

Vakuové ventily

Dělení podle různých principů

Podle funkčnosti

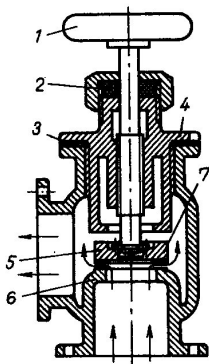
- oddělovací
- napouštěcí
- zavzdušňovací
- omezení čerpací rychlosti

Ovladání

- ruční
- pneumatický
- elektromagnetický

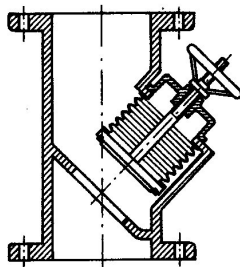
Oblast použití

- hrubé vakuum
- HV vakuum
- UHV, XHV vakuum

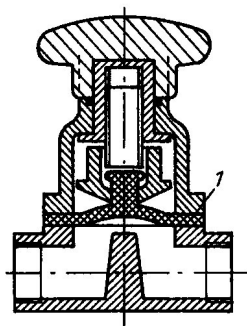


Obr. 6.27. Ventil s talířkem přitlačovaným šroubem

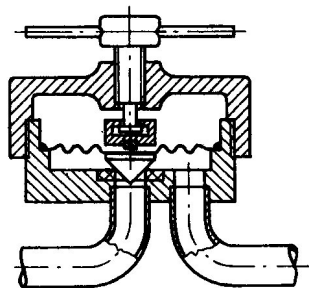
1 – rukojeť; 2 – těsnění; 3 – těsnicí kroužek; 4 – horní příruba; 5 – talířek; 6 – dolní příruba; 7 – těsnění talířku



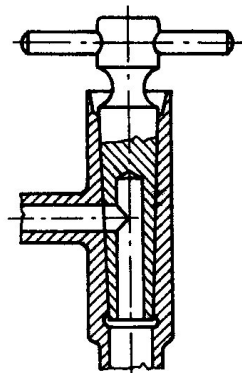
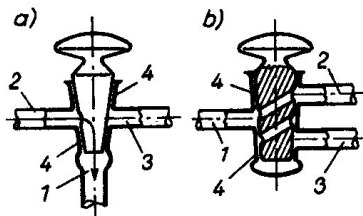
Obr. 6.28. Ventil těsněný vlnovcem



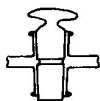
Obr. 6.32. Ventil pro nízké vakuum s membránovým těsněním (firma Leybold)



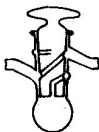
Obr. 6.33. Řez ventilu s kuželovým čepem a membránovým těsněním pro ultravysoké vakuum



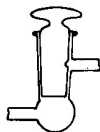
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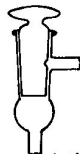
(a)



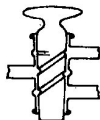
(b)



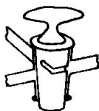
(c)



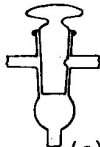
(d)



(e)



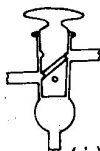
(f)



(g)



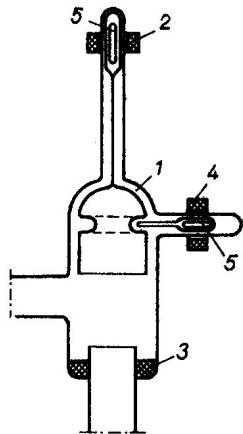
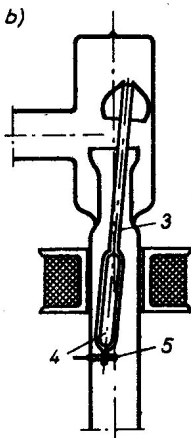
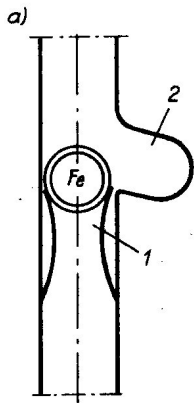
(h)

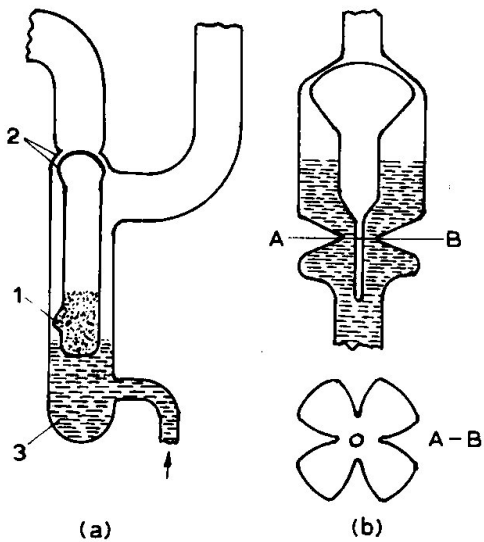


(i)



(j)





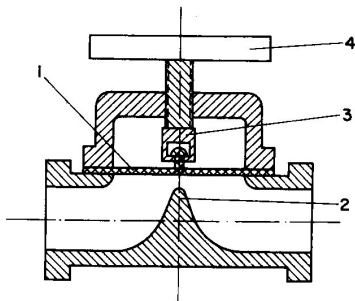
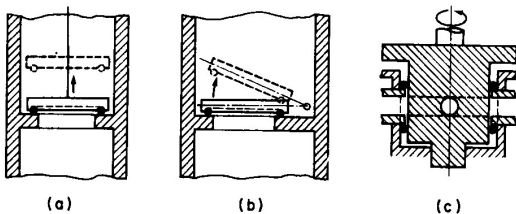
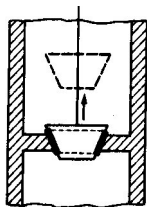
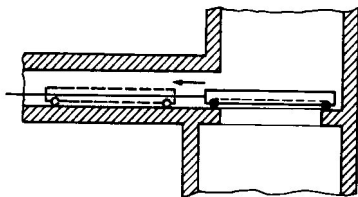


Fig. 7.61 Diaphragm valve.

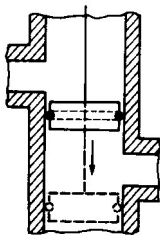




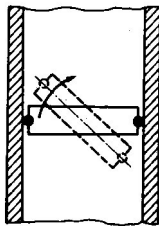
(d)



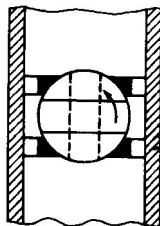
(e)



(f)



(g)



(h)

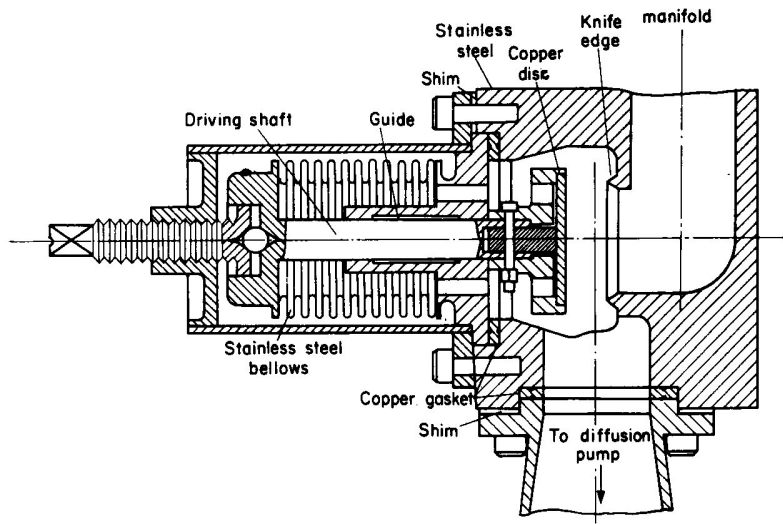


Fig. 7.65 Ultra-high vacuum valve. After Baker (1962).

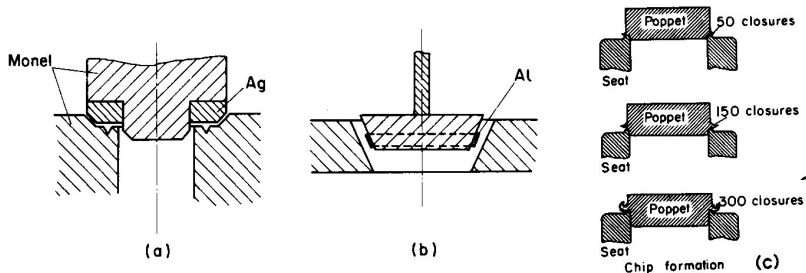
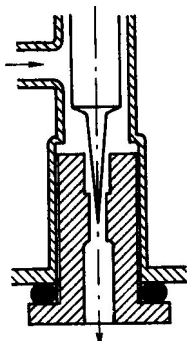
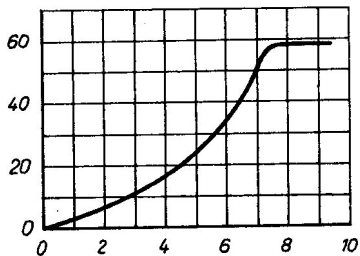


Fig. 7.63 Closing systems of all-metal valves; (a) with flat silver ring (Bills and Allen, 1955); (b) with aluminum conical ring (Kienel and Lorenz, 1960); (c) with copper poppet (Parker and Mark, 1961).

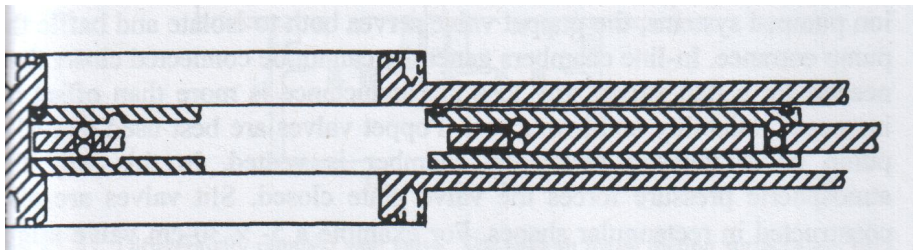
Jehlový ventil



$I_N (\text{cm}^3(\text{NTP})\text{s}^{-1})$



Deskový ventil



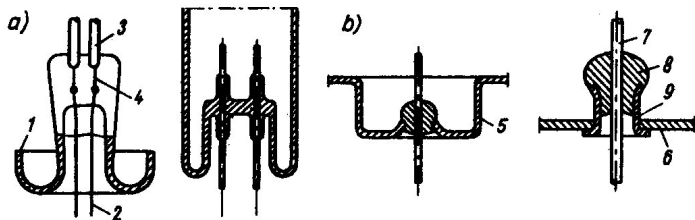
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- deskové ventily - při otevírání dif.tlak menší než ~ 30 hPa
- ventily s kovovým těsněním - omezený počet cyklů
- jehlové ventily - nedotahovat silou
- zábrusové ventily - dobře namazat

Elektrické průchodky

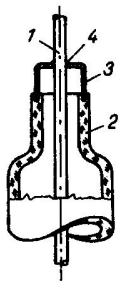
Vakuum v rozsahu tlaků 1-5000 Pa je velmi špatný elektrický izolant.
Průchodky vybíráme podle:

- napětí
- proudu
- frekvence

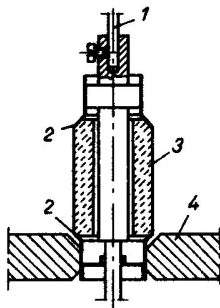


Obr. 6.47. Elektrické průchodky pro slabé proudy

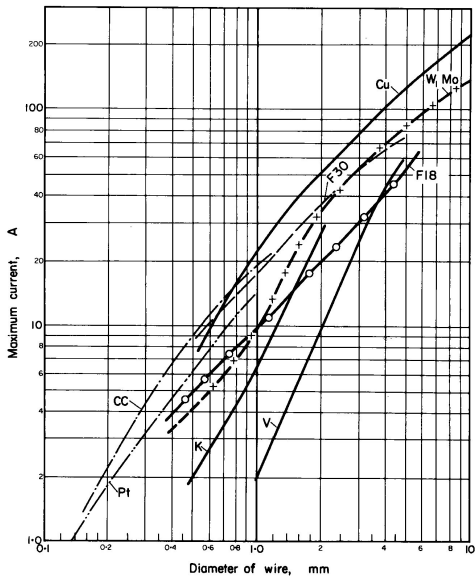
a) vodič z plášťového nebo platinovaného drátku zataveného ve skle, b) průtáv skleněnou perličkou zatavenou do otvoru v kovové stěně



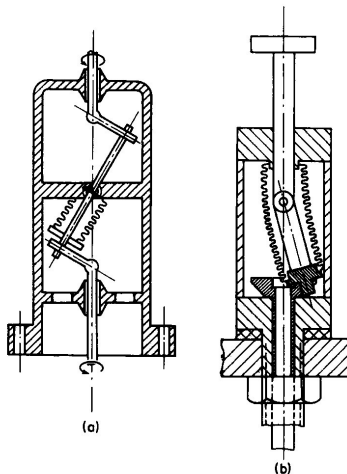
Obr. 6.48. Silnoproudá průchodka
skleněnou trubicí
1 – průtav; 2 – sklo; 3 – kovarová
čepička; 4 – pájka

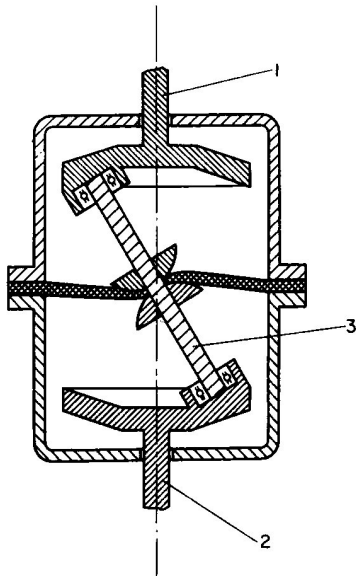


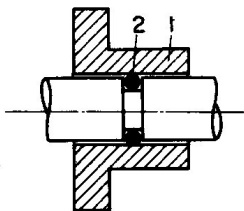
Obr. 6.49. Silnoproudá průchodka kovovou
stěnou s keramickým izolátorem
1 – přívod; 2 – spoj kovu s keramikou;
3 – keramika; 4 – stěna vakuového
systému



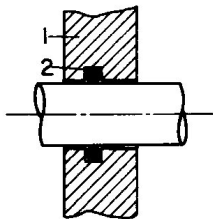
Přenos rotace do vakua



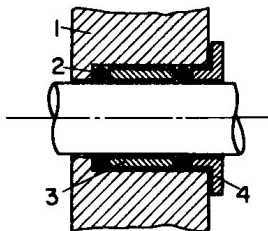
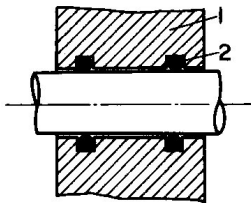




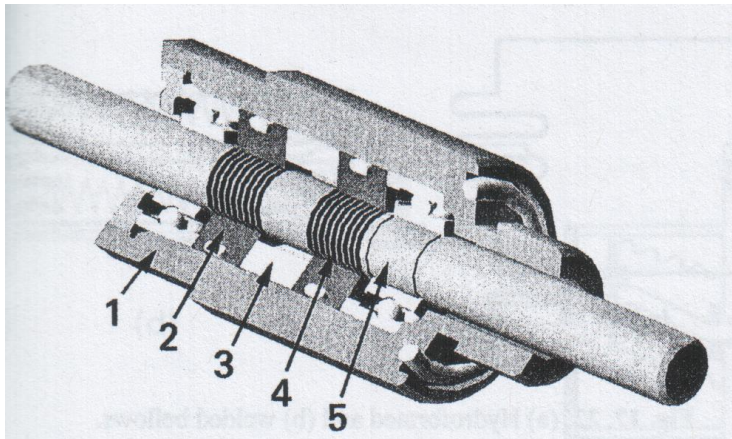
(a)



(b)



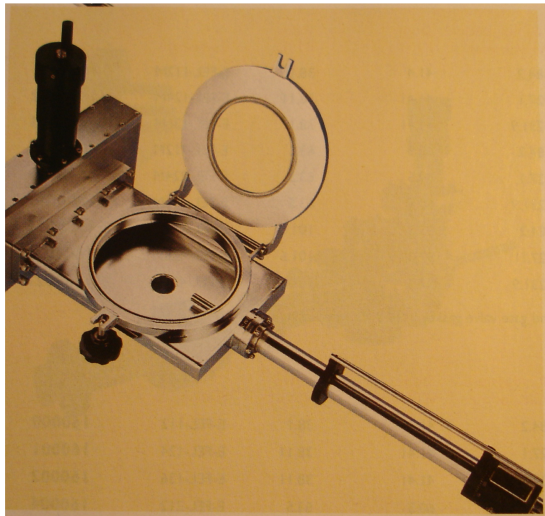
Rotace - ferro kapaliny



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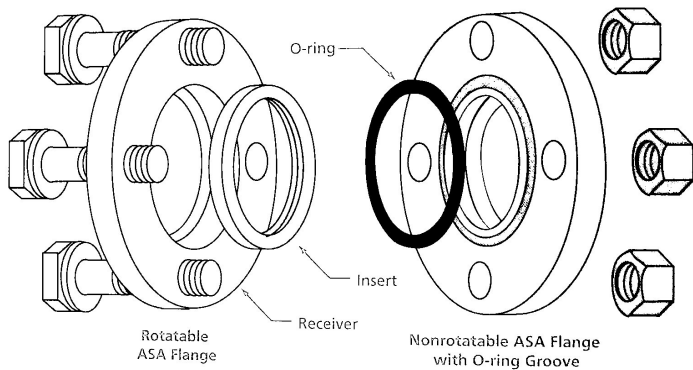
¹⁹F.OHanlon: A Users Guide to Vacuum Technology, Wiley (2003)

Load lock

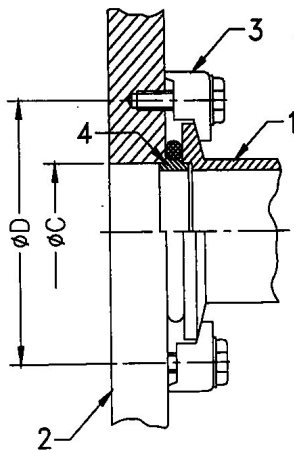
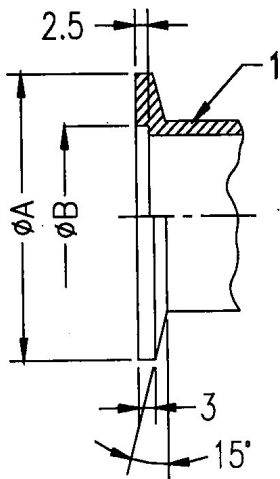


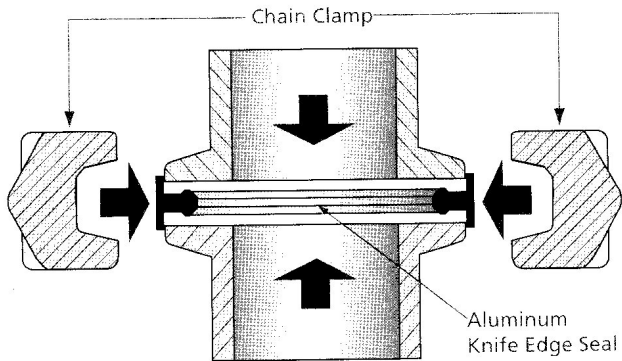
Rozebíratelné spoje

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



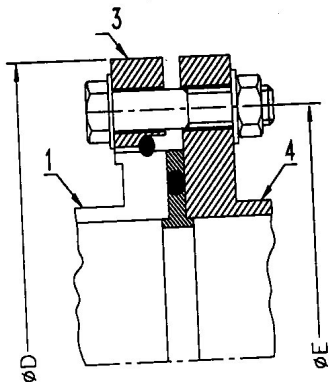
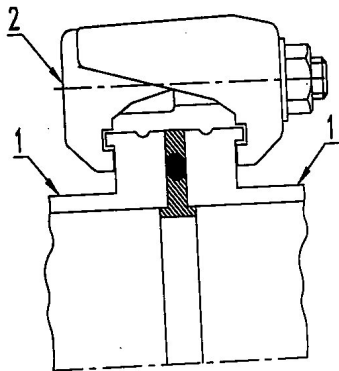
ISO-KF



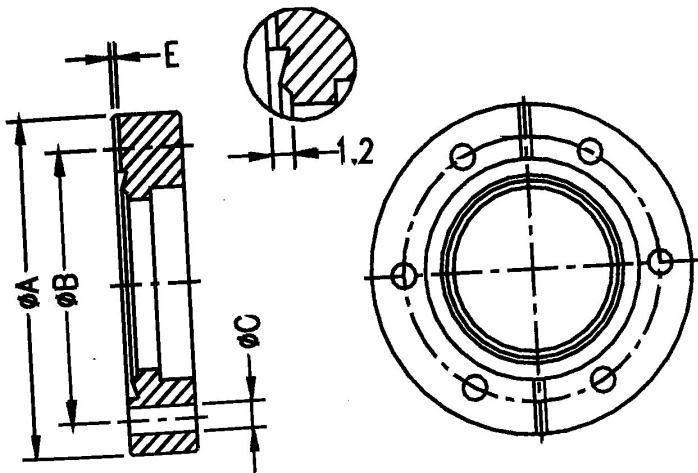


23

ISO-K, ISO-F



24



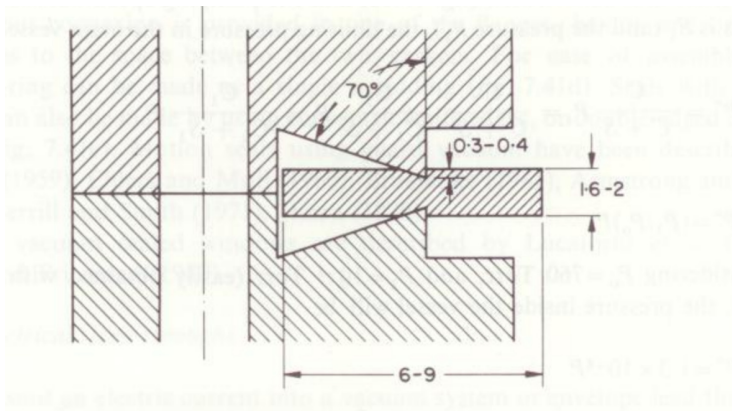
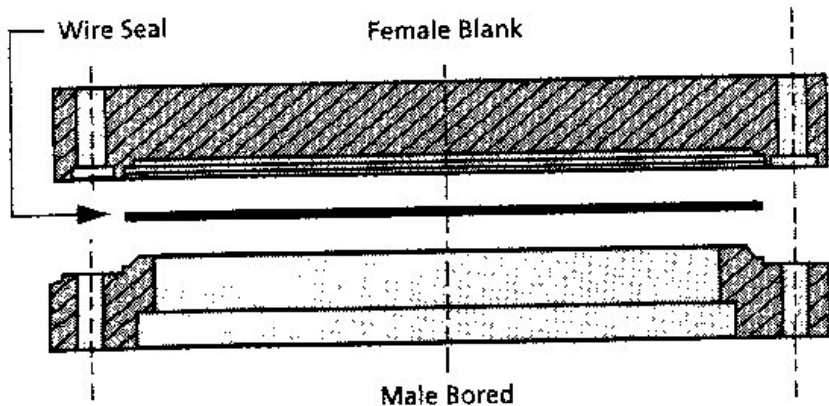


Fig. 7.39 The Conflat seal (Varian). After Wheeler and Carlson (1962).

Wire seal flanges



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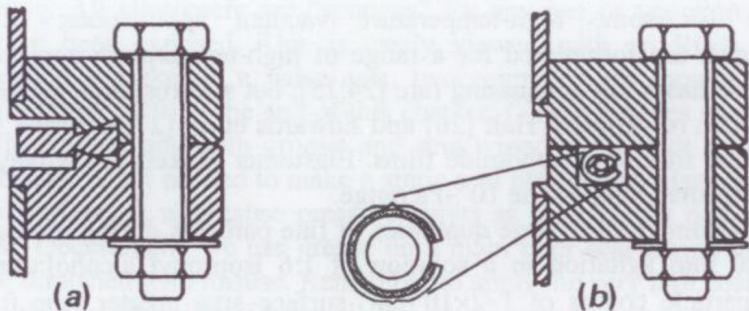


Fig. 17. 10 Metal gasket seals: (a) ConFlat type knife edge seal; (b) Helicoflex Delta seal.

těsnění	min. tep [°C]	max. tep. [°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

Měrka pro XHV vakuum

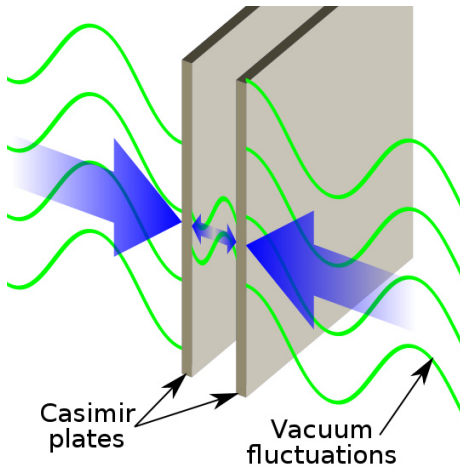
Bent Belt-Beam - ionizační manometr

- 3BG-03
- citlivost $5 \sim 8 \times 10^{-2} \text{ Pa}^{-1}$
- min. tlak $5 \times 10^{-12} \text{ Pa}$

pro porovnání ionizační manometr z vak. praktika PBR 260

- rozsah měření $5 \times 10^{-10} - 1000 \text{ hPa}$

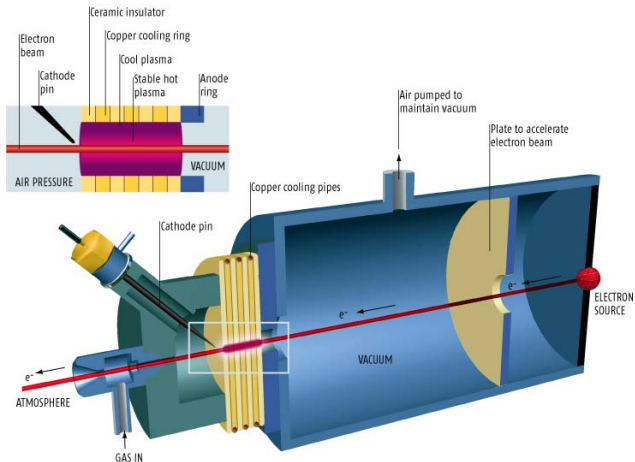
Casimirův jev



Plazmové okno

PLASMA WINDOW

The stabilised plug of plasma seals the vacuum chamber to air but allows the electron beam to pass through



Vodní pára ve vakuových systémech

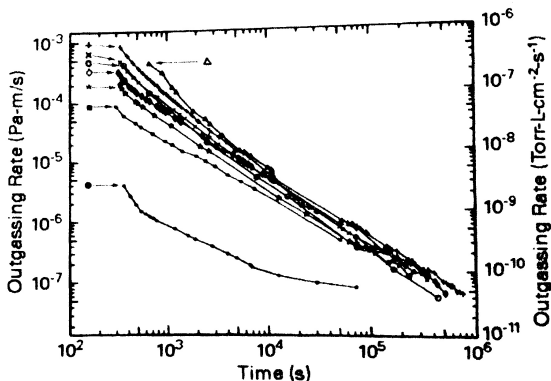


Fig. 4.5 Outgassing measurements for different H₂O exposures during venting of a 304 stainless steel chamber of inner surface area 0.4747 m². ○ Ambient air exposed, 7.8 ml absorbed; △ 600 ml exposed, 16.8 ml absorbed; + 400 ml exposed, 9.2 ml absorbed; × 200 ml exposed, 7.2 ml absorbed; ◇ 100 ml exposed, 3.6 ml absorbed; ★ 10 ml exposed, 2.3 ml absorbed; ■ N₂ gas with <10 ppm H₂O exposed, 0.7 ml absorbed; ● dry N₂ 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.

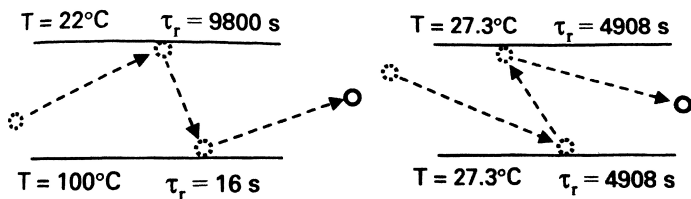
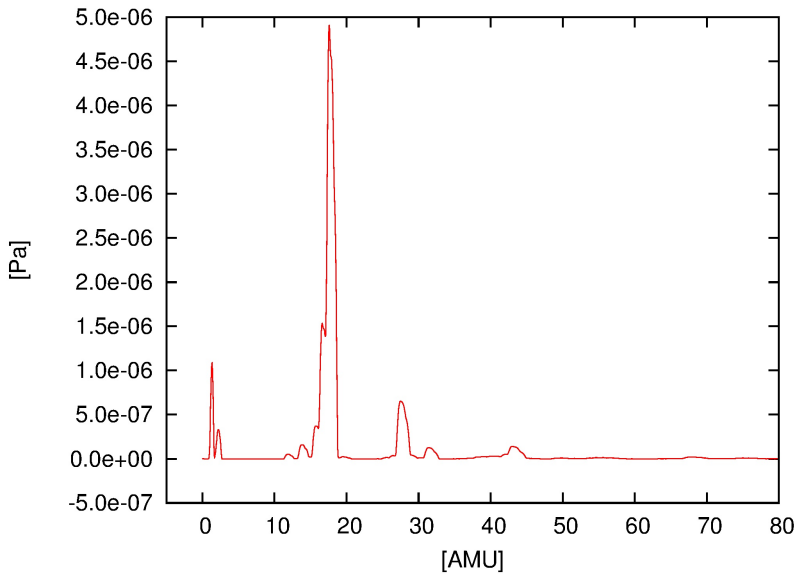
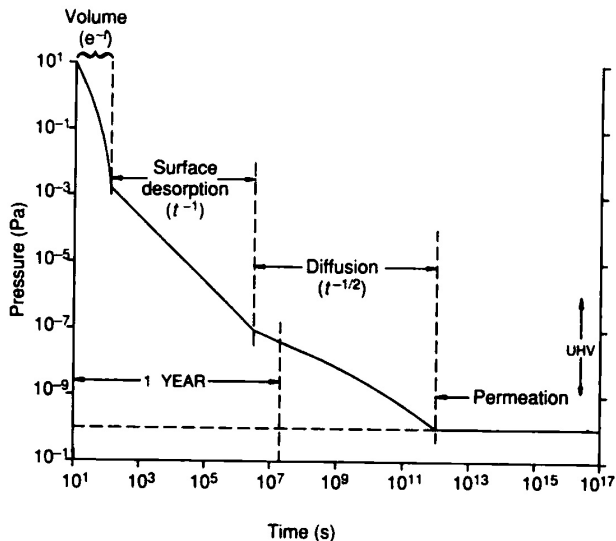


Fig. 4.8 The total residence time for a water molecule after two bounces from a metal surface is shown to be the same for two sets of surface temperatures; a sticking coefficient of one was assumed. This example illustrates the necessity of baking all surfaces within a vacuum chamber. Unbaked surfaces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



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