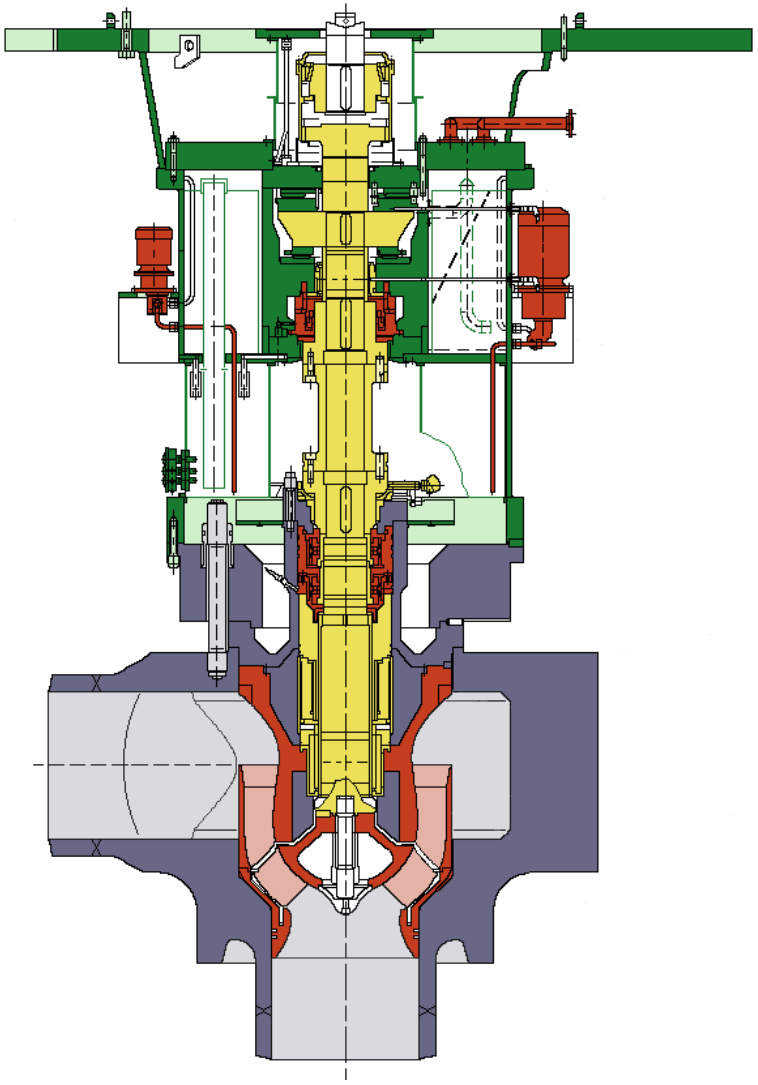
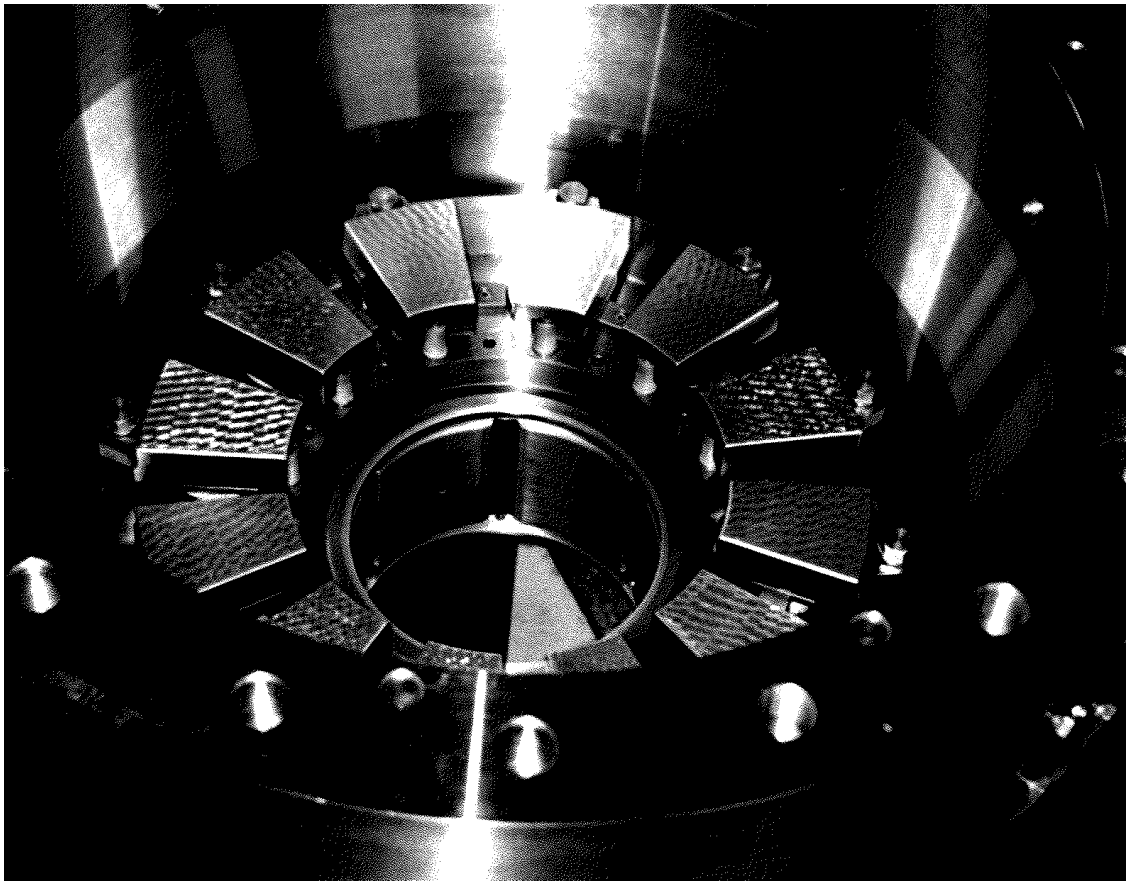
Slide Bearings

- General information
- Function and Design Criteria
- External Influences



General Information

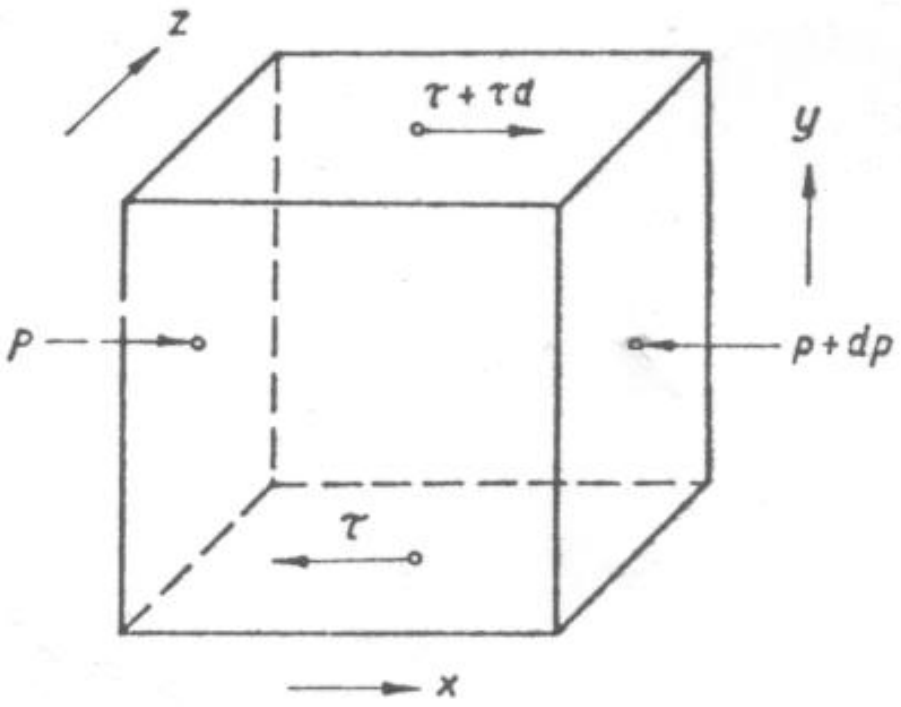
- Liquid Friction
- Main Types of Slide Bearings
- Materials in Use



Liquid Friction

- Newton's formula for liquid friction:

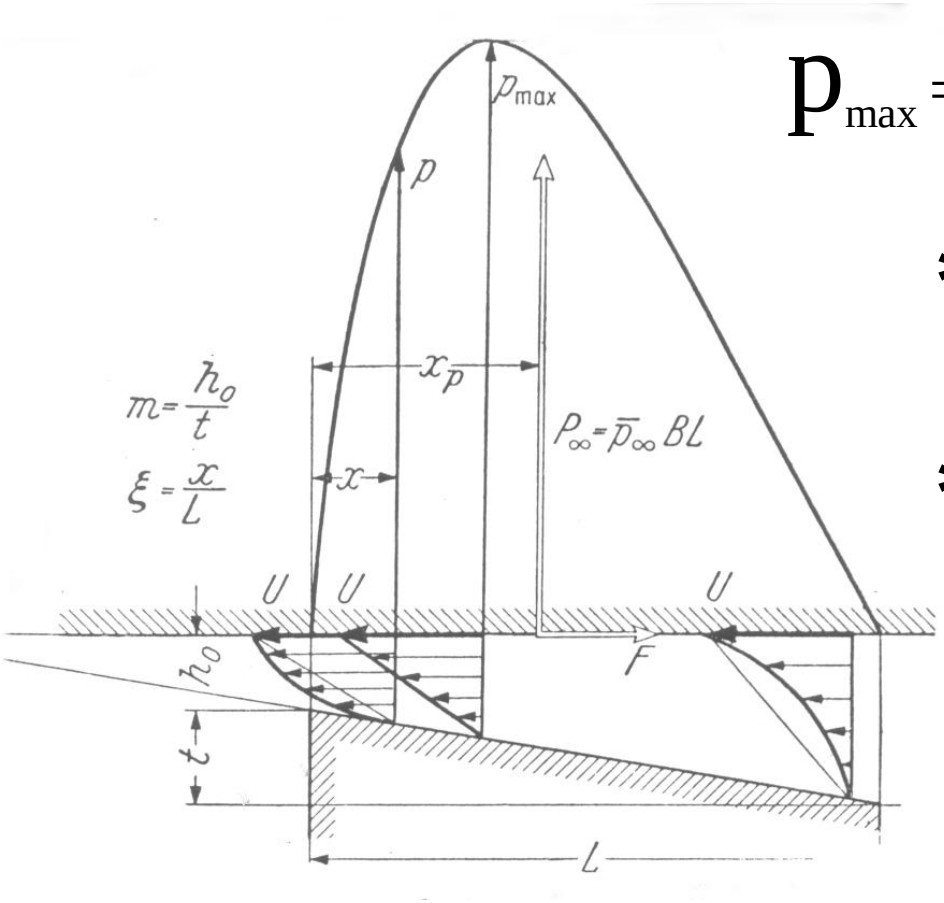
$$\tau = \eta * du / dy \qquad \text{(inner friction)}$$



$$dp/dx = d\tau/dy$$

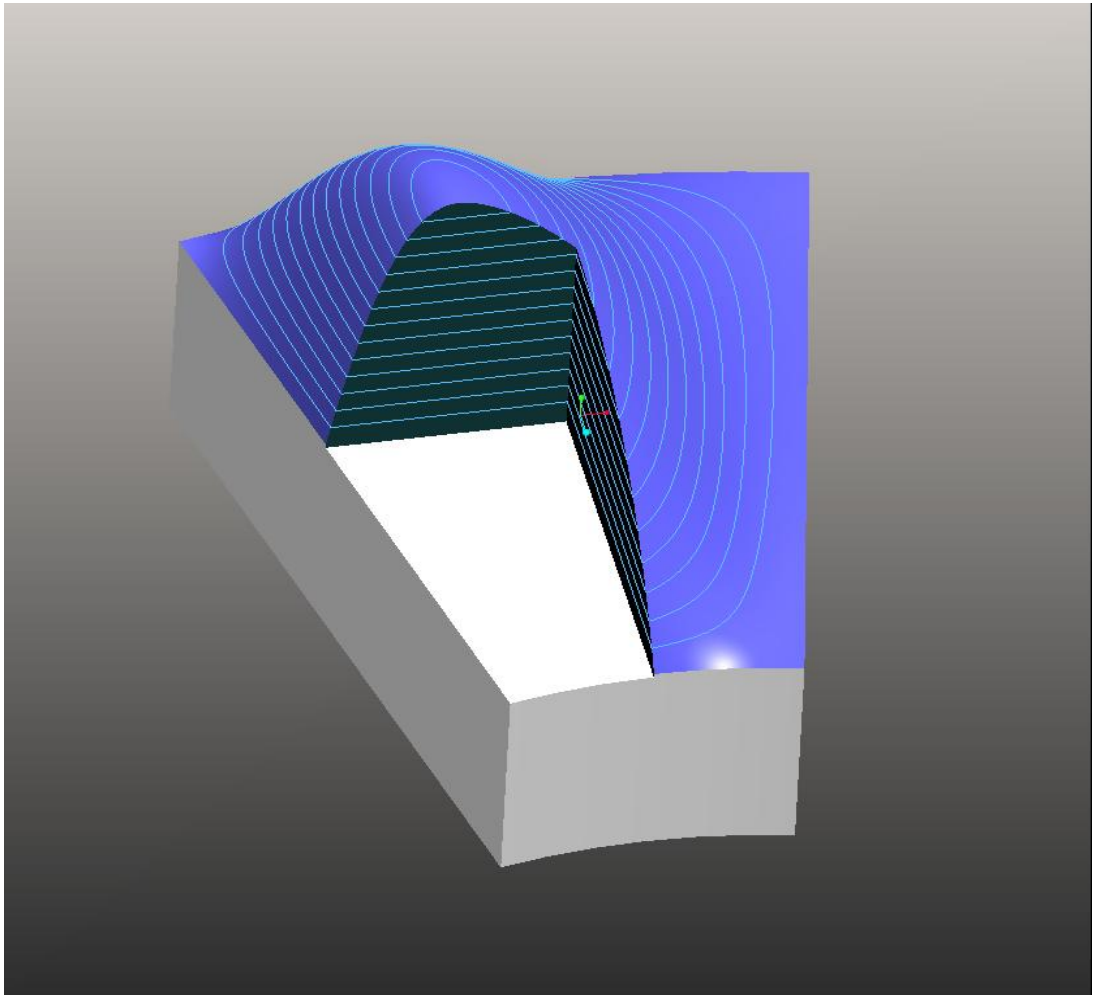
Liquid Friction

Oil film:



$$p_{max} = 6u * \eta * L/h_0^{\,2} * * m/[4 *(1+m) * * (1+2m)]$$

Isobars of pad pressure



Liquid Friction

- Solving of Reynolds' differential equation:

$$\Delta T = 4*k * p * (2 + k\sigma^2) / (\rho*c)$$

ΔT …temp. diff. betw. inlet and outlet edge

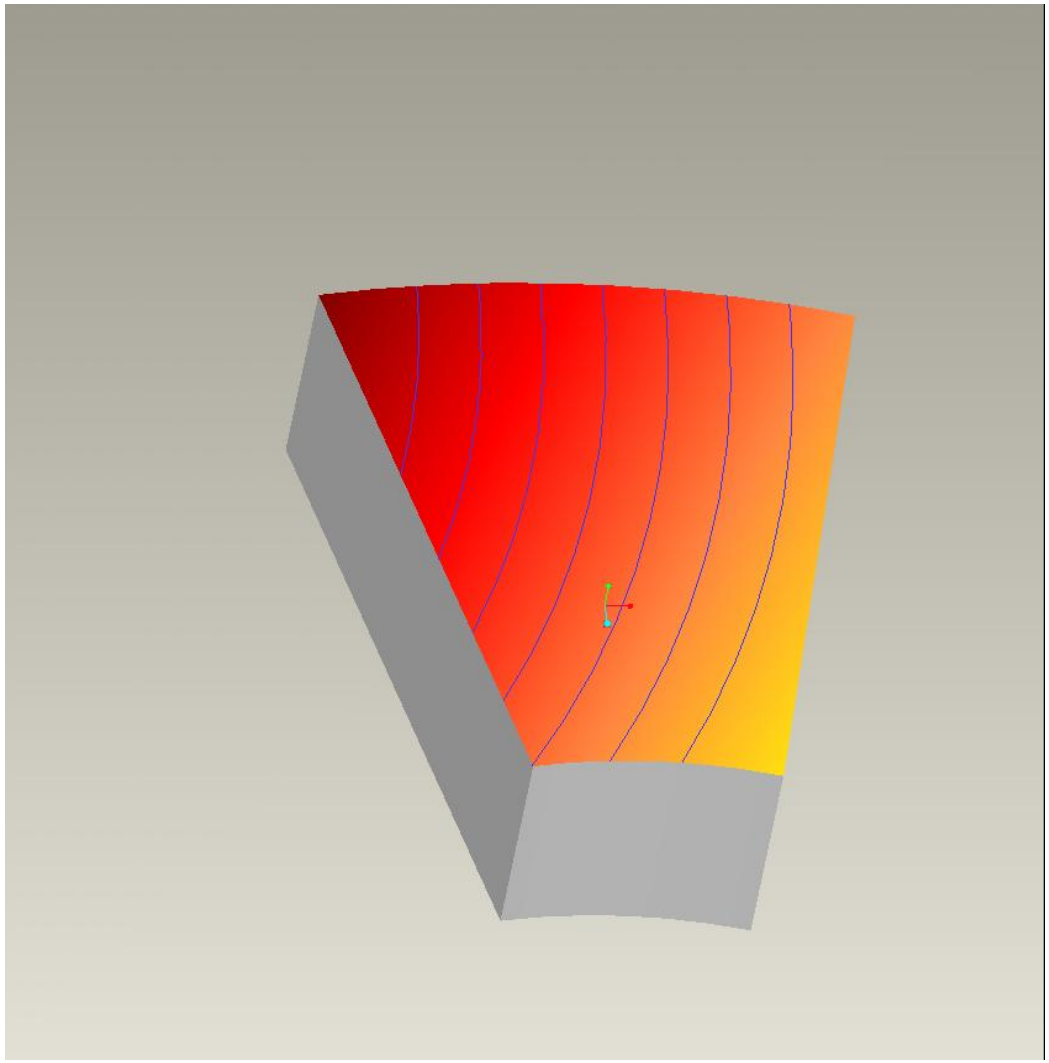
p……mean pressure

$\sigma = L/B$….length div. by width

c……spec. heat of liquid

ρ……spec. weight of liquid

Isothermal lines of thrust pad



- Temperature at inlet edge
- Temperature at outlet edge
- Temperature difference

Function of liquid friction bearings

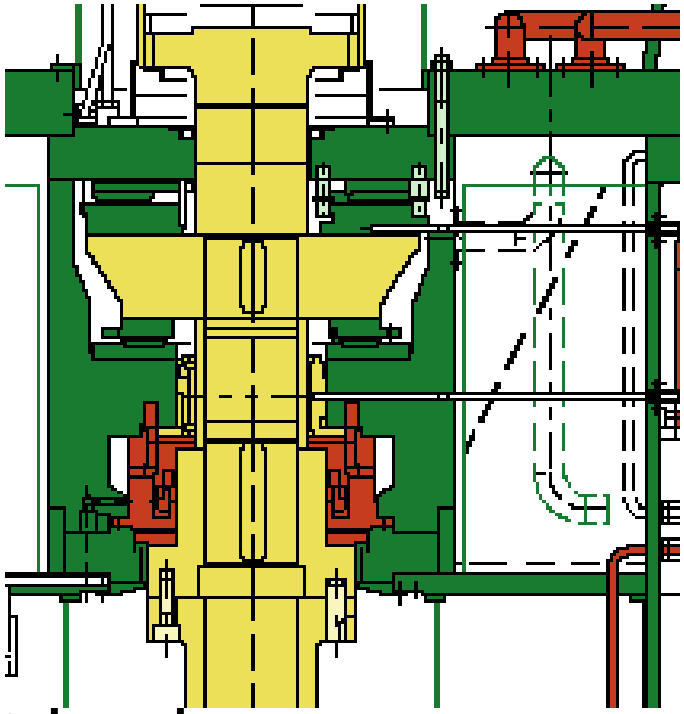
- Difference in diameter: shaft and bearing

- tilting of pads

Main Types of Slide Bearings

Axial (Thrust) Bearings

- fixed pads
- tilting pads



Radial Bearings with/without load

- single surface
- multiple surfaces (fixed or tilting pads)

Materials in Use

Running surface: steel in different hardness degrees (> 150 HB)

Bearing surface:

- White metal
- Bronze
- PTFE (TEFLON)

White Metal

Tin based alloys (without lead):

- good mechanical properties below 120° C

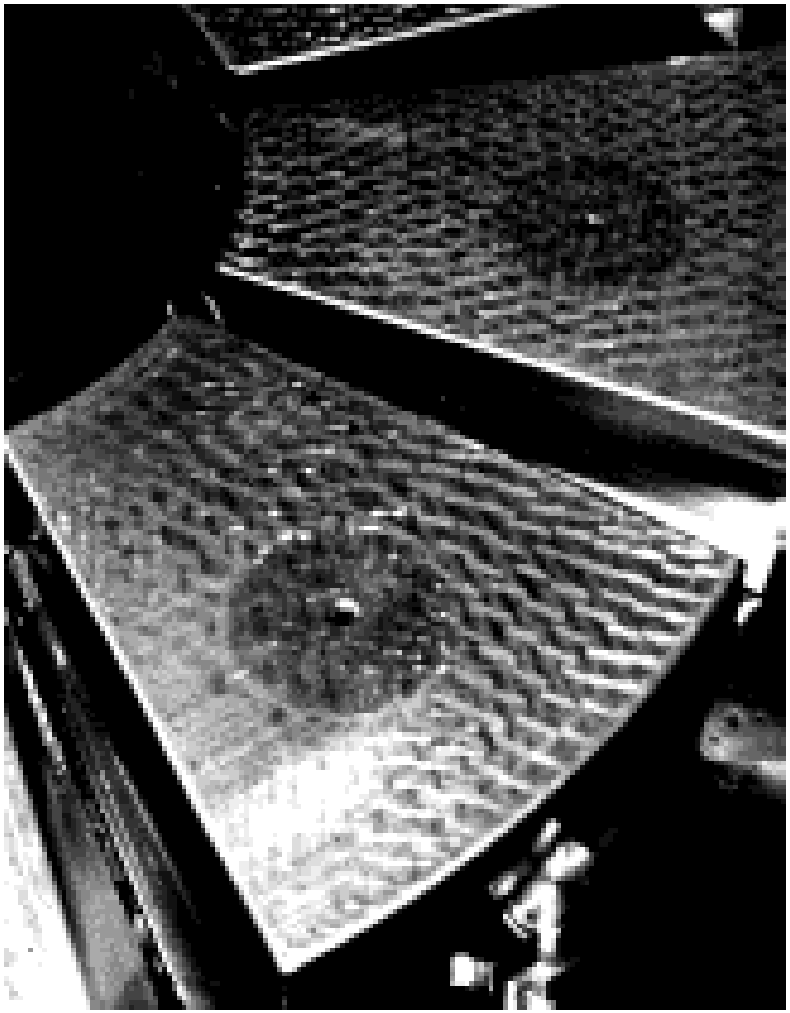
White metal with lead:

- good properties in case of no lubrication

Bronze

- for higher temperatures

- for higher loads

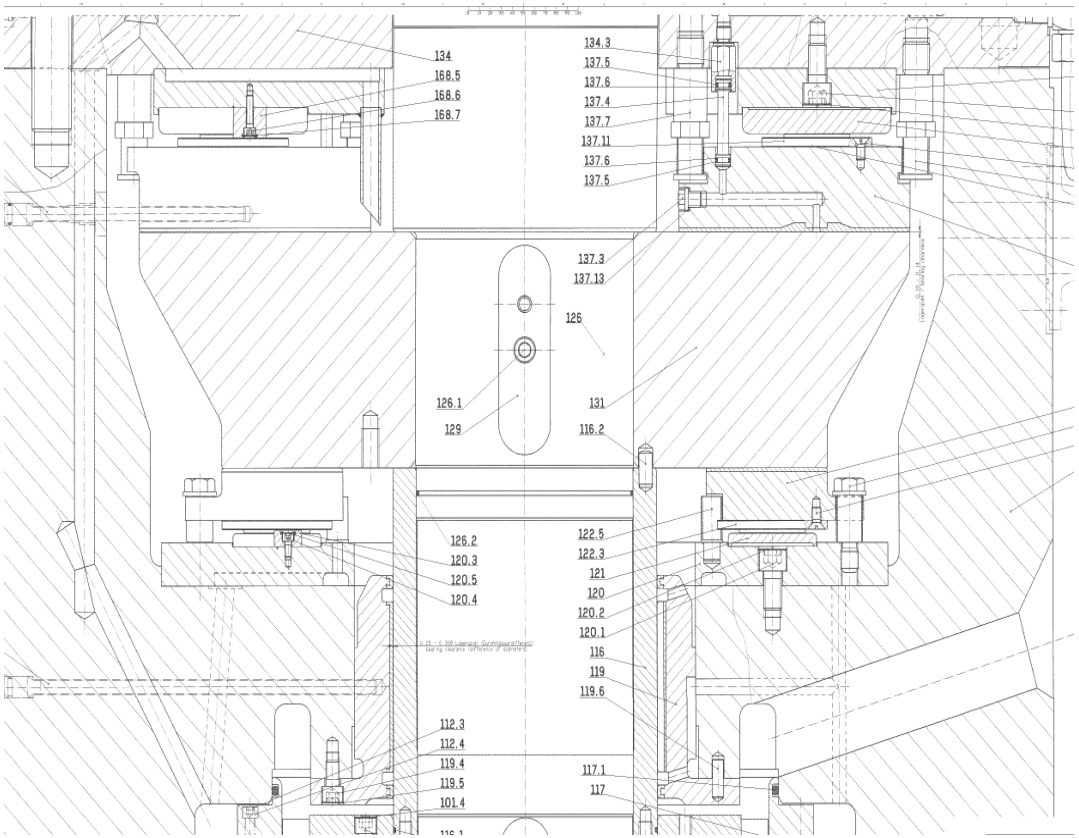


PTFE (TEFLON)

- for low noise level
- lower losses
- lower temperature
- lower live time

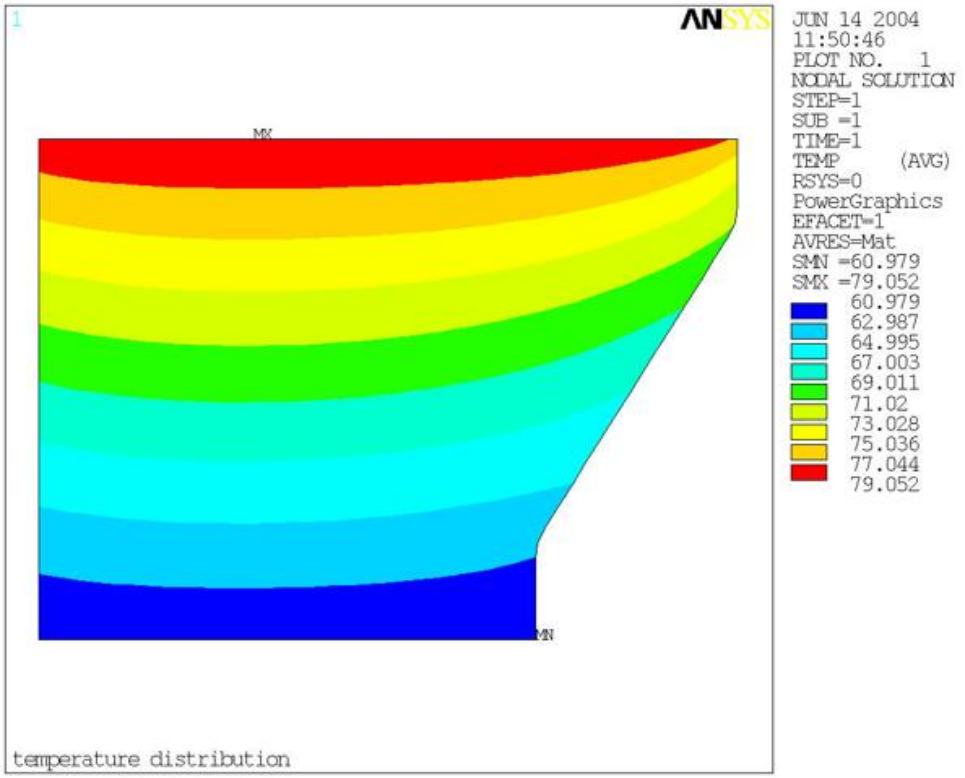
Design Criteria

- Internal limits
- Other losses in Bearings
- External Influences



Internal Limits

- Oil film Thickness
- Temperature
- Limits of Materials
- Oil film stiffness



Other Losses in Bearings

- Friction losses of rotating parts in oil

  $\sim n^{2,6}$ …. for disks and cylinders

- Losses of sealing rings

  n^2 ….on cylinder surface

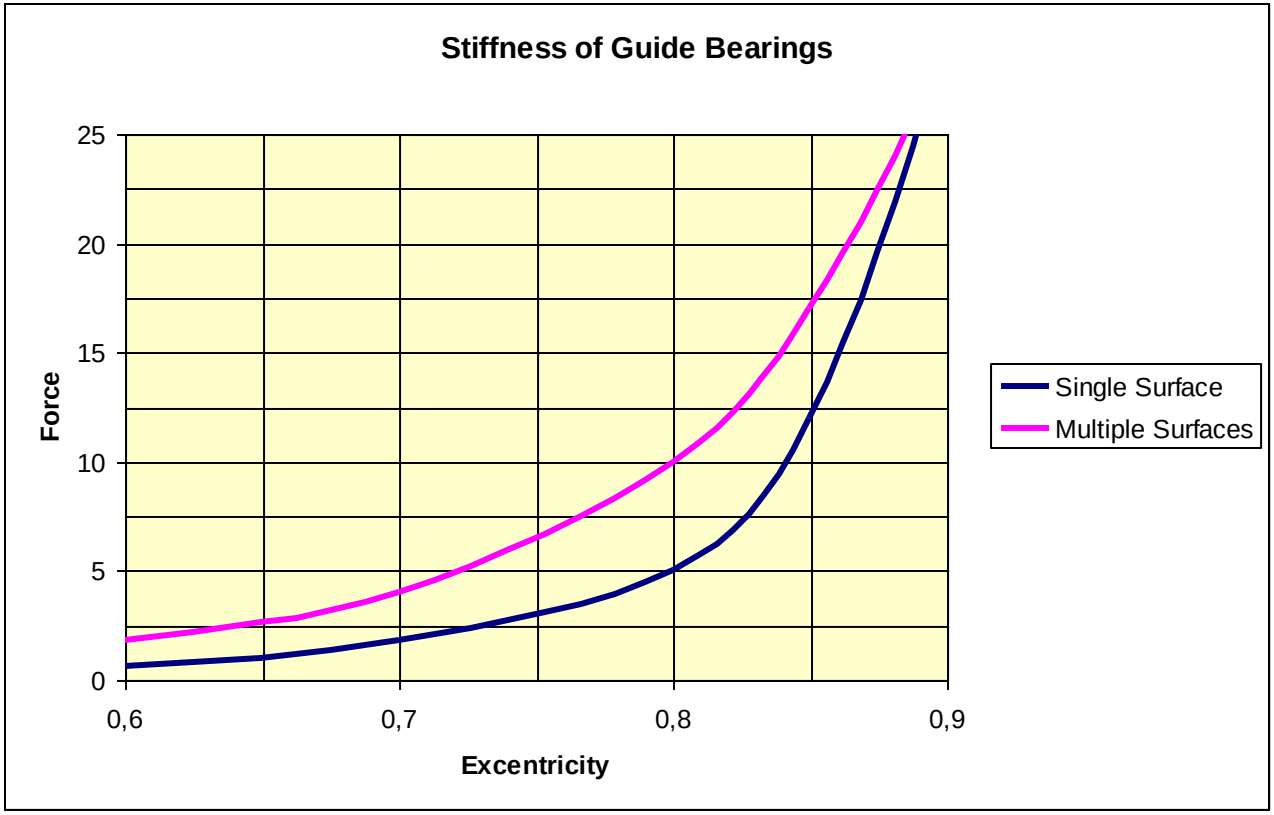
- Pump losses (in case of self lubricating bearings)

  $\sim n^2$

- Thrust bearing losses

  $\sim n^{1,7}$

Oil-film stiffness of guide bearings



External Influences

- Oil: air release ability, foam behaviour
- Coolers: design of coolers, water temperature
- Static and dynamic load: vibrations