Design and calculations of a Gearbox - Report

Here are some points which should be addressed in the report. Some requirements are given in the project, attached below. This is one way of doing it, but the order of the different points can be different.

Analysis of the gearbox:

- Set up a clear product specification
- Develop 4 – 5 concepts and choose one for further development and calculations

Calculations – the size of the gearbox:

- Select the number of steps
- Calculate gear ratio in each steps
- Calculate the number of teeth
- Check the contact ratio
- Total gear ratio within 1%
- Make a simple 3D sketch

Calculations of the gears and the shafts:

- Calculate the force components of the pinion and gears
- Calculate the stress components, bending – and contact stress
- Draw diagrams for: Shear -, Axial force, Bending -, Torsional moment
- Calculate the diameters of the shafts
- Check the deflections and the angular deflections
- Decide the shape of the shafts
- Check the shafts against fatigue
- Check the critical speed (rotational frequency)

Connection between the gears and the shaft:

- For the pinion and gears, check the shrink fit (interference fit): transmitted power (torque), stress in the pinion gears, (Note: try H7/s6 if you are not able to choose the fit).

Bearings:

- For the pinion and gears:
- Choose bearings, “enradiga spårkullager”, SKF ?
- Choose oil
- Calculate the keys between the shafts and the flanges

NOTICE: After discussion with the representative of the class, we have decided that doing the FEA of one bearing in the gearbox wall, is out of the project. For those who have already started, and completed this issue, they will, of course, get credit for this work.

University of Agder
Mechatronics

MAS 413 Machine Technical Systems

Design of a gearbox

Candidates:

For one customer we are asked to design a gearbox for use in conjunction with a concrete mixer. The gearbox is driven by an electric motor and a requirement is that the concrete mixer should be in operation for 8 to 10 hours per day.

For the gearbox the following requirements are provided:

Speed of the input shaft 1: n_1 = ?? rpm

Effect on the shaft: P_1 = ? kW

Total gear ratio: i_t = ??

Pressure angle: $\alpha = 20^o$

Helix angle: $\beta = 15^o$

In addition, all the gears should be fastened to the shafts using interference fit. The couplings between the electric motor and the input shaft, and between the output shaft and the equipment are flanges. The flanges are attached to the shafts by keys. One can assume that the box is made of cast iron and the construction and detailing of the complete box is therefore outside this task.

But a detailed design using FEA is required for the highest loaded "middle" shaft, and also the part of the housing where the bearings are attached.

So the job is to select the concept, design individual items and document the work. The report shall include product specification, number of steps and calculations of: the gear ratio per step, dimensions of the gears, stresses in the shafts, the deflection of the shafts, interference fits, key connections, choice of rolling bearings, etc. etc.

Create construction drawings of the gearbox (ie, minimum total assembly drawing and detail drawing of the incoming shaft). Drawings could be done in SolidWorks, AutoCad or sketched by hand. The report can for example be written using MS Word.

Basis: Issued materials.

Out: **21.01.25**

In: **10.04.25**