MMAN2130 T3-2019

Design for High Volume Assignment 2

Weighting: 35%

Due: 11:55am, 25th November, 2019 (Monday Week 11)

Design for High Volume Assignment Requirements

With the success of your pump prototype, your group has received an order for 24,000 units of the pump. Your group is now required to write an engineering report to propose a high-volume (HV) design and process plan to manufacture the pump which you have prototyped.

The functional specification should still be followed. However, components can be combined should it be able to reduce any costs. Additionally, the customer has specified that the pump will operate in a dry and stable environment at normal room temperature and pressure.

In this assignment, you must now consider the new constraints and goal of your design for a HV situation. This includes material selection analysis, proposed changes to part designs and high-volume manufacturing plans.

A successful engineering report should have a logical structure with concise information. Avoid repeating the same information and ensure grammar and language is consistent.

High-Volume Re-design

The manufacturing process for your prototype and HV design will vary considerably. Consequently, it is imperative that you consider your pump design to suit HV manufacturing methods. Additionally, it may be beneficial to combine parts together to reduce manufacturing steps as cost is an important driver to stay competitive in the market.

Any important features of your HV design should be explained clearly as well as the changes from your prototype.

Additionally, to visualise the HV design, engineering drawings for each HV components must be included along with an assembly chart and an assembly drawing showing the whole pump HV design, including all off-the-shelf components.

Material Selection Analysis

Material selection is an important consideration for any designs. Materials must be selected to best suit the desired features and constraints of the design. To successfully make a material choice, you should consider the materials selection procedure covered in the course.

The process should include:

- Translation:
    - Identify the function, constraints, objectives and free variables and quantify where possible
- Screening
    - Investigate viable materials based on attribute limits through the use of a material selection charts
- Ranking
    - Identify material's suitability for the design ordering them based on the objective criterion using the materials index table and the materials selection charts. Please attach the relevant materials index table from which you choose the materials index from.
- Documentation
    - Explore the character of the shortlisted candidate materials in more depth discussing pros and cons to select the most suitable material.

A material selection analysis needs to be done for each part of your HV pump design, discussing factors that influence your choice. However, you are encouraged to be concise in your reasoning. Should two different components have the exact same function (in terms of loadings), constraints and objectives, they may both be analysed together.

To help with this process, you should consult seminar materials, pre-seminar activities and Ashby's "Materials Selection in Mechanical Design" 4th Edition which is available as an eBook via the UNSW Library. The relevant chapters are chapter 3-6 and a more comprehensive set of materials index table can be found in appendix C. You are expected to use this reference and cite accordingly.

Additionally, you are allowed to simplify your components as a basic shape for the materials selection processes (particularly for the materials index table). For example, your piston can be assumed to simply be a straight rod. Please state all assumptions where applicable.

Process Planning

Once your design has been solidified, you must now consider the manufacturing processes for **each** HV design components. To do this, you must compare **Four** different HV manufacturing methods summarising the pros and cons of each for your pump components.

Out of the four different methods you have analysed for each component, you are then required to select the **two** best method to perform a cost analysis to ultimately select the most cost-effective method. A sample cost analysis table can be found in the seminar notes. However, numbers should be based on real values with a source. (Request for a quote if possible)

An overall routing chart showing each component's processes and assemblies must then be created based on the selected manufacturing process.

Referencing

You are required to use the IEEE referencing style

Suggested Structure: (This is just a guide. Further breakdown of sub-headings should be considered if appropriate.)

1. Signed group submission coversheet
2. Table of Contents, Figures, Tables
3. Introduction
4. High-Volume Re-design
    a. HV design discussions for each HV components
    b. Assembly chart of HV design
    c. Assembly drawing of HV design
5. Material Selection Analysis
    a. A material selection analysis for each HV component
6. Process Planning
    a. Research on relevant HV manufacturing methods (**four** different methods for each component)
    b. Cost analysis of HV manufacturing methods and selection (best **two** methods discussed in section 6a.)
7. Conclusion
8. Appendix
    a. AS1100 Engineering drawings of HV components
    b. Routing chart for HV manufacturing
9. Bibliography
    a. Use the IEEE style (in text) for referencing and citation.
10. (Optional) A group reflection on this course as a whole. You are free to make constructive criticisms and provide suggestions for course improvements.

Additional Information

This is a group assignment where all members are expected to contribute to its completion. There will be **No** Peer Scaling at the end of this assignment. Groups are expected to ensure team communication exists and tasks are delegated to complete this assessment task. (Much like in a real-world engineering project). If your team has serious concerns in terms of team member contribution (e.g. a member stops responding to messages and emails). Please email the head tutor at least 1 week **BEFORE** the due date.

Helpful note!

NOTE: "The indices listed in Tables C.1 through C.7 are, for the most part, based on the objective of minimizing mass. To minimize material cost, use the index for minimum mass, replacing the density, ρ" (Materials Selection for Mechanical Design, 4th Edition, Appendix C)