



BRODSKI ENERGETSKI SUSTAVI

Porivni sustavi (2)



Porivni sustav (sklop, blok)

- porivni stroj
- sustav prijenosa snage
- propulzor



Prijenos snage

- $\eta_p = f(D, n)$
- direktan
 - krut: prirubnica ili kruta spojka
 - elastičan: elektromagn. i hidrauličke spojke
- indirektan
 - zupčani prijenos (97-99%)
 - električni prijenos

Prijenos snage – sporookretni motor

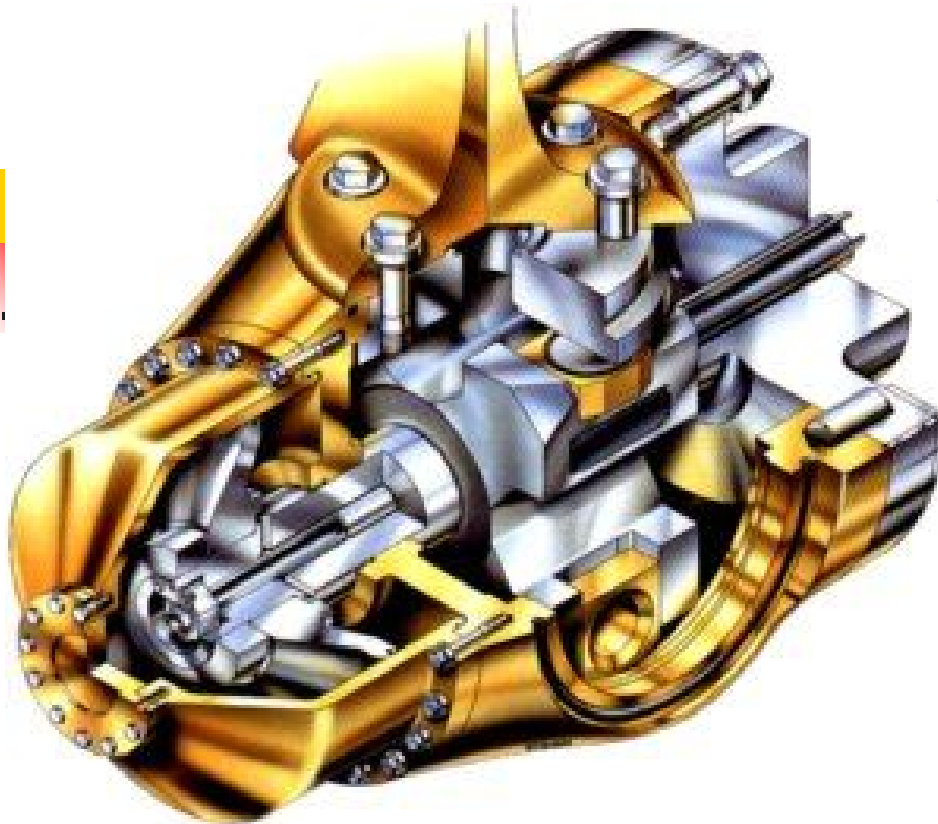
- direktan prijenos – vratilo
- masu vratila preuzimaju radijalni ležajevi
- porivnu silu stvorenu radom vijka preuzima aksijalni (odrivni) ležaj – Mitchelov ležaj
- reduktor se primjenjuje kod brzookretnih strojeva kako bi se smanjila brzina vrtnje vijka

Propulzor

- vijak
 - s fiksnim krilima FPP (prekretni motor)
 - prekretni CPP (prekretanje motora u nuždi)
- oblik i presjek
- broj krila
- smjer vrtnje
- kontrarotirajući
- sapnice
- druge izvedbe

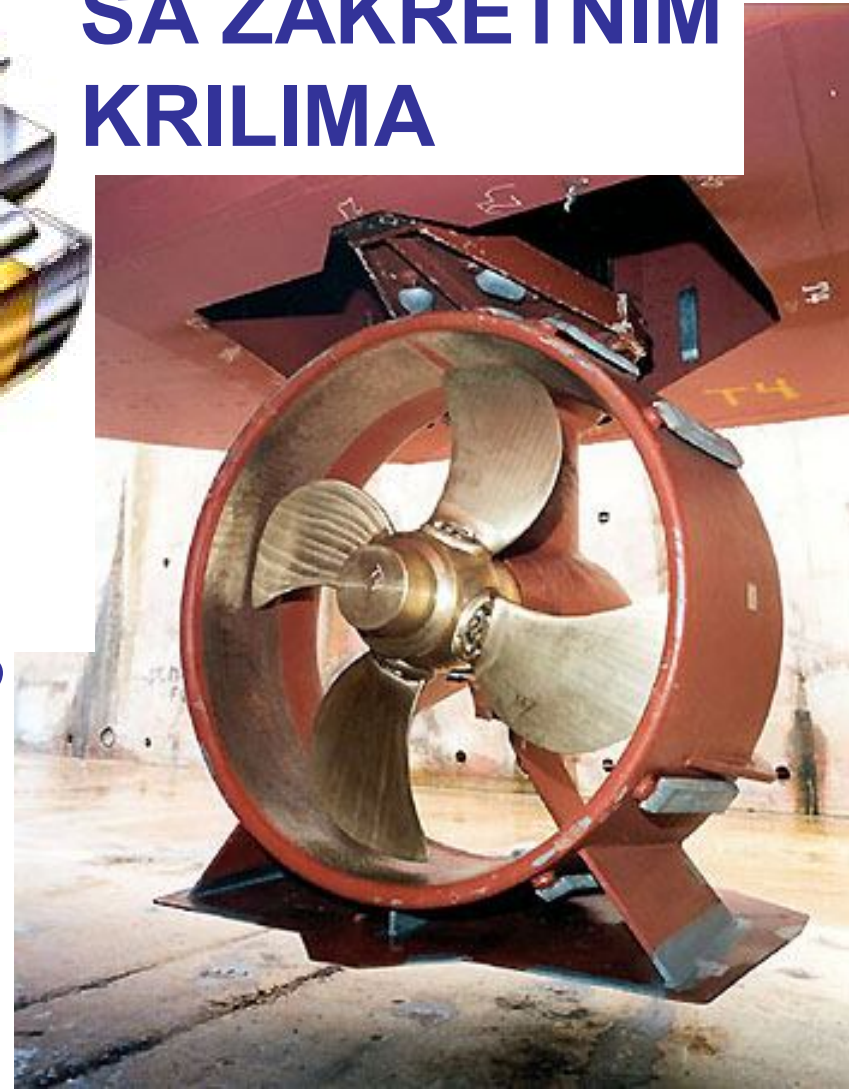


PROPELER SA ZAKRETNIM KRILIMA

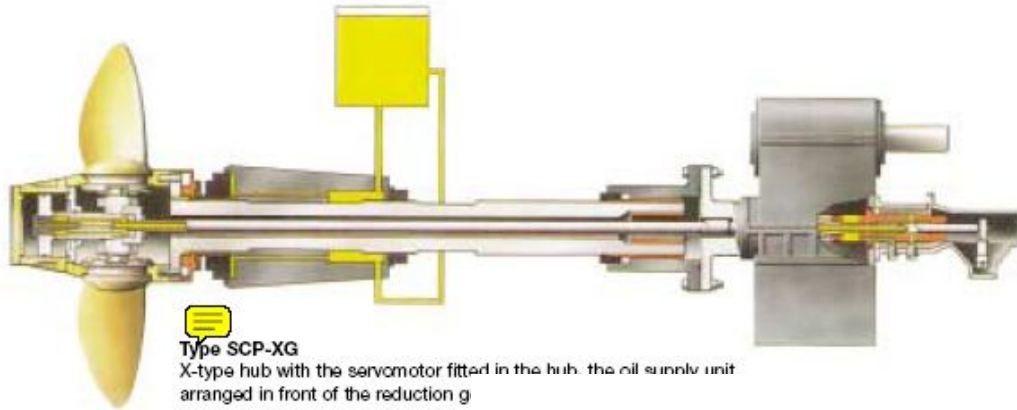


Zašto sapnica?

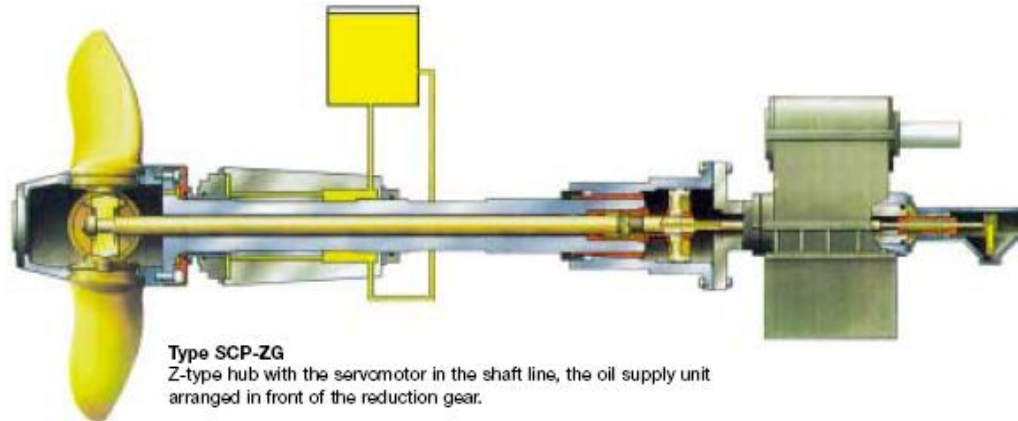
1. štiti propeler
2. usmjerava vodu
3. η poriva



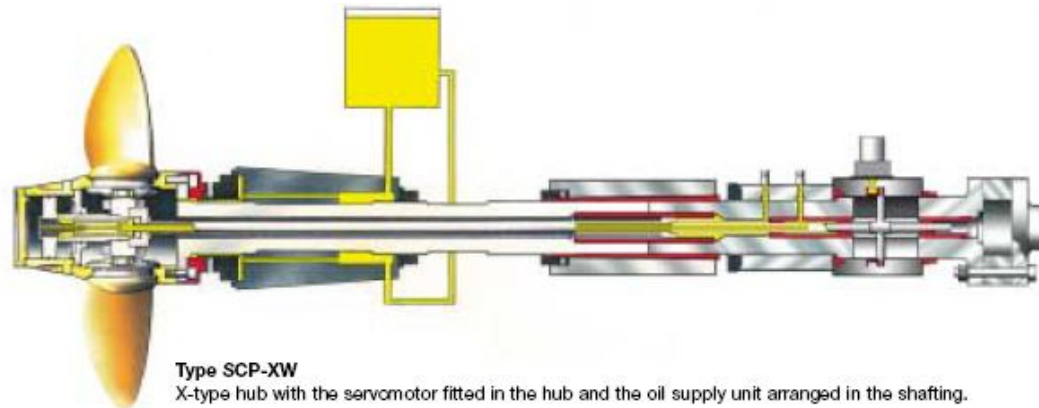
ZAKRETANJE KRILA



Type SCP-XG
X-type hub with the servomotor fitted in the hub, the oil supply unit arranged in front of the reduction gear

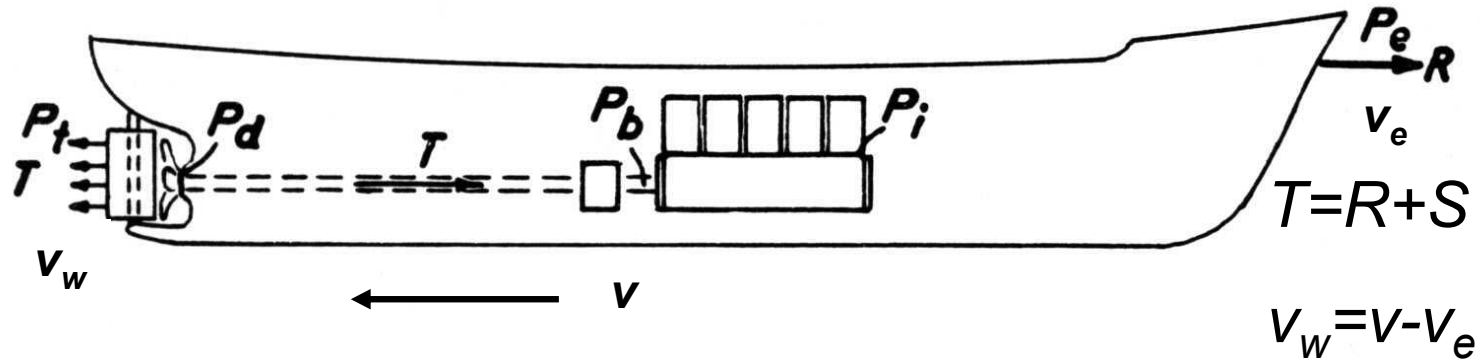


Type SCP-ZG
Z-type hub with the servomotor in the shaft line, the oil supply unit arranged in front of the reduction gear.



Type SCP-XW
X-type hub with the servomotor fitted in the hub and the oil supply unit arranged in the shafting.

Stupanj iskoristivosti poriva



$$\eta_p = \frac{P_b}{P_i} \cdot \frac{P_d}{P_b} \cdot \frac{P_t}{P_d} \cdot \left(\frac{P_e}{P_t} \right)$$

$$\eta_p = \frac{P_e}{P_i}$$

$$\eta_p = \eta_m \cdot \eta_o \cdot \eta_p \cdot (\eta_h)$$



Pojmovi

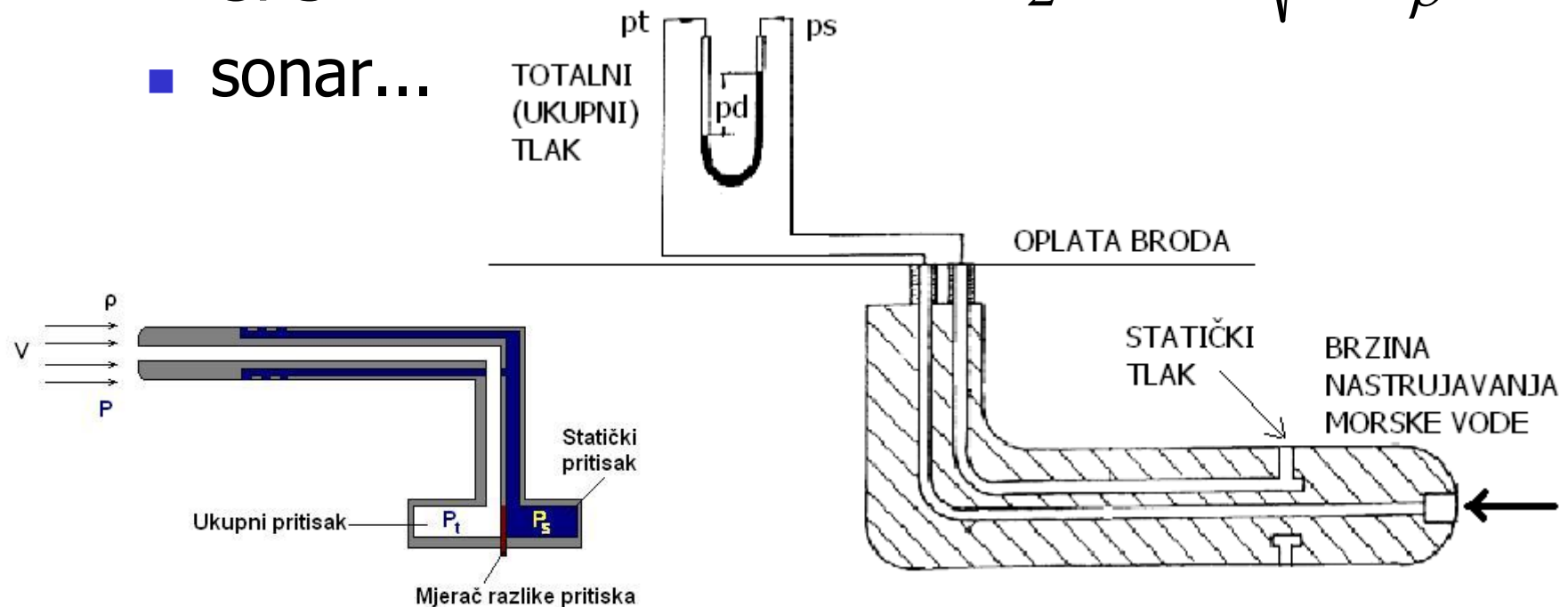
- uspon (pitch) vijka H [m] – u nekim udžbenicima se označava P
- broj okretaja vijka n [min^{-1}]
- brzine
 - stvarna brzina broda (prema dnu ili kopnu), engl. speed of advance
 - relativna brzina broda

Mjerenje brzine broda

- Pitot-ova cijev (Pitotlog)
- GPS
- sonar...

$$p_t = p_s + p_d$$

$$p_d = \frac{\rho v^2}{2} \Rightarrow v = \sqrt{\frac{2(p_t - p_s)}{\rho}}$$





Slip ili skliz

- prividni ili stvarni
- odnos teoretskog gibanja vijka i brzine strujanja vode ili brzine broda
- uspon vijka - H [m], broj okretaja propelera - n [o/min], brzina strujanja vode (speed of ship) ili efektivna brzina broda (speed of advance) – v ili v_e [m/s]

$$s_p = \frac{\frac{Hn}{60} - v}{\frac{Hn}{60}} \cdot 100[\%] \quad s_s = \frac{\frac{Hn}{60} - v_e}{\frac{Hn}{60}} \cdot 100[\%]$$



Mjerenje snage glavnog stroja

- na osovini: $P_s = M_t \cdot \omega$ $\omega = 2\pi \cdot n$
- torziometar $\sigma = \frac{M_t}{W_p}; \sigma = E \cdot \varepsilon \Rightarrow M_t = EW_p \cdot \varepsilon$
- optički
- DM: indikator
- DM: procesni

$$P_i = p_i \cdot \frac{D^2 \pi}{4} \cdot \frac{S \cdot n}{30} \cdot z \cdot \tau$$



Pokusna vožnja na mjernoj milji

- odnos v, P, n
- dokaz brodovlasniku o izvedenosti projekta
- procjena propelera
- daljnje praćenje broda
- budući projekti i modeli