SLIP BEARING

1. TECHNICAL DESCRIPTION, BACKGROUND

Figure 2 shows the slip bearing for an industrial gas turbine rotor. The slip bearing operates with oil, supplied continuously by a pump. The geometrical data: shaft diameter d = 400 *mm*, overall bearing length L = 500 *mm*, mean clearance t = 2 *mm*. Operational data: rotor speed: n = 1500 *RPM*.

2. PHENOMENON

The bearing oil is warming up, the outlet temperature is higher than the inlet one: $T_{\mathrm{out}} > T_{\mathrm{in}}$.

3. FIND THE REASON

4. ENGINEERING CALCULATIONS

A/ The inlet temperature is T_{in} = 300 *K*. The outlet temperature should not rise above T_{out} = 380 *K*, in order to avoid the degradation of oil.

Calculate the heat power absorbed by the oil. P = ? [W]

B/ Calculate the oil mass flow rate necessary to extract the heat from the bearing.
q_m = ? [kg/s]

C/ We would like to avoid oil velocity higher than v = 2 *m/s* in the oil supply line. What is the minimum diameter of the oil supply pipe? d_{pipe} = ? [m]

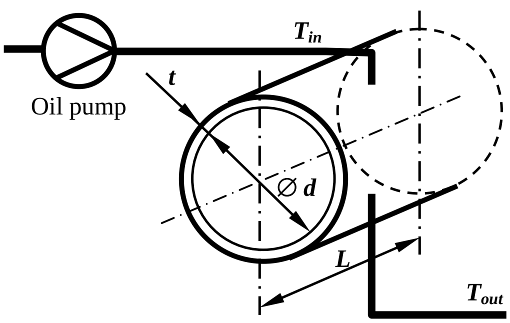

Figure 2.

Further data:

- The density of oil is $\rho = 800\ kg/m^3$
- The kinematic viscosity of oil at 300 *K* is $\nu_{300} = 10^{-4}\ m^2/s$
- The kinematic viscosity of oil at 380 *K* is $\nu_{380} = 0.8 \cdot 10^{-4}\ m^2/s$
- The specific heat of oil is $c = 2000\ J/(kgK)$