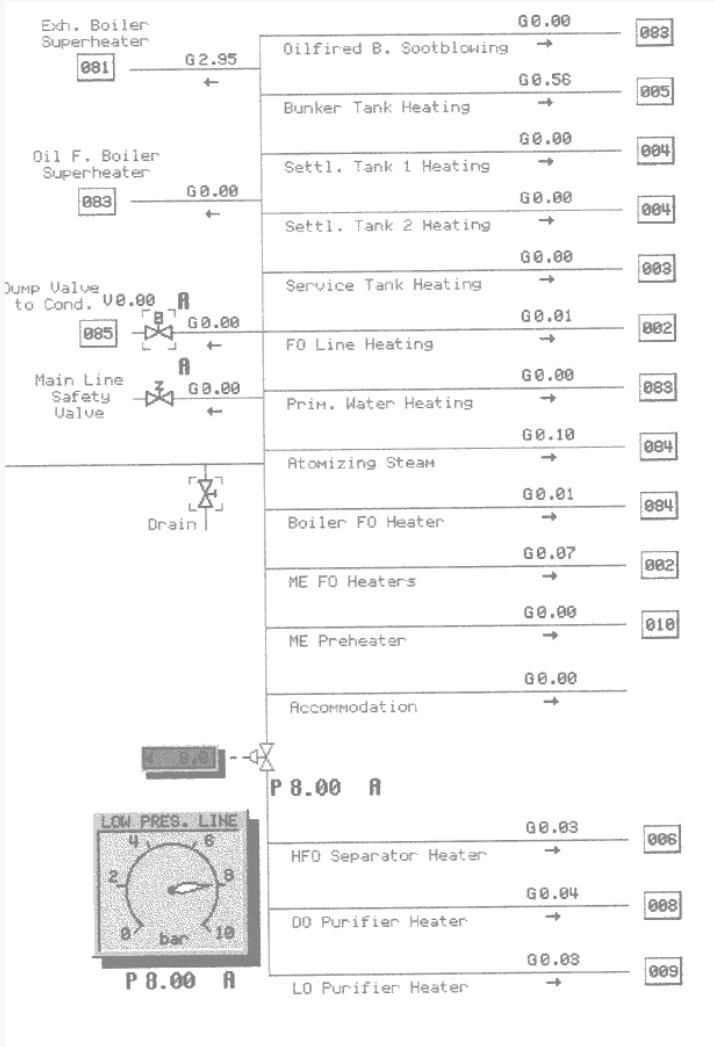
BRODSKI POMOĆNI SUSTAVI

POGONSKI CJEVOVODI

(para, kondenzat i napojna voda)

Namjena



- **grijanje**:
  - gorivo,
  - ulje,
  - teret,
  - klimatizacija,
  - propuhivanje
  - brodska sirena…
- turbine

Sustav pare

- $v_{dop} \leq 20$ m/s
- kapacitet kotla [t/h]
- gornji dijelovi strojarnice/kotlovnice
- kompenzacija dilatacija
- drenaža (propuhivanje) – do ispod podnica
- redukcijski ventil

Sustav pare

- dva kotla: zajednički cjevovodi pare, propuhivanja, otpjenjivanja (zaporni i nepovr. ili zap.-nep. ventili prije zajedničkog spoja); kompenzacija
- ne voditi blizu tankova goriva, osim za grijanje (max. 220°C)
- cijevi za grijanje nerastavljivo spojene (zavarivanje, spojka)

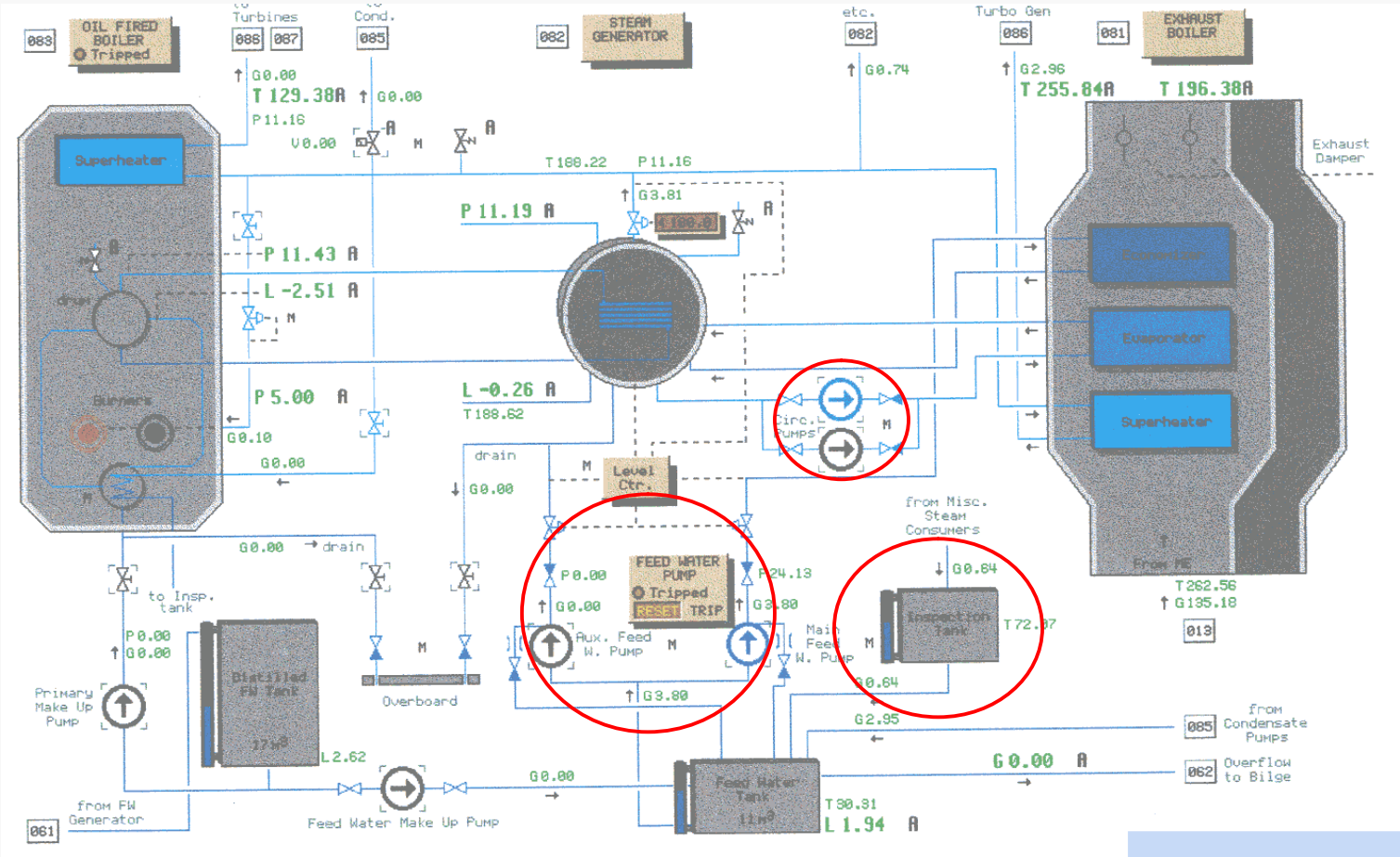
Sustav kondenzata

- porivna turbina jedan, pomoćne turbine zajednički kondenzator
- dvije rashladne pumpe morske vode
- dvije pumpe kondenzata ($Q=1{,}25Q_p$)
- mjerenje: tlaka, razine kondenzata, temperature, slanosti
- iz kondenznih lonaca u observacijski tank – mlaki zdenac

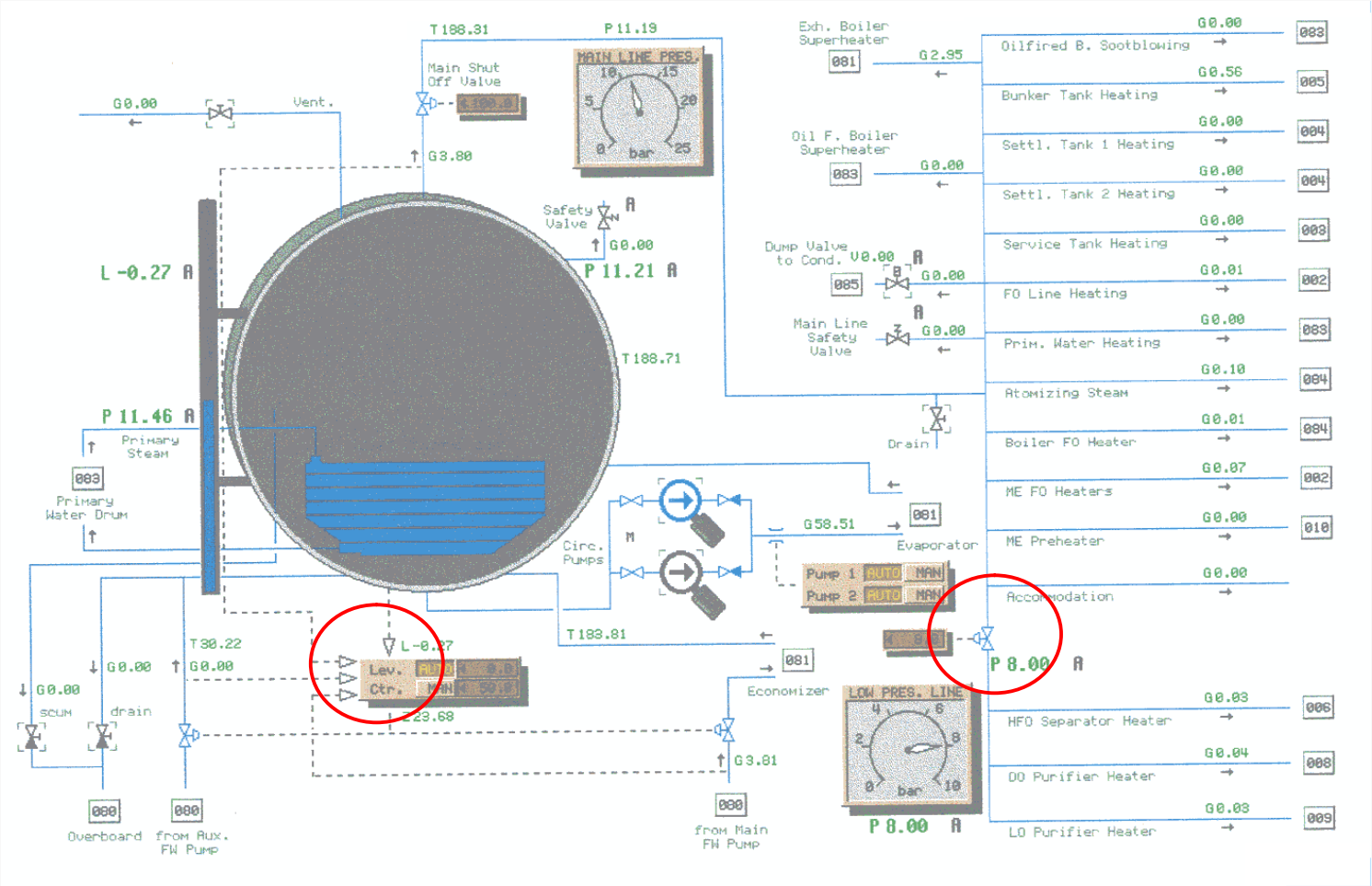
Sustav napojne vode

- dvije napojne pumpe s neovisnim pogonom
- može li jedna pumpa?
- kapacitet pumpi:
  - ručna regulacija: $\geq 1{,}5Q_{kotla}$
  - automatska regulacija: $\geq 1{,}15Q_{kotla}$
- prisilna cirkulacija: dvije cirkulacijske pumpe
- usis iz: mlakog zdenca i t. napojne vode
- dva posebna i neovisna cjevovoda

Shema sustava



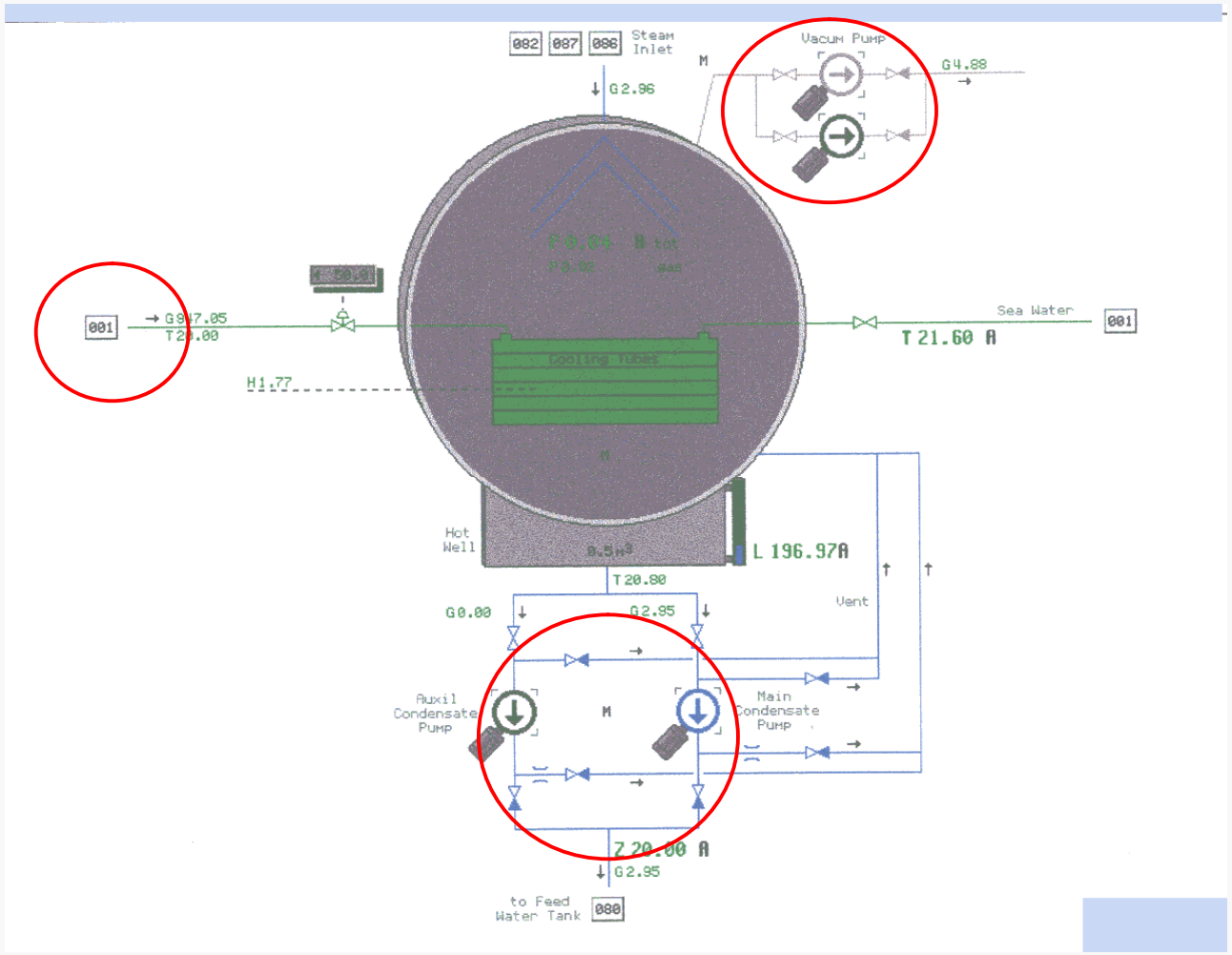
Parni bubanj, sakupljač pare



Kondenzator

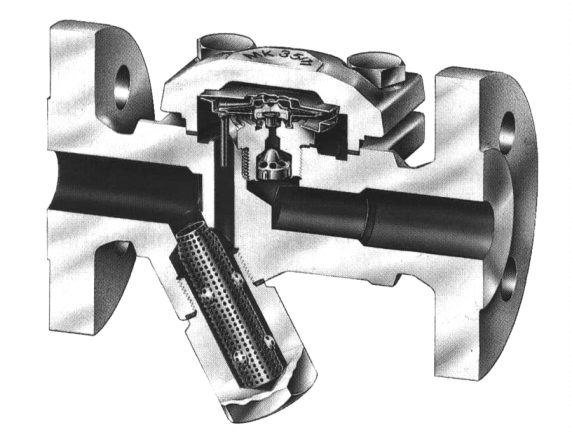
- atmosferski, vakuumski
- hlađenje: direktno, indirektno

Vakuumski kondenzator

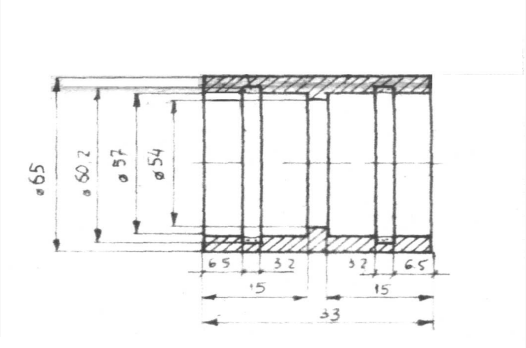


Grijači

- zaporni ventil
- kondenzni lonac (plovak, bimetalna traka, dinamički)



Grijanje
(tankova, goriva, tereta)



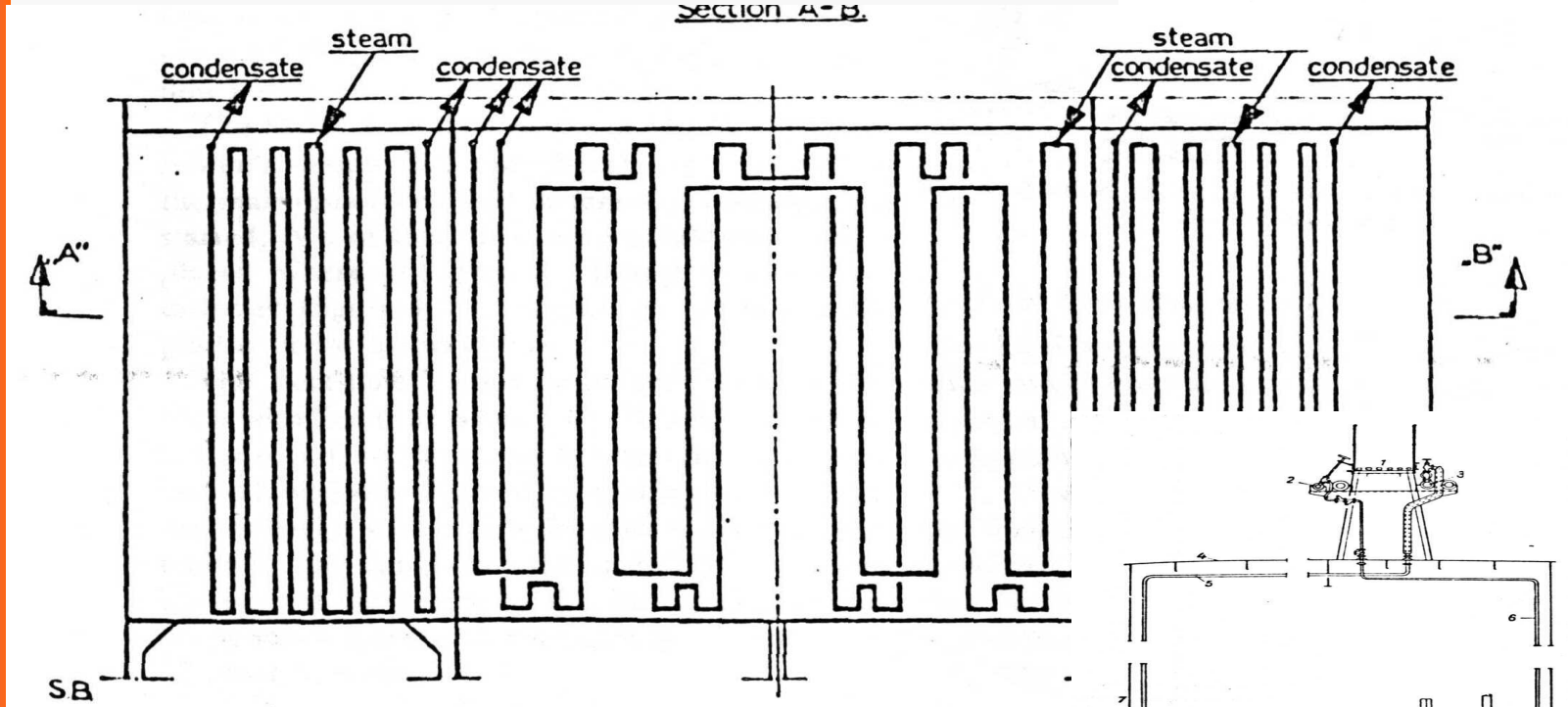
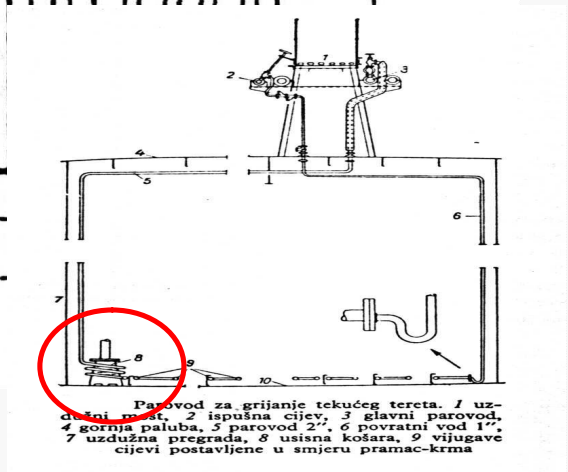
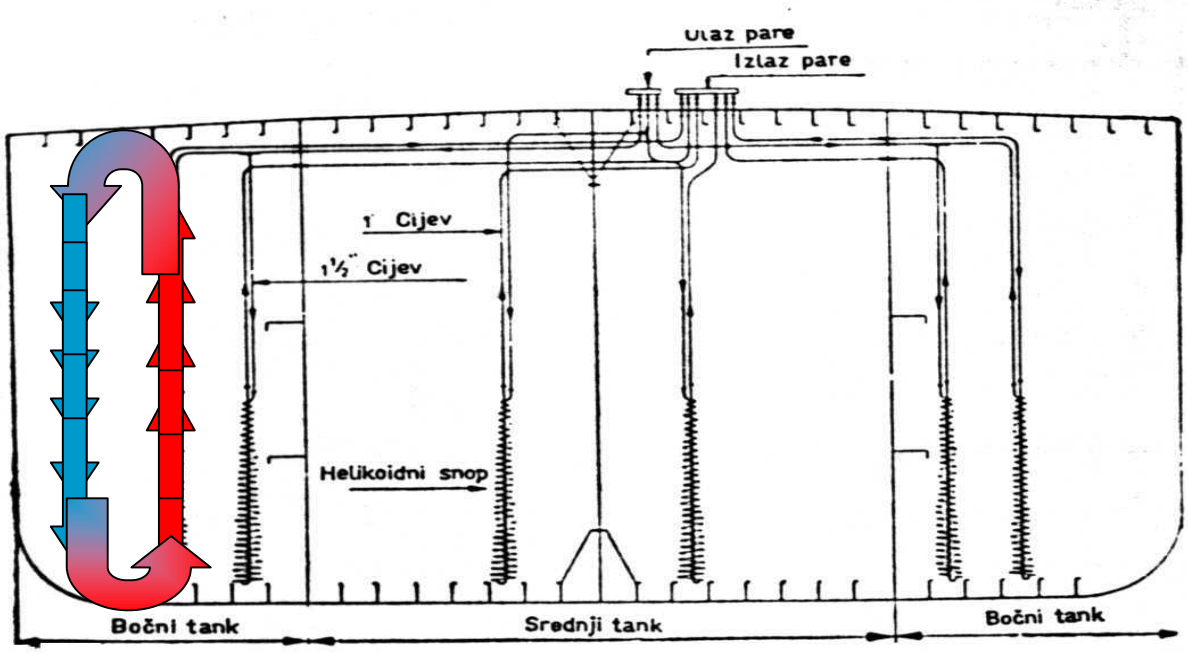


Fig. 3. Lay-out of heating coils



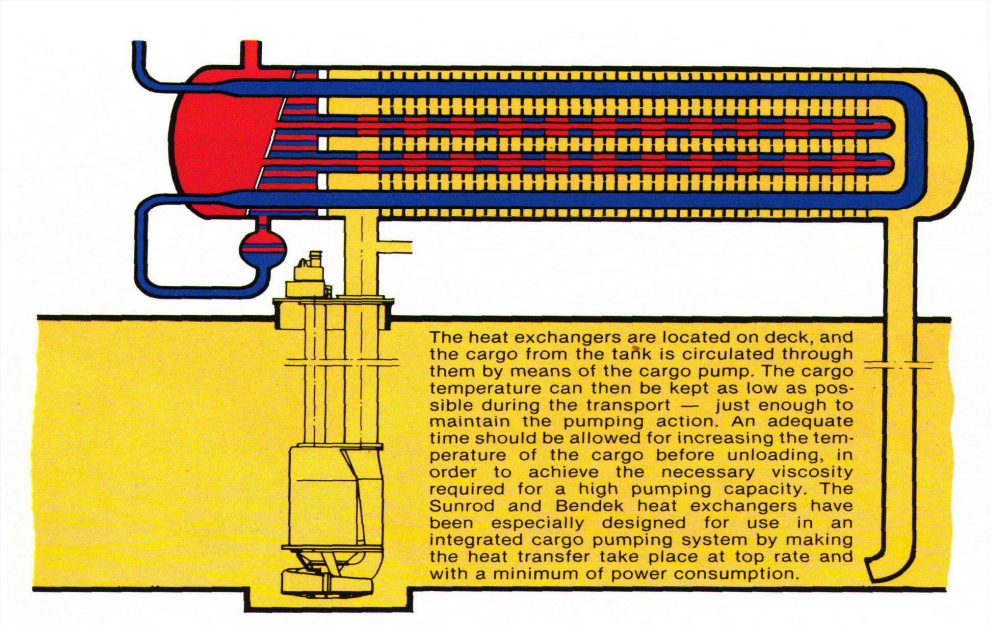
Parovod za grijanje tekućeg tereta. *1* uzdužni most, *2* ispušna cijev, *3* glavni parovod, *4* gornja paluba, *5* parovod 2'', *6* povratni vod 1'', *7* uzdužna pregrada, *8* usisna košara, *9* vijugave cijevi postavljene u smjeru pramac-krma

Strujanje u tanku



Helikoidni snopovi cijevi za grijanje tekućeg tereta

Cijevni zagrijači



Cijevi:

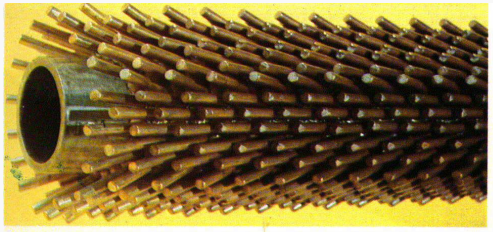
-glatke

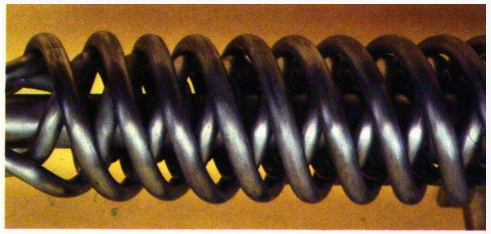
-orebrene

-izdanci

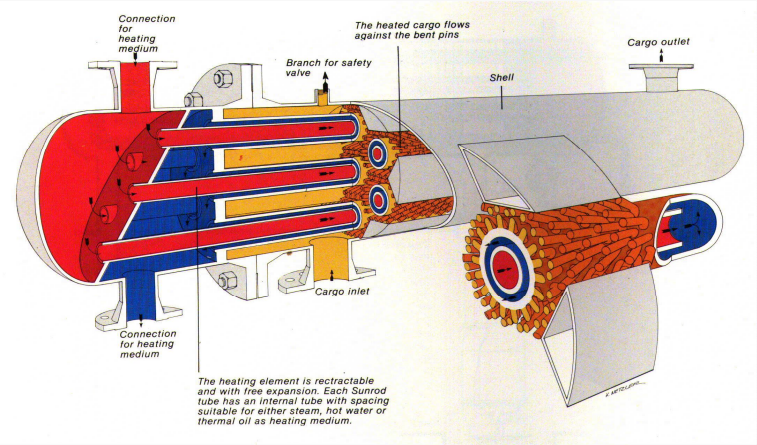
-ravne

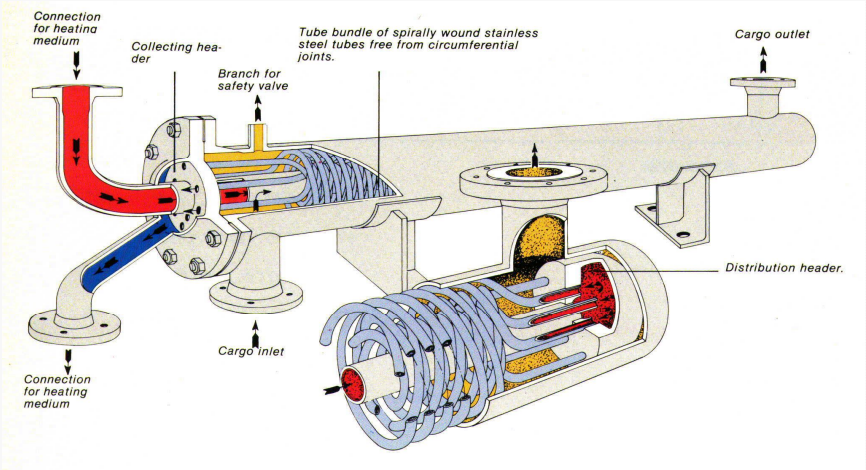
-spiralne



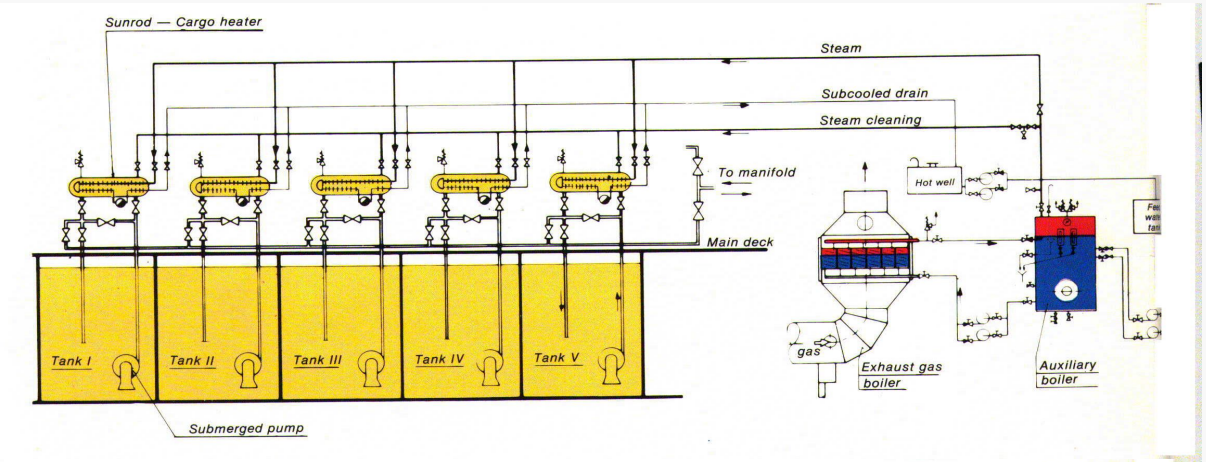


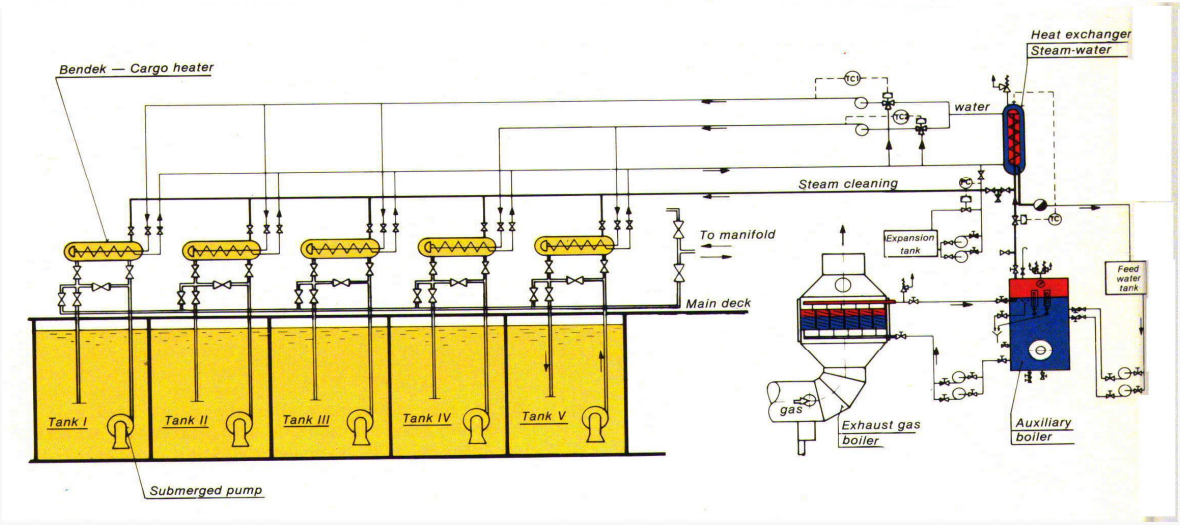
Strujanje pare - kondenzata





Direktno i indirektno grijanje

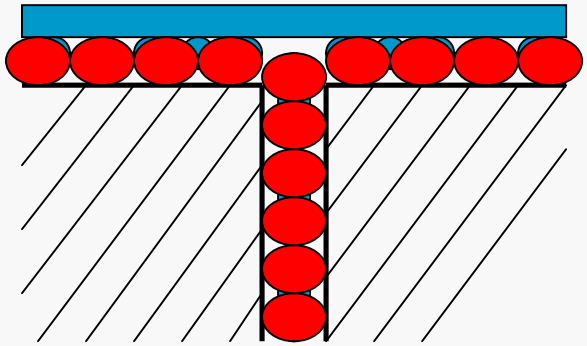


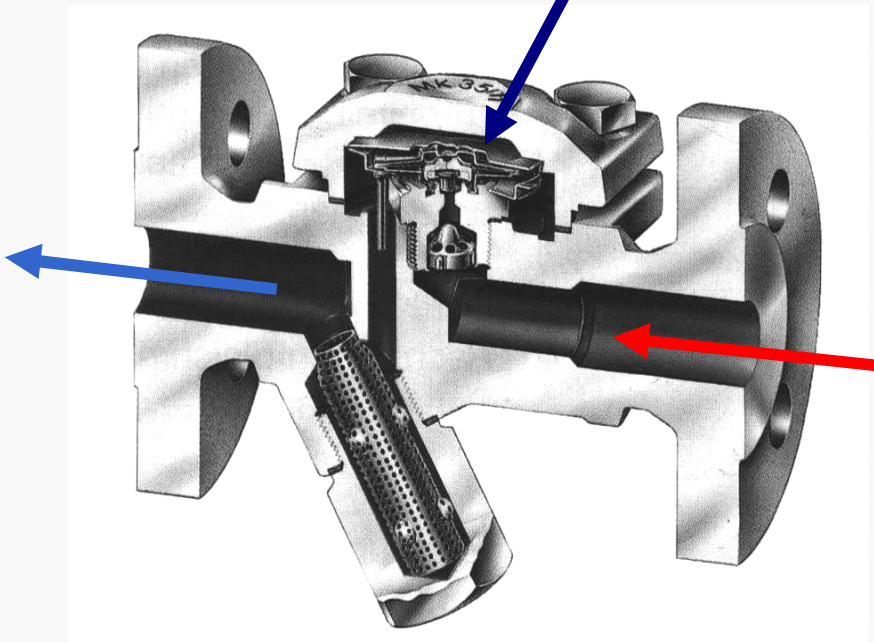


Kondenzni lonac

$$p_s + p_d = konst.$$

DISK





Dinamički kondenzni lonac

Povrat – inspekcijski tank

- sekcije
- pokazno staklo
- preljev