-05558
118	x	4	2-02271
118	x	4,5	2-05646
118	x	5	2-02016
118,6	x	4	2-06432
119	x	7	2-07243
119,2	x	5,7	2-03044
119,5	x	3	2-13079
120	x	2,5	2-01468
120	x	3	2-03720
120	x	3,5	2-02043
120	x	4	2-03482
120	x	4,5	2-01208
120	x	5	2-03070
120	x	6	2-05427
120	x	7	2-05663
120	x	10	2-02746
120	x	15	2-05402
120,65	x	3,175	2-06404
121	x	3	2-07239
121	x	5	2-08985
121	x	5,3	2-07261
122	x	2	2-03426
122	x	3	2-04231
122	x	3,5	2-05622
122	x	4	2-03232
122	x	10	2-08879
123	x	6	2-06235
123	x	6,5	2-03721
123,2	x	7	2-06168
123,4	x	3,5	2-07345

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
123,8	x	4,76	2-04425
124	x	3	2-02410
124	x	3,25	2-08811
124,2	x	5,7	2-03610
125	x	3	2-07065
125	x	3,5	2-05518
125	x	4	2-01231
125	x	5	2-04613
125	x	6	2-07145
125	x	10	2-02519
125,2	x	6,9	2-06944
126	x	4	2-03407
126,4	x	7	2-06169
127	x	3,175	2-06405
127	x	4	2-04160
127	x	5,33	2-06624
128	x	2,5	2-04761
128	x	3	2-04548
128	x	4,5	2-05541
128	x	6	2-02914
128	x	7	2-08196
128	x	9	2-09443
129	x	3,5	2-11768
129	x	4	2-02249
129,2	x	5,7	2-04398
129,5	x	7	2-06170
130	x	2,5	2-04402
130	x	3	2-05833
130	x	4	2-01752
130	x	4,5	2-04350
130	x	5	2-05985
130	x	6	2-03344
130	x	7,5	2-03795
131	x	5,3	2-07265
131	x	9	2-11564
132	x	2	2-05475
132	x	3	2-04525
132	x	3,55	2-12040
132	x	4	2-02542
132	x	6	2-04152
132,7	x	7	2-06189
132,9	x	3,53	2-11428
133	x	1,5	2-09100
133	x	3,5	2-03317
133	x	7	2-06538
133,4	x	5,34	2-05408
133,5	x	3,25	2-08535
133,5	x	4	2-09767
133,6	x	2,2	2-03411
134,5	x	7	2-06625
135	x	2,5	2-02298
135	x	3	2-07613
135	x	3,5	2-03857
135	x	3,8	2-07097
135	x	5	2-02898
135	x	6	2-07105
135	x	7	2-08197
136	x	3	2-03803
136	x	3,5	2-03785
136	x	4	2-00324

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
136,5	x	5,33	2-06626
137	x	2,3	2-07108
137	x	3	2-08781
137	x	4	2-00970
137	x	7	2-03006
138	x	2	2-06758
138	x	3,5	2-03784
138	x	5	2-07487
138	x	6	2-01255
138	x	8	2-05083
138,7	x	3	2-08463
139	x	2,4	2-11530
139	x	4	2-03480
139,1	x	7	2-06147
139,2	x	5,7	2-07978
139,3	x	3,53	2-06475
139,7	x	5,33	2-06627
140	x	1,9	2-09965
140	x	3	2-02974
140	x	4	2-03486
140	x	4,5	2-11509
140	x	5	2-04008
140	x	10	2-02518
142	x	4	2-01407
142	x	7,5	2-03816
142	x	9	2-04656
142,2	x	7	2-06191
142,47	x	3,53	2-05815
142,8	x	2,5	2-12389
142,9	x	5,33	2-06628
143	x	5	2-06663
143	x	6	2-05792
144	x	3	2-03787
144	x	3,8	2-09988
144	x	4	2-05582
144	x	5	2-04446
144,2	x	5,7	2-09749
145	x	2	2-08472
145	x	2,5	2-05403
145	x	3	2-07434
145	x	3,5	2-05447
145	x	4	2-01529
145	x	5	2-01191
145,4	x	7	2-06192
146	x	5	2-03918
146,1	x	5,33	2-06629
147	x	3,5	2-06254
148	x	2,7	2-09960
148	x	10	2-09895
148,6	x	7	2-04911
148,82	x	3,53	2-07213
149,2	x	5,33	2-06630
149,2	x	5,7	2-05572
149,6	x	3	2-08896
150	x	2	2-07163
150	x	3	2-01760
150	x	4	2-02581
150	x	4,5	2-02254
150	x	5	2-03117
150	x	6	2-01732

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
152	x	3,55	2-06560
152	x	6,5	2-02692
152	x	7	2-01275
153	x	3,5	2-03233
153	x	6	2-03923
153	x	10	2-06022
154,2	x	5,7	2-07339
155	x	2	2-06720
155	x	3	2-04573
155	x	4	2-05350
155	x	5	2-07492
155,58	x	7	2-06631
156	x	2	2-05477
156	x	4	2-00325
156	x	5	2-04953
156	x	10	2-09894
157	x	2,3	2-07854
157	x	3	2-13113
157	x	3,5	2-11767
157	x	4	2-05793
157	x	5	2-03896
158	x	6	2-03234
158,1	x	7	2-05632
158,34	x	3,53	2-06533
159,2	x	5,7	2-04498
159,5	x	3	2-13080
159,5	x	7	2-06632
160	x	3	2-02256
160	x	4	2-02662
160	x	5	2-04354
160	x	10	2-01196
161,9	x	6,99	2-06397
162	x	2	2-11466
162	x	2,3	2-07109
162	x	3	2-08043
162	x	4	2-03235
163,6	x	2,2	2-03412
164,5	x	7	2-06194
164,7	x	3,53	2-05939
165	x	2	2-02984
165	x	2,4	2-06008
165	x	3	2-05194
165	x	4	2-01835
165	x	5	2-04159
165	x	5,5	2-04210
166	x	6	2-04776
166,7	x	7	2-06633
167	x	4	2-00969
167	x	5	2-03709
167,6	x	3,53	2-08585
168	x	3	2-05887
168	x	4	2-00597
168,5	x	5,5	2-07855
170	x	3	2-03794
170	x	3,5	2-05448
170	x	4	2-03386
170	x	5	2-12716
170	x	8	2-09947
170,8	x	7	2-06195
170,82	x	5,33	2-12802

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
171	x	3,53	2-05940
172	x	2,3	2-07852
172	x	4	2-02633
172	x	6	2-02731
173	x	2,1	2-05751
173	x	3	2-07086
173	x	4	2-03320
173	x	5	2-07382
174	x	3	2-04537
174,3	x	3,5	2-01253
174,6	x	7	2-06634
175	x	4	2-11853
175	x	5	2-05634
175	x	5,7	2-11186
175	x	6	2-04614
175	x	7	2-06843
177	x	3	2-11650
177	x	4	2-01610
177,2	x	7	2-06196
178	x	3,5	2-13114
178	x	6	2-07212
178	x	6,5	2-07843
178	x	10	2-04739
179	x	3	2-04363
180	x	2	2-12203
180	x	3	2-02975
180	x	4	2-03487
180	x	5	2-00526
180	x	8	2-05092
180	x	14	2-09962
181	x	2,3	2-07851
181	x	7	2-03110
182	x	7	2-06021
182,6	x	5,5	2-01522
183	x	2	2-07846
183	x	7	2-01276
183	x	10	2-09912
184	x	3	2-03910
184	x	5	2-04847
184	x	8	2-03710
185	x	2	2-09992
185	x	2,6	2-04983
185	x	3	2-02199
185	x	3,55	2-12039
185	x	4,5	2-03387
185	x	6	2-11409
186	x	7	2-03916
187	x	4	2-05727
187,3	x	7	2-06635
188	x	2	2-04738
188	x	5	2-03539
188	x	6	2-09979
188	x	7	2-05290
189,2	x	5,7	2-07977
189,9	x	7	2-06198
190	x	3	2-13115
190	x	3,53	2-07388
190	x	5	2-03715
190	x	6	2-03812
190	x	8,5	2-07088

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
192	x	2	2-04550
192	x	4	2-04165
192	x	18	2-03818
193	x	2	2-04645
193	x	7	2-11487
195	x	3	2-03909
195	x	10	2-05078
195,6	x	4,4	2-05980
196	x	4	2-00599
196,2	x	7	2-06199
197	x	8	2-12786
198	x	5	2-05104
198	x	6	2-02794
200	x	2,6	2-06971
200	x	3	2-07245
200	x	4	2-03714
200	x	5	2-05103
200	x	5,3	2-09981
200	x	6	2-04612
200	x	6	2-04612
200,5	x	2,4	2-07949
201,5	x	3,53	2-09380
202	x	4	2-01611
202	x	6	2-06043
202,6	x	7	2-05633
202,8	x	3,53	2-13139
203	x	3	2-05526
205	x	2	2-05460
205	x	3	2-03552
205	x	4	2-06274
205	x	5	2-04703
206	x	7	2-05797
208	x	4	2-03488
208	x	6	2-06389
208	x	8	2-07494
209	x	7	2-07263
209,14	x	3,53	2-11506
209,2	x	5,7	2-04087
210	x	3	2-02200
210	x	4	2-03814
210	x	5	2-03656
210	x	6	2-03208
210	x	6,3	2-11189
210	x	10	2-01528
210	x	12	2-02982
210,5	x	2,4	2-07945
212	x	5	2-04982
214	x	6	2-07502
215	x	5	2-04497
215	x	8	2-03037
215,3	x	7	2-06215
215,5	x	3,53	2-08584
216	x	1,5	2-03811
216	x	2	2-09705
216	x	2,3	2-07110
216	x	3	2-03825
216	x	4	2-01408
217	x	5,33	2-13019
218	x	5	2-12616
218	x	6,15	2-07381

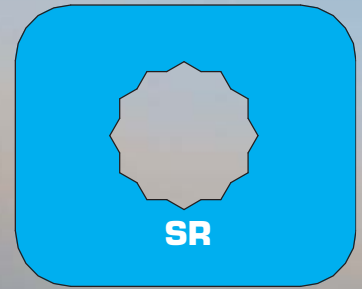
d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
218,5	x	4,5	2-05831
220	x	2	2-06759
220	x	3	2-07460
220	x	5	2-06138
221,6	x	7	2-06636
221,62	x	5,33	2-12990
222	x	4	2-03491
222	x	6,3	2-09570
222	x	10	2-04964
223	x	3,3	2-07916
224	x	3,8	2-06932
225	x	3	2-05534
225	x	5	2-03810
225	x	8	2-02627
226	x	3,6	2-07806
226	x	4	2-05896
227	x	3,5	2-11860
228	x	3	2-09460
228	x	3	2-09460
228	x	4	2-03705
228	x	6	2-02486
228	x	7	2-06216
228	x	10	2-06384
230	x	2	2-09993
230	x	5	2-01761
230	x	6	2-02729
233	x	3	2-05832
234	x	2,5	2-07394
234,54	x	3,53	2-11108
235	x	4	2-03655
235	x	5	2-02618
235	x	6	2-07106
236	x	5,3	2-09982
236	x	10	2-11008
238	x	3,7	2-04574
238	x	4	2-02405
238	x	5	2-06497
238	x	5,33	2-13018
239,3	x	5,7	2-09904
239,5	x	8	2-06819
240	x	2	2-11528
240	x	2,5	2-05295
240	x	3	2-02201
240	x	5	2-03872
240,67	x	5,33	2-11202
240,7	x	7	2-06217
242	x	4	2-06425
242	x	6	2-07699
242	x	15	2-05469
243	x	8,5	2-05640
244	x	3	2-06826
244	x	7	2-07488
244,5	x	3,5	2-09418
245	x	5	2-02579
246	x	8	2-12785
248	x	5	2-06724
250	x	1,5	2-11527
250	x	3	2-03809
250	x	4	2-04986
250	x	5	2-05079

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
250	x	6	2-07623
250	x	7	2-02730
251	x	8	2-03711
252	x	4	2-01612
253	x	6	2-07489
253	x	7	2-06469
253,37	x	5,33	2-11852
253,4	x	7	2-06218
253,59	x	3,53	2-11109
254	x	4	2-05726
255	x	5	2-07454
255,6	x	2,2	2-03540
256	x	4	2-01409
258	x	6	2-05035
258	x	7	2-05080
259,7	x	7	2-06637
260	x	3	2-07236
260	x	4	2-04985
260	x	5	2-08195
262	x	4	2-04118
262	x	13	2-06837
265	x	5	2-03531
265	x	6	2-07107
265	x	10	2-01279
266,1	x	7	2-06219
266,29	x	3,53	2-11855
267	x	4	2-06426
270	x	3	2-07853
270	x	4	2-08562
270	x	5	2-08303
272	x	4	2-09936
272,4	x	7	2-06638
275	x	4	2-02202
275	x	5	2-03522
278,8	x	7	2-06220
278,99	x	3,53	2-12162
280	x	4	2-03388
280	x	5	2-03716
280	x	6	2-03549
280	x	8	2-05819
280	x	8,2	2-12609
282	x	4	2-03490
285,1	x	7	2-06639
289	x	3,5	2-02758
290	x	2	2-11644
290	x	3	2-03718
290	x	5	2-11339
290	x	6	2-02369
290	x	8	2-07535
291,5	x	7	2-06221
292	x	4	2-12012
295	x	6	2-02756
297	x	4	2-06385
297,8	x	7	2-06640
299,3	x	5,7	2-09905
300	x	8	2-09900
302	x	4	2-11286
302	x	5	2-02895
303	x	3	2-04452
304,17	x	5,33	2-12686

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
304,2	x	7	2-06222
304,39	x	3,53	2-06810
305	x	4	2-07517
305	x	5	2-03045
305	x	8	2-09370
310	x	4	2-13120
310	x	5	2-05081
310	x	6	2-09112
312	x	4	2-03492
315	x	4	2-08565
316,2	x	7	2-06441
316,9	x	7	2-06223
320	x	5	2-03717
325	x	8	2-05694
329,6	x	7	2-06224
330	x	5	2-03729
330	x	6	2-04167
330	x	8	2-03617
336	x	2	2-12497
340	x	4	2-08198
340	x	5	2-08563
342,3	x	7	2-06225
343	x	6	2-03614
343	x	7	2-06468
345	x	4	2-12680
345	x	5	2-02276
345	x	8	2-08566
348	x	8	2-08302
350	x	5,5	2-04808
353	x	8,3	2-07490
355	x	4	2-07234
355	x	7	2-06226
355	x	8	2-09901
360	x	4	2-01164
360	x	5	2-11340
365	x	8	2-12491
365	x	10	2-09980
367	x	3,5	2-03535
367,7	x	7	2-06227
368	x	6	2-02793
370	x	3	2-01452
370	x	4	2-03752
370	x	5,5	2-03985
372	x	6,3	2-09937
374	x	5	2-09101
375	x	3	2-11150
380	x	5	2-05630
380,4	x	7	2-06228
382	x	4	2-11151
382	x	14	2-11126
383	x	6,3	2-09935
383,5	x	3,5	2-09419
390	x	4	2-07235
390	x	11	2-03753
393,1	x	7	2-06229
395	x	2,4	2-11553
395	x	5	2-04757
400	x	4	2-05249
400	x	5	2-03413
408	x	5	2-02255

d <sub>1</sub>	x	d <sub>2</sub>	Tool-no.:
410	x	4	2-13093
414	x	16	2-06820
418	x	7	2-09863
420	x	4	2-01613
420	x	5	2-11246
426	x	7	2-05698
430	x	7	2-06519
430	x	11	2-08927
438	x	15,2	2-09758
439,5	x	5	2-13081
440	x	4	2-12042
444	x	11	2-05699
445	x	5	2-05539
455	x	5	2-08543
460	x	4	2-01614
465	x	5	2-05502
469	x	11	2-05700
470	x	10	2-09783
474	x	16	2-06821
475	x	8	2-05817
480	x	4	2-08199
489	x	11	2-05701
490	x	5	2-01530
501	x	14	2-07835
510	x	6	2-12635
516	x	15	2-09600
530	x	5	2-01521
538	x	6	2-03615
550	x	4	2-11281
559,1	x	6,35	2-01168
570	x	4	2-08886
590	x	4	2-09022
598,82	x	3,53	2-09827
600	x	6	2-05118
610	x	7	2-05795
629	x	11	2-05702
630	x	14	2-07924
643	x	5	2-09902
673	x	7	2-13006
676	x	8	2-09784
680	x	14	2-08382
690	x	7	2-05794
695	x	6	2-06378
700	x	8	2-12492
709	x	5	2-11475
710	x	6	2-11398
715	x	6	2-11801
720	x	6	2-09939
740	x	6	2-09430
745	x	3,2	2-11284
785	x	8	2-05818
790	x	5	2-09903
840,8	x	2,62	2-12346
854	x	7	2-13007
870	x	8	2-09917
882	x	3	2-09873
886	x	4	2-09872
908	x	1,78	2-08070
910	x	8	2-09918

# HECKER® GSM® STAR RING SR1 ROD, SHAFT AND CYLINDER SEAL



## SEAL PROPERTIES

- circular profile with 12 sealing edges
- special shapes upon request
- O-ring grooves
- low friction and breakaway forces



## APPLICATION

- measuring and control systems
- hydraulic and pneumatic systems
- rotary and pivoting pistons
- low pressures

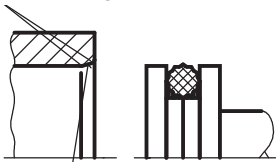
## MATERIALS

- selection according to the respective operating conditions
- materials as per material list

## INSTALLATION

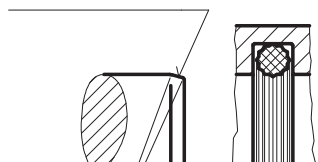
- installation dimensions according to the list of dimensions
- to be latched into the provided area
- installation auxiliary to be provided
- sharp edges to be avoided

rounded edges



insertion chamfer

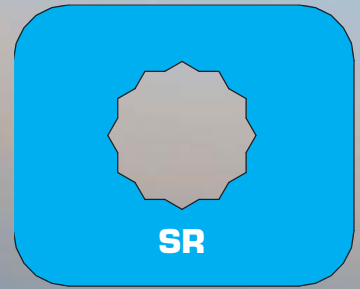
insertion chamfer



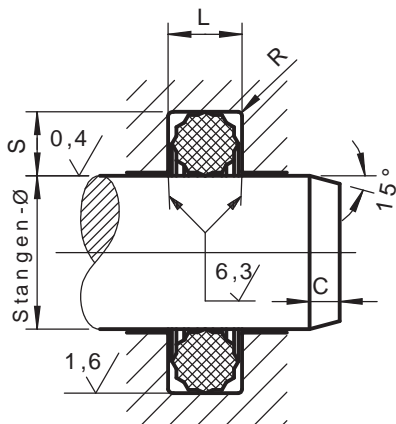
rounded edges

# HECKER® GSM®

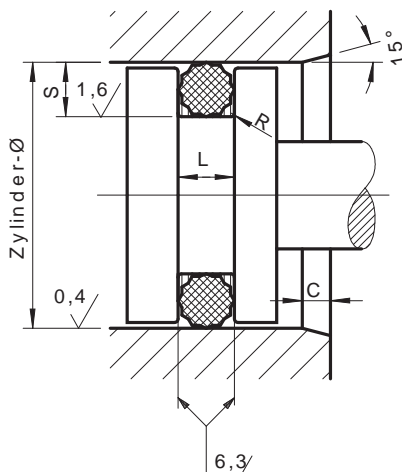
## STAR RING SR1 ROD, SHAFT AND CYLINDER SEAL



### INSIDE SEALING



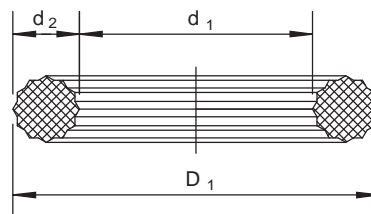
### OUTSIDE SEALING



### SEALING: DYNAMIC AXIAL AND ROTATING MOTIONS

Cross section diameter $\varnothing d_2$	axial motion			rotating motion			R	C
	S	Tol.	L+0,2	S	Tol.	L+0,2		
2	1,8	-0,02	2,3	1,9	-0,02	2,3	0,2	1,5
2,4	2,15		2,8	2,28		2,8		
2,5	2,25		2,9	2,38		2,9		
2,65 (2,62)	2,35		3	2,5		3		
3	2,7		3,4	2,85		3,4		
3,15	2,85	-0,03	3,6	3	-0,03	3,6	0,3	2
3,5 (3,53)	3,2		4	3,3		4		
4	3,65		4,5	3,8		4,5		
4,5	4,1		5	4,3		5		
5	4,55		5,5	4,75		5,5		
5,3 (5,33)	4,9		5,9	5,05		5,9		
5,5	5,05		6,1	5,2		6,1		
5,7	5,2		6,3	5,4		6,3		
6	5,5		6,7	5,7		6,7		
6,3	5,75		7	6		7		
6,5	5,95	-0,05	7,2	6,15	-0,05	7,2	0,5	3,5
7 (6,99)	6,4		7,7	6,65		7,7		
8	7,3		8,6	7,6		8,6		
8,4	7,7		9	8		9		
9	8,25		9,6	8,55		9,6		
10	9,2	10,7	9,5	10,7	0,6	4,5		

Selection of the correct outside or inside diameter of the star ring for the sealing of cylinders, shafts and rods.



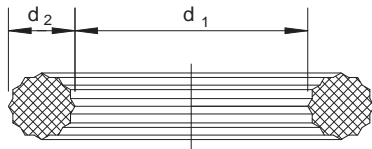
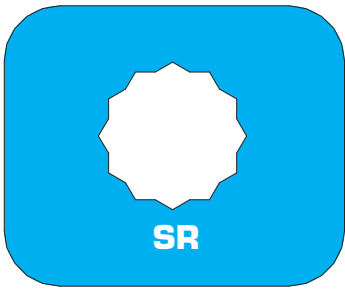
Outside sealing

Star ring outside diam. D1 equal or up to 3% smaller than cylinder diameter D

Inside sealing:

Star ring inside diam. d1 equal to rod diameter d.





### INSIDE DIAMETERS

$d_1$	TOLERANCE
over 2 up to 10	+/-0,13 +/-0,17
over 10 up to 20	+/-0,18 +/-0,22
over 20 up to 40	+/-0,23 +/-0,32
over 40 up to 60	+/-0,39 +/-0,54
over 60 up to 120	+/- 0,55 +/-0,97
over 120 up to 150	+/-1,0 +/-1,2
over 150 up to 200	+/-1,24 +/-1,55
over 200 up to 250	+/- 1,59 +/-1,88
over 250 up to 300	+/-1,93 +/-2,21
over 300 up to 400	+/-2,25 +/-2,84
over 400 up to 500	+/-2,91 +/-3,45
over 500 up to 630	+/-3,54 +/-4,22
over 630 up to 800	+/-4,38 +/-6,3

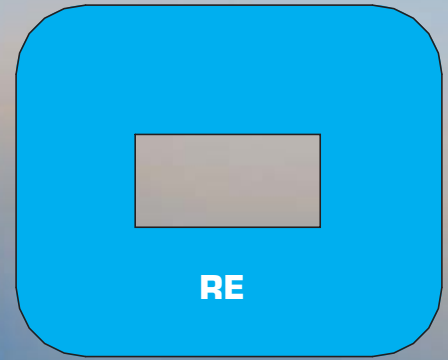
### CROSS SECTION DIAMETERS

$d_2$	TOLERANCE
up to 1,78	+/-0,08
over 1,78 up to 2,65	+/-0,09
over 2,65 up to 3,55	+/-0,10
over 3,55 up to 5,3	+/-0,13
over 5,3 up to 7	+/-0,15
over 7 up to 10	+/-0,18
over 10 up to 20	+/-0,20

Nennmasse			Tool-no.:
$d_1$	x	$d_2$	
2,4	x	2	2-07892
3,5	x	3	2-07870
5	x	2	2-08275
7	x	3	2-07275
8	x	2,5	2-07529
9	x	2,5	2-07700
10	x	2,62	2-08255
11	x	3	2-07315
12	x	3	2-07277
12	x	3,3	2-07447
13	x	3	2-07475
14	x	2,5	2-07608
14	x	3	2-07342
15	x	2,5	2-07780
15	x	3	2-07278
16	x	2,65	2-08515
16	x	2,83	2-09147
18	x	2,5	2-08127
18	x	3	2-07280
19	x	2,5	2-08087
20	x	3	2-07281
20	x	5	2-07282
20,5	x	2,5	2-07514
22	x	3	2-07343
24	x	3	2-07283
25	x	3,5	2-07446
25	x	3,7	2-07668
25	x	4	2-07599
26	x	6	2-07532
28	x	3,5	2-11536
30	x	3	2-07443
32	x	4	2-07287
33	x	2,5	2-08939
33	x	4	2-07344
34	x	4	2-07348
35	x	4	2-07288
36	x	3	2-07289
38	x	3	2-08537
40	x	3	2-07291
40	x	4	2-07919
43	x	3	2-07953
44	x	2,9	2-08940
45	x	4	2-08770
46	x	3	2-08262
47,5	x	3	2-11384
48	x	4	2-07774
52	x	3,5	2-11938
54	x	2	2-07750
55	x	4	2-07293
56	x	3,5	2-11939
58	x	4	2-07530
60	x	6	2-07294
62	x	3	2-07295
64	x	5	2-07410
68	x	4	2-07297
68	x	6	2-07640
70	x	5,5	2-07800
72	x	4	2-07298
74,2	x	5,7	2-08044
75	x	4	2-07725

Nennmasse			Tool-no.:
$d_1$	x	$d_2$	
78,3	x	2,62	2-09707
80	x	3	2-07299
80	x	5	2-07300
80	x	6	2-07301
83	x	3	2-11120
84	x	3	2-09775
88	x	3	2-09420
90	x	3	2-07515
90	x	5	2-07303
91	x	5	2-07316
97	x	3,5	2-11937
100	x	5	2-07516
103	x	3	2-11265
107	x	3	2-11483
107	x	3,5	2-11935
110	x	3,5	2-11936
110	x	4	2-07512
116	x	3,5	2-11933
117	x	4	2-11383
118	x	6	2-07304
122	x	4	2-07513
127	x	3,5	2-11934
128,5	x	3,5	2-09709
130	x	4	2-11382
160	x	7	2-07837
170	x	5	2-08267
171	x	5	2-09708
210	x	5	2-08268
220	x	5	2-08265
230	x	5	2-08266
250	x	5	2-08858
252	x	5	2-07579
256	x	5	2-07580
260	x	5	2-08269
270	x	5	2-08753
280	x	5	2-08270

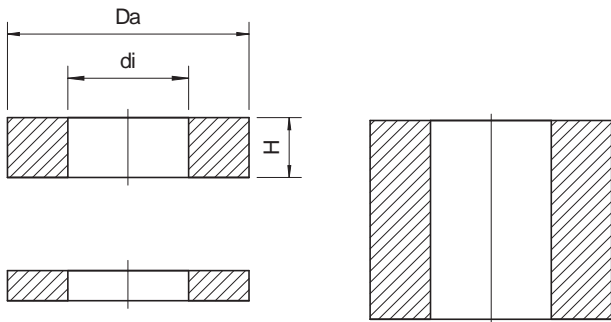
**RE  
RECTANGULAR RINGS**



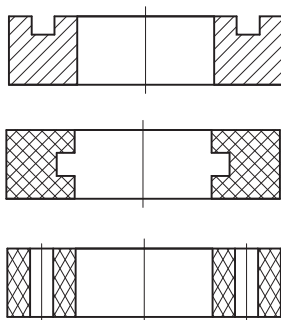
**SEAL PROPERTIES**

The name ".RE" is the collective-name for all circular articles, that show a quadratic or rectangular cross-section-profile.

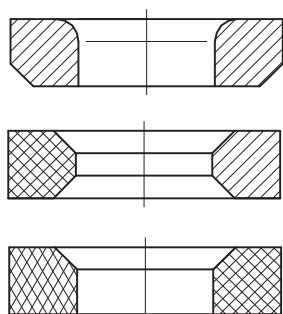
**EXAMPLES RE1**



**EXAMPLES RE2**



**EXAMPLES RE9**



RE-rings are so versatile usable (e.g. flat-seals, buffers, shaft-seals) that particular areas of use cannot be established.

The application of these form-pressed or form-poured parts is meaningful however only there, where the low precision and exact dimensioning of stamped or slaughtered rings is not enough.

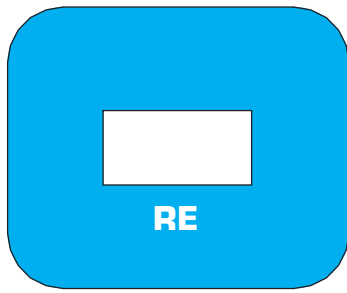
**MATERIALS**

RE-rings can be delivered in all our materials.

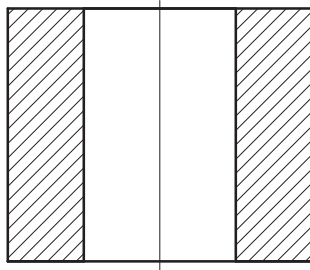
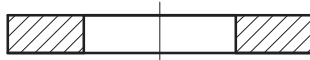
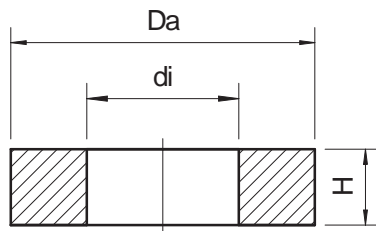
**TYPES OF TOOLS**

- tools for rubber materials
- tools for fabric materials
- tools for polyurethan materials

The delivery-possibility of the RE-rings for the three material-groups is shown in the following dimension table (column: tool-no.). In this dimension table, only the profile RE1 is presented. With demand for the profiles RE2 and RE9, we ask you to turn to our technical advice.



### EXAMPLES RE1



In the dimension table, only the rings produced from presses or poured tools are contained. Parts manufactured as tubes can be stung on the wished height H.

dimension table			Tool-no.:		
di	Da	H	rubber	fabric	Polyurethan
0,75	2,15	1,5	2-07440		
1,4	2,7	0,76	2-07754		
1,6	3,2	0,6	2-09617		
1,7	3,2	5	2-08116		
1,8	2,8	2	2-13040		
2	6	6			V-1269
2	8	4	2-09045		
2	8	8			V-2843
2	9,5	7			V-3808
2,5	6	2	2-12064		
2,5	6	3	2-12065		
2,5	6,3	50			V-2921
2,5	11,5	6			V-3807
2,5	11,5	8			V-4088
2,6	8,5	5,5			V-2583
3	4,8	2,5	2-08821		
3	7	3	2-09186		
3	18	50			V-2679
3	20	4	2-05177		
3,6	6,8	4			V-2874
3,6	10	5,5			V-1864
3,7	12,5	12,5	2-04755		
3,8	10	3	2-02533		
4	6	2,5	2-08822		
4	7	2	2-09288		
4	7	9	2-09225		
4	7	15			V-3181
4	7,5	20			V-3865
4	8	15			V-3182
4	8,5	3,7	2-05480		
4	8,5	20			V-3866
4	9	1,5	2-04653		
4	9	15			V-3183
4	10	15			V-3241
4	12	105			V-2584
4	13	4	2-09331		
4	14	4			V-485
4	15	4	2-12897		
4	19,5	1,5	2-09192		
4	25	16			V-3529
4	33	2	2-09843		
4,1	11	3	2-12999		
4,1	13,5	4	2-12762		
4,25	10	6,5	2-07268		
4,5	8	2	2-06694		
4,5	8	9	2-12291		
4,5	8	9			V-1947
4,5	18	5	2-02245		
4,5	48,6	3	2-07900		
4,6	14,2	3	2-08550		
4,6	18,7	3	2-06977		
4,6	21,7	3	2-06978		
4,6	24	3	2-08860		
4,6	26,7	3	2-06979		
4,6	30	3	2-08861		
4,8	13,1	3	2-05493		
4,8	25,4	4	2-01395		
4,9	8	2,7	2-12889		
5	9	1	2-08313		
5	9,5	80			V-4125

## dimension table

## Tool-no.:

di	Da	H	rubber	fabric	Polyure- than
5	10	7	2-12259		
5	10	8	2-01843		
5	10,5	2	2-04607		
5	11	11			V-1903
5	13	8			V-1227
5	14	2	2-06968		
5	16,5	5,5	2-06492		
5	17,7	120			V-2729
5	20	4	2-00550		
5	22	5	2-03341		
5	28	9,5	2-03133		
5	60	2,5	2-09834		
5,2	15	9	2-12649		
5,2	15	12	2-12274		
5,2	20	12	2-12240		
5,4	12	100			V-4161
5,5	10	3,7	2-05479		
5,5	10,7	6,5	2-07831		
5,6	6,6	1,2	2-12275		
5,6	7,6	2,5	2-08823		
5,75	13	3	2-06602		
5,8	13	3	2-06055		
5,8	13,1	3	2-07507		
5,8	13,15	3	2-07222		
5,8	13,35	3	2-07539		
5,9	10	2	2-02948		
6	8	2,5	2-04084		
6	9,5	20			V-3867
6	10	20			V-3722
6	10,5	2	2-09624		
6	10,5	20			V-3868
6	11	20			V-3723
6	11,5	70			V-3869
6	12	20			V-3724
6	15,8	6	2-01374		
6	16,5	9,8			V-3474
6	18	60			V-4170
6	20,5	5	2-07731		
6	22	5	2-01914		
6	27,5	6,5	2-06494		
6,2	13,3	60			V-2615
6,4	11	70			V-3609
6,4	14,5	3,9	2-09139		
6,5	9	1,5	2-09093		
6,5	15	2	2-04608		
6,5	18	12	2-03859		
6,7	7,7	0,9	2-12366		
6,8	14	30			V-1784
6,9	10	2	2-02949		
7	11,6	2,5	2-06173		
7	11,6	3,7	2-06124		
7	11,7	14			V-2887
7	12	12	2-03619		
7	13	8	2-00981		
7	13,5	3	2-09182		
7	15	4	2-12105		
7	15	9	2-12800		
7	15	120			V-3476
7	15,6	2,3	2-07075		
7	18	4			V-0478

## dimension table

## Tool-no.:

di	Da	H	rubber	fabric	Polyure- than
7	18	40			V-0581
7	20,8	6	2-01375		
7	22	4	2-00549		
7	33	2	2-11417		
7	60	2,5	2-11424		
7,05	17	4	2-12470		
7,2	20	12	2-12241		
7,5	12	2,5	2-06172		
7,5	12	3,7	2-06123		
7,5	13	1	2-07128		
7,8	20	12,5	2-12566		
8	10	2,5	2-03921		
8	10	2,5	2-08824		
8	11	80			V-3216
8	12	3	2-12121		
8	12,6	4,5	2-11470		
8	15	2	2-05106		
8	15,8	12	2-11328		
8	16	3	2-00052		
8	16	12	2-11326		
8	16	15	2-11561		
8	16	23	2-07437		
8	16	75			V-2985
8	16,5	7	2-03618		
8	17	12	2-11327		
8	18	1,5	2-01912		
8	18	200			V-1954
8	19	12	2-11329		
8	20	250			V-2621
8	20,2	12	2-11330		
8	21	12	2-07436		
8	22	150			V-3567
8	23,4	12	2-11331		
8	26	12	2-11332		
8	31	15	2-05289		
8	35	300			V-0557
8,5	18	12	2-03860		
9	12,6	3	2-07882		
9	15	9	2-11594		
9	16	7,5	2-05984		
9	19	7	2-03965		
9	21	3	2-03160		
9	27	200			V-0992
9	30	300			V-556
9,5	15	40			V-4156
9,5	16,5	5	2-02724		
9,5	18,6	12,2	2-08976		
9,5	19,1	50			V-3667
9,5	20	9	2-13000		
9,5	22	4	2-12104		
9,5	22	120			V-3477
9,5	26,5	120			V-2722
9,7	14	1	2-06128		
9,7	17,2	3			V-2856
9,8	15,7	3	2-05222		
9,8	16	2	2-02958		
9,8	20	3	2-06839		
10	15	100			V-3506
10	15,5	5,5	2-09857		
10	16	3	2-00022		

dimension table			Tool-no.:		
di	Da	H	rubber	fabric	Polyure- than
10	16,5	3,4	2-06325		
10	17,5	3	2-08761		
10	19	100			V-3917
10	20	2	2-11909		
10	21,8	6	2-01758		
10	22	40			V-0569
10	25	5			V-0757
10	25	25			V-0767
10	25	150			V-3562
10	26	15	2-03805		
10	27	14,5	2-02911		
10	30	40			V-0023
10	35	300			V-2774
10	36	5	2-01913		
10	38	6			V-0242
10	50	10	2-06130		
10,5	30	300			V-2764
10,7	13,7	1,5	2-09347		
11	15	4,4	2-09046		
11	16	2,2	2-06692		
11	17	3	2-12122		
11	22	105			V-1042
11	23	25	2-06240		
11	24	5	2-01829		
11	70	10	2-09629		
11,5	15,1	3	2-07895		
11,5	17	100			V-4201
11,8	14,8	1,35	2-08502		
11,8	16	2	2-03145		
12	14	2,5	2-08825		
12	17	1	2-01298		
12	17	100			V-3640
12	18	2	2-05176		
12	18	10	2-00023		
12	22	8	2-04162		
12	24	4	2-00553		
12	24	12	2-01352		
12	26	5	2-02244		
12	30	20	2-00720		
12	30	300			V-2508
12	32	5			V-0447
12	32	150			V-3568
12	33,7	6	2-01960		
12	40	300			V-1159
12	50	85			V-0585
12	55	8			V-0244
12	60	8		2-04668	
12,5	20	300			V-1262
12,5	22	365			V-4176
12,5	30	300			V-2768
12,5	35	300			V-2778
12,5	40	300			V-2787
13	18	10	2-01560		
13	19	2,4	2-05251		
13	20	2,7	2-02313		
13	20	7	2-09090		
13	24	200			V-1941
13	24,5	12	2-12378		
13	25	35			V-0453
13	38	8	2-09215		
13,5	19,1	52			V-3666

dimension table			Tool-no.:		
di	Da	H	rubber	fabric	Polyure- than
13,5	22,5	3,6	2-06448		
13,5	23	10	2-06041		
13,5	30	300			V-2769
14	16	1,9	2-09142		
14	17,6	3	2-07896		
14	19	9			V-1724
14	20	28			V-2573
14	22	3,5	2-06689		
14	28	5	2-12152		
14	38,5	250			V-0695
14,2	20	2,2	2-05571		
14,4	19	2,5	2-11580		
14,5	26	15			V-0369
14,5	35	300			V-2780
15	18	2	2-07974		
15	21	2	2-11812		
15	22	3	2-04675		
15	22	4,5		2-01524	
15	23,5	15	2-03802		
15	28	30			V-1468
15	29	4	2-11346		
15	29	10	2-03801		
15	29	10	2-03801		
15	30	20			V-1183
15	30	30			V-1182
15	58	5	2-02644		
15	58	5			V-0621
15,2	23,5	2	2-01069		
15,5	21,5	75			V-2986
15,7	21,7	3	2-05181		
15,8	20,5	2	2-02224		
15,9	38,1	5,5	2-02800		
16	21	2	2-05278		
16	21	2,2	2-05528		
16	21	2,6	2-06693		
16	21	20			V-1561
16	22	4	2-12086		
16	22,5	98			V-2423
16	24	5,5	2-07635		
16	26	3	2-05547		
16	26	5	2-05755		
16	28	8			V-0376
16	28,7	6	2-01465		
16	36	3	2-05948		
16	38,7	200			V-3316
16,5	30	300			V-2771
16,5	35	300			V-2782
16,5	40	300			V-2791
16,8	22	3,1	2-04212		
17	20,6	3	2-07883		
17	30	300			V-0556
17	31	23,8	2-08626		
17	75	10			V-0245
17	90	12			V-0247
17,5	50,8	19	2-02798		
18	22,5	5	2-03687		
18	24	5	2-01828		
18	26	10	2-00024		
18	30	160			V-3500
18	32	13,7	2-07664		

nominal dimensions			Tool-no.:		
di	Da	H	rubber	fabric	Polyure- than
18	34	10	2-03798		
18	35	5		2-01023	
18	38	10		2-08111	
18	43,7	6	2-02513		
18	56,7	6	2-02659		
18,5	40	300			V-2793
19	20	0,8	2-11689		
19	29	5	2-04013		
19	29	300			V-3169
19	31,5	4,5	2-03197		
19	40	150			V-2852
19	42	10	2-04308		
19,5	22	20			V-0013
19,5	23,1	3	2-07884		
19,5	26	153			V-3839
19,5	31,5	150			V-2719
19,5	40	350			V-1987
20	23,4	12	2-00607		
20	26	4	2-01802		
20	26	15	2-03800		
20	30	8	2-01803		
20	32	300			V-3729
20	34	10	2-03804		
20	40	10		2-07729	
20	43,5	29			V-2873
20	47	4	2-02476		
20	70	40			V-1873
20,5	32	21	2-11274		
21	6	4	2-00551		
21,5	36,3	4,4	2-09020		
21,9	25,9	1,35	2-08501		
22	12	4	2-00552		
22	26	3	2-06746		
22	30	300			V-2773
22	31	1	2-01536		
22	38	25			V-1781
22,2	47,6	12,7	2-02799		
22,5	26,1	3	2-07897		
22,5	27,5	2	2-05914		
22,5	38	200			V-2931
22,6	27	1,5	2-09424		
23,5	36,3	4	2-09271		
23,6	26,6	2,8	2-07894		
23,8	24,6	3	2-07890		
24	34	6	2-07634		
24	40	35			V-1181
24	40	40			V-1180
24	45	200			V-0705
24,4	30	2	2-04683		
24,5	34	12,2	2-08950		
24,8	31,5	3			V-0474
25	33	1	2-07115		
25	35	5	2-06095		
25	35	300			V-0557
25	49,4	210			V-3372
25	62	4		2-04003	
25	155	50			V-2127
25,4	29	3	2-07898		
25,4	32,4	2,5	2-02908		

nominal dimensions			Tool-no.:		
di	Da	H	rubber	fabric	Polyure- than
25,4	32,4	5,5	2-02909		
25,4	37,5	14,2	2-06206		
26	38	10	2-09524		
26	40	300			V-3828
27	40	5			V-2865
27	41	4		2-12294	
27	44	30			V-4050
27	46	300			V-2928
27	50	9	2-06879		
27,3	30,3	3	2-04978		
27,3	48,3	5	2-12592		
27,5	34,5	3	2-06036		
27,6	30	3,3	2-09594		
27,6	33	2	2-09339		
28	33	2,5	2-08568		
28	33	5	2-08045		
28	38	40			V-0672
28	39	1,5	2-03527		
28	48	10		2-07730	
28,5	32,1	3	2-07899		
28,5	35	4	2-06140		
29	35	3	2-05180		
29	42	5,9	2-11359		
29	50	1,5	2-08503		
29	55	200			V-0704
29,4	41,9	6	2-02531		
29,5	45	50			V-2291
29,5	55	250			V-2267
30	33,4	12,7	2-00606		
30	36	1,5	2-11658		
30	36	3			V-0489
30	36	12	2-04464		
30	37	75			V-2333
30	40	30			V-0891
30	42	4	2-11076		
30	44	1,7	2-08551		
30	45	300			V-2665
30	48	5			V-0920
30	49,5	310			V-1758
30	50	4			V-0454
30	50	50			V-1184
31	45	3	2-06350		
31,5	92,5	15	2-11277		
31,6	48	500			V-2167
32	37	5	2-07966		
32	43	6			V-0178
32,3	35,3	2,8	2-07655		
32,5	36,5	3	2-06556		
32,5	52	250			V-2223
33	43	225			V-4168
33	60	200			V-3487
34	5	3,5	2-01140		
34	37,6	3	2-07885		
34	39	20			V-3774
34	40	4		2-01443	
34	41	3,5	2-02477		
34	42	300			V-3565
34	45	6		2-01401	
34	47	140			V-1142
34	60	300			V-1211

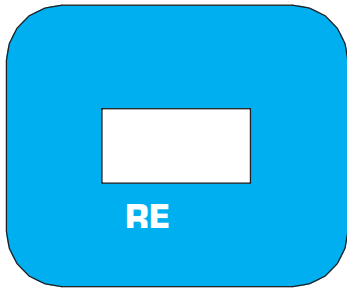
nominal dimensions			Tool-no.:		
di	Da	H	rubber	fabric	Polyure- than
34	65	5			V-0702
34,3	46,9	6	2-02532		
35	40	3	2-11813		
35	52	8	2-01251		
35	58	5			V-0916
36	45	6		2-01402	
36	45	7	2-09016		
37	43	89,5			V-2759
37	47	30			V-0935
37,73	40,87	1,27	2-12876		
38	41	2	2-07975		
38	48	29			V-1539
38	48	30			V-0641
38	48	53			V-3776
38	59	205			V-3596
38	65	200			V-3493
38,5	46,5	5	2-05233		
38,5	58,5	31			V-2704
39	65	5			V-2872
39,6	49,4	200			V-3785
40	43,6	3	2-07886		
40	45	5	2-07967		
40	47	0,4	2-02164		
40	50	60			V-3992
40	90	15			V-1152
40,3	65	6,5	2-11105		
40,5	70	185			V-4203
41	54	5,9	2-11360		
41	56	4		2-12293	
41,28	47,2	3,05	2-12664		
42	51	1,5	2-12235		
42	54	12,8	2-07847		
42	55	5	2-02461		
42	58	3	2-06822		
42	70	2	2-02154		
42,3	54,3	38			V-2708
43	70	200			V-1169
43	80	5			V-0706
43,5	78,5	4,5			V-0016
43,9	48	3	2-11271		
44	49,6	250			V-1604
44	50	3			V-0490
44	52	4	2-01630		
45	53	4	2-01335		
45	53	8	2-07620		
45	75	6	2-06454		
45	200	12			V-2878
45,5	55,2	5	2-05654		
46	51	2,5	2-08567		
46	55	16	2-02928		
46	57	140			V-1141
46	66	10			V-3959
46,9	52,7	3	2-11270		
47	51	2	2-08145		
47	60,3	8		2-03428	
47	62	13			V-1072
48	52	2	2-07139		
48	75	200			V-1583
48	85	5			V-0703
48,5	54,4	3			V-2965

nominal dimensions			Tool-no.:		
di	Da	H	rubber	fabric	Polyure- than
49	55	3	2-09915		
49	62	200			V-1557
49	100	110			V-3469
50	55	5	2-07968		
50	56	4	2-08852		
50	65	8		2-07177	
50	70	10	2-12367		
50	70	55			V-2237
50	80	30			V-1786
50	150	14			V-0625
50,5	59,5	3	2-09850		
51,5	69	57			V-0900
52	64	10	2-12429		
52	68	6		2-12296	
52	70	40	2-03078		
53	65	16	2-09970		
53	88,5	17,5			V-2705
54	58	2	2-07751		
54	90	5		2-12295	
55	75	3	2-01827		
55	75	10	2-04562		
55,5	59	16	2-00573		
56	90	67			V-4178
56	102	15			V-0603
56,4	67,3	5,4	2-12126		
58	72	7		2-01836	
58	73	6		2-05029	
59	78	300			V-4126
59,8	64	3	2-11268		
59,9	80	120			V-0901
60	67	3,5	2-02393		
60	70	2	2-02154		
60	75	12	2-02658		
60	100	5	2-05378		
61	64	16,5	2-00601		
62	90	200			V-1693
62	97	15			V-3133
62,5	71	45	2-11940		
63	71	1,5	2-12477		
63	75	10	2-12430		
64	82	4	2-11078		
64	82	9			V-2400
65	85	12		2-09348	
65	86	11		2-01786	
65	122	3	2-02412		
66	86	8		2-04674	
67	81	5			V-1435
68	72	18	2-00602		
68	78	4,5		2-01523	
68	80	6	2-05248		
69	81,3	6	2-09796		
70	80	5,5		2-01515	
70	90	4			V-0818
70	102	50			V-1787
70	110	32			V-1849
71	75	2,5	2-07889		
71	75	18	2-07827		
71	96	200			V-2591
71,5	75	18	2-00574		
71,5	81	10	2-12023		

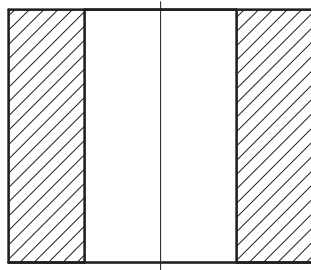
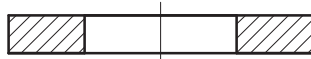
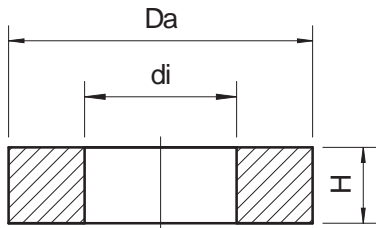
nominal dimensions			Tool-no.:		
di	Da	H	rubber	fabric	Polyure- than
72	90	5			V-4193
72	92	10			V-1423
72	100	25			V-0753
75	85	5	2-03292		
75,5	80	2,5	2-07497		
76	85	250			V-3272
76	86	10	2-12431		
76	90	10	2-12417		
76	100	25			V-2783
76,5	80,5	2	2-06268		
76,5	80,5	100			V-1545
77	110	10	2-12820		
77	110	10			V-3727
77,8	100	15	2-09943		
77,8	100	200			V-2516
78,5	96,5	9	2-02915		
79	89	4	2-09928		
79	97,5	9	2-09778		
80	95	40			V-1859
80	100	25			V-2784
80	100	135			V-3575
80	105	4	2-11079		
81	96	12		2-03944	
82	92	8	2-11502		
82	114	8	2-03175		
84	100	8	2-01958		
84	100	17	2-03062		
84	100	25			V-2785
84	104	16	2-03683		
84	108	4,7			V-2760
85	99	3	2-03633		
85	112	6	2-11005		
85	115	8		2-12004	
86	90	2,5	2-07140		
86	100	25			V-2786
86	100	200			V-3377
88	100	5	2-04599		
89	107	9	2-02916		
89	107,5	9	2-09777		
90	120	200			V-2612
90,5	94,5	21,5	2-01777		
91	95	24	2-00575		
92	100	1	2-03634		
93	107	7		2-09951	
97	108,5	6	2-00702		
100	110	5	2-08405		
100	125	4	2-11080		
100	130	4		2-12292	
102	130	10			V-1352
104	140	10	2-07817		
105	115	5	2-05444		
105	120	3	2-01957		
110	124	3	2-03668		
110	130	28			V-3940
110	137	14,5		2-09411	
110	140	10	2-07356		
114,3	127	3,175	2-03174		
115	125	45		2-08125	
115	145	10		2-12088	
117,6	137	8	2-11103		

nominal dimensions			Tool-no.:		
di	Da	H	rubber	fabric	Polyure- than
117,9	200	200			V-1896
118	135	7	2-05030		
118	150	12			V-0779
120	140	10		2-07720	
123	145	500			V-2123
124	136	25			V-3608
126	136	8	2-05913		
130	146	8	2-07671		
130	155	4	2-11081		
130	170	20	2-03328		
134	149	3	2-03217		
138	148	5	2-11597		
138	150	26,5	2-11179		
140	160	2	2-11539		
140	160	20			V-0377
143	176,4	28	2-09689		
145	220	18			V-0473
150	166	22,5			V-2693
150	180	10		2-12392	
150,5	199,5	10		2-11988	
150,5	201,5	10		2-11989	
150,5	203,5	10		2-11990	
150,5	204,5	10		2-11991	
152	159,4	3,7	2-06783		
157	185	11	2-09540		
160	185	4	2-11082		
161,9	177,8	152			V-2183
162	180	20	2-05510		
165	200	12	2-09950		
165	225	25			V-2571
168	180	26,5	2-12290		
168	188	20			V-1827
168	213	6			V-0535
175	195	2	2-11538		
177,9	200	200			V-1896
184	191,4	3,7	2-06782		
186	198	6	2-11467		
187	206	10		2-05961	
195	270	18			V-0031
200	240	10		2-12349	
203	228,5	19		2-09766	
205	225	2	2-11537		
206,8	225,5	10,5		2-08659	
210	223	6,5		2-06562	
210	226	10		2-08587	
210	230	4	2-06304		
214	273	70			V-2427
215	241	12,5	2-05872		
220	250	30,5		2-09284	
228,6	260,4	20		2-07189	
230	245	14,5	2-09554		
230	275,6	28	2-09871		
237	250	6,5		2-06563	
250	259,2	17	2-09803		
250	286	8			V-0055
278	294	8,5	2-09954		
278	380	70			V-0796
284	308	12	2-06961		
289,9	329,9	12		2-12003	
290	329	1	2-06379		





### EXAMPLES RE1

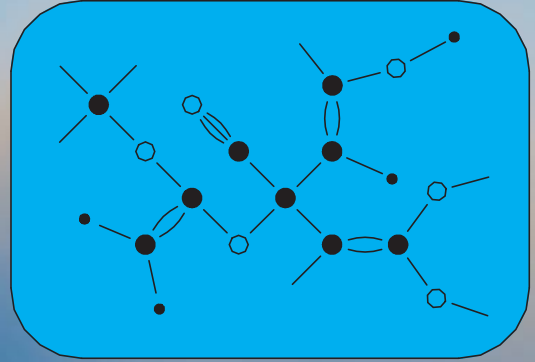


In the dimension table, only the rings produced from presses or poured tools are contained. Parts manufactured as tubes can be stung on the wished height H.

nominal dimensions			Tool-no.:		
di	Da	H	rubber	fabric	Polyure- than
290	350	1	2-06380		
290	350	4	2-09326		
297	400	70			V-0057
298	333	20	2-11997		
300	320	4	2-06303		
304,5	324	10	2-11688		
307,5	540	107			V-2321
319,2	373,4	6,4	2-07544		
325	332,4	3,7	2-06781		
326	350	12	2-02470		
343	400	2	2-06273		
360	400	26		2-09333	
360	450	0,5	2-07912		
368	403	25	2-12373		
377	384,4	3,7	2-06780		
380	420	27		2-08885	
400	440	29		2-09311	
416	440	15	2-02285		
435	459	12	2-02469		
435	459	15	2-03987		
451	465	4	2-12792		
499	571	104			V-2184
500	540	32,5		2-09327	
503	517	4	2-12793		
524	548	12	2-07938		

**HECKER® GSM®**

**MATERIALS**



## **MATERIALS**

The seal has to be chosen with the same care as other construction elements. This applies to the shape and size as well as the material which must be suitable for the agent and the conditions of application. The large number of various agents, pressures and temperatures has resulted in a multitude of different elastomers and plastics finding their way into sealing-technology. Conversely, the development of modern machines has been significantly supported through advances in the rubber technology which have simultaneously taken place.

Cross-linked polymers with the known elastic characteristics are designated as rubber or elastomers. The non-cross-linked raw product is referred to as caoutchouc. The elasticity of the cross-linked product occurs when the individual polymer chains are pushed against one another under stress (tension, pressure), on relief or as a result of the lateral networks more or less returning to their initial starting point. Opposed to this, thermoplasts (polyethylene, polystyrene, PTFE) exhibit no lateral networks nor elasticity; they remain deformed after elongation. Thermoset materials (phenol or epoxy resins), with a high portion of rigid, short networks, become deformed by only a few per cent points.

The multitude of available elastomer grades results from the different caoutchouc types which can be made into different materials through corresponding formulations. The task of the mixture development is to create an elastomer material out of a raw caoutchouc which - due to its chemical structure - has shown certain characteristics, with characteristics that are optimized for the required conditions of application.

Of greater significance is the resistance of an elastomer to the different agents. With this, two types of transformation occur: physical and chemical processes. The first includes the swelling or shrinkage (change in volume) of an elastomer in an agent. In the case of swelling, the elastomer absorbs an agent whereby the technical values change, for example, the rigidity values are reduced. But this does not mean that the seal would not be able to function. As recommended values, a swelling of 10-25% can be tolerated with static installation or 4-7% with dynamic installation. The elastomer can be mechanically destroyed by excessive swelling or the increase in volume leads to increased friction so that, for example, pistons can no longer be moved. In the case of shrinkage, compounding ingredients are dissolved by the medium. This case is critical for the practical application because through this, under certain conditions, the seal no longer sufficiently lies on the sealing surface and through this, leakage can result. Moreover, the danger of destruction through secondary action exists when, for example, the flexibility to cold deteriorates as a result of a dissolving action of a plasticizer.

The chemical reaction of the agent leads most often to the destruction of the elastomer in that, through chemical reactions, the polymer chain disintegrates, oxidises or is changed in some other way. As a result, the material loses its technological characteristics.

These chemical reactions include ageing due to heat, reactions due to light, ozone and oxygen. The chemical reactivity depends on the structure of the caoutchouc. The more unsaturated olefin double bonds there are in polymer chains, the easier chemical reactions take place (i.e. with NR). A saturated caoutchouc which contains no or only a few reactive double bonds is stable against chemical reactions (i.e. EPM/EPDM, FPM). NBR, with a mean number of double bonds lies therefore, in respect to for example the heat ageing and the resistance to oxidation, between these extremes. Although CR contains just as many double bonds as NR, the chlorine atoms which are bound to the polymer chain, however, considerably reduce the reactivity.

A similarly simple relation exists also between caoutchouc and swelling in mineral oils and fuels (physical action). Mineral oils and fuels are, chemically seen, covalent compounds of hydrocarbons and therefore, are most compatible with chemically similar, covalent caoutchouc with pure hydrocarbon bindings. This consistency results in a good solubility in each other, that is, considerable swelling (i.e. NR, EPM/EPDM). If the caoutchouc contains a rising percentage of polar groups (chlorine, nitrile or ester groups), the swelling reduces accordingly, as is the case with NBR in the series of 18-38% contents of acrylonitrile (ACN). Fluororubber, which contains for the most part, fluorine-carbon-bonds show even less swelling in mineral oils. On the other hand, caoutchouc with polar groups opposed to polar solvents (ester, ketone, chlorinated hydrocarbons) are unstable. Hence, it follows that there is no elastomer material which is resistant to all polar and to all covalent solvents and their composition (varnish solvents). The silicone rubber which possesses no hydrocarbons but rather a silicone-oxygen-skeleton and therefore reacts differently (resistant to mineral oils and heat / air), is an exception.

## MECHANICAL-TECHNOLOGICAL TESTS

Each material is carefully tested before its release and use. Various, important characteristics will be briefly discussed in the following section.

### HARDNESS (DIN 53505, DIN 53519-2)

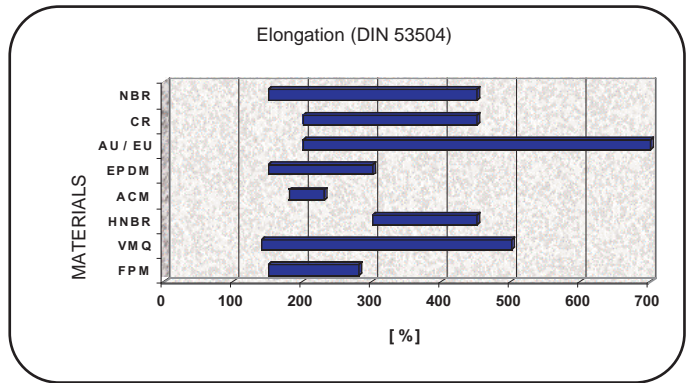
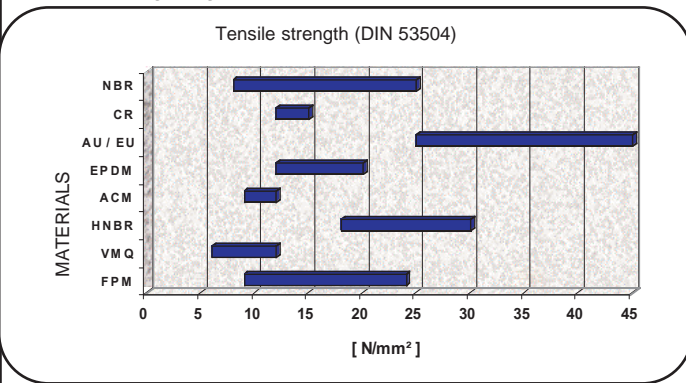
The most common quality of characterization of elastomers is the hardness. It is measured in Shore A or D according to DIN 53505. Elastomers are normally tested according to shore A. Above the approximately 95 Shore A, the measurement takes place according to shore D. The two procedures are differentiated by the shaping of the penetration piece and in the spring characteristic with which the penetration piece is to be stressed.

Another method is the determination of the micro-hardness in IRHD according to DIN 53519, which especially finds application in small sample pieces.

The shore hardness must be adjusted to the pressure demands. The softer the elastomer, the easier it is to be deformed and in certain conditions to be pressed into the opening. On the other hand, thanks to the better flexibility, a softer elastomer seals at lower pressures and on uneven surfaces. For most of the purposes of application, materials with 70 to 90 Shore A have been well proven. These types show an optimum of wishes for characteristics. Harder materials often show less elongation and a higher compression set. Softer materials are more easily deformed.

### TENSILE STRENGTH AND ELONGATION TO TEAR (DIN 53504)

Tensile strength and elongation to tear are referred to as comparison values for the characterization of elastomer materials. In the installed condition, only small elongations are permitted. Recommended values for the different elastomer types can be seen in the following diagrams.



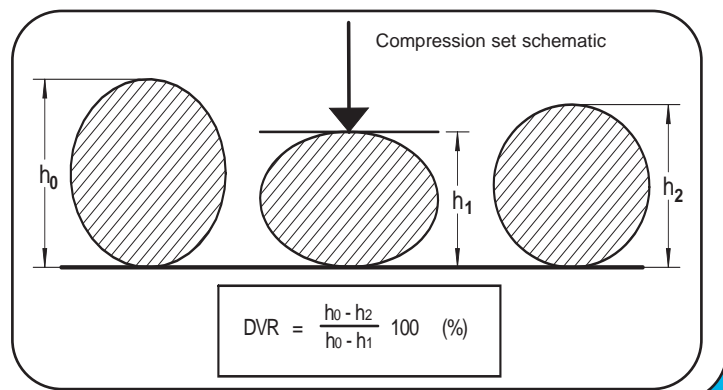
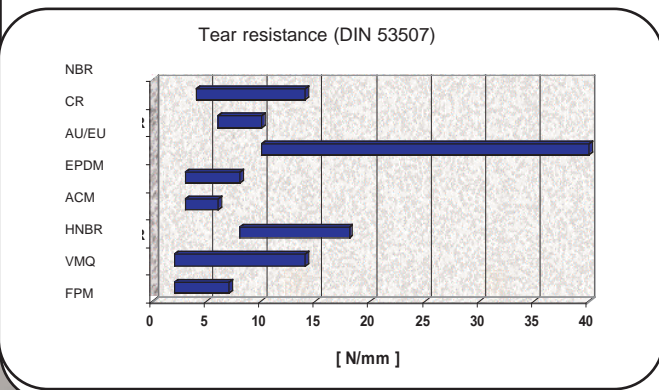
### TEAR RESISTANCE (DIN 53507)

Of greater importance for the practical application is the resistance to tear propagation whereby a cut elastomer part resists the propagation of the tear whilst under tensile load.

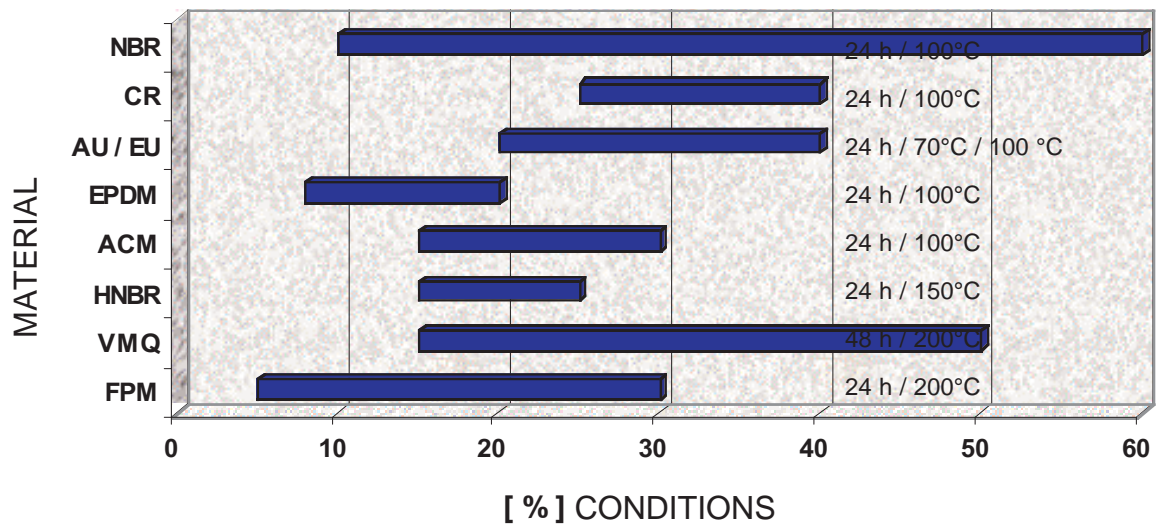
### COMPRESSION SET (DIN ISO 815)

The compression set indicates up to which percentage the induced compression of a test piece at a given temperature remains compressed after the removal of the stress. A small compression set, therefore, means that the material recovers well. This is an advantage for seals, especially with changing work conditions.

The standard test piece B is a cylindrical disc with a diameter of 13.0±0.5 mm and 6.3±0.3 mm thick. This test piece is compressed by 25% of its thickness (that means 6,0 mm thickness to 4,5 mm). It is stored in this condition for a defined time at a certain temperature. After expiration of the test time, the test piece is released. After 30 minutes storage at room temperature, the thickness is measured (i.e., here 5,7 mm). That means, in this example, the compression set amounts to 20% (remaining deformation 0,3 mm in respect to the original included deformation of 1,5 mm)



### Compression set



### THERMAL CHARACTERISTICS

Elastomers exhibit optimal characteristics over a wide range of temperatures and within this area, allow for a long life expectation. There exist, depending on rubber type, two temperature areas in which the characteristics are changed considerably. Below a certain temperature, the glass transition temperature, elastomers lose their elasticity and also their ability to be mechanically stressed. This transition is reversible, that is, after warming, the original characteristics are re-established. There are different methods for measuring the lower temperature limit, for example, thermoanalytic methods.

The upper temperature limit is determined by each effective agent. The continuous exceeding of the upper temperature limit leads, in contrast to exceeding the lower temperature limit, to non-reversible changes of the elastomer materials.

The upper temperature limit is also determined by a weakening of thermoplastic materials. A constantly pass over the upper temperature limit leads to non reversible changes and therefore to a disruption of the material.

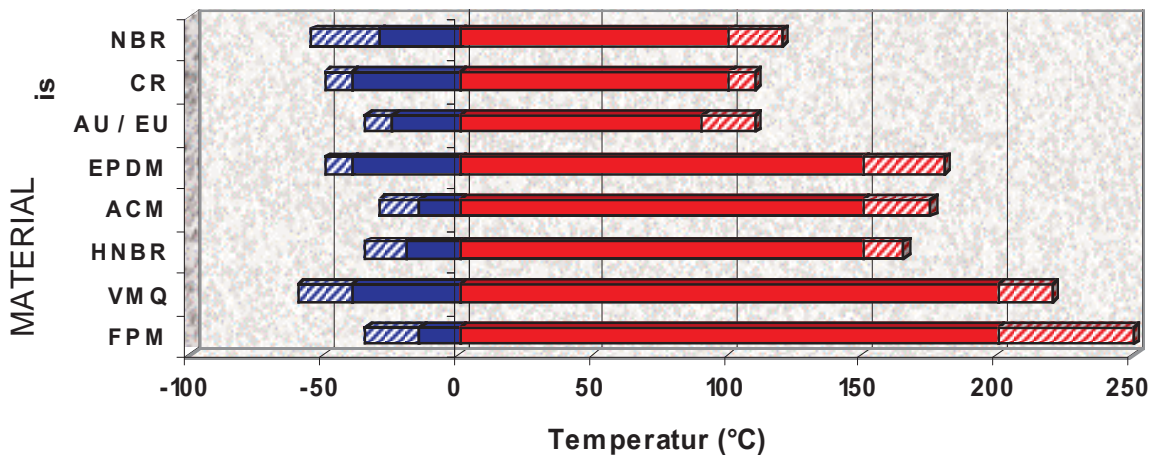
Approvals:

With some applications from the multiplicity of the possibilities, for example in the food-area or in the gas-supply, special requests for the sealants are to be looked for. Only specially developed materials or materials with the necessary admissions are usable. This requires the corresponding knowledge of the manufacturers.

Application values for the individual material groups in the media water and air can be seen in the following diagram. The high thermal expansion coefficient of elastomer materials is to be observed during application. It is between  $100$  and  $160 \times 10^{-6}$ .

### TEMPERATURE LIMITS OF ELASTOMER MATERIALS

The hatched area is only for especially optimized materials. Constant maximum temperature and maximum pressure should not occur simultaneously.



## GAS SUPPLY

<b>NORM</b>	<b>MATERIAL</b>	<b>HARDNESS</b>	<b>CONDITIONS AND RESULT</b>
DIN EN 682	258	FKM 80	Typ GB; Härte 80 (Range of temp.: -5/+50 °C)
DIN EN 549	258	FKM 80	Hardness H3; Class of temperature E1: 0/+150 °C
	266	FKM 72	Hardness H3; Class of temperature E1: 0/+150 °C
	707	NBR 72	Hardness H3; Class of temperature B2: -20/+80°C

## FOOD

<b>NORM</b>	<b>MATERIAL</b>	<b>HARDNESS</b>	<b>CONDITIONS AND RESULT</b>
FDA: 21 CFR 177.2600	117	VMQ 72	
	126	VMQ 60	
	128	VMQ 80	
	202	FKM 72	
	204	FKM 90	
	212	FKM 72	
	287	EPDM 73	
	293	EPDM 82	
	297	EPDM 75	
	302	HNBR 72	
	317	HNBR 72	

## DRINKING WATER

<b>NORM</b>	<b>MATERIAL</b>	<b>HARDNESS</b>	<b>CONDITIONS AND RESULT</b>
Elastomerleitlinie (UBA)	287	EPDM 73	Seals, Range of cold and hot water
	293	EPDM 82	Seals, Range of cold and hot water
DVGW W 270 (11-2007)	287	EPDM 73	Seals D1/D2
	293	EPDM 82	Seals D1/D2

## OTHERS

<b>NORM</b>	<b>MATERIAL</b>	<b>HARDNESS</b>	<b>CONDITIONS AND RESULT</b>
DIN EN ISO 10993-5	287	EPDM 73	Zytotoxizität / Biokompatibilität
USP Class VI	287	EPDM 73	USP Class VI - 121 °C

## OXYGEN

<b>NORM</b>	<b>MATERIAL</b>	<b>HARDNESS</b>	<b>CONDITIONS AND RESULT</b>
Oxygen, gaseous	258	FKM 80	max. 150 °C / max. 40 bar
	287	EPDM 73	max. 60 °C / max. 10 bar



# HECKER® ELASTOMER MATERIALS

Basis of material	Material No. WS	colour (if notlack)	Hardness (+/- 5 ShA)	Temp.range from (°C)	Temp.range up to (°C)	Media resistance	Approvals	WS
VMQ MVQ Silikon	105	blue	50	-40	+ 230	hot air, oxygen, ozone, natural surroundings, animal and herbal fat and oils		105
	106	blue	60				106	
	107	blue	72				107	
	108	blue	81				108	
	117	grey	72				FDA	117
	126	uncoloured	60				126	
	128	grey	80				FDA	128
FPM FKM Fluor-elastomere	202	dark brown	72	-15	+250	mineral oils, fat, treacly inflammable hydraulic liquids, aliphatic and chlorinated hydrocarbons, very well for vacuum	FDA	202
	204		90				FDA	204
	212		72				FDA	212
	231		60	-10			223	
	232		72	-30			232	
	241		61	- 10			241	
	242		72				242	
	258		80	-15			DVGW, BAM	258
	266		72				DVGW	266
EPDM EPM Ethyl-Propylen-Elastomere	283		85	-40	+200	Hot water, superheated steam, brake fluid, hydraulic liquids based on glycol or phosphoric acid basis, lyes, solvents. Not resistant to mineral oil.		283
	287		72				BAM, FDA, KTW USP Class VI, Ozon, W270	287
	293		82				KTW, FDA, Ozon	293
	297		73				FDA	
HNBR	312		75	- 25	+ 170	aliphatic hydrocarbons, mineral oils, fat, hot waters, glycols, good mechanical qualities		302
	317		74	-20			FDA	308
CR	528		86	- 40	+ 120	refrigerants		528
	556		62				556	
	557		71				557	
NBR	602		73	- 50	+ 120	mineral oils, fats, fuels, hydraulic liquids, salty liquids, watered acids and lyes		602
	603		82				603	
	607		72				- 40	607
	636		65	- 30			636	
	637		71				DVGW	637
	638		85				DVGW	638
	655		50	655				
	678		80	678				
	707		73	DVGW			707	
	857		75	- 20			857	
	858		87				858	
	859		92				859	
	877		67				877	

The stated maximum-temperatures are limits, that are to be seen in the context of the contact-medium and the business-pressure. The duration-use-temperatures always lie lower. If you don't find an acceptable material, please contact us.



## HECKER® POLYURETHANE-MATERIALS

Very high tensile strength and elongation to tear, very high resistance to tear propagation, good resistance to mineral oils and fuels.

Basis Group	Material WS	colour	hardness ( $\pm 5$ ShA)	Temperature range		Characteristic features
Polyurethane AU	900	nature	94	- 20	+ 90	VULKOLLAN® Cast material
	907	nature	72	- 20	+ 90	VULKOLLAN® Cast material
	910	nature	81	- 20	+ 90	VULKOLLAN® Cast material
	917	nature	76	- 20	+ 90	VULKOLLAN® Cast material
	918	nature	88	- 20	+ 90	VULKOLLAN® Cast material
Polyurethane EU	968	red	85	- 30	+ 90	good hydrolyse resistance
	969	red	96	- 30	+ 90	good hydrolyse resistance

Polyurethanes are not applicable for the use in aromatic carbons, chlorinated medias, solvents, alkaline solutions and acids.

## HECKER® FABRIC MATERIALS

Basis Group	Fabric	MATERIAL WS	Colour	Hardness (+/- 5ShA)	Temp. range (°C) from:	Temp. range (°C) up to:	Characteristic features	Peculiarities
FPM FKM Fluor-elastome-re	cotton	022	black	94	-15	+200	mineral oils, fat, treacly inflammable hydraulic liquids (HFD), aliphatic, aromatic and chlorinated hydrocarbons	
	aramide	025	black	94	-15	+200		
CR	aramide	054	black	94	-40	+110	refrigerants	
NBR	cotton	071	black	94	-25	+120	mineral oils, fat, fules, hydraulic liquids, salty liquids, watered acides and lyes	Standard for use in hydraulics
		072	black	94	-25	+120		
		089	black	94	-25	+120		
		090	black	98	-25	+120		
		094	black	98	-25	+120		

## HECKER® PTFE MATERIALS

Basis Group	MATERIAL WS	Colour	Temp. range (°C) from:	Temp. range (°C) up to:	Characteristic features	Peculiarities
PTFE virginal	7010	white	- 200	+ 260	Outstanding resistance to chemicals (The properties can be adapted to different applications due to an appropriate addition of special fillers. PTFE with fillers enlarge the range of application and enable the optimization of the material for a specific application.	
PTFE with glass	7214	grey				
PTFE with carbon	7238	black				
PTFE with bronze	7280	brown				
PTFE with bronze and carbon	7281	brown				
PTFE cold-flow-reduced, pure	7060	white				
PTFE cold-flow-reduced, with carbon	7338	black				cold-flow-reduced

The stated maximum-temperatures are limits, that are to be seen in the context of the contact-medium and the business-pressure. The duration-use-temperatures always lie lower.

## FLUID SEALS - SEALING SYSTEMS FOR THE USE IN FLUID APPLICATIONS

Fluid-technology for hydraulics and pneumatics transfers strength and performance to boost, to control and to move. Consequently it matters to the fluid technology that in determined areas an overpressure is built up and is hold as long as this requires the function.

Because a simple sealing gap, also as a function of his geometry and the viscosity of the pressure medium, this demand without leakage does not fulfil, become in most cases contact sealings in use.

The requirements to these sealings or to the used sealing materials are of varied nature:

- avoidance of leakage
- "automatic" reacting to pressure changes
- effectiveness about a wide temperature area
- good slip behaviourness
- high abrasive strength
- compatibility with the pressure media
- material elasticity (to the balance of dimension changes, for example, with expansions by high pressure)
- controversy with moved sealings: Density versus friction
- compromise between necessary sealing effect and more sufficient lubrication

They form a huge number of factors of influence and their interaction as a basis for an extremely complicated tribological system, consisting of sealing, countersurface and medium:

- movement speed
- temperature
- viscosity, chemical and physical properties of the medium
- Form and physical properties of the sealing element
- quality of the involved surfaces
- specific installation situation

This requires, on the one hand, a constant advancement of the materials, on the other hand a constant optimisation of the form of the sealing.

The fluid-technology makes high demands for the developers and manufacturers from sealing systems.

The application fields, for example in mobile and stationary arrangements, agricultural and forest applications, tool machines or in the air and space technologies are varied broadly and are characterised by most different operating conditions and demands.

Pressures up to 60 MPa (600 cash), temperature areas from -40 to +300 °C, together with other influences of the surrounding put the range of the application conditions.

To be able to guarantee the functional security the sealing systems have to be chosen material-sided and geometry-sided very carefully.

The users expect quick and exact forecasts about the long time behaviour from sealings. On the base of continuous basic research becomes the knowledge of the tribological processes an constancy extent and the sealing geometry is in an enduring development stage e.g. with help of the FEM (Finite elements method).

## BASIC MATERIALS

### NITRILE RUBBER (NBR)

Butadien-acrylonitrile-copolymer with superior resistance to swelling in aliphatic hydrocarbons, normal gasoline and mineral oils. This resistance against swelling is even more pronounced with an increasing percentage of acrylonitriles, furthermore, the gas density is improved in this series. On the other hand, the flexibility to cold and compression set improves with an increasing acrylonitrile percentage. Permanent temperature in mineral oil: 110°C.

Good ageing stability.

Low compression set

Resistant to: Petrol, mineral oil, fuel, dilute acids and alkaline solutions.

Not resistant to: Aromatic hydrocarbons (toluol, xyloles), chlorinated hydrocarbons (tri, per), ketones, esters, ether, brake fluids based on glycole and hardly combustible hydraulic fluids of the HFD group.

### HYDROGENATED NITRILE RUBBER (HNBR)

Hydrogenated nitrile rubber (HNBR) is obtained through total or partial hydrogenation of nitrile rubber (NBR) whereby the double bonds in the main chain must be neutralized. The saturated main chain offers a very good resistance to oxidation and chemical reactions. The nitrile group is responsible for the swelling resistance to oil, fuels and other covalent agents. Emphasis must be placed on the excellent physical characteristics: the good abrasion resistance, the resistance to hot air and ozone. The resistance against swelling increases, as with NBR, with the acrylonitrile (ACN) content. The application data are the same as for NBR, however, a higher resistance to temperature and a substantially better ageing stability is guaranteed.



### **CHLOROPRENE RUBBER (CR)**

This rubber type is difficult to ignite, shows good elasticity and cold flexibility as well as excellent conduct against weathering and ozone influences.

Permanent temperature: 100°C

Resistant to: Mineral oil (medium resistance against oil), alkaline solutions and acids, refrigerants (frigenes, freones).

Not resistant to: Aromatic amines, chlorinated hydrocarbons, ketones, esters, ether.

### **ETHYLENE-PROPYLENE RUBBER (EPM/EPDM)**

Contains only a low percentage of oxidation sensitive double bonds and through this, has a very good ageing stability and a good resistance against warmth and ozone.

Very good compression set.

Resistant to: Hot water, vapour (up to 180°C), lees, acids, alkaline solutions, ketones, esters, brake and hydraulic fluids based on glycole (HFC).

Not resistant to: Petrol, mineral oil, aromatic amines and chlorinated hydrocarbons.

### **SILICONE RUBBER (VMQ)**

Through the special chemical formulation with silicone and oxygen atoms, VMQ contains a series of excellent characteristics:

- very resistant to ozone and oxygen
- very good ageing stability
- applicable at dry heat of up to 200°C
- best low temperature flexibility up to -60°C
- low compression set with medium resistance to tear propagation
- very high resistance to tear propagation with higher compression set

Resistant to: Hot air, mineral oils (up to 150°C), water (up to 100°C), aqueous acids and alkaline solutions

Not resistant to: Fuels, aromatic amines, chlorinated solvents, esters, ketones, concentrated acids and alkaline solutions, hot vapour.

### **FLUORORUBBER (FKM)**

Excellent chemical and temperature resistance. Excellent resistance also to oxygen and ozone.

Applicable up to 200°C

Resistant to: Oils, fuels, hardly combustible hydraulic fluids (with the exception of strongly polar types like Skydrol 500A), aromatic amines, chlorinated hydrocarbons, acids and alkaline solutions.

Not resistant to: Polar solvents (ketones, esters), short chain alcohols (methanol), short chain carbon acids (acetic acid), amines, ammonia, brake fluids based on glycole.

### **POLYACRYLATE RUBBER (ACM)**

Very good heat and oil resistance, even against oils containing additives. Good ageing and ozone stability.

Resistant to: Mineral oils up to 150°C

Not resistant to: Hot water, vapour, aromatic amines, chlorinated hydrocarbons, esters, ketones.

### **POLYURETHANES (AU, EU)**

Very good materials which are resistant to wear and structurally stable and which have an excellent elasticity. Due to the high resistance to abrasion they are suitable for rough service conditions.

Resistant to: Mineral oils, normal petrol, type EU also against water-containing hydraulic fluids of the HFA type.

Not resistant to: Hot water, acids, alkaline solutions, aromatic amines and chlorinated hydrocarbons.

### **RUBBER-IMPREGNATED FABRICS**

For seals which are exposed to high mechanical stress (i.e., as a result of high pressure to be sealed) the stability of the pure elastomer is no longer sufficient. For such cases, there are fabric-reinforced materials. The surface structure allows the deposition of lubricants and with this, promotes the necessary formation of lubricating film between seal and counter surface. In addition to this, larger housing gaps can be spanned with fabric seals and pressure rings.

Cotton fabric in different strengths and an aramide fabric are available. These are impregnated with NBR, CR and FPM. The applied aramide fabric is distinguished by excellent stability characteristics and a high resistance to temperature. The applicability is limited in steam, acid and lyes.

### **THERMOPLASTIC SEALING ELASTOMERS**

In this material group it is tried, to infer rubber-elastic properties-elastic qualities with thermo-sculptural processability. This is possible in different ways.

One of the possibilities is the mixing of not or only weakly linked up rubber with thermoplasts (blends). As a result you get processable thermo-plastical material with the behavior of elastomers. However, these materials have only a subordinated meaning in the sealing technology.

## ELASTOMERS FOR SEALING TECHNOLOGY

The extreme temperature-borders only are valid in each case for specifically optimized materials. They are to be always viewed in the context of the contact-medium.

Polymere	Abbreviations as per DIN ISO 1629 or ASTM D 1418-85	Brand names (selection)	Temperature range (°C)	Costs (relative)
Nitrile	NBR	Perbunan® Europrene N®	-55 up to +120	1
Chloroprene	CR	Baypren® Neoprene®	-50 up to +100	1
Polyurethane	AU / EU	Vulkollan® Urepan®	-35 up to +110	6
Ethylene-propylene	EPM/EPDM	Buna EP® Vistalon® Nordel®	-50 up to +180	1
Polyacrylate	ACM	Nipol AR®	-30 up to +150	4
Hydrogenated nitrile	HNBR	Therban® Zetpol®	-35 up to +165	8
Silicone	VMQ, PMQ, PVMQ	Elastosil® Silopren®	-100 up to +220	4-20
Fluor silicone	FMQ, FVMQ		-60 up to +175	30
Fluor	FKM	Viton® Dyneon® Tecnoflon® Dai-EL®	-30 up to +250	15-50
Perfluorkautschuk	FFKM	Kalrez®	-10 up to +325	2000

## MECHANICAL-TECHNOLOGICAL TESTING METHODS

Characteristics	Test specification	Unit
Hardness	DIN 53505, 53519	ShA, ShDIRHD
Density	DIN 53479	g/cm <sup>3</sup>
Tensile strength	DIN 53504	N/mm <sup>2</sup>
Elongation to tear	DIN 53504	%
Tear resistance	DIN 53507, 53515	N/mm
Compression set	DIN ISO 815	% (condition)
Abrasion	DIN 53516	mm <sup>3</sup>
Low temperature properties	DIN 53545	°C
Behavior in fluids	TR10 DIN 53521	ASTM D 1329 °C



## THE MOST COMMON TPE TYPES

Other efforts are linking to a copolymerisation between rubber and thermoplasts, or in using polyamide, polyester or polyurethane in segments. Common characteristics of these combined copolymers is the physical crosslinking between the intermolecular forces. A chemical interlinking does not take place. The representatives most important for the sealing industry of this group are thermo-plastic polyurethanes (TPE U) and the polyetheresters (TPE-E).

TPE-O and TPE-X	No chemical cross-linking
TPE-U	Thermoplastil polurethanes (AU, EU)
Others	MPR, EA
TPE-E	Polyetheresters
TPA-A	Polyetheramides
TPE-S	Styrol-triblocked-copolymers

## THERMOPLASTIC POLYURETHANES (TPE U)

On account of her versatility become thermoplastic polyurethanes (TPE U) more and more used in the sealing industry. Reasons for it are the excellent wear-resistance and the extruding resistance of these materials. Also with the tear resistance, the tensile strength and the elongation to tear, the TPE-U materials have an advantage in comparison to standard elastomers.

For TPE U hard segments and soft segments become tightened about an urethane reaction. The hard segments are able to crystalline with themselves. The macromolecules thereby physically link up. At higher temperatures these areas can be broken up. The TPE U can be thereby processed thermo-plastically.

By variation of the hard segments and soft segments a big number of optimised thermoplastic polyurethanes can be realized. Customizing for specific applications or contact medias is possible.

Standard TPE U materials have a very good resistance against mineral oil-basic media. Optimised TPE U are often very good resistant to hydrolysis and suitable for HFA-, HFB-, HEES-and HETG liquids. Even for the application in acids and lyes are materials available. Indeed, materials for nonpolar media, as a rule, are not suitable for polar media, and vice versa. There is not the universally applicable material existing.

For the fluid power sealing applications common TPE-U materials lie in the hardness area from 80 Shore A to 70 Shore D. Their application temperature area lies with approx. from -35 to 100°C. Optimised materials also leave use temperatures to -50°C or for a short time up to 145°C.

### Thermoplastic polyetheresters (TPE-E)

TPE-E-Materialien also are blockcopolymeres with hard- and soft-segments. They possess very good wear-qualities, high solidities, a high flexibility and very good constancy against oils and hydraulics-liquids. These materials are not applicable for polar medias as acids, alkalines ord glycoles and temperates above 70°C. Typical TPE-E materials have a hardness between 35 and 75 Shore D. The temperature range ist between -50°C up to 130°C.

## PHYSICAL QUALITIES / MECHANICAL-TECHNOLOGICAL EXAMINATIONS

The judgment of the material-qualities with consideration on the intended application takes place analogously to the elastomeres. For the judgments of the behaviour in cold surroundings, also the TR-10-method is used (after ASTM D 1329).

## THERMAL CHARACTERISTICS

Thermal-plastic elastomers are applicable for a wide range of temperatures. The lower temperature limit is determined by the glass transition temperature. Below this limit the elastomers lose their elasticity and also their ability to be mechanically stressed. As a result a leakage or a crash of the seal is possible. The glass transition temperature ist reversible. The upper temperature limit is determined by melting of the materials and the parts. This deforming is irreversible.

## **PTFE (POLYTETRAFLUORETHYLENE)**

High temperature resistant plastic. due to extremely low friction, they exhibit no stick-slip effect. Good mechanical and excellent chemical characteristics.

PTFE (Polytetrafluorethylen) is among the Thermoplasten under the plastics. It is belonging to the fluoride-plastic-group. PTFE is created from the elements carbon and fluoride through polymerisation, that unites itself during the polymerisation to macro-molecules and forms an unsolvable, part-crystalline plastic.

Applicable for temperatures from -200°C up to +260°C. Resistant to all media with the exception of alkaline metals, fluorine and some fluorine compounds.

Mechanical properties and heat conductivity are variable by compounding this material with further filling materials.

## **PTFE SEALING MATERIALS**

Neside the so-called pure (virginal PTFE) the properties of PTFE can be adapted to different applications due to an appropriate addition of special fillers. PTFE compounds enlargen the range of application and enable the optimization of the material for a specific application (e.g. for higher pressures or better abrasion resistance).

## **PROPERTIES OF PTFE SEALINGS**

- outstandig resistance to chemicals
- a very high operable temperature range (-200°C up to 250°C)
- a very low abrasion coefficient; even in the case of insufficient lubrication no stick-slip-effect
- antiadesive surface
- not inflammable; in the case of fire contact however toxic fluor gas would escape
- very good electrical insulation properties
- physiological recognized as safe, resistant to atmospheric corrosion and does not absorb water

In the machines and vehicle-construction, the outstanding gliding properties are used for sealings. Within the mentioned temperature-area, the material doesn't have any chemical changes also in the long run.

Most materials cannot be attached caused by the good anti-adhesion-behavior at PTFE. This has the advantage furthermore that only low stick-slip effects appear with small relatively-movements. The abrasion rates are very low (0,04 to 0,09).

PTFE is completely fast to light without stabilizers - and UV-staedy. Its behavior is environment-neutral and gives away no pollutants to its surroundings it caused by its insolubility.

No Cadmium, heavy metal-connections, fire-save-medias, FCKW or other toxic substances, are contained in pure PTFE.

## **HYDRAULIC FLUIDS**

Combustible hydraulic oils (mineral oils): alloyed for higher stresses (HL, HLP)

### Non-combustible hydraulic fluids

HFA oil in water emulsion with max. 20% combustible partes. For service temperatures from +5 up to +55 °C.

HFB water-in-oil emulsion with max. 60% combustible parts. For temperatures from +5 up to +60 °C.

HFC aqueous polymer solutions e.g. polyglycols as a mixture of polymers, solution aids and water. For temperatures from -20 up to +60 °C.

HFD waterfree hydraulic fluids

a) phosphoric ester HFDR

b) chlorinated hydrocarbons HFDS

c) mixtrues from a) and b) HFDT

temperatures from -20 up to +150 °C.

### Biologically degredable hydraulic fluids

native oils (e.g. rape oil) HETG

synthetic esters HEES

When using these media we kindly ask you to contact our staff working in our laboratories.

# APPLICATION FIELDS OF FABRIC-REINFORCED ELASTOMERS

Despite development of the special elastomer materials, these cannot meet all requests, that are put at sealing-materials in the heavy-duty-hydraulics and mobile-hydraulics.

For these operating-areas, HECKER can offer sealings from fabric-reinforced elastomers.

The surface-structure of the sealings makes the storage of lubricants possible and favors the necessary lubricating film with it between sealing and counter-surface.

Additionally, with fabric reinforced materials and their high extrusion-force a bigger casing-split than with sealings from pure rubber can be bridged.

As materials, Aramid and cotton-materials are available with different stitch-wideness and coatings.

With the HECKER-Standard-fabric-materials and profiles, solutions for most sealing-applications are possible.

For special-applications can in close cooperation between the customer and our development-engineers particular profiles and special-materials be developed.



# HECKER® HYDRO V HYDRAULIC ROD SEAL (PATENTED)

## U-RING IN PERFECTION

- highest sealing-effect even in the case of extreme operating-conditions by means of optimal lip design and supporting elements with sealing function
- permanent good operating behaviour by means of stabilized lubricating film and exactly defined position in the groove
- low starting friction by means of medium storage within the supporting elements
- supporting elements with storage effect and defined leading-back of the lubricating film during the return stroke of the rod
- high abrasion resistance, minimal wear
- low compression set, ensuring a long-term sealing function
- uncomplicated installation

## FUNCTIONING PRINCIPLE OF U-RINGS

U-rings are known as reliable sealing elements for the sealing of rods and plungers with reciprocating movement.

The contact pressure between sealing lip and rod is decisive for the sealing property of the U-ring. In order to achieve a high dynamic sealing effect, the sealing lip has to contact the rod only in the area of the sealing edge, independent of pressure or speed.

With regard to a high service safety and a high wear resistance, it is necessary that a lubricating film is formed in the contact area between sealing lip and rod. This very thin lubricating film adheres to the rod when it is extended. Leakage-free operation is guaranteed provided that the lubrication film gets back into the pressure chamber during the return stroke of the rod.

## HECKER® HYDRO V - U-RING IN PERFECTION

Due to the interaction of optimal lip design and supporting elements with sealing function, the HECKER Hydro V-ring offers the preconditions for high sealing capability and long service life.

Our developed V-shaped supporting elements guarantee best function of the sealing lip for the whole operating range, as uncontrolled deformations of the U-ring due to the service parameters (pressure, speed, temperature e.g.) are prevented.

In addition, the function of the U-ring is improved by means of the directional scraping effect of the V-shaped support elements, leading to higher sealing capability.

When the rod is extended, the lubricating film is partly scraped away and stored by the v-shaped supporting elements. During return movement, the lubricating film adhering to the rod is directly led to the sealing lip and forced back into the pressure chamber.

## APPLICATION

HECKER® Hydro V-rings are applied for the sealing of rods and plungers with reciprocating movement in hydraulic systems.

## MATERIAL WS 979

Highly wear resistant polyurethane, hardness 93 shore A, with low compression set, extremely high extrusion resistance and wide temperature range.

## OPERATING RANGES

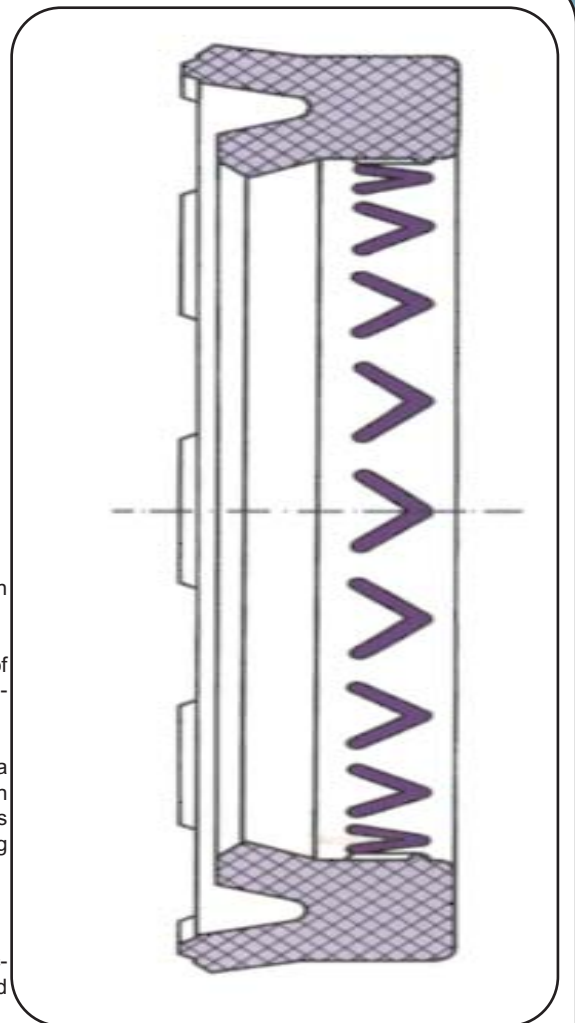
(based on laboratory tests)

Media:	hydraulic oils on mineral oil basis
Operating pressure:	$p < 400 \text{ bar (40 MPa)}$
Temperature:	$- 35^\circ - + 100^\circ \text{ C}$
Speed:	$V < 0,5 \text{ m/s}$

For particular cases of application, special materials are available (e.g. FPM, EPDM).

## INSTALLATION DIMENSIONS

Dimensions according to the standard DIN/ISO 5597 or others. For the dimensions available, please contact us.



**sealing force  
+ lubricating film  
= functionsafety**



**optimal  
sealing lip  
+ active  
V-support  
= U-ring  
in perfection**

# HECKER® MATERIALS & MIXTURES

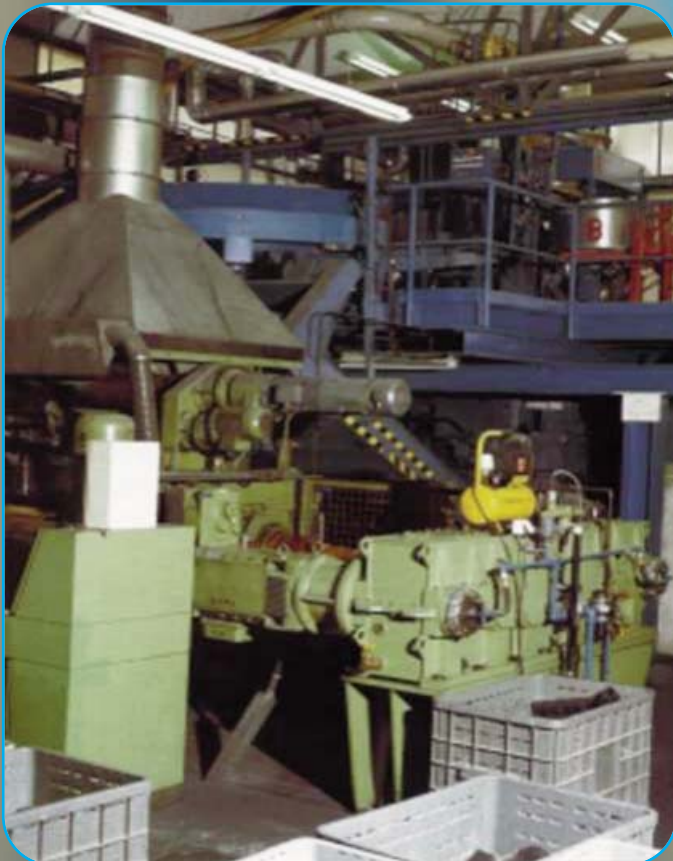
**HECKER  
MATERIALS AT  
ITS BEST**

HECKER® supplies you not only with sealings and other technical parts from most high-quality materials but supplies you also with selected rubber-mixtures from own development or after your own formulas. HECKER® delivers fast and inexpensively, also in small quantities.

Mixtures from the materials NBR, EPDM, CR, FPM or HNBR as furs, plates, unending-strips, strained or in form of brutes to the direct processing.

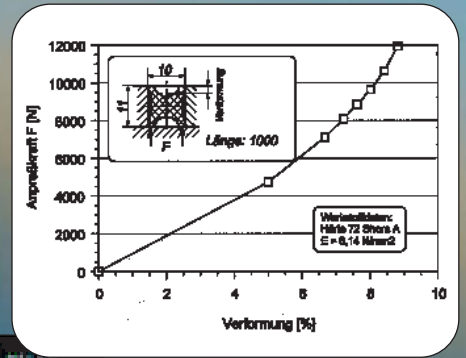
Send us your inquiry or your problem. We select the material been suitable for you and make a corresponding offer for you. We like to also make an offer for particular requests for you over a material-development after your targets.

Become a content customer of GSM® sealings, technical parts and mixtures "MADE BY HECKER®".

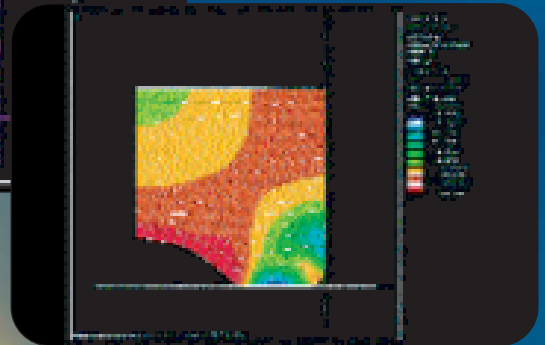


# HECKER WERKE Finite-Elements-Analysis for development ... and service

## EVALUATION



## FEM-MODELLING

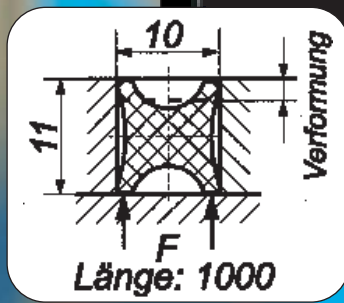


AT A PRESSURE OF 5%

## ELASTOMERES

Under consideration of the not-linear behaviour of elastomers, distortions, pressing forces and tension-tops can be simulated under realistic operating conditions.

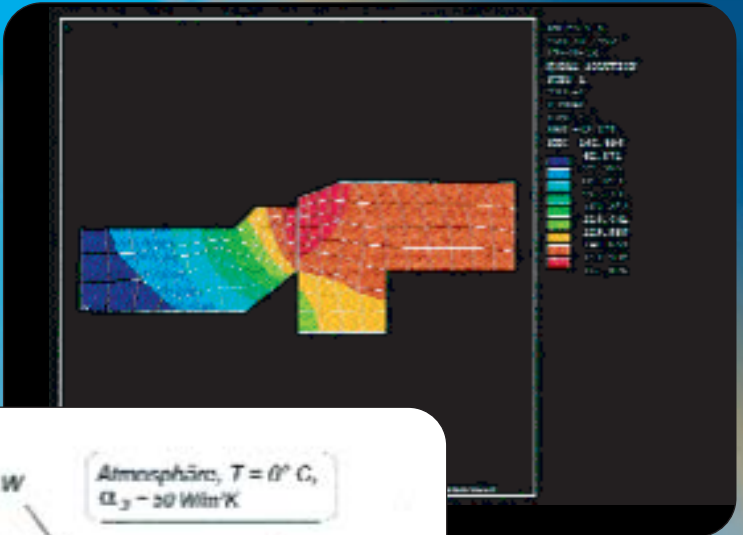
Our designers can take these results to develop the best seal for your need.



GEOMETRY

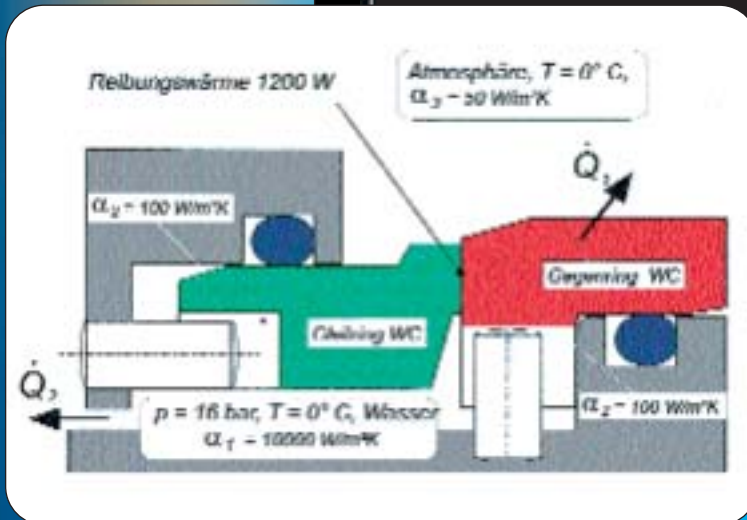
## MECHANICAL SEALS

Distortions through heat-lengthening and pressure are crucial for the operating of mechanical seals. The distortions become visible in an FE-Simulation. The results of this simulations help to construct the best performing sealing solution.



CALCULATED TEMPERATURES IN THE PART BECOME VISIBLE

## GEOMETRY AND ADDITIONAL CONDITIONS



**IF YOU NEED FURTHER INFORMATIONS  
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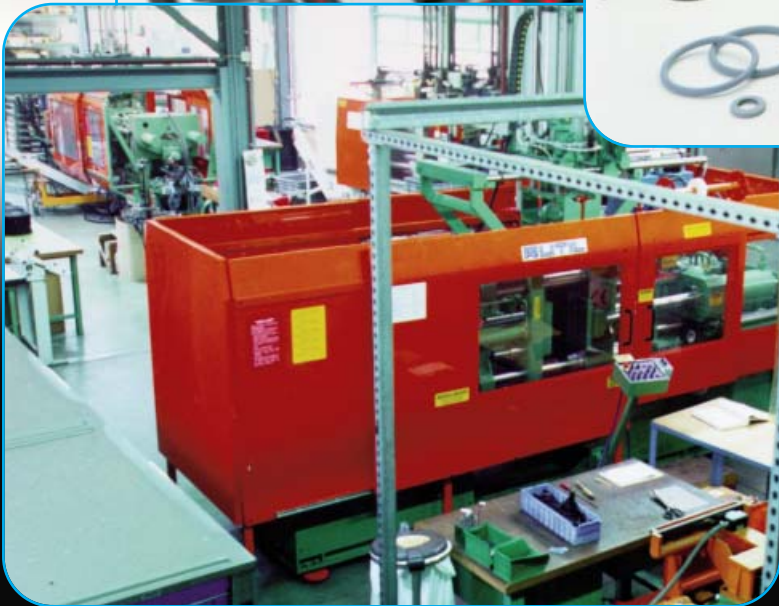
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