

Avoid These Technical Writing Mistakes

Here's how to overcome a dozen common problems, including poor organization, inappropriateness for the audience, "technicalese," long sentences, big words, inconsistent usage, redundancy, a poorly defined topic, and inadequate content.

Robert W. Bly,
The Center for Technical
Communication

The average engineer in industry cannot write clear, lucid prose. He or she may know the basics — sentence structure, grammar, punctuation, and exposition. However, most engineers have just a few poor stylistic habits that mar their technical writing, making it dull and difficult to read.

Why do engineers write so poorly? Many feel that writing is time consuming, unimportant, and unpleasant. Others lack confidence in their ability to communicate, or simply don't know how to get started. A third group has the desire to write well, but lacks the proper training.

This article discusses the 12 most common problems in technical writing and provides tips on how to recognize them and how to solve them.

1. Poor organization

According to a survey of hundreds of engineers who have attended my writing seminars, poor organization is the number one problem in engineering writing. As one technical writer points out, "If the reader believes the content has some importance to him, he can plow through a report even if it is dull or has lengthy sentences and big words. But, if it's poorly organized — forget it. There's no way to make sense of what is written."

Poor organization stems from poor planning. A computer programmer who would never think of writing a complex program without first drawing a flow chart would probably knock out a draft of a user's manual without making notes or

an outline. In the same way, a builder who requires detailed blueprints before laying the first brick will write a letter without really considering the message, audience, or purpose.

Before you write, plan. Create a rough outline that spells out the contents and organization of your paper or report. The outline need not be formal. A simple list, doodles, or rough notes will do. Use whatever form suits you.

By the time you finish writing, some things in the final draft might be different from the outline. That's okay. The outline is a tool to aid in organization, not a commandment etched in stone. If you want to change it as you go along, fine.

The outline helps you divide the writing project into many smaller, easy-to-handle pieces. The organization of these parts depends on the type of document you're writing.

In general, it's best to stick with standard formats. A laboratory report, for example, includes: an abstract; table of contents; summary; introduction; main body (theory, apparatus and procedures, results, and discussions); conclusions and recommendations; nomenclature; references; and appendices. An operating manual includes: a summary; introduction; description of the equipment; instructions for routine operation, troubleshooting, maintenance, and emergency operation; and an appendix containing a parts list, spare-parts list, drawings, figures, and manufacturer's literature.

If the format isn't strictly defined by the type of document you are writing, se-

lect the organizational scheme that best fits the material. Some common formats include:

- *Order based on location.* An article on the planets of the solar system might begin with Mercury (the planet nearest the sun) and end with Pluto (the planet farthest out).

- *Order based on increasing difficulty.* Computer manuals often start with the easiest material and, as the user masters basic principles, move on to more complex operations.

- *Alphabetical order.* This is a logical way to arrange a booklet on vitamins (A, B-3, B-12, C, D, E, and so on) or a directory of company employees.

- *Chronological order.* Here you present the facts in the order in which they happened. History books are written this way, as are many case histories, feature stories, and corporate biographies.

- *Problem/solution.* Another format appropriate to case histories and many types of technical reports, the problem/solution scheme begins with “Here’s what the problem was” and ends with “Here’s how we solved it.”

- *Inverted pyramid.* This is the style used in newspapers, where the lead paragraph summarizes the story and the following paragraphs present the facts in order of decreasing importance. You can use this format in journal articles, letters, memos, and reports.

- *Deductive order.* You can start with a generalization, then support it with particulars. Scientists use this format in research papers that begin with the findings and then state the supporting evidence.

- *Inductive order.* Another approach is to begin with specific instances, and then lead the reader to the idea or general principles the instances suggest. This is an excellent way to approach trade journal feature stories.

- *List.* The article you’re now reading is a list article because it describes, in list form, the most common problems in technical writing. A

technical list article might be titled “Six Tips for Designing Wet Scrubbers” or “Seven Ways to Reduce Your Plant’s Electric Bill.”

2. Misreading the reader

When I admit to doing some direct-mail copywriting as part of my consulting work, people turn up their noses. “I always throw that junk in the garbage,” they say. “Who would ever buy something from a letter addressed to ‘Dear Occupant’?”

They’re right, of course. Written communications are most effective when they are targeted and *personal*. Your writing should be built around the needs, interests, and desires of the reader.

With most technical documents — articles, papers, manuals, reports, brochures — you are writing for many readers, not an individual. Even though we don’t know the names of our readers, we need to develop a picture of who they are — their job title, education, industry, and interests:

- *Job title.* Engineers are interested in your compressor’s reliability and performance, while the purchasing agent is more concerned with cost. A person’s job influences his perspective of your product, service, or idea. Are you writing for plant engineers? Office managers? CEOs? Machinists? Make the tone and content of your writing compatible with the professional interests of your readers.

- *Education.* Are your readers PhDs or high-school dropouts? Are they chemical engineers? Do they understand computer programming, thermodynamics, physical chemistry, and the calculus of variations? Write simply enough so that even the least technical of your readers can understand what you are saying.

- *Industry.* When engineers buy a reverse-osmosis water purification system for a chemical plant, they want to know every technical detail down to the last pipe, pump, fan, and filter. Marine buyers, on the other hand, have only two basic

questions: “What does it cost?” and “How reliable is it?” Especially in promotional writing, know what features of your product appeal to the specific markets.

- *Level of interest.* An engineer who has responded to your ad is more likely to be receptive to a sales call than someone who the salesperson calls on “cold turkey.” Is your reader interested or disinterested? Friendly or hostile? Receptive or resistant? Understanding the reader’s state of mind helps you tailor your message to meet that person’s needs.

If you don’t know enough about your reader, there are ways to find out. If you are writing an article for a trade journal, for example, get several copies of the magazine and study it before you write. If you are presenting a paper at a conference, look at the conference brochure to get a feel for the audience who will be attending your session. If you are contributing text to product descriptions, ask the marketing or publications department about the format in which the material will be published, how it will be distributed, and who will be reading it.

3. Writing in “technicalese”

Anyone who reads technical documents knows the danger of “technicalese” — the pompous, overblown style that leaves your writing sounding as if it were written by a computer or a corporation instead of a human being.

“Technicalese,” by my definition, is language more complex than the concepts it serves to communicate. By loading up their writings with jargon, clichés, antiquated phrases, passive sentences, and an excess of adjectives, technicians and bureaucrats hide behind a jumble of incomprehensible memos and reports.

To help you recognize “technicalese,” I’ve shown a few samples from diverse sources in Table 1. Note how the authors seem to be writing to impress rather than to express. All of these excerpts are real.

Table 1. Avoid “technicalese” such as this.

“Will you please advise me at your earliest convenience of the correct status of this product?” — Memo from an advertising manager

“All of the bonds in the above described account having been heretofore disposed of, we are this day terminating same. We accordingly enclose herein check in the amount of \$30,050 same being your share realized therein, as per statement attached.” — Letter from a stockbroker

“This procedure enables users to document data fields described in master files that were parsed and analyzed by the program dictionary.” — Software user’s manual

Table 2. Use the active voice to make your writing more direct and vigorous.

Passive Voice	Active Voice
Control of the bearing-oil supply is provided by the shutoff valves.	Shutoff valves control the bearing-oil supply.
Leaking of the seals is prevented by the use of O-rings.	O-rings keep the seals from leaking.
Fuel-cost savings were realized through the installation of thermal insulation.	The installation of thermal insulation cut fuel costs.

How do you eliminate “technicalese” from your writing? Start by avoiding jargon. Don’t use a technical term unless it communicates your meaning precisely. Never write “mobile dentition” when “loose teeth” will do just as well. When you avoid jargon, your writing can be easily read by novices and experienced professionals alike.

Use contractions. Avoid clichés and antiquated phrases. Write simply.

Use the active voice as much as possible. In the active voice, action is expressed directly: “John performed the experiment.” In the passive voice, the action is indirect: “The experiment was performed by John.”

When you use the active voice, your writing will be more direct and vigorous; your sentences, more concise. As you can see in the samples in Table 2, the passive voice seems puny and stiff by comparison.

4. Lengthy sentences

Lengthy sentences tire the reader and make your writing hard to read.

A survey by Harvard professor D. H. Menzel indicates that in technical papers, the sentences become difficult to understand when they exceed 34 words in length.

One measure of writing clarity, the Fog Index, takes into account sentence length and word length. Here’s how it works:

First, determine the average sentence length in a short (100 to 200 words) writing sample. To do this, divide the number of words in the sample by the number of sentences. If parts of a sentence are separated by a semicolon (;), count each part as a separate sentence.

Next, calculate the number of big words (words with three or more syllables) per 100 words of sample. Do not include capitalized words, combinations of short words (butterfly, moreover), or words that are three syllables because of the suffixes *-ed* or *-es* (accepted, responses).

Finally, add the average sentence length to the number of big words per 100 words and multiply by 0.4. This

gives you the Fog Index for the sample.

The Fog Index corresponds to the years of schooling the reader needs to be able to read and understand the sample. A score of 8 or 9 indicates high-school level; 13, a college freshman; 17, a college graduate.

Popular magazines have Fog Indexes ranging from 8 to 13. Technical journals should rate no higher than 17.

Obviously, the higher the Fog Index, the more difficult the writing is to read. In his book “Gene Control in the Living Cell” (Basic Books), J. A. V. Butler leads off with a single 79-word sentence: “In this book I have attempted an accurate but at the same time readable account of recent work on the subject of how gene controls operate, a large subject which is rapidly acquiring a central position in the biology of today and which will inevitably become even more prominent in the future, in the efforts of scientists of numerous different specialists to explain how a single organism can contain cells of many different kinds developed from a common origin.”

With 17 big words, this sample has a Fog Index of 40 — equivalent to a reading level of 28 years of college education! Obviously, this sentence is way too long. Here’s a rewrite I came up with: “This book is about how gene controls operate — a subject of growing importance in modern biology.” This gets the message across with a Fog Index of only 14.

Give your writing the Fog Index test. If you score in the upper teens or higher, it’s time to trim sentence length. Go over your text, and break long sentences into two or more separate sentences. To further reduce average sentence length and add variety to your writing, you can occasionally use an extremely short sentence or sentence fragments. Like this one.

Short sentences are easier to grasp than long ones. A good guide for keeping sentence length under control is to write sentences that can be spoken aloud without losing your breath. (Do *not* take a deep breath before doing this test.)

5. Big words

Engineers sometimes prefer to use big, important-sounding words instead of short, simple words. This is a mistake; fancy language just frustrates the reader. Write in plain, ordinary English and your readers will love you for it.

Table 3 lists a few big words that occur often in technical literature, along with shorter and preferable, substitutions.

Chemical engineering has a special language all its own. Technical terms are a helpful shorthand when you're communicating within the profession, but they may confuse readers who do not share your special background.

Take the word "yield," for example. To a chemical engineer, yield is a measure of how much product a reaction produces. But, to car drivers, yield means slowing down (and stopping, if necessary) at an intersection.

Other words that have special meaning to chemical engineers but have a different definition in everyday use include: vacuum, pressure, batch, bypass, recycle, concentration, mole, purge, saturation, and catalyst.

Use legitimate technical terms when they communicate your ideas precisely, but avoid using jargon just because the words sound impressive. Do not write that material is "gravimetrically conveyed" when it is simply dumped.

Technical readers are interested in detailed information — facts, figures, conclusions, and recommendations. Do not be content to say something is good, bad, fast, or slow when you can say *how* good, *how* bad, *how* fast, or *how* slow. Be specific whenever possible, as shown in Table 4.

The key to success in technical writing is to *keep it simple*. Write to express — not to impress. A relaxed, conversational style can add vigor and clarity to your work, as illustrated in Table 5.

6. Writer's block

Writer's block isn't just for professional writers; it can afflict engineers and managers, too. Writer's block is the inability to start putting words on paper or computer, and it stems from anxiety and fear of writing.

When technical people write, they're afraid to make mistakes, and so they edit themselves word by word, inhibiting the natural flow of ideas and sentences. Professional writers know that writing is a process consisting of numerous drafts, rewrites, deletions, and revisions. Rarely does a writer produce a perfect manuscript on the first try.

Here are a few tips to help you overcome writer's block:

- Break the writing up into short sections, and write one section at a time. Tackling many little writing assignments seems less formidable a

Table 3. Use short words instead of long ones.

Big Word	Shorter Alternative
Terminate	End
Utilize	Use
Incombustible	Fireproof
Substantiate	Prove
Eliminate	Get rid of

task than taking on a large project all at once. This also benefits the reader. Writing is most readable when it deals with one simple idea rather than multiple complex ideas. Your entire paper can't be simple or restricted to one idea, but each section of it can.

- Write the easy sections first. If you can't get a handle on the main argument of your report or paper, begin

Table 4. Be as specific as possible in technical descriptions.

General	Specific
A tall spray dryer	A 40-ft-tall spray dryer
Plant	Petroleum refinery
Unit	Evaporator
Unfavorable weather conditions	Rain
Structural degradation	A leaky roof
High performance	95% efficiency

Table 5. Keep it simple by using an informal conversational style.

Formal Technical Style	Informal Conversational Style
The data provided by direct examination of samples under the lens of the microscope are insufficient for the purpose of making a proper identification of the components of the substance.	We can't tell what it is made of by looking at it under the microscope.
We have found during conversations with customers that even the most experienced of extruder specialists have a tendency to avoid the extrusion of silicone profiles or hoses.	Our customers tell us that experienced extruder specialists avoid extruding silicone profiles or hoses.
The corporation terminated the employment of Mr. Joseph Smith.	Joe was fired.

with something routine, such as the section on “Apparatus” or “Procedures.” This will get you started and help build momentum.

- Write abstracts, introductions, and summaries last. Although they come first in the final document, it doesn’t make sense to try to sum up a paper that hasn’t been written yet.

- Avoid grammar-book rules that inhibit writers. One such rule says every paragraph must begin with a topic sentence (a first sentence that states the central idea of the paragraph). By insisting on topic sentences, teachers and editors throw up a block that prevents students and engineers from putting their thoughts on paper. Professional writers don’t worry about topic sentences (or sentence diagrams or ending a sentence with a preposition). Neither should you.

- Sleep on it. Put your manuscript away and come back to it the next morning — or even several days later. Refreshed, you’ll be able to edit and rewrite effectively and easily.

7. Poorly defined topic

Effective writing begins with a clear definition of the specific topic you want to write about. The big mistake many engineers make is to tackle a topic that’s too broad. For example, the title “Project Management” is too all-encompassing for a technical paper. You could write a whole book on the subject. But, by narrowing the scope, say, with the title “Managing Chemical Plant Construction Projects With Budgets Under \$500,000,” you get a clearer definition and a more-manageable topic.

It’s also important to know the purpose of the document. You may say, “To give technical information.” But, think again. Do you want the reader to buy a product? Change methods of working? Look for the underlying purpose beyond the mere transmission of facts.

8. Inadequate content

You’ve defined your topic, audience, and purpose. The next step is

to do some homework, and to gather information on the topic at hand. Most engineers I know don’t do this. When they’re writing a trade-journal article, for example, their attitude is, “I’m the expert here. So I’ll just rely on my own experience and know-how.”

That’s a mistake. Even though you’re an expert, your knowledge may be limited, your viewpoint lopsided. Gathering information from other sources helps round out your knowledge or, at the very least, verify your own thinking. And there’s another benefit: backing up your claims with facts is a real credibility builder.

Once you’ve crammed a file folder full of reprints and clippings, take notes on index cards or a computer. Not only does note-taking put the key facts at your fingertips in condensed form, but reprocessing the research information through your fingers and brain puts you in closer touch with your material.

9. Stopping after the first draft

Once you gather facts and decide how to organize the piece, the next step is to sit down and write. When you do, keep in mind that the secret to successful writing is rewriting.

You don’t have to get it right on the first draft. The pros rarely do. E. B. White, essayist and co-author of the writer’s resource book “The Elements of Style,” was said to have rewritten every piece nine times.

Maybe you don’t need nine drafts, but you probably need more than one. Use a simple three-step procedure that I call SPP — Spit, Prune, and Polish.

When you sit down to write, just spit it out. Don’t worry about how it sounds, or whether the grammar’s right, or if it fits your outline. Just let the words flow. If you make a mistake, leave it. You can always go back and fix it later. Some engineers find it helpful to talk into a tape recorder or dictate to an assistant. If you can type and have a personal computer, great.

Some old-fashioned folks even use typewriters or pen and paper.

In the next step, pruning, print out your first draft (double-spaced, for easy editing) and give it major surgery. Take a red pen to the draft and cut all unnecessary words and phrases. Rewrite any awkward passages to make them smoother, but if you get stuck, leave it and go on; come back to it later. Use your word processing program’s cut-and-paste feature to cut the draft apart and reorganize to fit your outline or to improve on that outline. Then, print out a clean draft. Repeat the pruning step, if necessary, as many times as you want.

In the final stage, polish your manuscript by checking such points as equations, units of measure, references, grammar, spelling, and punctuation. Again, use the red pen and then print out a fresh copy with corrections.

10. Inconsistent usage

“A foolish consistency,” wrote Ralph Waldo Emerson, “is the hobgoblin of little minds.” This may be so. But, on the other hand, inconsistencies in technical writing will confuse your readers and convince them that your scientific work and reasoning are as sloppy and unorganized as your prose.

Good technical writers strive for consistency in the use of numbers, hyphens, units of measure, punctuation, equations, grammar, symbols, capitalization, technical terms, and abbreviations.

For example, many writers are inconsistent in the use of hyphens. A common rule is: two words that form an adjective are hyphenated. Thus, write: first-order reaction, fluidized-bed combustion, high-sulfur coal, space-time continuum.

“The U.S. Government Printing Office Style Manual,” Strunk and White’s “The Elements of Style,” and your organization’s writing manual can guide you in the basics of grammar, punctuation, abbreviation and capitalization.

11. Dull, wordy prose

Technical professionals are busy people. Make your writing less time-consuming for them to read by telling the whole story in the fewest possible words.

How can you make your writing more concise? One way is to avoid redundancies — a needless form of wordiness in which a modifier repeats an idea already contained within the word being modified.

For example, a recent trade ad described a product as a “new innovation.” Could there be such a thing as an *old* innovation? The ad also said the product was “very unique.” Unique means “one of a kind,” so it is impossible for anything to be *very* unique.

By now, you probably get the picture. Some other redundancies that have come up in technical literature are listed in Table 6, along with the correct way to rewrite them.

Many technical writers are fond of overblown expressions such as “the fact that,” “it is well known that,” and “it is the purpose of this writer to show that.” These take up space, but add little to meaning or clarity.

The list in Table 7 includes some of the wordy phrases that appear frequently in technical literature. The column on the right offers suggested substitutes.

12. Poor page layout

To enhance readability, break your writing up into short sections. Long, unbroken blocks of text are stumbling blocks that intimidate and bore readers. Breaking your writing up into short sections and short paragraphs — as in this article — makes it easier to read.

Use visuals. Drawings, graphs, and other visuals can reinforce your text. In fact, pictures often communicate better than words; we remember 10% of what we read, but 30% of what we see.

Visuals can make your technical communications more effective. Table 8 summarizes the different types of graphics and what they can show.

Table 6. Avoid redundancy.

Redundant	Concise
Advance plan	Plan
Actual experience	Experience
Two cubic feet in volume	Two cubic feet
Cylindrical in shape	Cylindrical
Uniformly homogeneous	Homogeneous

Table 7. Substitute simple words for wordy phrases.

Wordy Phrase	Suggested Substitute
During the course of	During
In the form of	As
In many cases	Often
In the event of	If
Exhibits the ability to	Can

Table 8. Use graphics effectively.

Type of Visual	What it Illustrates
Photograph or illustration	What something looks like
Map	Where something is located
Exploded view	How something is put together
Schematic diagram	How something is organized
Graph	How much there is (quantity); How one parameter varies as a function of another
Pie chart	Proportions and percentages
Bar chart	Comparisons between quantities
Table	A body of related data
Mass and energy balances	What goes in and what comes out

Closing thoughts

These tips should help eliminate some of the fear and anxiety you may have about writing, as well as make the whole task easier and more productive.

Finally, keep in mind that success in writing — or any form of communication — is largely a matter of attitude: If you don’t think writing is important enough to take the time to do

it right, and you don’t really care about improving, you probably won’t. However, if you believe that writing is important and you want to improve, you will. CEP

R. W. BLY is the director of The Center for Technical Communication (201/385-1220), a Dumont, NJ-based consulting firm that helps engineers, managers, and other corporate employees improve their technical and business writing skills. He has presented writing and communication seminars for numerous clients, including Foxboro, IBM, Cardiac Pacemakers, Metrum Instrumentation, Medical Economics, U.S. Army, Arco Chemical, and Thoroughbred Software. He holds a BS in chemical engineering from the Univ. of Rochester. He has written more than 100 articles and 35 books, including “The Elements of Technical Writing” (Macmillan) and “The Ultimate Unauthorized Star Trek Quiz Book” (HarperCollins).

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