

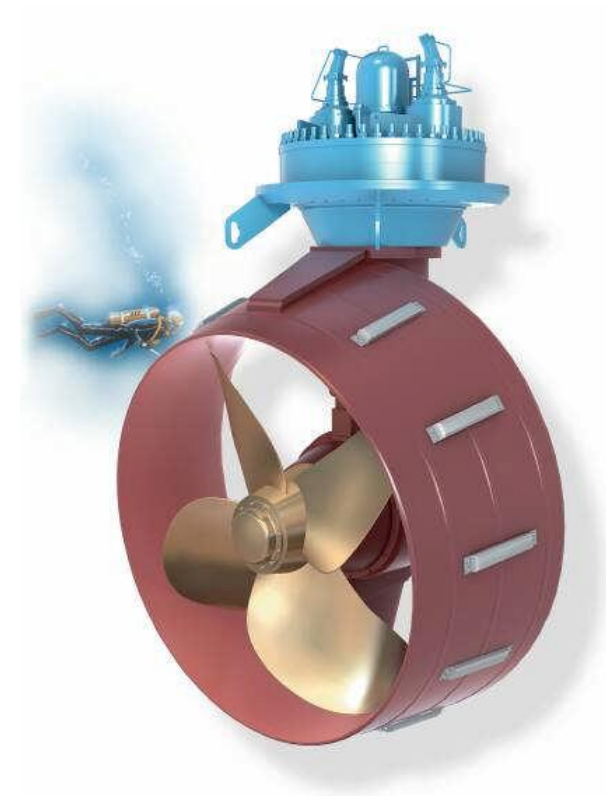


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# Propeller in a nozzle

Finding clearance between the propeller tip and the nozzle

- Having a sufficient gap between the propeller tip and the nozzle is of practical importance to avoid interference.
- Nozzle inner diameter larger than propeller diameter.
- When looking at tip clearance; only inner surface of nozzle and the tip section of the propeller is important.
- From clearance point of view the geometry can be simplified into two cylinders – see next slides.



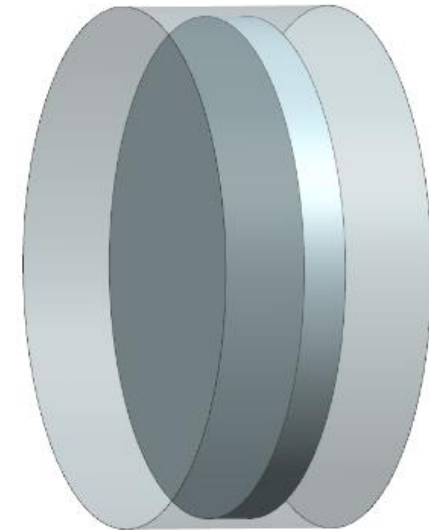
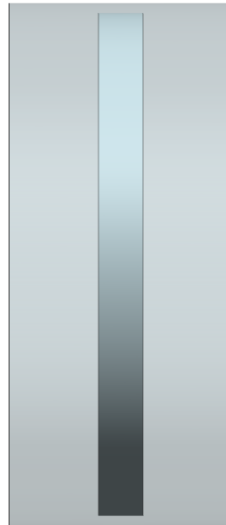


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# Standard case

Propeller concentric with nozzle

- Clearance:
  - $0.5 \times (\text{Dia nozzle} - \text{Dia prop})$
- Easy – no problem!



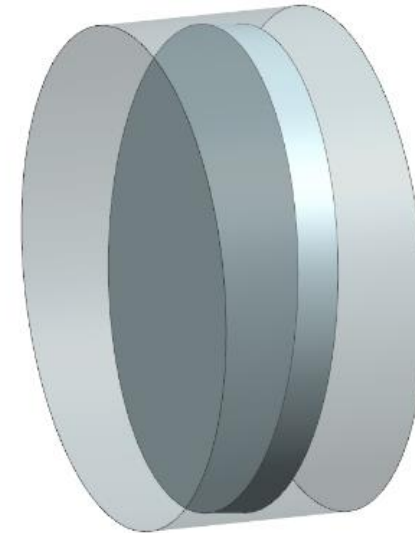
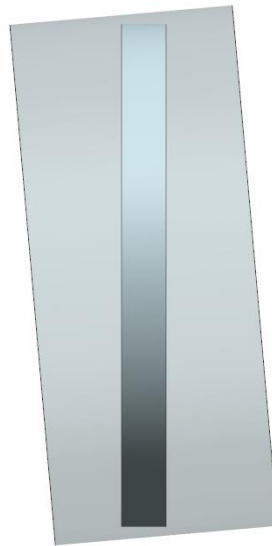


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# Tilted case

Nozzle tilted with regards to propeller

- Clearance:
  - How to calculate analytically?
- It is tempting to see this as a 2D problem only looking at the top or bottom in the left picture, but it is not, the case needs to be considered in 3D.

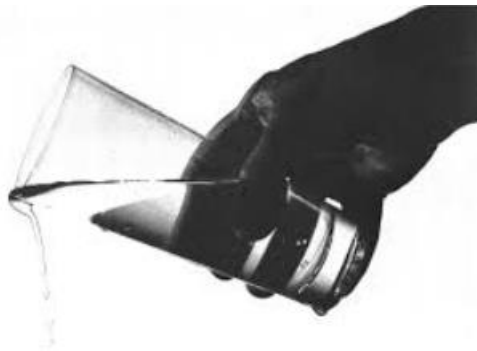




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# Background

- Why are nozzles sometimes tilted?
  - To avoid or minimize the Coanda effect when propellers with nozzles are close to the ship hull



The water follows the glass as a result of the Coanda effect