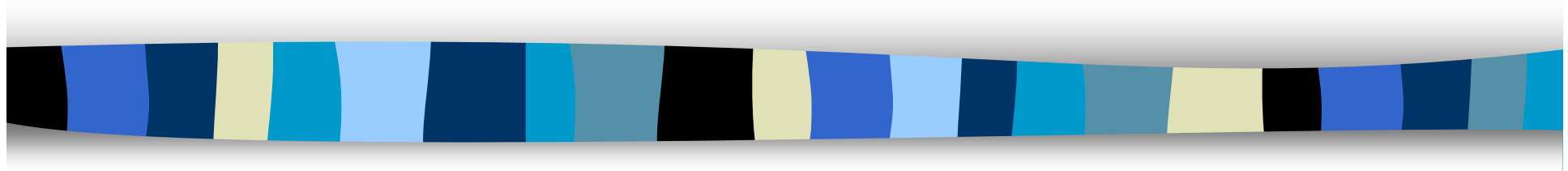
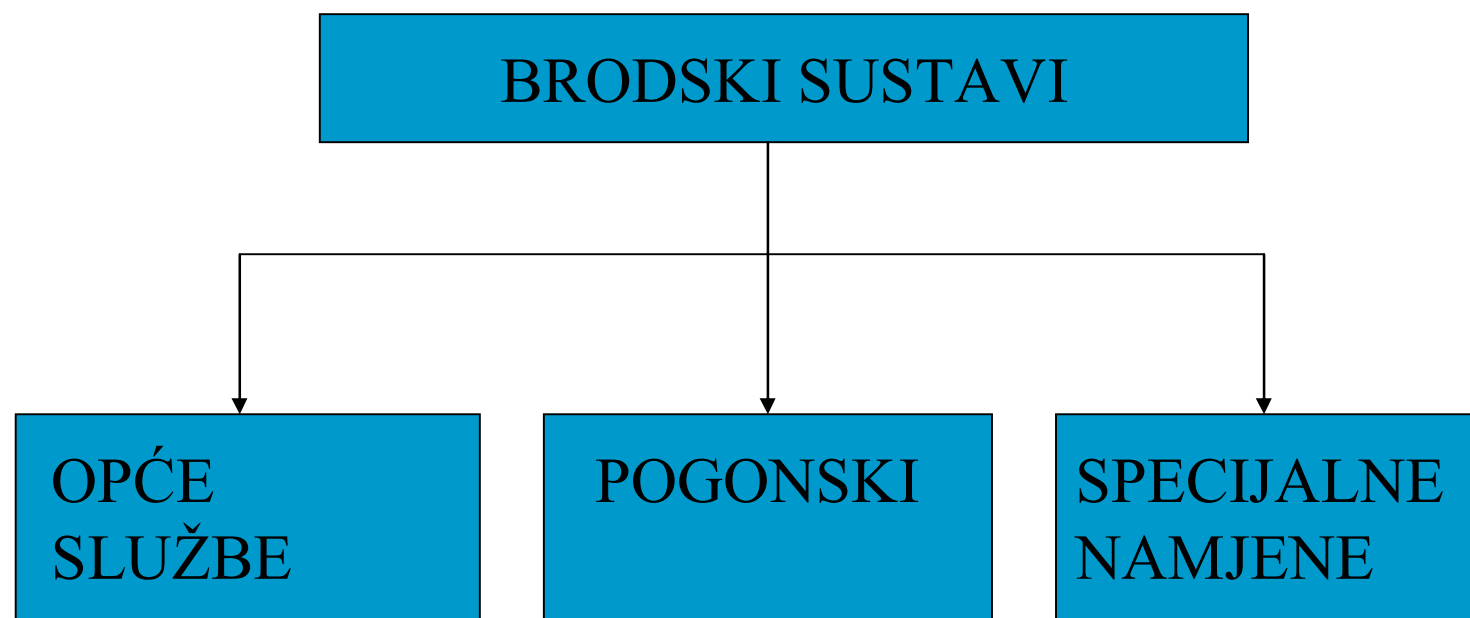


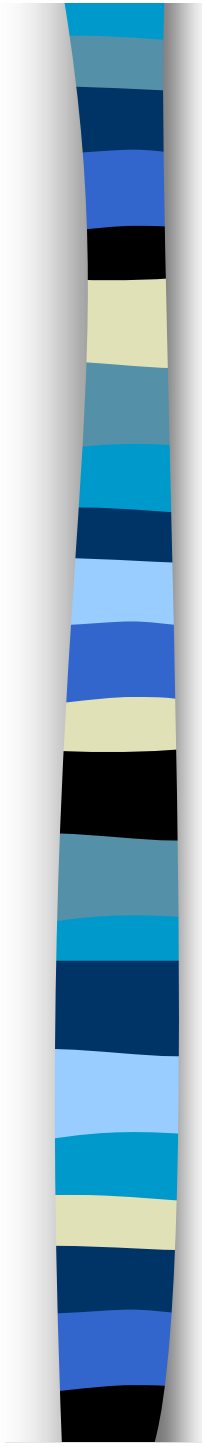
BRODSKI POMOĆNI SUSTAVI



UVOD: podjela, elementi
cjevovoda, materijali i zaštita,
označavanje, dimenzioniranje

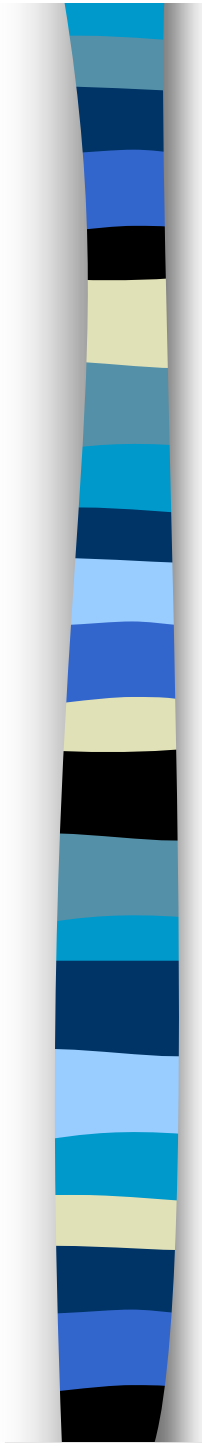
Podjela





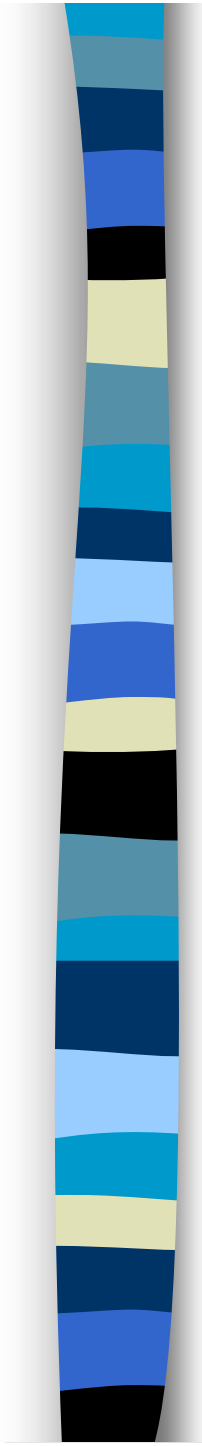
Cjevovodi opće službe

- kaljužni i izljevni
- balastni
- odušivanja, otplinjavanja, preljevni, sondiranja
- ventilacije i klimatizacije (rashladni sustavi)
- hidrauličkih pogona
- protupožarni...



Pogonski cjevovodi*

- goriva
- ulja za podmazivanje
- rashladne vode
- komprimiranog zraka
- pare, kondenzata i napojne vode
- ispušnih plinova
- ispirnog zraka



Cjevovodi specijalne namjene

- ukrcaja i iskrcaja tereta, uključujući posušivanje tankova i ocjeđivanje cjevovoda
- grijanje i hlađenje tereta
- specifičnosti kod ukapljenih plinova
- pranja tankova
- inertnog plina

Označavanje

Morska voda

Slatka voda

Komprimirani zrak

Teško gorivo

Lako gorivo

Para

Ulje

7/1/2014

ISO 14726



The ISO 14726 standard defines the principle colours for identifying pipes. Each of the following colours indicates a certain group of substances. As this is an international standard and most ships sail in international waters, all text is in English only.

Group colour	Substance	Group colour	Substance
Black	Waste Media	Orange	Oils other than fuel
Blue	Fresh Water	Silver	Steam
Brown	Fuel	Red	Fire Fighting
Green	Sea Water	Violet	Acids, Alkalis
Grey	Non-flammable gases	White	Air in ventilation systems
Copper	Masses (dry and wet)	Yellow	Flammable gases

Legend	Colour	Layout 5	Layout 6	Layout 7	Legend	Colour	Layout 5	Layout 6	Layout 7

Waste Media					Oil other than fuel				
Waste Media	227 000	227 001	227 170		Oil other than fuel	227 02 1	227 002	227 30 1	
Black Water	227 001	227 002	227 171		Used oil	227 022	227 003	227 302	
Waste Oil	227 002	227 003	227 172		Thermal oil	227 023	227 004	227 303	
Bilge Water	227 003	227 004	227 173		Dirty oil	227 024	227 005	227 304	
Exhaust gas	227 004	227 005	227 174		Lubricating oil	227 025	227 006	227 305	
Sewage	227 005	227 006	227 175		Hydraulic oil	227 026	227 007	227 306	

Fresh Water					Steam				
Fresh Water	227 006	227 007	227 176		Steam	227 027	227 008	227 307	
Condensate from heating systems	227 007	227 008	227 177		Steam for heating	227 028	227 009	227 308	
Fresh water-sanitary	227 008	227 009	227 178		Bleeder steam	227 029	227 010	227 309	
Cooling fresh water	227 009	227 010	227 179		LP Drains	227 030	227 011	227 310	
Feed water	227 010	227 011	227 180		Supply steam	227 031	227 012	227 311	
Distillate	227 011	227 012	227 181		Exhaust steam	227 032	227 013	227 312	
Potable water	227 012	227 013	227 182		HP Drains	227 033	227 014	227 313	
Chilled water	227 013	227 014	227 183						
Condensate	227 014	227 015	227 184						

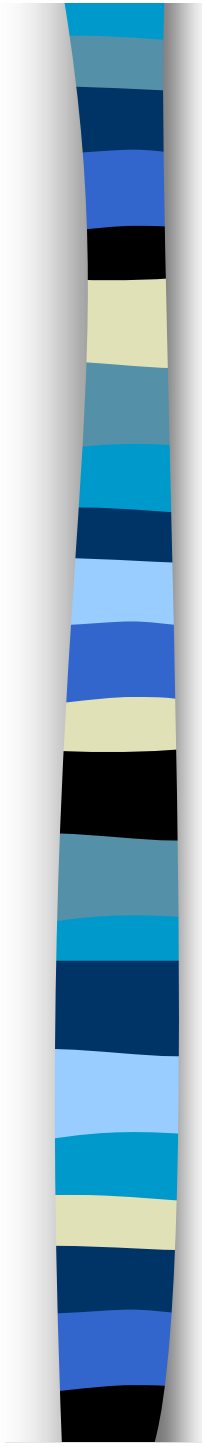
Fuel					Fire fighting				
Fuel	227 005	227 006	227 185		Fire fighting	227 034	227 005	227 314	
Heavy Fuel	227 006	227 007	227 186		Fire-fighting fresh water	227 035	227 006	227 315	
Liquid gas	227 007	227 008	227 187		Fire-fighting sea water	227 036	227 007	227 316	
Petrol	227 008	227 009	227 188		Fire-fighting CO2 gas	227 037	227 008	227 317	
Diesel Fuel	227 009	227 010	227 189		Sprinkler water	227 038	227 009	227 318	
					Fire-fighting powder	227 039	227 010	227 319	
					Fire-fighting foam	227 040	227 011	227 320	

Sea water					Acids & Alkalis				
Sea water	227 010	227 011	227 190		Acids & Alkalis	227 041	227 102	227 321	
Ballast water	227 011	227 012	227 191						
Cooling sea water	227 012	227 013	227 192						
Sanitary sea water	227 013	227 014	227 193						

Non-flammable gases					Air in ventilation systems				
Non-flammable gases	227 014	227 015	227 194		Air in ventilation systems	227 042	227 103	227 322	
Oxygen	227 015	227 016	227 195		Natural exhaust air	227 043	227 104	227 323	
Breathing gas	227 016	227 017	227 196		Supply air, atmospheric	227 044	227 105	227 324	
Nitrogen	227 017	227 018	227 197		Natural supply air	227 045	227 106	227 325	
Refrigerant	227 018	227 019	227 198		Mechanical exhaust air	227 046	227 107	227 326	
Pressure air HP	227 019	227 020	227 199						
Breathing air	227 020	227 021	227 200						

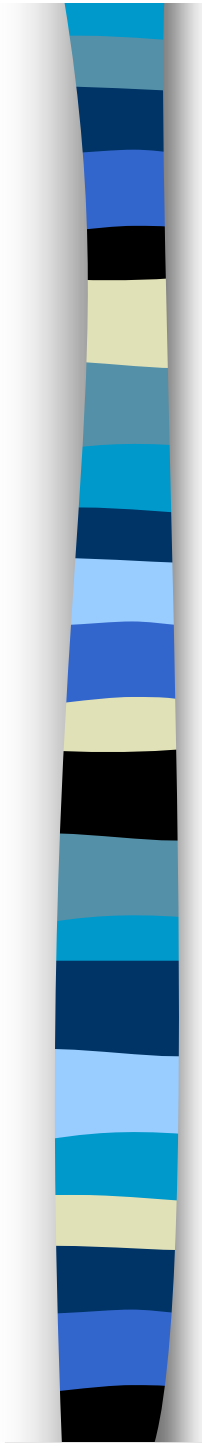
Masses					Flammable gases				
Masses	227 107	227 108	227 199		Flammable gases	227 047	227 108	227 327	
					Hydrogen	227 048	227 109	227 328	
					Acetylene	227 049	227 110	227 329	
					Mixture of Propane/Butane	227 050	227 111	227 330	

PIPE MARKING



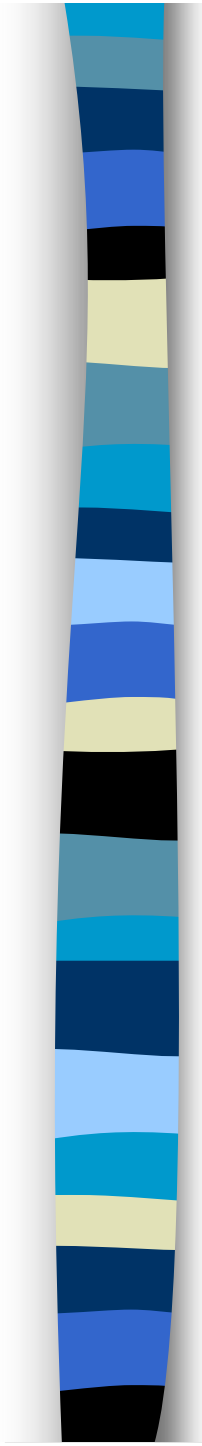
Proračun

- nacionalni i internacionalni propisi
- propisi klasifikacijskog društva
- zahtjevi brodovlasnika
- preporuke proizvođača opreme



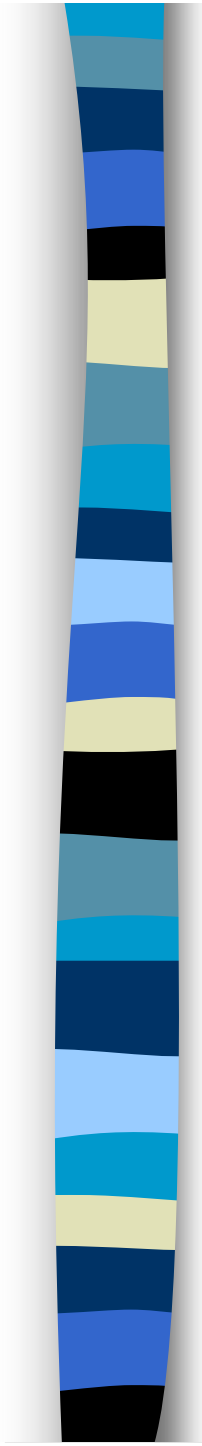
Proračun

- unutarnji promjer - d_u
- debljina stijenke - s
- pad tlaka kroz cjevovod - Δp
- produljenje cjevovoda zbog promjene temperature - Δt
- dimenzije dijelova sustava (pumpi, filtara, izmjenjivača topline...)



Cjevovodi (dio 8), opći zahtjevi

- proračunski tlak
$$p_i = 1,5 \left(\frac{\sigma_d^{100}}{\sigma_d^t} \right)^* p [MPa]$$
- * za $t > 300^\circ\text{C}$
- hidrauličko ispitivanje: za klase I i II, para i napajanje, gorivo s $p > 0,35 \text{ MPa}$
- materijali:
 1. čelik (bešavne ili zavarene*)
do 400°C ugljični ili manganski, do 500°C niskolegirani,
preko 500°C legirani



Cjevovodi (dio 8), opći zahtjevi

2. Cu – bešavne, do 200°C ili s Ni do 300°C
3. žilavi lijev (kaljuža, balast i TT) do 350°C
4. sivi lijev (balast i TT)
5. Pb – rijetko, izljevi u nadgrađu
6. plastične (doglasne, sanitarne i odljevne, za ventilaciju i sl.)

Cjevovodi (dio 8), opći zahtjevi

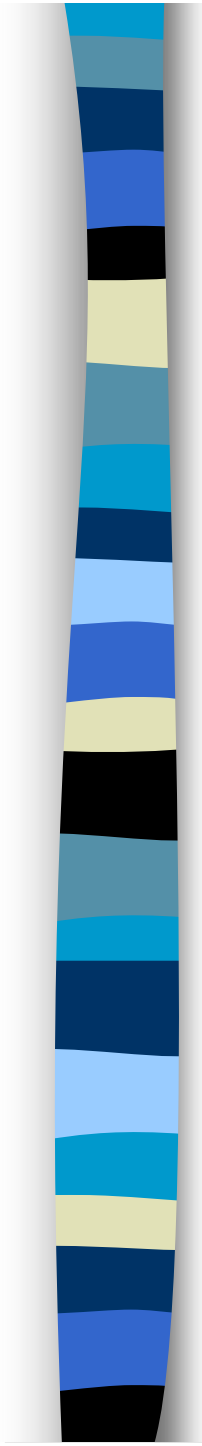
- d_u $d_u = \sqrt{\frac{4 \cdot \dot{V}}{\pi \cdot v_{dop}}}$ $s_o = \frac{d \cdot p}{2\sigma_d \cdot \varphi + p} [mm]$
- $s = s_o + b + c$
- *pad tlaka* $\Delta p = \sum_{i=1}^n \lambda_i \frac{l_i}{d_i} \cdot \frac{\rho \cdot v_i^2}{2} + \sum_{j=1}^m \zeta_j \cdot \frac{\rho \cdot v_j^2}{2}$
- *toplinsko rastezanje* $\Delta l = \alpha \cdot l_o \cdot \Delta t$

$$\Delta p = p_1 \left(1 - \sqrt{1 - 1275 \cdot \lambda \frac{m^2 \cdot l}{d^5 \cdot p_1 \cdot \rho_1}} \right)$$

$$p_1 [kp / cm^2]$$

$$\rho_1 [kg / m^3]$$

$$l = l_{uk} + l_a, l_a = \frac{\zeta \cdot d}{\lambda}$$



Primjer 1

Odredi potreban kapacitet pumpe slatke vode visoke temperature za motor snage 10000 kW i 50%-tnog stupnja iskoristivosti, ako je potrebno od ukupno dovedene količine energije odvesti 25%.

Rješenje: $P=10000 \text{ kW}$; $\eta=0,5$; $Q_{VT}=0,25Q_{dov}$

$$Q_{dov} = \frac{P}{\eta}$$

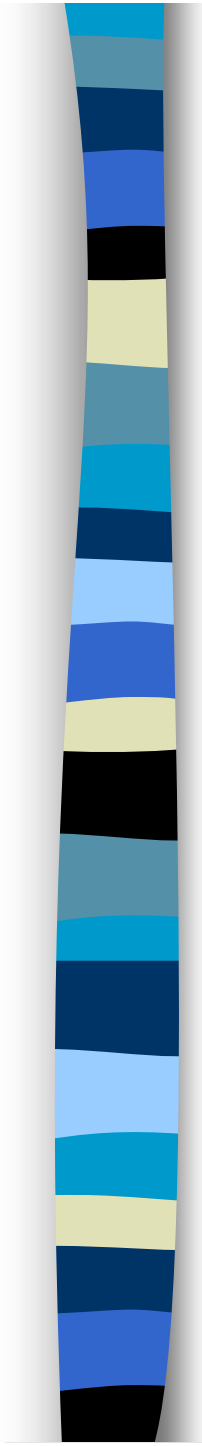
$$Q_{dov} = 10000 / 0,5 = 20000 \text{ kW}$$

$$Q_{VT} = 0,25 \cdot Q_{dov}$$

$$Q_{VT} = 0,25 \cdot 20000 = 5000 \text{ kW}$$

$$m = \frac{Q_{VT}}{c_w \cdot \Delta t}$$

$$m = 5000 \cdot 10^3 / 4000 \cdot 10 = 125 [\text{kg} / \text{s}] \Rightarrow \dot{m} = 450 [\text{m}^3 / \text{h}]$$



Primjer 2

Odredi potreban unutarnji promjer cijevi ako je kapacitet pumpe slatke vode visoke temperature poznat (iz prethodnog zadatka).

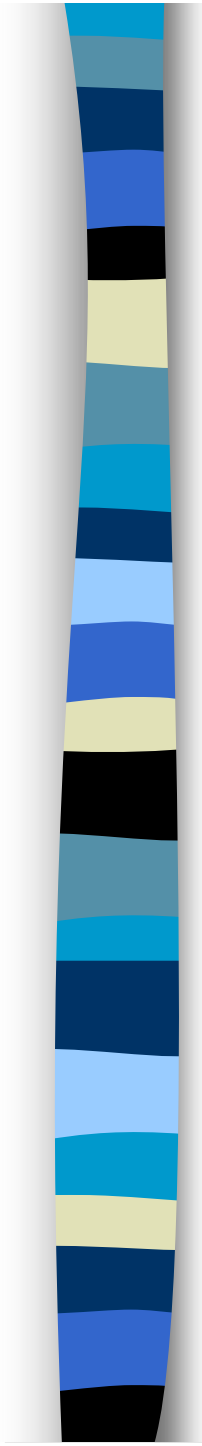
Rješenje: 450 m³/h

$$d_u = \sqrt{\frac{4\dot{V}}{\pi \cdot v_{dop}}}$$

$$d_u = \sqrt{\frac{4 \cdot 450}{\pi \cdot 1,5 \cdot 3600}}$$

$$d_u = 0,3257m$$

$$Usvojenod_u = 350mm$$



Primjer 3

Dimenzioniraj cirkulacijsku (booster) pumpu goriva glavnog motora specifične potrošnje goriva $b_e=160\text{g/kwh}$, snage 8000kW .

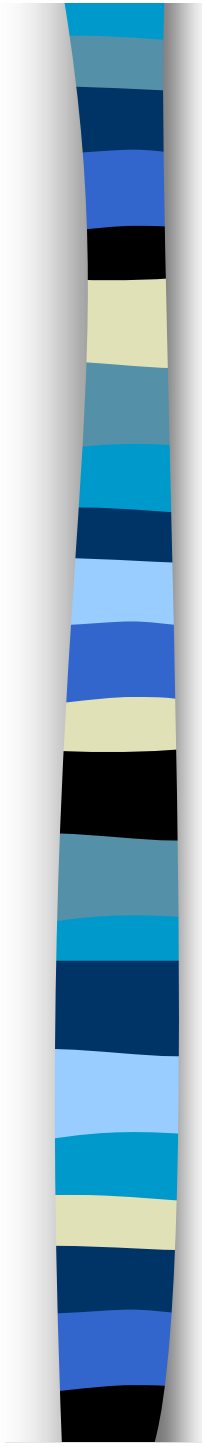
Rješenje: $P=8000\text{ kW}$; $b_e=160\text{g/kwh}$

$$B = b_e \cdot P$$

$$B = 160 \cdot 10^{-3} \cdot 8000 = 1280 [\text{kg} / \text{h}] = 1,28 [\text{t} / \text{h}]$$

$$\dot{V} = \frac{B}{\rho}$$

$$\dot{V} = \frac{1,28}{0,9} = 1,422 [\text{m}^3 / \text{h}]$$

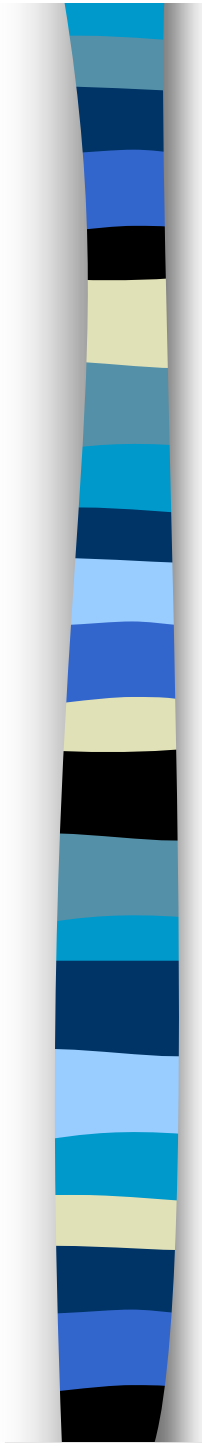


Korisne jednađbe

$$G = \frac{b_e \cdot P}{3600} [kg / s], b_e [kg / kWh], P_{mcr} [kW] \quad \begin{array}{l} \text{kapacitet pumpe} \\ \text{goriva} \end{array}$$

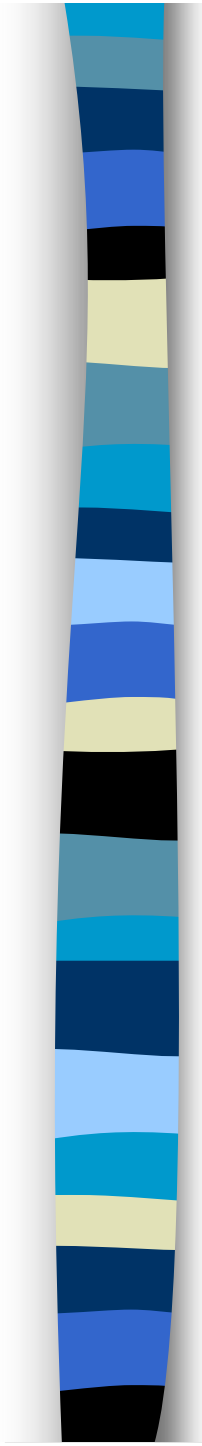
$$G = \frac{P \cdot 1,18 \cdot b_e \cdot 24}{\rho \cdot T} [l / h] \quad \begin{array}{l} \text{kapacitet separatora} \\ \text{goriva} \end{array}$$

$$A = \frac{G \cdot c_p \cdot (\vartheta_{izl} - \vartheta_{ul})}{k \cdot \Delta t_{\log}} [m^2] \quad \begin{array}{l} \text{površina grijača} \\ \text{(goriva)} \end{array}$$



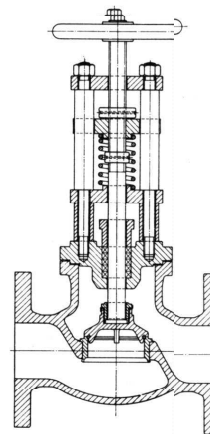
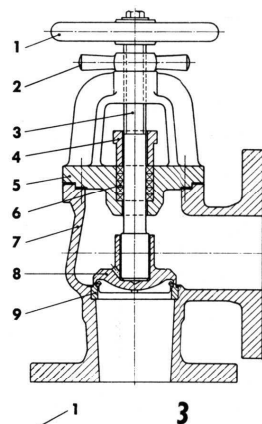
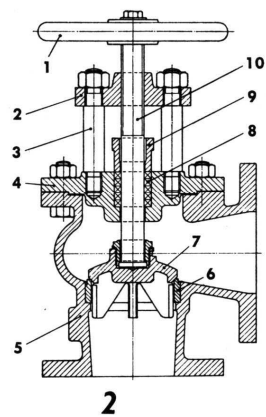
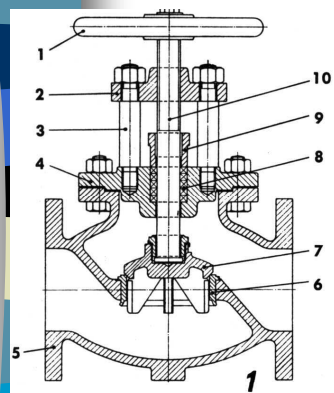
Elementi sustava

- zaporni elementi
- filtri
- kompenzatori dilatacija
- spojevi
- brtve
- usisne kutije, kondenzni lonci...
- BPU (pumpe, separatori...)

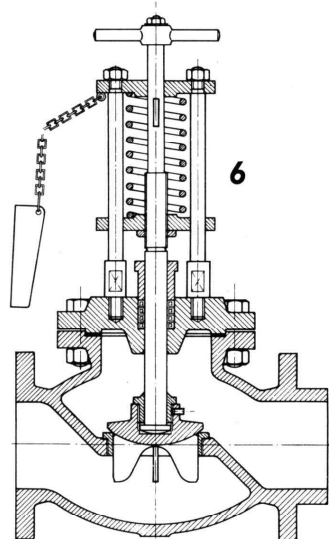
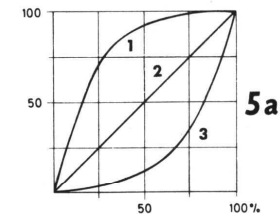
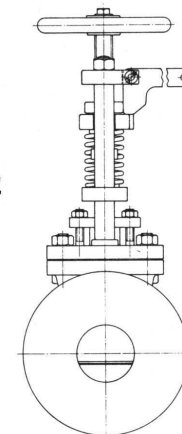


Zaporni elementi (tijela)

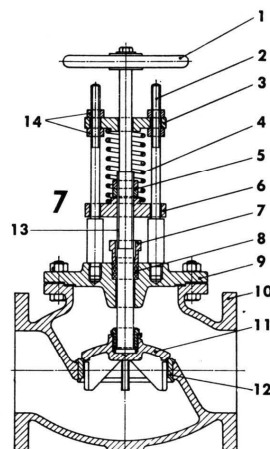
- ventili (ND $\geq 50\text{mm}$)
- zasuni
- pipci (ND $< 50\text{mm}$)
- podjele: prema odnosu smjera kretanja zapornog tijela i smjera strujanja fluida, prema obliku zapornog tijela, prema načinu djelovanja...



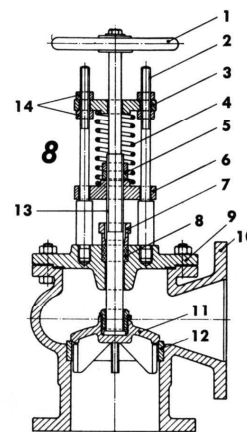
4



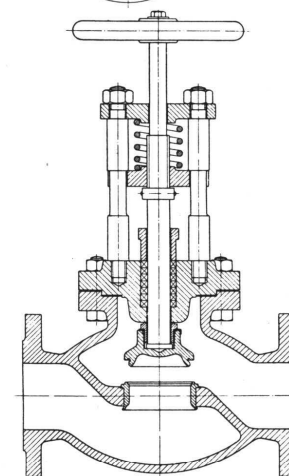
6



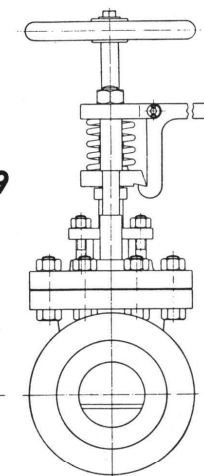
7



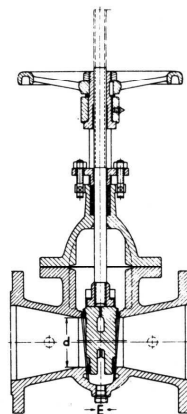
8



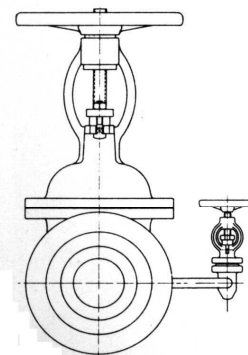
9



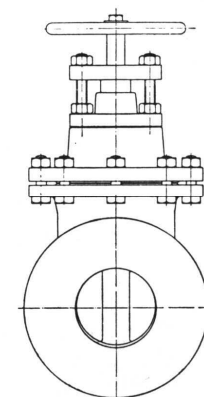
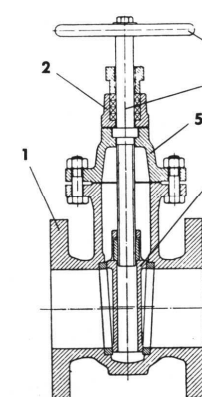
10

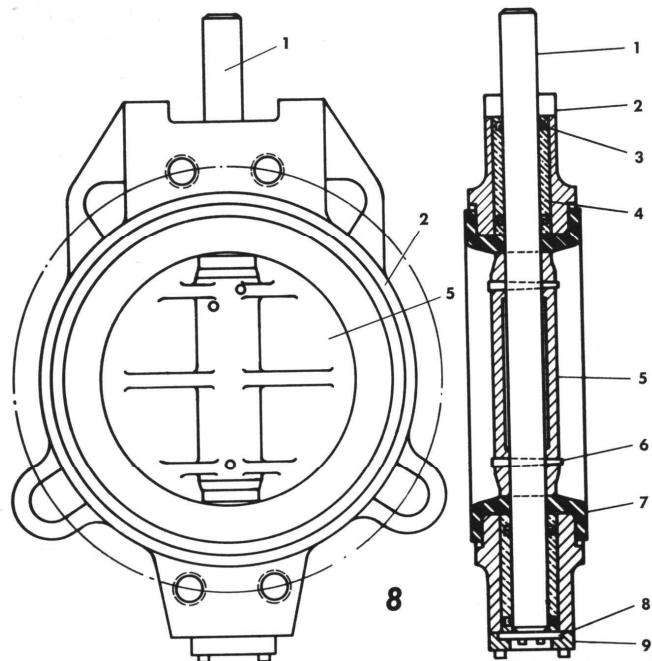
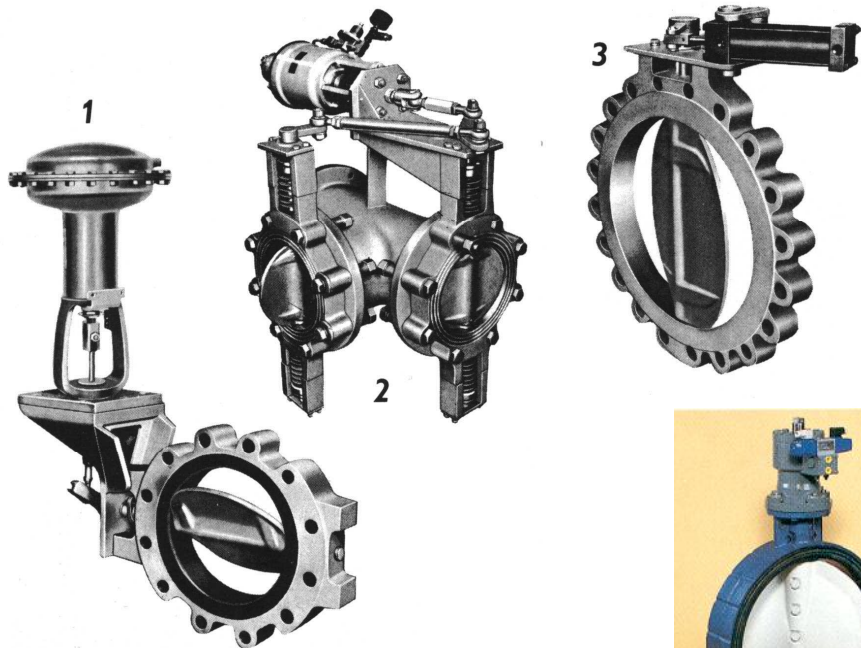


11

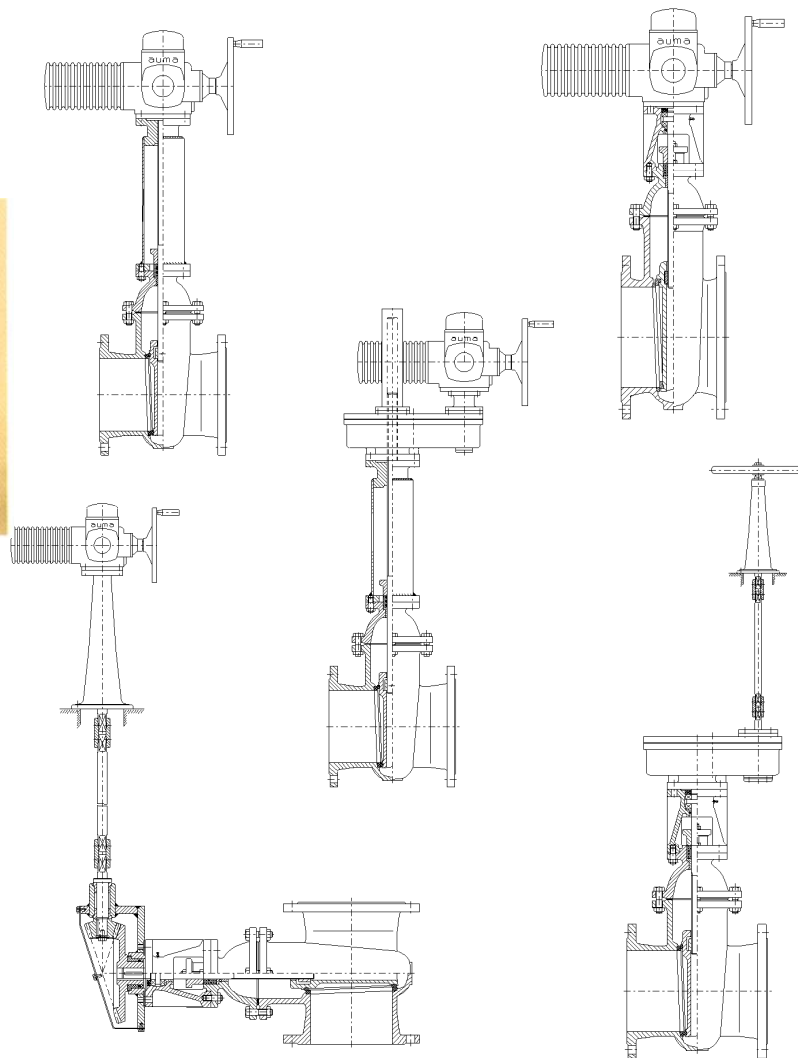


12





UPRAVLJANJE ZASUNIMA
ABSPERRSCHIEBER - ANTRIEBE
GATE VALVES DRIVES



METALSKA INDUSTRIJA VARAŽDIN d.d.

HRVATSKA

42000 VARAŽDIN, Fabijanska 33 • Telefon: +385 +42 404-100 • Fax: +42 242-004 • E-mail: prodaja-miv@vz.hinet.hr
1-0-2

03/2003

OVALNI ZASUNI S JARMOM PREMA DIN-u 3352 PN 10/16 DN 40 – 600

OVALABSPERRSCHIEBER MIT SPINDELAUFSATZ NACH DIN 3352 PN 10/16 DN 40 – 600

GATE VALVE WITH OVAL BODY AND OUTSIDE STEM SCREW ACC. TO DIN 3352 PN 10/16 DN 40 – 600



Broj artikla
Artikelnummer
Model N°

V2 – 11

NAZIVNI PROMER NENNWEITE NOMINAL SIZE	NAZIVNI TLAK NENNDRUCK PRESSURE RATING	PRIRUBNICE FLANSHE FLANGES EN 1092-2 (DIN 2501)	VODNI ISPITNI TLAK WASSERPRÜFDRUCK TEST PRESSURE EN 1092-2 bar	KUCIŠTE GEHAUSE BODY	ZATVORENO IM ABSCHLUSS CLOSED	DOZVOLJENI RADNI TLAK KOD TEMPERATURE ZULASSIGER DRUCK BEI TEMPERATUR ADMISSIBLE PRESSURE AT TEMPERATURE
DN	PN bar	bar				TEKUĆINE DO 120°C max 200°C
40 – 600	16	16	25	16	10	10
40 – 600	10	10	16	10	6	6

NAMJENA: VODA, PITKA VODA, PLIN, PARA I VRELA VODA, NAFTA, ZRAK
VERWENDUNG: WASSER, TRINKWASSER, GAS, DAMPF UND HEISSWASSER, ÖL, LUFT
APPLICATION: WATER, DRINKING-WATER, GAS, STEAM AND SUPERHEATED WATER, OIL, AIR

Ugradna mjera: EN 558-1 SERIJA 15 (DIN 3202 red F 5)

Baulängereihe: EN 558-1 SERIES 15 (DIN 3202 Reihe F 5)

Face to face: EN 558-1 SERIES 15 (DIN 3202 Series F 5)

ISPITIVANJE IZVRŠENO PREMA EN 12266 (DIN 3230)

FERTIGUNGSKONTROLLE NACH EN 12266 (DIN 3230)

TEST ACCORDING TO EN 12266 (DIN 3230)

Prirubnice izvedene za ugradnju prema EN 1092-2 (DIN 2501) ili na zahtjev prema DIMA 1882, UNI, BS, ANSI, NF

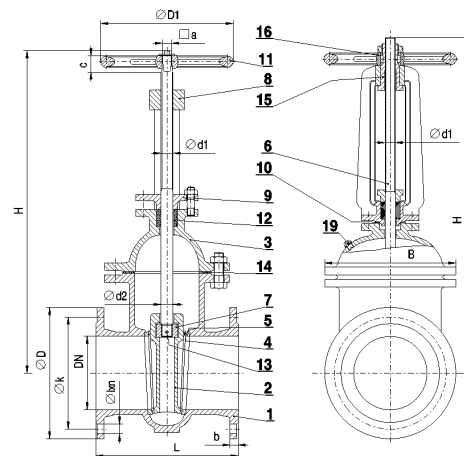
Einbaufansche nach EN 1092-2 (DIN 2501) oder auf Anfrage nach DIMA 1882, UNI, BS, ANSI, NF.

Installation flanges according to EN 1092-2 (DIN 2501) or on request according to DIMA 1882, UNI, BS, ANSI, NF.

Upravljanje ručnim kolom. Na zahtjev hidrauličko ili pneumatičko upravljanje, elektromotorni pogon, reduktor.

Handradbetätigung. Auf Anfrage hydraulische oder pneumatische Steuerung, Elektroantrieb, Reduktionsgetriebe.

Hand wheel operation. On request hydraulic or pneumatical actuation, electric actuator, gear-box.



DN 40 – DN 150

Podizhuće vreteno | ručno kolo

Spindel und Handrad steigend

Rising stem with hand wheel

DN 40 – DN 1200

Podizhuće vreteno, ručno kolo nepodizhuće

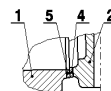
Spindel steigend, Handrad fast

Rising stem through hand wheel

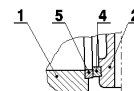
BRTVLJENJE
ABDICHTUNG
SEALING



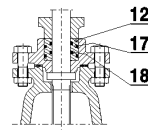
GGG / GGG



NIRO / NIRO
Bz / Bz



Ms / Ms
Bz / Bz



„O“ BRTVE
„O“ RING

POZ TEIL PART	MATERIJAL PO EN-u WERKSTOFF NACH EN MATERIAL ACC TO EN	MATERIJAL PO DIN-u WERKSTOFF NACH DIN MATERIAL ACC TO DIN
1	EN-GJS-600-7	GGG 60
2	EN-GJS-600-7	GGG 60
3	EN-GJS-600-7	GGG 60
4, 5	CC484K	CuSn7ZnPb
-	-	CuAl 8
-	X5CrNi 18-10	X5CrNi 18 10
-	-	NiFe 2
-	CW 608	CuZn 37
6	X20Cr13	X20Cr13
7	EN-GJS-600-7	GGG 60
-	CC484K	CuSn12 Ni
8	EN-GJS-600-7	GGG 60
9	EN-GJS-600-7	GGG 60
-	CC484K	CuSn7ZnPb
10	ARAMID	ARAMID
11	EN-GJL-250	GG 25
12	PTFE	PTFE
-	CC 480 K	CuSn 10
13	X20Cr13	X20Cr13
14	ARAMID	ARAMID
15	CC760S	CuZn33Pb
16	X20Cr13	X20Cr13
17	EPDM	EPDM
18	EPDM	EPDM
19	A2	A2

Ostali materijali na upit.
Andere Werkstoffe auf Anfrage.
Other materials on request.



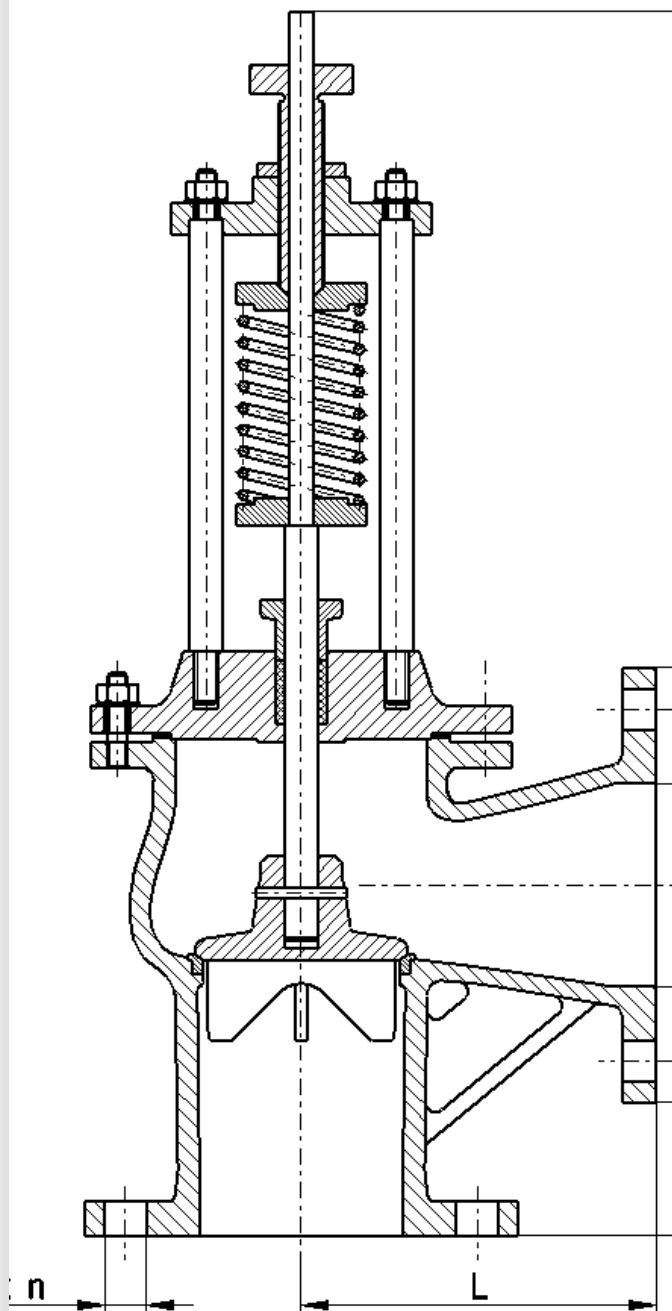
METALSKA INDUSTRIJA VARAŽDIN d.d.

HRVATSKA

42000 VARAŽDIN, Fabijanska 33 • Telefon: +385 +42 404-100 • Fax: +42 242-004 • E-mail: prodaja-miv@vz.hinet.hr

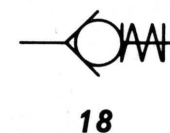
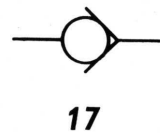
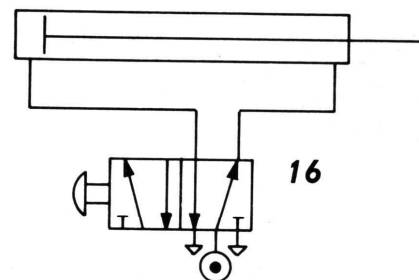
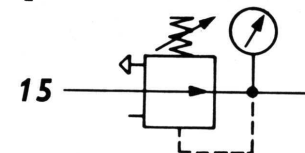
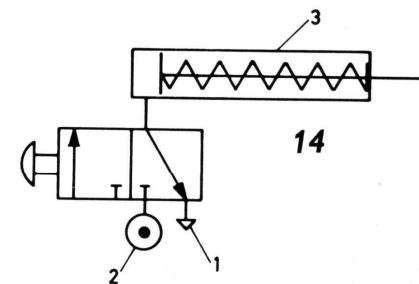
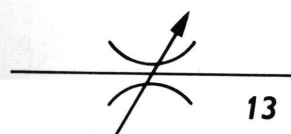
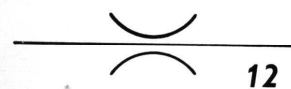
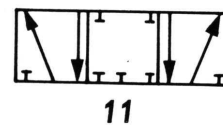
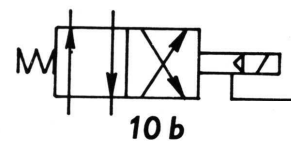
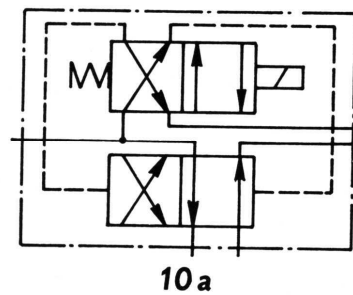
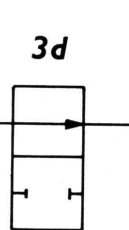
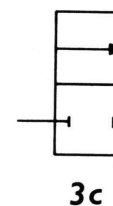
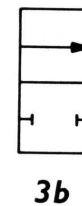
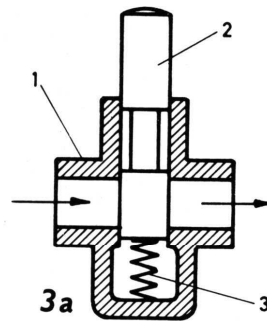
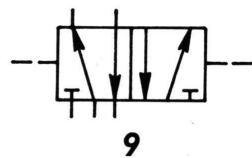
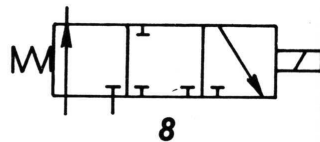
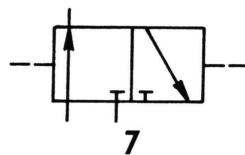
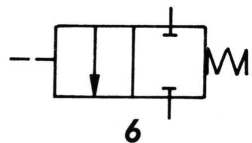
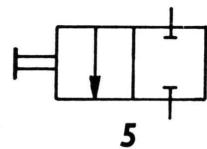
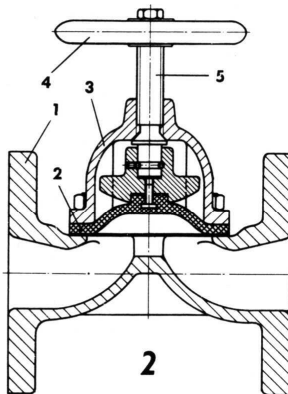
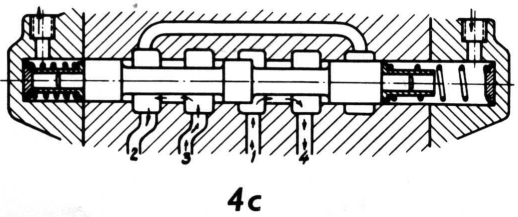
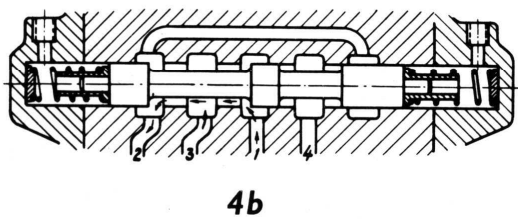
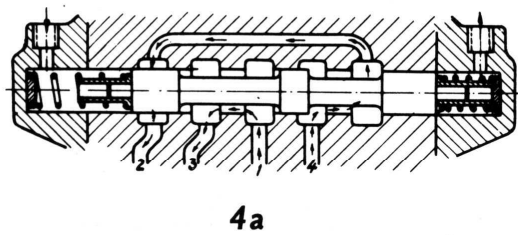
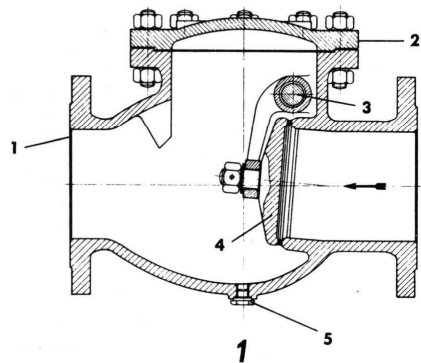
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VENTILSKA STANICA

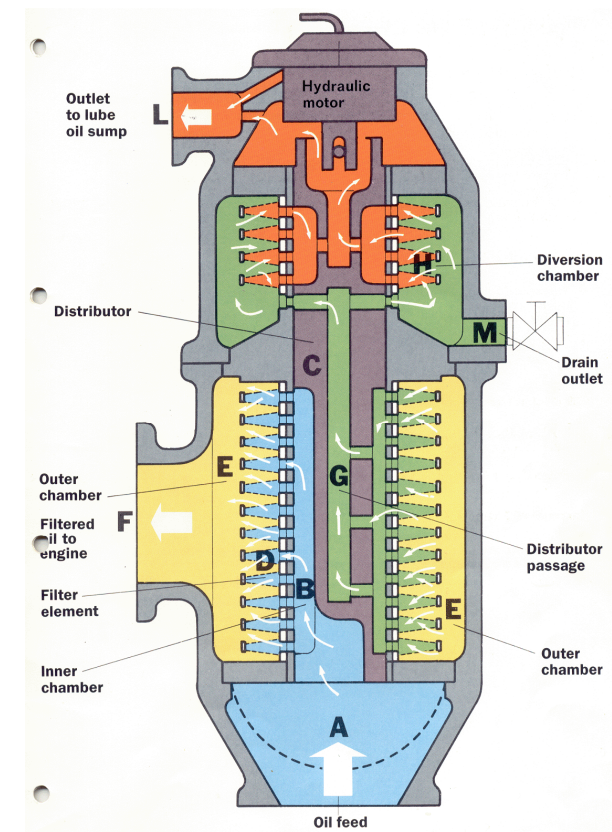




Filtri

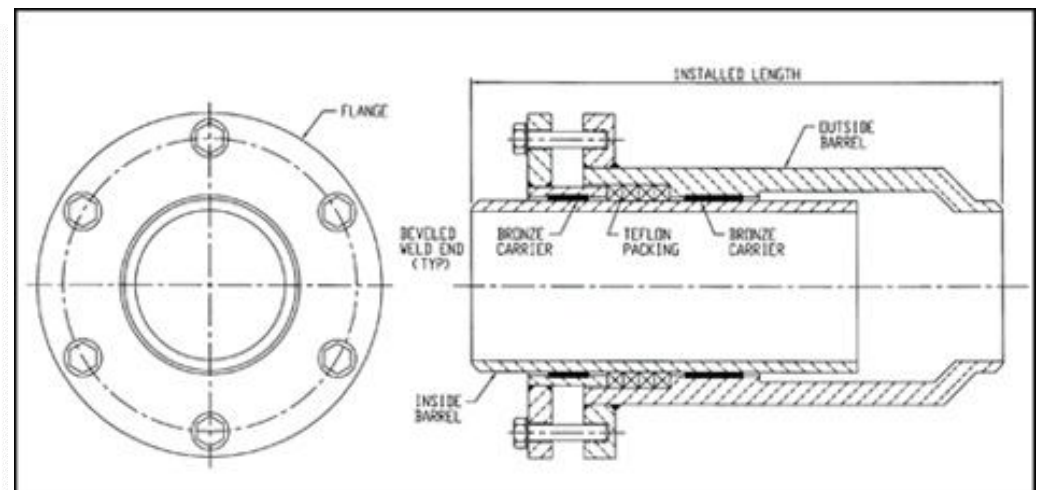
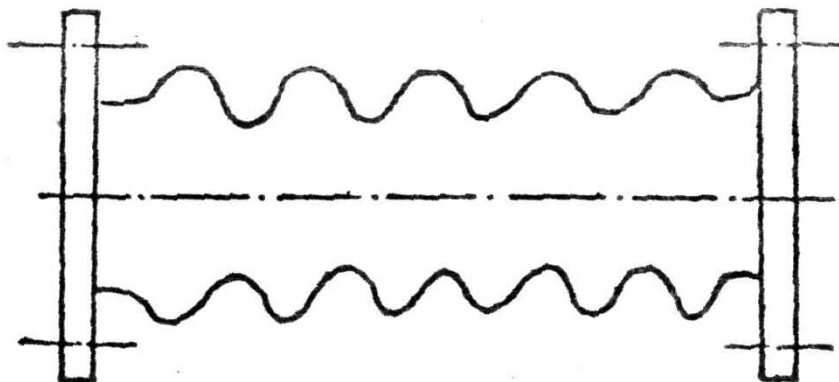
- način filtriranja
- finoća (veličina čestica)

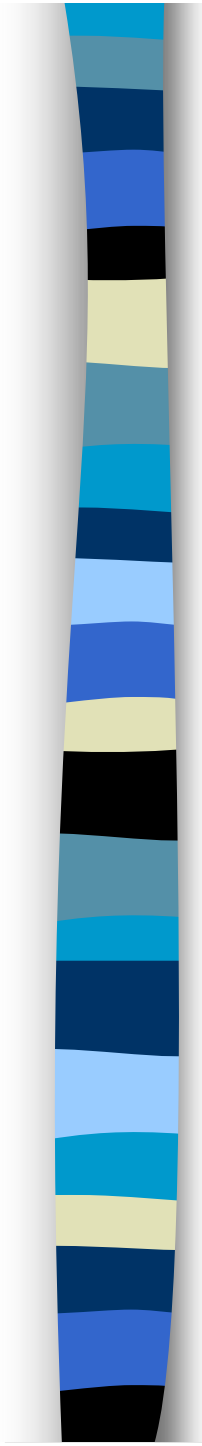
7/1/2014



Kompenziranje dilatacija

- vođenjem cjevovoda, koljenima
- “cijevne lire”
- klizni
- korugirani lim

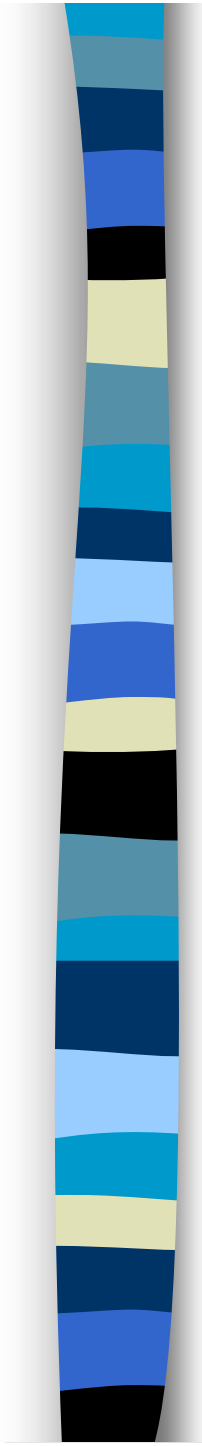




Spojevi

- rastavljivi
- nerastavljivi

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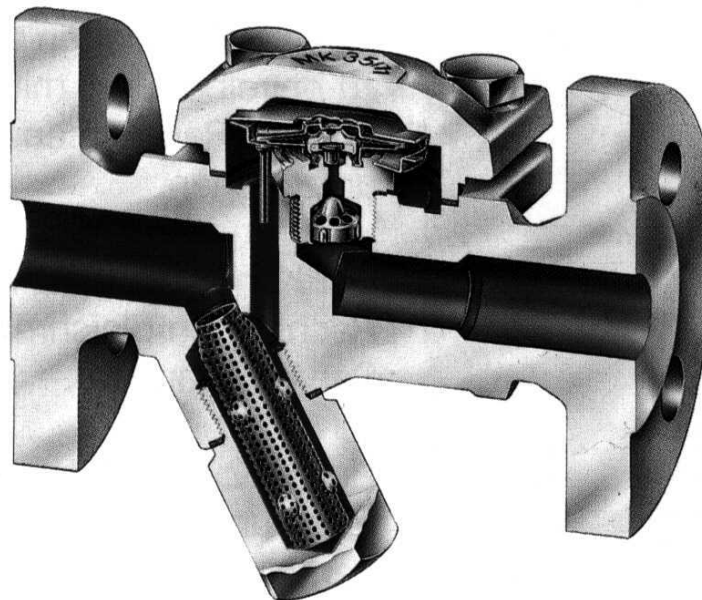


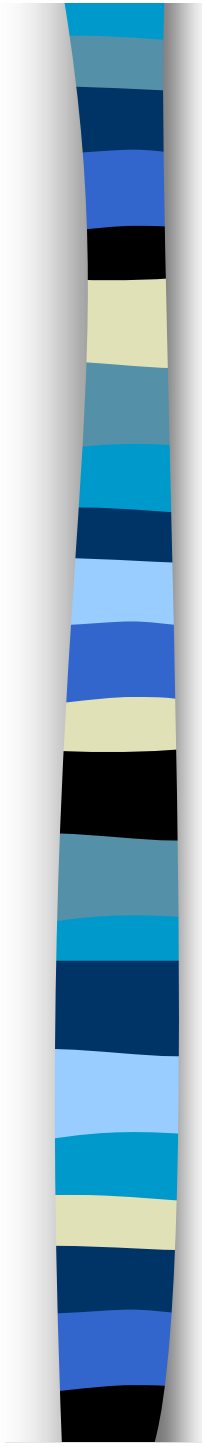
Brtve

- odgovaraju fluidu, temperaturi, tlaku
- papir, tekstolit, guma, bakar...

Kondenzni lonci

- na izlazu pare iz grijača, sprečavaju prolaz neukapljene pare (mokre, zasićene), a otvaraju prolaz kondenzatu

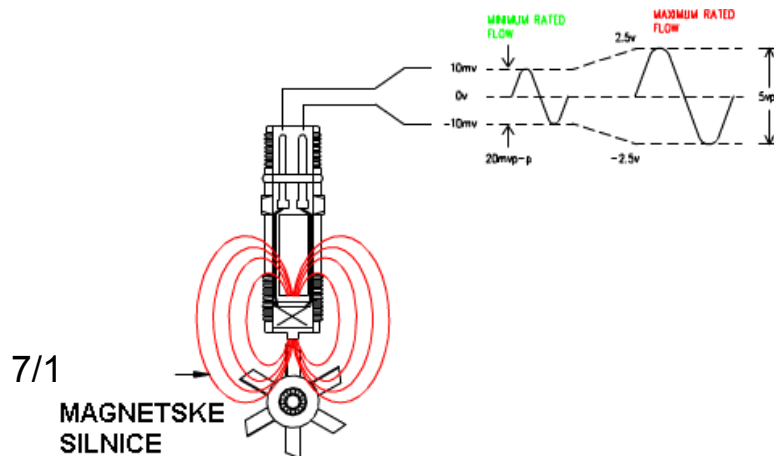
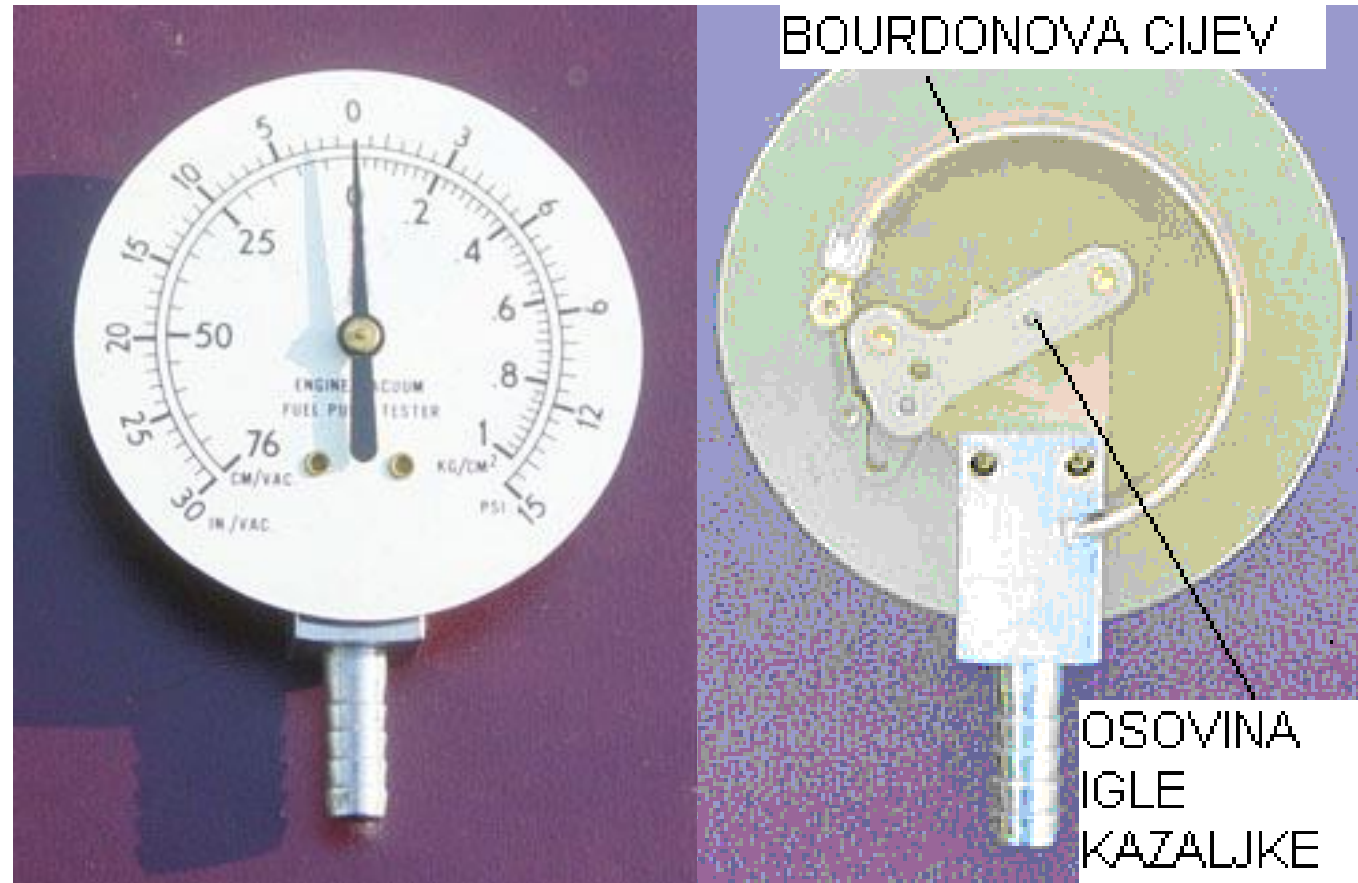




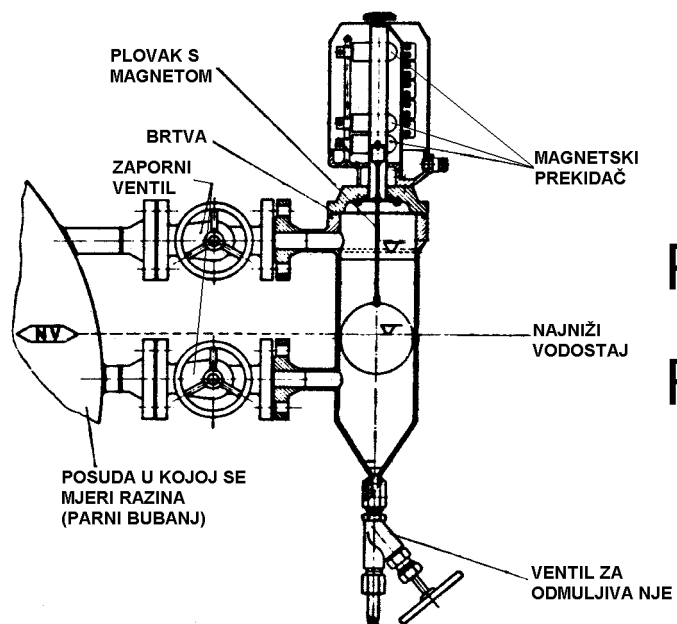
Regulacijska i kontrolna armatura

- procesni mjerni instrumenti tlaka, temperature, razine, protoka, viskoziteta i dr.
- indikacija (analogna, digitalna)
- alarmiranje (prekidači)
- zaštitna djelovanja

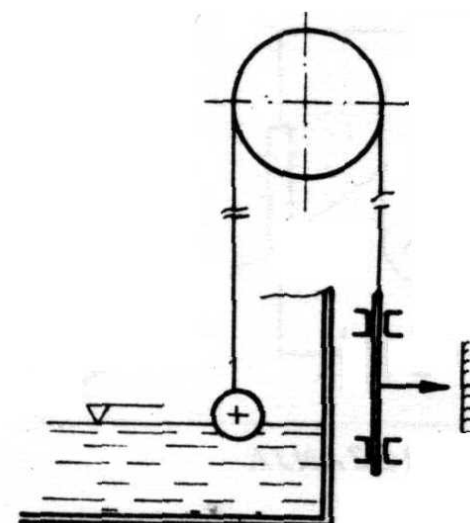
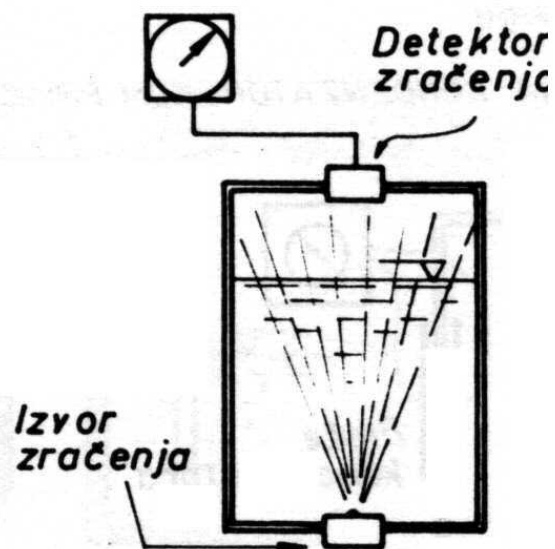
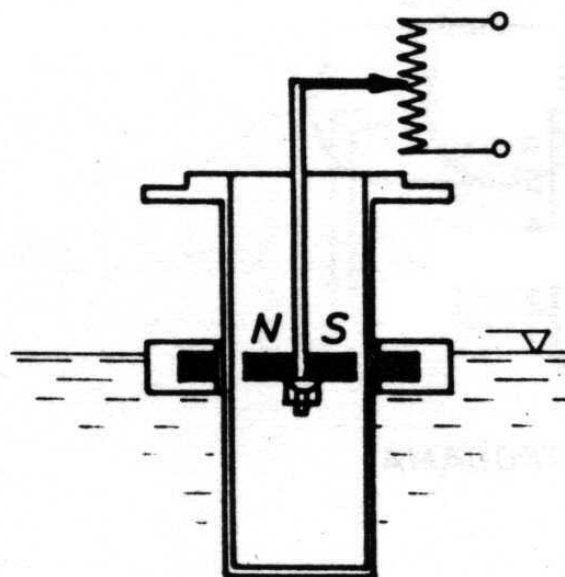
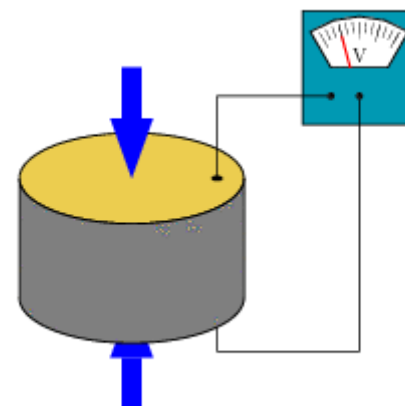
MANOMETAR S BOURDONOVOM CIJEVI

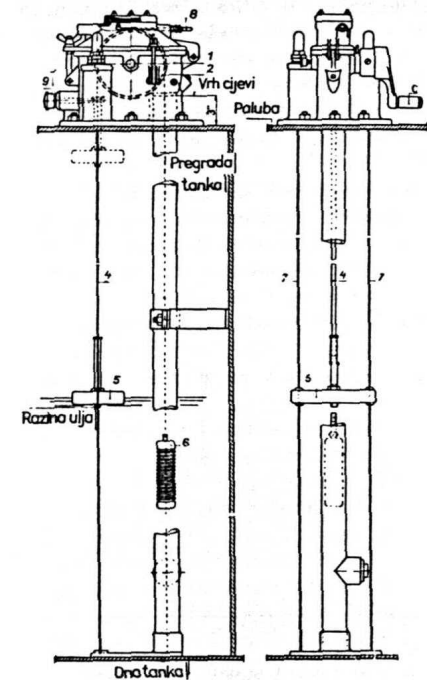
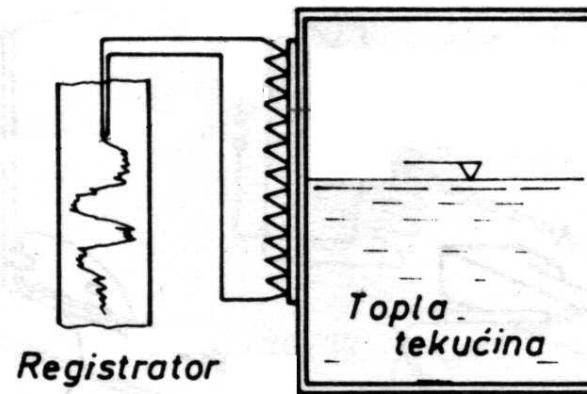
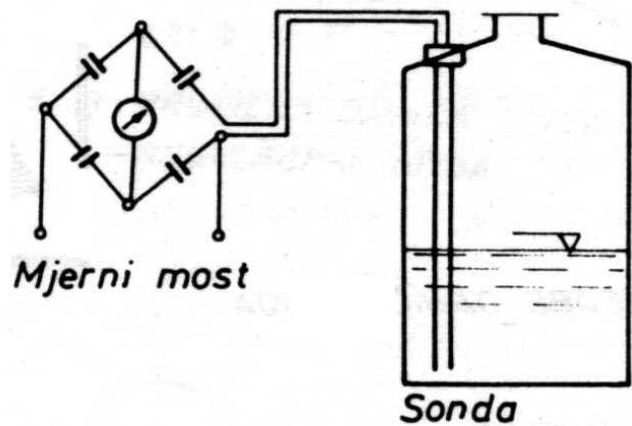


MJERAČ
PROTOKA

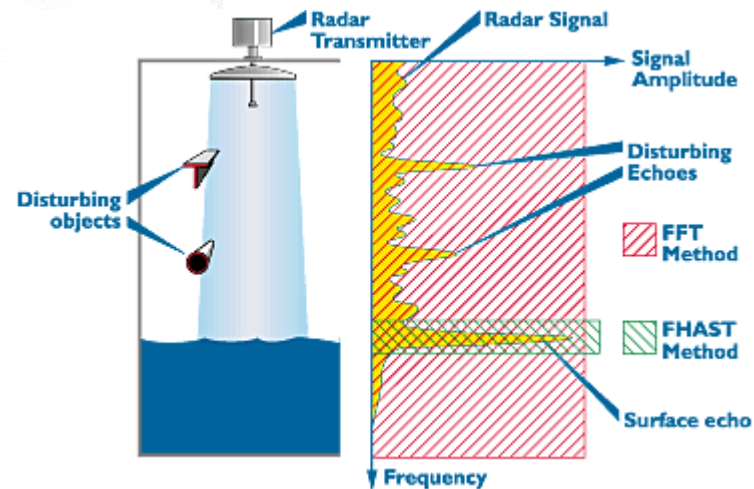
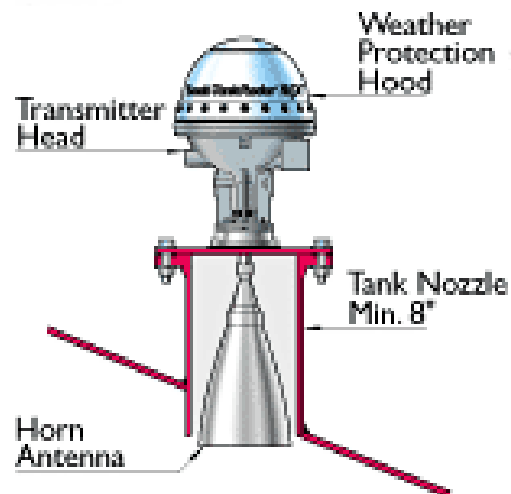


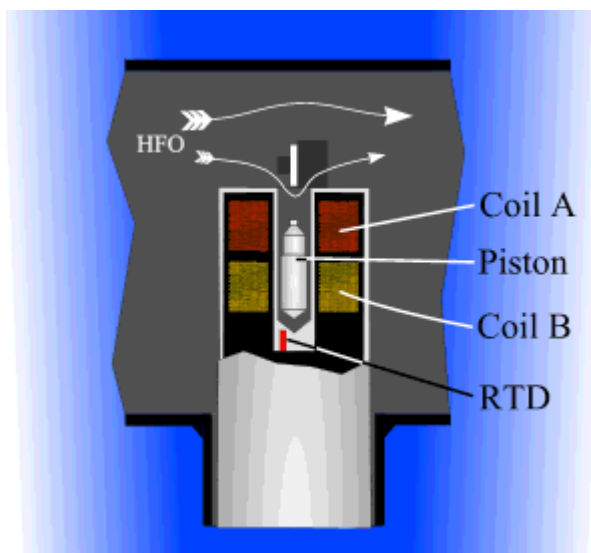
PREKIDAČ RAZINE





Uređaj za mjerenje visine tekućine u tanku. 1 kućište, 2 kotač za čeličnu vrpca, 3 ručka kotača, 4 čelična kalibrirana vrpca, 5 plovak, 6 uteg, 7 žice za vođenje plovka, 8 brisač okna za očitavanje oznake na kalibriranoj vrpci

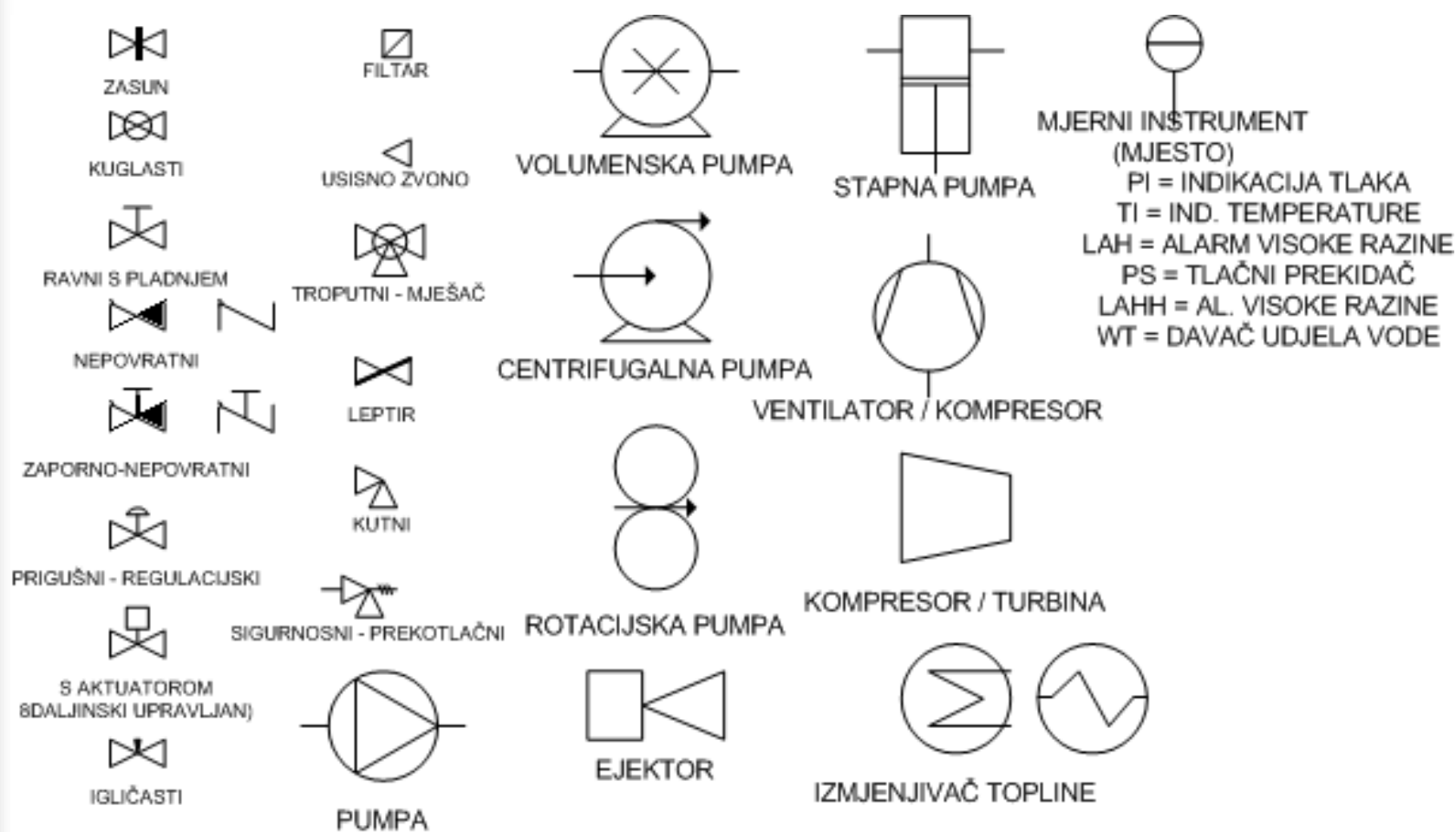




DAVAČ VISKOZITETA

7/1/2014

Simboli u shemama



7/1/2014