Vakuové ventily

Dělení podle různých principů

Podle funkčnosti

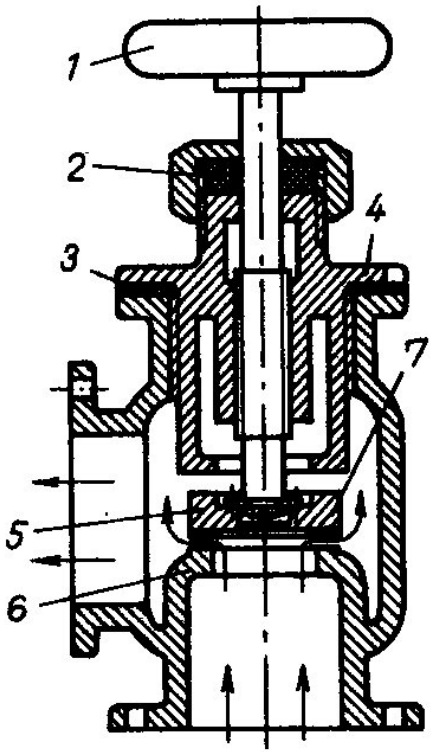
- oddělovací
- napouštěcí
- zavzdušňovací
- omezení čerpací rychlosti

Ovladání

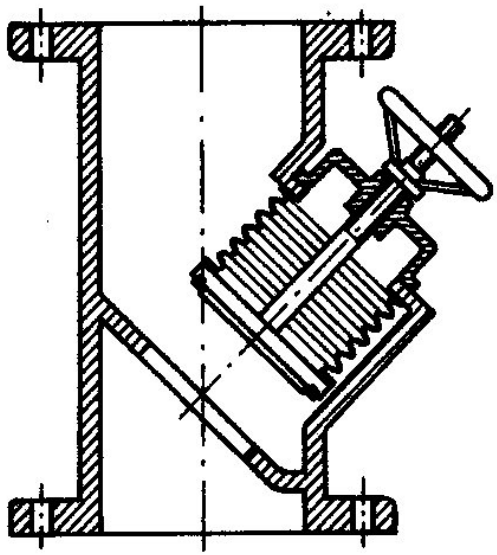
- ruční
- pneumatický
- elektromagnetický

Oblast použití

- hrubé vakuum
- HV vakuum
- UHV, XHV vakuum

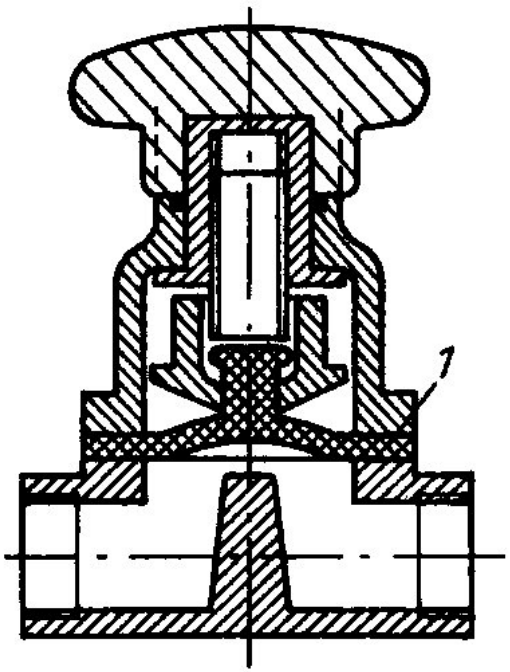


Obr. 6.27. Ventil s talířkem přitlačovaným šroubem
1 – rukojeť; *2* – těsnění; *3* – těsnicí kroužek; *4* – horní příruba; *5* – talířek; *6* – dolní příruba; *7* – těsnění talířku

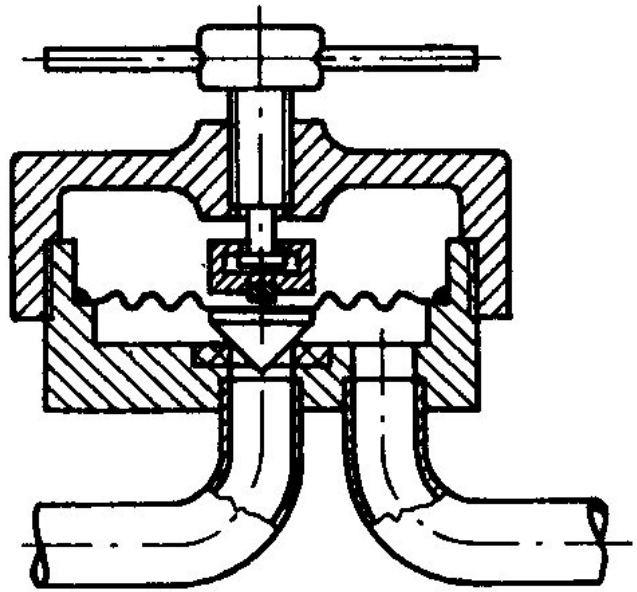


Obr. 6.28. Ventil těsněný vlnovcem

J. Groszkowski: Technika vysokého vakua, SNTL, Praha 1981

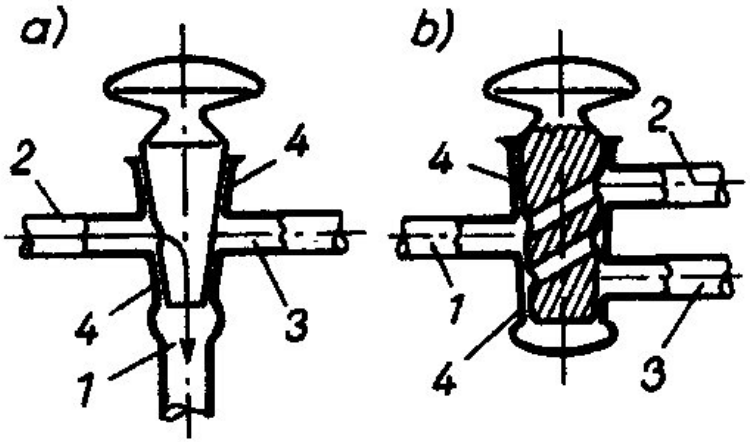


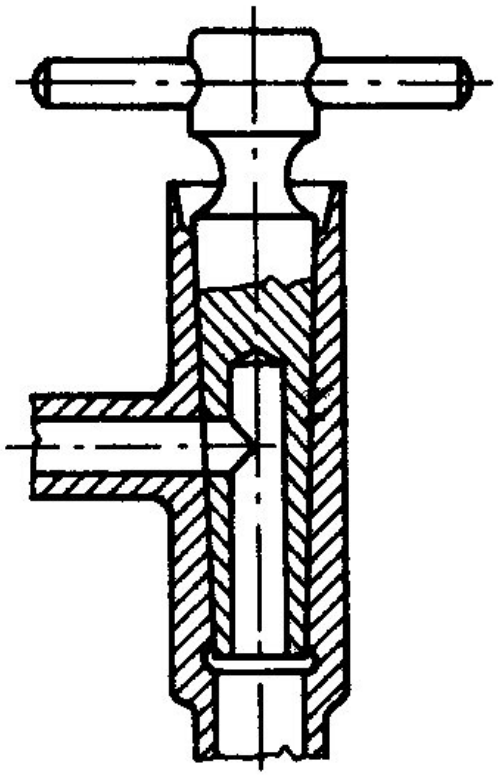
Obr. 6.32. Ventil pro nízké vakuum s membránovým těsněním (firma Leybold)



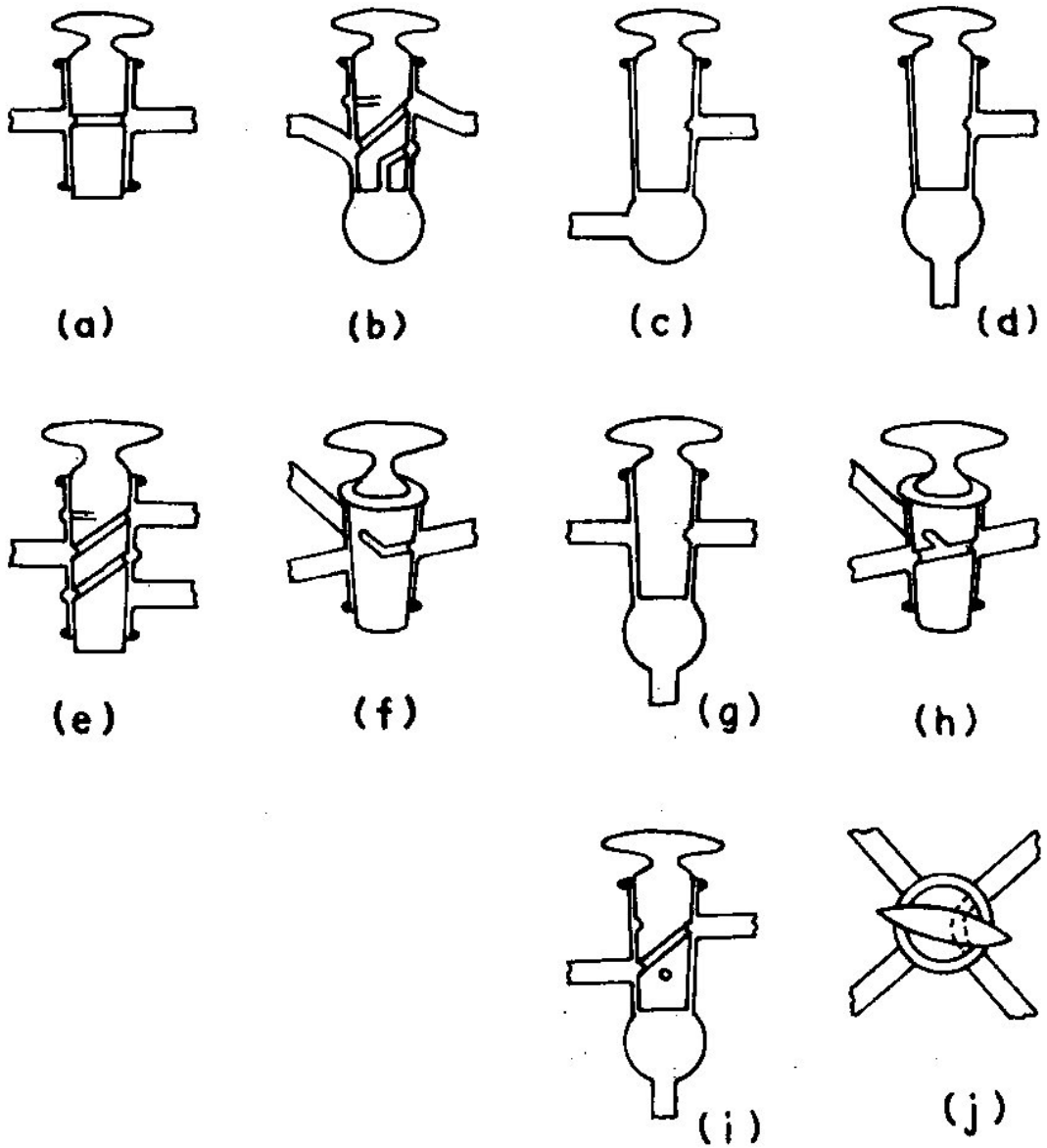
Obr. 6.33. Řez ventilu s kuželovým čepem a membránovým těsněním pro ultravysoké vakuum

J. Groszkowski: Technika vysokého vakua, SNTL, Praha 1981

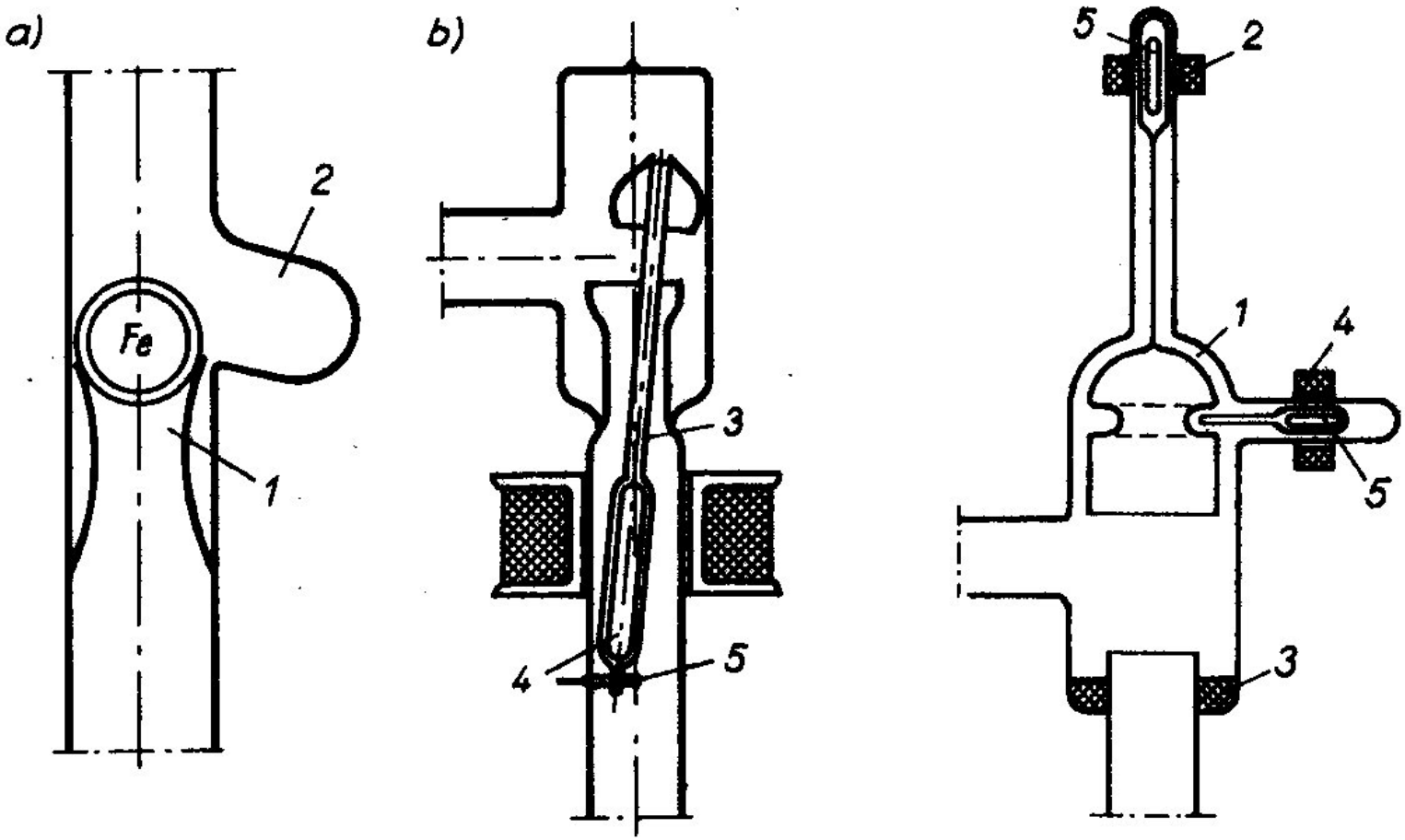




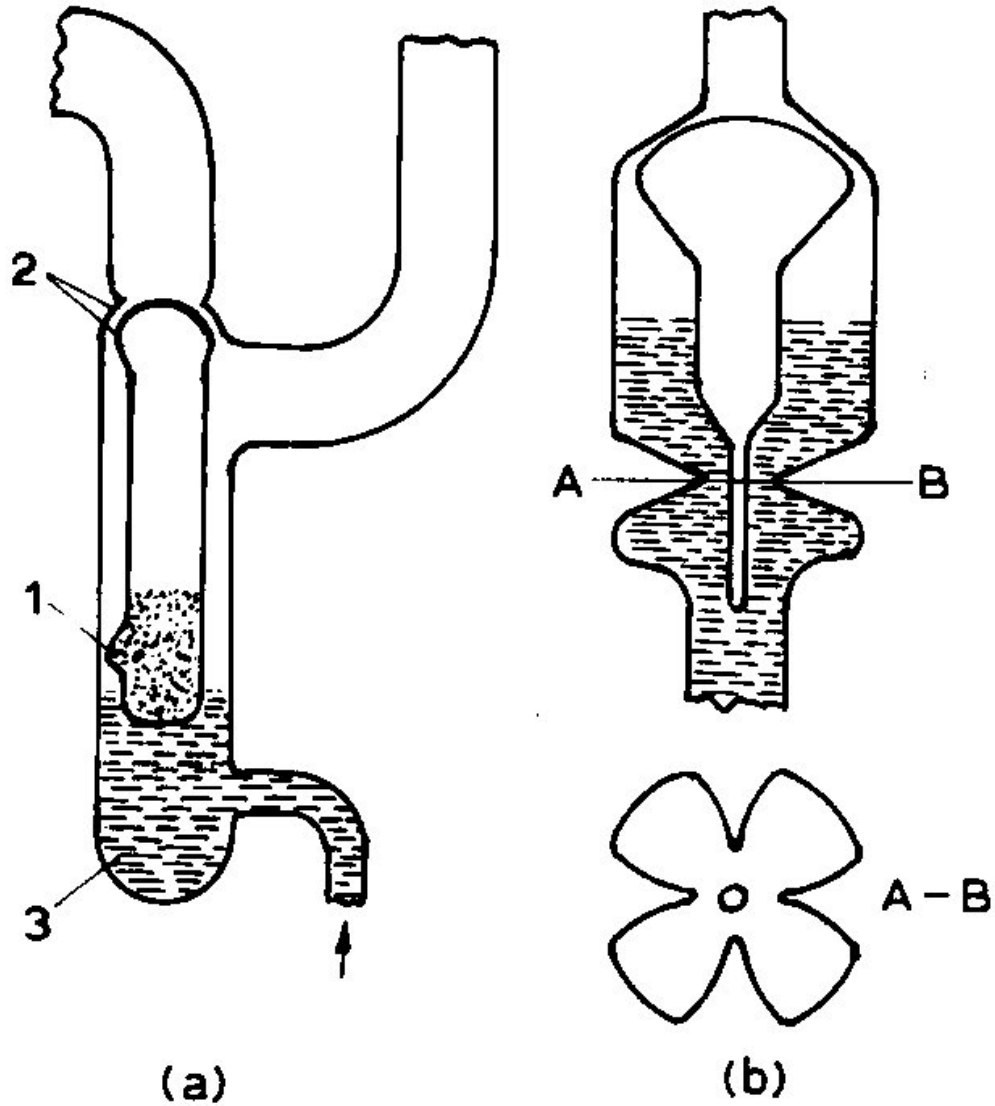
J. Groszkowski: Technika vysokého vakua, SNTL, Praha 1981



A. Roth: Vacuum technology, Elsevier, 1990



J. Groszkowski: Technika vysokého vakua, SNTL, Praha 1981



A. Roth: Vacuum technology, Elsevier, 1990

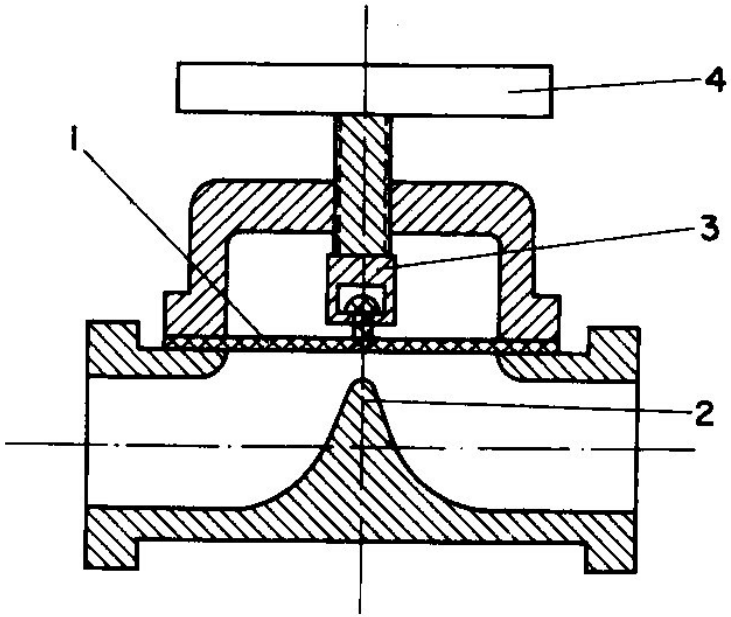
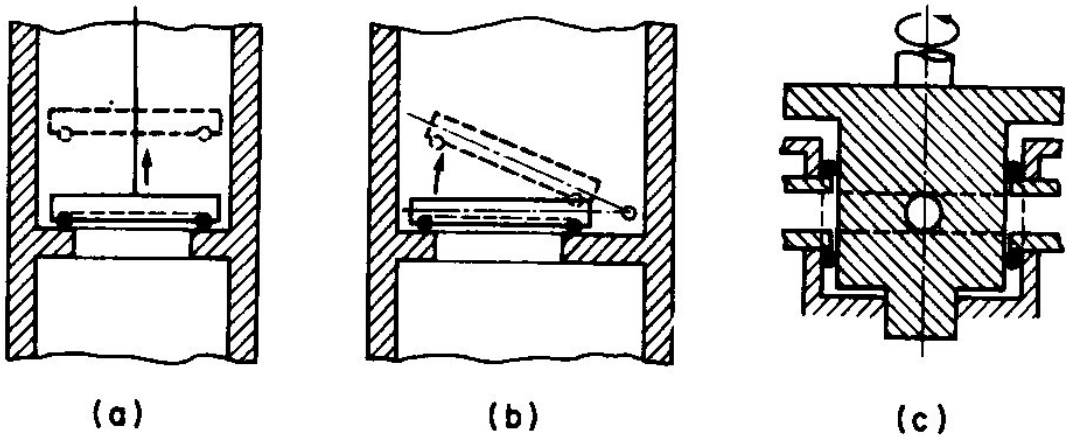
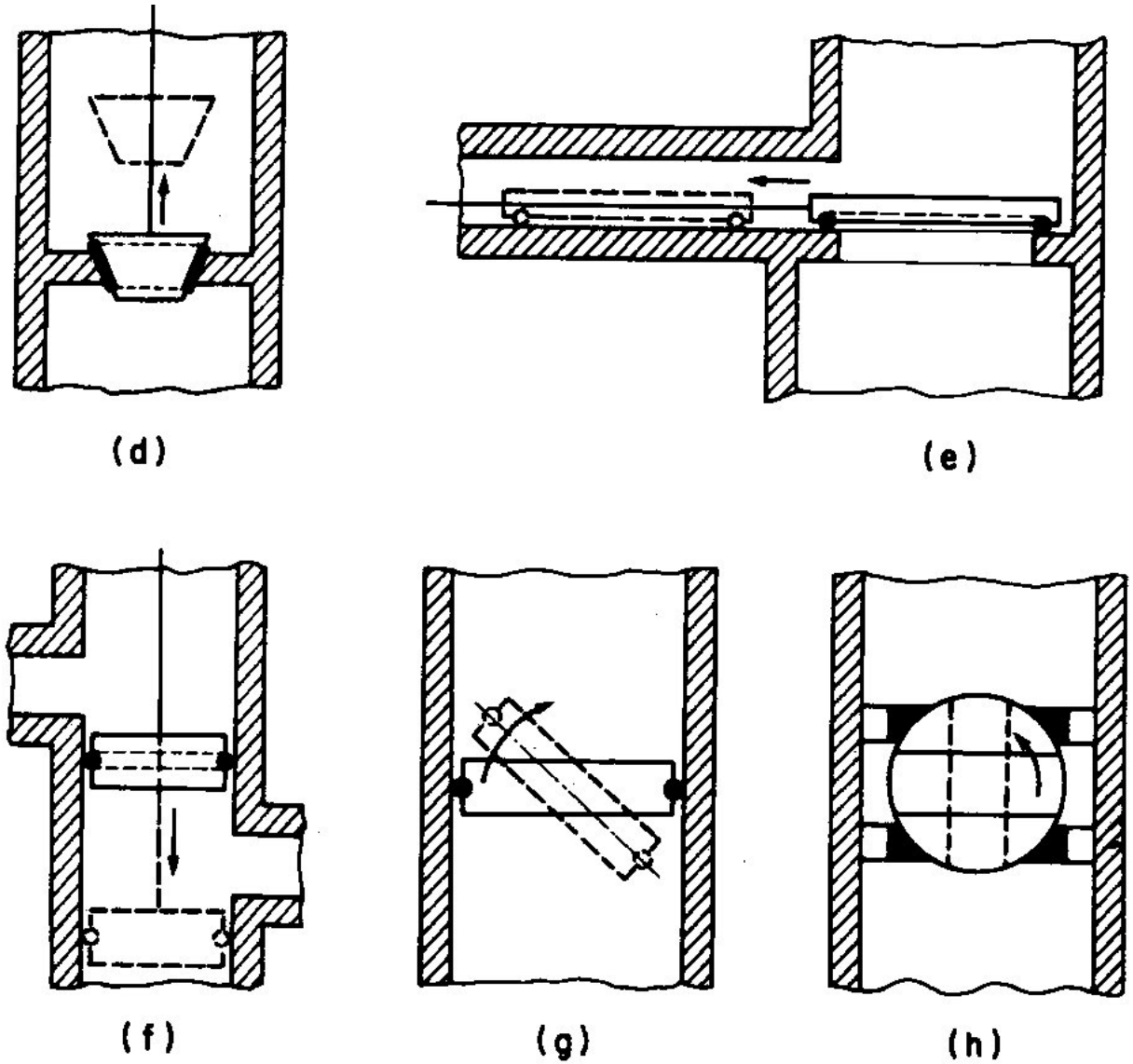


Fig. 7.61 Diaphragm valve.



A. Roth: Vacuum technology, Elsevier, 1990



A. Roth: Vacuum technology, Elsevier, 1990

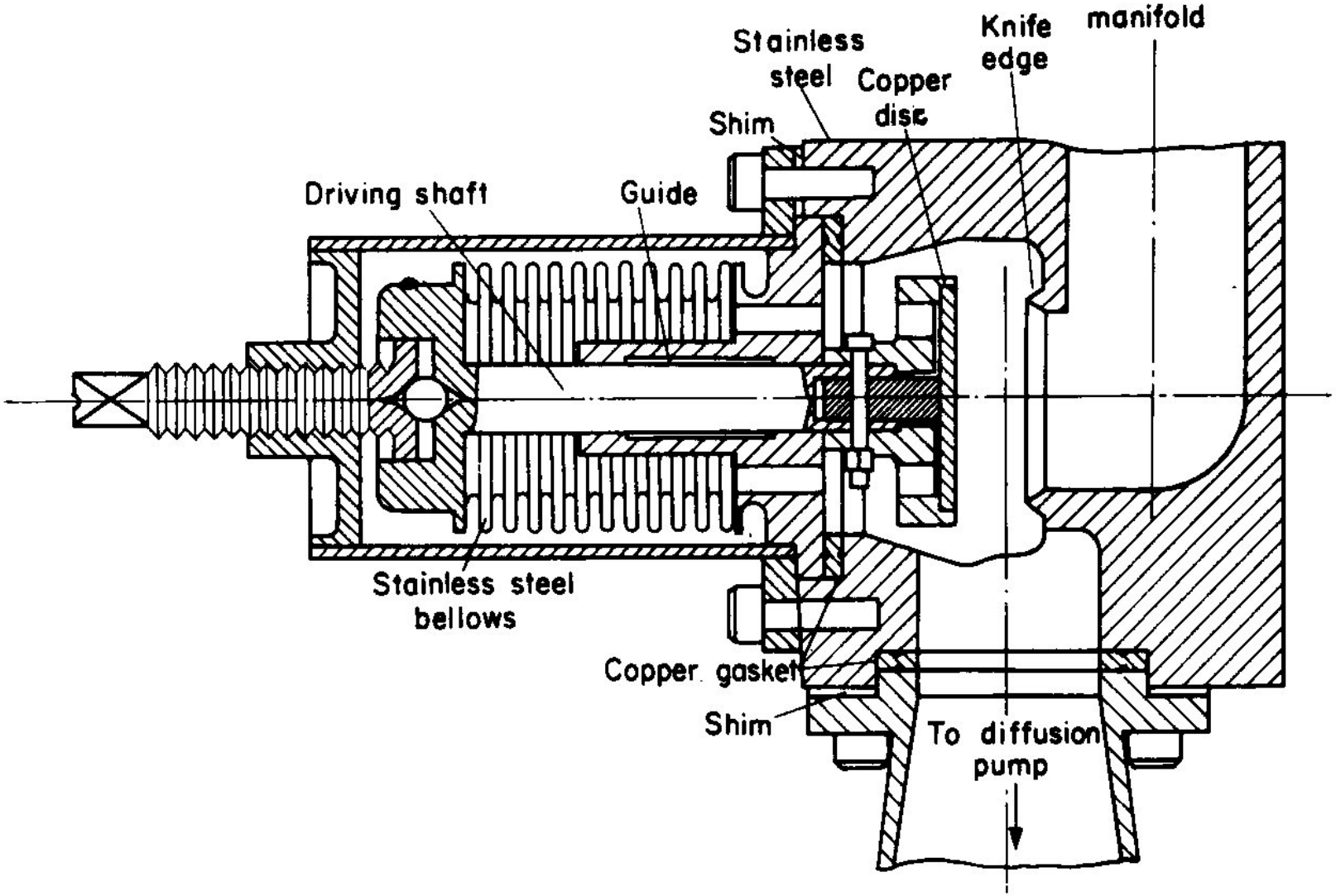


Fig. 7.65 Ultra-high vacuum valve. After Baker (1962).

A. Roth: Vacuum technology, Elsevier, 1990

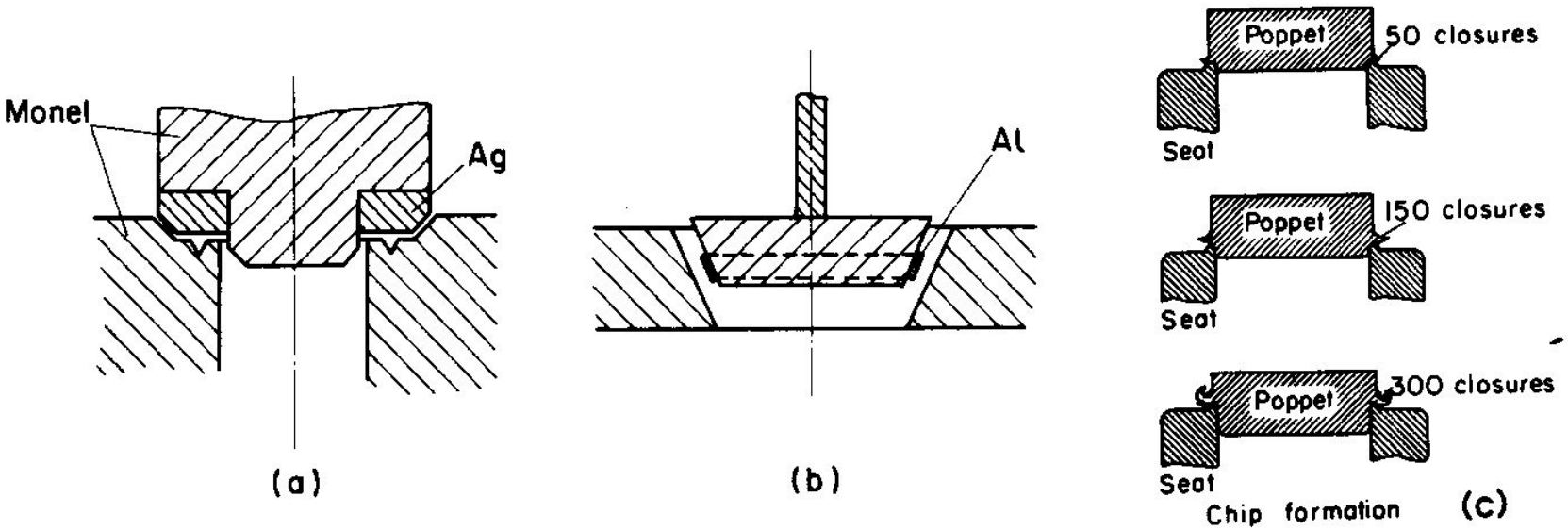
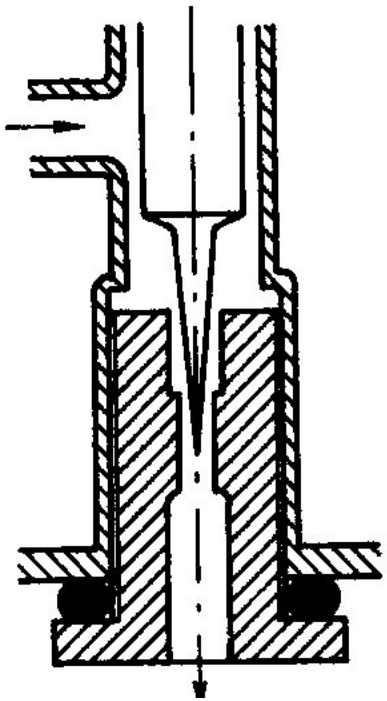
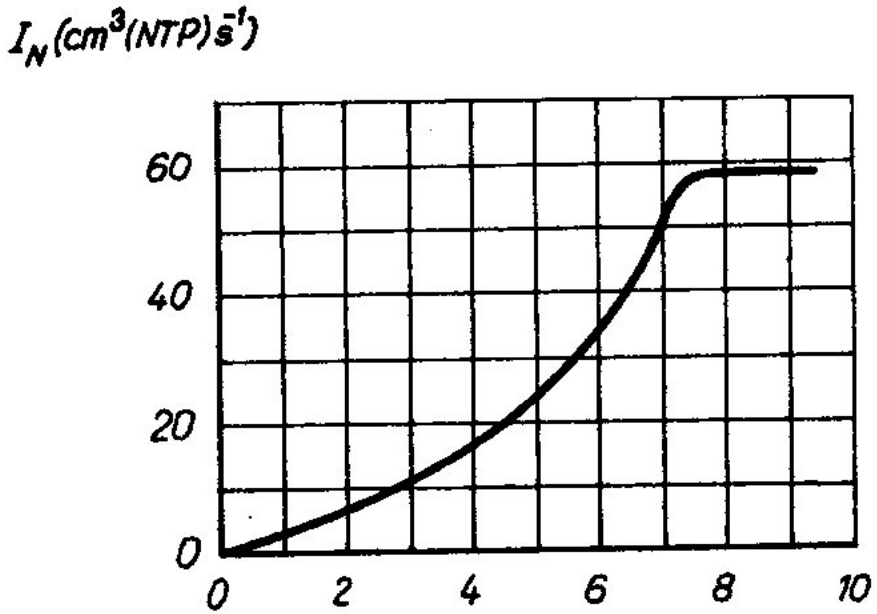


Fig. 7.63 Closing systems of all-metal valves; (a) with flat silver ring (Bills and Allen, 1955); (b) with aluminum conical ring (Kienel and Lorenz, 1960); (c) with copper poppet (Parker and Mark, 1961).

A. Roth: Vacuum technology, Elsevier, 1990

Jehlový ventil



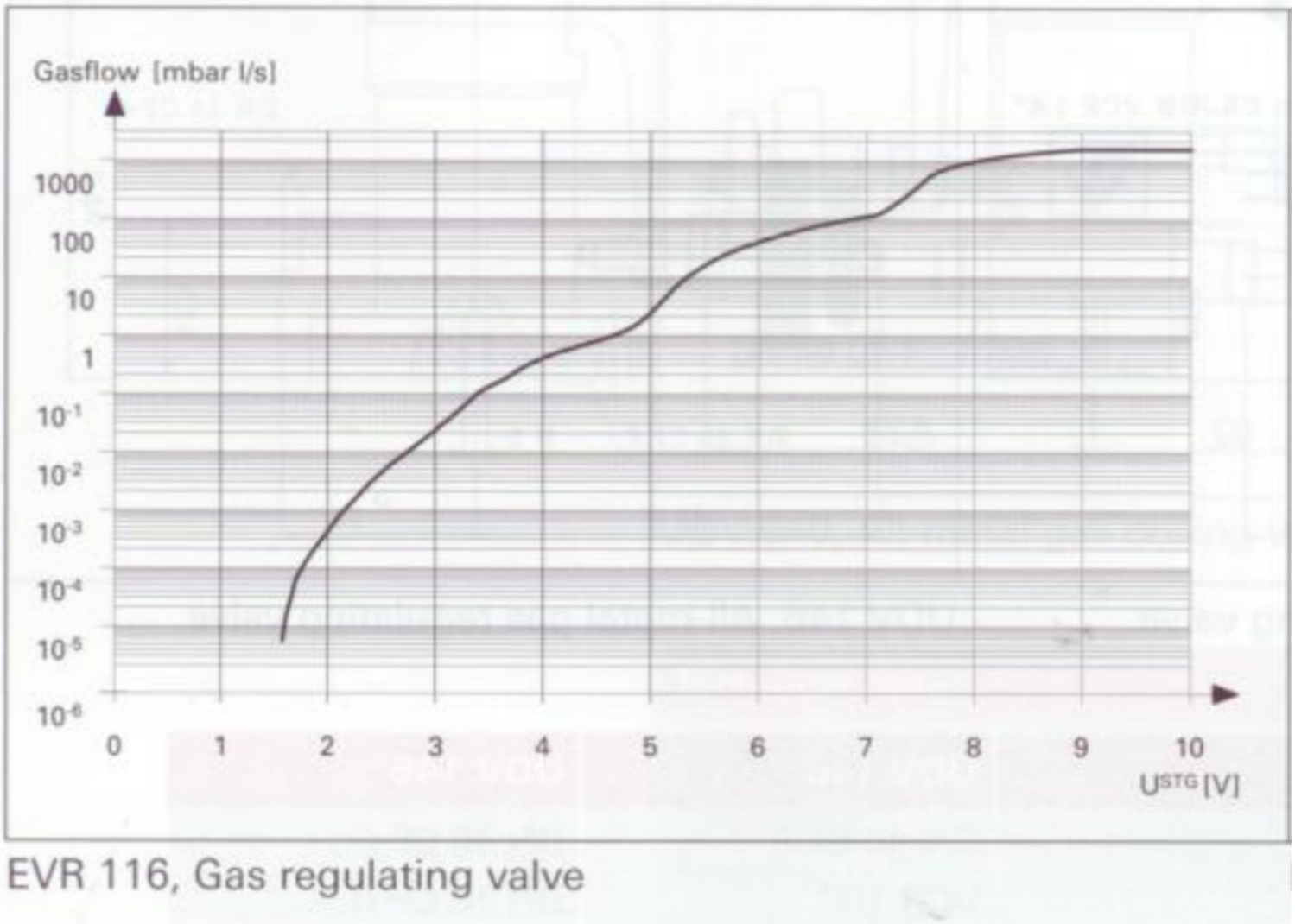


J. Groszkowski: Technika vysokého vakua, SNTL, Praha 1981

EVN-116

firemní mat. Pfeiffer

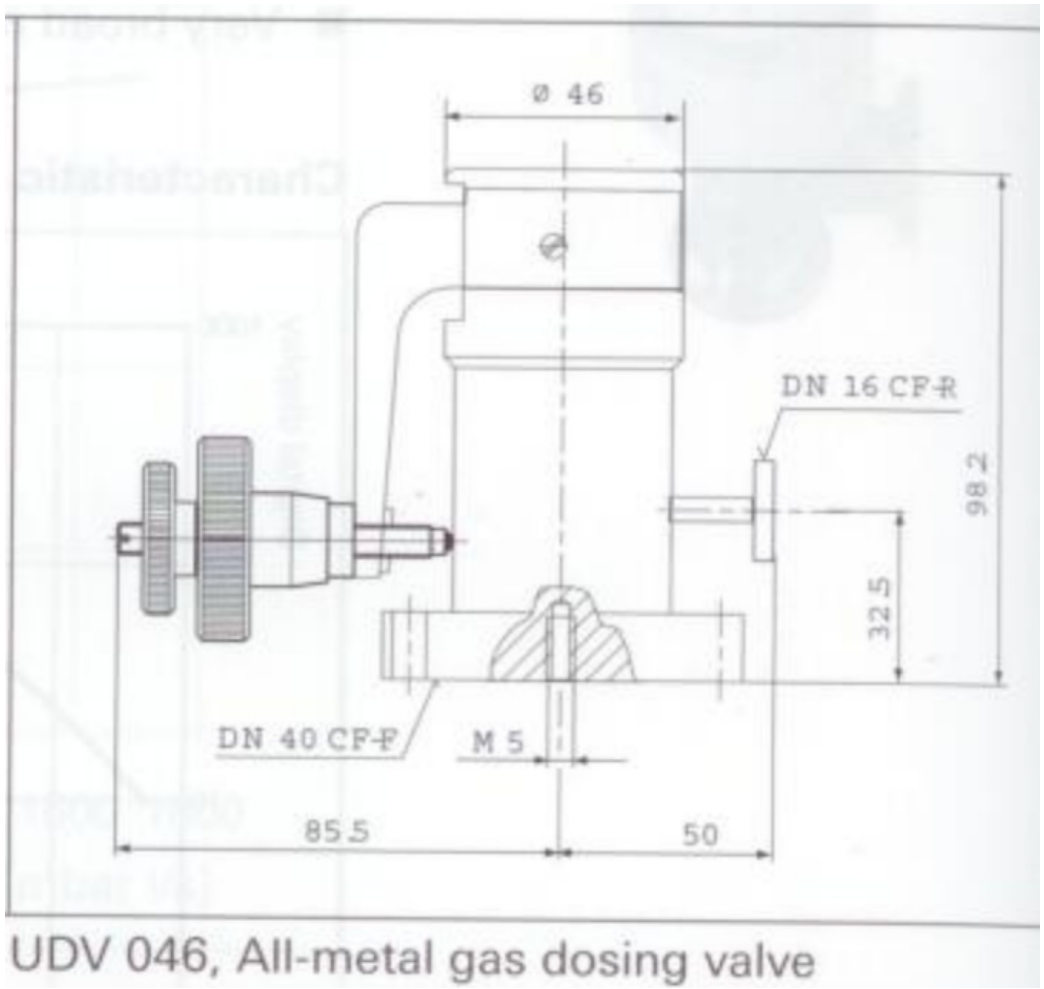
EVR-116



EVR 116, Gas regulating valve

firemní mat. Pfeiffer

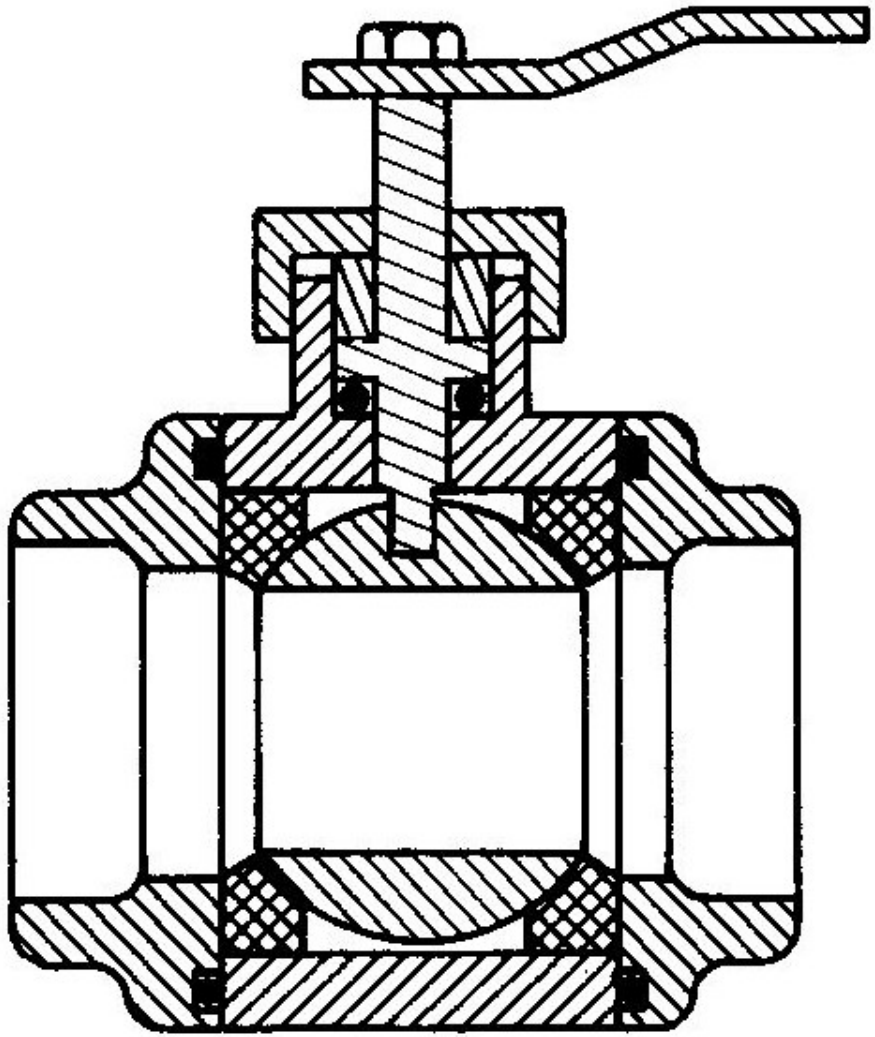
UDV-046



UDV 046, All-metal gas dosing valve

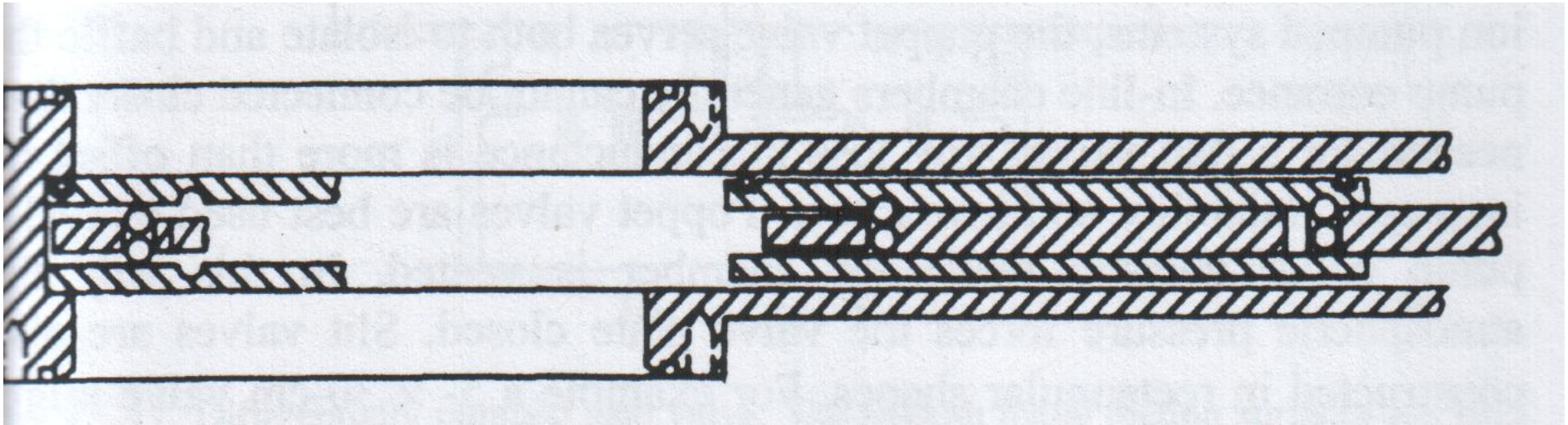
firemní mat. Pfeiffer min. 1×10^{-9} hPal/s

Kulový ventil



A. Roth: Vacuum technology, Elsevier, 1990

Deskový ventil



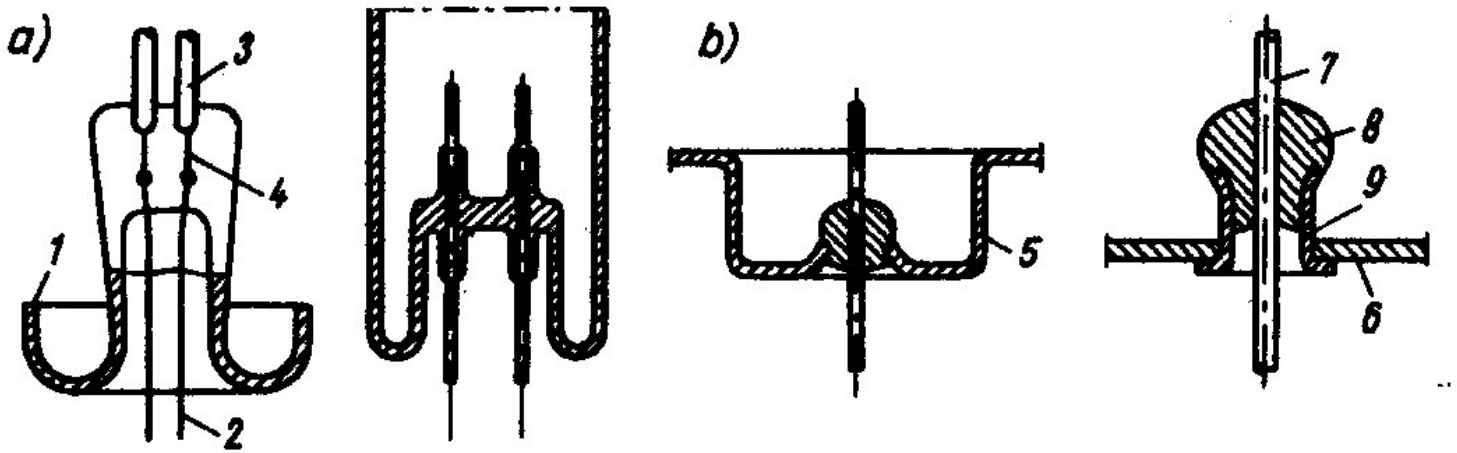
F.OHanlon: A Users Gaude to Vacuum Technology, Wiley (2003)

- deskové ventily - při otevírání dif.tlak menší než $\sim$ 30 hPa
- ventily s kovovým těsněním - omezený počet cyklů
- jehlové ventily - nedotahovat silou
- zábrusové ventily - dobře namazat

Elektrické průchodky

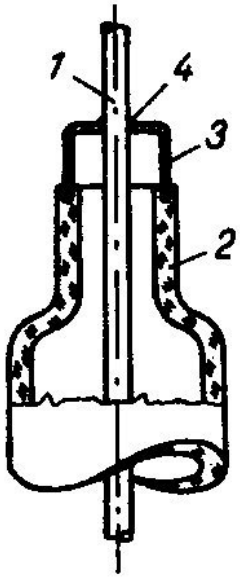
Vakuum v rozsahu tlaků 1 – 5000 Pa je velmi špatný elektrický izolant.
Průchodky vybíráme podle:

- napětí
- proudu
- frekvence

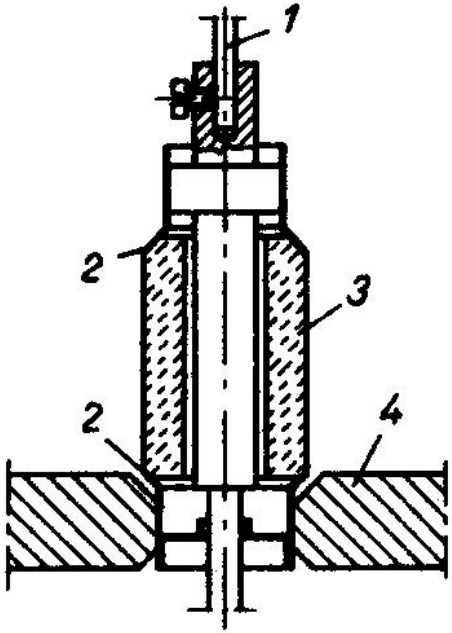


Obr. 6.47. Elektrické průchodky pro slabé proudy
a) vodič z plášťového nebo platinovaného drátku zataveného ve skle, b) průtav skleněnou perličkou zatavenou do otvoru v kovové stěně

J. Groszkowski: Technika vysokého vakua, SNTL, Praha 1981

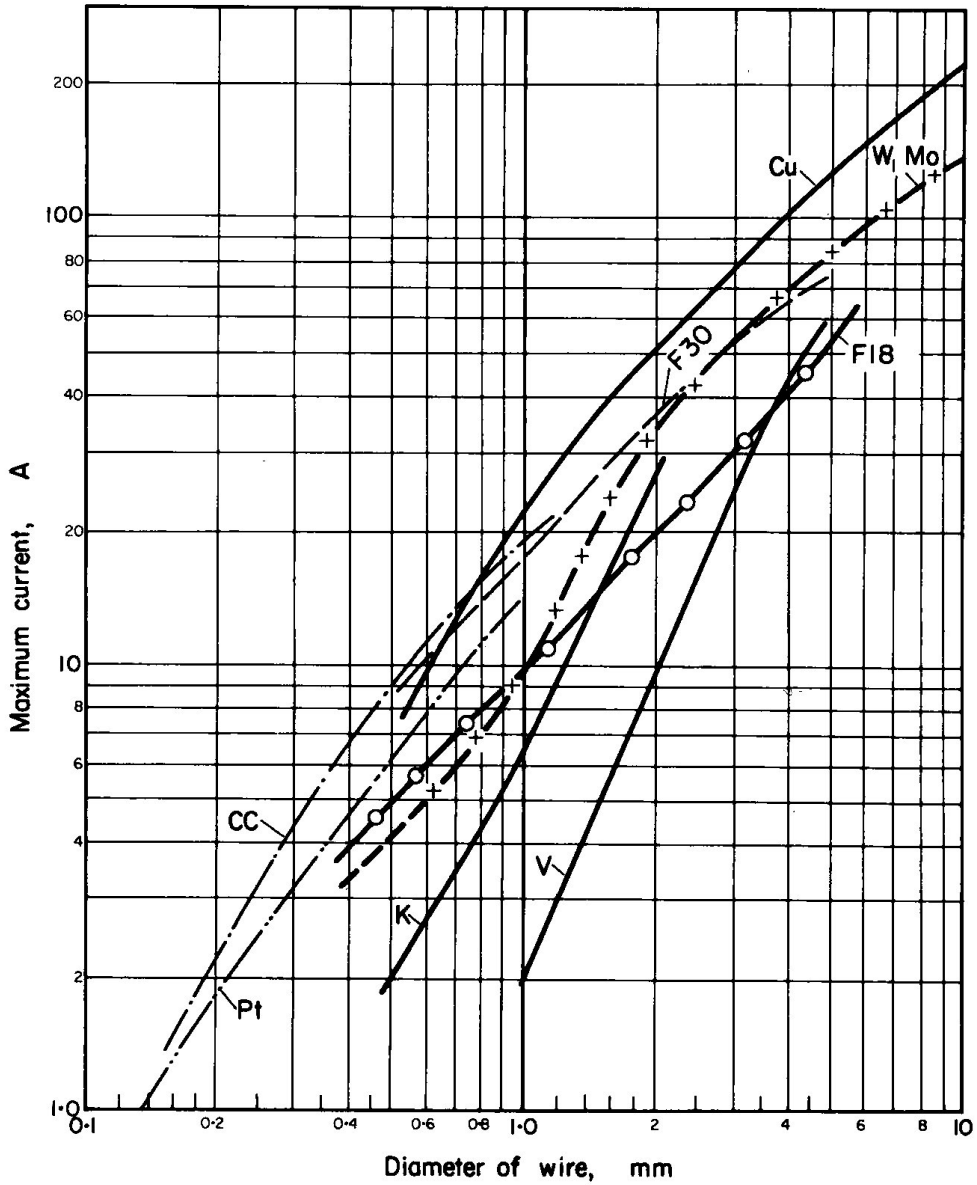


Obr. 6.48. Silnoproudá průchodka skleněnou trubicí
1 – průtav; *2* – sklo; *3* – kovarová čepička; *4* – pájka



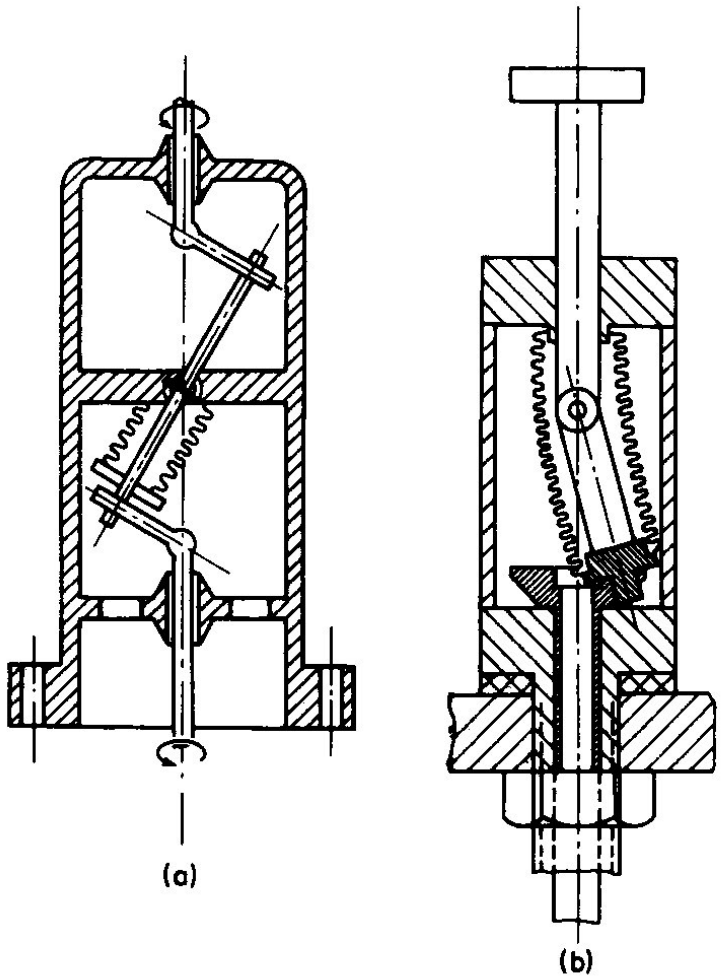
Obr. 6.49. Silnoproudá průchodka kovovou stěnou s keramickým izolátorem
1 – přívod; *2* – spoj kovu s keramikou; *3* – keramika; *4* – stěna vakuového systému

J. Groszkowski: Technika vysokého vakua, SNTL, Praha 1981

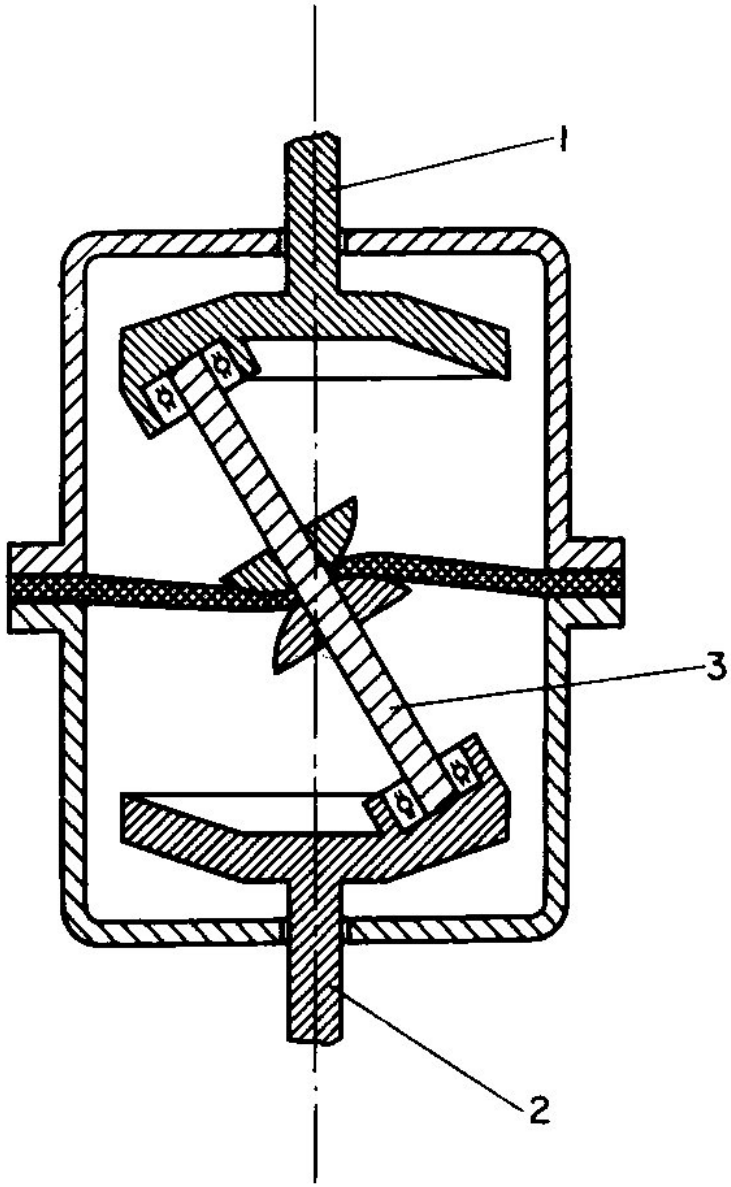


A. Roth: Vacuum technology, Elsevier, 1990

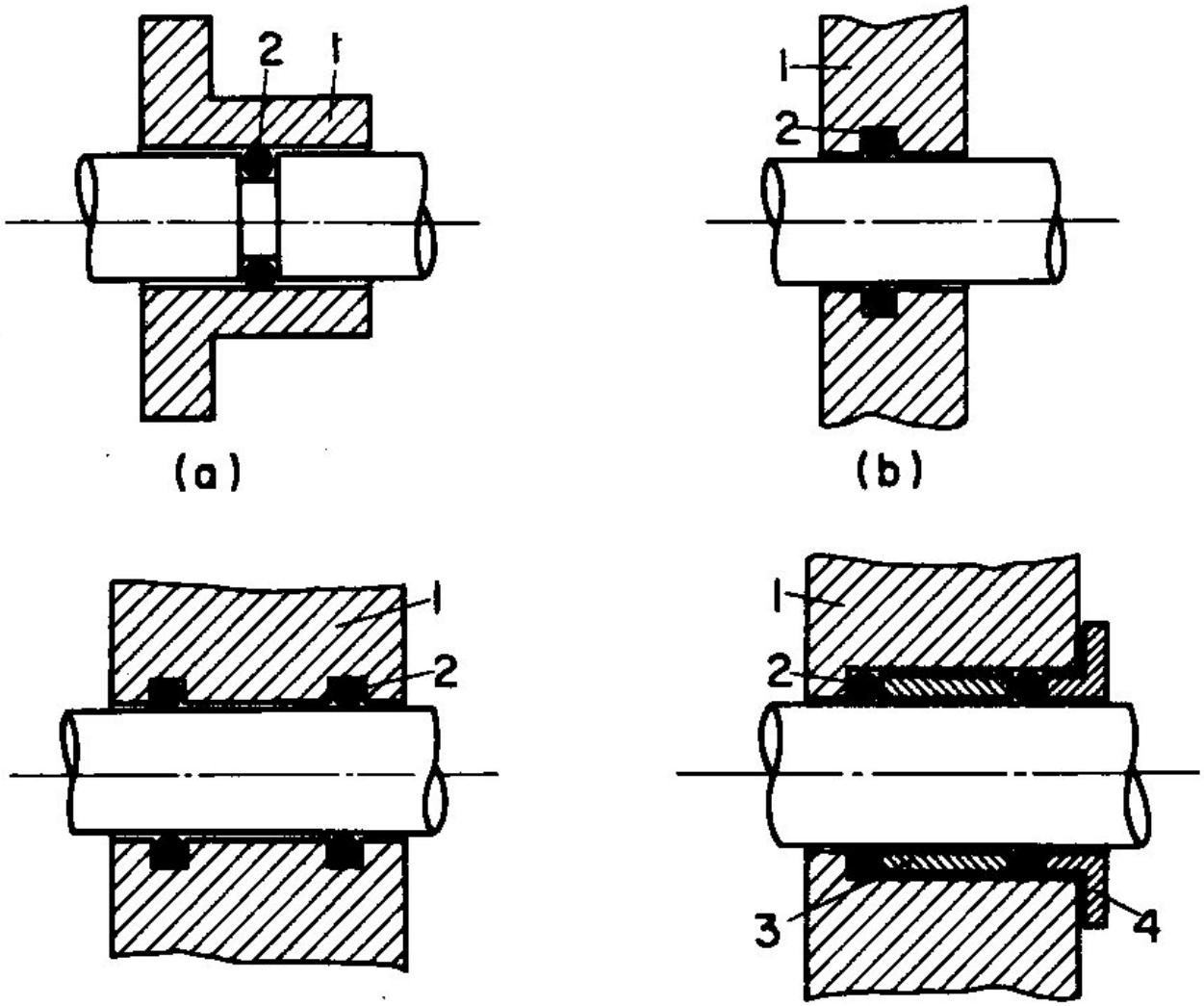
Přenos rotace do vakua



A. Roth: Vacuum technology, Elsevier, 1990

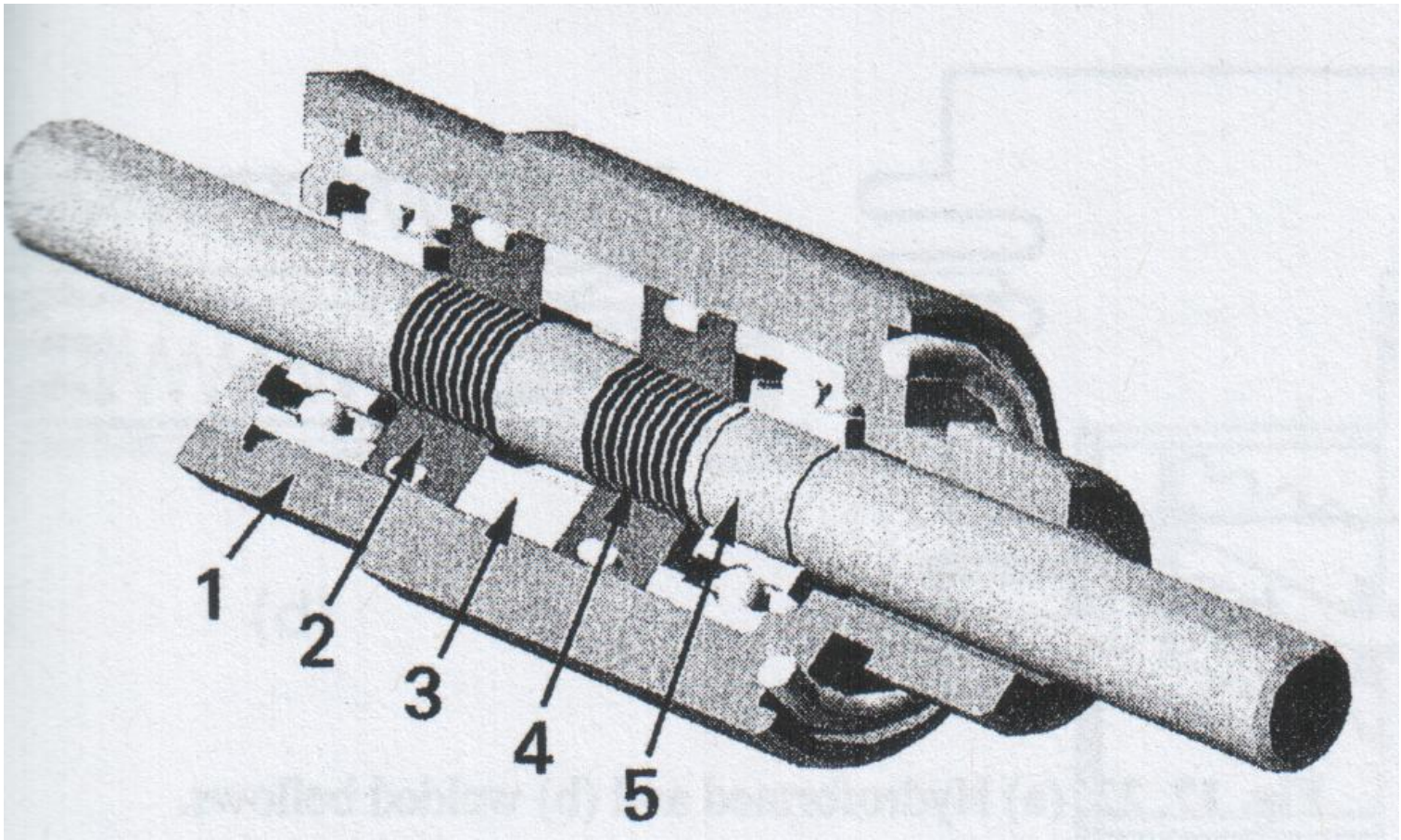


A. Roth: Vacuum technology, Elsevier, 1990



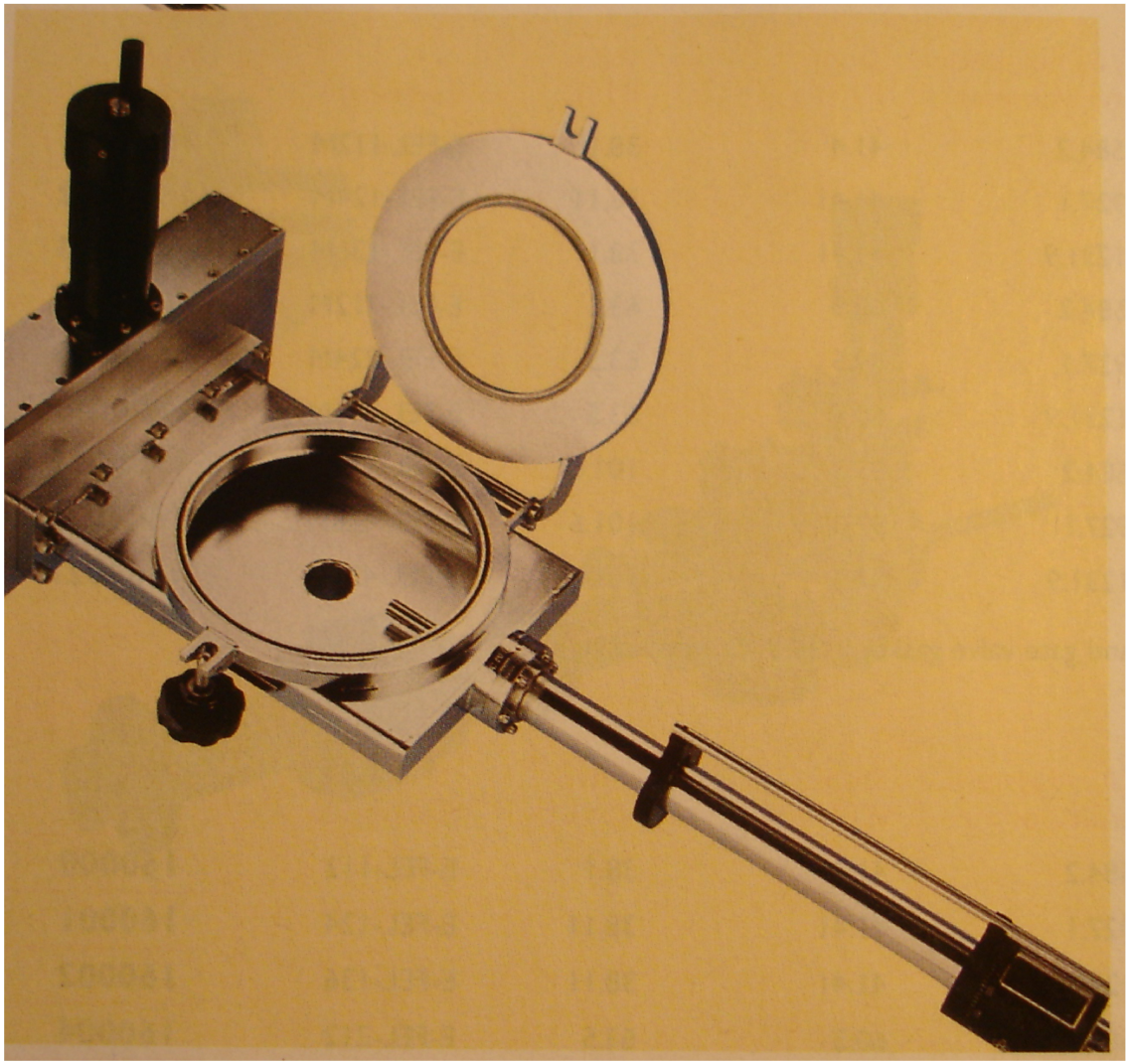
A. Roth: Vacuum technology, Elsevier, 1990

Rotace - ferro kapaliny



F.OHanlon: A Users Gaude to Vacuum Technology, Wiley (2003)

Load lock

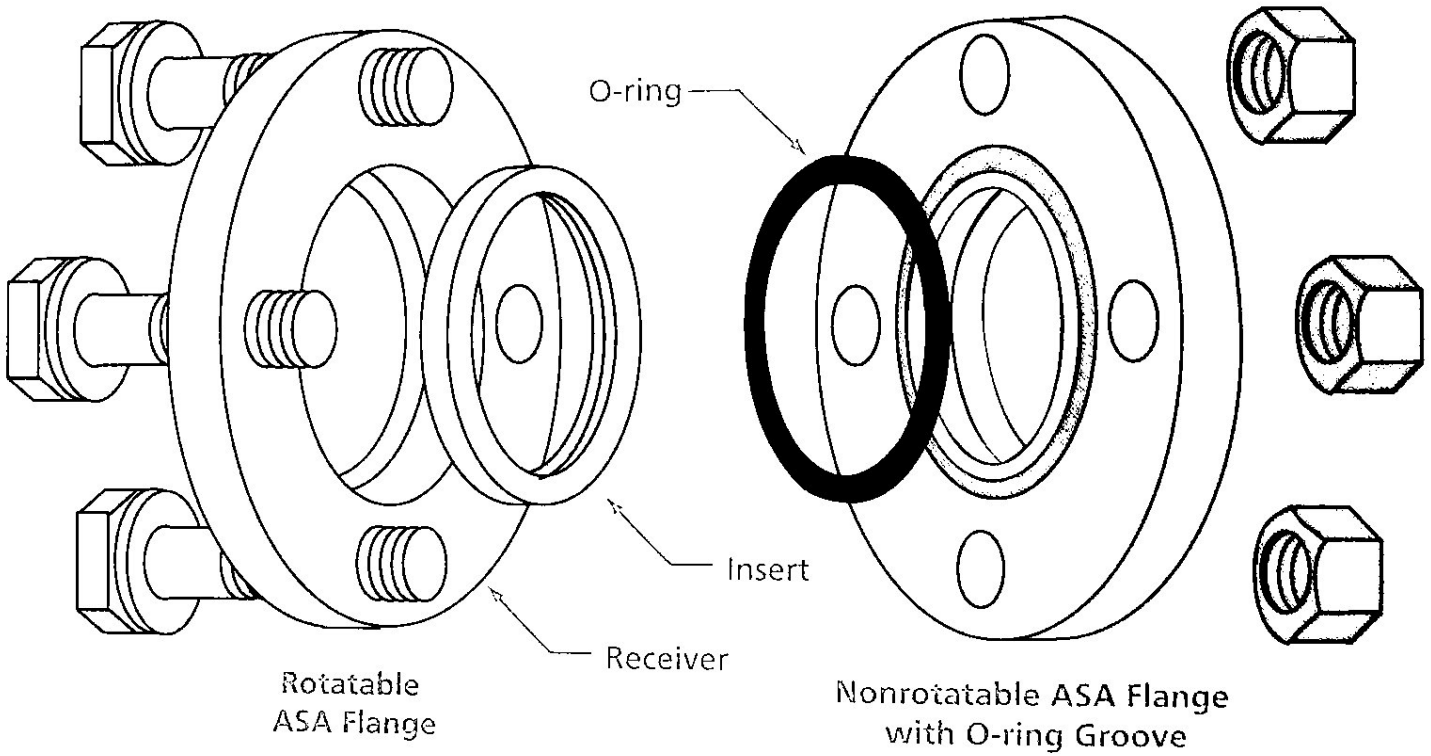


firemní materiály firmy Caburn MDC

Rozebiratelné spoje

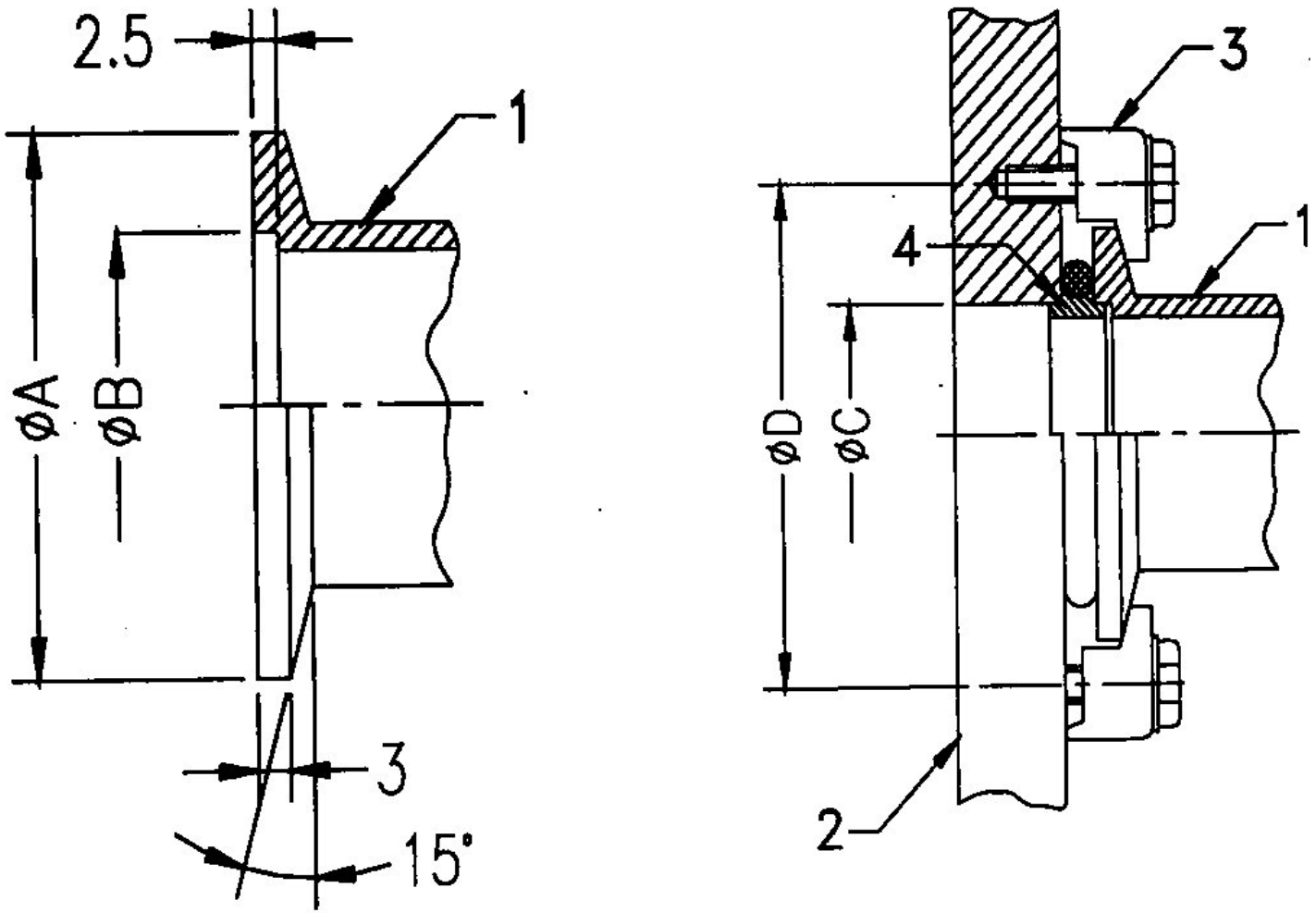
- ASA
- ISO-KF, (NW)
- ISO-K, ISO-F
- CF
- Wire seal flanges
- Helicoflex

ASA

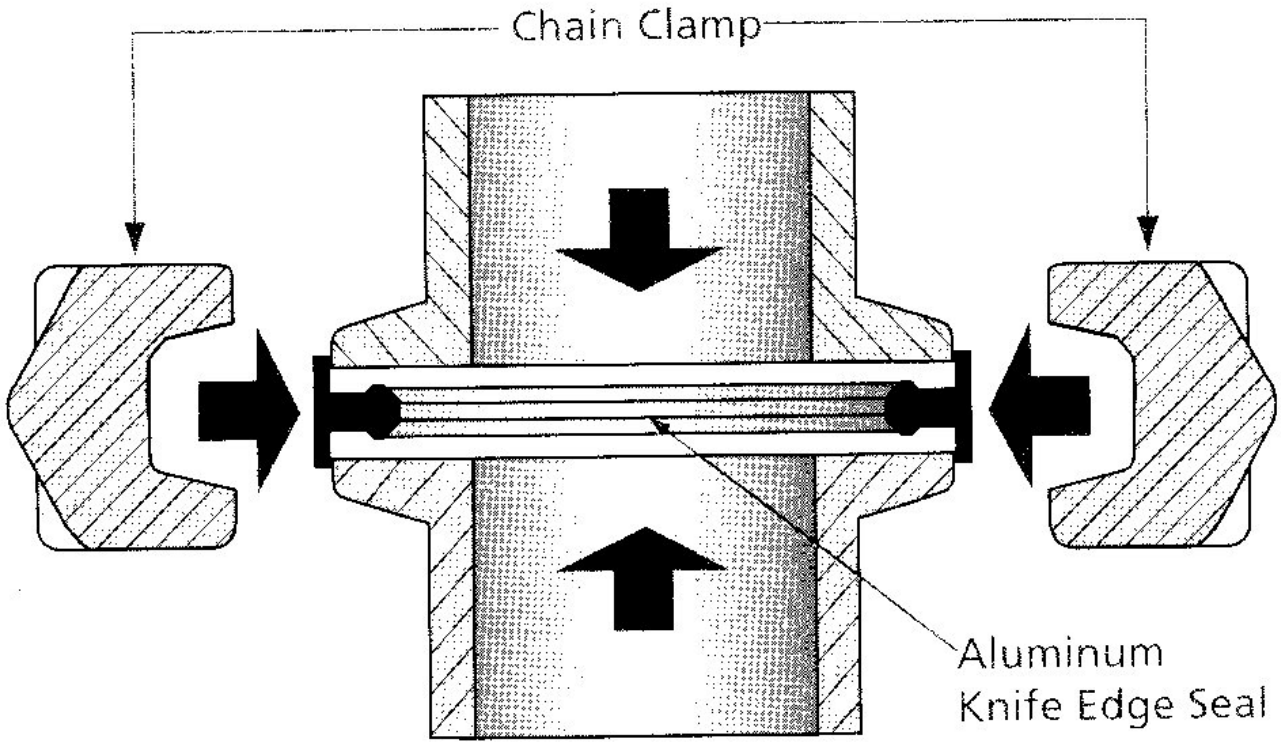


firemní materiály firmy Nor-Cal

ISO-KF

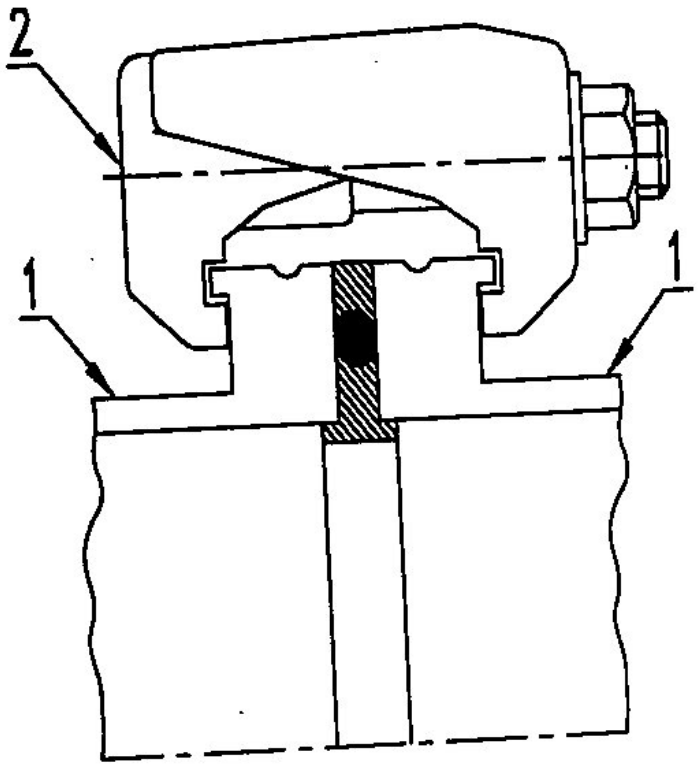


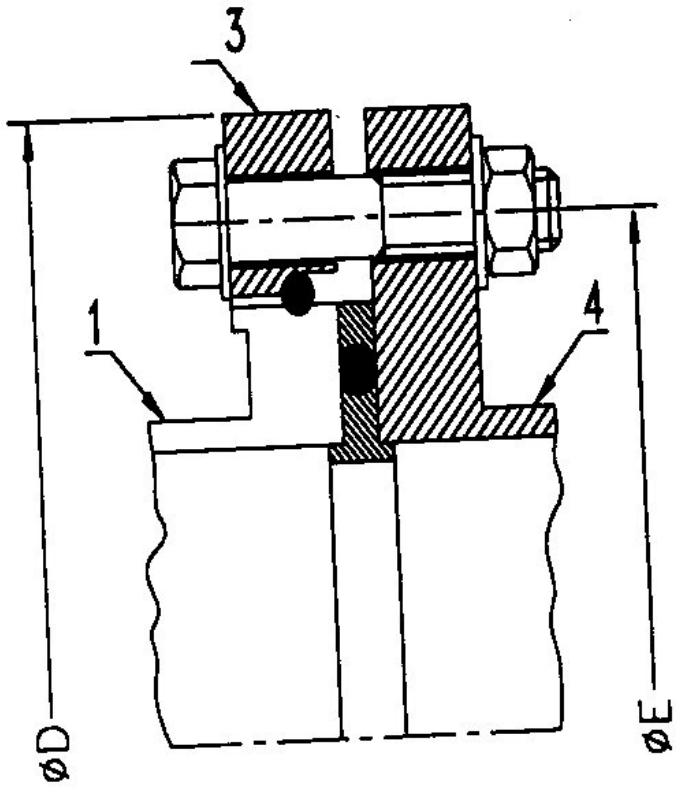
firemní materiály firmy Pfeiffer



firemní materiály firmy Nor-Cal

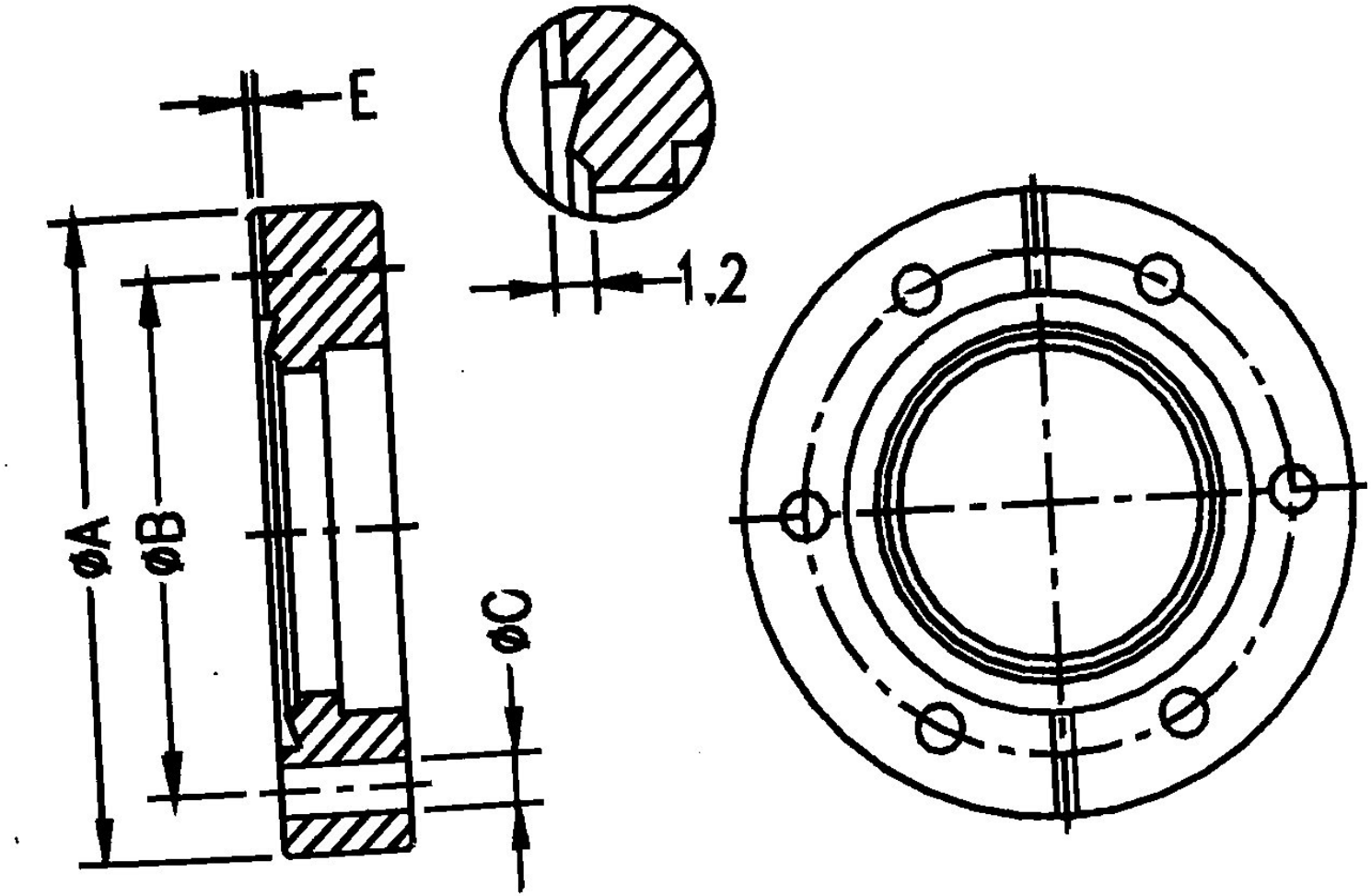
ISO-K, ISO-F





firemní materiály firmy Pfeiffer

CF



firemní materiály firmy Pfeiffer

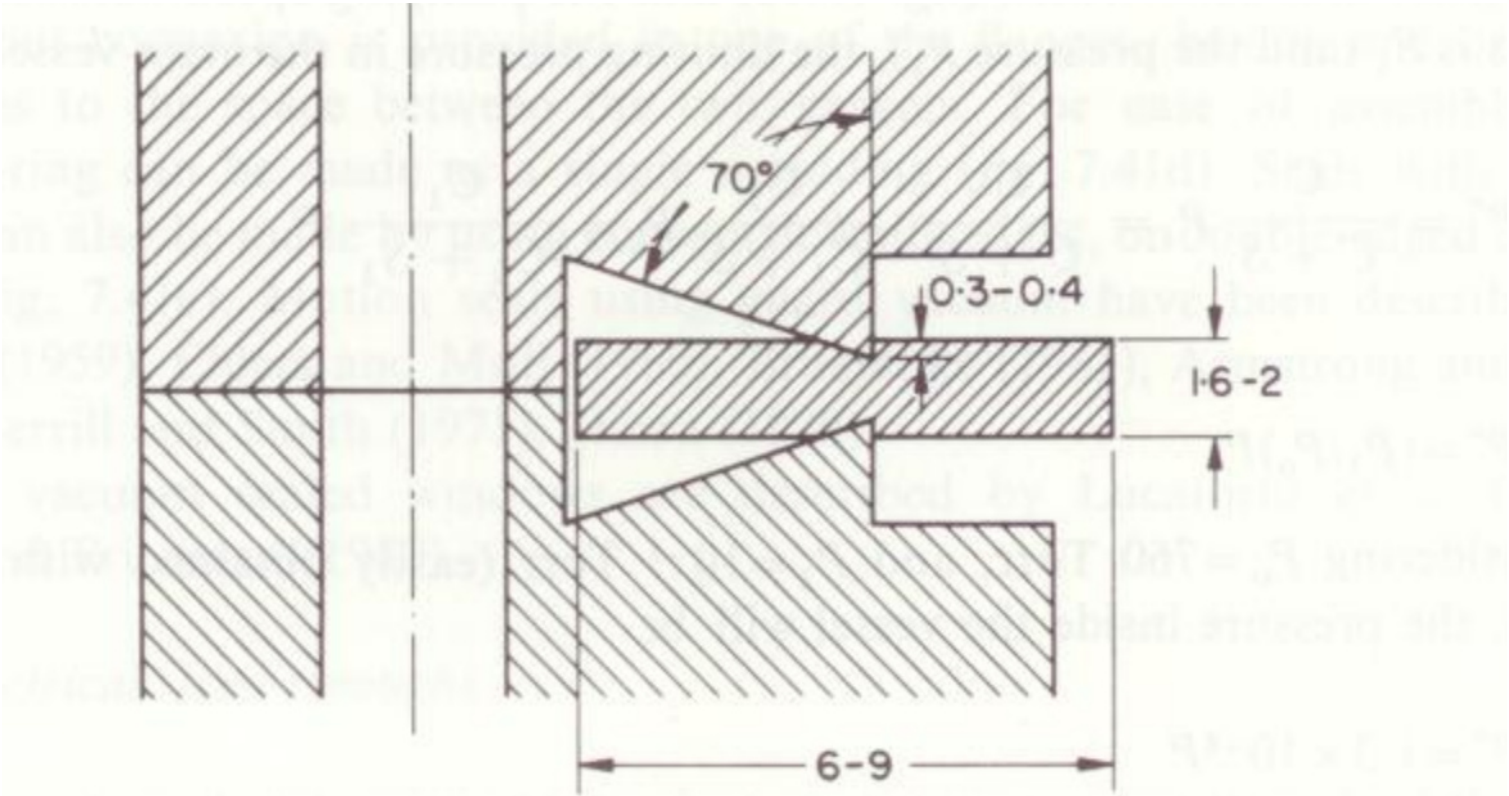
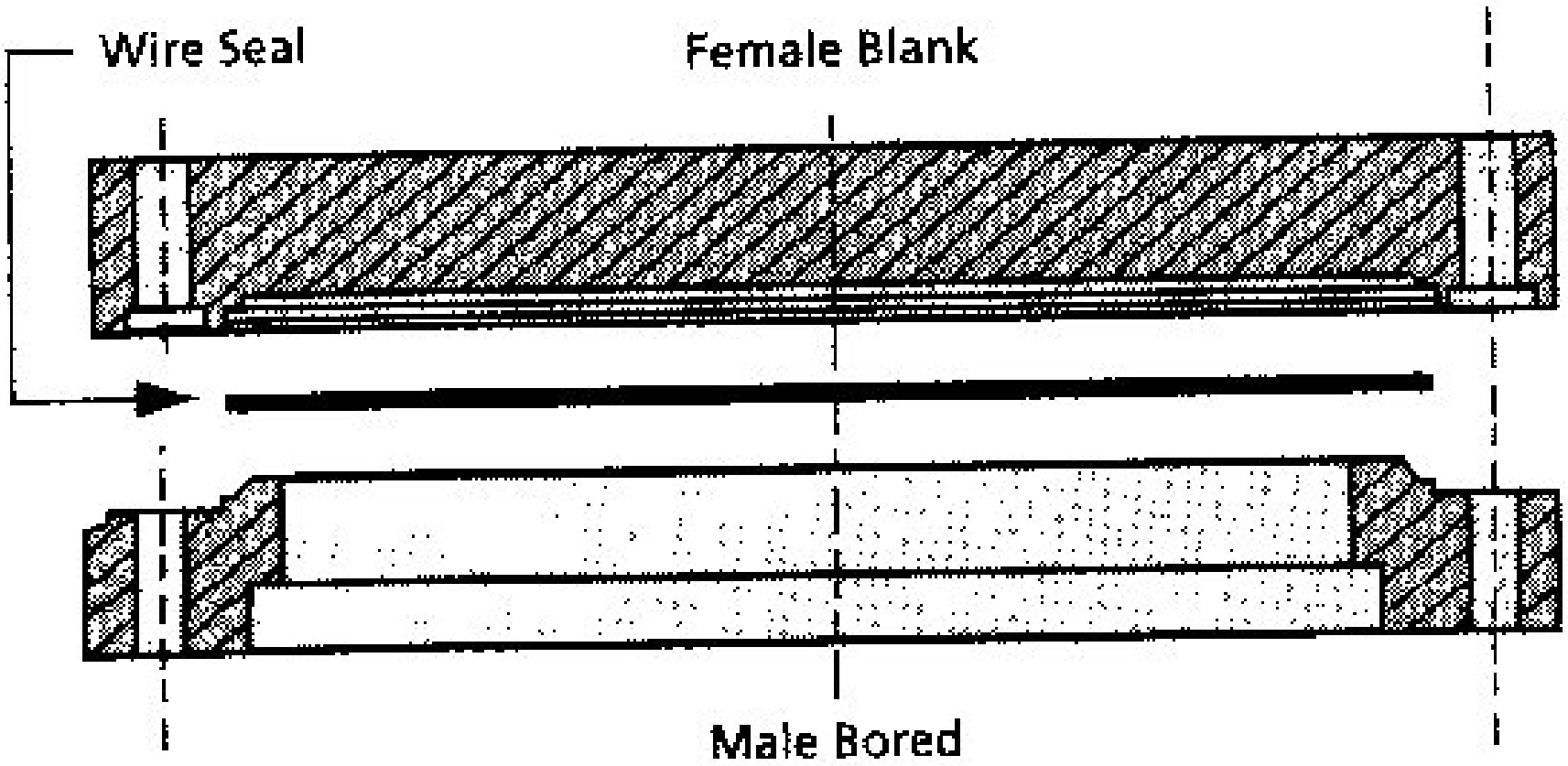


Fig. 7.39 The Conflat seal (Varian). After Wheeler and Carlson (1962).

A. Roth: Vacuum technology, Elsevier, 1990

Wire seal flanges



firemní materiály firmy Nor-Cal

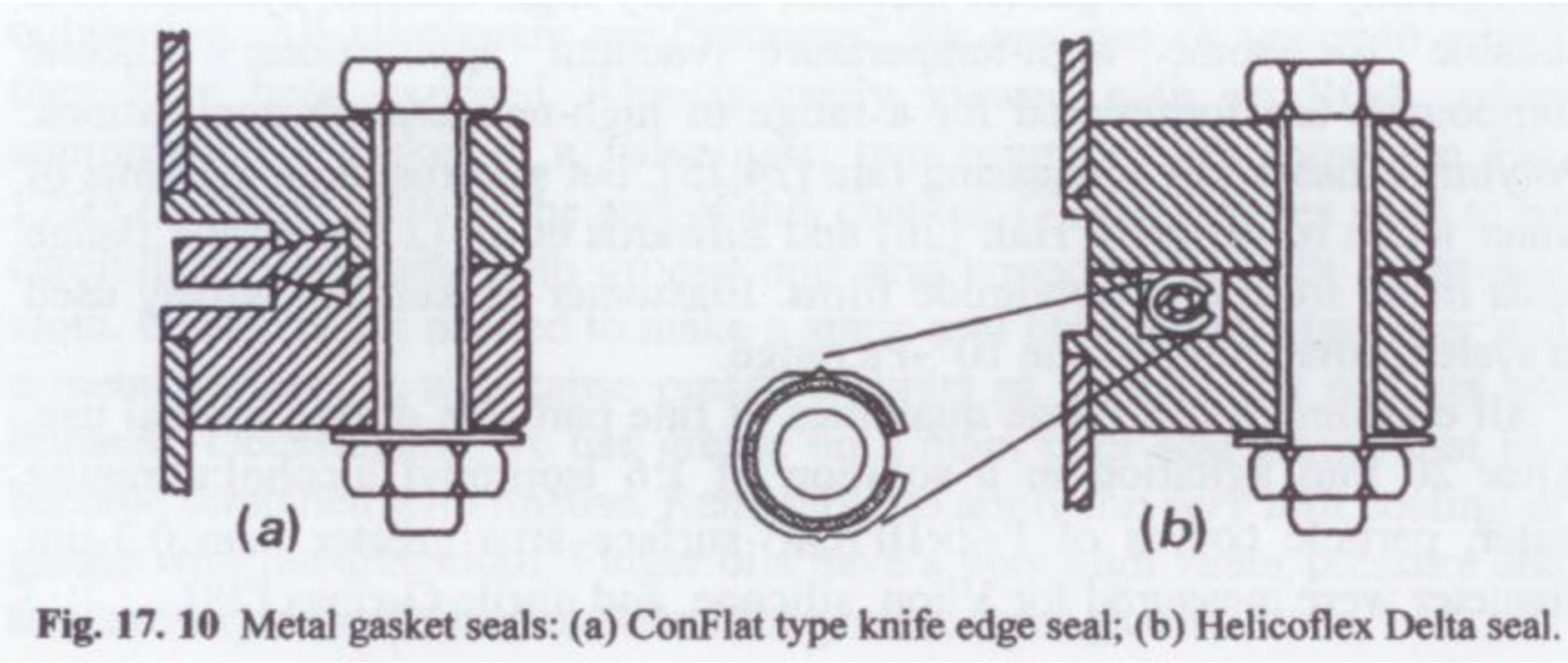


Fig. 17. 10 Metal gasket seals: (a) ConFlat type knife edge seal; (b) Helicoflex Delta seal.

F.OHanlon: A Users Gaude to Vacuum Technology, Wiley (2003)

těsnění	min. tep [$^{\circ}C$]	max. tep. [$^{\circ}C$]
elastomer		
FKM	-15	150
NBR	-25	120
CR	-5	120
EPDM	-50	130
silikon	-55	200
kov		
Cu	-196	200
Cu + Ag	-196	450
Al	-196	150
In	-196	60

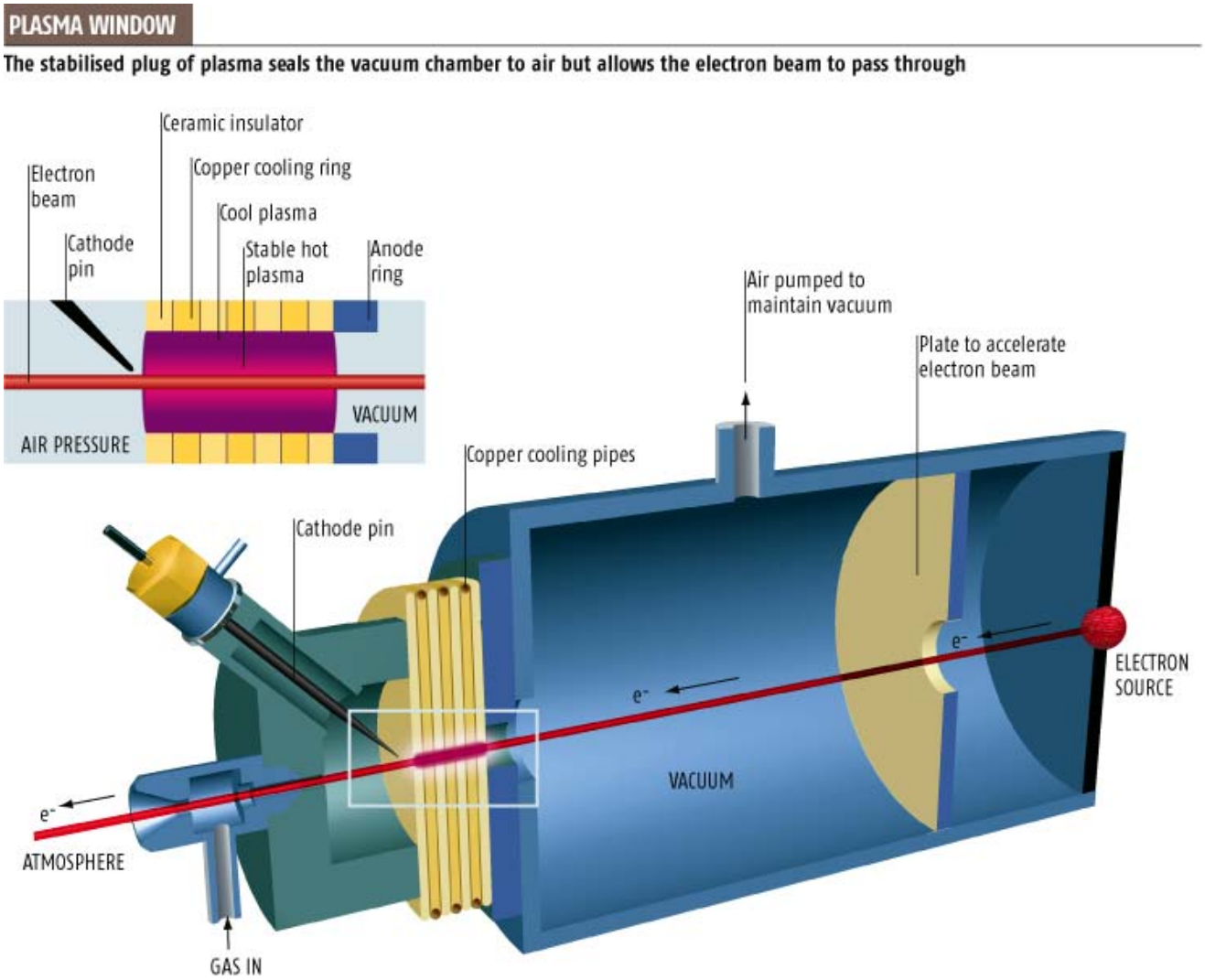
Ohebné spoje

- připojení primárních vývěv
  - kovové vlnovce
    - bellows - změna délky při změně tlaku
    - flexible metal hose
  - tlustostěnné hadice
  - hadice s kovovou spirálou

Další prvky

- tlakové spínače
- 2D a 3D posuvy
- ohřev a rotace vzorků
- systémy pro povlakování
- plazmové okénko

Plazmové okno



http://www.newscientist.com

Vodní pára ve vakuových systémech

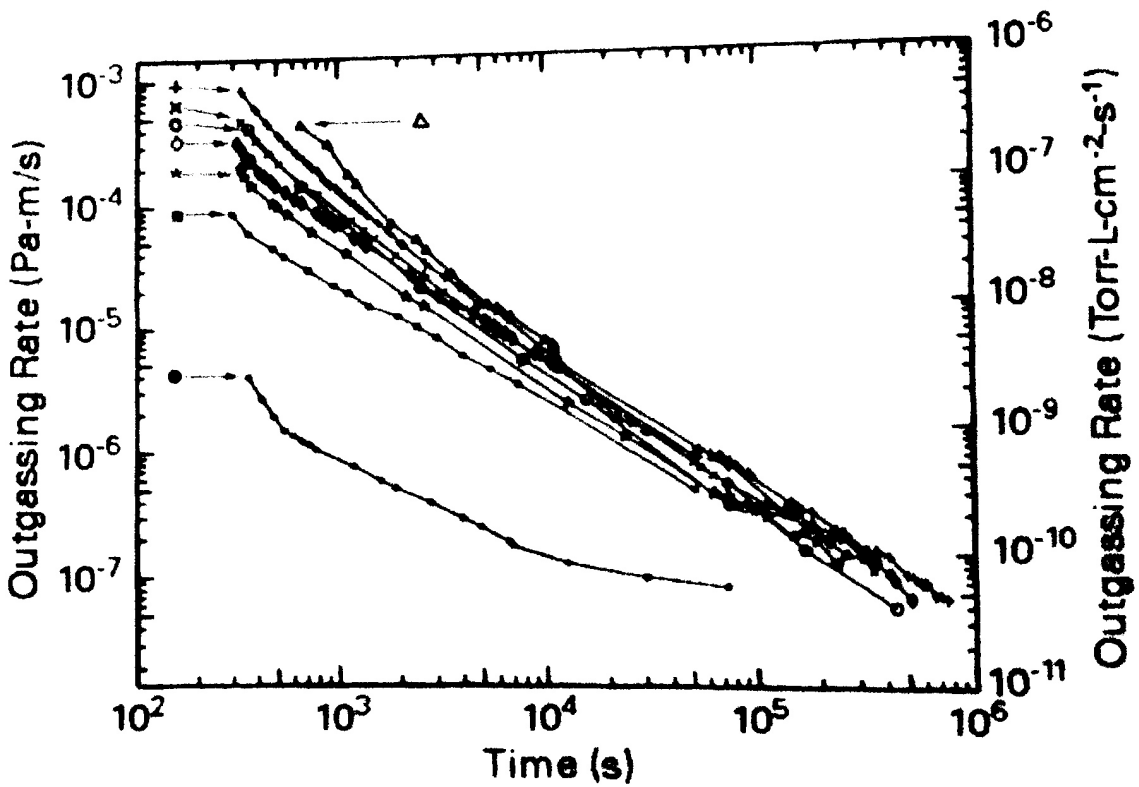


Fig. 4.5 Outgassing measurements for different H_2O exposures during venting of a 304 stainless steel chamber of inner surface area 0.4747 m^2. ○ Ambient air exposed, 7.8 ml absorbed; Δ 600 ml exposed, 16.8 ml absorbed; + 400 ml exposed, 9.2 ml absorbed; × 200 ml exposed, 7.2 ml absorbed; ◊ 100 ml exposed, 3.6 ml absorbed; ★ 10 ml exposed, 2.3 ml absorbed; ■ N_2 gas with <10 ppm H_2O exposed, 0.7 ml absorbed; ● dry N_2 gas exposed, 0.017 ml absorbed; Reprinted with permission from *J. Vac. Sci. Technol. A*, 11, p. 1702, M. Li and H. F. Dylla. Copyright 1993, AVS–The Science and Technology Society.

F.OHanlon: A Users Gaude to Vacuum Technology, Wiley (2003)

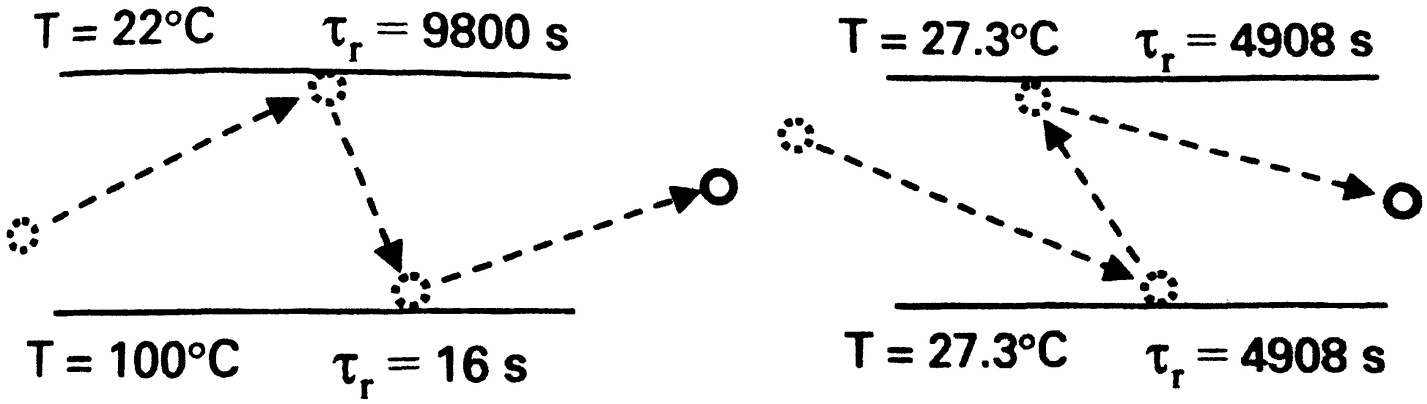
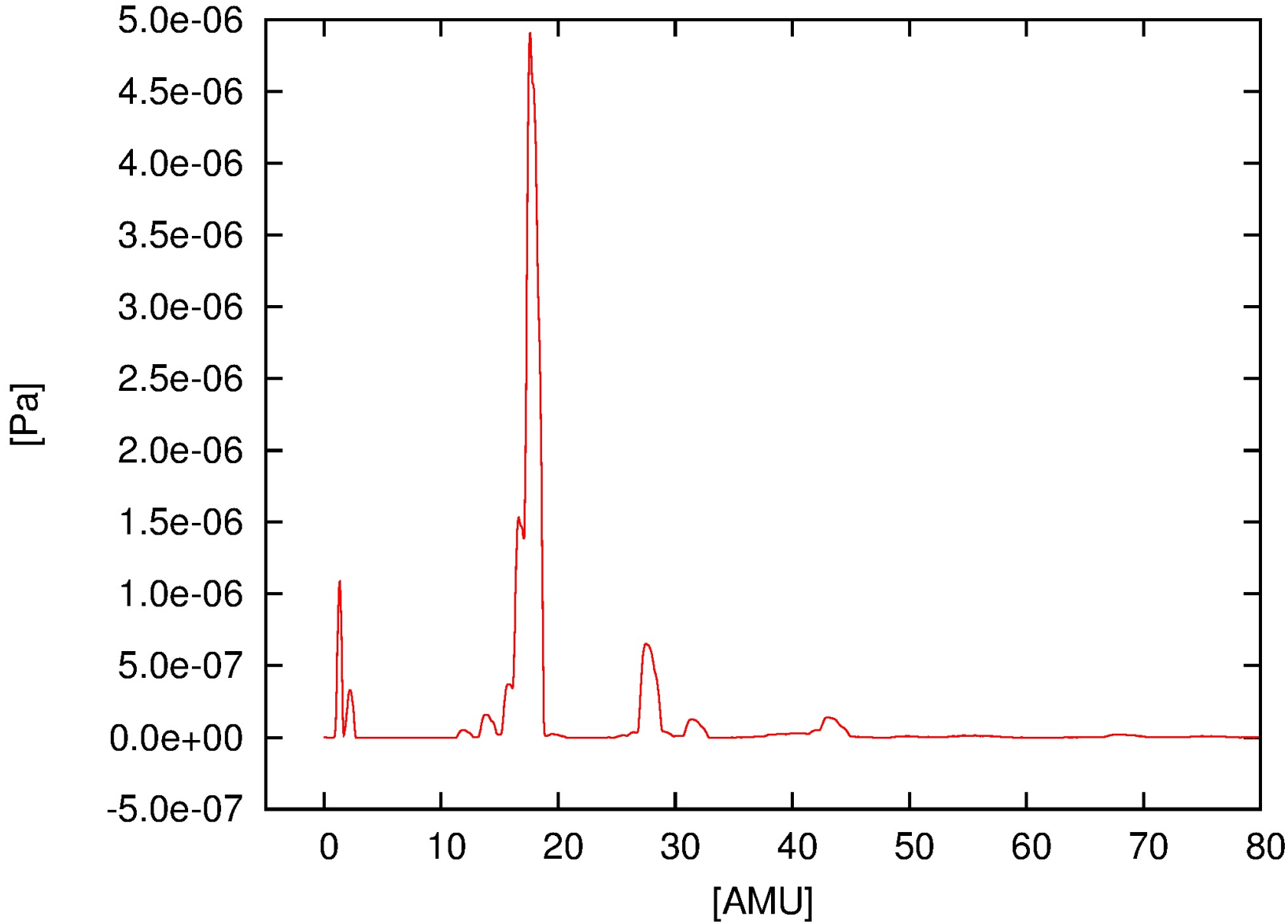
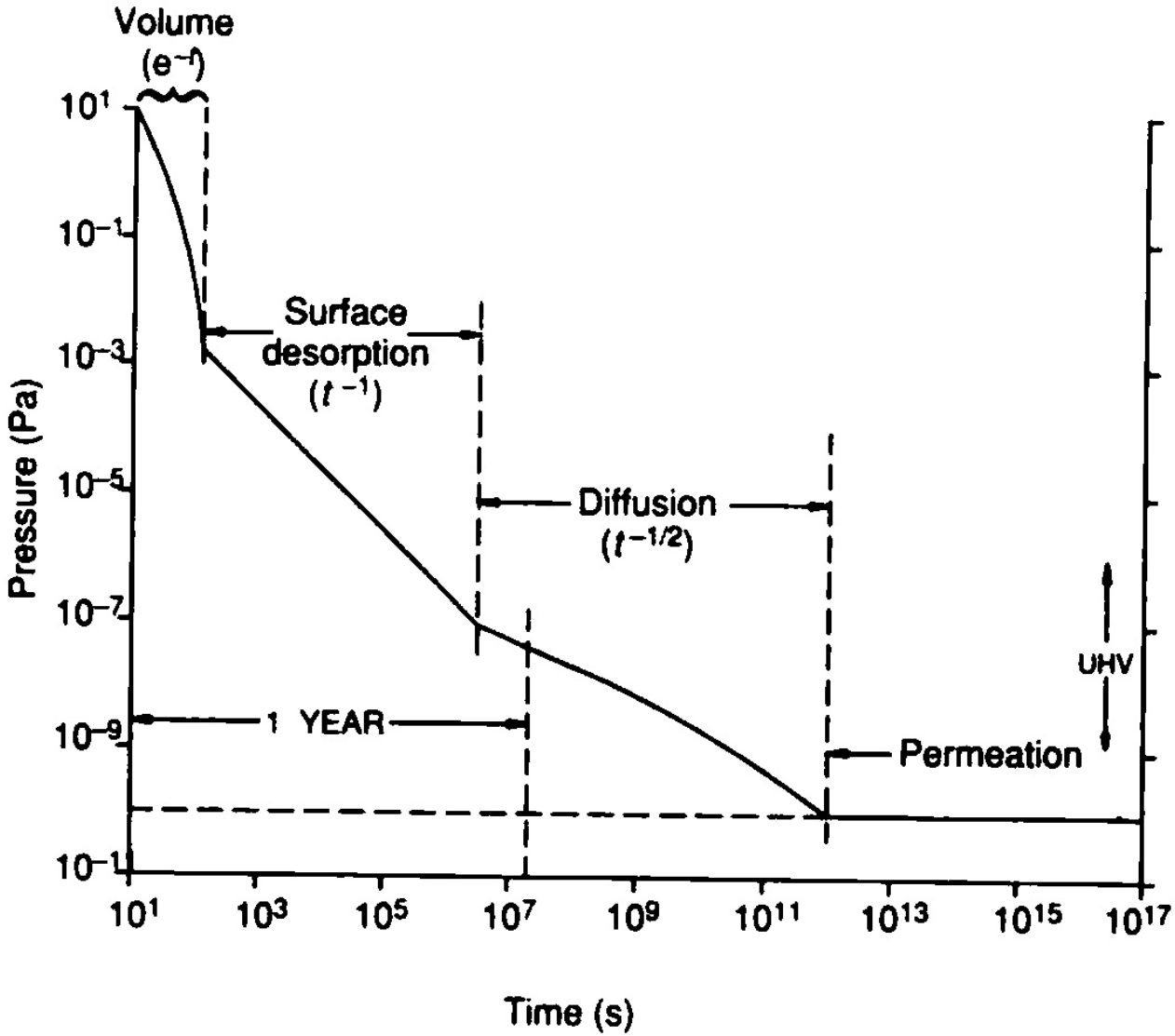


Fig. 4.8 The total residence time for a water molecule after two bounces from a metal surface is shown to be the same for two sets of surface temperatures; a sticking coefficient of one was assumed. This example illustrates the necessity of baking all surfaces within a vacuum chamber. Unbaked surfaces dominate the behavior of the system.

F.OHanlon: A Users Gaude to Vacuum Technology, Wiley (2003)


5.0e-06
4.5e-06
4.0e-06
3.5e-06
3.0e-06
2.5e-06
2.0e-06
1.5e-06
1.0e-06
5.0e-07
0.0e+00
-5.0e-07
[Pa]
0
10
20
30
40
50
60
70
80
[AMU]

Typická křivka čerpání vakuové komory bez vypékání



Delchar: Vacuum Physics and Techniques, Chapman Hall, 1993

Česká vakuová společnost

- zpravodaj
- Pragovak
- Letní školy vakuové techniky
- www.vakspol.cz