

To: Mechanical Engineering Students
From: Mechanical Engineering Faculty
Date: January 10, 2005
Subject: Guidelines for Writing Technical Memos in the Mechanical Engineering Program
CC: Rebecca DaPra, Trine Kvidal, Communication Instructors
Attachments: 3

Introduction

Memos are a concise and effective way to communicate information internal to a company or organization. As such, memos should be organized and written in a manner that allows the reader to readily access the important information. The purpose of the present memo is to 1) describe a set of authors' guidelines for writing technical memos specific to the Mechanical Engineering (ME) program and 2) provide a template/model of the basic formatting features of the standardized ME memo.

Methods and Procedures

Memo Format. Memos are written in third person using formal English (no slang). Margins are 1 inch on all sides. Page numbers are centered at the bottom of each page. The main body of the text is left-justified. Paragraphs are separated by a double space and are not indented. All text utilizes the Times Roman font.¹ Appropriate font sizes and styles are listed in Table 1. The length of the memo ranges between 1-5 pages, depending on the assignment, but should be as short as possible to convey the necessary information. Single-sided copies are strongly preferred, and multiple pages must be stapled.

Lists. Lists may be used to highlight a group of related items or topics. If there is no preferential ordering to the list, then simple bullets should be used, such as:

- Item 1
- Item 2
- Item 3

To emphasize a particular order, e.g., importance, chronological, etc., an enumerated list should be used. In the case of descriptive lists containing complete sentences, the leading phrase is italicized:

1. *Monday.* Skies were cloudy. About 3 inches of snow fell in the upper elevations.
2. *Tuesday.* Temperatures dropped below freezing in the valley.
3. *Wednesday.* Very low visibility existed due to the onset of an inversion. Pollution levels in the valley exceeded the safe limit, as determined by the EPA.

Descriptive lists may either be enumerated or bulleted.

Results

All figures and tables should be placed in an attachment if they are not subjects of primary discussion. Figures and tables in attachments must be referenced to by number in the main text

¹ Footnotes are numbered consecutively from the beginning of the document and placed at the bottom of the same page on which they are referenced.

of the memo. Figures and tables that are primary discussion subjects should be included in the main text. The word “figure” and “table” is capitalized when it refers to a specific item in the memo or attachment. For example, Figure 1 shows the aerodynamic drag of a test specimen as a function of the freestream velocity and angle of attack. In most cases, the instructor will require error bars on the experimental data, to indicate the uncertainty or statistical variation associated with any given data point.

Figures and Tables. A figure may be a graphical plot, schematic, or photograph. Each figure and table must have an adequate caption that provides enough description so that the reader does not have to consult the main body of text to understand the content of the figure or table. In a graphical plot, the axes are labeled appropriately with the corresponding units of measurement in parentheses. For example, do not use “column 1” and “column 2” as axes labels. There is no title above the figure. If two or more lines are plotted in the same figure, then a legend must be used. Different line styles in the plot should be made distinctly clear.

Equations. Equations are numbered consecutively, with the reference number appearing inside parenthesis and right-justified on the same line as the equation. Equations are meant to read like sentences and, as such, are punctuated accordingly. For example, with aerodynamic forces, the drag force, D , on an object can be represented by the equation

$$D = \frac{1}{2} \rho C_D V_\infty^2 S, \quad (1)$$

where ρ is the density of the fluid (in this case, air), C_D is the drag coefficient, V_∞ is the velocity of the fluid (or the sphere through the fluid), and S is a shape factor. For a sphere, the drag coefficient can be approximated by the equation

$$C_{D,sphere} \approx \frac{24}{Re} + \frac{6}{1 + \sqrt{Re}} + 0.4, \quad (2)$$

where Re is the Reynolds number (a dimensionless number). Re can be calculated using

$$Re = \frac{2\rho V_\infty r}{\mu}, \quad (3)$$

where r is the radius of the sphere and μ is the viscosity of the fluid (in this case, air). The shape factor, S , for a sphere is equivalent to the frontal area of the sphere (a circle), or

$$S = \pi r^2. \quad (4)$$

Attachments. Attachments follow the main text of the memo and include a descriptive title at the top of each page. Attachment 1 contains the figures and tables most relevant to the main points of the memo. Figures and tables appear in Attachment 1 according to the order in which they are referenced in the main text. In some cases, the instructor may require additional detailed information of a more secondary nature, such as tables of raw data, hand calculations, and computer codes. Each additional attachment must be referenced explicitly in the main text. For example, Attachment 2 contains the raw data associated with the results presented in Figure 1.

Discussion

The following list describes the expected content in the main parts of a typical technical memo:

1. *Introduction.* The introduction includes a brief statement of the purpose of the memo and a brief summary of any necessary background information.

2. *Methods and Procedures.* This section describes the experimental, numerical, and/or theoretical methods used in the work. A schematic of the experimental setup is referenced, if appropriate.
3. *Results.* Figures and tables, containing the relevant technical information, are referenced and described in the results section.
4. *Discussion.* The discussion section contains information relative to the interpretation of the results. For example, experimental data may be compared to the appropriate engineering theory.
5. *Conclusion.* This section contains a brief summary of the main conclusions drawn from the work. Recommendations for future work may also be included, when necessary.

Individual instructors may require additional sections or variations to the traditional sections listed above.

Conclusions

The standardized ME memo is meant to eliminate potential grading issues associated with memo format. In this manner, the grade on the memo should reflect an appropriate balance between 1) the accuracy of the technical information presented and 2) the effectiveness of the communication (grammar, organization, clarity, etc.). Attachment 3 provides a basic list of criteria for evaluating memos. Specific grading criteria and weighting, however, will necessarily vary between courses and assignments.

Attachment 1: Figures and Tables

Table 1. Font sizes and types used in the standardized ME technical memo.

Font Size	Font Style			
	Regular	Bold	Underline	Italic
14		Memo title above border of heading		
12	Main text; Heading; Equations	Main section titles*	Subsection titles*	Leading phrase in descriptive lists
11	Figure and table captions; Tables	Figure and table identifiers that precede text of caption		
10	Footnotes			

* First letter of each word in title is capitalized.

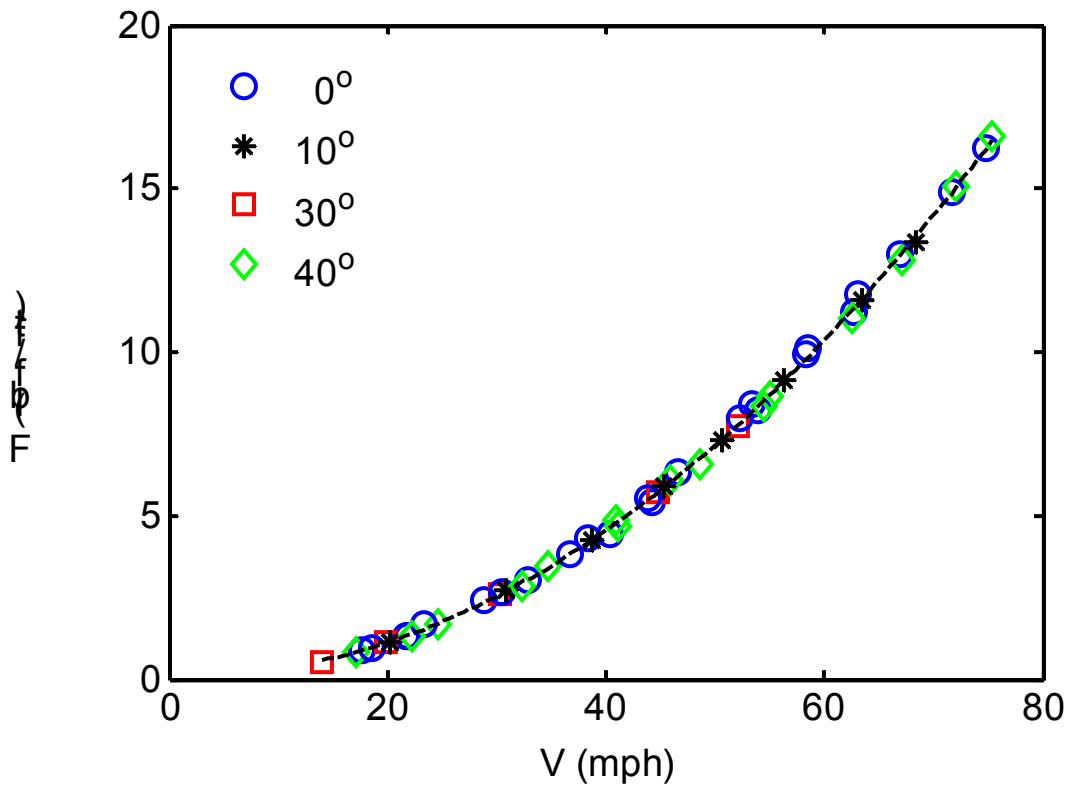


Figure 1. Plot of the aerodynamic drag of the test specimen versus freestream velocity, for four different

Attachment 2: Raw Data

Raw data from experiment 1.

Thermocouple Number	x_i (m)	x_i/L	First Measured Temperature (C)	Second Measured Temperature (C)
1	0.0048	0.0051	115.0	111.9
2	0.0352	0.0383	100.8	98.3
3	0.0962	0.1046	77.5	75.7
4	0.1572	0.1709	64.0	62.7
5	0.2334	0.2538	50.9	50.3
6	0.3095	0.3367	40.9	41.0
7	0.4619	0.5025	32.2	32.5
8	0.6143	0.6683	27.6	28.0
9	0.7667	0.8341	25.6	25.8
10	0.9191	1.0000	24.9	25.1

Attachment 3: Criteria for Evaluating Memos

Memos will be graded on the following basic criteria (not necessarily ordered by importance), in addition to other criteria required by the individual instructor:

- Appropriateness and accuracy of technical content (as required by the instructor)
- Effectiveness of introductory paragraph describing the purpose/topics of memo
- Effectiveness of concluding paragraph summarizing main points in the memo
- Organization of ideas and technical information (accessibility to reader)
- Professional appearance
- Consistency in tone and sentence style
- Presentation of figures, tables, and equations
- Content of the attachments
- Correct spelling, word usage, mechanics, and grammar