ME 433 - Design Report Format

1. Cover Page

Title of Project
Names of Team Members
Date

Summary (100-200 words): Briefly describe the nature of the problem, the model study experiments you conducted in order to calculate numerical values for prototype rpm, total pressure head rise in inches of water, and brake horsepower. Specify the numerical values for these quantities.

2. Table of Contents

List the major sections of your report referenced by the starting page number of each section.

3. Introduction

Describe in detail the nature of the problem, the experiments you conducted, and how the experimental data were used to specify prototype operating conditions.

4. Experimental Apparatus and Procedure

(a) Experimental flow apparatus: Describe the flow system and instrumentation by referring to Fig. 1 (to be provided by Instructor).

(b) Initial measurements: Describe the data taking procedures you followed when obtaining data at a fixed model flow rate ($Q_m \cong 2800$ cfm) and the problems observed when uncertainty estimates were applied to the η vs C_Q results. (Refer to Appendix A for how a model flow rate of 2800 cfm was determined from the specified operating conditions, to Appendix B for how $(\Delta h_v)_m$ in inches of water was evaluated corresponding to the specified model flow rate, and to Appendix C for the analytical development of the equation used to calculate the uncertainty in η).

(c) Final measurements: Describe the rationale for retaking the data; this time at three different rpms over a restricted C_Q range in order to determine peak efficiency.

Results and Discussion

(a) Initial results: Discuss Fig. 2 (η vs C_Q) based on measurements taken at $Q \cong$ 2800 cfm.

(b) Final results: Discuss Fig. 3 (η vs C_Q) and Fig. 4 (C_P vs C_Q) based on measurements at three different rpms. (Use a different symbol for each rpm in these figures.) Explain how least-squares-fits (LSF) of the data were used to determine peak efficiency, C_Q*, and C_P*, and give numerical values for these variables. Show the analytical LSF equation in each figure. Refer the reader to Appendix D for tabulated data and data reduction formulas used to calculate the results shown in Figs. 3 and 4.

(c) Prototype operating conditions: Explain how model study results were converted to prototype-related variables. Refer to Appendix E for details of the calculations.

Conclusions

Tabulate final values of prototype rpm, total pressure head rise in inches of water, and brake horsepower. Comment on the accuracy of these results based on the model study experiments used to generate these values. Suggest possible ways that the data taking procedures and/or instrumentation could be modified to improve the accuracy of the results.

Figures

Place Figs. 1-4 after **Conclusions** and before **Appendices.**

Appendices

Appendix A: Calculation of the model flow rate $Q_m \cong 2800$ cfm for the specified operating conditions.

Appendix B: Evaluation of $(\Delta h_v)_m$ in inches of water corresponding to $Q_m \cong 2800$ cfm. (Show complete "hand" calculations with all conversion factors included in the equations).

Appendix C: Uncertainty estimates for η. (Show a sample "hand" calculation).

Appendix D: Measured data and calculated results. (Show tabulated data and results based on initial and final measurements using a separate table for each set of measurements (2 tables). Be sure to include units for all dimensional column headings in the tables. Show all equations used to reduce the data and include all necessary conversion factors in these equations. "Hand" calculations to reduce the data are not necessary.

Appendix E: Calculation of prototype operating conditions. (Show complete "hand" calculations of how prototype-related variables were calculated from model study results for peak efficiency, C_Q*, and C_P*).