Dizajn procesných zariadení

Spájanie potrubí-2.časť

Prednáška

Vypracoval: Ing. Martin Juriga, PhD.

Bratislava, december 2016

Spájanie potrubí

Prevádzkový tlak
- Vákuum
- Nízky tlak
- Vysoký tlak
- Extrémne vysoký tlak

Prevádzková teplota
- Extrémne nízka teplota /Kryogénne systém/
- Nízka teplota
- Extrémne vysoká teplota

Médium
- Korozívne
- Abrazívne
- atď

Aplikácia
- účel, skúsenosť, tradícia

Náklady
- montážne
- Prevádzkové
- bezpečnosť
-Dospupnosť

Materiál
- Železné materiáli
- Kovové materiáli / meď, olovo, .../
- Plast
- Sklo

Spájanie potrubí - nerozobeateľne
-Screwed Piping S /prípade THD Thread/
-Butt-Welded Piping BW
-Socket-Welded Piping SW
- patentovo chránené spôsoby (napr. Victaulic, PVC-U atď)

Spájanie potrubí - rozoberateľne
- príruba FLG
- spojka /clamp, union, .../
- spojka s tvarovým členom
- patentovo chránené spôsoby

Pressure
- System pressure
- Pressure peaks

Temperature
- Medium
- Environment
- Operation/standstill

Application
- Hydraulic
- Pneumatic
- central lubrication
- process industry
- severeness

Medium
- hydraulic oil type
- Compressed air
- Water/seawater
- other fluids

Best solution

- **zero leakage**
- **high reliability**
- **easy assembly**
- **low total cost**
- **standard products**

Assembly
- Mass production
- On-site installation
- Industrial assembly
- Field repair

Flow rate
- Volume flow
- medium viscosity
- System dynamics
- Tube selection

Specifications
- International standards
- End user specification
- approvals
- availability

Environment
- weather
- humidity
- Stationary/mobile

Space
- Space limitations
- Tube bending capabilities

Spájanie potrubí

Sklo

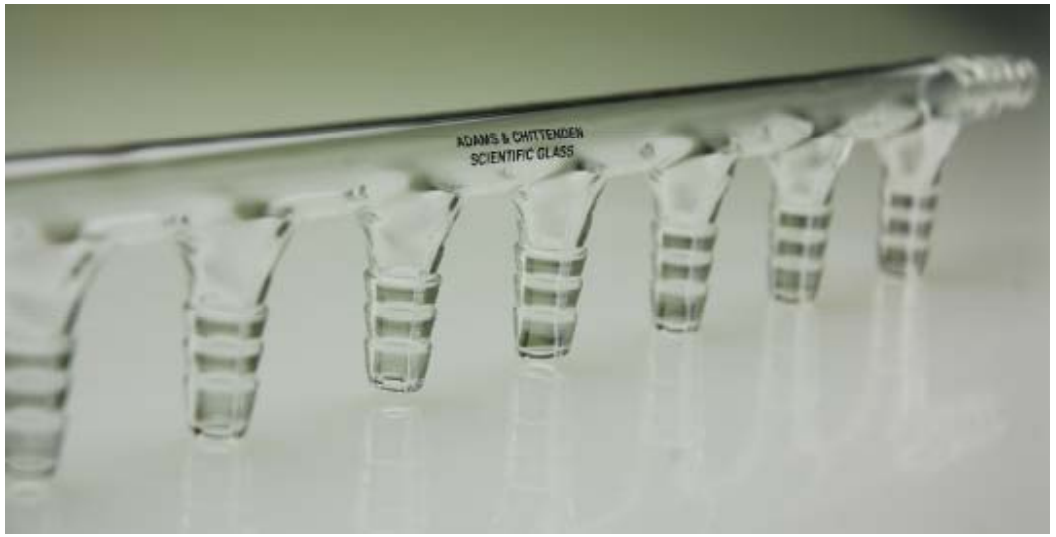
Sférické spoje s objímkou.

- O-krúžkom s objímkou

Spájanie potrubí

Sklo

- pripojenie na hadicu /OLIVKA/



Spájanie potrubí

Sklo

- Schott Glass Flanges / ADAMS & CHITTENDEN /

Spájanie potrubí

Sklo

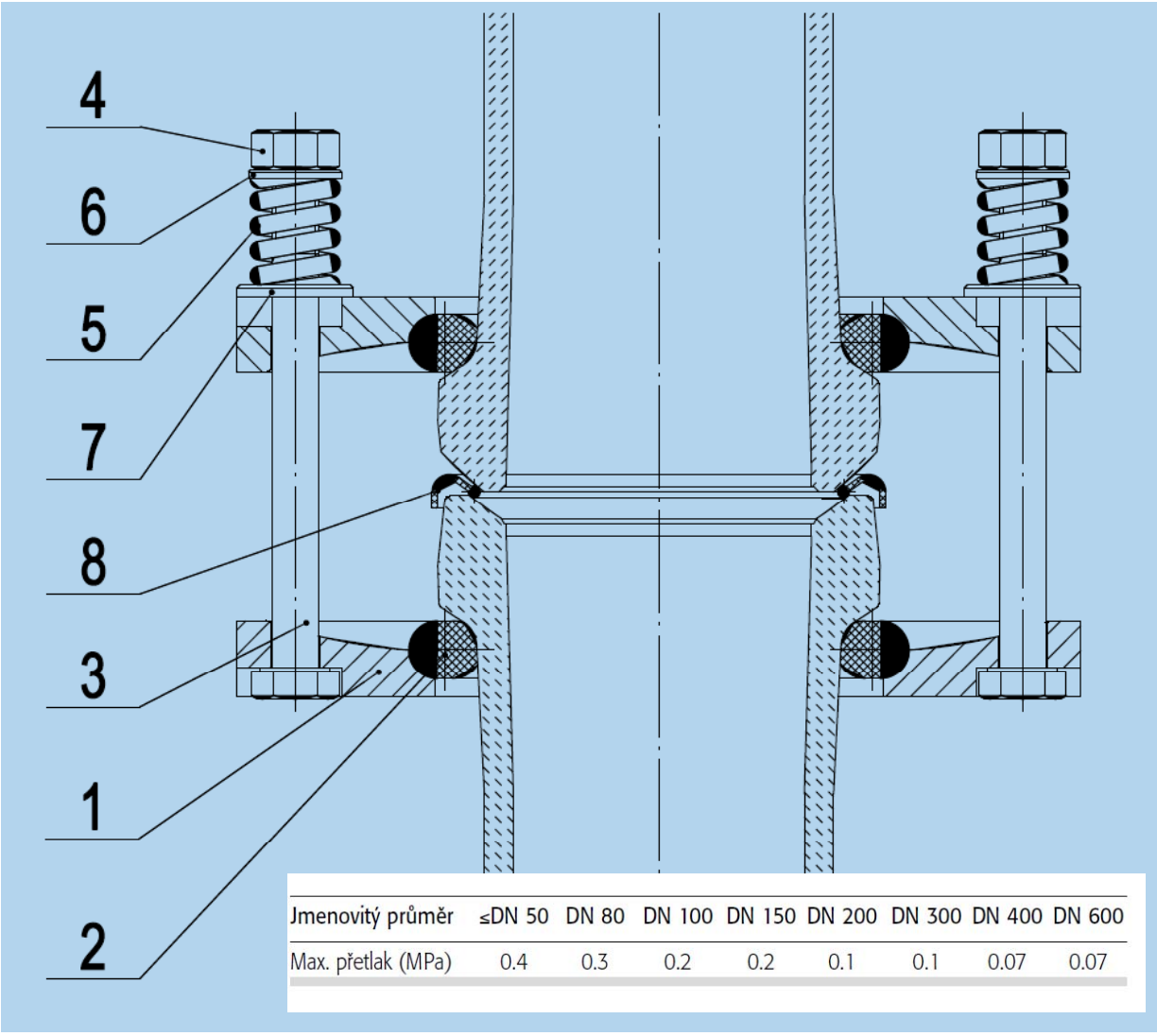
- NW Glass Flanges / ADAMS & CHITTENDEN

Spájanie potrubí

Sklo

- Koncovky KZ a PZ /SIMAX/

1 Příruba
2 Podložný segment (kroužek, korále, spirála)
3 Šroub
4 Matice
5 Pružina (pro PTFE)
6 Podložka
7 Podložka
8 Těsnění (není součástí spoje)

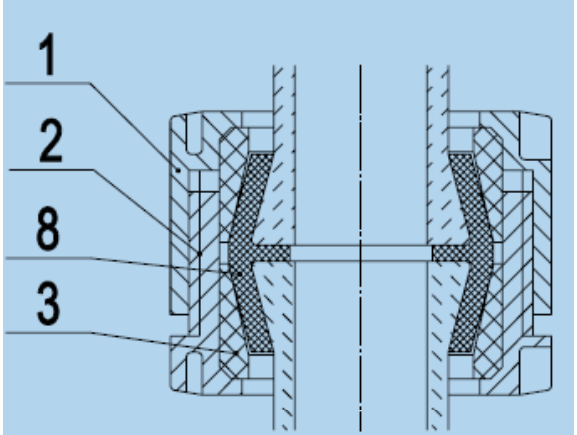


Jmenovitý průměr	≤DN 50	DN 80	DN 100	DN 150	DN 200	DN 300	DN 400	DN 600
Max. přetlak (MPa)	0.4	0.3	0.2	0.2	0.1	0.1	0.07	0.07

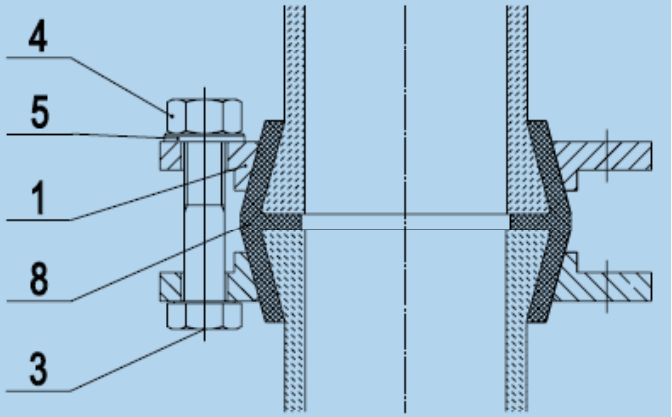
Spájanie potrubí

Sklo

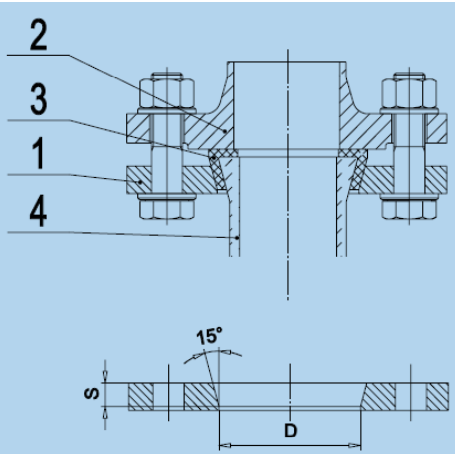
- Koncovky RK /SIMAX/



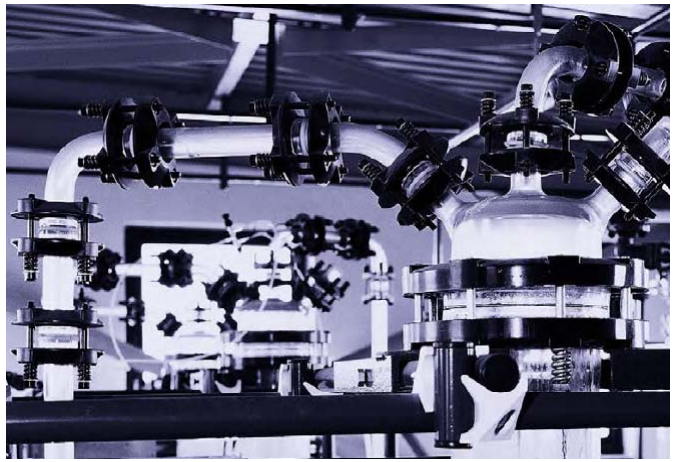
1 Matice
2 Šroub
3 Kroužek
8 Průchodka
(není součástí spoje)



1 Příruba
3 Šroub
4 Matice
5 Podložka
8 Průchodka
(není součástí spoje)



1 Protipříruba
2 Přivařovací příruba
3 Průchodka seříznutá na polovinu
4 Skleněná koncovka RK



Spájanie potrubí

Vákuové aplikácie

Špecifikum vákuových Aplikácií
-Komplikovaná detekcia úniku /podsávanie/
- minimalizácia rozoberateľných spojov.

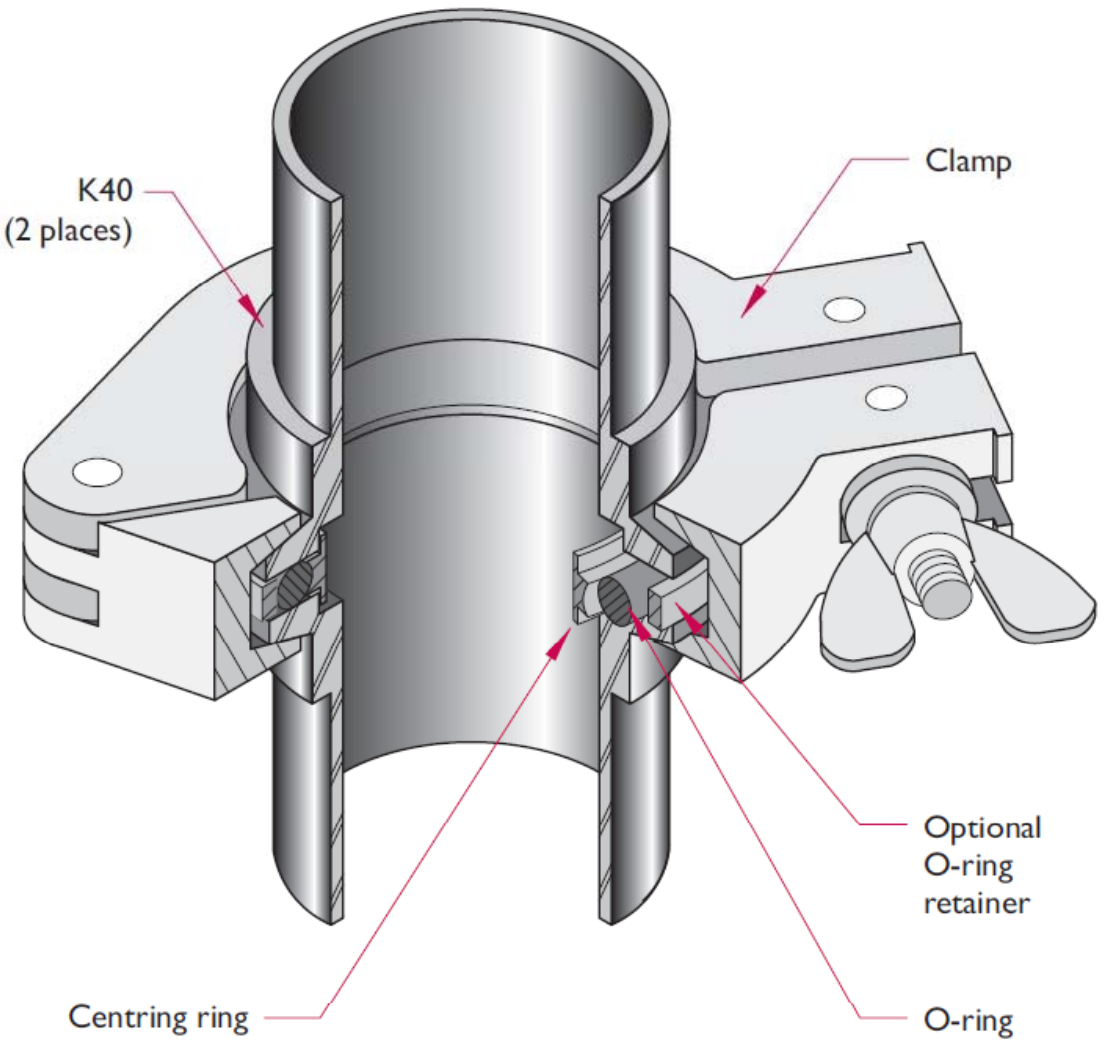
Štandartne používané materiáli

SS: 304L, 316L a 316LN
Hliník, mosadz

Tesnenia
-Guma
-Polytetrafluoroethylene (PTFE) /teflon/, viton
-kov /meď,

ISO KF

Typical installation

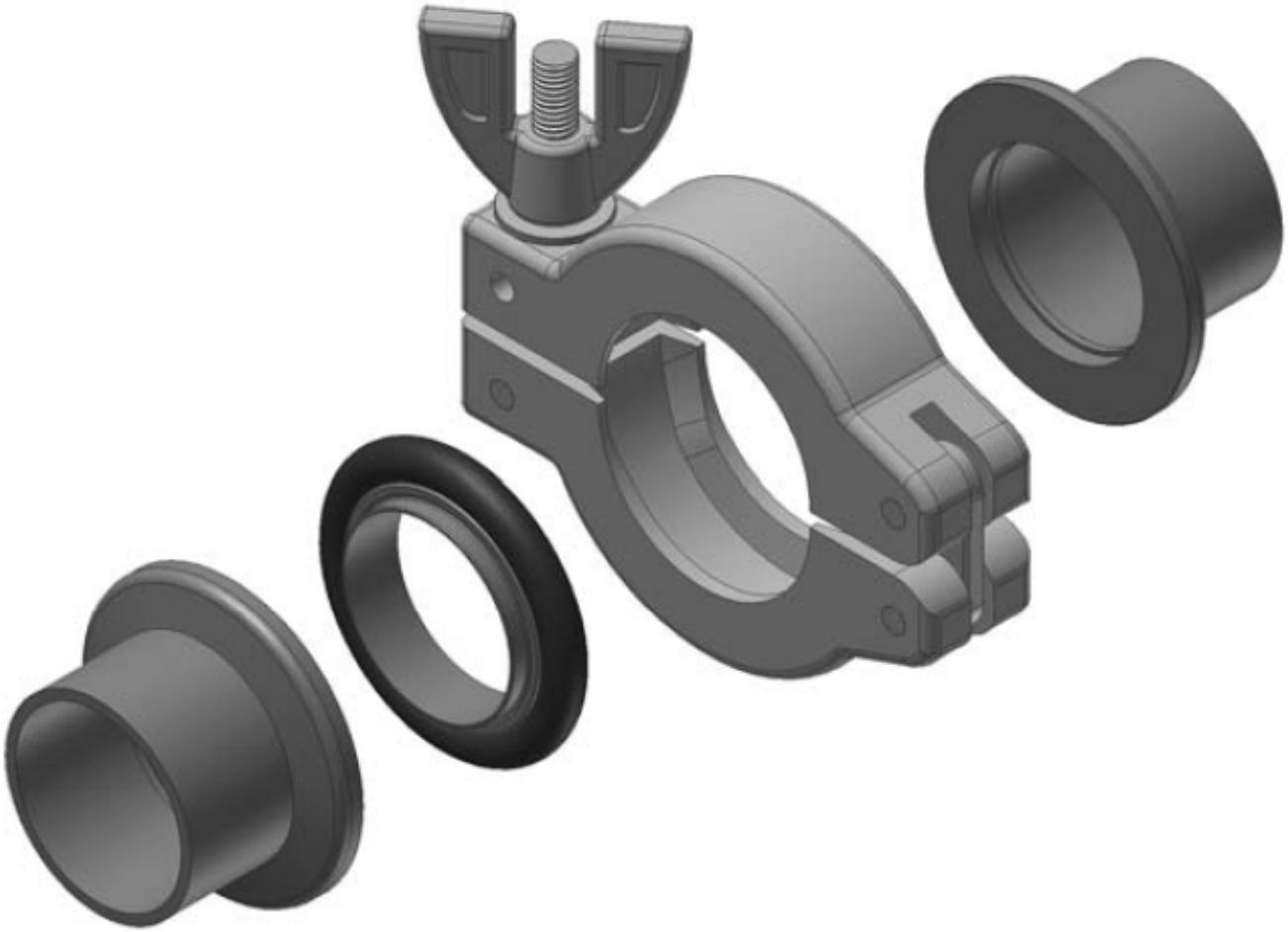


Spájanie potrubí

Vákuové aplikácie

KF
/Klein Flansche/
DIN 28403
ISO 2961

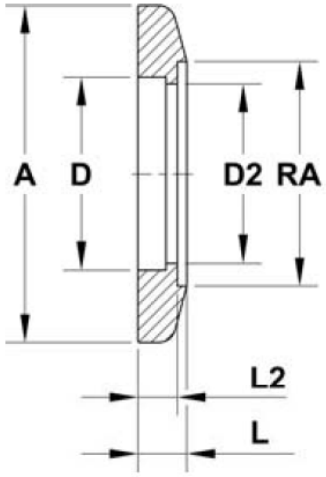
Tlak
760 Torr ~ 1.10-8 Torr
Teplota
~ 180 C°



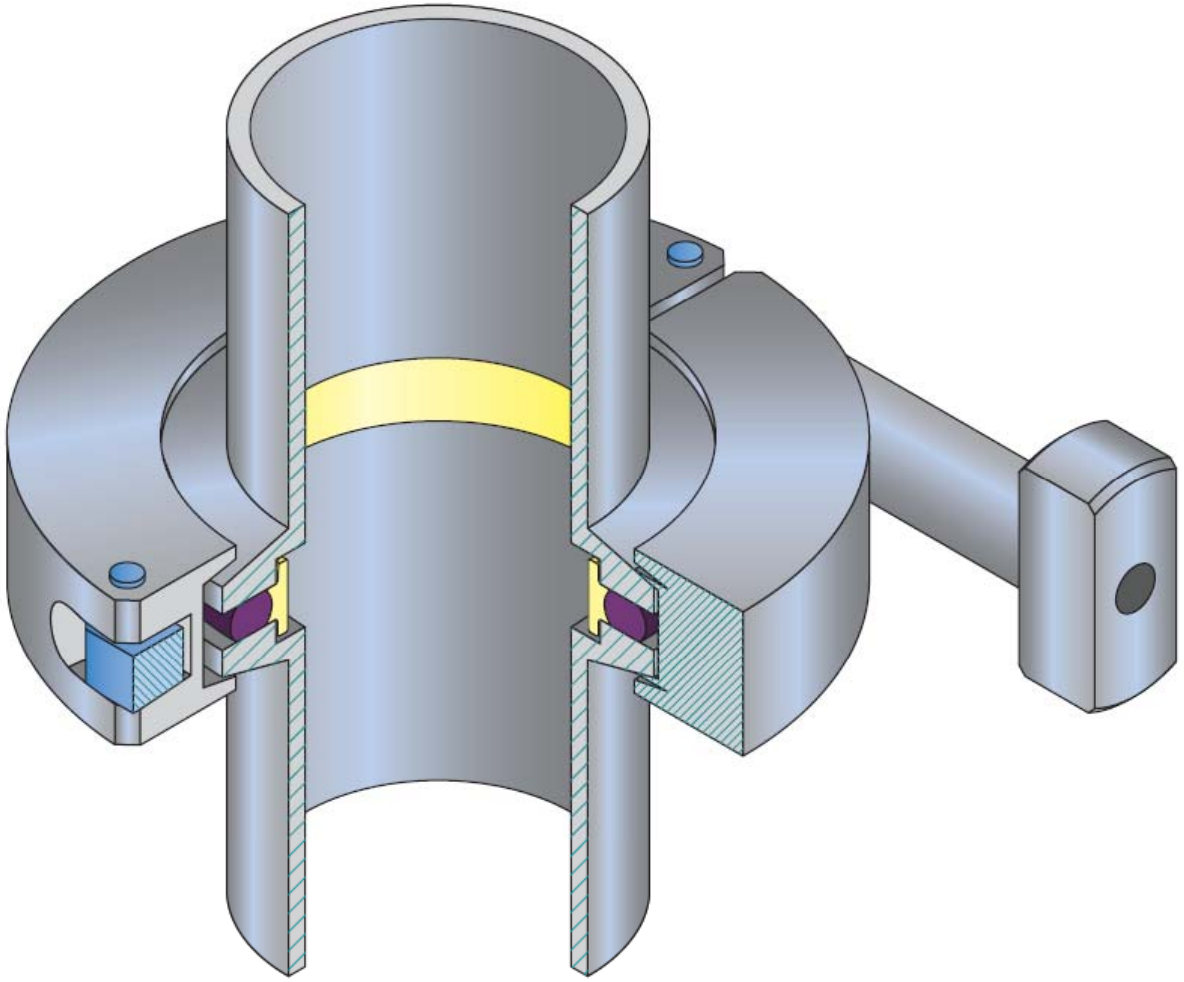
Spájanie potrubí

Vákuové aplikácie

KF
/Klein Flansche/
DIN 28403
ISO 2961



KF Flange



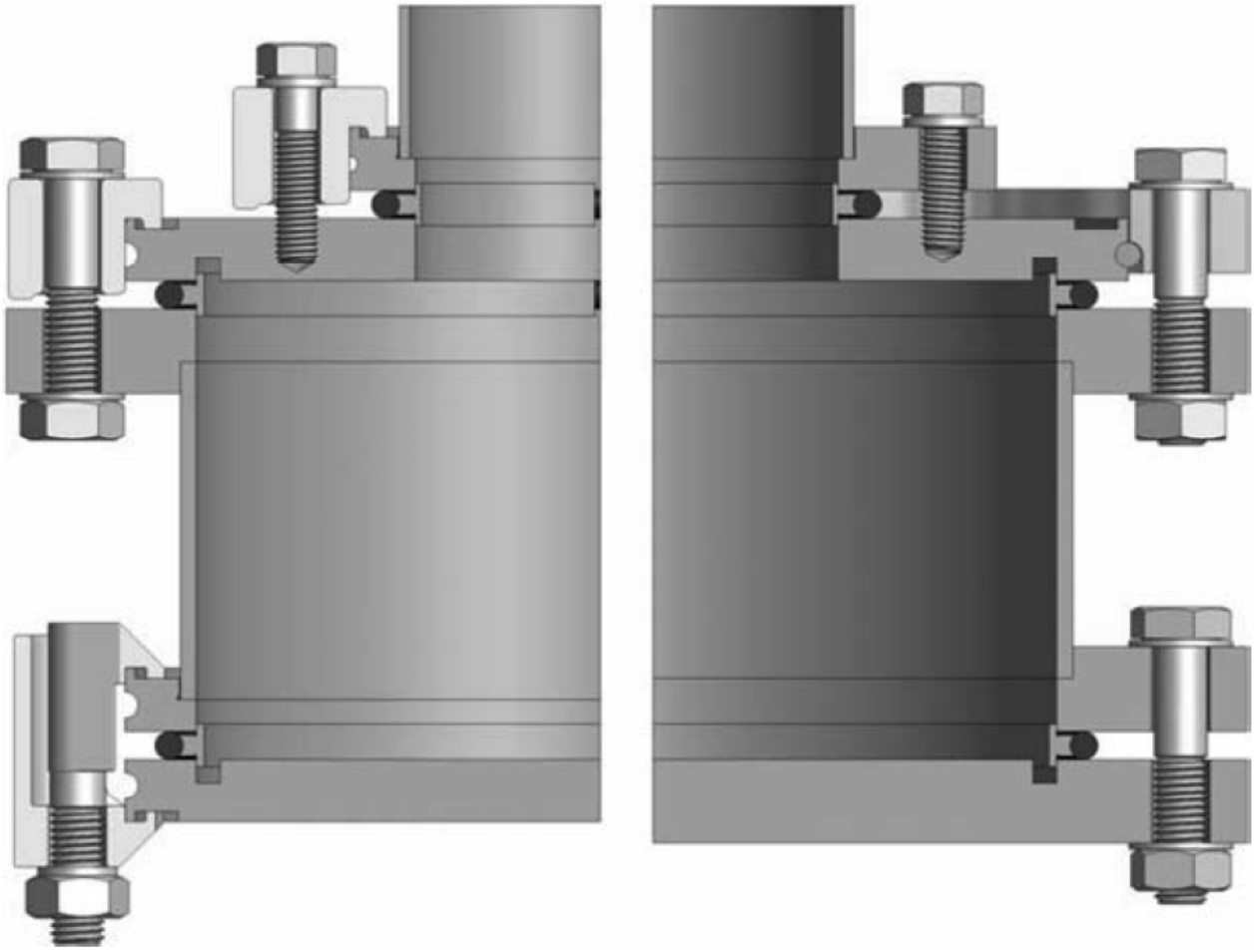
Spájanie potrubí

Vákuové aplikácie

ISO-K / ISO-F
DIN 28404
ISO 1609

- Pre väčšie priemery ako KF.
-Veľká variabilita kombinácií.

Tlak
760 Torr ~ 1.10-8 Torr
Teplota
~ 180 C°

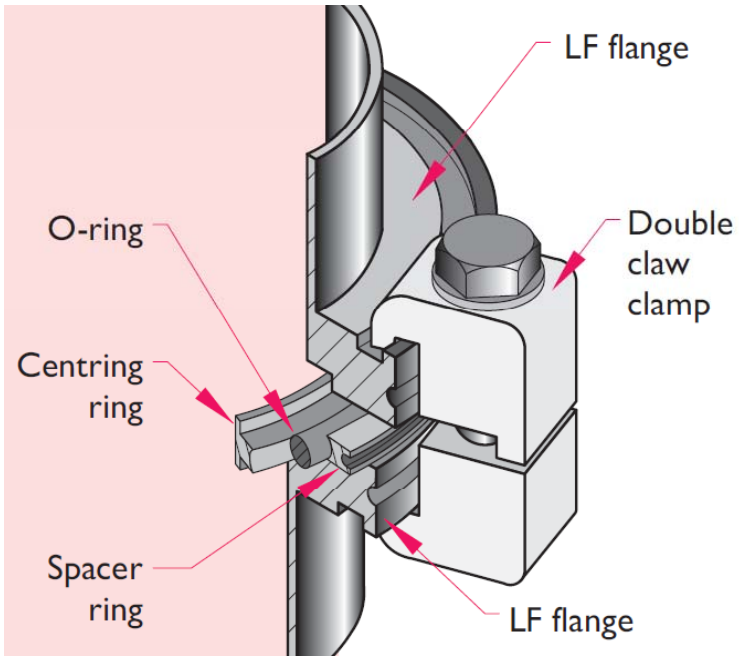


Spájanie potrubí

Vákuové aplikácie

ISO-K / ISO-F
DIN 28404
ISO 1609

ISO- F
Príruba s dierami.



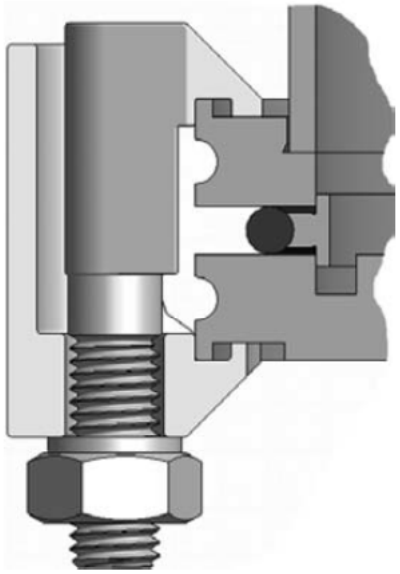
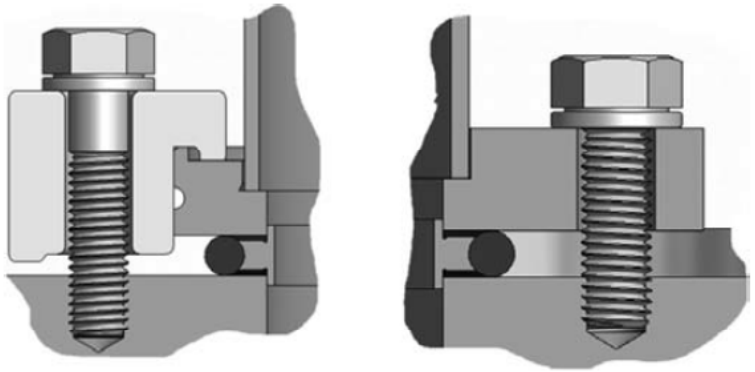


Figure 3: Combination ISO-K / ISO-F

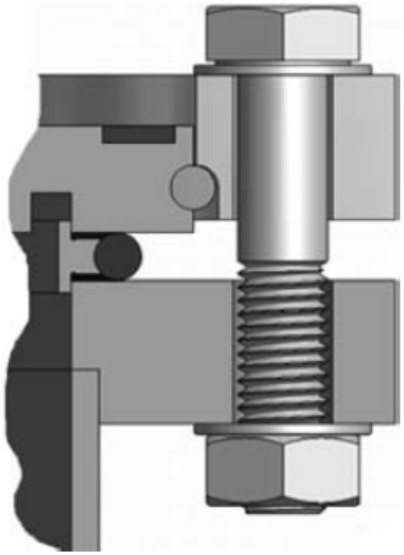


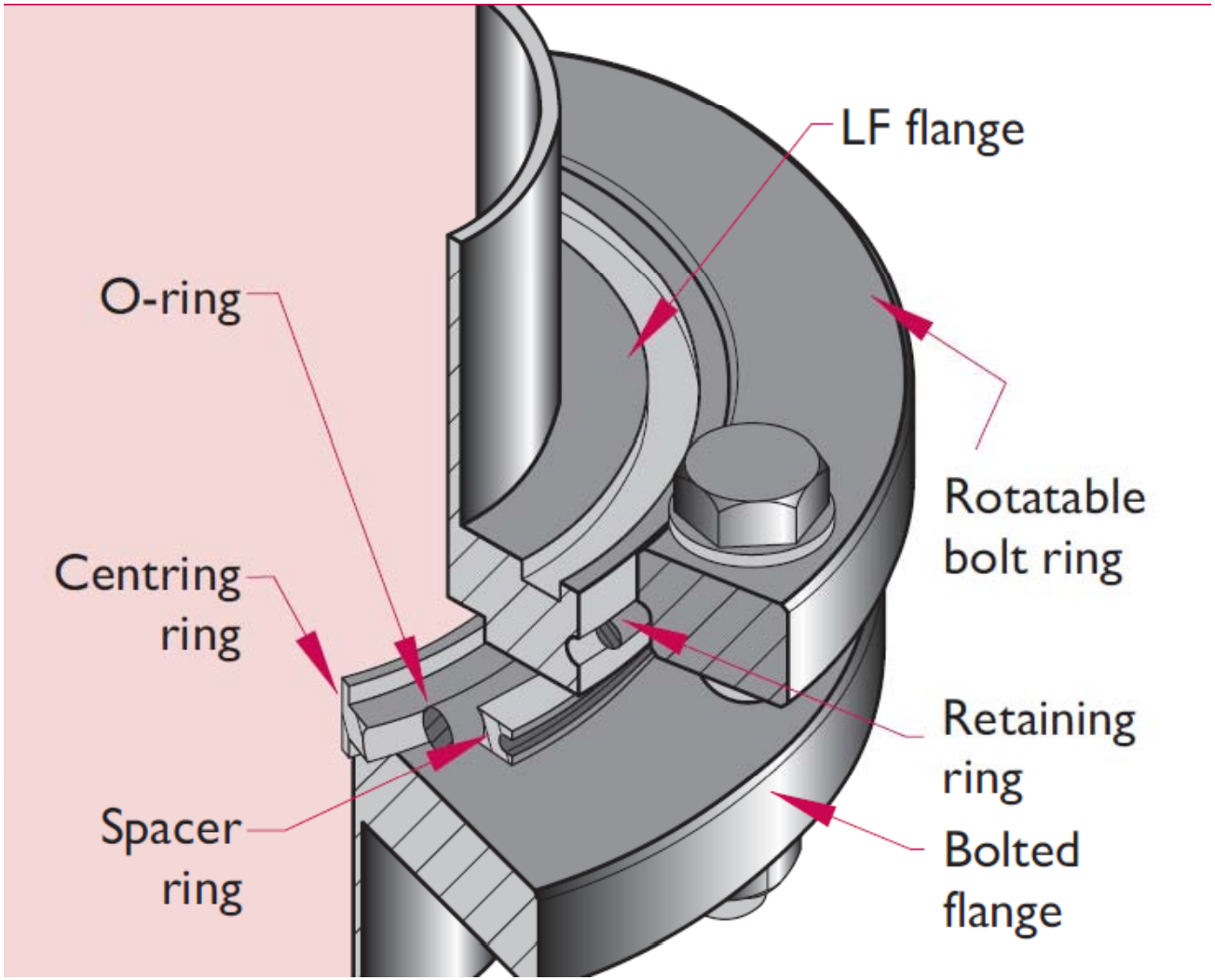
Spájanie potrubí

Vákuové aplikácie

ISO-K / ISO-F
DIN 28404
ISO 1609

ISO- K sa dá po spojení s krúžkom zmodifikovať na ISO-F





Spájanie potrubí

Vákuové aplikácie

CF
ConFlat Flange
ISO 3669
ISO/TS 3669-2

UHV – ultra vysoké vákuum

Tlak
760 Torr ~ 1.10-13 Torr
Teplota
-196 °C ~ 450C° a viac pre 316LN

OFHC – oxygen free high conductivity

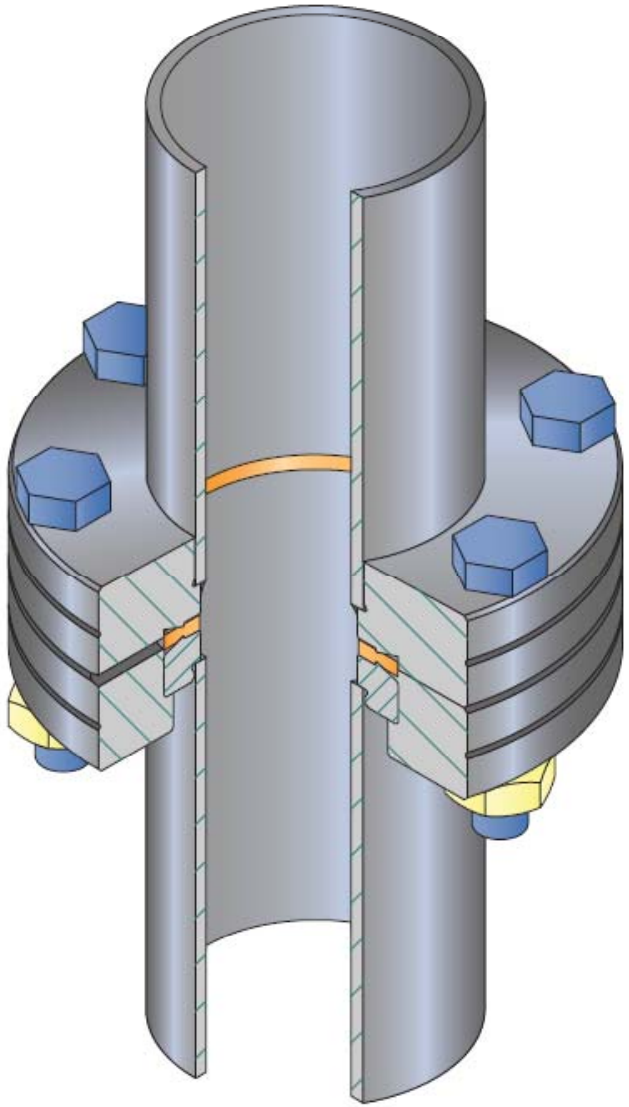
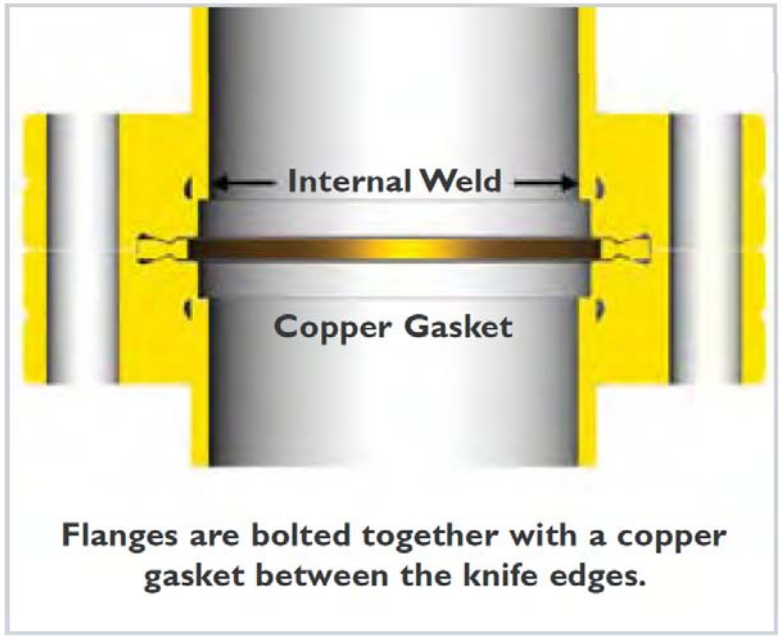


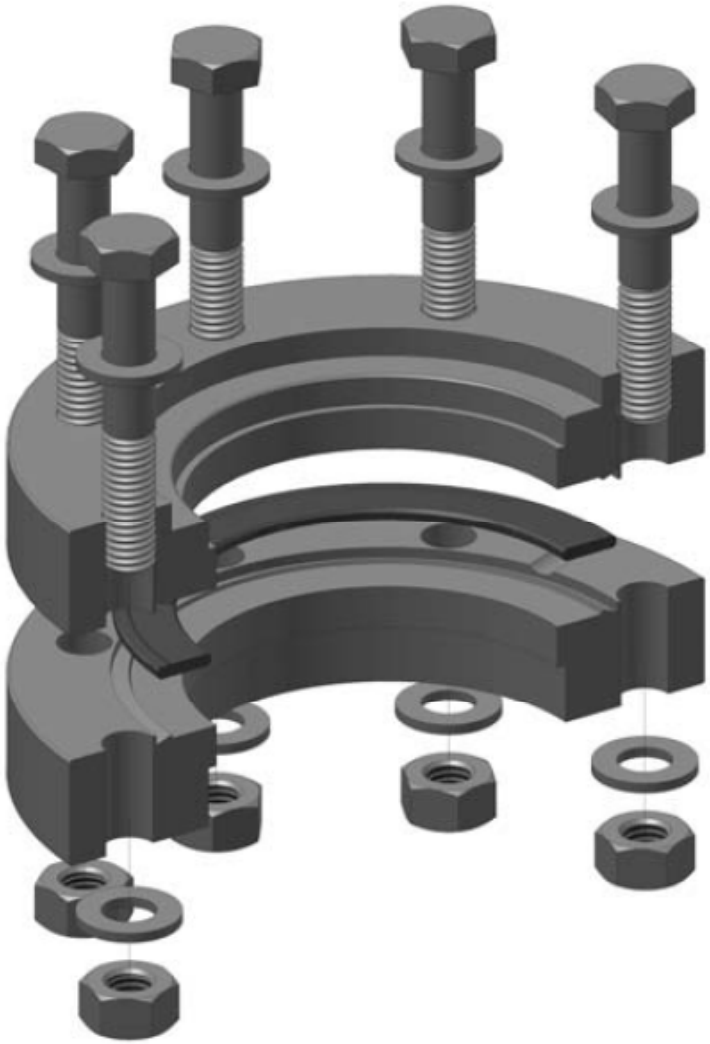
Figure 1: ConFlat Flange Assembly

Spájanie potrubí

Vákuové aplikácie

CF
ConFlat Flange
ISO 3669
ISO/TS 3669-2





Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia – John Guest

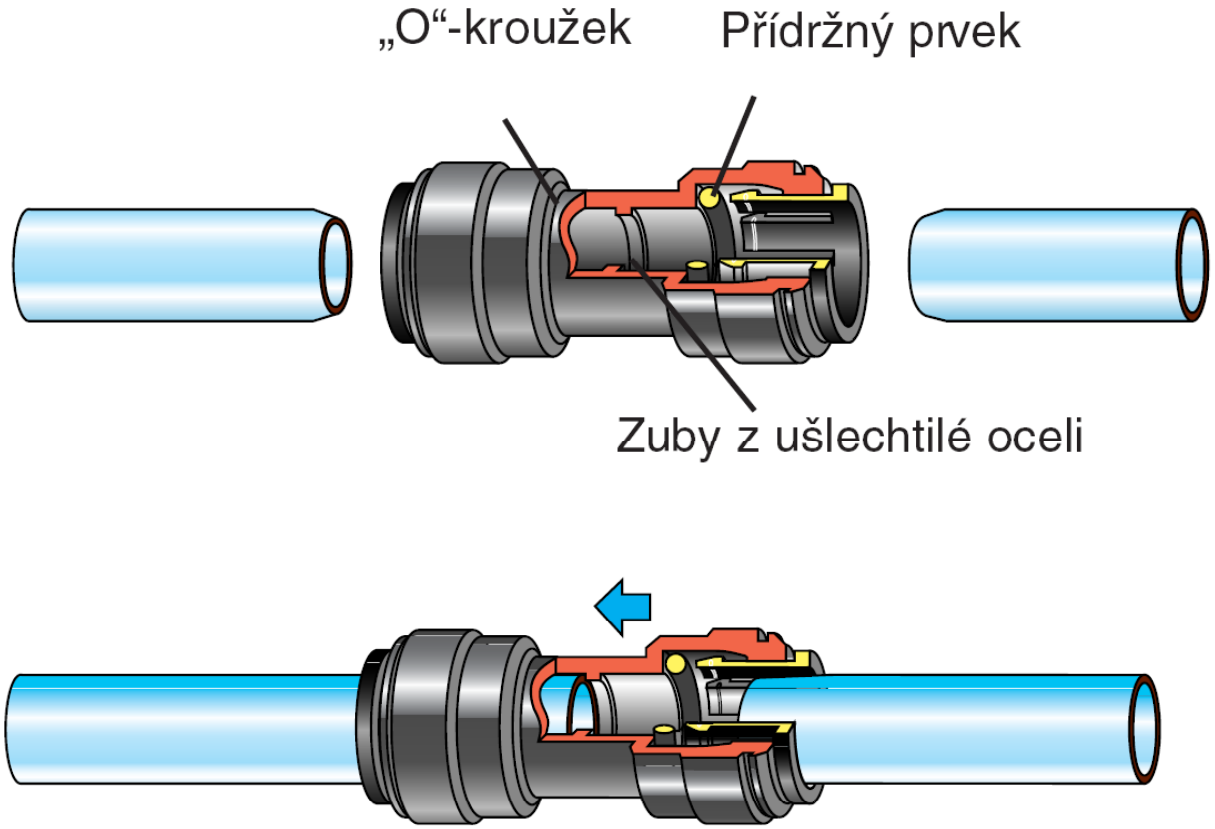
PE, PP, PUR – rúry malých priemerov.

-Nasúvací systém

- nízke tlaky, nízke teploty

-Jednoduchá príprava, jednoduchá montáž

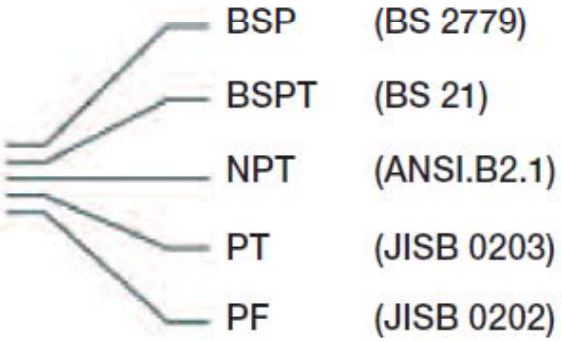
-Vhodné pri častej demontáži.



Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia – John Guest

Teplota	Tlak* Rozměry	Rozměry
	5/32“-5/16“ 4 mm-8 mm	3/8“-1/2“ 9,5 mm-22 mm
Vzduch -20 °C	16 bar	10 bar
Kapalina a vzduch +1 °C	16 bar	10 bar
+23 °C	16 bar	10 bar
+70 °C	10 bar	7 bar



Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia – Victaulic

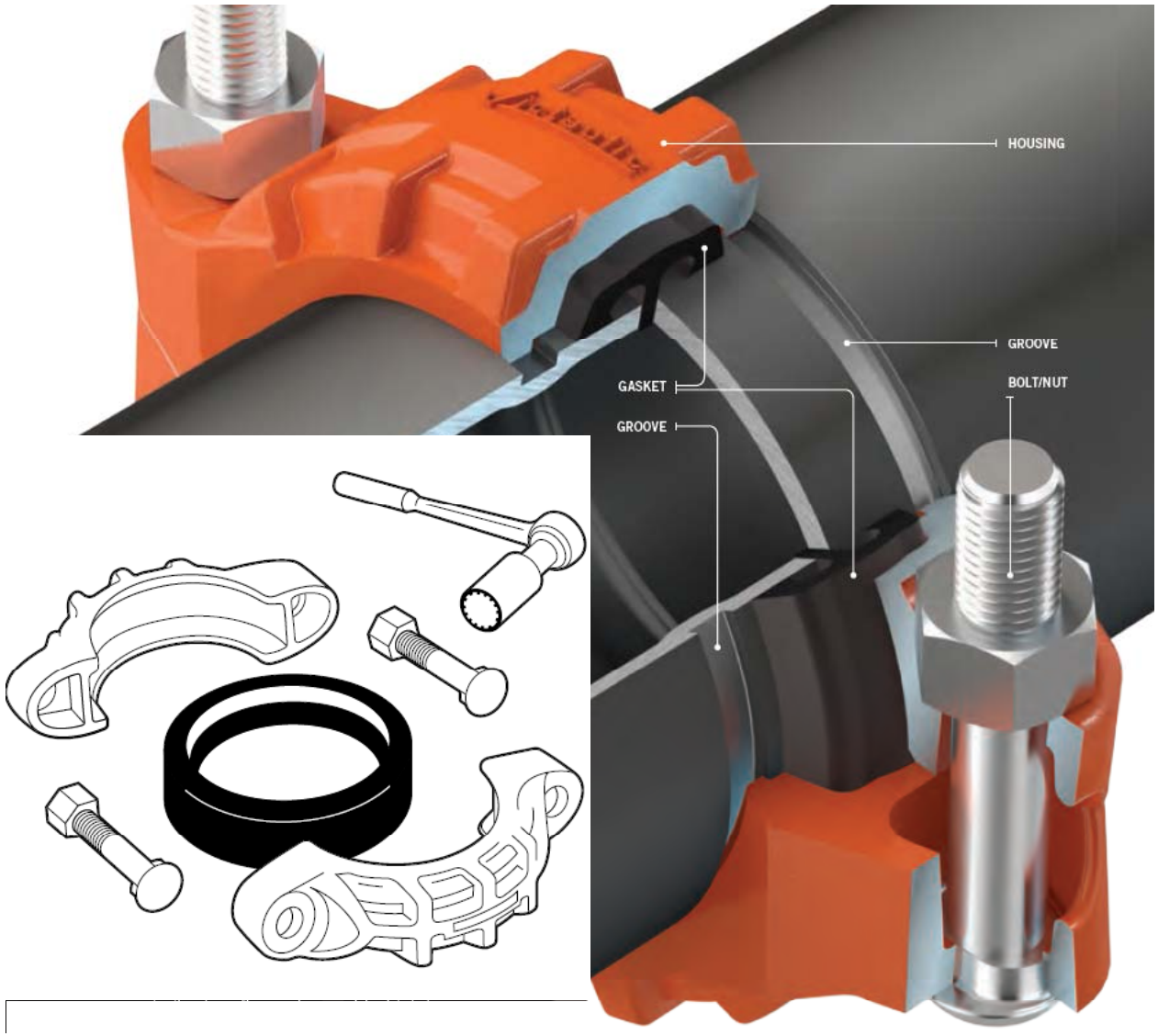
-Nízke celkové inštalačné náklady

-Čisté riešenie / oproti zváraným potrubiam/

- rýchla montáž

-Jednoduchá demontáž a inšpekcia potrubia, prípadne modifikácia existujúceho.

-Aplikovateľné pre široký rozsah aplikácií

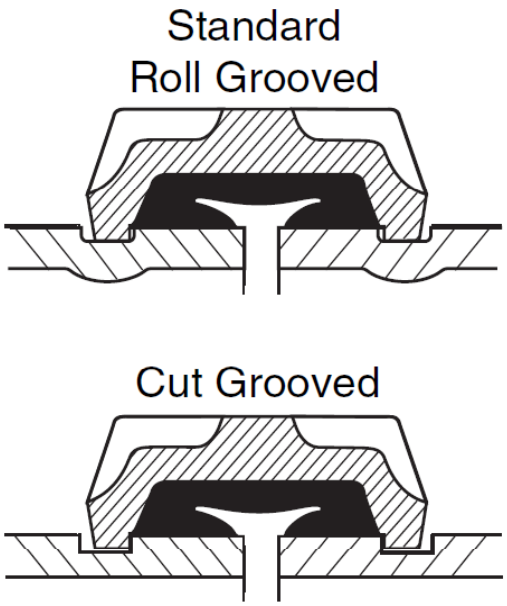


Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia – Victaulic

-Drážka sa môže rezať priamo na mieste,

- Požitie valcovaných drážok do 45“ /1050mm/



COUPLING MAXIMUM WORKING PRESSURE (Standard Wall Steel Pipe)

Pipe Size		Pipe Wall Thick. Sched.	Coupling Style – Working Pressure – PSI/kPa											
Nominal Diameter In./mm	Actual Outside Dia. In./mm		Style 07 Rigid	Style W07 AGS Rigid	Style 77 Flexible	Style W77 AGS Flexible	Style 75 Flexible	Style 78 Snap-Joint®	Style 791 Boltless	Style 741 Flange Adpt.	Style W741 AGS Flange Adapter	Style 743 Flange Adpt.	HP-70 Rigid	HP-70ES EndSeal®
3/4 20	1.050 26,7	40	– –	– –	1000 6900	– –	– –	– –	– –	– –	– –	– –	– –	– –
1 25	1.315 33,7	40	750 5175	– –	1000 6900	– –	– –	300 2065	– –	– –	– –	– –	– –	– –
1 1/4 32	1.660 42,4	40	750 5175	– –	1000 6900	– –	– –	300 2065	– –	– –	– –	– –	– –	– –
1 1/2 40	1.900 48,3	40	750 5175	– –	1000 6900	– –	500 3450	300 2065	– –	– –	– –	– –	– –	– –
2 50	2.375 60,3	40	750 5175	– –	1000 6900	– –	500 3450	300 2065	700 4825	300 2065	– –	720 4965	1000 6900	2500 17235

Spájanie potrubí

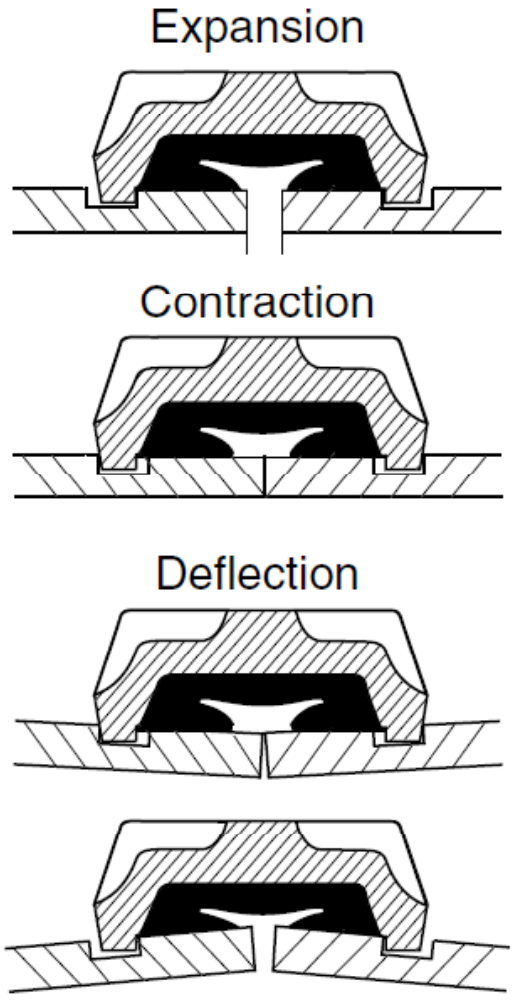
Príklad patentovaného spôsobu spájanie potrubia – Victaulic

- do maximálneho tlaku 17,23 MPa/a/. Vhodné aj pre vákuum

- Rigidný spoj . Nedovoľuje vzájomný pohyb podobne ako príruba alebo zvar

-Flexibilný spoj – lineárny pohyb pre každý spoj 6,35 mm. Dovoľuje prenášať aj ohybové namáhanie

-Stress free system.




Installation-Ready™


Standard


Reducing

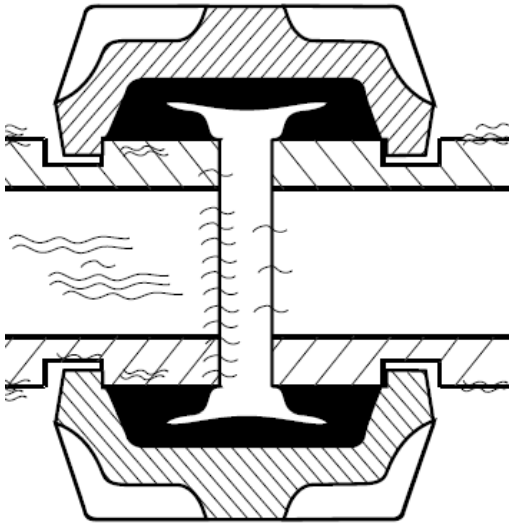

Vic-Flange®

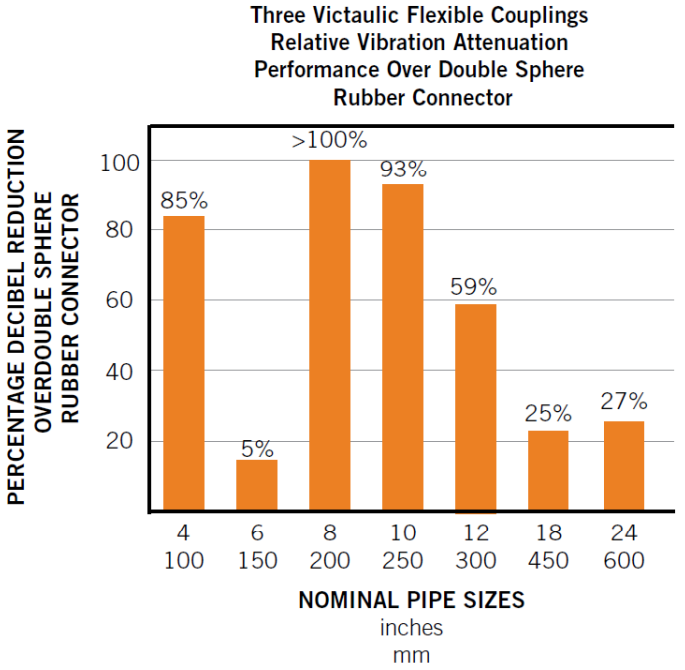
Grade	Temp. Range[7]	Compound	Color Code
M2	–40°F to +160°F –40°C to +71°C	Epichlorohydrin	White Stripe
V	–30°F to +180°F –34°C to +82°C	Neoprene	Yellow Stripe
O	+20°F to +300°F –7°C to +149°C	Fluoroelastomer	Blue Stripe
L	–30°F to +350°F –34°C to +177°C	Silicone	Red Gasket
A	+20°F to +180°F –7°C to +82°C	White Nitrile	White Gasket

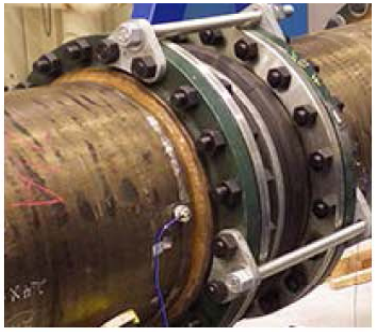
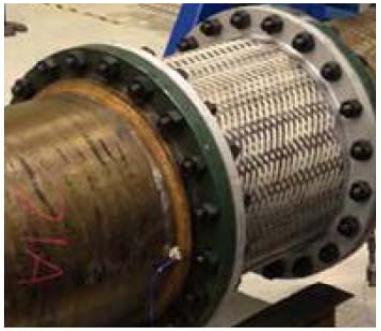
Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia – Victaulic

- Spoj je schopný kompenzovať hluk a vibrácie



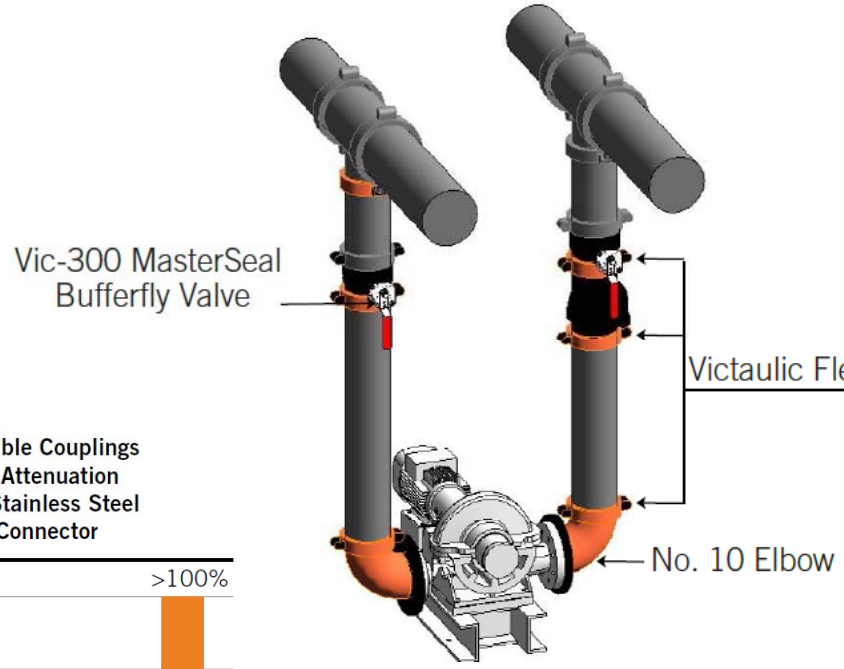


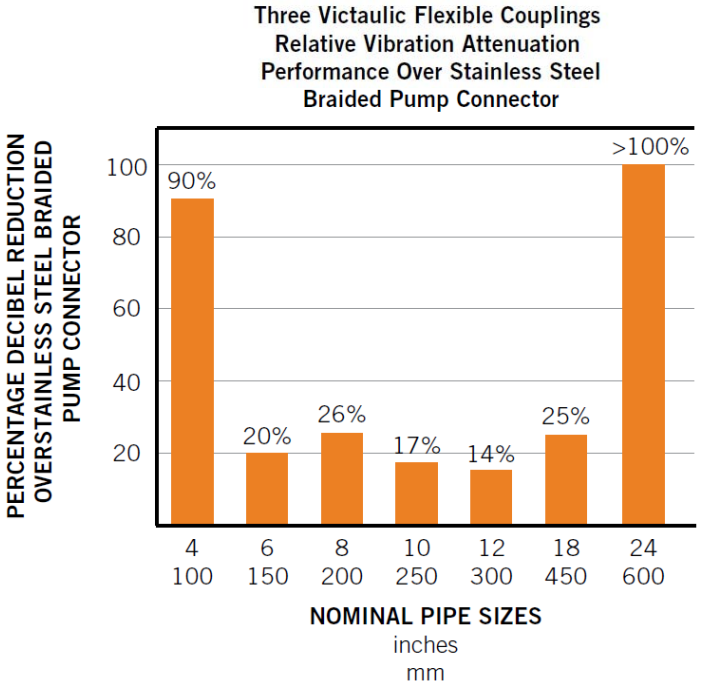
Products Tested		
Victaulic Flexible Couplings	Double Sphere Rubber Connector	Stainless Steel Braided Pump Connector
		

Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia – Victaulic

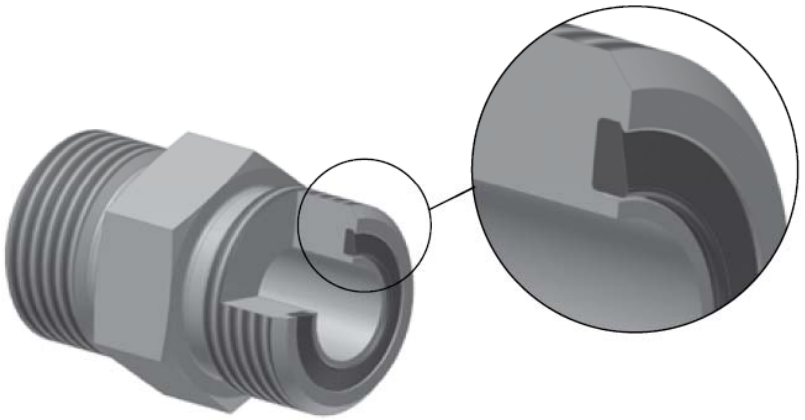
- Spoj je schopný kompenzovať hluk a vibrácie

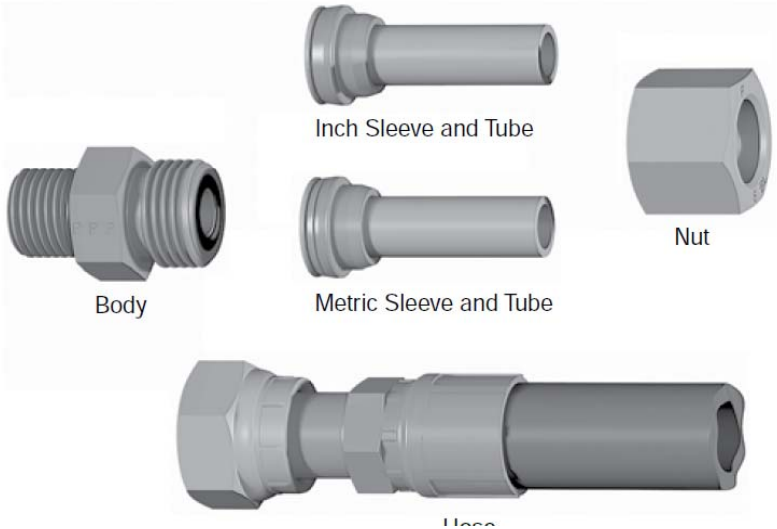


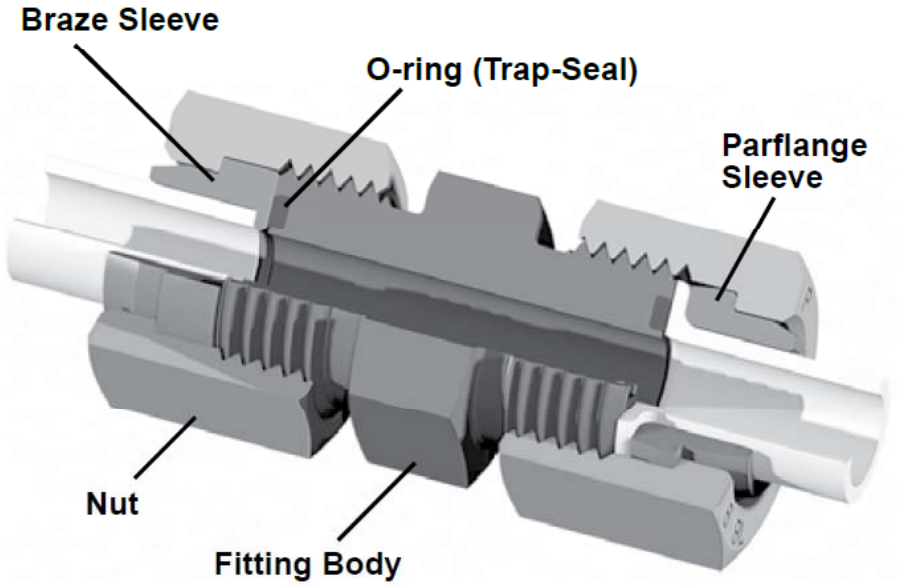


Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia
Parker SEAL-LOK







Spájanie potrubí

Príklad patentovaného
spôsobu spájanie
potrubia
Parker SEAL-LOK

Before tightening the nut

After tightening the nut

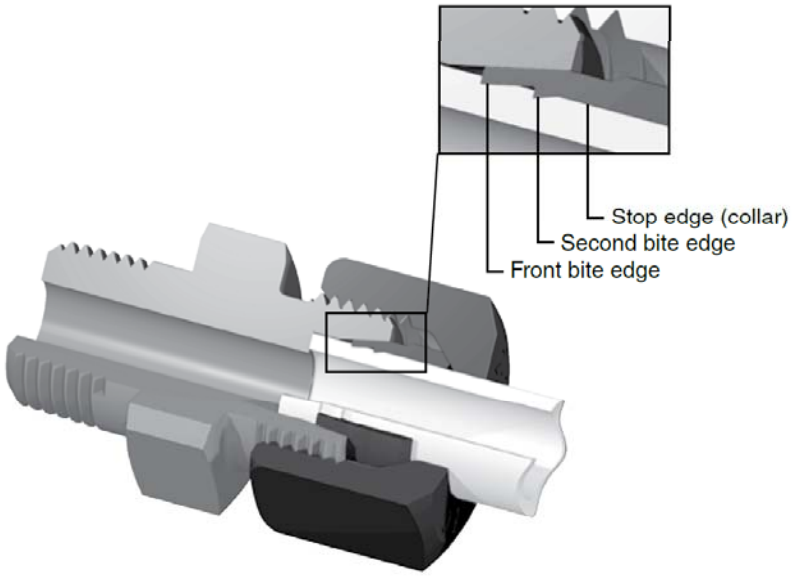
Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia Parker SEAL-LOK

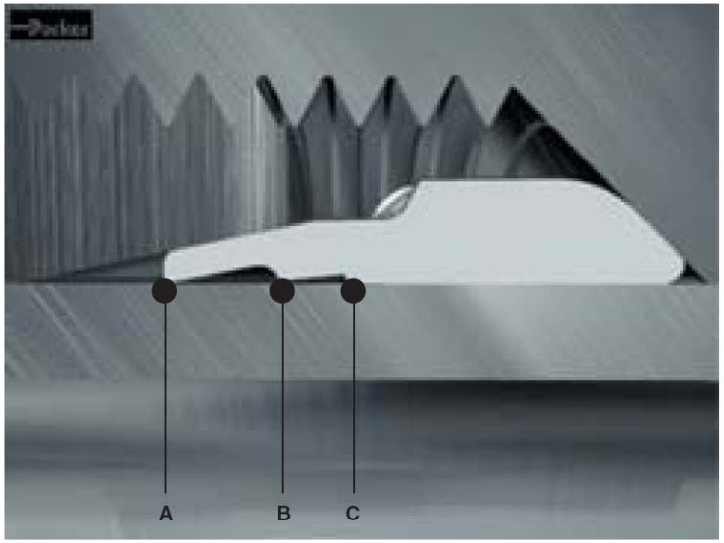
Nuts, Sleeves, Locknuts	**BL** Tube Nut A9	**BML** Tube Nut - mm Hex A9	**TPLS (Metric)** Parflange Sleeve A9	**TPL (Inch)** Parflange Sleeve A9	**TL (Inch)** Braze Reducer Sleeve A10
TLS (Metric) Braze Reducer Sleeve A10	**SBR (Inch and Metric)** Braze Ring A11	**WLNL** Bulkhead Locknut A11	**WLNML** Blkhd Locknut - mm Hex A11	**Straights**	**HLO** Union A12
HMLO Union - mm Hex A12	**WLO** Bulkhead Union A12	**WMLO** Bulkhead Union - mm Hex A13	**WF5OLO** ORFS Blkhd / SAE-ORB A13	**F5OLO** ORFS / SAE-ORB A14	**FF5OLO** ORFS - Long / SAE-ORB A14
FLO ORFS / NPTF A14	**GLO** ORFS / NPTF A15	**F87OMLO** ORFS / ISO 6149 A15	**F82EDMLO** ORFS / Metric-ED A15	**F42EDMLO** ORFS / BSPP-ED A15	**LOHB3** ORFS / Braze Socket A16
MMLOHB3 ORFS / Braze - mm Hex A16	**LOHT3** ORFS / Tube Weld A16	**Straight Swivels**	**TRLON** Tube End Reducer A17	**LOHL6** Extender and Expander A17	**HL6** ORFS Swivel Union A17
F65OL ORFS Swivel / SAE-ORB A18	**G65L** ORFS Swivel / SAE-ORB A18	**F6L** ORFS Swivel / NPTF A18	**G6L** ORFS Swivel / NPTF A18	**F687OML** ORFS Swivel / ISO 6149 A19	**F682EDML** ORFS Swivel / Metric-ED A19
F642EDML ORFS Swivel / BSPP-ED A19	**45° Elbows**	**WNLO** Bulkhead Union A19	**WNMLO** Bulkhead Union - mm Hex A20	**V6LO** ORFS Swivel Elbow A20	**V5OLO** ORFS / SAE-ORB A20
V87OMLO ORFS / ISO 6149 A20	**VLO** ORFS / NPTF A21	**V4OMLO** ORFS / BSPP-ORR A21	**90° Elbows**	**ELO** Union Elbow A21	**EMLO** Union Elbow - mm Hex A21

Spájanie potrubí

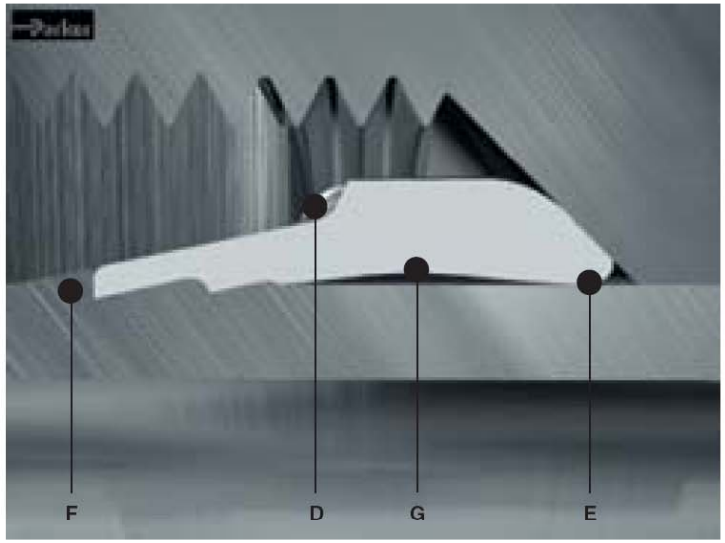
Príklad patentovaného spôsobu spájanie potrubia Parker EO



High pressure – Due to the application of even better materials combined with the special processing of individual components, EO-PSR can be used in applications of up to 800 bar (S series) and 500 bar (L series).



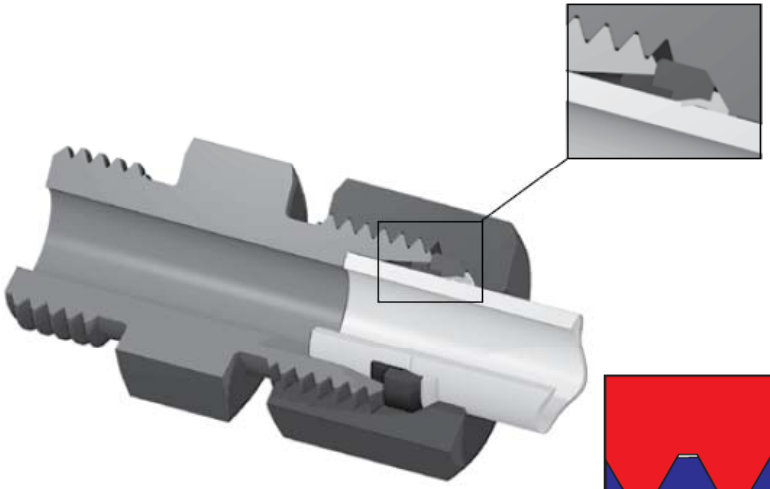
Before tightening the nut

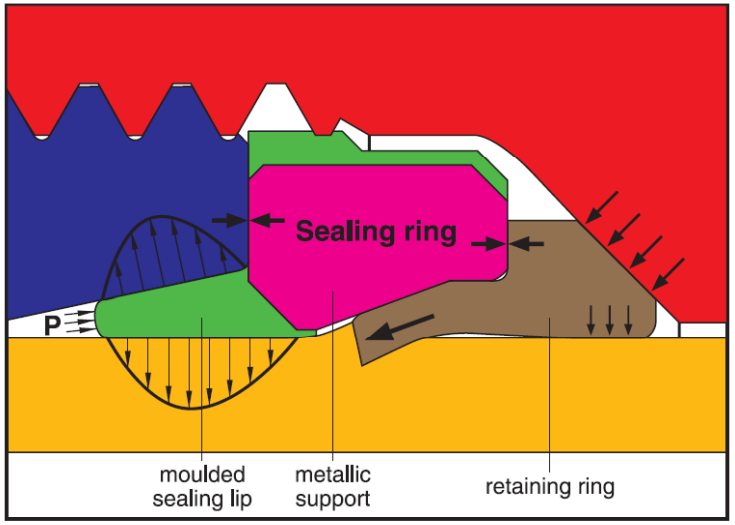


After tightening the nut

Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia
Parker EO-2





The metallic support of the sealing ring acts just like an integrated pre-assembly tool.

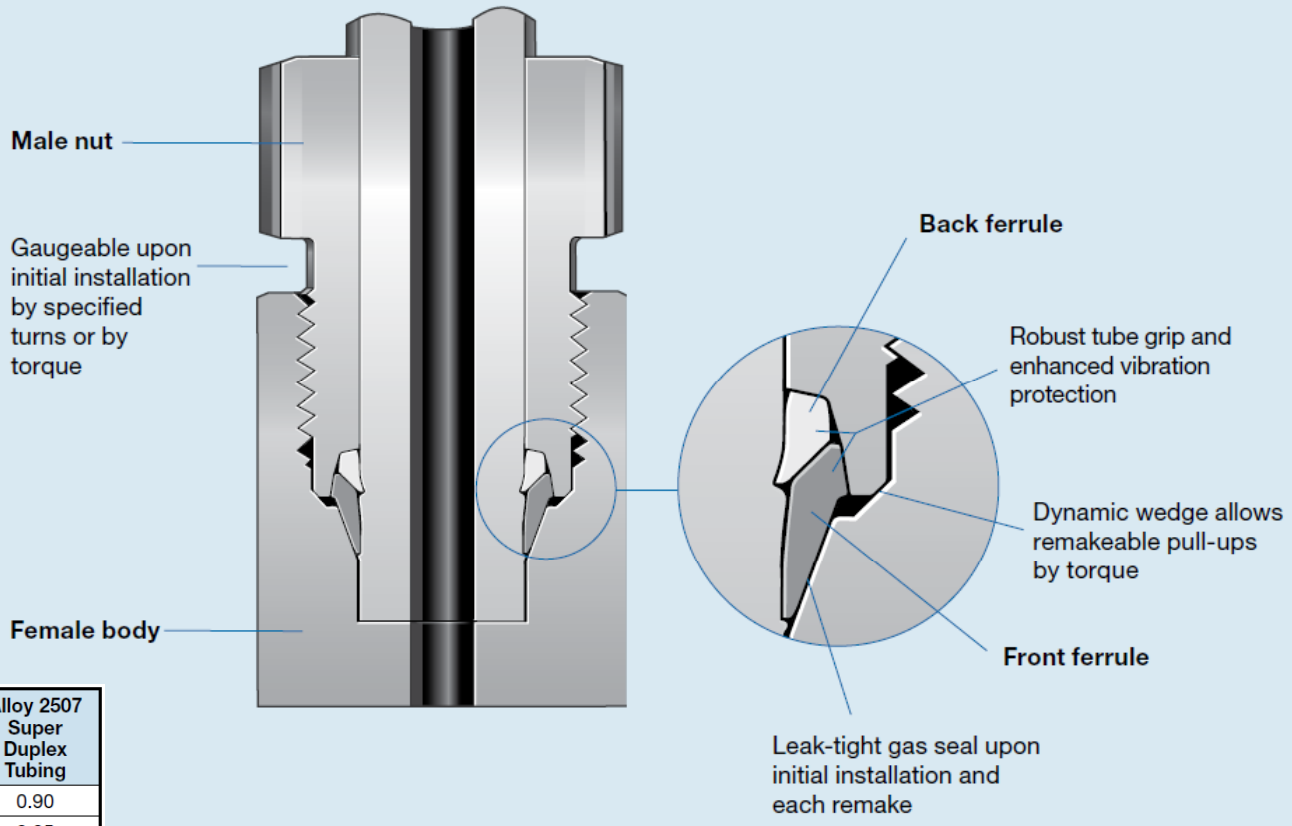
EO-2: Safe dry – clean – leakfree

Increased pressure – Due to the application of even better materials combined with the special processing of individual components, EO-2 can be used in applications of up to 800 bar (S series) and 500 bar (L series).

Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia
Swagelok FK

Swagelok Medium-Pressure Tube Fittings—FK Series



Tube OD mm	Wall Thickness mm	Working Pressure bar (psig)
6	2.2	1034 (15 000)②
10	3.5	1034 (15 000)②
12	4.5	1034 (15 000)

Temperature		Heavy-Wall Annealed 316 SS Tubing	Cold-Drawn 1/8 Hard 316 SS Tubing	Alloy 2507 Super Duplex Tubing
°F	°C			
200	93	1.00	1.00	0.90
300	148	1.00	1.00	0.85
400	204	0.96	0.93	0.82
600	315	0.85	0.93	0.81①
800	426	0.79	0.92	—
1000	537	0.76	0.84	—

Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia
Swagelok FK

Fig. 1

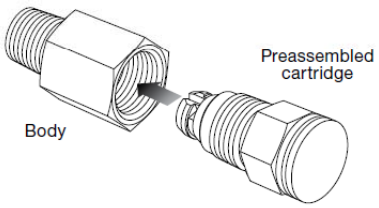


Fig. 2

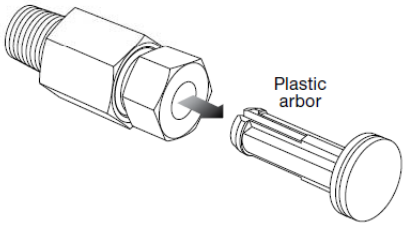


Fig. 3

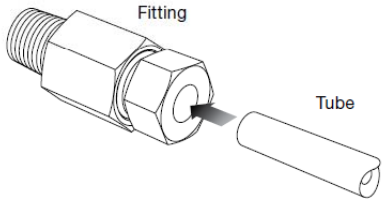


Fig. 4

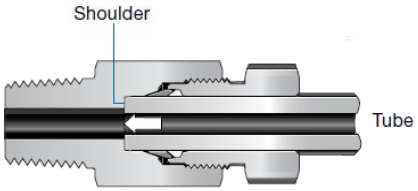


Fig. 5

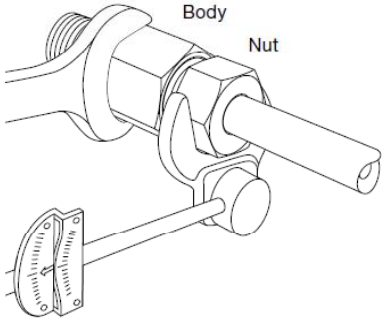
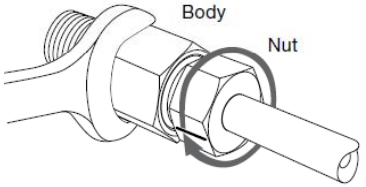


Fig. 6



Tube OD	Required Torque	
	ft·lb	N·m
1/4 in., 6 mm	25	33.9
3/8 in.	45	61.1
10 mm	100	136
1/2 in., 12 mm	110	150
9/16 in.	170	231

Fig. 1

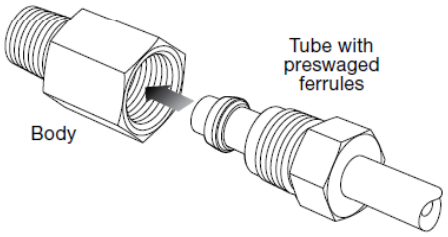


Fig. 2

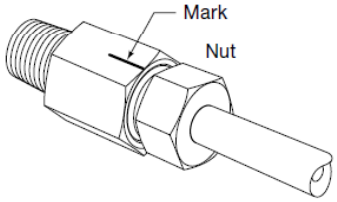
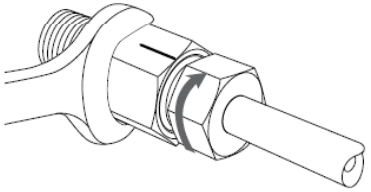
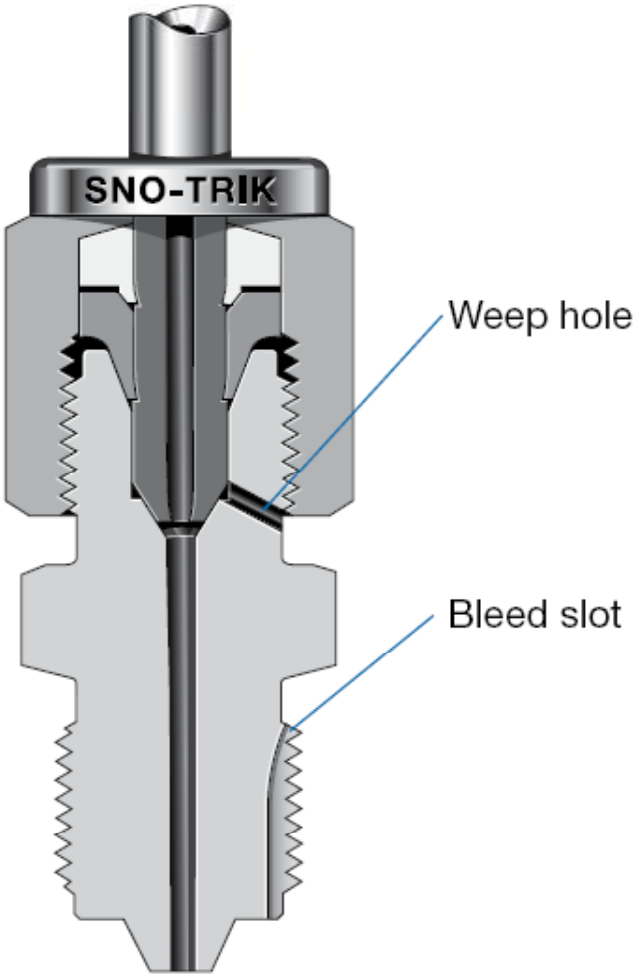


Fig. 3



Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia
Swagelok SNO-TRIK



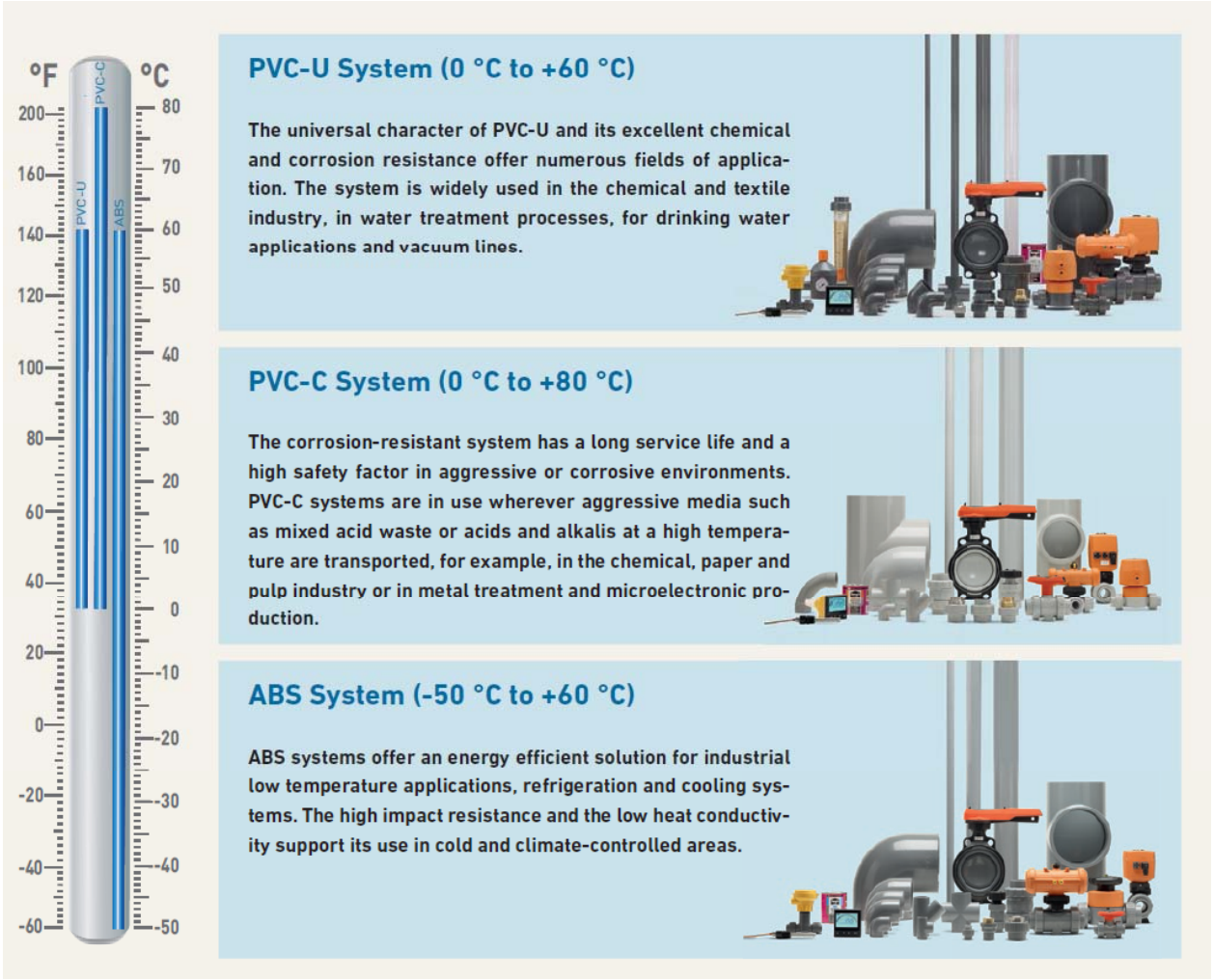
Tube OD in.	Uniform Thread Size	Ordering Number	Dimensions, in. (mm) A	D	E	F	G	Pressure Rating psig (bar)
1/4	9/16-18	SS-440-1-44M	1.96 (49.8)	0.82 (20.8)	0.09 (2.3)	5/8	3/4	60 000 (4134)
	3/4-16	SS-440-1-64M	2.32 (58.9)			13/16		
3/8	9/16-18	SS-640-1-44M	2.24 (56.9)	1.04 (26.4)	0.09 (2.3)	13/16	15/16	
	3/4-16	SS-640-1-64M	2.41 (61.2)		0.12 (3.0)			
9/16	3/4-16	SS-940-1-64M	3.01 (76.5)	1.45 (36.8)	0.12 (3.0)	1 1/4	1 3/8	
	1 1/8-12	SS-940-1-94M	3.19 (81.0)		0.19 (4.8)			

Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia
George Fisher
Lepené potrubia PVC, ABS

Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia George Fisher
Lepené potrubia: PVC,ABS



Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia George Fisher
Lepené potrubia: PVC,ABS

Material specifications	Cemented systems		
Systems	**PVC-U**	**PVC-C**	**ABS**
Material	Polyvinylchloride	Polyvinylchloride	Acrylnitrile-Butadien-Styrene
Colour	RAL 7011	RAL 7038	RAL 7001
Density	g / cm³ - 1.38	g / cm³ - 1.50	g / cm³ - 1.035
Thermal Expansion Coefficient	mm / m K - 0.075	mm / m K - 0.065	mm / m K - 0.1
Heat conductivity at 23 °C	0.17 W / m K	0.15 W / m K	0.15 W/m K
Yield Stress at 23 °C	N / mm² ≥ 52	N / mm² ≥ 53	N / mm² ≥ 40
VICAT Temperature °C	≥ 76	≥ 103	≥ 94
Silicone Free	√	√	√
Drinking Water Certificates	√		

Spájanie potrubí

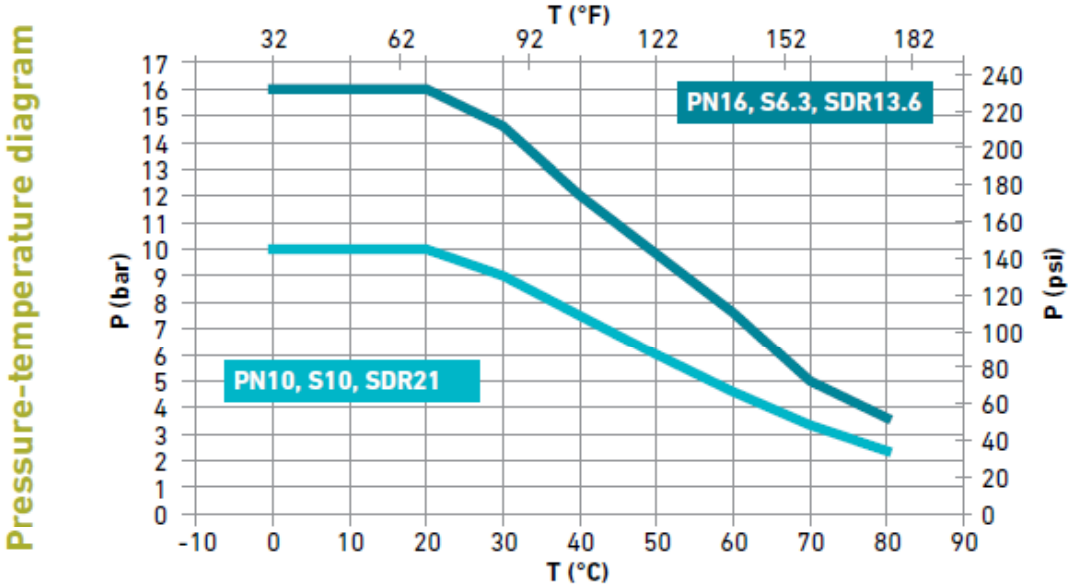
Príklad patentovaného spôsobu spájanie potrubia George Fisher
Lepené potrubia: PVC,ABS

Chemical resistance at 20 °C (Applications can be very dependent on the concentration)		Amorphous thermoplastics		
Media	**Chemicals**	**PVC-U**	**PVC-C**	**ABS**
Oxidizing Acids (HNO3, H2CrO4, H2SO4 , etc.)	$HNO_3 \leq 25\,\%$	+	+	-
	$25\,\% \leq HNO_3 \leq 65\,\%$	o	+	-
	H_2CrO_4 aqueous solution	o	o	-
	$H_2SO_4 \leq 70\%$	+	+	-
	$70\,\% \leq H_2SO_4 \leq 96\,\%$	+	+	-
Non Oxidizing Acids (HCl, HF, etc.)	$HCl \leq 30\,\%$	+	+	-
	$HF \leq 40\,\%$	+	-	-
	$40\,\% \leq HF \leq 75\,\%$	-	-	-
Organic (formic acid, acetic acid, citric acid, etc.)	$HCOOH \leq 25\,\%$	+	+	o
	$25\,\% \leq HCOOH \leq$ tech. pure	+	-	-
	$CH_3COOH \leq 50\,\%$	+	+	-
	$50\,\% \leq CH_3COOH \leq$ tech. pure	o	-	-
	$C_3H_4OH(COOH)_3$	+	+	-
Bases	Inorganic (NaOH, KOH, etc.)	+	o	-
	Organic (amine, imidazole, etc.)	o	-	-
Salts	NaCl, $FeCl_2$, $FeCl_3$, $CaCl_2$, etc.	+	+	+
Halogens	Chlorine, bromine, iodine, (no fluorine)	o	o	-
Fuels / Oils	Aliphatic hydrocarbons	+	o	-
	Aromatic hydrocarbons	-	-	-
Solvents	Chlorinated hydrocarbons	-	-	-
	Ketones	-	-	-
	Alcohols	o	-	-
	Esters	-	-	-
	Aldehydes	-	-	-
Phenols	Phenol, Kresol, etc.	-	-	-
Oxidizing agents	NaOCl, ozone, etc.	o	o	-

+ resistant o conditionally resistant, please consult us - not resistant

Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia George Fisher
Lepené potrubia: PVC,ABS



Spájanie potrubí

Príklad patentovaného spôsobu spájanie potrubia George Fisher
Lepené potrubia: PVC,ABS

Adaptors

Adaptors

Bends

Bends

Elbows

Elbows

Reducers

Reducers

End Caps

End Caps

Flange Joints

Flange Joints

Diaphragm Valves

Manual and pneumatic diaphragm valves offer optimal flow geometry.

Diaphragm Valves

Socket Fittings

Socket Fittings

Tees

Tees

Unions

Unions