

# Vacuum Fittings

ISO - KF

ISO - K

ISO - F

CF

# Feedthroughs

177.01.02

Excerpt from the Oerlikon Leybold Vacuum Full Line Catalog

Product Section C13

Edition May 2007

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## Only available for purchase in North and South America

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## Introduction

According to DIN 28 400, the term "Ultra-high Vacuum (UHV)" designates the pressure range below  $10^{-7}$  mbar.

Several physical quantities, such as mean free path, monolayer time, flow density of the particles impinging on the walls, leak rate and the degassing rate are of significance in the characterization of this pressure range. For the definitions of these quantities refer to technical publications on this subject.

In order to attain or maintain pressures below  $10^{-7}$  mbar, the following pre-conditions must be met:

- The vapor pressure of the pump fluid or lubricant should be in accordance with the desired ultimate pressure
- the leak and degassing rates of the entire apparatus including its installations must be extremely low.

Generally, both leak rate and back-streaming effects through the pump can be kept at sufficiently low levels by using suitable UHV sealing materials and pumps.

However, a sufficiently low outgassing rate can only be achieved by baking out the entire apparatus at temperatures of about 300 °C for a longer period of time. It is only under these conditions that the mono-layers of atoms or molecules, which attach quite firmly to the surfaces of the vacuum apparatus including its installations, are desorbed. Consequently, components for UHV systems are generally made of stainless steel. Metal gaskets, ceramic feedthroughs and bakeable observation windows are used exclusively.

For applications in the extreme UHV range (XHV) the outgassing rate of the CF flanges and the UHV components can be reduced by about two orders of magnitude by a special degassing process.

The high standard of development and manufacture combined with the use of high quality materials guarantee that UHV components from Oerlikon Leybold Vacuum are able to meet even the most demanding requirements.

## Advantages to the User

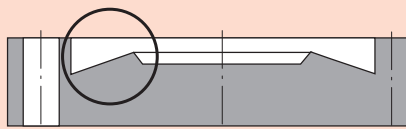
- Stabilized Oerlikon Leybold Vacuum knife-edge
- High reliability
- Special knife edge profiles ensure the highest degree of leak tightness
- Flange connection can be baked out up to 450 °C
- Easy to assemble, helium-tight
- Symmetrical flange connection
- Equal sealing profiles
- Small outside diameter with respect to the nominal width
- Can be joined by welding or brazing using any desired process, also with other nickel chromium steel grades
- For use either with a flat gasket made of OFHC copper (oxygen-free) or FPM O-ring
- Self-centering
- Fixed and rotary flanges in almost any size

# These Arguments Prove Oerlikon Leybold Vacuum's QUALITY

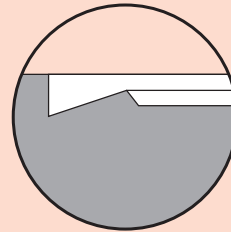
- Availability of all components at short notice
- World-wide advice at any time to answer your questions relating to vacuum systems
- Utilization of most advanced manufacturing methods
- Environment-friendly cleaning baths with complete waste disposal and recycling facilities
- Environment-friendly and secure packaging
- Total Quality Management methods during all processing stages
- Controlled material quality
- Compatible to your existing flanges of the same system
- Highly leak-tight down to leak rates of  $1 \times 10^{-9}$  mbar x l x s<sup>-1</sup>; all components are subjected to a helium leak test
- Low outgassing rates of the materials through
  - choice of the right material quality, especially for vacuum apparatus
  - excellent cleaning methods
- Documentation available for all components

- The well-proven Oerlikon Leybold Vacuum geometry for the cutting edges

## The stabilized Oerlikon Leybold Vacuum profile for the cutting edges



Diagrammatic view

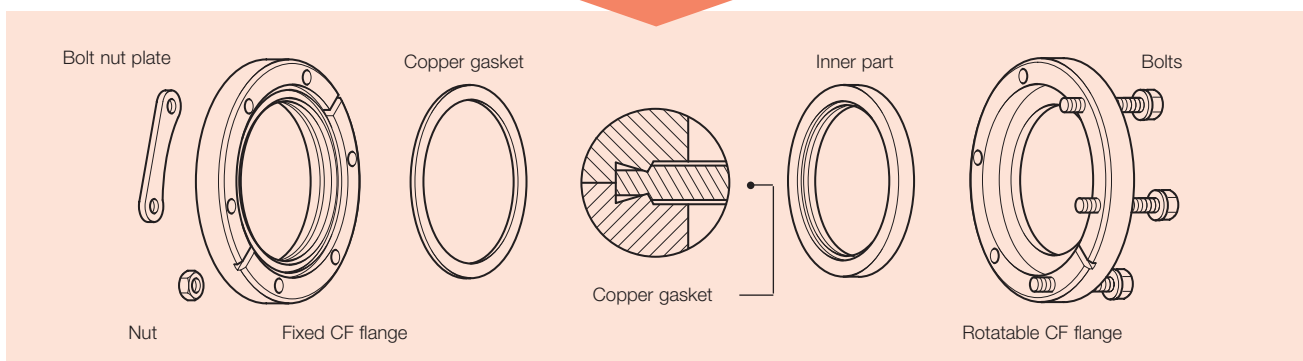


Partial view

- Forged steel materials of high tensile strength and density
- Material quality for standard applications DIN 1.4301 corresponds to AISI 304
- Tightly checked, **close dimensional tolerances** for the entire sealing geometry
- **Low degassing rates** of the tube material used

## Advantages

Reliable sealing of UHV connections  
over hundreds of  
heating cycles



## General

Vacuum systems (i.e. systems for pressures ranging from 2.5 bar to  $10^{-9}$  mbar ( $1.9 \times 10^{-3}$  Torr to  $0.75 \times 10^{-9}$  Torr)) are quickly and easily assembled owing to the modular construction principle which is based on interchangeable standard components by means of vacuum-tight, demountable flange connections. Individual components may be exchanged easily at any time. Depending on the intended use and size of the connection, flanges of different types have been developed. The KF flange connection was developed by Oerlikon Leybold Vacuum many years ago and has been widely accepted by all users of vacuum equipment. This product section lists all flange connections and fittings including adaptors for ultra-high vacuum components.

Components marked with [ $< 1000$  mbar ( $< 750$  Torr)] are not allowed for use at pressures exceeding 1000 mbar abs.

The components and flange connections are intended for use in connection with vacuum systems. They have not been designed to support mechanical loads. All loads must be supported separately at the connection components.

## Flange Designations

The designations used by Oerlikon Leybold Vacuum for clamp flanges, fixed flanges (bolted) and collar flanges with retaining rings correspond both to the international standards <sup>1)</sup> and to the usual nomenclature in vacuum technology.

<sup>1)</sup> The nominal width DN corresponds only approximately to the inner diameter, i.e. is not necessarily identical to the inner diameter. Differences in the actual inner diameter are quite normal in practice and do not contravene standards.

## Materials

### Stainless Steel

German Material No.	AISI/SAE	DIN Designation
1.4301	304	X5 CrNi 18 10
1.4305	303	X10 CrNi S 18 9
1.4306	304 L	X2 CrNi 19 11
1.4310	301	X12 CrNi 17 7
1.4401	316	X5 CrNiMo 17 12 2
1.4404	316 L	X2 CrNiMo 17 12 2
1.4435	316 L	X2 CrNiMo 18 14 3
1.4541	321	X10 CrNiTi 18 9
1.4571	316 Ti	X6 CrNiMoTi 17 12 2
1.4552	–	X5 CrNiNb 18 9

### Aluminum

German Material No.	AISI	DIN Designation
3.0255.10	AA 1050 1-0	Al 99.5 w
3.0615.71	AA 6012-T6	AlMgSiPb
3.1655.53	AA 2011-T352	AlCuBiPb
3.2162.05	380.0 (AA)	GD-AISI8Cu3
3.2315.08	6082-F (AA)	AlMgSi1
3.2315.71	6082-T6	AlMgSi1
3.2315.72	6063 (AA)	AlMgSi1
3.2381.02	520.0 (AA)	GK AlSi 10 Mg
3.2381.62	520.0 (AA)	GK AlSi 10 Mgwa
3.2582.05	160 X	GD-AISI 12

### Steel

German Material No.	AISI	DIN Designation
1.0037	–	St 37-2
1.0308.07	–	St 35
1.1141	–	CK 15
1.1181	–	CK 35

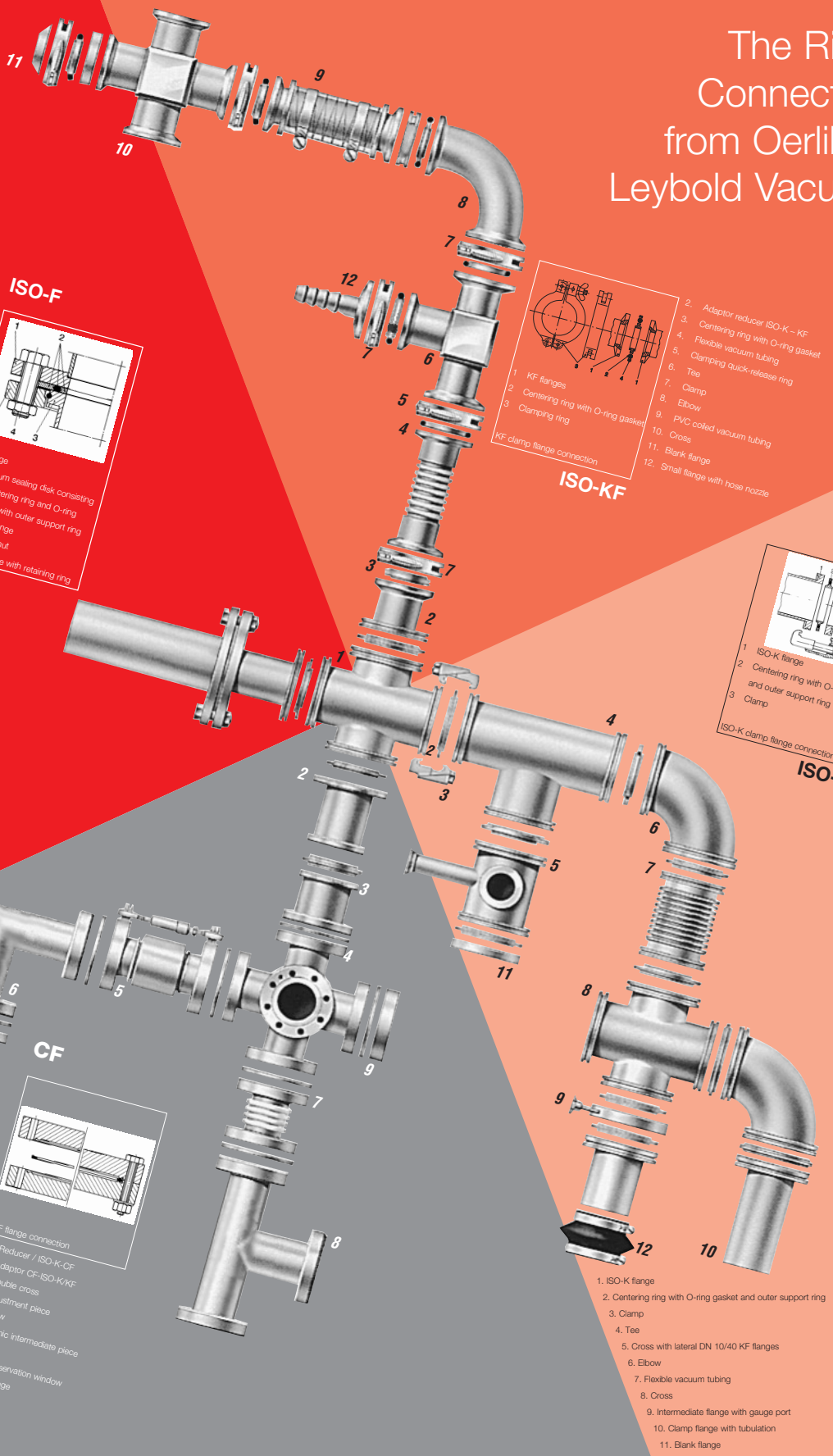
### Gaskets

Code Designation	Chemical Designation	Typical Trade Name
CR	Chloroprene-caoutchouc	Neoprene
FPM	Fluor-caoutchouc	Viton®
NBR	Acrylonitrile-butadienrubber	Perbunan®
PTFE	Polytetrafluorethylene	Teflon®
EPDM	Ethylene propylene dien rubber	–

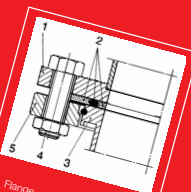
### Hoses and Tubes

Code Designation	Chemical Designation	Typical Trade Name
NR	Natural rubber	–
PVC	Polyvinylchloride	–

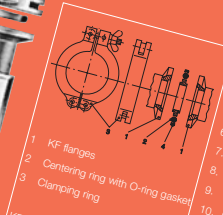
# The Right Connection from Oerlikon Leybold Vacuum



## ISO-F



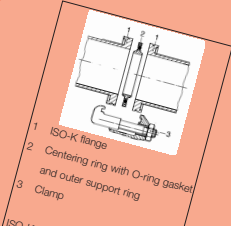
1. Flange
2. Vacuum sealing disk consisting of centering ring and O-ring gasket with outer support ring
3. ISO-K flange
4. Bolt with nut
5. Collar flange with retaining ring



1. KF flanges
2. Centering ring with O-ring gasket
3. Clamping ring

## ISO-KF

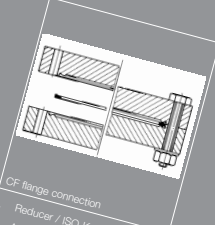
2. Adaptor reducer ISO-K - KF
3. Centering ring with O-ring gasket
4. Flexible vacuum tubing
5. Clamping quick-release ring
6. Tee
7. Clamp
8. Elbow
9. PVC coated vacuum tubing
10. Cross
11. Blank flange
12. Small flange with hose nozzle



1. ISO-K flange
2. Centering ring with O-ring gasket and outer support ring
3. Clamp

## ISO-K

## CF



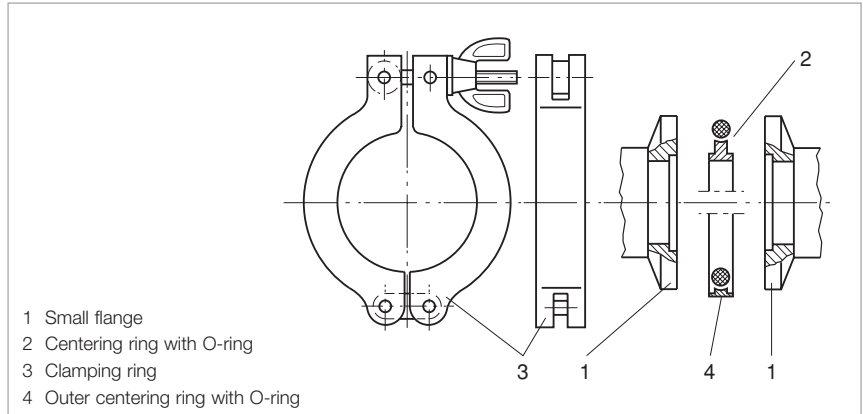
- CF flange connection
2. Reducer / ISO-K-CF
3. Adaptor CF-ISO-K/KF
4. Double cross
5. Adjustment piece
6. Elbow
7. Ceramic intermediate piece
8. Tee
9. UHV observation window
10. Blank flange

1. ISO-K flange
2. Centering ring with O-ring gasket and outer support ring
3. Clamp
4. Tee
5. Cross with lateral DN 10/40 KF flanges
6. Elbow
7. Flexible vacuum tubing
8. Cross
9. Intermediate flange with gauge port
10. Clamp flange with tubulation
11. Blank flange
12. Flexible compensation element

# Flange Connections

## ISO-KF Connection

The ISO-KF connection (to DIN 28 403 and ISO 2861) permits rapid fitting and replacement of components in vacuum systems. It consists of two symmetrical KF flanges (1), a centering ring with O-ring gasket (2) and a clamping ring (3). High vacuum tight KF connections can be made without the use of tools simply by turning the wing nut of the clamping ring.

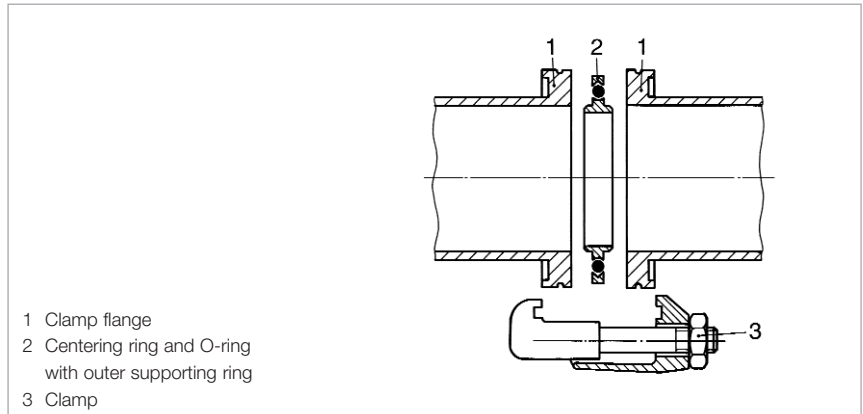


ISO-KF flange connection

## ISO-K Clamp Flange Connection

The clamp flange connection (to DIN 28 404 and ISO 1609) allows components from DN 63 to DN 630 to be connected in any position regardless of the bolt hole arrangement on any fixed flanges.

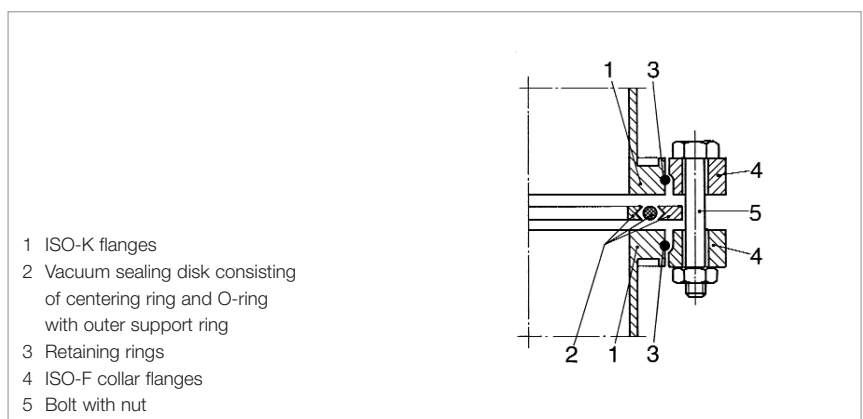
It consists of two clamp flange components (1), a centering ring (2) with an outer ring enclosing the O-ring gasket, and several clamps (3) which the connection is assembled and tightened with. Since the centering ring can be firmly inserted into the centering groove of the flange, even horizontal connections are quickly and easily fitted.



ISO-K clamp flange connection

## ISO-F / DIN Fixed Bolted Flange Fittings

With the appropriate collar flanges, the clamp flange can be connected to various fixed bolted flange systems (ISO-F, DN 2501, etc.) see figures in section "ISO-F and DIN 2501 Fixed Flange Fittings".

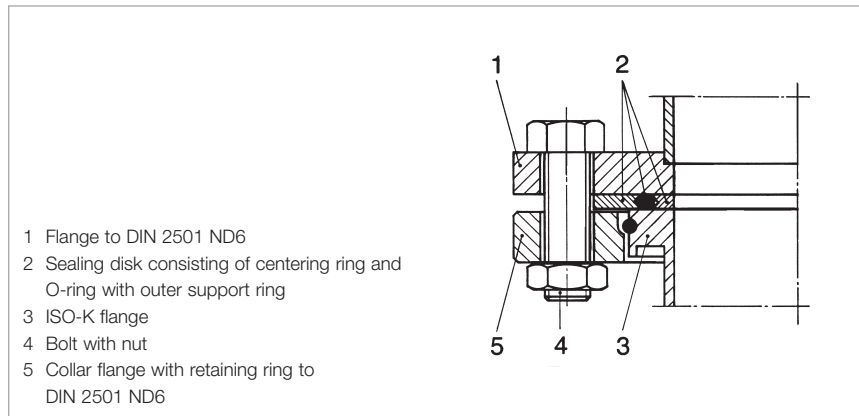


Clamped flange connection with collar flanges

## Bake Out Temperatures for the Gaskets

CR and FPM gaskets can be inserted in all listed flange types, while aluminum gaskets may be used for higher vacuum requirements.

CR gaskets can be used in the temperature range from -40 °C to +100 °C [-40 °F to +212 °F] (max. bakeout temperature), FPM gaskets from -15 °C to +150 °C [+5 °F to +302 °F] (max. bakeout temperature). Aluminum gaskets from -196 °C to +200 °C [-321 °F to +392 °F] (max. bakeout temperature gradient;  $\Delta T$  max. 2.5 °/min).



Connection between a DIN 2501 ND 6 flange and an ISO-K flange with DIN 2501 collar flange

# Products

## ISO-KF Flange Fittings and Components

### DN 16 ISO-KF to DN ISO-50 KF Aluminum Design (to DIN 28 403) [Tubes similar DIN 28 403]

The small flange connection developed by Oerlikon Leybold Vacuum has become the basis of the international standard for vacuum technology.

#### Advantages to the User

- Quick, safe and reliable
- No tools are need to provide a vacuum-tight seal
- Suitable down to pressures of  $10^{-7}$  mbar ( $0.75 \times 10^{-7}$  Torr)
- Easy to disassemble and clean
- In the case of special requirements as to degassing for the purpose of reducing the outgassing rate and in case of special requirements as to corrosion resistance, we recommend the use of stainless steel components.

#### Quick Clamping Ring

#### Advantages to the User

- Quick and effective fitting and disassembly
- Can be fitted with one hand

- Closing action via lever with clamping spring
- Corrosion resistant

### DN 16 ISO-KF to DN ISO-50 KF Stainless Steel Design (to DIN 28 403) [Tubes similar DIN 28 403]

#### Advantages to the User

- Quick, safe and reliable
- Can be baked out up to 200 °C (392 °F) when using metal seals
- Can be degassed up to 150 °C (302 °F) with FPM gaskets
- With metal seals suitable for pressures down to  $10^{-9}$  mbar ( $0.75 \times 10^{-9}$  Torr)
- Corrosion resistant
- Low degassing rate
- For standard applications involving pressures up to 2.5 bar ( $1.9 \times 10^3$  Torr) abs. even with outside ring resp. ultra sealing ring and 3-part clamping ring 5 bar
- Can be degassed up to 200 °C (392 °F) with UHV aluminum rings or disks

### Flexible Compensation Elements

Vacuum systems and pump systems often require components which are capable of protecting sensitive instruments against impacts or excessive vibrations while linking tubes at the same time.

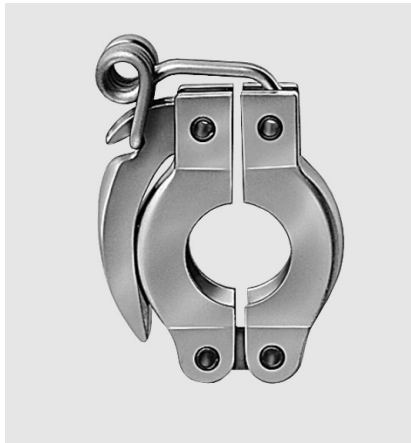
#### Advantages to the User

- Easy and quick to install
- Safe and reliable
- Tubes may be turned in any direction
- No centering and sealing ring required
- Capable of withstanding temperatures up to 80 °C (176 °F)
- Suitable for pressures down to  $10^{-5}$  mbar ( $0.75 \times 10^{-5}$  Torr)

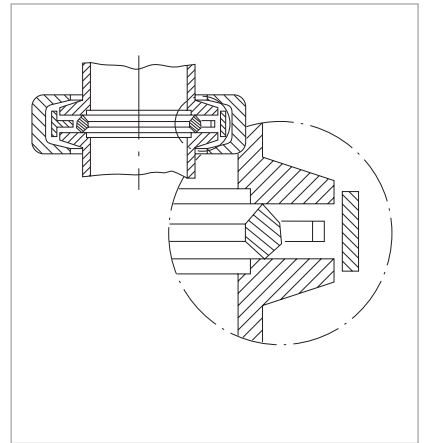




Fitting a centering ring to a KF component



Quick clamping ring



Small flange connection with ultra sealing ring



Fitting an elbow



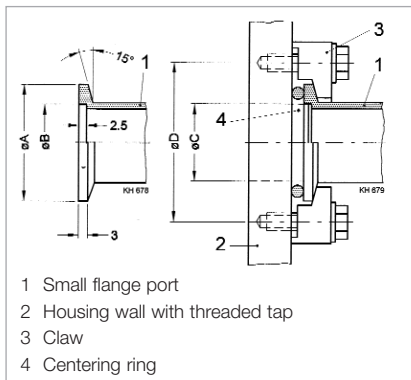
Clamping ring for ultra sealing disk



Small flange connection with clamping ring



Small flange components made of stainless steel

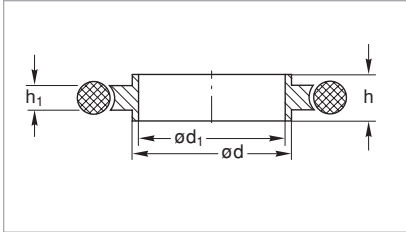


Small flange connection

### Technical Data

Nominal diameter		A	B	C	D	Number of claws
DN 10 ISO-KF	mm	30.0	12.2	12.2	45.0	4
	in.	1.18	0.48	0.48	1.77	
DN 16 ISO-KF	mm	30.0	17.2	17.2	45.0	4
	in.	1.18	0.68	0.68	1.77	
DN 25 ISO-KF	mm	40.0	26.2	26.2	55.0	4
	in.	1.57	1.03	1.03	2.17	
DN 40 ISO-KF	mm	55.0	41.2	41.2	71.0	4
	in.	2.17	1.62	1.62	2.80	
DN 50 ISO-KF	mm	75.0	52.4	52.4	91.0	4
	in.	2.95	2.06	2.06	3.58	

## Centering Rings (Aluminum 3.1655.53/Stainless Steel 1.4305) with O-Ring (CR/FPM)



Dimensional drawing for the centering rings with O-ring

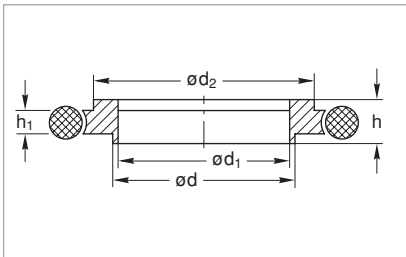
### Technical Data

DN	ISO-KF	10	16	20	25	32	40	50
d	mm	12	17	22	26	34	41	52
	in.	0.47	0.67	0.87	1.02	1.34	1.61	2.05
d <sub>1</sub>	mm	10	16	20	25	32	40	50
	in.	0.40	0.63	0.79	0.98	1.26	1.57	1.97
h	mm	8	8	8	8	8	8	8
	in.	0.31	0.31	0.31	0.31	0.31	0.31	0.31
h <sub>1</sub>	mm	3.9	3.9	3.9	3.9	3.9	3.9	3.9
	in.	0.15	0.15	0.15	0.15	0.15	0.15	0.15

### Ordering Information

Aluminum/CR		183 21	183 26	183 22	183 27	183 23	183 28	183 25
Part No.								
Aluminum/FPM		182 01	182 06	182 02	182 07	182 03	182 08	182 05
Part No.								
Stainless steel/FPM		883 21	883 46	883 22	883 47	883 23	883 48	883 25
Part No.								

## Centering Ring Adaptors (Aluminum 3.1655.53/Stainless Steel 1.4301) with O-ring (NBR/FPM)



Dimensional drawing for the centering ring adaptors with O-ring

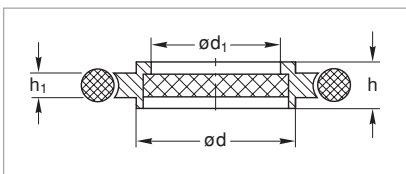
### Technical Data

DN	ISO-KF	10/16	20/25	32/40
d	mm	12	22	34
	in.	0.47	0.87	1.34
d <sub>1</sub>	mm	10	20	32
	in.	0.40	0.79	1.26
d <sub>2</sub>	mm	17	26	41
	in.	0.67	1.02	1.61
h	mm	8	8	8
	in.	0.31	0.31	0.31
h <sub>1</sub>	mm	3.9	3.9	3.9
	in.	0.15	0.15	0.15

### Ordering information

Aluminum/FPM		182 56	182 57	182 58
Part No.				
Aluminum/NBR		183 56	183 57	183 58
Part No.				
Stainless steel/FPM		883 56	883 57	883 58
Part No.				

## Centering Rings (Stainless Steel) with Sintered Metal Filter (Stainless Steel 1.4404 and O-Ring (FPM))



Dimensional drawing for the centering rings with sintered metal filter and O-ring

### Technical Data

DN	ISO-KF	10	16	25	40	50
d	mm	12	17	26	41	52
	in.	0.47	0.67	1.02	1.61	2.05
d <sub>1</sub>	mm	8	14	23	38	48
	in.	0.31	0.55	0.91	1.50	1.89
h	mm	8	8	8	8	8
	in.	0.31	0.31	0.31	0.31	0.31
h <sub>1</sub>	mm	3.9	3.9	3.9	3.9	3.9
	in.	0.15	0.15	0.15	0.15	0.15

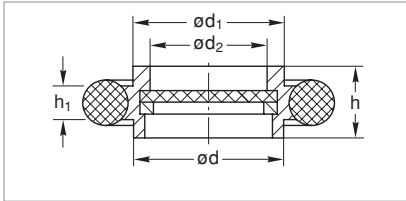
### Ordering information

Stainless steel	Part No.	883 50	883 51	883 52	883 53	883 54
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Air throughput at 20 °C and 200 mbar differential pressure approx. 1 m<sup>3</sup> x h<sup>-1</sup> x cm<sup>2</sup>; pore size: 20 µm

**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Centering Rings with Fine Filter (Stainless Steel 1.4305), O-Ring (FPM)



Dimensional drawing for the centering rings with fine filter

### Technical Data

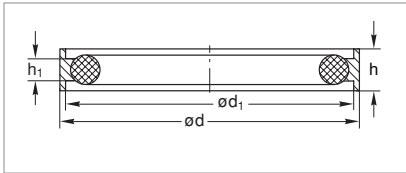
DN	ISO-KF	10	16	25	40	50
d	mm	12	17	26	41	52
	in.	0.47	0.67	1.02	1.61	2.05
d <sub>1</sub>	mm	12	17	26	41	52
	in.	0.47	0.67	1.02	1.61	2.05
d <sub>2</sub>	mm	9	13.5	22	35.5	46
	in.	0.35	0.53	0.87	1.4	1.81
h	mm	8	8	8	8	8
	in.	0.31	0.31	0.31	0.31	0.31
h <sub>1</sub>	mm	3.9	3.9	3.9	3.9	3.9
	in.	0.15	0.15	0.15	0.15	0.15

### Ordering information

Stainless steel	Part No.	883 95	883 96	883 97	883 98	883 99
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Filter material: Stainless steel mesh 1.4404, size of pore: 4 µm, separation grade: 1 µm particles to 98%

## Outer Centering Rings (Aluminum 3.1655.53) with O-Ring (CR/FPM)



Dimensional drawing for the outer centering rings with O-ring

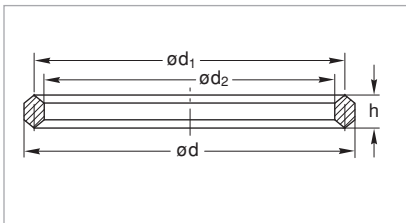
### Technical Data

DN	ISO-KF	10/16	20/25	32/40	50
d	mm	32	42	57	77
	in.	1.26	1.65	2.24	3.03
d <sub>1</sub>	mm	30.2	40.2	55.2	75.2
	in.	1.19	1.58	2.17	2.96
h	mm	7	7	7	7
	in.	0.28	0.28	0.28	0.28
h <sub>1</sub>	mm	3.9	3.9	3.9	3.9
	in.	0.15	0.15	0.15	0.15

### Ordering information

Aluminum/CR	Part No.	183 50	183 51	183 52	183 59
Aluminum/FPM	Part No.	183 53	183 54	183 55	183 60

## Ultra Sealing Rings (Aluminum 3.2315.71)



Dimensional drawing for the ultra sealing rings

### Technical Data

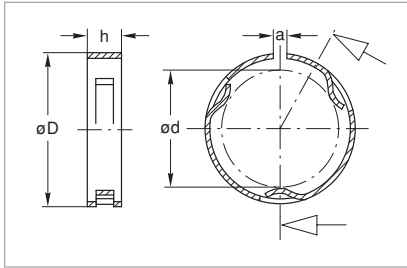
DN	ISO-KF	10/16	20/25	32/40	50
d	mm	25.6	35.6	50.6	65.6
	in.	1.01	1.40	1.99	2.58
d <sub>1</sub>	mm	22.6	32.6	47.6	62.6
	in.	0.89	1.38	1.87	2.46
d <sub>2</sub>	mm	19.6	29.6	44.6	59.6
	in.	0.77	1.17	1.76	2.35
h	mm	4.5	4.5	4.5	4.5
	in.	0.18	0.18	0.18	0.18

### Ordering Information

Aluminum (set of 3 pieces)	Part No.	883 73	883 75	883 77	883 79
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**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Outer Support Rings (Stainless Steel 1.4310) for Ultra Sealing Rings



Dimensional drawing for the outer support rings

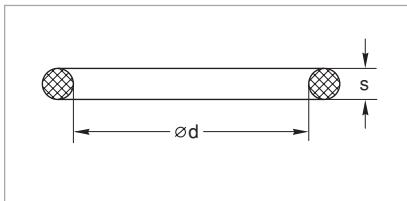
### Technical Data

DN	ISO-KF	10/16	20/25	32/40	50
a	mm	32	42	57	77
	in.	0.12	0.12	0.12	0.12
D	mm	32	42	57	77
	in.	1.26	1.65	2.24	3.03
d	mm	25	35	50	65
	in.	0.98	1.38	1.97	2.56
h	mm	7	7	7	7
	in.	0.28	0.28	0.28	0.28

### Ordering Information

Stainless steel	Part No.	883 74	883 76	883 78	883 69
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## Spare O-Ring Gaskets for KF Flange Connections



Dimensional drawing for the spare O-ring gaskets for KF flange connections

### Technical Data

DN	ISO-KF	10	16 <sup>1)</sup>	20	25 <sup>1)</sup>	32	40 <sup>1)</sup>	50
d	mm	15	18	25	28	40	42	55
	in.	0.59	0.71	0.98	1.10	1.57	1.65	2.17
s	mm	5	5	5	5	5	5	5
	in.	0.20	0.20	0.20	0.20	0.20	0.20	0.20

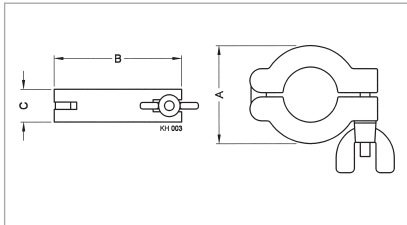
### Ordering Information

FPM (set of 10 pieces)

Part No.	210 600	210 605	210 610	210 615	210 620	210 625	210 630
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<sup>1)</sup> Also for adaptor/centering rings

## Clamping Rings (Aluminum 3.2582.05)



Dimensional drawing for the clamping rings

### Technical Data

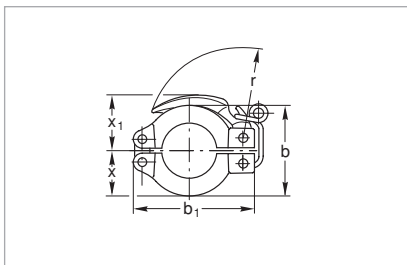
DN	ISO-KF	10/16	20/25	32/40	50
A	mm	45	55	70	95
	in.	1.77	2.17	2.76	3.74
B	mm	72	90	123	
	in.	2.40	2.83	3.54	4.84
C	mm	16	16	18	25
	in.	0.63	0.63	0.71	0.98

### Ordering Information

Aluminum	Part No.	183 41	183 42	183 43	183 45
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Max. torque at the wing nut: 2 Nm

## Quick Clamping Rings (Aluminum 3.2582.05)



Dimensional drawing for the quick clamping rings

### Technical Data

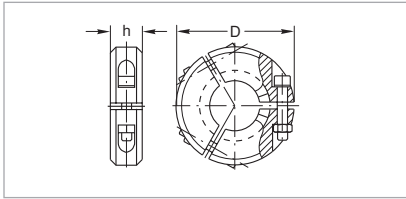
DN	ISO-KF	10/16	20/25	32/40
b	mm	45	55	70
	in.	1.77	2.17	2.76
b <sub>1</sub>	mm	61	72	90
	in.	2.40	2.83	3.54
r	mm	48	56	74
	in.	1.89	2.20	2.91
x	mm	22	27	35
	in.	0.87	1.06	1.38
x <sub>1</sub>	mm	30	34	44
	in.	1.18	1.34	1.73

### Ordering Information

Aluminum	Part No.	183 46	183 47	183 48
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**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Clamping Collars (Aluminum 3.2162.05) for Ultra Sealing Rings



Dimensional drawing for the clamping collars for ultra sealing rings

### Technical Data

DN	ISO-KF	10/16	20/25	32/40	50
D	mm	52	75	90	115
	in.	2.05	2.95	3.54	4.52
h	mm	18	20	23	28
	in.	0.71	0.79	0.90	1.10

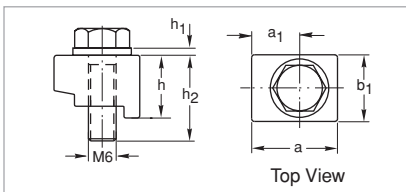
### Hexagon socket screw to DIN 912

mm	M 4 x 30	M 6 x 30	M 8 x 35	M 8 x 50
in.	M 4 x 1.18	M 6 x 1.18	M 8 x 1.38	M 8 x 1.97

### Ordering Information

Aluminum	Part No.	882 75	882 77	882 78	882 79
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## Claw, complete (Aluminum 3.2315.08)



Dimensional drawing for the claw, complete

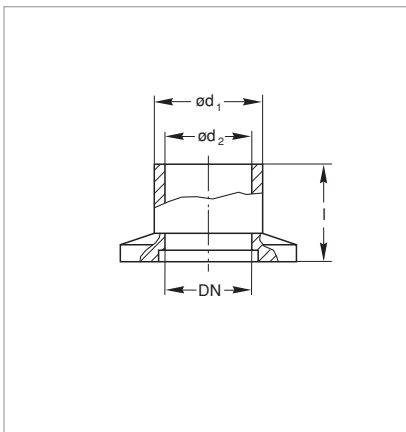
### Technical Data

DN	ISO-KF	10 - 50
a	mm	19.5
	in.	0.77
a <sub>1</sub>	mm	11.5
	in.	0.45
b <sub>1</sub>	mm	14.0
	in.	0.55
h	mm	12.5
	in.	0.49
h <sub>1</sub>	mm	1.6
	in.	0.06
h <sub>2</sub>	mm	20.0
	in.	0.79

### Ordering Information

Aluminum (Set of 4 pieces)	Part No.	885 00
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## KF Flanges with Short Tubulation (Steel 1.0037 / Stainless Steel 1.4301)



Dimensional drawing for the KF flanges with short tubulation

### Technical Data

DN	ISO-KF	10	16	25	40	50
d <sub>1</sub>	mm	16	20	30	45	55
	in.	0.63	0.79	1.18	1.77	2.17
d <sub>2</sub>	mm	12	16	26	41	51
	in.	0.47	0.63	1.02	1.61	2.01
l	mm	20	20	20	20	20
	in.	0.79	0.79	0.79	0.79	0.79

### Ordering Information

Steel	Part No.	182 31	182 32	182 33	182 34	182 35
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### Technical Data

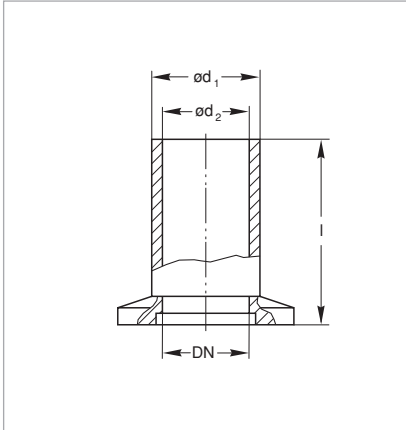
DN	ISO-KF	10	16	25	40	50
d <sub>1</sub>	mm	16	20	30	45	54
	in.	0.63	0.79	1.18	1.77	2.13
d <sub>2</sub>	mm	12	16	26	41	50
	in.	0.47	0.63	1.02	1.61	1.97
l	mm	20	20	20	20	20
	in.	0.79	0.79	0.79	0.79	0.79

### Ordering Information

Stainless steel	Part No.	866 31	866 32	866 33	866 34	866 35
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**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## KF Flanges with Long Tubulation (Steel 1.0037 / Stainless Steel 1.4301)



Dimensional drawing for the KF flanges with long tubulation

### Technical Data

DN	ISO-KF	10	16	25	40	50
$d_1$	mm	16	20	30	45	55
	in.	0.63	0.79	1.18	1.77	2.17
$d_2$	mm	12	16	26	41	51
	in.	0.47	0.63	1.02	1.61	2.01
$l$	mm	70	70	70	70	70
	in.	2.76	2.76	2.76	2.76	2.76

### Ordering Information

Steel	Part No.	182 81	182 82	182 83	182 84	182 85
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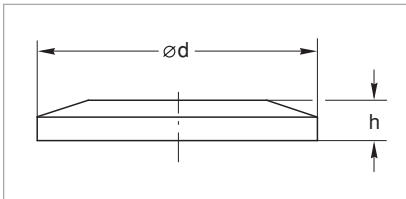
### Technical Data

DN	ISO-KF	10	16	25	40	50
$d_1$	mm	16	20	30	45	54
	in.	0.63	0.79	1.18	1.77	2.13
$d_2$	mm	12	16	26	41	50
	in.	0.47	0.63	1.02	1.61	1.97
$l$	mm	70	70	70	70	70
	in.	2.76	2.76	2.76	2.76	2.76

### Ordering Information

Stainless steel	Part No.	866 81	866 82	866 83	866 84	866 85
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## Blank Flanges (Aluminum 3.2315.71 / Stainless Steel 1.4301)



Dimensional drawing for the blank flanges

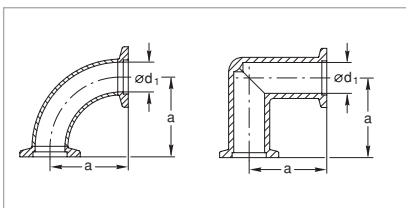
### Technical Data

DN	ISO-KF	10	16	25	40	50
$d$	mm	30	30	40	55	75
	in.	1.18	1.18	1.57	2.17	2.95
$h$	mm	5	5	5	5	6
	in.	0.20	0.20	0.20	0.20	0.24

### Ordering Information

Aluminum	Part No.	184 41	184 46	184 47	184 48	184 45
Stainless steel	Part No.	884 41	884 36	884 37	884 38	884 45

## Pipe Bend 90° (Stainless Steel 1.4301) / Mitred Elbow 90° (Aluminum 3.2315.08)



Dimensional drawings for the elbows 90° (stainless steel, left) and the mitred elbows 90° (aluminum, right)

### Technical Data

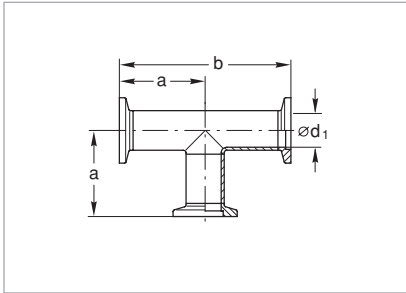
DN	ISO-KF	16	25	40	50		
$a$	mm	40	50	65	70		
	in.	1.57	1.97	2.56	2.76		
$d_1$	mm	16	15	25	39	40.5	49
	in.	0.63	0.59	0.98	1.34	1.59	1.93
Conductance	l/s	6.5	-	18.9	-	56.5	-

### Ordering Information

Aluminum	Part No.	184 36	-	184 37	-	184 38	-	-
Stainless steel	Part No.	-	884 61	-	884 62	-	884 64	884 65

**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

### Tees (Aluminum 3.2315.08 / Stainless steel 1.4301)



Dimensional drawing for the tees

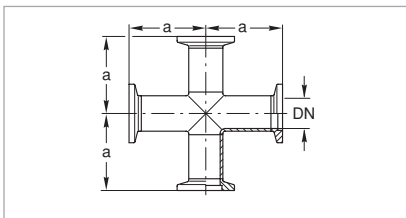
#### Technical Data

DN	ISO-KF	16	25	40	50			
a	mm	40	50	65	70			
	in.	1.57	1.97	2.56	2.76			
b	mm	80	100	130	140			
	in.	3.15	3.94	5.12	5.51			
d <sub>1</sub> (Aluminum)	mm	16	25	39	-			
	in.	0.63	0.98	1.54	-			
d <sub>1</sub> (Stainless steel)	mm	16	25	40.5	53			
	in.	0.63	0.98	1.59	2.09			
Conductance	l/s	6.5	-	18.9	-	56.5	-	-

#### Ordering Information

Aluminum	Part No.	<b>184 06</b>	-	<b>184 07</b>	-	<b>184 08</b>	-	-
Stainless steel	Part No.	-	<b>884 71</b>	-	<b>884 72</b>	-	<b>884 74</b>	<b>884 75</b>

### 4-Way Crosses (Aluminum 3.2315.08 / Stainless 1.4301)



Dimensional drawing for the 4-way crosses

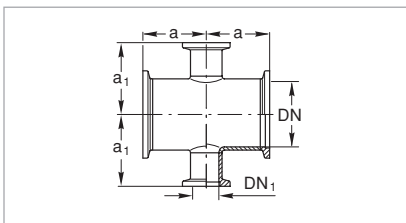
#### Technical Data

DN	ISO-KF	16	25	40	50			
a	mm	40	50	65	70			
	in.	1.57	1.97	2.56	2.67			
Conductance	l/s	6.5	-	18.9	-	56.5	-	-

#### Ordering Information

Aluminum	Part No.	<b>184 71</b>	-	<b>184 74</b>	-	<b>184 75</b>	-	-
Stainless steel	Part No.	-	<b>884 85</b>	-	<b>884 86</b>	-	<b>884 87</b>	<b>884 88</b>

### 4-Way Reducer Crosses with DN 16 Flanges (Aluminum 3.2315.08 / Stainless steel 1.4301)



Dimensional drawing for the 4-way reducer crosses with lateral DN 16 flanges

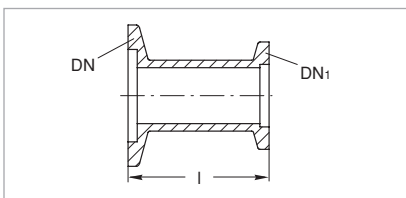
#### Technical Data

DN/DN <sub>1</sub>	ISO-KF	25/16	40/16	50/16
a	mm	35	40	50
	in.	1.38	1.57	1.97
a <sub>1</sub>	mm	35	45	50
	in.	1.38	1.77	1.97

#### Ordering Information

Aluminum	Part No.	<b>184 57</b>	<b>184 58</b>	-
Stainless steel	Part No.	<b>884 96</b>	<b>884 97</b>	<b>884 98</b>

### Reducers (Aluminum 3.2315.72 / Stainless Steel 1.4305)



Dimensional drawing for the reducers

#### Technical Data

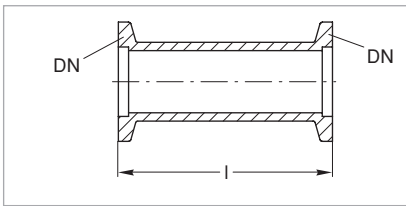
DN/DN <sub>1</sub>	ISO-KF	25/16	40/16	40/25	50/40
l	mm	40	40	40	40
	in.	1.57	1.57	1.57	1.57

#### Ordering Information

Aluminum	Part No.	<b>183 86</b>	<b>183 89</b>	<b>183 87</b>	<b>183 88</b>
Stainless steel	Part No.	<b>885 04</b>	<b>885 07</b>	<b>885 05</b>	<b>885 06</b>

**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Intermediate Pieces (Aluminum 3.2315.72 / Stainless Steel 1.4301)



Dimensional drawing for the intermediate pieces

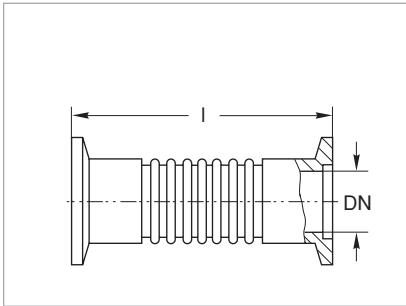
### Technical Data

DN	ISO-KF	16	25	40
l	mm	80	100	130
	in.	3.15	3.94	5.12

### Ordering Information

Aluminum	Part No.	184 80	184 81	184 82
Stainless steel	Part No.	884 17	884 18	884 19

## Bellows (Stainless Steel 1.4571) with Flanges (Stainless Steel 1.4301)



Dimensional drawing for the bellows with flanges

### Technical Data

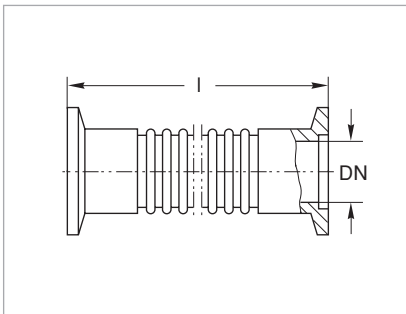
DN	ISO-KF	16	25	40	50
l	mm	70	80	100	100
	in.	2.76	3.15	3.94	3.94
Wall thickness	mm	0.13	0.13	0.15	0.2
	in.	0.005	0.005	0.006	0.008
max. extension, axial	mm	10.5	13	18	16
	in.	0.41	0.51	0.71	0.63
Compression	mm	6.5	8	11	10
	in.	0.26	0.31	0.43	0.39
Tension	mm	4	5	7	6
	in.	0.16	0.20	0.28	0.24
max. angle	degrees <sup>1)</sup>	± 21	± 17	± 15	± 15
Lateral motion	mm	± 4	± 3.5	± 7	± 8
	in.	± 0.16	± 0.14	± 0.28	± 0.31

### Ordering Information

Stainless steel	Part No.	872 41	872 43	872 45	872 46
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<sup>1)</sup> When utilizing the maximum bending angle, no extension along the axial axis will be possible!

## Vacuum Hoses <sup>1)</sup> with Flanges (Stainless Steel 1.4571)



Dimensional drawing for the vacuum hoses with flanges

### Technical Data

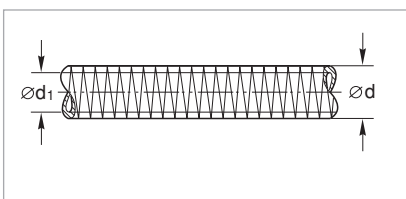
DN	ISO-KF	16	25	40	50
Max. bending radius (inside) with multiple bending	mm	68.5	103.0	129.0	198.0
	in.	2.70	4.06	5.08	7.80
with single bend	mm	50	63	100	130
	in.	1.97	2.48	3.94	5.12
Wall thickness	mm	0.2	0.2	0.2	0.3
	in.	0.008	0.008	0.008	0.01

### Ordering Information

l = 250 mm ( 9.84 in.)	Part No.	867 81	867 83	867 85	867 86
l = 500 mm (19.69 in.)	Part No.	867 91	867 93	867 95	867 96
l = 750 mm (29.53 in.)	Part No.	867 41	867 43	867 45	867 46
l = 1000 mm (39.37 in.)	Part No.	868 01	868 03	868 05	868 06

<sup>1)</sup> Flexible vacuum hoses must be linked to an external mechanical assembly

## PVC Coiled Vacuum Hoses without Flanges



Dimensional drawing for the PVC vacuum hoses

### Technical Data

DN	ISO-KF	16	25	40
d	mm	23	33	53
	in.	0.91	1.30	2.09
d <sub>1</sub>	mm	16	25	40
	in.	0.63	0.98	1.57
Length	m	by the metre	by the metre	by the metre

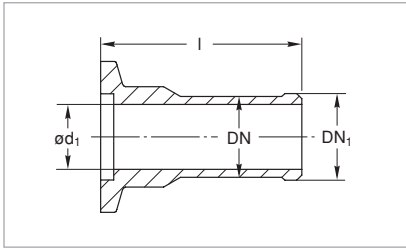
### Ordering Information

PVC coiled vacuum hose	Part No.	172 41	172 42	172 43
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**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.



## KF Flanges with Hose Nozzle (Aluminum 3.0615.71)



Dimensional drawing for the KF flanges with hose nozzle

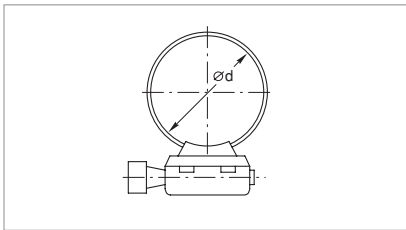
### Technical Data

DN	ISO-KF	16	25	40
DN <sub>1</sub> (tube)	mm	17	26	41
	in.	0.67	1.02	1.61
l	mm	40	40	40
	in.	1.57	1.57	1.57
d <sub>1</sub>	mm	13	22	37
	in.	0.51	0.87	1.46

### Ordering Information

Aluminum	Part No.	182 45	182 46	182 47
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## Hose Clamps (Stainless Steel 1.4301)



Dimensional drawing for the hose clamps

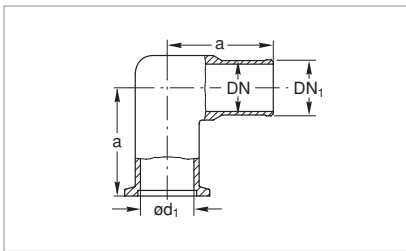
### Technical Data

DN	ISO-KF	16	25	40
d (min. / max.)	mm	13 / 32	19 / 44	29 / 76
	in.	0.51 / 1.26	0.75 / 1.73	1.14 / 2.99

### Ordering Information

Stainless steel	Part No.	866 21	866 22	866 23
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## Elbows 90° with Hose Nozzle (Aluminum 3.2381.02)



Dimensional drawing for the elbows 90° with hose nozzle

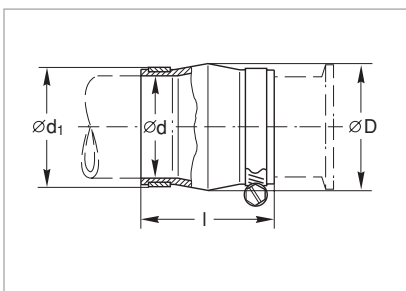
### Technical Data

DN	ISO-KF	16	25	40
DN <sub>1</sub> (tube)	mm	17	26	41
	in.	0.67	1.02	1.61
a	mm	40	50	65
	in.	1.57	1.97	2.56
d1	mm	16	25	39
	in.	0.63	0.98	1.54

### Ordering Information

Aluminum	Part No.	182 15	182 16	182 17
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## CR Compensation Elements with Integrated Support Ring



Dimensional drawing for the compensation elements with integrated support ring

### Technical Data

DN	ISO-KF	16	25	40
D	mm	44	50	68
	in.	1.73	1.97	2.68
d (tube tolerance)	mm	16	25	40
	in.	0.63	0.98	1.57
d <sub>1</sub>	mm	24	33	48
	in.	0.94	1.30	1.89
l	mm	58	60	64
	in.	2.28	2.36	2.52

Leak rate mbar x l x s <sup>-1</sup>	≤ 1 x 10 <sup>-5</sup>	≤ 1 x 10 <sup>-5</sup>	≤ 1 x 10 <sup>-5</sup>
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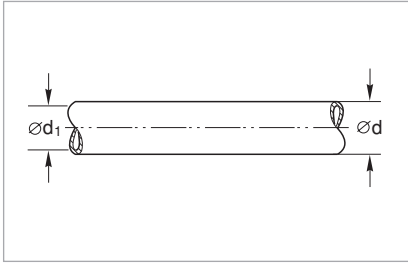
### Ordering Information

Stainless steel/CR	Part No.	182 78 <sup>1)</sup>	182 79 <sup>1)</sup>	182 80 <sup>1)</sup>
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<sup>1)</sup> Is supplied complete with stainless steel hose clamps

**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Rubber Vacuum Hoses (NR) for Hose Nozzles



Dimensional drawing for rubber vacuum hoses

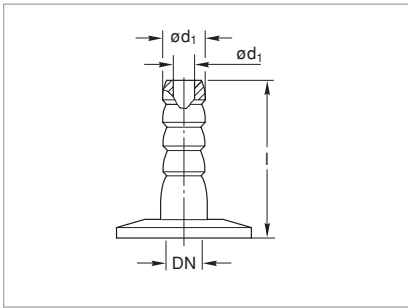
### Technical Data

DN	ISO-KF	10	16	20
d	mm	17	25	32
	in.	0.66	0.98	1.26
d <sub>1</sub>	mm	7	10	16
	in.	0.28	0.39	0.63
Length	m	by the metre	by the metre	by the metre
Hardness – Shore A –		55 ± 5	55 ± 5	55 ± 5
Temperature range	°C	-30 to +85	-30 to +85	-30 to +85
	°F	-22 to +185	-22 to +185	-22 to +185

### Ordering Information

Rubber vacuum hose	Part No.	172 02	172 03	172 04
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## KF Flanges with Hose Nozzles (Aluminum 3.0615.71 and Stainless Steel 1.4305)



Dimensional drawing for the KF flanges with hose nozzle

### Technical Data

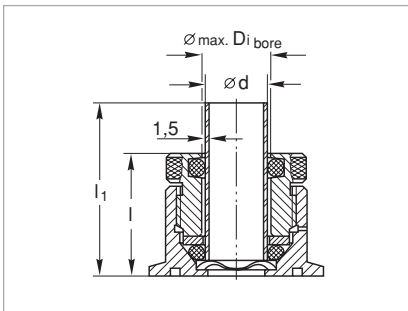
DN	ISO-KF	16	25	40
d	mm	12	12	12
	in.	0.47	0.47	0.47
d <sub>1</sub> <sup>1)</sup>	mm	7	7	7
	in.	0.26	0.26	0.26
l	mm	40	40	40
	in.	1.57	1.57	1.57

### Ordering Information

Aluminum	Part No.	182 90	182 91	182 92
Stainless steel	Part No.	885 14	885 08	885 09

<sup>1)</sup> Also recommended inside diameter for the hose

## KF Flanges with Compression Fitting for Glass/Metal/Plastic Tubes (Aluminum 3.0615 / FPM)



Dimensional drawing for the KF flanges with compression fitting

### Technical Data

DN	ISO-KF	10	40
b	mm	1.5	1.5
	in.	0.06	0.06
d (glass)	mm	10	26
	in.	0.39	1.02
l	mm	30	45
	in.	1.18	1.77
l <sub>1</sub>	mm	50	65
	in.	1.97	2.56
Di <sub>bore</sub> -max.	± 0.2 mm	11	27
	± 0.008 in.	0.43	1.06

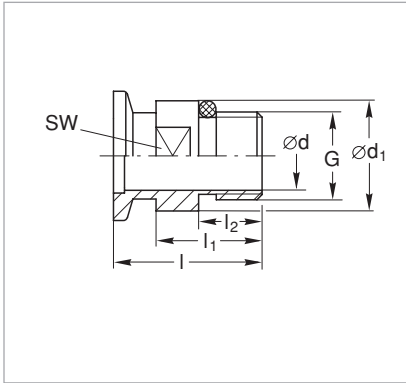
### Ordering Information

Compression Fitting	Part No.	184 61	184 66
Sealing set (FPM) for high temperatures (150 °C (302 °F)) (set = 10 pieces)	Part No.	105 94	-

Only for pressure ≤ 1000 mbar ( ≤ 750 Torr)

**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Screw-in Flanges (Stainless Steel 1.4305 / FPM)



Dimensional drawing for the screw-in flanges

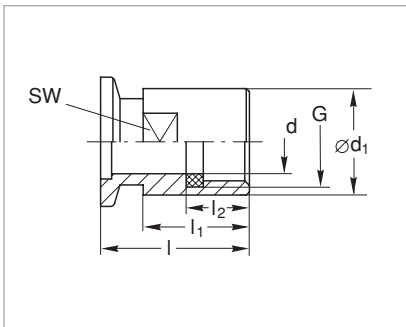
### Technical Data

DN	ISO-KF	10	16	16	25	16	40
l	mm	35	35	42	45	26	50
	in.	1.34	1.34	1.65	1.77	1.02	1.97
l <sub>1</sub>	mm	25	25	–	35	–	40
	in.	0.98	0.98	–	1.34	–	1.57
l <sub>2</sub>	mm	15	15	11,5	25	8	30
	in.	0.59	0.59	0.45	0.98	0.31	1.18
d	mm	12	16	5	25	5	41
	in.	0.47	0.63	0.20	0.98	0.20	1.61
d <sub>1</sub>	mm	22	26	–	39	–	54
	in.	0.87	1.02	–	1.54	–	2.13
G (according to DIN ISO 228-1)		3/8"	1/2"	M 16 x 1.5	1"	1/8"	1 1/2"
		3/8"	1/2"	M 16 x 0.06	1"	1/8"	1 1/2"
SW (width across flats)	mm	19	22	17	36	13	50
	in.	0.75	0.87	0.67	1.42	0.51	1.97

### Ordering Information

Stainless steel	Part No.	<b>886 30</b>	<b>886 31</b>	–	<b>886 32</b>	–	<b>886 33</b>
Stainless steel 1.4571	Part No.	–	–	–	–	<b>160 26</b>	–
Nickel-plated steel	Part No.	–	–	<b>168 40</b>	–	–	–

## Screw-on Flanges (Stainless Steel 1.4305 / FPM)



Dimensional drawing for the screw-on flanges

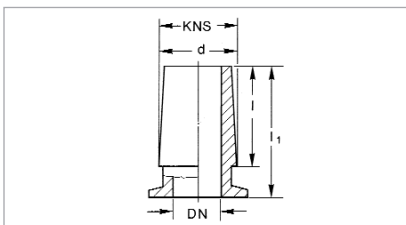
### Technical Data

DN	ISO-KF	10	16	25	40
l	mm	35	35	45	50
	in.	1.34	1.34	1.77	1.97
l <sub>1</sub>	mm	25	25	35	40
	in.	0.98	0.98	1.34	1.57
l <sub>2</sub>	mm	15	15	25	30
	in.	0.59	0.59	0.98	1.18
d	mm	10	15	24	38
	in.	0.39	0.59	0.94	1.50
d <sub>1</sub>	mm	20	25	39	54
	in.	0.79	0.98	1.54	2.13
G (according to DIN ISO 228-1)		3/8"	1/2"	1"	1 1/2"
SW (width across flats)	mm	17	21	36	50
	in.	0.67	0.83	1.42	1.97

### Ordering Information

Stainless steel	Part No.	<b>884 25</b>	<b>884 26</b>	<b>884 27</b>	<b>884 28</b>
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## ISO-KF Flanges with Ground Cone (Stainless Steel 1.4301)



Dimensional drawing for the KF flanges with ground cone

### Technical Data

DN	ISO-KF	16	25	40
KNS - d / l	mm	19 / 26	29 / 32	45 / 40
	in.	0.75 / 1.02	1.14 / 1.26	1.77 / 1.57
l <sub>1</sub>	mm	40	45	55
	in.	1.57	1.77	2.17
Taper		1:10	1:10	1:10

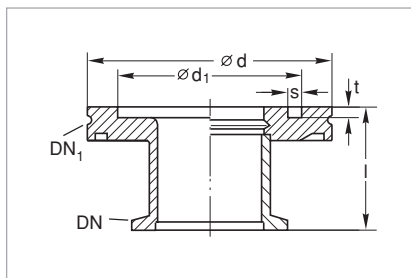
### Ordering Information

Stainless steel	Part No.	<b>184 87</b>	<b>184 85</b>	<b>184 86</b>
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**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

# Adaptors

## Adaptors/Reducers ISO-KF – ISO-K



Dimensional drawing for the adaptor reducers ISO-KF – ISO-K; left: aluminum; right: stainless steel

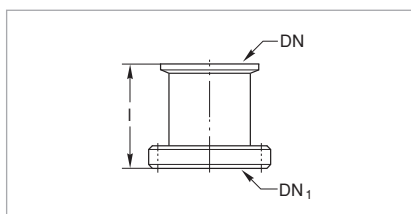
### Technical Data

DN	ISO-KF	40	50	40
DN <sub>1</sub>	ISO-K	63	63	100
d <sub>1</sub>	mm	70	70	102
	in.	2.76	2.76	4.02
l	mm	40	45	40
	in.	1.57	1.77	1.57
s	mm	5	5	5
	in.	0.2	0.2	0.2
t	mm	4.5	4.5	4.5
	in.	0.18	0.18	0.18
Weight	kg	0.5	0.6	0.8
	lbs	1.10	1.32	1.77

### Ordering Information

Stainless steel 1.4301	Part No.	<b>887 40</b>	<b>887 41</b>	<b>887 42</b>
Aluminum 3.2315.71	Part No.	<b>269 40</b>	<b>269 41</b>	–

## Adaptors ISO-KF – CF (Stainless Steel 1.4301)



Dimensional drawing for the adaptors CF – ISO-KF

### Technical Data

DN	ISO-KF	16	16	25	25	40
DN <sub>1</sub>	CF	16	40	16	40	40
or	inch	1 5/16"	2 3/4"	1 5/16"	2 3/4"	2 3/4"
l	mm	35	30	35	30	50
	in.	1.38	1.18	1.38	1.18	2.17

### Ordering Information

Stainless steel 1.4301	Part No.	<b>837 81</b>	<b>837 82</b>	<b>837 83</b>	<b>837 84</b>	<b>837 36</b>
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## Copper Gaskets for CF-Flanges (OFHC-Copper - Oxygen-Free)

### Technical Data

DN	CF	16	40	63	100	160	200	250
Set of 10		x	x	x	x	x	x	–
Set of 5		–	–	–	–	–	–	x
Inside diameter	mm	16.2	39.0	63.6	101.8	152.6	203.4	254.0
	in.	0.64	1.54	2.5	4.0	6.0	8.0	10.0

### Ordering Information

OFHC Copper	Part No.	<b>839 41</b>	<b>839 43</b>	<b>839 44</b>	<b>839 45</b>	<b>839 46</b>	<b>839 47</b>	<b>839 48</b>
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## FPM Gaskets for CF-Flanges

### Technical Data

DN	CF	16	40	63	100	160	200	250
Set of 5		x	x	–	–	–	–	1 FPM O-ring with Support Ring
Profile seal, set of 2		–	–	x	x	x	x	–
Gasket with support ring		–	–	–	–	–	–	x
Degassing temperature								
	°C	160	160	160	160	160	160	160
	°F	320	320	320	320	320	320	320

### Ordering Information

FPM	Part No.	<b>839 21</b>	<b>839 23</b>	<b>839 34</b>	<b>839 35</b>	<b>839 36</b>	<b>839 37</b>	<b>839 03</b>
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**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Bolts, Nuts and Washers for CF-Flanges

### Technical Data

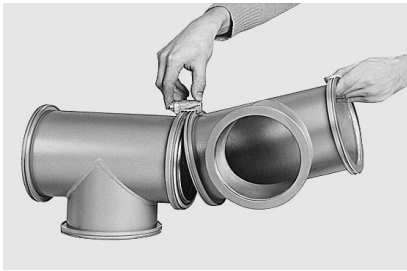
DN	CF	16	40	63/100	160	200/250
Dimensions (d x l)	mm	M 4 x 20	M 6 x 35	M 8 x 50	M 8 x 55	M 8 x 60
	in.	M 4 x 0.79	M 6 x 1.38	M 8 x 1.97	M 8 x 2.17	M 8 x 2.36
Torque	Nm	4	10	20	20	20
Quantity per set						
	Bolts	25	25	25	25	25
	Nuts	25	25	25	25	25
	Washers	25	25	25	25	25

### Ordering Information

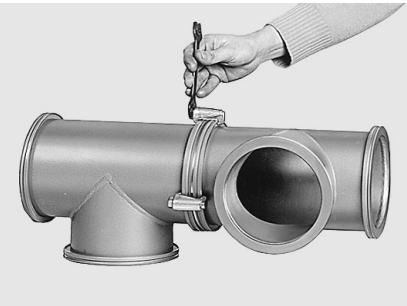
Set	Part No.	839 00	839 01	839 04	839 05	839 07

**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

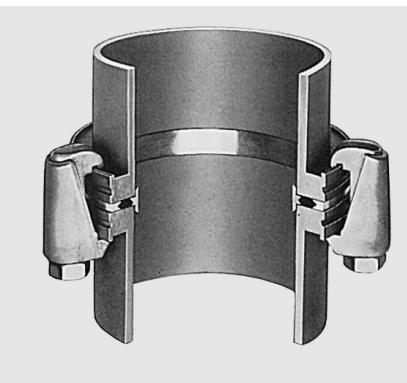
# (ISO-K) Clamp Flange Fittings and Components



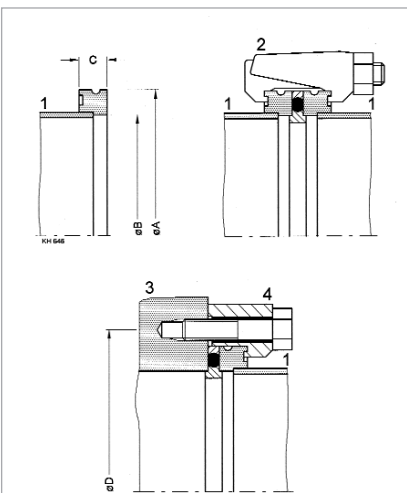
Attaching a clamp flange component and fitting of the clamp



Tightening the clamping bolt



ISO-K clamp flange connection



- 1 Clamp flange
- 2 Claw
- 3 Base plate
- 4 Claw

## Flange Components DN 63 to DN 630 ISO-K (to DIN 28 404 in line with ISO 1609/3669)

The clamp flange connection was introduced to the vacuum industry by Oerlikon Leybold Vacuum. Since the fitting of clamp flanges does not depend on any bolt holes in the flange, these components may be installed in any orientation.

### Advantages to the User

- Quick to fit
- Safe and reliable
- Can be turned in any direction
- Easy to disassemble, thus easy to clean
- Suitable for pressures down to  $10^{-7}$  mbar ( $0.75 \times 10^{-7}$  Torr) when using O-rings and down to  $10^{-9}$  mbar ( $0.75 \times 10^{-9}$  Torr) when using metal gaskets
- Easily adaptable to other flange systems
- Mounted by means of clamps (ISO-K) or collar flange with retaining ring (ISO-F, DIN 2501)
- Clamp flange components are used with CR or FPM gaskets or with ultra sealing disks made of aluminum

- Degassing temperatures
  - for CR, max. 100 °C
  - for FPM, max. 150 °C
  - for the ultra sealing disk, max. 200 °C

The pressure range for the application depends in each case on the sealing method which is used and is thus limited for ultra sealing disks to  $10^{-9}$  mbar ( $0.75 \times 10^{-9}$  Torr), for FPM gaskets to  $10^{-8}$  mbar ( $0.75 \times 10^{-8}$  Torr) and for CR sealed components to  $10^{-7}$  mbar ( $0.75 \times 10^{-7}$  Torr).

### Flexible Compensation Elements (CR)

Vacuum systems and pump systems often require components which are capable of protecting sensitive instruments against impacts or excessive vibrations while linking tubes at the same time.

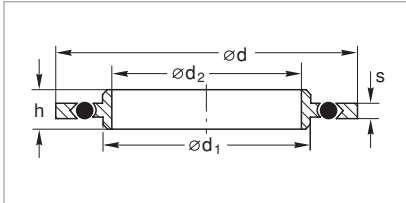
### Advantages to the User

- Easy and quick to install
- Safe and reliable
- Tubes may be turned in any direction
- No centering ring and sealing ring is needed since the seal is provided by the smooth tube surface
- Capable of withstanding temperatures up to 100 °C (212 °F)
- Suitable for pressures down to  $10^{-5}$  mbar ( $0.75 \times 10^{-5}$  Torr)

### Technical Data

Nominal diameter		A	B	C	Number of clamps	D	Screws for claws	Number of claws
DN 63 ISO-K	mm	95	70	12	4	110	M 8 x 35	4
	in.	3.74	2.76	0.47				
DN 100 ISO-K	mm	130	102	12	4	145	M 8 x 35	8
	in.	5.12	4.02	0.47				
DN 160 ISO-K	mm	180	153	12	4	200	M 10 x 35	8
	in.	7.09	6.02	0.47				
DN 200 ISO-K	mm	240	213	12	6	260	M 10 x 35	12
	in.	9.45	8.39	0.47				
DN 250 ISO-K	mm	290	261	12	6	310	M 10 x 35	12
	in.	11.42	10.28	0.47				
DN 320 ISO-K	mm	370	318	17	8	395	M 12 x 50	12
	in.	14.57	12.52	0.67				
DN 400 ISO-K	mm	450	400	17	8	480	M 12 x 50	16
	in.	17.72	15.75	0.67				
DN 500 ISO-K	mm	550	501	17	12	580	M 12 x 50	16
	in.	21.65	19.72	0.67				
DN 630 ISO-K	mm	690	651	22	12	720	M 12 x 55	20
	in.	17.17	25.63	0.87				

## Centering Rings (Aluminum / Stainless Steel) with O-Ring (NBR)



Dimensional drawing for the centering rings with O-ring

### Technical Data

DN	ISO-K	63	100	160	200	250	320
d	mm	96	128	179	239	287	358
	in.	2.76	4.02	6.02	8.39	10.28	12.52
d <sub>1</sub>	mm	70	102	153	213	261	318
	in.	2.64	3.9	5.91	8.27	10.16	12.32
d <sub>2</sub>	mm	67	99	150	210	258	313
	in.	2.64	3.9	5.91	8.27	10.16	12.32
h	mm	8	8	8	8	8	14
	in.	0.31	0.31	0.31	0.31	0.31	0.55
s	mm	3.9	3.9	3.9	3.9	3.9	5.6
	in.	0.15	0.15	0.15	0.15	0.15	0.22

### Ordering Information

Aluminum/FPM	Part No.	<b>268 41</b>	<b>268 42</b>	<b>268 43</b>	<b>268 44</b>	<b>268 45</b>	<b>268 46</b>
Aluminum/CR	Part No.	<b>268 05</b>	<b>268 06</b>	<b>268 09</b>	<b>268 19</b>	<b>268 17</b>	<b>268 18</b>
Stainless steel/FPM	Part No.	<b>887 03</b>	<b>887 04</b>	<b>887 07</b>	<b>887 02</b>	<b>887 08</b>	-

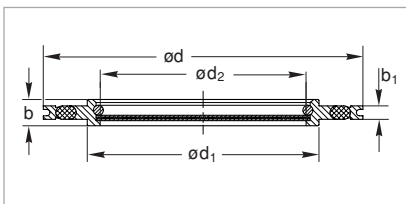
### Technical Data

DN	ISO-K	400	500	630	800	1000
d	mm	440	541	691	840	1040
	in.	17.32	21.9	27.2	33.07	40.94
d <sub>1</sub>	mm	400	501	651	800	1000
	in.	15.75	19.72	25.65	31.5	39.37
d <sub>2</sub>	mm	395	496	646	795	995
	in.	15.55	19.53	25.43	31.18	39.17
h	mm	14	14	14	14	14
	in.	0.55	0.55	0.55	0.55	0.55
s	mm	5.6	5.6	5.6	5.6	5.6
	in.	0.22	0.22	0.22	0.22	0.22

### Ordering Information

Aluminum/FPM	Part No.	<b>268 47</b>	<b>268 48</b>	<b>268 49</b>	<b>268 50</b>	-
Aluminum/CR	Part No.	<b>268 14</b>	<b>268 15</b>	<b>268 16</b>	-	-

## Centering Rings with Fine Filter (Stainless Steel 1.4301), O-Ring (FPM)



Dimensional drawing for the centering rings with fine filter

### Technical Data

DN	ISO-K	63	100
b	mm	8	8
	in.	0.31	0.31
b <sub>1</sub>	mm	4	4
	in.	0.16	0.16
d	mm	96	128
	in.	3.78	5.04
d <sub>1</sub>	mm	70	102
	in.	2.76	4.02
d <sub>2</sub>	mm	62	94
	in.	2.44	3.7

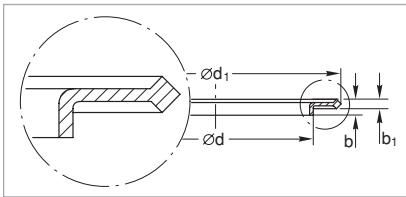
### Ordering Information

Stainless steel	Part No.	<b>887 20</b>	<b>887 21</b>
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Filter material: Stainless steel 1.4404, size of pores: 4 µm, separation grade: 1 µm particles to 98%

**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Ultra Sealing Disks (Aluminum 3.2315.70) <sup>1)</sup>



Dimensional drawing for the ultra sealing disks

### Technical Data

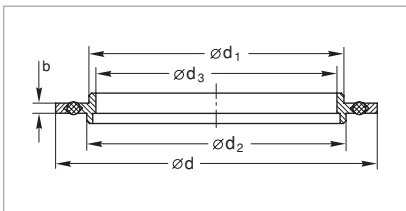
DN	ISO-K / ISO-F	63	100	160	250
b	mm	4.5	4.5	4.5	4.5
	in.	0.18	0.18	0.18	0.18
b <sub>1</sub>	mm	2.6	2.6	2.6	2.6
	in.	0.10	0.10	0.10	0.10
d	mm	69.8	101.8	152.8	260.8
	in.	2.75	4.01	6.02	10.27
d <sub>1</sub>	mm	85.6	116.6	166.6	276.6
	in.	3.37	4.59	6.56	10.89

### Ordering Information

Aluminum	Part No.	886 24	886 25	886 26	886 27
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<sup>1)</sup> Only for collar ring connections

## Centering Ring Adaptors (Aluminum) with O-Ring (FPM), ISO-K to LF Standard



Dimensional drawing for the centering ring adaptors with O-ring

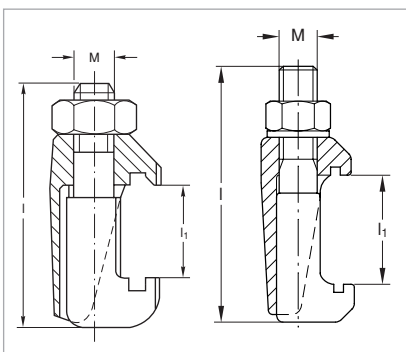
### Technical Data

DN	ISO-K / LF	100 / 100	160 / 150	250 / 250
b	mm	4	4	4
	in.	0.16	0.16	0.16
d	mm	126	177	285
	in.	4.96	6.97	11.22
d <sub>1</sub>	mm	100	150	250
	in.	3.94	5.91	9.84
d <sub>2</sub>	mm	102	153	261
	in.	4.02	6.02	10.28
d <sub>3</sub>	mm	95	145	244
	in.	3.74	5.71	9.61

### Ordering Information

Aluminum/FPM	Part No.	105 25	105 35	105 45
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## Clamps for ISO-K



Dimensional drawing for the clamps, right: Part No. 210 061

### Technical Data

DN	ISO-K	63 / 250	63 / 250	320 / 500	630	320 / 630
Number of required clamps per connection		4 / 6	4 / 6	8 / 12	12	8 / 12
M	thread	M 10	M 10	M 12	M 12	M 12
	mm	60	68	78	88	82.5
l	in.	2.36	2.68	3.07	3.46	3.25
	mm	17 to 27	25 to 35	27 to 39	31 to 49	29 to 47
l <sub>1</sub>	in.	0.67 to 1.06	0.98 to 1.38	1.06 to 1.54	1.22 to 1.93	1.14 to 1.85

### Ordering Information

1 set = 4 clamps

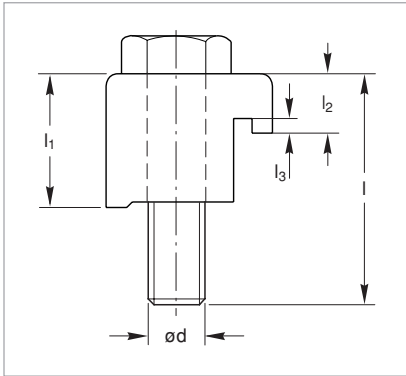
Galvanized steel 1.1181	Part No.	267 01	267 02	267 10	267 11	-
Stainless steel 1.4401	Part No.	887 99	-	-	-	210 061

Exact numbers of clamps see first page of the section "(ISO-K) Clamp Flange Fittings and Components"

**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.



## Claws (Galvanized Steel 1.1181) for ISO-K



Dimensional drawing for the claws for ISO-K

### Technical Data

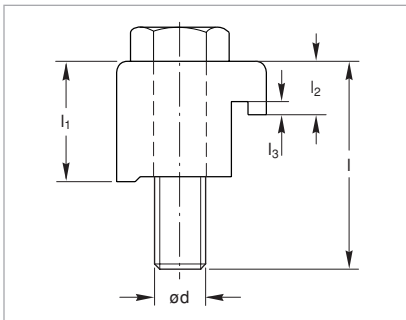
DN	ISO-K	63 / 100	160 / 250	320 / 500	630
Number of required claws per connection		4 / 8	8 / 12	12 / 16	20
d	thread	M 8	M 10	M 12	M 12
l	mm	35	35	50	55
	in.	1.38	1.38	1.97	2.17
l <sub>1</sub>	mm	22.5	23	36.5	41.5
	in.	0.89	0.91	1.44	1.63
l <sub>2</sub>	mm	8.6	9.1	15.9	16
	in.	0.34	0.36	0.63	0.63
l <sub>3</sub>	mm	2.5	2.5	2.5	2.5
	in.	0.10	0.10	0.10	0.10

### Ordering Information

1 set = 4 claws	Part No.	268 25	268 26	268 27	268 28
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Exact numbers of clamps see first page of the section "(ISO-K) Clamp Flange Fittings and Components"

## Claws for Sealing Groove in Base Plate (Galvanized Steel 1.1181) for ISO-K



Dimensional drawing for the claws for sealing groove

### Technical Data

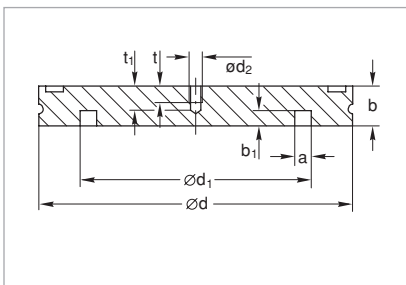
DN	ISO-K	63 / 100	160 / 250	320 / 500
d	thread	M 8	M 10	M 12
l	mm	30	35	45
	in.	1.18	1.38	1.77
l <sub>1</sub>	mm	18.6	19	31
	in.	0.73	0.75	1.22
l <sub>2</sub>	mm	8.6	9.0	16.0
	in.	0.34	0.35	0.63
l <sub>3</sub>	mm	2.5	2.5	2.5
	in.	0.10	0.10	0.10

### Ordering Information

1 set = 4 claws	Part No.	268 76	268 77	268 78
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Exact numbers of clamps see first page of the section "(ISO-K) Clamp Flange Fittings and Components"

## Blank Flanges (Nickel-Plated Steel 1.0037 / Stainless Steel 1.4301)



Dimensional drawing for the blank flanges

### Technical Data

DN	ISO-K	63	100	160	200	250	320	400	500	630
a	mm	5	5	5	5	5	5	5	5	5
	in.	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
b	mm	12	12	12	12	12	17	17	17	22
	in.	0.47	0.47	0.47	0.47	0.47	0.67	0.67	0.67	0.87
b <sub>1</sub>	mm	4.5	4.5	4.5	4.5	4.5	6.5	6.5	6.5	6.5
	in.	0.18	0.18	0.18	0.18	0.18	0.26	0.26	0.26	0.26
d	mm	95	130	180	240	290	370	450	550	690
	in.	3.74	5.12	7.09	9.45	11.42	14.57	17.72	21.65	27.17
d <sub>1</sub>	mm	70	102	153	213	261	318	400	501	651
	in.	2.76	4.02	6.02	8.39	10.28	12.52	15.75	19.72	25.63
d <sub>2</sub>	thread	M 8	M 8	M 8	M 8	M 8	M 8	M 8	M 8	M 8
t	mm	8	8	8	8	8	8	8	8	8
	in.	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
t <sub>1</sub>	mm	12	12	12	12	12	12	12	12	12
	in.	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47

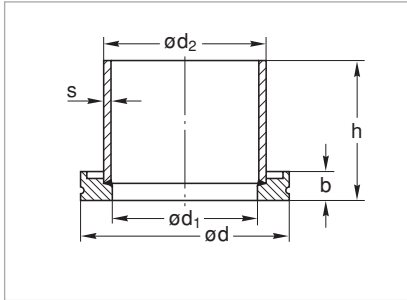
### Ordering Information

Nickel-plated steel										
Part No.	269 47	269 48	269 49	-	269 56	-	-	-	-	-
Stainless steel										
Part No.	887 55	887 56	887 57	887 54	887 58	887 59	887 60	887 61	887 62	

M 8 threaded bore from nominal size DN 500

**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Clamp Flanges with Tubulation (Steel 1.0831, 1.0308 / Stainless Steel 1.4301)



Dimensional drawing for the clamp flanges with tubulation

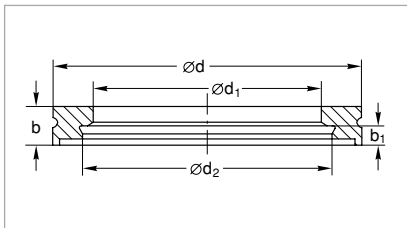
### Technical Data

DN	ISO-K	63	100	160	200	250	320	400	500	630
d	mm	95	130	180	240	290	370	450	550	690
	in.	3.74	5.12	7.09	9.45	11.42	14.57	17.72	21.65	27.17
d <sub>1</sub>	mm	70	102	153	213	261	318	400	501	651
	in.	2.76	4.02	6.02	8.39	10.28	12.52	15.75	19.72	25.63
d <sub>2</sub>	mm	76.1	108	159	219.1	267	324	406	508	660
	in.	3.00	4.25	6.26	8.63	10.51	12.76	15.98	20.00	25.98
d	mm	100	100	100	100	100	100	100	100	100
	in.	3.94	3.94	3.94	3.94	3.94	3.94	3.94	3.94	3.94
s (steel)	mm	2.9	2.9	2.9	-	3	3	3	4	5
	in.	0.11	0.11	0.11	-	0.12	0.12	0.12	0.16	0.20
s (stainless steel)	mm	2.3	2	2	3	3	3	3	4	5
	in.	0.09	0.08	0.08	0.12	0.12	0.12	0.12	0.16	0.20
b	mm	12	12	12	12	12	17	17	17	22
	in.	0.47	0.47	0.47	0.47	0.47	0.67	0.67	0.67	0.87

### Ordering Information

Steel	Part No.	269 04	269 05	269 06	-	269 17	-	-	-	-
Stainless steel	Part No.	886 40	886 41	886 42	886 43	887 18	887 19	886 46	-	886 48

## Welding Flanges



Dimensional drawing for the welding flanges

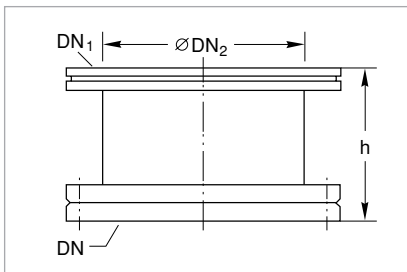
### Technical Data

DN	ISO-K	63	100	160	200	250
b	mm	12	12	12	12	12
	in.	0.47	0.47	0.47	0.47	0.47
b <sub>1</sub>	mm	6	6	6	6	6
	in.	0.24	0.24	0.24	0.24	0.24
d	mm	95	130	180	240	290
	in.	3.74	5.12	7.09	9.45	11.42
d <sub>1</sub>	mm	70	102	153	213	261
	in.	2.76	4.02	6.02	8.39	10.28
d <sub>2</sub>	mm	76.6	108.7	159.8	219.8	267.8
	in.	3.02	4.28	6.29	8.65	10.54

### Ordering Information

Steel 1.0831	Part No.	269 61	269 62	269 63	-	269 65
Stainless steel 1.4301	Part No.	886 61	886 62	886 63	886 64	886 65

## Adaptors ISO-K - CF



Dimensional drawing for the adaptors ISO-K - CF

### Technical Data

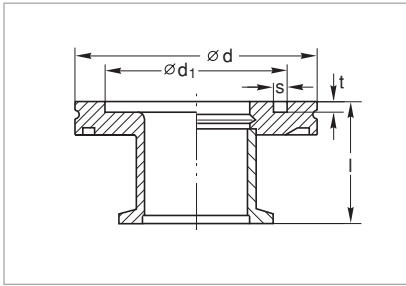
DN	CF	63	100	160
o. D.	inch	4 1/2"	6"	8"
DN <sub>1</sub>	ISO-K	63	100	160
	mm	66	104	153
DN <sub>2</sub>	in.	2.60	4.09	6.02
	mm	90	90	90
h	in.	3.54	3.54	3.54

### Ordering Information

DIN 1.4301	Part No.	837 01	837 02	837 03
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**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Adaptors-Reducers ISO-K – KF



Dimensional drawing for the adaptors-reducer ISO-K – KF;  
left: aluminum; right: stainless steel

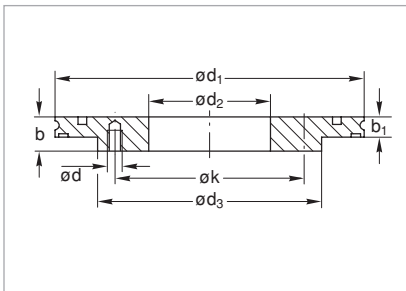
### Technical Data

DN	ISO-K / KF	63 / 40	63 / 50	100 / 40
d	mm	95	95	130
	in.	3.74	3.74	5.12
d <sub>1</sub>	mm	70	70	102
	in.	2.76	2.76	4.02
l	mm	40	45	40
	in.	1.57	1.77	1.57
s	mm	5	5	5
	in.	0.2	0.2	0.2
t	mm	4.5	4.5	4.5
	in.	0.16	0.16	0.16
Weight	kg	0.5	0.6	0.8
	lbs	1.1	1.32	1.77

### Ordering Information

Stainless steel 1.4305	Part No.	887 40	887 41	887 42
Aluminum 3.2315.71	Part No.	269 40	269 41	-

## Reducing Flanges (Stainless Steel 1.4301)



Dimensional drawing for the reducing flanges

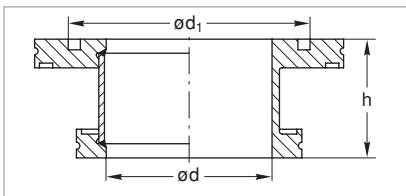
### Technical Data

DN	ISO-K	160/63	160/100	200/100	200/160	250/160
b	mm	22	25	20	25	22
	in.	0.87	0.98	0.79	0.98	0.87
b <sub>1</sub>	mm	12	12	12	12	12
	in.	0.47	0.47	0.47	0.47	0.47
d	thread	M 8	M 8	M 8	M 10	M 10
d <sub>1</sub>	mm	180	180	240	240	290
	in.	7.09	7.09	9.49	9.49	11.42
d <sub>2</sub>	mm	130	165	165	225	225
	in.	5.12	6.50	6.50	8.86	8.86
d <sub>3</sub>	mm	70	102	102	153	153
	in.	2.76	4.02	4.02	6.02	6.02
k	mm	110	145	145	200	200
	in.	4.33	5.71	5.71	7.87	7.87

### Ordering Information

Stainless steel	Part No.	886 14	886 15	886 17	886 16	886 50
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## Reducers (Stainless Steel 1.4305)



Dimensional drawing for the reducers

### Technical Data

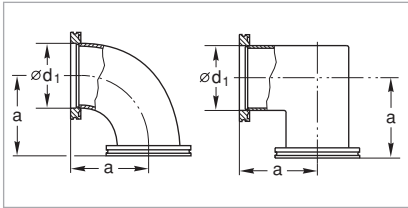
DN	ISO-K	100/63	250/200
d	mm	70	213
	in.	2.76	8.39
d <sub>1</sub>	mm	102	261
	in.	4.02	10.28
h	mm	50	50
	in.	1.97	1.97

### Ordering Information

Stainless steel	Part No.	887 89	887 93
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**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Pipe Bend (Stainless Steel 1.4301); from DN 160 ISO-K Mitred Elbow



Dimensional drawing for the pipe bends (left) and the mitred elbows (right)

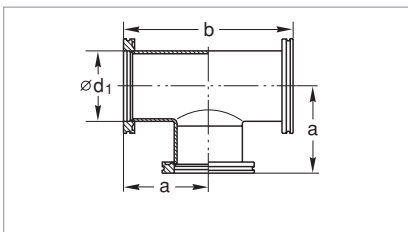
### Technical Data

DN	ISO-K	63	100	160	250
a	mm	88	108	138	208
	in.	3.46	4.25	5.43	8.19
d <sub>1</sub>	mm	70	102	153	261
	in.	2.76	4.02	6.02	10.28
Weight	kg	1.1	2.2	5.9	9.9
	lbs	2.43	4.8	13.02	21.85
Conductance	l/s	208	470	1200	3700

### Ordering Information

Stainless steel	Part No.	887 25	887 26	887 27	887 28
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## Tees (Stainless Steel 1.4301)



Dimensional drawing for the tees

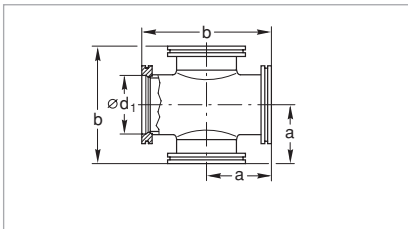
### Technical Data

DN	ISO-K	63	100	160	250
a	mm	88	108	138	208
	in.	3.46	4.25	5.43	8.19
b	mm	176	216	276	416
	in.	6.93	8.50	10.87	16.38
d <sub>1</sub>	mm	70	102	153	261
	in.	2.76	4.02	6.02	10.28
Weight	kg	1.6	3.2	7.6	17.0
	lbs	3.53	7.06	16.78	37.53

### Ordering Information

Stainless steel	Part No.	887 35	887 36	887 37	887 38
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## 4-Way Crosses (Stainless Steel 1.4301)



Dimensional drawing for the 4-way crosses

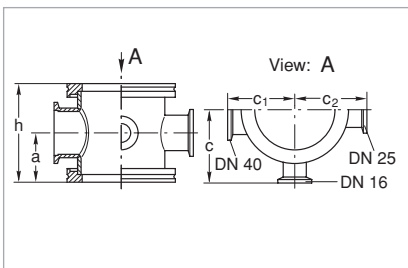
### Technical Data

DN	ISO-K	63	100	160	250
a	mm	88	108	138	208
	in.	3.46	4.25	5.43	8.19
b	mm	176	216	276	416
	in.	6.93	8.50	10.87	16.38
d <sub>1</sub>	mm	70	102	153	261
	in.	2.76	4.02	6.02	10.28

### Ordering Information

Stainless steel	Part No.	887 45	887 46	887 47	887 48
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## Branching Pieces with Lateral DN 16/25/40 KF Flanges (Stainless Steel 1.4301)



Dimensional drawing for the branching pieces with lateral DN 16/25/40 flanges

### Technical Data

DN	ISO-K	63	100	160
a	mm	44	50	50
	in.	1.73	1.97	1.97
h	mm	88	100	100
	in.	3.46	3.94	3.94
c	mm	66	82	107
	in.	2.60	3.23	4.21
c <sub>1</sub>	mm	59	77	105
	in.	2.32	3.03	4.13
c <sub>2</sub>	mm	64	80	107
	in.	2.52	3.15	4.21

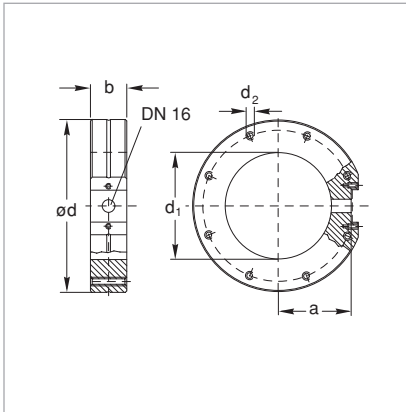
### Ordering Information

Stainless steel	Part No.	886 71	886 72	886 73
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Can not be used with collar flanges ISO-F and DIN 2501

**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Measurement Flanges



Dimensional drawing for the measurement flanges

### Technical Data

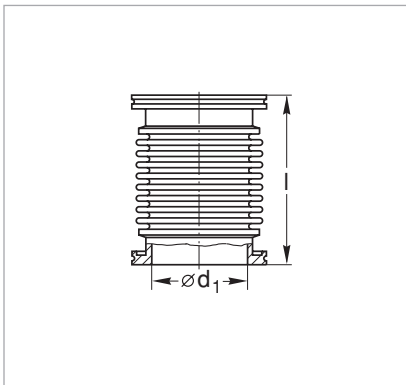
DN	ISO-K	63	100	160
a	mm	52.3	71.3	102.3
	in.	2.06	2.81	4.03
b	mm	30	30	30
	in.	1.18	1.18	1.18
d	mm	130	165	225
	in.	5.12	6.50	8.86
d <sub>1</sub>	mm	70	102	153
	in.	2.76	4.02	6.02
d <sub>2</sub>	thread	M 8	M 8	M 10
	Number of threaded holes	4	8	8

### Ordering Information

Stainless steel 1.4301	Part No.	286 60 <sup>1)</sup>	286 61 <sup>1)</sup>	286 62 <sup>1)</sup>
Recommended centering ring	Part No.	2x 887 03	2x 887 04	2x 887 07
Required claws kits	Part No. 268 25	2 kits	4 kits	-
Required claws kits	Part No. 268 26	-	-	4 kits

<sup>1)</sup> Washers and nuts for DN 16 KF are included

## Bellows (Stainless Steel 1.4571) with Flanges (Stainless Steel 1.4391)



Dimensional drawing for the bellows

### Technical Data

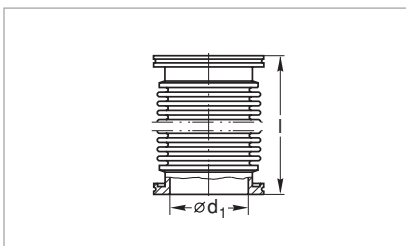
DN	ISO-K	63	100	160	250
d <sub>1</sub>	mm	70	102	153	261
	in.	2.76	4.02	6.02	10.78
l	mm	132	132	150	200
	in.	5.20	5.20	5.91	7.87
Weight	kg	1.0	3.9	6.2	9.3
	lbs	2.21	8.61	13.69	20.53
Max. extension, axial	mm	40	56	44	60
	in.	1.57	2.20	1.73	2.36
Compression	mm	20	28	22	30
	in.	0.79	1.10	0.87	1.18
Tension	mm	20	28	22	30
	in.	0.79	1.10	0.87	1.18
Max. bending angle	degrees <sup>1)</sup>	± 30°	± 30°	± 14°	± 13°
Lateral displacement	mm	7	9	3.5	4.5
	in.	0.28	0.35	0.14	0.18

### Ordering Information

Stainless steel	Part No.	887 70	887 71	887 72	887 68
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<sup>1)</sup> When utilizing the maximum bend, no extension along the axial axis will be possible!

## Flexible Vacuum Hoses (Stainless Steel 1.4571) with Flanges (Stainless Steel 1.4301)



Dimensional drawing for the flexible vacuum hoses

### Technical Data

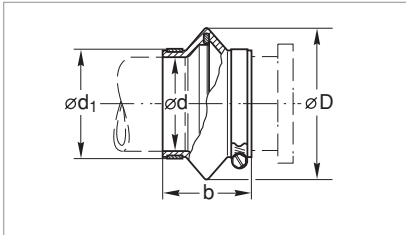
DN	ISO-K	63	63	63	63	100	100	100	100
d <sub>1</sub>	mm	70	70	70	70	102	102	102	102
	in.	2.76	2.76	2.76	2.76	2.76	4.02	4.02	4.02
l	mm	250	500	750	1000	250	500	750	1000
	in.	9.84	19.69	29.53	39.37	9.84	19.69	29.53	39.37
Max. bending radius with multiple bending	mm	250	250	250	250	370	370	370	370
	in.	9.84	9.84	9.84	9.84	14.57	14.57	14.57	14.57
with single bend	mm	160	160	160	160	240	240	240	240
	in.	8.30	8.30	8.30	8.30	9.45	9.45	9.45	9.45

### Ordering Information

Stainless steel	Part No.	868 37	867 97	868 34	868 07	868 38	867 98	868 35	868 08
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**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Flexible Compensation Elements (CR)



Dimensional drawing for the flexible compensation elements

### Technical Data

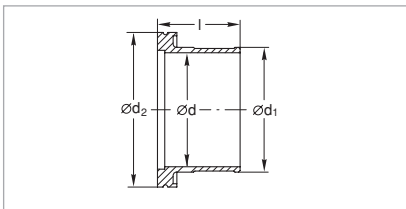
DN	ISO-K	63	100	160
D	mm	120	150	200
	in.	4.72	5.91	7.87
d	mm	75	106	155
	in.	2.95	4.17	6.10
d <sub>1</sub>	mm	85	116	165
	in.	3.35	4.57	6.50
b	mm	70	72	72
	in.	2.76	2.83	2.83

### Ordering Information

CR	Part No.	272 23 <sup>1)</sup>	272 24 <sup>1)</sup>	272 25 <sup>1)</sup>
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<sup>1)</sup> Is supplied complete with stainless steel hose clamps

## Connections for Flexible Compensation Elements (Aluminum 3.2315.71)



Dimensional drawing for the connections for flexible compensation elements

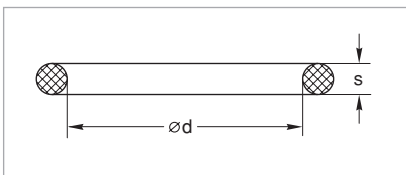
### Technical Data

DN	ISO-K	63	100	160
d	mm	70	102	150
	in.	2.76	4.02	5.91
d <sub>1</sub>	mm	76	107	156
	in.	2.99	4.21	6.14
d <sub>2</sub>	mm	95	130	180
	in.	3.74	5.12	7.09
l	mm	51	56	56
	in.	2.01	2.20	2.20

### Ordering Information

Aluminum	Part No.	272 35	272 36	272 37
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## Spare O-Ring Gaskets for Clamp Flange Fittings



Dimensional drawing for the spare O-ring for clamp flange fittings

### Technical Data

DN	ISO-K	63	100	160	200	250	320
d	mm	75	107	158	208	253	329
	in.	2.95	4.21	6.22	8.19	9.96	12.95
s	mm	5	5	5	5	5	7
	in.	0.20	0.20	0.20	0.20	0.20	0.28

Quantity per set		5	5	5	5	5	1
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### Ordering Information

FPM	Part No.	210 635	210 645	210 650	210 655	210 660	210 665
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### Technical Data

DN	ISO-K	400	500	630	800	1000
d	mm	405	506	658	808	1006
	in.	15.94	19.92	25.90	31.80	39.61
s	mm	7	7	7	7	7
	in.	0.28	0.28	0.28	0.28	0.28

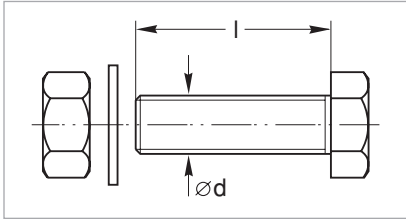
Quantity per set		1	1	1	1	1
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### Ordering Information

FPM	Part No.	210 670	210 675	210 680	210 685	210 690
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**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Bolts for Clamp Flange Fittings (Steel 8.8, zinc coated)



Dimensional drawing for the bolts  
for clamp flange fittings

### Technical Data

DN	ISO-K	63 - 100	160 - 250	320 - 500	630
<b>Dimensions</b>					
d	thread	M 8	M 10	M 12	M 12
l	mm	40	50	70	80
	in.	1.57	1.97	2.76	3.15
<b>Quantity per set</b>					
Bolts		8	12	16	20
Nuts		8	12	16	20
Washers		8	12	16	20

### Ordering Information

Set	Part No.	887 81	887 82	887 83	-

**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

# ISO-F and DIN 2501 Fixed Flange Fittings, ND 6

**Note: ND 6 states a dimension and not refer to an operating pressure of 6 bar!**

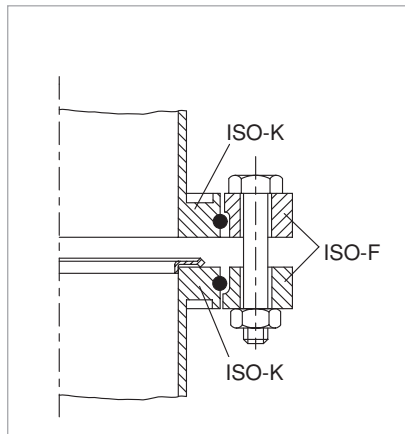


Mating clamp flanges with tubulation using collar rings and sealing disk

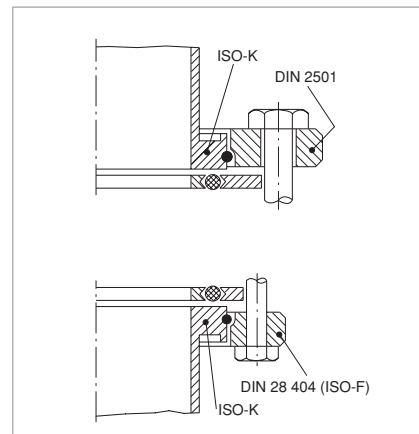
In addition to clamp flange connections, fixed welded flanges (ISO-F or to DIN 2501) are used in the area of vacuum engineering to interconnect valves, pumps and other components.

## Advantages to the User

- A high vacuum seal is maintained also at large nominal width and high mechanical loads
- Evenly distributed sealing force through a large number of bolts
- Can be easily adapted to other flange systems
- Vacuum sealing disks consist of a CR O-ring seal with inner and outer aluminum ring
- Fixed flanges and collar flanges may also be constructed as all-metal seals by using ultra sealing disks



Mating clamp flanges using bolted collar rings and ultra sealing disk



Comparison:  
Clamp flange with collar flange to DIN 2501 and clamp flange with collar flange to DIN 28 404; ISO-F

## Collar Flange

## Steel

## Stainless Steel

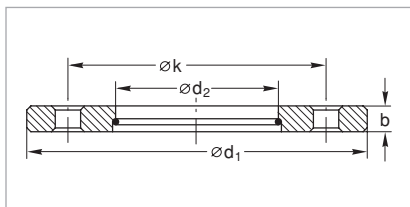
Bolts and nuts	Galvanized 8.8 steel	1.4401
Retaining ring	Steel	1.4310

**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.



# ISO-F Fixed Flange Fittings

## ISO-F Collar Flanges with Retaining Ring for use with Clamp Flange Fittings (Steel 1.0037)



Dimensional drawing for collar flanges with retaining ring

### Technical Data

DN	ISO-F	63	100	160	200	250
$d_1$	mm	130	165	225	285	335
	in.	5.12	6.50	8.86	11.22	13.19
$d_2$	mm	95.6	130.6	180.9	240.9	290.9
	in.	3.76	5.14	7.12	9.48	11.45
k	mm	110	145	200	260	310
	in.	4.93	5.71	7.87	10.24	12.20
b	mm	12	12	16	16	16
	in.	0.47	0.47	0.63	0.63	0.63

### Ordering Information

Nickel-plated steel	Part No.	267 67	267 70	267 71	267 68	-
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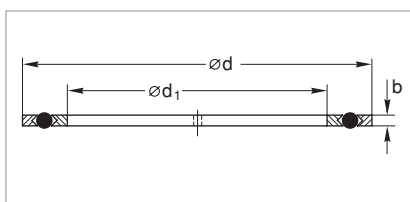
### Technical Data

DN	ISO-F	320	400	500	630
$d_1$	mm	425	510	610	750
	in.	16.73	20.08	24.02	29.53
$d_2$	mm	370.8	451.0	551.0	691.0
	in.	14.60	17.76	21.69	27.2
k	mm	395	480	580	720
	in.	15.51	18.90	22.83	28.35
b	mm	20	20	20	24
	in.	0.79	0.79	0.79	0.79

### Ordering Information

Nickel-plated steel	Part No.	267 76	267 74	267 75	267 77
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## Vacuum Sealing Disks for ISO-F Flanges (Aluminum/CR)



Dimensional drawing for vacuum sealing disks

### Technical Data

DN	ISO-F	63	100	160	250	320
d	mm	98	132	185	295	375
	in.	3.86	5.20	7.28	11.61	14.76
$d_1$	mm	73	107	160	270	330
	in.	2.87	4.21	6.3	10.63	12.99
b	mm	4	4	4	4	6
	in.	0.16	0.16	0.16	0.16	0.24

### Ordering Information

Aluminum/CR	Part No.	171 09	171 10	171 11	171 12	171 19
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### Technical Data

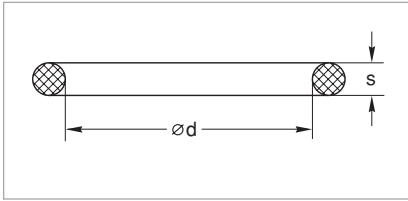
DN	ISO-F	400	500	630	800	1000
d	mm	460	560	701	870	1070
	in.	18.11	22.05	27.60	34.25	42.13
$d_1$	mm	415	515	656	825	1025
	in.	16.34	20.28	25.83	32.48	40.35
b	mm	6	6	6	6	6
	in.	0.24	0.24	0.24	0.24	0.24

### Ordering Information

Al/CR	Part No.	171 14	171 15	171 16	171 17	171 18
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**Important:** In the table of Section "General" the German designation for the type of steel is also stated in accordance with AISI.

## Spare O-Ring Gaskets ISO-F Flange Connection



Dimensional drawing for O-rings

### Technical Data

DN	ISO-F	63	100	160	250	320
d	mm	80	110	165	265	325
	in.	3.15	4.33	6.50	10.43	12.75
s	mm	5	5	5	5	8
	in.	0.20	0.20	0.20	0.20	0.31
Quantity per set		5	5	5	5	1

### Ordering Information

CR	Part No.	210 701	210 711	210 716	210721	210 726
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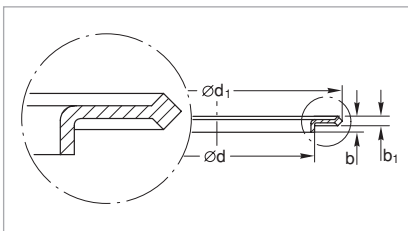
### Technical Data

DN	ISO-F	400	500	630	800	1000
d	mm	412	510	640	820	1023
	in.	16.22	20.08	25.20	32.28	40.28
s	mm	8	8	8	8	8
	in.	0.31	0.31	0.31	0.31	0.31
Quantity per set		1	1	1	1	1

### Ordering Information

CR	Part No.	210 731	-	210 741	210 746	210 751
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## Ultra Sealing Disks (Aluminum 3.2315.71) for ISO-F Flanges



Dimensional drawing for O-rings

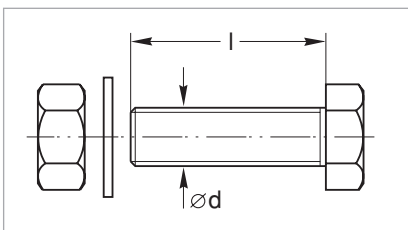
### Technical Data

DN	ISO-K / ISO-F	63	100	160	250
b	mm	4.5	4.5	4.5	4.5
	in.	0.18	0.18	0.18	0.18
b <sub>1</sub>	mm	2.6	2.6	2.6	2.6
	in.	0.10	0.10	0.10	0.10
d	mm	69.8	101.8	152.8	260.8
	in.	2.75	4.01	6.02	10.27
d <sub>1</sub>	mm	85.6	116.6	166.6	276.6
	in.	3.37	4.59	6.56	10.89

### Ordering Information

Aluminum	Part No.	886 24	886 25	886 26	886 27
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## Bolts for ISO-F Flange Connection (Steel 8.8, zinc coated)



Dimensional drawing for the bolts for ISO-F flange connections

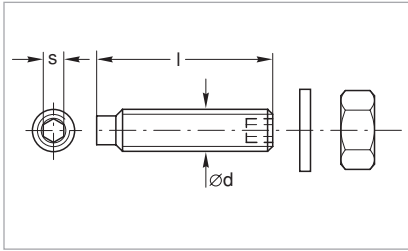
### Technical Data

DN	ISO-F	63 - 100	160 - 250	320 - 500	630
Dimensions					
d	thread	M 8	M 10	M 12	M 12
	mm	40	50	70	80
	in.	1.57	1.97	2.76	3.15
Quantity per set					
Bolts		8	12	16	20
Nuts		8	12	16	20
Washers		8	12	16	2

### Ordering Information

Set	Part No.	887 81	887 82	887 83	887 84
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## Bolts, Nuts and Washers for Joints with VAT Gate Valves



Dimensional drawing for the set screws, nuts and washers

### Technical Data

DN	ISO-F	40 CF	63-100 ISO-F/63-200 CF	160-250 ISO-F
<b>Dimensions</b>				
<b>d</b>	<b>thread</b>	M 6	M 8	M 10
<b>l</b>	<b>mm</b>	35	45	55
	<b>in.</b>	1.38	1.77	2.17
<b>s</b>	<b>mm</b>	3	4	6
	<b>in.</b>	0.12	0.16	0.24

### Quantity per set

<b>Bolts</b>	6	16	12
<b>Nuts</b>	6	16	12
<b>Washers</b>	6	16	12

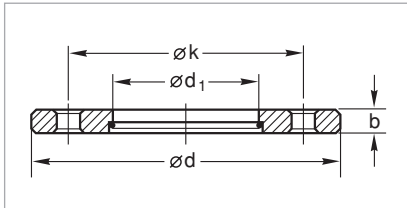
### Ordering Information

Set	Part No.	839 11	839 13	210 071
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# DIN 2501 Fixed Flange Fittings; Dimensions to DIN 2501, ND 6

**Note: ND 6 states a dimension and does not refer to an operating pressure of 6 bar!**

## Collar Flanges with Retaining Ring (Steel 1.0037)



Dimensional drawing for collar flanges with retaining ring

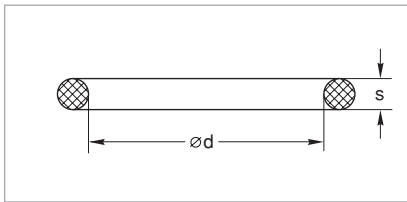
### Technical Data

DN	DIN	63	100	160	250
d	mm	160	210	265	375
	in.	6.30	8.27	10.43	14.76
d <sub>1</sub>	mm	95.6	130.6	180.9	290.9
	in.	3.76	5.14	7.12	11.45
k	mm	130	170	225	335
	in.	5.12	6.69	8.86	13.19
b	mm	12	15	15	15
	in.	0.47	0.59	0.59	0.59

### Ordering Information

Steel	Part No.	267 47	267 50	267 51	-
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## Spare O-Ring Gaskets for Vacuum Sealing Disks DIN 2501



Dimensional drawing for O-ring gaskets

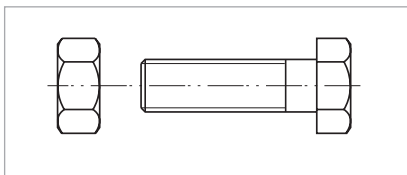
### Technical Data

DN	ISO-F	63	100	160
d	mm	80	110	165
	in.	3.15	4.23	6.50
s	mm	5	5	5
	in.	0.20	0.20	0.20
Quantity per set		5	5	5

### Ordering Information

CR	Part No.	210 701	210 711	210 716
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## Bolts and Nuts for DIN Collar Flange



Dimensional drawing for bolts and nuts

### Technical Data

DN	DIN	63	100	160	250	
Dimensions	d	thread	M 12	M 16	M 16	M 15
		mm	40	50	50	50
		in.	1.57	1.97	1.97	3.15
Number of bolts/nuts required		4	8	8	12	

### Ordering Information

1 bolt (galvanized 8.8 steel)	Part No.	201 02 381	201 02 434	201 02 434	201 02 434
1 nut (galvanized 8.8 steel)	Part No.	211 01 115	211 01 117	211 01 117	211 01 117

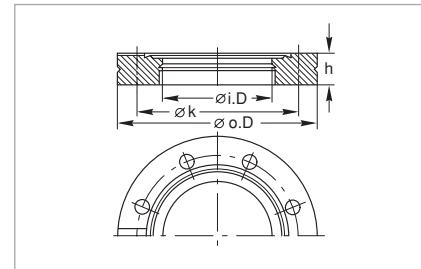
**For sealing ISO-K flanges see the centering rings described in the section “(ISO-K) Clamp Flange Fittings and Components”.**



# CF Flanges



The CF flange connection consists of two identical flanges with a flat gasket made of **OFHC copper**, bolts, nuts and washers.



Dimensional drawing for CF flanges

## Sealing Principle

When assembling the CF flange connection, the flat copper gasket fits with a slight clearance into the outer recess of the flanges and thus assures good centering of the flange connection. If the flange bolts are properly tightened according to the instructions, the knife edge of the flanges penetrates into the flat copper gasket, whereby the shear action of the outer face of the cutting edge - as seen from the flange axis - produces a yield pressure on the copper gasket, while the inner face of the edge produces a cutting action.

During this process the copper gasket adapts it-self optimally to the micro-structure of the outer knife edge. This explains the high sealing effect and the especially low leak rates of CF flange connections. A radial groove extending right up to the sealing ring is provided for leak testing of the flange connection. In order to ensure that the sealing knife edge is not damaged during frequent use of the flanges, the conventional geometry of such knife edges for CF flanges has been developed further. By using the Oerlikon Leybold Vacuum developed obtuse angled knife edge profile the strength of the sealing knife

edges has been significantly stabilized. In addition to the actual knife edge, the flanges are provided with a concentric sealing surface for placement of a FPM gasket or a supporting ring with FPM O-ring, which may be baked up to 150 °C (does not apply to observation windows).

This design has the advantage, that it is possible to equip the apparatus with elastomer gaskets prior to final assembly, so that the system can be tested under normal high vacuum conditions.

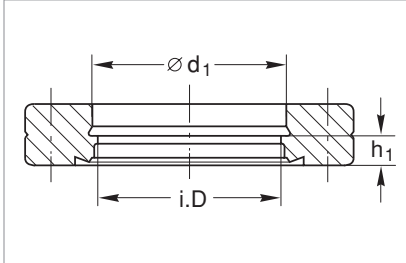
## Technical Data

DN	CF	16	40	63	100	160	200	250
Outside diameter o. D.	inch	1.33"	2.75"	4.50"	6.00"	8.00"	10.00"	12.00"
Outside diameter o. D.	mm	34.0	69.5	113.5	152.0	202.5	253.0	305.0
Inside diameter i. D.	inch	0.33"	1.375"	2.50"	4.00"	6.00"	8.00"	10.00"
Inside diameter i. D.	mm	16.0	36.8	66.0	104.0	155.0	200.0	250.0
Bolt circle diameter k	mm	27.0	58.7	92.2	130.3	181.0	231.8	284.0
High h	mm	7.5	13.0	17.5	20.0	22.0	24.5	24.5
Number of holes		6	6	8	16	20	24	32
Hole diameter	mm	4.3	6.6	8.4	8.4	8.4	8.4	8.4

## Conversion Factors

- Magnetizing field H, unit:  $A \times m^{-1}$   
Previously used unit: Oersted (Oe)  $1 Oe = 79,577 (A \times m^{-1})$
- Strength of the magnetic field B, unit:  $Vs \times m^{-2} = Tesla (T)$   
Previously used unit: Gauß (G)  $1 G = 10^{-4} Vs \times m^{-2} = 10^{-4} T$

### CF Bore Flanges, Fixed



Dimensional drawing for the CF bore flanges, fixed

#### Technical Data

DN	CF	16	40	63	100	160	200	250
Outside diameter	inch	1.33"	2.75"	4.50"	6.00"	8.00"	10.00"	12.00"
Inside diameter	mm	16.0	36.8	66.0	104.0	155.0	200.0	250.0
$d_1$	mm	18.3	40.3	70.3	108.5	159.5	205.5	256.5
$h_1$	mm	4.2	5.5	9.5	11.0	12.0	12.5	12.5

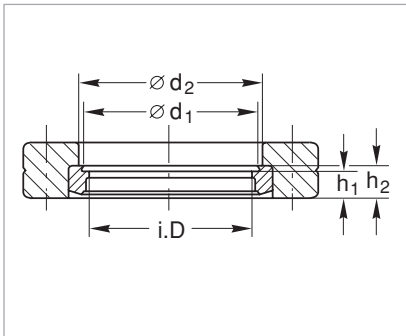
For missing dimensions see "Technical Data" at the beginning of the Section "CF Flanges"

#### Ordering Information

Material: DIN 1.4301

Part No. **835 41 835 37 835 38 835 39 835 40 835 47 835 49**

### CF Bore Flanges, Rotatable



Dimensional drawing for the CF bore flanges, rotatable

#### Technical Data

DN	CF	16	40	63	100	160	200	250
Outside diameter	inch	1.33"	2.75"	4.50"	6.00"	8.00"	10.00"	12.00"
Inside diameter	mm	16.0	36.8	66.0	104.0	155.0	200.0	250.0
$d_1$	mm	18.3	40.3	70.3	108.5	159.5	205.5	256.5
$d_2$	mm	18.6	41.0	71.0	109.0	160.0	206.0	257.0
$h_1$	mm	4.2	5.5	9.5	11.0	12.0	12.5	12.5
$h_2$	mm	5.8	7.6	12.6	14.3	15.8	17.1	18.0

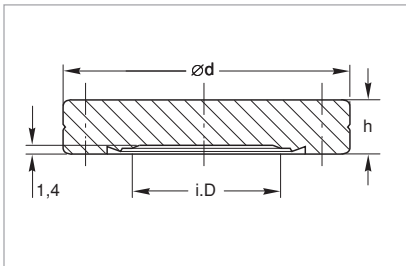
For missing dimensions see "Technical Data" at the beginning of the Section "CF Flanges"

#### Ordering Information

Material: DIN 1.4301

Part No. **835 61 835 58 835 59 835 60 835 69 835 67 835 78**

### CF Blank Flanges, Fixed



Dimensional drawing for the CF blank flanges, fixed

#### Technical Data

DN	CF	16	40	63	100	160	200	250
Outside diameter	inch	1.33"	2.75"	4.50"	6.00"	8.00"	10.00"	12.00"
Inside diameter	mm	14	38	66	104	155	205	256
$d$	mm	34.0	69.5	113.5	152.0	202.5	253.0	305.0
$h$	mm	7.5	13.0	17.5	20.0	22.0	24.5	24.5

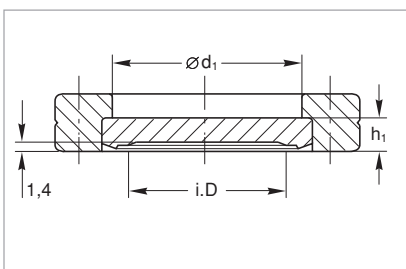
For missing dimensions see "Technical Data" at the beginning of the Section "CF Flanges"

#### Ordering Information

Material: DIN 1.4301

Part No. **835 01 835 03 835 04 835 05 835 06 835 07 835 09**

### CF Blank Flanges, Rotatable



Dimensional drawing for the CF blank flanges, rotatable

#### Technical Data

DN	CF	16	40	63	100	160	200	250
Outside diameter	inch	1.33"	2.75"	4.50"	6.00"	8.00"	10.00"	12.00"
Inside diameter	mm	14	38	66	104	155	205	256
$d_1$	mm	18.6	41.0	71.0	109.0	160.0	206.0	257.0
$h_1$	mm	5.8	7.6	12.6	14.3	15.8	17.1	18.0

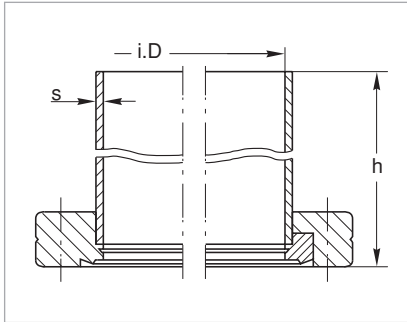
For missing dimensions see "Technical Data" at the beginning of the Section "CF Flanges"

#### Ordering Information

Material: DIN 1.4301

Part No. **835 21 835 23 835 24 835 25 835 26 835 27 835 29**

## CF Flanges with Tube End



Dimensional drawing for the CF flanges with tube end; left fixed, right rotatable

### Technical Data

DN	CF	16	40	63	100	160
Outside diameter	inch	1.33"	2.75"	4.50"	6.00"	8.00"
Inside diameter	mm	16.0	36.8	66.0	104.0	155.0
s	mm	1.0	1.6	2.0	2.0	2.0
h	mm	38	63	105	135	167

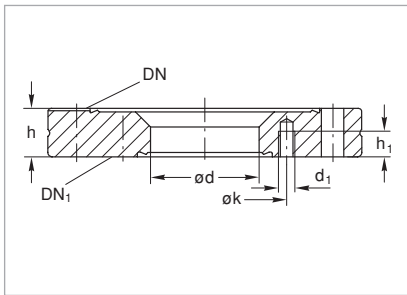
For missing dimensions see "Technical Data" at the beginning of the Section "CF Flanges"

### Ordering Information

Material: DIN 1.4301

Tube end	Part No.	835 51	835 31	835 32	835 33	835 34
fixed	Part No.	835 71	835 82	835 74	835 75	835 76
rotatable	Part No.					

## CF Reducing Flanges



Dimensional drawing for the CF reducing flanges, fixed

### Technical Data

DN	CF	40	63	100	100	160	160
Outside diameter	inch	2.75"	4.50"	6.00"	6.00"	8.00"	8.00"
DN <sub>1</sub>	CF	16	40	40	63	40	100
k	mm	27.0	58.7	58.7	92.2	58.7	130.0
h	mm	13.0	17.5	20.0	20.0	22.0	22.0
h <sub>1</sub>	mm	5.5	9.0	9.0	11.0	9.0	11.0
d	mm	16	39	39	66	39	104
d <sub>1</sub>	mm	M 4	M 6	M 6	M 8	M 6	M 8

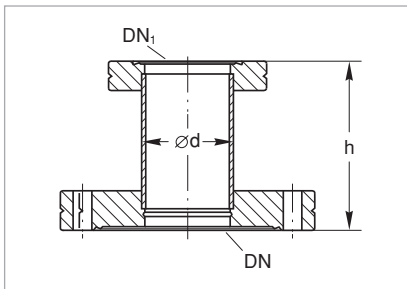
For missing dimensions see "Technical Data" at the beginning of the Section "CF Flanges"

### Ordering Information

Material: DIN 1.4301

Part No.	836 85	836 86	836 87	836 89	836 90	836 91	
Matching stud bolts	Part No.	839 10	839 11	839 11	839 13	839 11	839 13

## CF Reducing Pieces



Dimensional drawing for the CF reducing pieces

### Technical Data

DN	CF	40	63	100	100	160
Outside diameter	inch	2.75"	4.50"	6.00"	6.00"	8.00"
DN <sub>1</sub>	CF	16	40	40	63	100
h	mm	45	75	75	95	105
d (tube)	mm	18	40	40	70	108

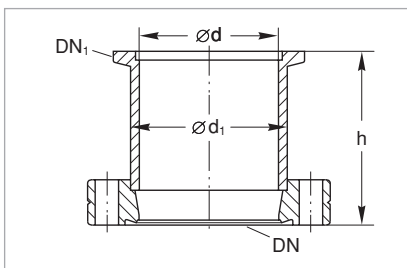
For missing dimensions see "Technical Data" at the beginning of the Section "CF Flanges"

### Ordering Information

Material: DIN 1.4301

Part No.	837 10	837 15	837 16	837 19	837 22
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## UHV CF/KF Adaptors



Dimensional drawing for the CF/KF adaptors

### Technical Data

DN	CF	16	16	40	40	40	63
Outside diameter	inch	1.33"	1.33"	2.75"	2.75"	2.75"	4.50"
DN <sub>1</sub>	KF	16	25	16	25	40	40
d	mm	16	16	16	26	37	41
h	mm	35	35	30	30	50	35
d <sub>1</sub> (tube)	mm	20	20	20	30	41	45

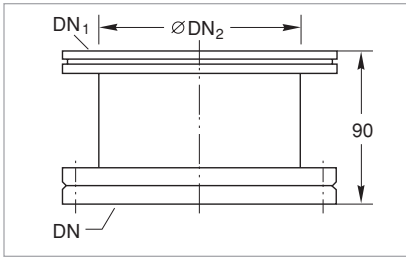
### Ordering Information

Material: DIN 1.4301

Part No.	837 81	837 83	837 82	837 84	837 36	837 86
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## UHV CF/ISO-K Adaptors



Dimensional drawing for the CF/ISO-K adaptors

### Technical Data

DN	CF	63	100	160
Outside diameter	inch	4.50"	6.00"	8.00"
DN <sub>1</sub>	ISO-K	63	100	160
DN <sub>2</sub>	mm	66	104	153

### Ordering Information

Material: DIN 1.4301

Part No.	<b>837 01</b>	<b>837 02</b>	<b>837 03</b>
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# Observation Windows for Vacuum Systems

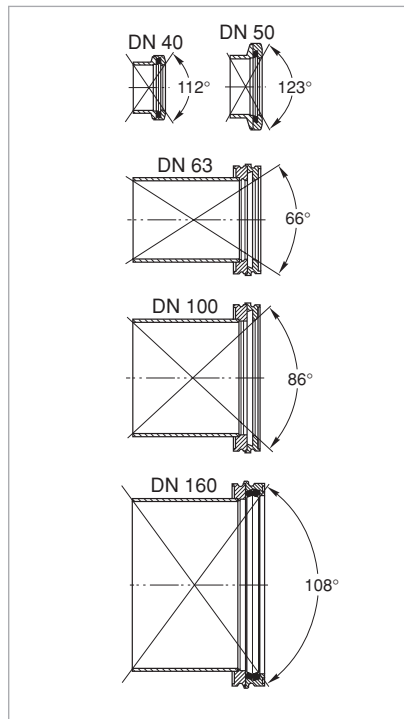


Observation of the phenomena in the vacuum chamber is very important for many vacuum processes. Measurements and monitoring can often be accomplished only by means of external instruments used under normal atmospheric pressure conditions.

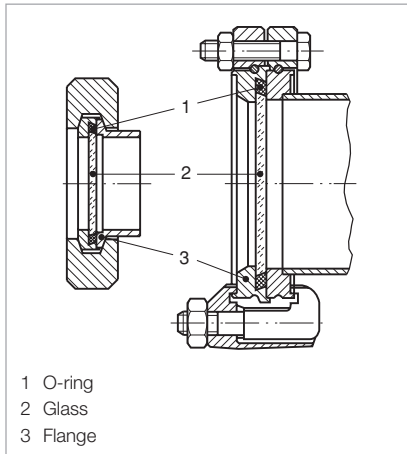
This calls for highly transparent, rugged observation windows featuring a wide angle view.

## Advantages to the User

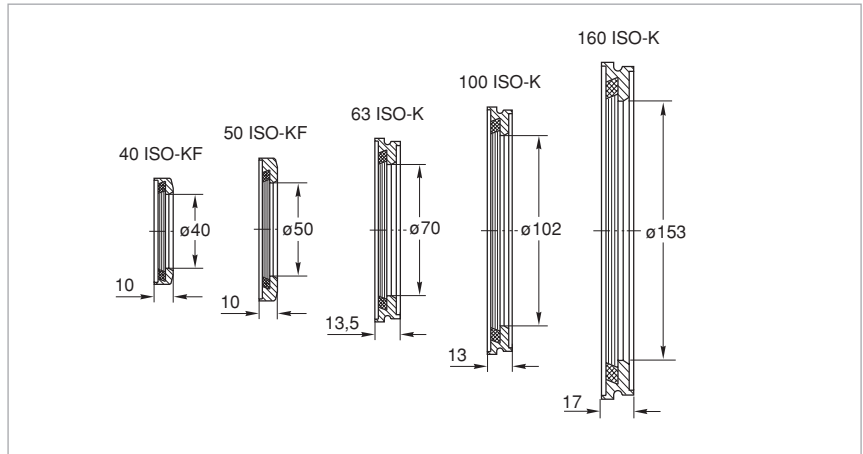
- Flat design
- Easy to fit and remove
- Easy to clean
- Wide viewing angle
- Can be baked out up to 150 °C (302 °F)
- May be combined with KF and ISO-K components
- No special mounting components are required
- The FPM O-ring seals against the atmosphere (integrated centering ring)
- Each observation window is subjected to a leak test (thereby ensuring safe operation!)



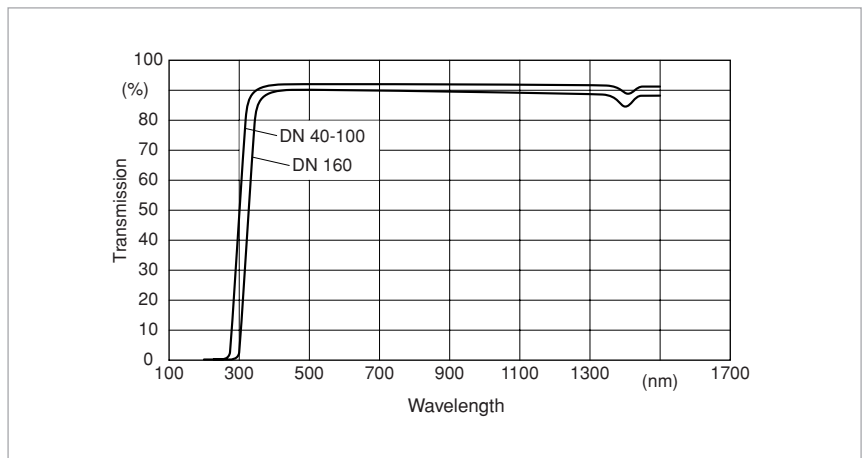
Viewing angle into vacuum chamber through observation window DN 40 ISO-KF - DN 160 ISO-K (mounting on matching flanges with tubulation)



ISO-KF and ISO-K observation windows, fully installed



Window dimensions for the observation windows



Transmittance as a function of the wavelength for Oerlikon Leybold Vacuum viewports DN 40 ISO-KF to DN 160 ISO-K for different window thicknesses

## Technical Data

## Observation Windows

DN		40 ISO-KF	50 ISO-KF	63 ISO-K	100 ISO-K	160 ISO-K
Thickness of glass window	mm	4	4	4	5	9
	in.	0.16	0.16	0.16	0.20	0.35
Diameter of glass window	mm	44	54	75	109	160
	in.	1.73	2.13	2.95	4.29	6.30
	mm	10.0	10.0	13.5	13.0	17.0
	in.	0.39	0.39	0.53	0.51	0.67
	mm	40	50	70	102	153
	in.	1.57	1.97	2.76	4.02	6.02
Viewing angle	°	112	123	66	86	108

The glass used is a borosilicate glass (BOROFLOAT® 33) with a refractive index of  $n = 1.472$   
 Dielectric number (at 25 °C (77 °F)) 4.8 at 1 MHz  
 Flange material Stainless steel 1.4301  
 Glass material Borosilicate  
 O-ring material FPM  
 Leak rate  $< 10^{-8}$  mbar x l/s

## Ordering Information

## Observation Windows

	DN	40 ISO-KF	50 ISO-KF	63 ISO-K	100 ISO-K	160 ISO-K
Observation Windows	Part No.	<b>210 131</b>	<b>210 132</b>	<b>210 133</b>	<b>210 134</b>	<b>210 135</b>

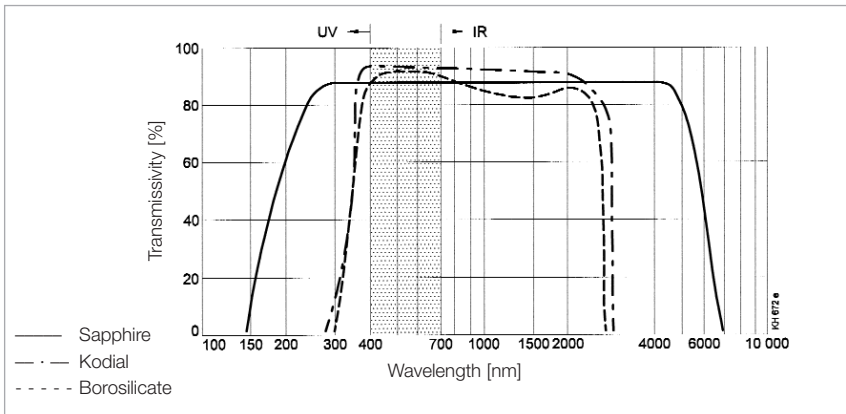
# CF Observation Windows



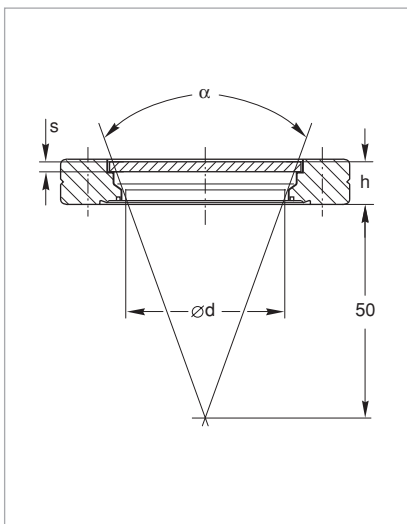
Standard glass is normally only used for visual observations, for photography of experiment details and, among other things, for pyrometer measurements.

## Advantages to the User

- Optically plane-parallel glass surface up to just before the edge
- Flange with a wide viewing angle



Optical transmissivity for the CF observation windows



Dimensional drawing for CF observation windows

## Technical Data

DN	CF	40	63	100	160
Thickness of the glass (s)	mm	3.0	3.5	6.0	8.0
Diameter of viewing area (d)	mm	38	65	90	135
Viewing angle (α)	°	38	57	71	92
Spacing of the glass (h), approx.	mm	11.0	16.4	8.0	10.0
Viewing distance	mm	50	50	50	50
Wavelength range	nm	400 to 3000	400 to 3000	400 to 3000	400 to 3000
Material		Vacon (compensation ring)	Vacon (compensation ring)	Vacon (compensation ring)	Vacon (compensation ring)
Mean transmission ratio	%	93 in the visible range	93 in the visible range	93 in the visible range	93 in the visible range
Type of glass		Kodial	Kodial	Kodial	Kodial
Max. heating rate	min	5	5	5	5
Max. bakeout temperature	°C	400	400	400	400

## Ordering information

CF observation window	Part No.	210 112	210 114	210 115	210 116
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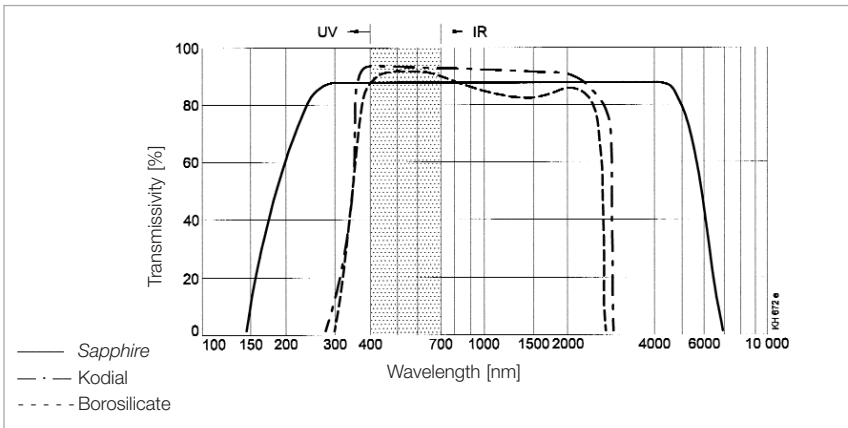
# CF Sapphire Observation Windows



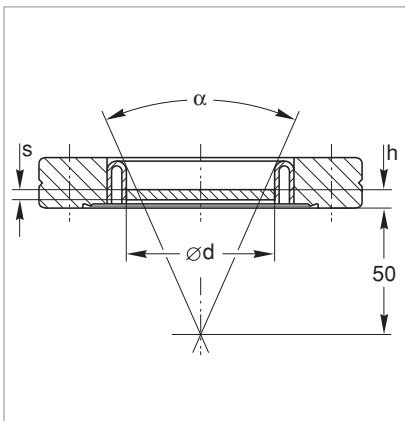
Sapphire exhibits a transmissivity range of 250 nm to 5500 nm. The infrared limit is shifted far in to the infrared range. For this reason, glass of this type is used in connection with sun simulation tests, Laser experiments, high-temperature plasma measurements and spectroscopic measurements, for example.

## Advantages to the User

- Optically plane-parallel glass surface up to just before the edge



Optical transmissivity for the CF Sapphire observation windows



Dimensional drawing for the CF sapphire observation windows

## Technical Data

DN	CF	40
Thickness of the glass (s)	mm	3.0
Diameter of viewing area (d)	mm	23
Viewing angle ( $\alpha$ )	°	23
Spacing of the glass (h), approx.	mm	10
Viewing distance	mm	50
Wavelength range	nm	250 to 5500
Mean transmission ratio	%	> 80
Type of glas		Sapphire
Max. heating rate	min	5
Max. bakeout temperature	°C	400

## Ordering information

CF sapphire observation windows	Part No.	210 122
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# CF Components



CF components are manufactured according to the requirements outlined in the introductory chapter. They are made from selected and corrosion resistant types of stainless steel. Both design and production methods are such, that the components meet the requirements of UHV applications. All components are fusion welded from the inside to prevent fissures and pocket holes (virtual leaks which cannot be located by leak detection methods from the outside). If welding from the outside cannot be avoided due to design constraints, the welding seam penetrates to the inner side, the side of the vacuum.

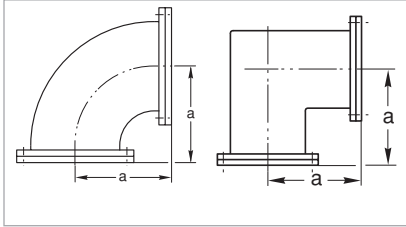
A carefully implemented cleaning process and suitable packaging for the components are essential pre-requisites for obtaining pressures in the UHV range within reasonably short pump down times after assembly (providing the remainder of the apparatus is clean too).

For applications in the extreme UHV range (XHV) the outgassing rate of the CF flanges and the UHV components can be reduced by about two orders of magnitude by a special degassing process.

## Advantages to the User

- Low degassing rates
- High degassing temperature
- Leak rates below  $1 \times 10^{-11} \text{ mbar} \times \text{l} \times \text{s}^{-1}$
- Basic dimensions correspond to those of the components from other international manufacturers
- Bolts may be inserted from the side of the body

## Pipe Bend 90°; from DN 160 CF Mitred Elbow



Dimensional drawing for the pipe bends 90° (left) and the mitred elbows (right)

### Technical Data

DN	CF	16	40	63	100	160
Outside diameter	inch	1.33"	2.75"	4.50"	6.00"	8.00"
a	mm	38	63	105	135	167

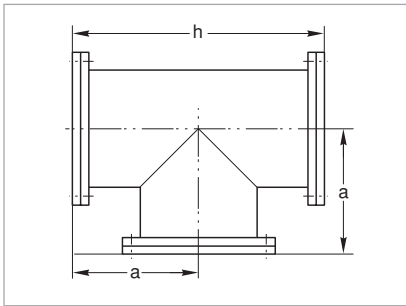
For missing dimensions see "Technical Data" at the beginning of the Section "CF Flanges"

### Ordering Information

Elbow 90° with a rotatable flange

Part No.	836 04	836 05	836 06	836 07	836 08
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## Tees



Dimensional drawing for the tees

### Technical Data

DN	CF	16	40	63	100	160
Outside diameter	inch	1.33"	2.75"	4.50"	6.00"	8.00"
a	mm	38	63	105	135	167
h	mm	76	126	210	270	334

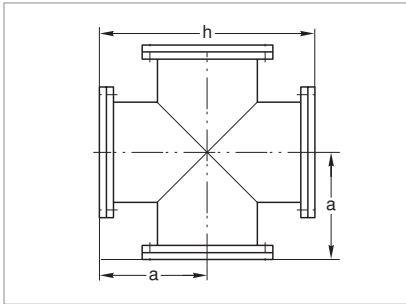
For missing dimensions see "Technical Data" at the beginning of the Section "CF Flanges"

### Ordering Information

Tee with a rotatable flange on each axis

Part No.	836 14	836 15	836 16	836 17	836 18
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## Crosses



Dimensional drawing for the crosses

### Technical Data

DN	CF	16	40	63	100	160
Outside diameter	inch	1.33"	2.75"	4.50"	6.00"	8.00"
a	mm	38	63	105	135	167
h	mm	76	126	210	270	334

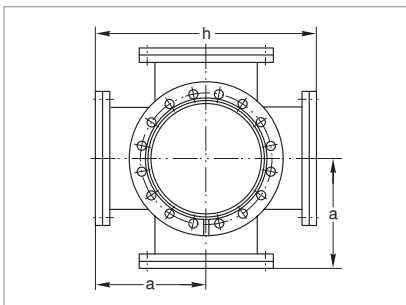
For missing dimensions see "Technical Data" at the beginning of the Section "CF Flanges"

### Ordering Information

Cross with a rotatable flange on each axis

Part No.	836 34	836 35	836 36	836 37	836 38
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## Double Crosses



Dimensional drawing for the double crosses

### Technical Data

DN	CF	40	63	100	160
Outside diameter	inch	2.75"	4.50"	6.00"	8.00"
a	mm	63	105	135	167
h	mm	126	210	270	334

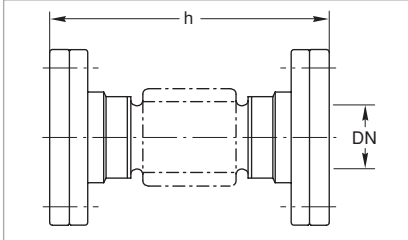
For missing dimensions see "Technical Data" at the beginning of the Section "CF Flanges"

### Ordering Information

Double cross with a rotatable flange on each axis

Part No.	836 45	836 46	836 47	836 48
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## Flexible Connecting Components (CF Bellows)



Dimensional drawing for the CF bellows

### Technical Data

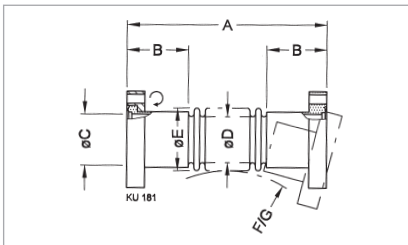
DN	CF	16	40	63	100	160
Outside diameter	inch	1.33"	2.75"	4.50"	6.00"	8.00"
h	mm	76 ±1.5	126 ±2.0	139 ±2.0	142 ±2.0	250 ±3.0

### Ordering Information

CF bellows with one rotatable flange

Part No.	880 01	880 02	880 03	880 04	-
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## Flexible Connecting Components (CF Corrugated Hoses)



Dimensional drawing for the CF corrugated hoses

### Technical Data

DN	CF	16	16	16	16
Outside diameter	inch	1.33"	1.33"	1.33"	1.33"
A = Length	mm	250	500	750	1000

### Ordering Information

CF corrugated hose with one rotatable flange

Part No.	885 56	885 68	885 65	885 73
----------	--------	--------	--------	--------

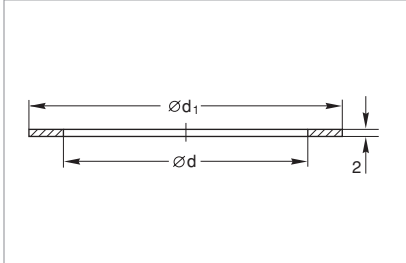
### Dimensions

DN	CF	16
B	mm	23.0
C	mm	16.0
D	mm	15.0
E	mm	22.5
F	mm	70.0
G	mm	50.0



# Accessories for CF Components

## Copper Gaskets for CF Flanges (OFHC Copper – Oxygen-Free)



Dimensional drawing for the copper gaskets for CF flanges

### Technical Data

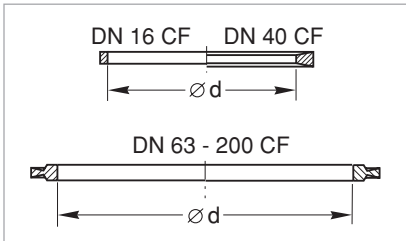
DN	CF	16	40	63	100	160	200	250
Outside diameter	inch	1.33"	2.75"	4.50"	6.00"	8.00"	10.00"	12.00"
d	mm	16.2	39.0	63.6	101.8	152.6	203.4	254.0
d <sub>1</sub>	mm	21.3	48.1	82.4	120.5	171.3	222.1	272.7
Set of 5		-	-	-	-	-	-	x
Set of 10		x	x	x	x	x	x	-

### Ordering Information

Qualität: Standard

Part No. 839 41 839 43 839 44 839 45 839 46 839 47 839 48

## FPM Profiled Gasket without Support Ring



Dimensional drawing for the profiled gaskets without support ring

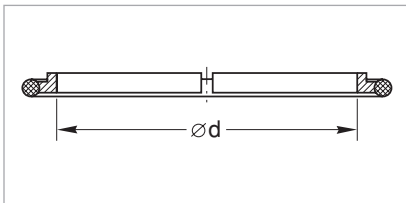
### Technical Data

DN	CF	16	40	63	100	160	200
Outside diameter	inch	1.33"	2.75"	4.50"	6.00"	8.00"	10.00"
d	mm	16.0	42.0	69.7	107.8	156.0	206.0
Bakeout temperature	°C	160	160	160	160	160	160
Set of 2		-	-	x	x	x	x
Set of 5		x	x	-	-	-	-

### Ordering Information

Part No. 839 21 839 23 839 34 839 35 839 36 839 37

## FPM O-ring with Support Ring



Dimensional drawing for the FPM O-rings with support ring

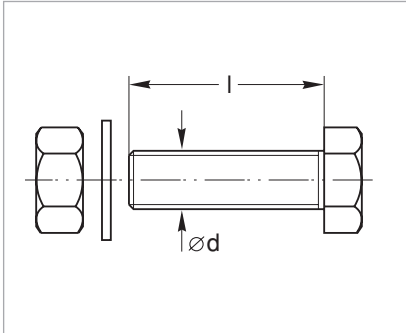
### Technical Data

DN	CF	250
Outside diameter	inch	12.00"
d	mm	248,3
Bakeout temperature	°C	160

### Ordering Information

Part No. 839 03

## Hexagon Bolts, Set for CF Flanges



Dimensional drawing for the hexagon bolts for CF flanges

### Technical Data

DN	CF	16	40	63	100	160	200	250
Outside diameter	inch	1.33"	2.75"	4.50"	6.00"	8.00"	10.00"	12.00"
Dimensions (d x l)	mm	M 4 x 20	M 6 x 35	M 8 x 45	M 8 x 50	M 8 x 55	M 8 x 60	M 8 x 60
Sealing torque <sup>1)</sup>	Nm (lbf-in)	4 35.40	10 88.51	20 177.02	20 177.02	20 177.02	20 177.02	20 177.02
Quantity per set								
Bolts		25	25	25	25	25	25	25
Nuts		25	25	25	25	25	25	25
Washers		25	25	25	25	25	25	25

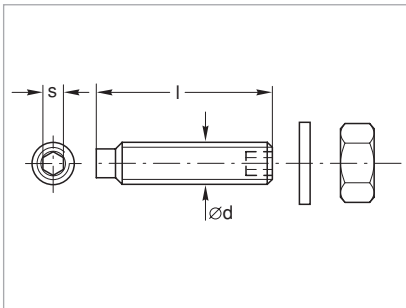
### Ordering information

Set	Part No.	839 00	839 01	838 81	839 04	839 05	839 07	839 07 <sup>2)</sup>
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<sup>1)</sup> With separating agent

<sup>2)</sup> 2 sets are required

## Set Screws, Nuts and Washers for CF Flanges



Dimensional drawing for the set screws, nuts and washers for CF flanges

### Technical Data

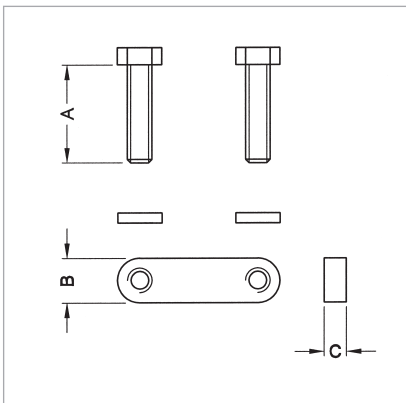
DN	CF	16	40	63 - 100
Dimensions (d x l)	mm	M 4 x 20	M 6 x 35	M 8 x 45
s	mm	2	3	4
Sealing torque <sup>1)</sup>	Nm (lbf-in)	4 35.40	10 88.51	20 177.02
Quantity per set				
Bolts		6	6	16
Nuts		6	6	16
Washers		6	6	16

### Ordering information

Set	Part No.	839 10	839 11	839 13
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<sup>1)</sup> With separating agent

## Bolts with Bolt Nut Plate and Washers



Dimensional drawing for the bolts with bolt nut plate and washers

### Technical Data

DN	CF	16	40	63	100/160
Outside diameter	inch	1.33"	2.75"	4.50"	6.00"/8.00"
Dimensions (d x l)	mm	M 4 x 20	M 6 x 35	M 8 x 45	M 8 x 55
A	mm	20	35	45	55
B	mm	7	10	12	12
C	mm	4	5	8	8
Sealing torque <sup>1)</sup>	Nm (lbf-in)	4 35.40	10 88.51	20 177.02	20 177.02
Quantity per set					
Bolts		6	6	8	20
Bolt nut plate		3	3	4	10
Washers		6	6	8	20

### Ordering information

Set	Part No.	838 87	838 88	838 89	838 91
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<sup>1)</sup> With separating agent

## Lubricant for Threads

This thread lubricant is preferably applied to stainless steel joints and is used to prevent bolts from seizing due to high temperatures or high mechanical stresses.

### Technical Data

Temperature	up to 1000 °C
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### Ordering information

Lubricant for threads, 28 g tube	Part No.	E 839 99
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# Feedthroughs

## Current Feedthroughs

### General

Electrical feedthroughs for vacuum applications, as well as their corresponding connectors, comply with the German VDE Regulations 0100, 0660 and 0110, Section 1. The latter refers to air gaps and leakage paths.

- All current feedthroughs are tested according to VDE Regulations

### Important

The special regional safety regulations must be observed! These may differ from the regulations which apply in Germany! The voltages stated on the following pages apply to atmospheric pressure and the right connector from Oerlikon Leybold Vacuum. The voltage specifications apply also to that part of the feedthrough which is exposed to the vacuum, provided the pressure in these areas is less than  $10^{-1}$  mbar ( $0.75 \times 10^{-1}$  Torr).

At pressures over  $10^{-1}$  mbar ( $0.75 \times 10^{-1}$  Torr) voltage breakdowns may occur depending on the distance between the electrodes, the type of rarefied gas, the type of contamination, the distribution of the electric field, etc.

Operators are advised to check each application individually or to get in touch with Oerlikon Leybold Vacuum for advice.

In applications where VDE regulations need not be applied, higher operating voltages are permissible. Please contact us for further information regarding your particular application.

The test and operating voltages refer to a vacuum pressure of  $< 1 \times 10^{-4}$  mbar ( $< 0.75 \times 10^{-4}$  mbar) and when using the connectors recommended by Oerlikon Leybold Vacuum. Electrical power may only be applied via the external plugs.

### Abbreviations used in connection with feedthroughs:

<b>F</b>	Feedthrough
<b>E</b>	Electric
<b>L</b>	Liquid
<b>N</b>	Normal
<b>P</b>	Precision
<b>F</b>	Frequency
<b>HC</b>	Current
<b>HV</b>	Voltage
<b>L</b>	Linear
<b>R</b>	Rotary

# Electrical Feedthroughs

## Technical Data

### FE 16 / 9S

### FE 16 / 9

Vacuum connection		DN 16 ISO-KF	DN 16 ISO-KF
Number of feedthroughs		9	9
Voltage per pole <sup>1)</sup>	V	50	50
Current per pole <sup>1)</sup>	A	2	2
Connection			
Vacuum side		solder connection	connector
Air side		connector	connector
Diameter of connecting wire	mm (in.)	1.2 (0.05)	1.2 (0.05)
Test voltage	V / Hz	500 / 50	500 / 50
Protection category	IP	68	68
Tightness	mbar x l x s <sup>-1</sup>	1 x 10 <sup>-9</sup>	1 x 10 <sup>-9</sup>
Pressure (absolute) <sup>2)</sup>	mbar (Torr)	1 x 10 <sup>-8</sup> to 2.5 (0.75 x 10 <sup>-8</sup> to 2.5)	1 x 10 <sup>-8</sup> to 2.5 (0.75 x 10 <sup>-8</sup> to 2.5)
Bakeout temperature (feedthrough, connector)	°C (°F)	130 (266)	130 (266)
Housing		nickel-plated brass	nickel-plated brass
Insulator		PEEK / Araldit	PEEK / Araldit
Seal		FPM	FPM
Contact (feedthrough, connector)		gold-plated brass	gold-plated brass

## Ordering Information

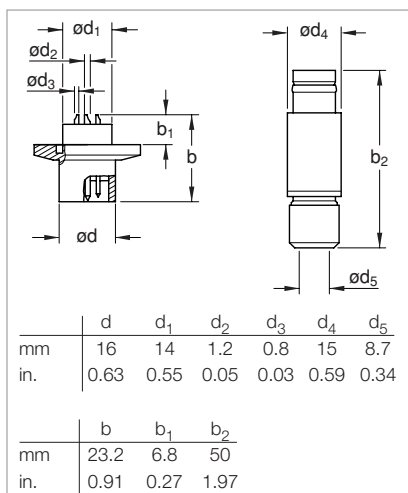
### FE 16 / 9S

### FE 16 / 9

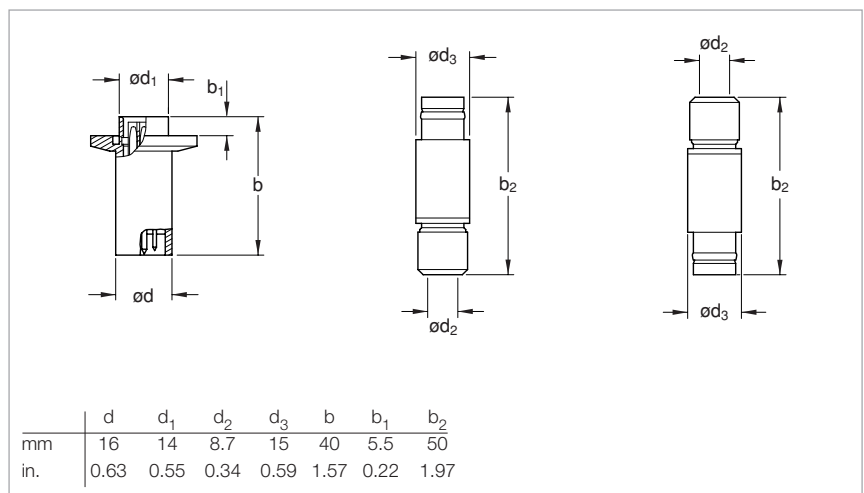
Electrical Feedthroughs	<b>Part No. 210 302</b>	<b>Part No. 210 304</b>
Connector: vacuum side	-	<b>Part No. 210 305</b>
Connector: air side	<b>Part No. 210 303</b>	<b>Part No. 210 303</b>

<sup>1)</sup> Local regulations concerning use must be followed

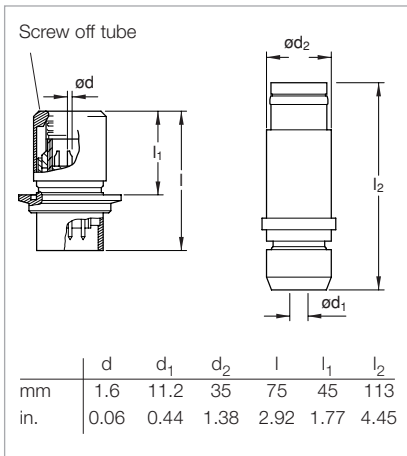
<sup>2)</sup> Pressure max. 10 bar (7.5 Torr) with external centering ring



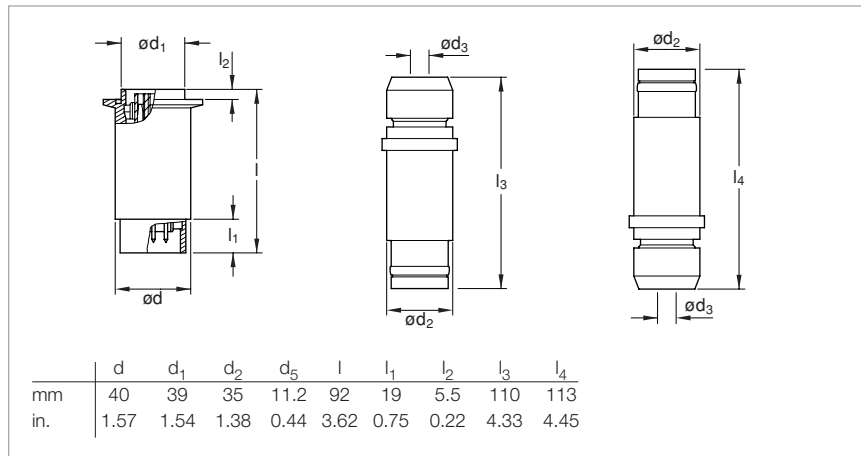
Dimensional drawing for the feedthrough FE 16/9S (left) and the connector for air side (right)



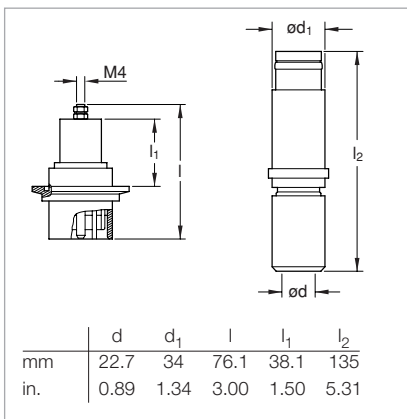
Dimensional drawing for the feedthrough FE 16/9 (left), the connector for vacuum side (middle) and the connector for air side (right)



Dimensional drawing for the feedthrough FE 40/7S (left) and the connector for air side (right)



Dimensional drawing for the feedthrough FE 40/7 (left), the connector for vacuum side (middle) and the connector for air side (right)



Dimensional drawing for the feedthrough FEHV 40/1 (left) and the connector for air side (right)



**Technical Data****FE 40 / 7S****FE 40 / 7****FEHV 40 / 1**

Vacuum connection		DN 40 ISO-KF	DN 40 ISO-KF	DN 40 ISO-KF
Number of feedthroughs		7	7	1
Voltage per pole <sup>1)</sup>	V	380	380	6000
Current per pole <sup>1)</sup>	A	16	16	25
Connection				
Vacuum side		solder connection	connector	screw coupling
Air side		connector	connector	connector
Diameter of connecting wire	mm (in.)	dia. 1.6 (0.06)	dia. 1.6 (0.06)	dia. 5 (0.2)
Test voltage	kV / Hz	–	–	15 / 50
Protection category	IP	68	68	68
Tightness	mbar x l x s <sup>-1</sup>	1 x 10 <sup>-9</sup>	1 x 10 <sup>-9</sup>	1 x 10 <sup>-9</sup>
Pressure (absolute) <sup>2)</sup>		1 x 10 <sup>-8</sup> mbar x l x s <sup>-1</sup> to 2.5 bar (1.9 Torr)	1 x 10 <sup>-8</sup> mbar x l x s <sup>-1</sup> to 2.5 bar (1.9 Torr)	1 x 10 <sup>-8</sup> mbar x l x s <sup>-1</sup> to 2.5 bar (1.9 Torr)
Bakeout temperature (feedthrough, connector)	°C (°F)	130 (266)	130 (266)	130 (266)
Housing		chrom-plated steel	chrom-plated steel	chrom-plated steel
Insulator		PTFE / Araldit	PTFE / Araldit	PTFE / Araldit
Seal		FPM	FPM	FPM
Contact (feedthrough, connector)		gold-plated stainless steel	gold-plated stainless steel	nickel-plated brass

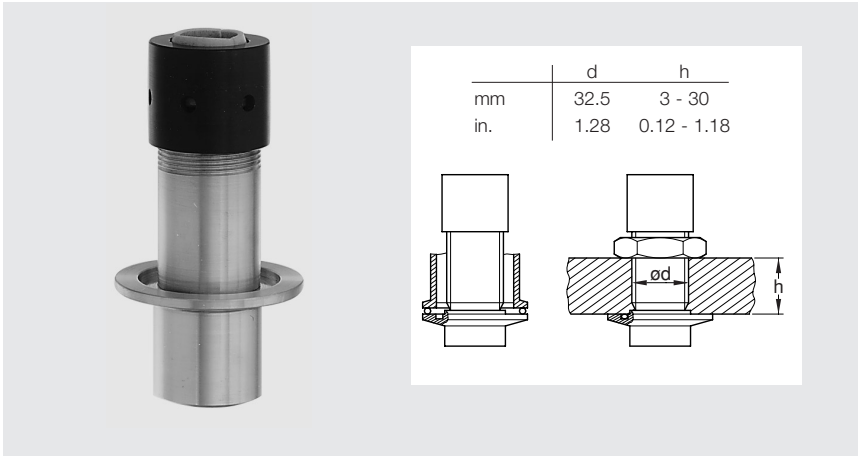
**Ordering Information****FE 40 / 7S****FE 40 / 7****FEHV 40 / 1**

Electrical Feedthroughs	<b>Part No. 210 325</b>	<b>Part No. 210 326</b>	<b>Part No. 210 350</b>
Connector: vacuum side	–	<b>Part No. 210 328</b>	–
Connector: air side	<b>Part No. 210 327</b>	<b>Part No. 210 327</b>	<b>Part No. 210 351</b>

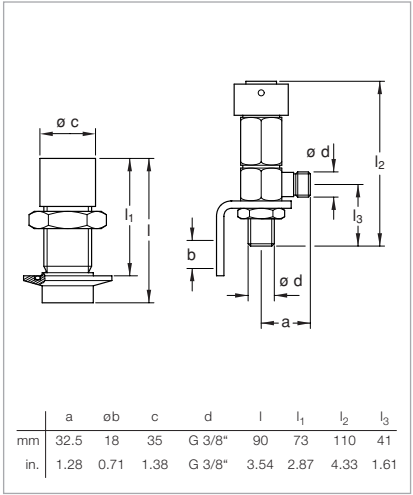
<sup>1)</sup> Local regulations concerning use must be followed

<sup>2)</sup> Pressure max. 10 bar (7.5 Torr) with external centering ring

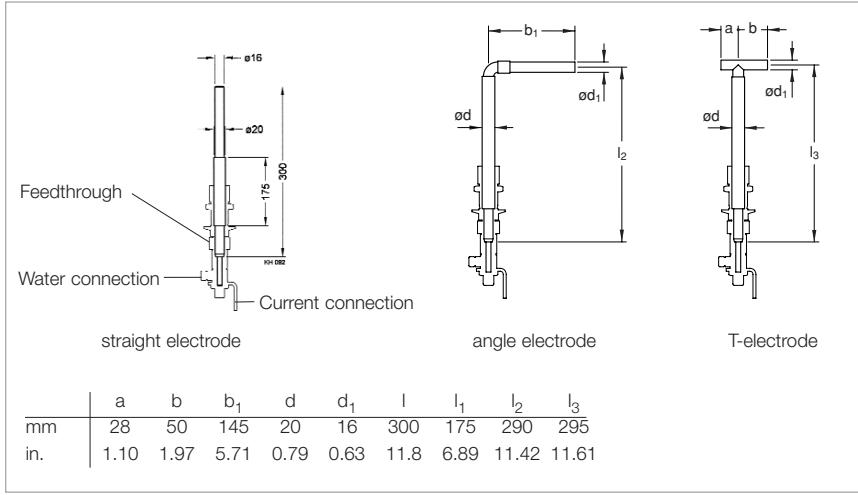
# High Current Feedthroughs



- Selection of electrodes
- Slide into mounted feedthrough
- Current connection with water cooling



Dimensional drawing for the feedthrough FEHC 40/1 (left) and current connection with water cooling (right)



Dimensional drawings for the copper electrodes for the feedthrough FEHC 40/1



**Technical Data****FEHC 40/1**

Vacuum connection		DN 40 ISO-KF
Number of feedthroughs		1
Voltage	V	50
Current	A	250
with water cooling	A	1500
Tightness	mbar x l x s <sup>-1</sup>	1 x 10 <sup>-9</sup>
Pressure (absolute)		1 x 10 <sup>-8</sup> mbar to 2.5 bar (max. 10 bar with external centering ring)
Bakeout temperature	°C (°F)	110 (230)
Housing		aluminum
Insulator		thermoplast and thermoset
Seal		FPM

**Ordering Information****FEHC 40/1**

High Current Feedthroughs	<b>Part No. 210 352</b>
Current connection with water cooling <sup>1)</sup>	<b>Part No. 210 356</b>
Straight electrode	<b>Part No. 210 353</b>
Angle electrode	<b>Part No. 210 354</b>
T-electrode	<b>Part No. 210 355</b>

<sup>1)</sup> not insulated

# Rotary Feedthroughs

- ISO-KF
- For transmitting high torque
- With FPM shaft seal and ball bearings

## Technical Data

### FR 25/50 N

### FR 63/100 N

Vacuum connection		DN 25 ISO-KF	DN 63 ISO-KF
Feedthrough / seal		FPM	FPM
Shaft connection	mm (in.)	dia. 8 (0.31)	dia. 20 (0.79)
Transferable torque	Nm	6	100
Rotational speed <sup>1)</sup>	1/min	1000	500
Shaft load			
Radial	N	150	500
Axial	N	50	100
Service life (revolutions)		20 000 000	10 000 000
Tightness, static	mbar x l x s <sup>-1</sup>	1 x 10 <sup>-9</sup>	1 x 10 <sup>-9</sup>
Pressure (absolute)		1 x 10 <sup>-9</sup> mbar to 1 bar	1 x 10 <sup>-9</sup> mbar to 1 bar
Operating temperature, max.	°C (°F)	50 (122)	50 (122)
Bakeout temperature	°C (°F)	110 (230)	110 (230)
Materials exposed to process media		stainless steel, aluminum, FPM	stainless steel, aluminum, FPM
Weight	kg (lbs)	0.2 (0.44)	2 (4.42)

## Ordering Information

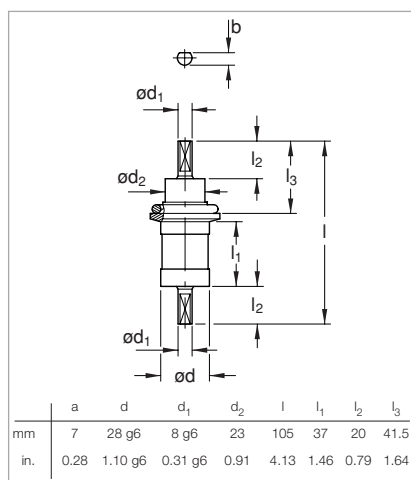
### FR 25/50 N

### FR 63/100 N

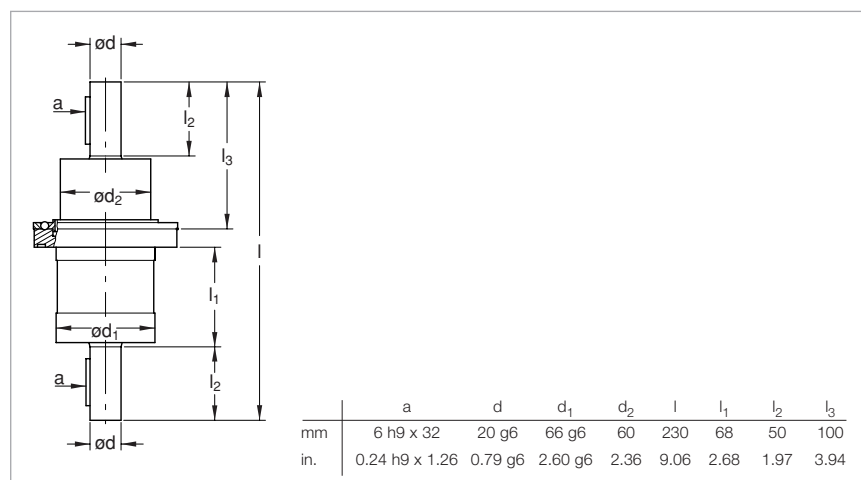
Rotary Feedthrough	<b>Part No. 210 151</b>	<b>Part No. 210 153 <sup>2)</sup></b>
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<sup>1)</sup> When a reduced service life is acceptable, the rotational speed can be increased by up to a factor of two

<sup>2)</sup> Centering ring, CR/aluminum Part No. 268 05, FPM/stainless steel Part No. 887 03



Dimensional drawing  
for the feedthrough FR 25/50 N



Dimensional drawing for the feedthrough FR 63/100 N

# Liquid Feedthroughs

- For H<sub>2</sub>O and LN<sub>2</sub>
- Thermically insulated
- Especially suited for very hot and very cold applications

## Technical Data

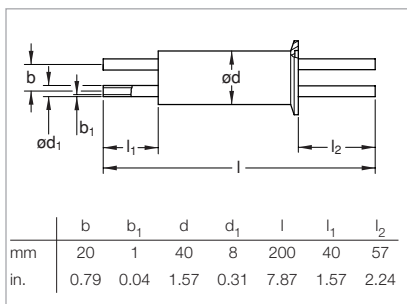
## FL 40K/2

Vacuum connection		DN 40 ISO-KF
Feedthrough / seal		welded
Connection	mm (in.)	dia. 8 x 1 (0.31 x 0.04)
Number of tubes		2
Tightness	mbar x l x s <sup>-1</sup>	1 x 10 <sup>-9</sup>
Pressure (absolute)		1 x 10 <sup>-9</sup> mbar to 2.5 bar (max. 10 bar with external centering ring)
Temperature range	°C (°F)	-200 to +150 (-328 to +302)
Material		stainless steel
Weight	kg (lbs)	0.3 (0.66)

## Ordering Information

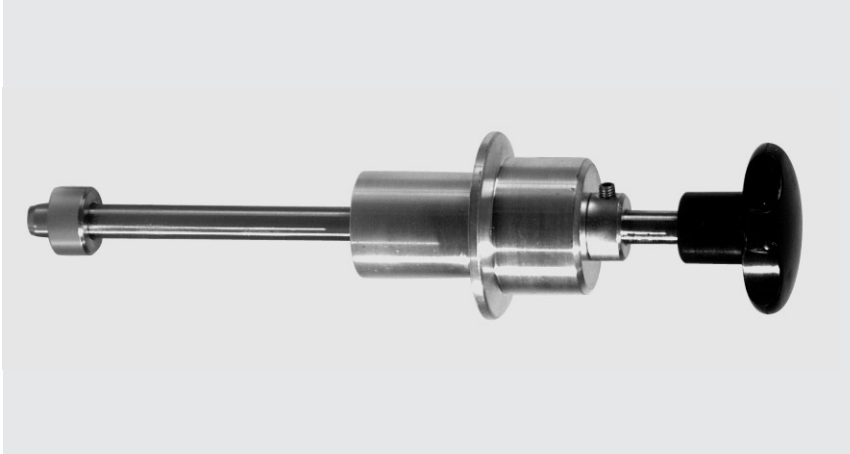
## FL 40K/2

Liquid Feedthrough	<b>Part No. 210 275</b>
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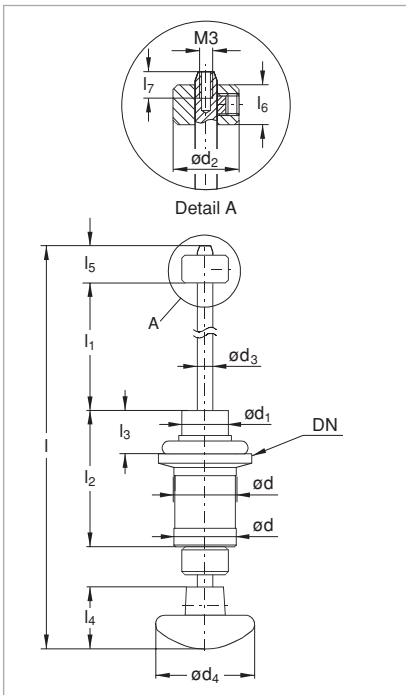


Dimensional drawing for the liquid feedthrough  
FL 40K/2

# Rotary / Linear Motion Feedthroughs



- Two FPM shaft seals
- Direct push/pull and rotary actuation
- With locking ring and optional anti-rotation device



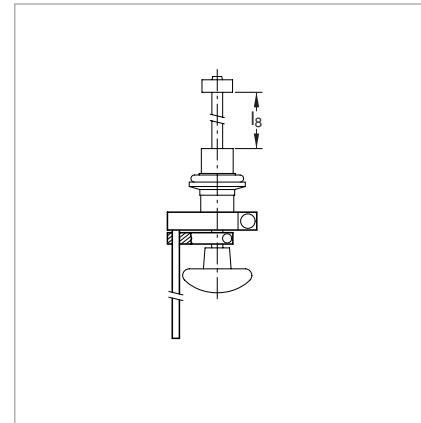
Dimensional drawing for the feedthroughs FNRL

## Dimension Table

Anti-rotation device	$l_3 = l_1$ from		
	FNRL 16/50	FNRL 25/100	
Part No. 210 225	mm in.	50 1.97	- -
Part No. 210 226	mm in.	- -	100 3.94

## Dimension Table

Feedthroughs	DN	d	d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	
FNRL 16/50	16	20g6 0.79g6	15 0.59	15 0.59	$5^{+0.03}_{-0.05}$ 0.20	
FNRL 25/100	25	25g6 0.98g6	23 0.91	22 0.87	$8^{+0.03}_{-0.05}$ 0.31	
		d <sub>4</sub>	l	l <sub>1</sub> max.	l <sub>2</sub>	l <sub>3</sub>
FNRL 16/50	mm	32	134	50	44	14
	in.	1.26	5.28	1.97	1.73	0.55
FNRL 25/100	mm	50	210	100	58	24
	in.	1.97	8.27	3.94	2.28	0.94
		l <sub>4</sub>	l <sub>5</sub>	l <sub>6</sub>	l <sub>7</sub>	
FNRL 16/50	mm	20	10.5	8	7	
	in.	0.79	0.41	0.31	0.28	
FNRL 25/100	mm	32	11	9	8	
	in.	1.26	0.43	0.35	0.31	



Dimensional drawing for the anti-rotation device

**Technical Data****FNRL 16/50****FNRL 25/100**

Vacuum connection		DN 16 ISO-KF	DN 25 ISO-KF
Feedthrough / seal		FPM	FPM
Shaft connection	mm (in.)	M 3 x 6 / dia. 5 (M 3 x 0.24 / dia. 0.20)	M 4 x 8 / dia. 8 (M 4 x 0.31 / dia. 0.31)
Stroke	mm (in.)	50 (1.97)	100 (3.94)
Shaft load			
Radial, at. max. displacement	N	10	15
Torsion	Nm	2	8
Tightness, static	mbar x l x s <sup>-1</sup>	1 x 10 <sup>-9</sup>	1 x 10 <sup>-9</sup>
Operating pressure range (absolute)		1 x 10 <sup>-8</sup> mbar to 1 bar	1 x 10 <sup>-8</sup> mbar to 1 bar
Operating temperature, max.	°C (°F)	50 (122)	50 (122)
Bakeout temperature	°C (°F)	110 (230)	110 (230)
Materials exposed to process media		stainless steel, aluminum, FPM	stainless steel, aluminum, FPM
Weight	kg (lbs)	0.1 (0.22)	0.2 (0.44)

**Ordering Information****FNRL 16/50****FNRL 25/100**

Rotary / linear feedthrough	<b>Part No. 210 200</b>	<b>Part No. 210 201</b>
Anti-rotation device	<b>Part No. 210 225</b>	<b>Part No. 210 226</b>

# CF Feedthroughs

CF feedthroughs are available in a variety of field-proven designs, specifically:

- Linear motion mechanical feedthroughs,
- Rotary motion mechanical feedthroughs,

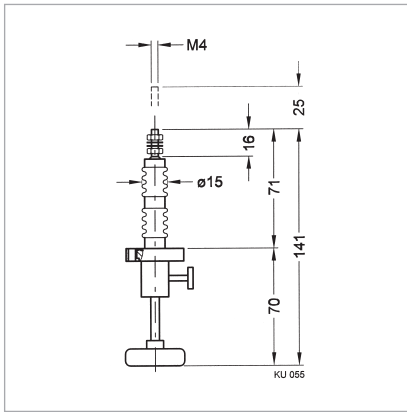
A stainless steel bellows is used to seal off the CF linear and rotary feedthroughs against the atmosphere.

All feedthroughs can be installed in the vacuum systems in any orientation.

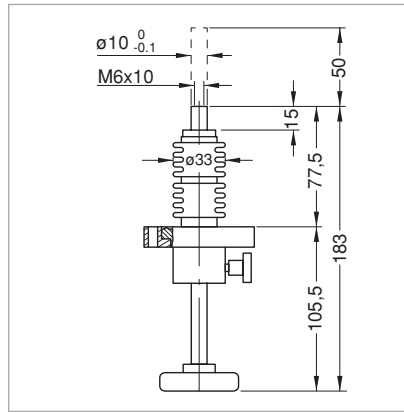
## Abbreviations used in connection with feedthroughs:

- F** Feedthrough
- E** Electric
- L** Liquid
- N** Normal
- P** Precision
- F** Frequency
- HC** Current
- HV** Voltage
- L** Linear
- R** Rotary

## Linear Motion Mechanical Feedthroughs



Dimensional drawing for the FNL 16/25 linear motion feedthrough



Dimensional drawing for the FNL 40/50 linear motion feedthrough

### Technical Data

### FNL 16/25

### FNL 40/50

		FNL 16/25	FNL 40/50
Nominal width	DN	16 CF-R	40 CF-R
Shaft connection	mm	M 4 x 16	M 6 x 10, $\phi$ 10
Feedthrough/seal		bellow	bellow
Actuator		manually	manually
Travel	mm	25	50
Scale division	mm	5	10
Shaft load			
Radial at max. displacement	N	20	200
Axial, against vacuum	N	85	140
Axial, against atmosphere	N	100	200
Torsion	Nm (lbf-in)	0.2 (1.77)	0.5 (4.43)
Tightness	mbar x l x s <sup>-1</sup>	$1 \times 10^{-10}$	$1 \times 10^{-10}$
Pressure absolute		$1 \times 10^{-9}$ mbar to 2 bar	$1 \times 10^{-9}$ mbar to 2 bar
Bakeout temperature	°C	300	300
Weight	kg (lbs)	0.15 (0.33)	0.75 (1.66)
Materials exposed to process media		Stainless steel	Stainless steel

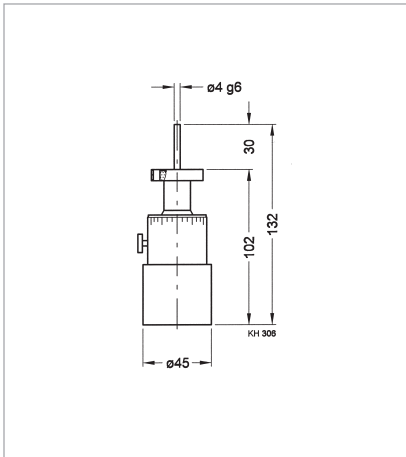
### Ordering information

### FNL 16/25

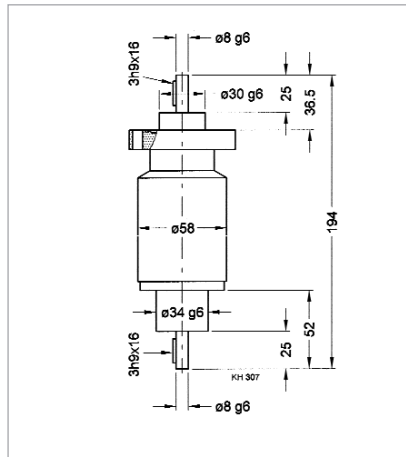
### FNL 40/50

Linear motion feedthrough	Part No. 210 250	Part No. 210 251
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# Linear Motion Mechanical Feedthroughs



Dimensional drawing for the FPR 16/5 N rotary feedthrough



Dimensional drawing for the FNR 40/20 N rotary feedthrough

The rotation of the drive knob is translated via a gearless drive system to the shaft on the vacuum side. This shaft runs on ball bearings which do not require any maintenance during the entire service life.

## Technical Data

### FPR 16/5 N

### FNR 40/20 N

Nominal width	DN	16 CF-F	40 CF-F
Shaft connection	mm	dia. 4	dia. 8
Feedthrough/seal		bellow	bellow
Transferable torque			
Dynamic	Nm (lbf-in)	0.4 (3.54)	4.0 (35.40)
Dynamic, at 300 °C	Nm (lbf-in)	0.2 (1.77)	2.0 (17.70)
Static	Nm (lbf-in)	0.2 (1.77)	3.0 (26.55)
Rotational speed	rpm	200	1000
at max. torque	rpm	–	500
Scale division	mm	10°	–
Shaft load			
Radial	N	10	60
Axial	N	5	20
Tightness	mbar x l x s <sup>-1</sup>	1 x 10 <sup>-10</sup>	1 x 10 <sup>-10</sup>
Pressure absolute		1 x 10 <sup>-9</sup> mbar to 2 bar	1 x 10 <sup>-9</sup> mbar to 2 bar
Operating temperature	°C	300	300
Bakeout temperature	°C	300	300
Weight	kg (lbs)	0.3 (0.66)	1.5 (3.31)
Materials exposed to process media		Stainless steel	Stainless steel

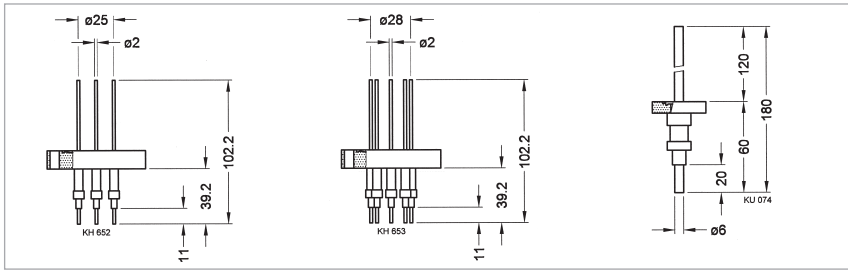
## Ordering information

### FPR 16/5 N

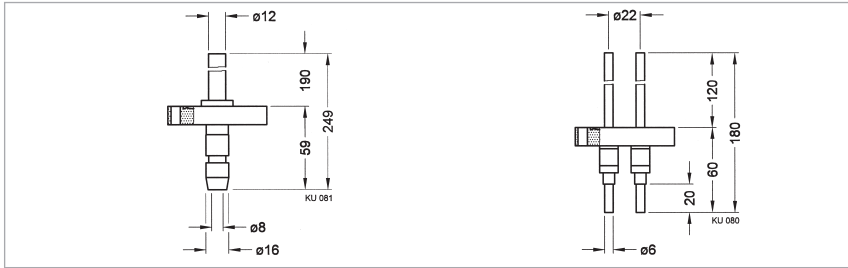
### FNR 40/20 N

Rotary feedthrough	<b>Part No. 210 154</b>	<b>Part No. 210 155</b>
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# Electrical Feedthroughs



Dimensional drawing for the electrical feedthrough FE 40/4 (left), FE 40/9 (middle) and FEHC 16/1 (right)



Dimensional drawing for the electrical feedthrough FEHC 40/1 (left) and FEHC 40/2 (right)

The electric UHV feedthroughs comply with the relevant VDE regulations.

Concerning the air gaps and creepage paths, they have been designed in accordance with VDE 0100, i.e. both sides of the feedthrough are tested under atmospheric pressure conditions.

## Technical Note

All electric specifications of the described voltage and current feedthroughs are rated in accordance with overvoltage class 1 and contamination grade 2.

## Technical Data

### FE 40/4      FE 40/9      FEHC 16/1      FEHC 40/1      FEHC 40/2

Nominal width	DN	CF 40-F	CF 40-F	CF 16-F	CF 40-F	CF 40-F
Number of feedthroughs		4	9	1	1	2
Number of connection pieces						
vacuum side (set)		5	10	2	1	2
atmospheric side (set)		5	10	2	1	2
Voltage per pole <sup>1)</sup>	kV	1	1	4	1	4
Current per pole <sup>1)</sup>	A	8	1	150	250/1000 <sup>2)</sup>	150
Bakeout temperature	°C	400	400	400	400	400
Temperature rise at max. current	°C/min	5	5	5	4	4
Tightness	mbar x l x s <sup>-1</sup>	1 x 10 <sup>-10</sup>	1 x 10 <sup>-10</sup>	1 x 10 <sup>-10</sup>	1 x 10 <sup>-10</sup>	1 x 10 <sup>-10</sup>
Pressure absolute		1 x 10 <sup>-10</sup> mbar to 2 bar	1 x 10 <sup>-10</sup> mbar to 2 bar	1 x 10 <sup>-10</sup> mbar to 2 bar	1 x 10 <sup>-10</sup> mbar to 2 bar	1 x 10 <sup>-10</sup> mbar to 2 bar
Flange		Stainless steel	Stainless steel	Stainless steel	Stainless steel	Stainless steel
Conductor		Stainless steel	Stainless steel	Copper	Copper	Copper
Insulator		Al <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>
Weight	kg (lbs)	0.3 (0.66)	0.4 (0.88)	0.15 (0.33)	0.5 (1.10)	0.45 (0.91)

## Ordering information

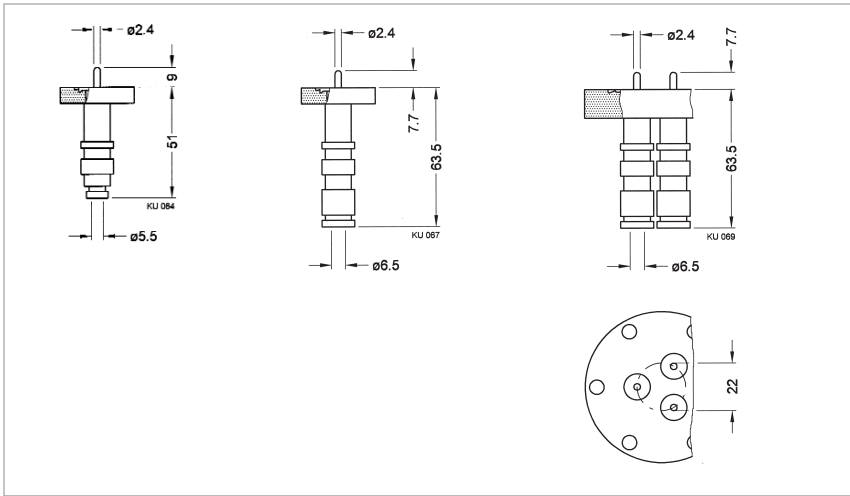
### FE 40/4      FE 40/9      FEHC 16/1      FEHC 40/1      FEHC 40/2

Current feedthrough	Part No. 210 310	Part No. 210 313	Part No. 210 335	-	Part No. 210 342
Connection piece, vacuum side (set)	Part No. 210 312	Part No. 2x 210 312	Part No. 210 337	-	Part No. 210 337
Connector, atmospheric side (set)	Part No. 210 311	Part No. 2x 210 311	Part No. 210 336	-	Part No. 210 336
Connector, atmospheric side, H <sub>2</sub> O cooled	-	-	-	-	-

<sup>1)</sup> Local safety regulations must be met

<sup>2)</sup> with water-cooling





Dimensional drawing for the electrical feedthrough FEF 16/1 (left), FEHV 16/1 (middle) and FEHV 40/3 (right)

The electric UHV feedthroughs comply with the relevant VDE regulations.

Concerning the air gaps and creepage paths, they have been designed in accordance with VDE 0100, i.e. both sides of the feedthrough are tested under atmospheric pressure conditions.

### Technical Note

All electric specifications of the described voltage and current feedthroughs are rated in accordance with overvoltage class 1 and contamination grade 2.

### Technical Data

#### FEF 16/1

#### FEHV 16/1

#### FEHV 40/3

	DN	CF 16-F	CF 16-F	CF 40-F
Nominal width	DN	CF 16-F	CF 16-F	CF 40-F
Number of feedthroughs		1	1	3
Voltage				
AC, 50 Hz	kV	0.35	3.5	3.5
DC	kV	0.5	5.0	5.0
Current	A	3	3	3
Frequency	MHz	150	–	–
Impedance	Ω	50 - 60	–	–
Insulation resistance at 20 °C	Ω	10 <sup>-10</sup>	10 <sup>-10</sup>	10 <sup>-10</sup>
Bakeout temperature				
with connector	°C	50	50	50
without connector	°C	400	400	400
Temperature rise at max. current	°C/min	5	5	5
Tightness	mbar x l x s <sup>-1</sup>	1 x 10 <sup>-10</sup>	1 x 10 <sup>-10</sup>	1 x 10 <sup>-10</sup>
Pressure absolute		1 x 10 <sup>-8</sup> mbar – 10 bar	1 x 10 <sup>-8</sup> mbar – 10 bar	1 x 10 <sup>-8</sup> mbar – 10 bar
Housing, flange, conductor		Stainless steel	Stainless steel	Stainless steel
Feedthrough, seal		Al <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>
Weight	kg (lbs)	0.14 (0.31)	0.14 (0.31)	0.5 (1.10)

### Ordering information

#### FEF 16/1

#### FEHV 16/1

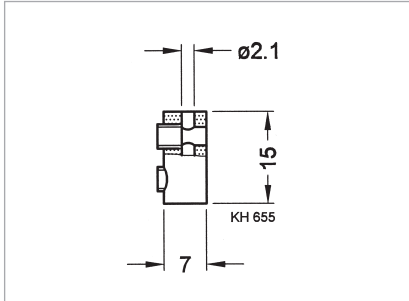
#### FEHV 40/3

	Part No. 210 404	Part No. 210 402	Part No. 210 403
Current feedthrough	Part No. 210 404	Part No. 210 402	Part No. 210 403
Inside plug	–	–	–
Outside plug (included in delivery)	<b>BNC UG 88/U</b>	<b>MHV UG 932/U</b>	<b>MHV UG 932/U</b>
Cable	<b>RG 58/U</b>	<b>RG 58/U</b>	<b>RG 58/U</b>

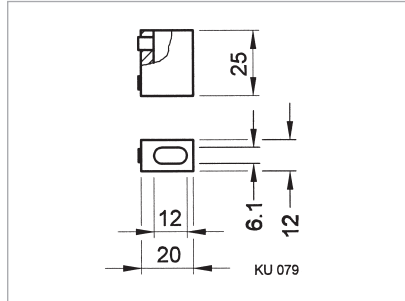
1) with elastomer seal up to 150 °C

# Accessories for Feedthroughs

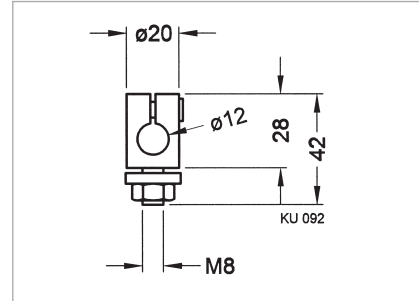
## Connectors, vacuum side



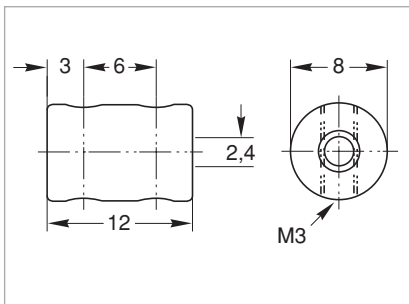
Dimensional drawing for the connector used on FE 40/4 / FE 40/9



Dimensional drawing for the connector used on FEHC 40/1



Dimensional drawing for the connector used on FE 16/1, FEHC 40/2 and FEHC 16/1



Dimensional drawing for the connector used on FEHV 16/1, FEHV 40/3 and FEF 16/1

### Technical Data

### Connectors Vacuum Side

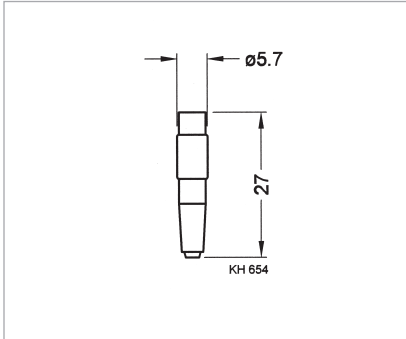
Connector for feedthrough	FE 40/4 / FE 40/9	FE 16/1 / FEHC 40/2 / FEHC 16/1	FEHC 40/1	FEHV 16/1 / FEHV 40/3 FEF 16/1
Current max.	A 12	90	1000	3
Bakeout temperature	°C 400	400	400	350
Material	Stainless steel	Stainless steel	Copper	Copper

### Ordering information

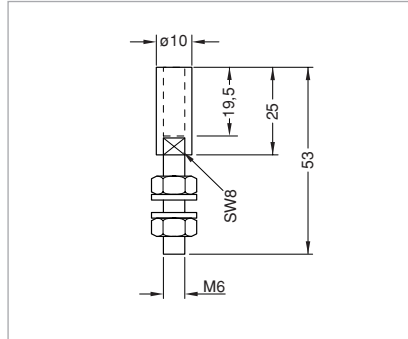
### Connectors Vacuum Side

Connector, vacuum side	-	-	-	Part No. 846 47
Connector, vacuum side (Set of 5)	Part No. 210 312	-	-	-
Connector, vacuum side (Set of 2)	-	Part No. 210 337	-	-

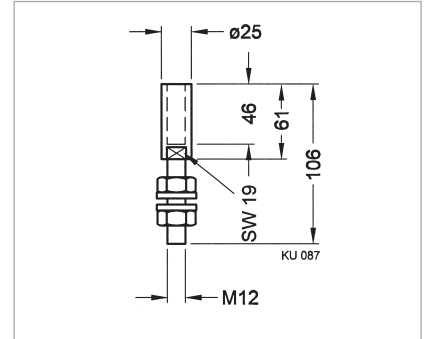
# Connectors, atmospheric side



Dimensional drawing for the outside plug used on FE 40 /4 and FE 40/9



Dimensional drawing for the outside plug used on FE 16/1, FEHC 40/2 and FEHC 16/1



Dimensional drawing for the outside plug used on FEHC 40/1

## Technical Data

### Connectors Atmospheric Side

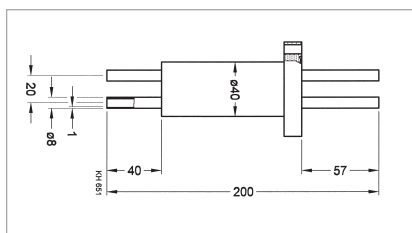
Connector for feedthrough		FE 40/4 / FE 40/9	FE 16/1 / FEHC 40/2 / FEHC 16/1	FEHC 40/1
Current max.	<b>A</b>	12	90	250
Not insulated, for use up to	<b>V</b>	50	50	50
Bakeout temperature	<b>°C</b>	50	150	150
Material		gold-plated brass	silver-plated brass	silver-plated brass

## Ordering information

### Connectors Atmospheric Side

Connector, atmospheric side	-	-	<b>Part No. 210 339</b>
Connector, atmospheric side (Set of 5)	<b>2 x Part No. 210 311</b>	-	-
Connector, atmospheric side (Set of 2)	-	<b>Part No. 210 336</b>	-

# CF Liquid Feedthrough



Dimensional drawing for the FL 40C/2 CF liquid feedthrough

The thermally insulated CF liquid feedthrough is used to convey cold or hot gases, liquids or liquid nitrogen.

## Technical Note

The ends of the tubes are long enough that they may be bent apart so that an UHV compatible connection can be provided.

## Technical Data

## FL 40C/2

Nominal width	DN	40 CF-F
Feedthrough / seal		welded / brazed
Connection	mm	dia. 8 x 1
Number of tubes		2
Tightness	mbar x l x s <sup>-1</sup>	1 x 10 <sup>-10</sup>
Pressure absolute		10 <sup>-9</sup> mbar to 10 bar (at 400 °C max. 2 bar)
Temperature range	°C	-400 to +400
Material		Stainless steel
Weight	kg (lbs)	0.4 (0.88)

## Ordering information

## FL 40C/2

CF liquid feedthrough	<b>Part No. 210 276</b>
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# Miscellaneous

## Vacuum Greases

### RAMSAY greases

for lubricating ground joints and drain valve in fore-vacuum lines consist of special grades of paraffin jelly to which caoutchouc is added for attaining the specific consistence.

### RAMSAY grease thick

is used to lubricate ground joints. Usable down to  $10^{-2}$  mbar/Torr.

### RAMSAY grease soft

is used to lubricate drain valves. Usable down to  $10^{-2}$  mbar/Torr.

### GLEITLEN

is a special grease used to lubricate stirrer shafts (KPG stirrers, among others) of all sizes in the laboratory. Usable down to  $10^{-2}$  mbar/Torr.

### LITHELEN

contains lithium compounds, and all components contributing to higher vapor pressures have been removed through high-vacuum pre-processing. It may be used within a wide temperature range (from 0 °C to 150 °C (32 °F to 302 °F)) and in all applications from atmospheric pressure down to  $10^{-8}$  mbar ( $0.75 \times 10^{-8}$  Torr).

### Silicone high-vacuum grease

#### Dow Corning

contains compounds of a high molecular weight together with chain elements containing silicon and oxygen. At temperatures over 220 °C (428 °F) the silicone grease will polymerise giving off gas. It may be used within a wide temperature range (from -40 °C to 200 °C (-40 °F to 392 °F)) and in all applications from atmospheric pressure down to  $10^{-6}$  mbar/Torr.

#### DYNAFAT

is used to lubricate gaskets.

Material safety data sheets are available upon request for professional users from: Email „documentation.vacuum@oerlikon.com“ or from the Internet „www.oerlikon.com“.

## Overview Sealing Greases

### Application Data

	RAMSAY grease, thick	RAMSAY grease, soft	GLEITLEN	LITHELEN	Silicone high-vacuum grease	DYNAFAT
Purpose	Greasing of ground joints and drain valves, usable down to pressures of $10^{-2}$ mbar/Torr	Greasing of ground joints and drain valves, usable down to pressures of $10^{-2}$ mbar/Torr	Lubrication of stirrer shafts (KPG stirrer)	Greasing of ground joints and drain valves at low pressures and high working temperatures	Greasing of ground joints and drain valves at low pressures and high working temperatures	Lubrication of gaskets

### Technical Data

	RAMSAY grease, thick	RAMSAY grease, soft	GLEITLEN	LITHELEN	Silicone high-vacuum grease	DYNAFAT
Vapor pressure at 20 °C (68 °F) mbar/Torr	$10^{-4}$	$10^{-4}$	$10^{-4}$	$10^{-10}$	$10^{-7}$	$10^{-3}$
Dripping point °C (°F)	> 56 (> 133)	> 56 (> 133)	> 50 (> 122)	> 210 (> 410)	<sup>1)</sup>	148 (298)
Max. working temperature °C (°F)	30 (86)	30 (86)	30 (86)	150 (302)	200 (392)	110 (230)

### Ordering Information

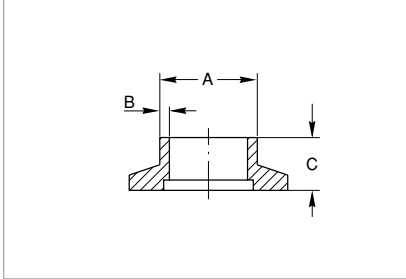
	RAMSAY grease, thick	RAMSAY grease, soft	GLEITLEN	LITHELEN	Silicone high-vacuum grease	DYNAFAT
Tin 50 g (0.11 lbs)	Part No. 177 32	Part No. 177 42	Part No. 176 38	-	-	-
Tube 50 g (0.11 lbs)	-	-	-	Part No. 176 44	Part No. 210 502	-
Tube 100 g (0.22 lbs)	-	-	-	-	-	Part No. 210 500

<sup>1)</sup> over 220 °C (428 °F) polymerisation

# Only available for purchase in North and South America

## ISO-KF Flange Fittings and Components

### KF Flanges with Short Weld Stub, Standard-Inch Diameters



Dimensional drawing for the KF flanges with short weld stub

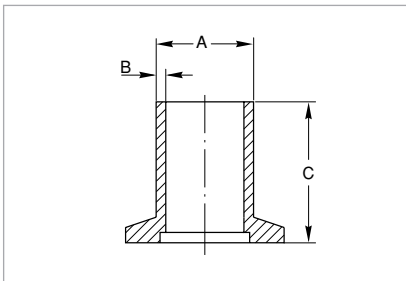
#### Technical Data

DN	KF	16	25	40	50
∅ A	mm	19	25.4	38.1	50.8
	in.	0.75	1.00	1.50	2.00
B	mm	1.7	1.7	2.1	2.1
	in.	0.065	0.065	0.083	0.083
C	mm	12.7	12.7	19.0	19.0
	in.	0.50	0.50	0.75	0.75
Tube fitting O.D. size		3/4"	1"	1 1/2"	2"

#### Ordering Information

Stainless steel	Part No.	899 611	899 612	899 614	899 615
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### KF Flanges with Long Weld Stub, Standard-Inch Diameters



Dimensional drawing for the KF flanges with long weld stub

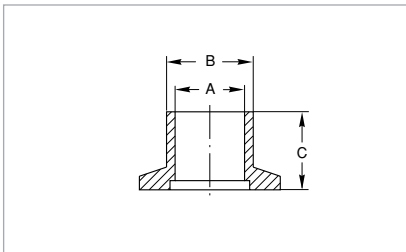
#### Technical Data

DN	KF	16	25	40	50
∅ A	mm	19	25.4	38.1	50.8
	in.	0.75	1.00	1.50	2.00
B	mm	1.7	1.7	2.1	2.1
	in.	0.065	0.065	0.083	0.083
C	mm	40.0	40.0	40.0	40.0
	in.	1.575	1.575	1.575	1.575
Tube fitting O.D. size		3/4"	1"	1 1/2"	2"

#### Ordering Information

Stainless steel	Part No.	899 621	899 622	899 624	899 625
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### KF Flanges with Weld Stub, Metric Diameters



Dimensional drawing for the KF flanges with weld stub

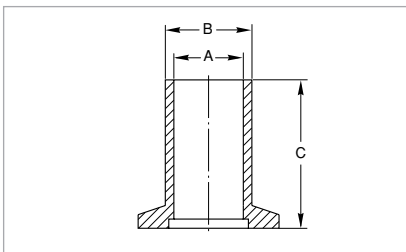
#### Technical Data

DN	KF	16	25	40	50
∅ A	mm	16	25	40	50
	in.	0.630	0.984	1.575	1.968
B	mm	20	28	45	55
	in.	0.787	1.102	1.772	1.165
C	mm	16	19	25	25
	in.	0.630	0.750	0.984	0.984

#### Ordering Information

Stainless steel	Part No.	884 21	884 22	884 23	883 85
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### KF Flanges with Weld Neck, Metric Diameters



Dimensional drawing for the KF flanges with weld neck

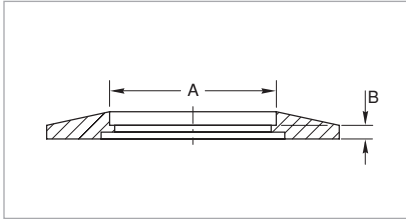
#### Technical Data

DN	KF	16	25	40
∅ A	mm	16	25	40
	in.	0.630	0.984	1.575
B	mm	20	28	45
	in.	0.787	1.102	1.772
C	mm	57	57	57
	in.	2.250	2.250	2.250

#### Ordering Information

Stainless steel	Part No.	884 31	884 32	884 33
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## Flanges with Welded Socket



Dimensional drawing for the flanges with welded sockets

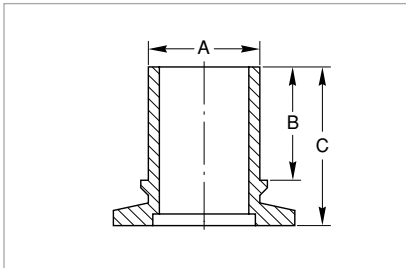
### Technical Data

DN	KF	16	25	40	50
∅ A	mm	17.3	26.2	41.1	52.1
	in.	0.68	1.03	1.62	2.05
B	mm	3.0	3.0	3.0	3.0
	in.	0.12	0.12	0.12	0.12
Tube fitting O.D. size		3/4"	1"	1 1/2"	2"

### Ordering Information

Stainless steel	Part No.	899 631	899 632	899 634	899 635
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## KF Flanges for Tube Fittings, Male



Dimensional drawing for the KF flanges for tube fittings, male

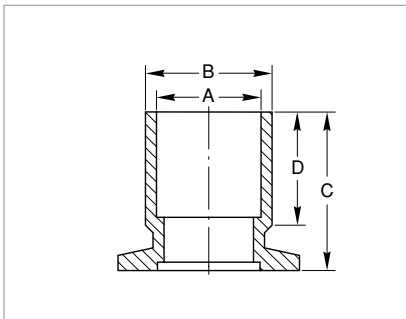
### Technical Data

DN	KF	16	25	40	40
∅ A	mm	19	29.0	44.5	41.0
	in.	0.750	1.125	1.750	1.625
B	mm	17.5	29.0	29.0	29.0
	in.	0.688	1.125	1.125	1.125
C	mm	29.0	35.0	46.0	46.0
	in.	1.125	1.375	1.812	1.812
Tube fitting I.D. size		3/4"	1 1/8"	1 3/4"	1 5/8"

### Ordering Information

Stainless steel	Part No.	910280119	910280120	910280126	910280121
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## KF Flanges for Tube Fittings, Female



Dimensional drawing for the KF flanges for tube fittings, female

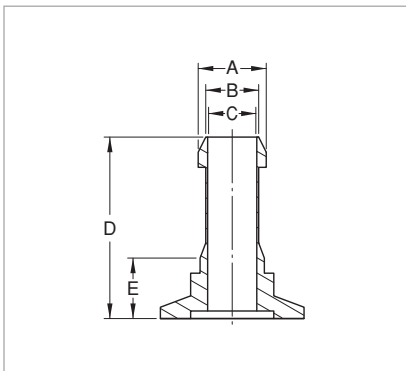
### Technical Data

DN	KF	16	25	40	40
∅ A	mm	19	29.0	54.0	41.0
	in.	0.754	1.130	2.130	1.630
∅ B	mm	22.0	32.0	57.0	44.5
	in.	0.875	1.250	2.240	1.750
C	mm	25.4	35.0	35.0	35.0
	in.	1.000	1.375	1.375	1.375
D	mm	13.0	17.0	16.0	19.0
	in.	0.500	0.672	0.625	0.750
Tube fitting O.D. size		3/4"	1 1/8"	2 1/8"	1 5/8"

### Ordering Information

Stainless steel	Part No.	910280122	910280123	910280124	910280125
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## KF Nipples, American Standard



Dimensional drawing for the KF nipples american standard

### Technical Data

DN	KF	16	16	25
∅ A	mm	9.5	16.1	16.1
	in.	0.375	0.635	0.635
∅ B	mm	7.6	14.3	14.3
	in.	0.300	0.563	0.563
C	mm	5.6	11.9	11.9
	in.	0.219	0.469	0.469
D	mm	40	40	40
	in.	1.575	1.575	1.575
E	mm	12.7	12.7	12.7
	in.	0.500	0.500	0.500
Tube fitting O.D. size		1/4"	1/2"	1/2"

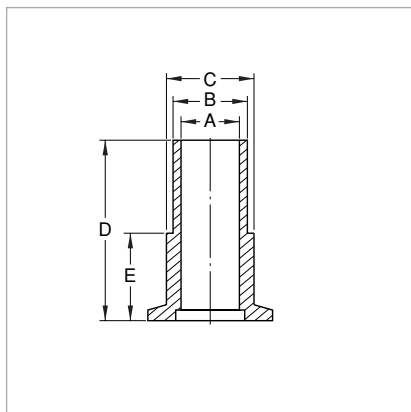
### Ordering Information

Stainless steel	Part No.	899 674	899 675	899 676
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# Only available for purchase in North and South America

## Adaptors

### Hose Adapter



Dimensional drawing for the hose adaptors

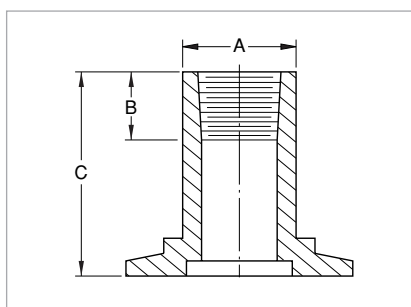
#### Technical Data

DN	KF	16	25	40
∅ A	mm	16	21	32
	in.	0.625	0.813	1.250
∅ B	mm	19.5	26	39
	in.	0.770	1.020	1.540
∅ C	mm	20	28	45
	in.	0.787	1.102	1.772
D	mm	29	29	29
	in.	1.125	1.125	1.125
E	mm	13	13	13
	in.	0.500	0.500	0.500
Nominal I.D. hose		3/4"	1"	1 1/2"

#### Ordering Information

Stainless steel	Part No.	992780668	992780670	992780672
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### KF/NPT Female Adapter



Dimensional drawing  
for the KF/NPT female adaptors

#### Technical Data

DN	KF	16	25	40
∅ A	mm	16	25	38
	in.	0.620	0.995	1.500
B	mm	10	10	10
	in.	0.394	0.394	0.394
C	mm	25.4	25.4	25.4
	in.	1.000	1.000	1.000
Pipe size NPT		1/8"	1/8"	1/8"

#### Ordering Information

Stainless steel	Part No.	899 604	899 605	899 606
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#### Technical Data

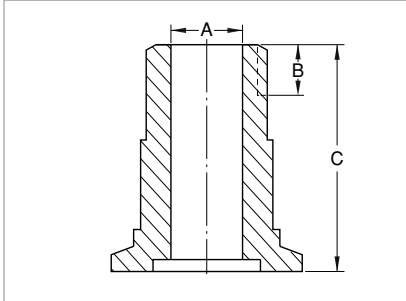
DN	KF	16	25	40
∅ A	mm	16	25	38
	in.	0.620	0.995	1.500
B	mm	10	10	10
	in.	0.394	0.394	0.394
C	mm	25.4	25.4	25.4
	in.	1.000	1.000	1.000
Pipe size NPT		1/4"	1/4"	1/4"

#### Ordering Information

Stainless steel	Part No.	899 643	899 644	899 645
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## KF/NPT Male Adapter



Dimensional drawing  
for the KF/NPT male adaptors

### Technical Data

DN	KF	16	25	40	40
∅ A	mm	9.5	16.0	25.4	38.2
	in.	0.375	0.625	1.000	1.503
B	mm	10.0	13.5	17.0	19.2
	in.	0.402	0.5343	0.683	0.757
C	mm	38.0	46.0	50.8	63.5
	in.	1.500	1.813	2.000	2.500
Pipe size NPT		1/4"	1/2"	1"	2"

### Ordering Information

Carbon steel	Part No.	992780678	992780679	992780680	899 619
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### Technical Data

DN	KF	16	25	25
∅ A	mm	9.5	16.0	23.8
	in.	0.375	0.625	0.937
B	mm	10.0	13.5	17.0
	in.	0.402	0.534	0.683
C	mm	38.0	46.0	63.5
	in.	1.500	1.813	2.500
Pipe size NPT		1/4"	1/2"	1"

### Ordering Information

Stainless steel	Part No.	899 601	899 602	899 626
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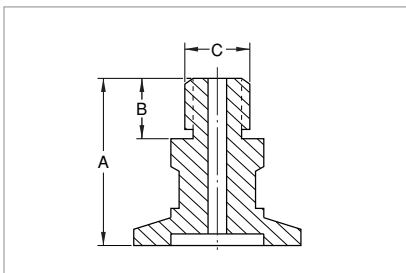
### Technical Data

DN	KF	40	40	40	40
∅ A	mm	25.4	31.8	38.1	38.2
	in.	1.000	1.250	1.500	1.503
B	mm	17.0	18.0	18.4	19.2
	in.	0.683	0.707	0.724	0.757
C	mm	50.8	63.5	63.5	63.5
	in.	2.000	2.500	2.500	2.500
Pipe size NPT		1"	1 1/4"	1 1/2"	2"

### Ordering Information

Stainless steel	Part No.	899 603	899 627	899 628	899 629
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## KF/Metric Adapter



Dimensional drawing for the KF/metric adaptors

### Technical Data

DN	KF	16
A	mm	50.8
	in.	2.000
B	mm	12.7
	in.	0.500
∅ C / thread	mm	M 16 x 1.5
	in.	M 16 x 0.06

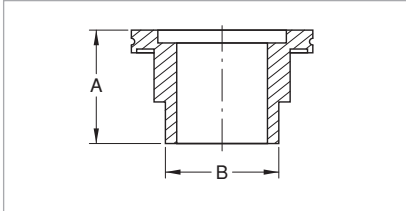
### Ordering Information

Carbon steel	Part No.	99258004
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# Only available for purchase in North and South America

## (ISO-K) Clamp Flange Fittings and Components

### ISO-K to NPT Adapter



Dimensional drawing for the ISO-K / NPT adapter

### Technical Data

DN	KF	63 ISO-K / 2" NPT
A	mm	60
	in.	2.362
∅ B	mm	51
	in.	2" NPT

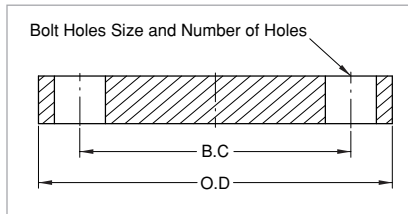
### Ordering Information

Stainless steel    Part No.    **72103040**

# Only available for purchase in North and South America

## ISO-F and DIN 2501 Fixed Flange Fittings

### Bold Type Flanges

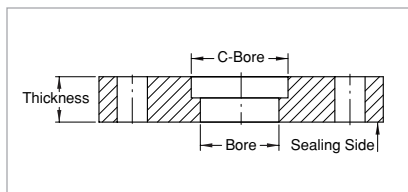


Dimensional drawing for bold type flanges

### Technical Data

Size	Bolt circle (B.C.) in in. dimensions in brackets ( ) are in mm	Outside diameter (O.D.) in in. dimensions in brackets ( ) are in mm	Bolt holes	
			Size	No. of holes
DIN 63 ISO-K	5.118 (130)	6.299 (160)	0.551 (14)	4
DIN 100 ISO-K	6.693 (170)	8.268 (210)	0.709 (18)	8
DIN 160 ISO-K	8.858 (225)	10.433 (265)	0.709 (18)	8
DIN 250 ISO-K	13.189 (335)	14.764 (375)	0.709 (18)	12
DIN 350 ISO-K	17.520 (445)	19.291 (490)	0.906 (23)	12
DIN 500 ISO-K	23.622 (600)	25.394 (645)	0.906 (23)	20
ANSI 3 inch	6.000 (152.4)	7.500 (190.5)	0.750 (19)	4
ANSI 4 inch	7.500 (190.5)	9.000 (228.6)	0.750 (19)	8
ANSI 6 inch	9.500 (241)	11.000 (279.4)	0.875 (22)	8
ANSI 8 inch	11.750 (298)	13.500 (343)	0.875 (22)	8
ANSI 10 inch	14.250 (362)	16.000 (406.4)	1.000 (25.4)	12
ANSI 12 inch	17.000 (432)	19.000 (483)	1.000 (25.4)	12
ANSI 16 inch	21.250 (540)	23.500 (597)	1.125 (29)	16
DIN 63 ISO-F	4.311 (110)	5.118 (130)	0.393 (10)	4
DIN 100 ISO-F	5.709 (145)	6.496 (165)	0.393 (10)	8
DIN 160 ISO-F	7.874 (200)	8.858 (225)	0.453 (11.5)	8
DIN 250 ISO-F	12.205 (310)	13.189 (335)	0.453 (11.5)	12
DIN 400 ISO-F	18.890 (480)	20.080 (510)	0.551 (14)	16

### Maximum Recommended Counter Bore for ANSI Blank Flanges (for Carbon or Stainless Steel Pipe)



Dimensional drawing for counter bore  
for ANSI blank flange

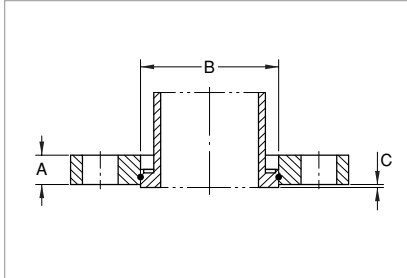
### Technical Data

ANSI size	Outside diameter (O.D.)	Bolt circle (B.C.)	No. of holes	Bolt holes		Thickness	Max. C-Bore
				Diameter			
3	7 1/2	6	4	3/4	7/8	4 1/4	
4	9	7 1/2	8	3/4	7/8	5 3/4	
6	11	9 1/2	8	7/8	15/16	7 1/2	

# Only available for purchase in North and South America

## ANSI Fittings

### Flanges, Rotatable Bolt Type



Dimensional drawing for the flanges, rotatable type  
(tube piece shown in phantom not included)

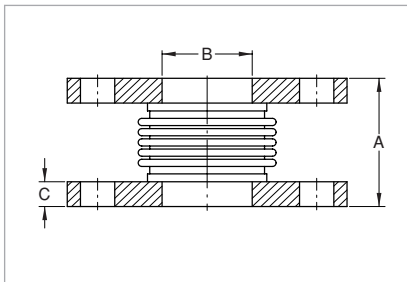
#### Technical Data

DN	ISO-K to ANSI	63 3 in.	100 4 in.	160 6 in.	250 10 in.
A	mm in.	13 0.500	13 0.500	16 0.625	22 0.875
∅ B	mm in.	95.5 3.760	131 5.140	181 7.120	291 11.453
C	mm in.	1 0.039	1 0.039	1 0.039	1 0.039

#### Ordering Information

Stainless steel	Part No.	982780700	982780701	982780702	982780703
Spare retaining ring	Part No.	23102401	23102402	23102412	23102413

### Bellows



Dimensional drawing for the bellows

#### Technical Data

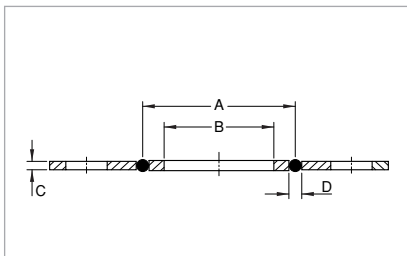
DN	ANSI	3 in.	4 in.	6 in.
A	mm in.	120 4.720	120 4.720	200 7.870
∅ B	mm in.	78 3.070	102 4.030	154 6.070
C	mm in.	12.7 0.500	12.7 0.500	12.7 0.500
Rated deflection in axial	mm in.	15 0.580	18 0.700	29.5 1.160
Rated deflection in lateral	mm in.	5 0.190	6 0.220	8 0.310
Spring rate	mm in.	263 12 / 4	340 15 / 4	260 23 / 7
Compression / tension	mm in.	0.460 / 0.140	0.560 / 0.140	0.900 / 0.260

#### Ordering Information

Stainless steel bellows with carbon steel flanges	Part No.	991051013	991051014	991051016
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Combined axial/lateral deflection cannot exceed 100 %. Example: 75 % axial rating - 25 % lateral rating

### Sealing Disk Assembly



Dimensional drawing for the sealing disk assembly

#### Technical Data

DN	ANSI	3 in.	4 in.	6 in.
∅ A	mm in.	91 3.600	121 4.750	171 6.720
∅ B	mm in.	78 3.070	102 4.030	154 6.070
C	mm in.	3.2 0.125	3.2 0.125	3.2 0.125
∅ D	mm in.	4 0.157	4 0.157	4 0.157

#### Ordering Information

Aluminum	Part No.	910181605	910181606	910181607
Stainless steel	Part No.	910181616	910181617	910181618



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