Guide to Writing your Final Reports

This document provides guidance on how to compose your final project reports.

General Advice

The primary objective of an engineering report is to transmit technical information to individuals having training comparable to that of the author. The information in the report should be presented as clearly and concisely as possible. Imagine that you are writing a report that you would want to read. Imagine that you will have to make an important decision based on the information in the report.

The technical content in the report will not be efficiently transmitted if the report is disorganized or poorly written. Conversely, regardless of how well the prose is written, the report needs to be built upon sound engineering and provide concrete evidence to support the conclusions.

Writing well takes effort. Writing well takes practice. Writing well requires learning how to edit and revise your own writing. Therefore, it is wise to practice writing regularly.

Reports

A final project report is more complicated than a lab report or technical research paper. Final project documentation is expansive and contains many different file formats. Your final project documentation also has evolved as the team's knowledge of the design problem and its solution evolves.

Complex Documentation Formats

A major complication with final reports is the scope and variety of documentation required to make a design transferable: CAD files, assembly instructions, bill of materials, etc. Including all this information in a single, written report would make the document unwieldy and, therefore, defeat the purpose of efficiently conveying information to the client and other engineering teams. Furthermore, the digital CAD files need to be made available in a format that engineers can easily reuse in continued development of the design.

General Report Writing Guidance

Have a look at the following writing resources

- The Elements of Style by William Strunk Jr. and E.B. White
- A Writer's Reference by Diana Hacker and Nancy Sommers
- thesaurus.com
- The Owl (*On-line Writing Lab*) at Purdue University

The following sections provide general guidance for writing technical documentation. This guidance also applies to final reports.

Purdue's OWL

The Purdue Online Writing Lab is an outstanding source of information on writing. If you have a question about the structure of documents, grammar, or citation of references, search OWL first. In particular, consider the following entry points to the OWL site.

- Writing in Engineering
- Professional, Technical Writing
- Research and Citation
- Grammar

Citation of Information not Created by the Team

All work of others – technical reports, images, data, equations, performance specifications, laboratory procedures, design documents – must be properly attributed to the source. The internet is an abundant source of information, and web browsers make it easy to copy text and images. Just because it is technically easy to copy from internet sources, *do not use information from the internet without attribution*.

For guidance on citations, refer to web sites by the American Society of Mechanical Engineers, the American Physical Society, the Institute of Electrical and Electronic Engineers, and the University of Pittsburgh Library.

- ASME Guide to references
- APS Example References
- IEEE Style Manual
- Pitt library guides on How to Reference Sources

Ethical and Professional Conduct

Appropriate citation of sources is an ethical responsibility of being an engineer. Refer to ASME's Ethical Standards for Authors. The basic ideas are to give credit where it is due, and not claim the work of others as your own.

In addition to the ethical obligation to cite prior work, engineers are responsible for the truthful and accurate reporting of results of analysis and experimentation. In its publication, On Being a Scientist, the National Academy of Engineering cite the U.S. Office of Science and Technology policy on behaviors that constitute research misconduct:

- *Fabrication is the "making up of data or results"*
- *Falsification is "manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately" represented in the research record."*
- *Plagiarism is "the appropriation of another person's ideas, processes, results, or words without giving appropriate credit"*

All of these behaviors are to be avoided.

Tables and Figures

All tables and figures should have a number and caption. Captions for tables go above the table, as shown in Table 1, below. Captions for figures go below the figure, as shown in Figure 1, below Software packages that create plots, e.g. Excel, R, MATLAB, provide the option of creating a plot title that is usually displayed above the plot axes. The plot title *is not a caption*. For a single plot frame, the title supplied by the software is usually redundant. When the figure is a composite of two or more plots, titles for individual plots are helpful. It is also highly recommended to insert tables (as data) instead of inserting an image (screen shot) of a table created in another software. Students may opt for creating the tables using the tools in MS Word. Table below shows both options.

Table 1: Dimensions of heat sinks. *H*, *L* and *W* are the height, length and width of the heat sink in inches. (Demonstration of a table caption.)

Label	*H* (mm)	*L* (mm)	*W* (mm)
A	18	43	44
B	10	53	53
C	5	43	44
D	10	53	53
E	25	53	54
F	17	43	44

Label	H (mm)	L (mm)	W (mm)
A	18	43	44
B	10	53	53

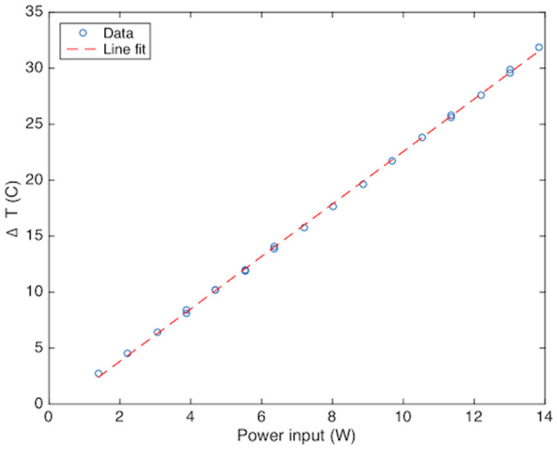

Figure 2: Measured temperature rise versus power input: demonstration of a figure caption.

Equations

There are two ways of presenting equations in technical documentation: in-inline and displayed. An in-line equation flows with the rest of the text. For example, Einstein's famous equation is e=mc2e=mc2. In-line equations can be used as a rhetorical device to aid reasoning, as shown in the following examples

The hydrostatic equation, p=ρghp=ρgh*, shows that the fluid pressure increases linearly with depth,* hh*, and does not depend on the volume of fluid.*

From the formula for moment of inertia of a rectangular cross section, I=112bh3I=112bh3*, the beam stiffness is significantly more influenced by changes to the beam depth,* hh*, than to changes to its width,* bb.

In both of the preceding examples, the in-line equation adds precision and clarity to the sentence. It would be less efficient and more clumsy to attempt conveying the same information in words only.

A displayed equation occupies a separate line in the document. For example, using the displayed equation format, the Bernoulli Equation is

$$\frac{p_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{p_2}{\gamma} + \frac{V_2^2}{2g} + z_2$$

Displayed equations should be centered and have a right-justified, numerical label in parenthesis. *Do not* label equations with "Equation" or other text, as illustrated bellow.

$$\frac{p_1}{\gamma} + \frac{V_1^2}{2g} + z_1 = \frac{p_2}{\gamma} + \frac{V_2^2}{2g} + z_2$$

~~(Equation 1)~~

Equation labels are only numbers

Displayed equations are preferred for your submissions over in-line equations, especially when documenting a calculation procedure or explaining analytical or experimental results. The use of equation numbers makes it easy to unambiguously refer to an equation. A displayed equation is also easier to find when scanning a document.

References

1. Institute of Medicine. 2009. *On Being a Scientist: A Guide to Responsible Conduct in Research*: Third Edition. Washington, DC: The National Academies Press. https://doi.org/10.17226/12192, p. 15
2. http://web.cecs.pdx.edu/~gerry/class/ME492/notes/guide_to_writing_for_capstone.html