A Guide to Technical Writing

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1.0 Introduction

Professionals in every discipline—including engineering, chemistry, medicine, metallurgy, and meteorology—must communicate information in a way that is clear, concise, and convincing. Effective communication begins with organized thinking. When ideas are well structured, they are much easier to express accurately in writing.

The purpose of this document is to help transform logical thinking into effective technical writing. It provides practical guidance on using the English language with accuracy, clarity, and purpose. While professionals in technical fields often rely on mathematics as the language of precision, written communication plays an equally important role. Mathematical formulas can describe complex concepts with exactness, but successful projects also depend on the ability to explain ideas, procedures, and results through language. Errors in engineering or science frequently arise from human mistakes rather than limitations of mathematics itself.

English, when used carefully, is capable of conveying information with the same degree of precision. Unfortunately, vague wording and poor communication are common despite the critical importance of clear writing and speaking. Whether preparing instructions for operating equipment, documenting research findings, or explaining the use of everyday products, effective communication is essential. In today's technology-driven world, well-designed products and systems are only as useful as the information that accompanies them.

Clear writing allows both technical facts and complex concepts to be understood without confusion. This guide demonstrates how careful planning, logical organization, thorough research, and thoughtful revision can improve the quality of technical documents. By applying these principles, writers can produce reports, procedures, specifications, memoranda, and correspondence that are informative, accurate, and engaging.

An effective technical document follows a logical structure with a clear introduction, organized body, and meaningful conclusion. Although technical writing focuses on factual information rather than storytelling, it still requires creativity, careful organization, critical thinking, and sustained effort. Presenting technical information effectively demands as much discipline as any other form of writing.

As technology continues to shape modern society, the need for precise communication becomes increasingly important. Decisions, innovations, and problem-solving all rely on the accurate exchange of information. However, maintaining clarity and accuracy can be challenging in an environment where information is often presented for impact rather than precision.

Technical writers must therefore avoid exaggeration, unnecessary jargon, fashionable expressions, and vague language that weaken meaning. The primary goal should always be to communicate information accurately and efficiently. Throughout history, skilled writers have demonstrated that clear and direct language is far more effective than unnecessary complexity. Technical writing should follow the same principle by emphasizing precision over style for its own sake.

In many respects, all forms of writing are technical because they require the careful selection and arrangement of words to communicate ideas. Words, phrases, and sentences serve as tools that transfer knowledge from the writer to the reader. Successful communication depends on understanding the audience's level of knowledge, presenting information logically, and eliminating unnecessary detail or ambiguity. When writers fail to express their intended meaning clearly, misunderstandings usually result from weaknesses in the writing rather than shortcomings of the reader.

Although technical writing is commonly associated with science and engineering, its principles apply across all forms of written communication. Every type of document benefits from accurate research, careful organization, and attention to detail. Poorly written statements can create confusion or unintended interpretations, while well-written documents communicate information efficiently and leave little room for misunderstanding.

Whether writing for colleagues, managers, government agencies, clients, or the general public, effective communication can influence decisions, secure project support, solve technical problems, obtain funding, or advance professional careers. These outcomes highlight the value of strong technical writing skills.

The following principles provide a useful foundation for effective technical communication:

- Make informing the reader your primary objective, while maintaining their interest.
- Present information in a way that enables readers to make informed decisions.
- Begin with clear facts and evidence before introducing more complex analysis or abstract concepts.

This course is organized into three main sections, each divided into three subsections.

The first section, “Writing with Impact”, introduces the fundamental principles of effective communication. Rather than focusing heavily on grammar and sentence structure, it emphasizes the careful selection of words and expressions, which are often the greatest challenge for technical writers.

The second section, “Creating Technical Documents”, explains how to plan, research, organize, and develop professional technical documents from beginning to end.

The final section, “Special Writing Tasks”, examines the preparation of specific document types, including procedures, technical reports, letters, memoranda, and technical specifications, providing guidance for producing documents that meet professional standards.

2.0 Writing with Impact

2.1 Choosing your words

English is a highly diverse language that has developed by adopting vocabulary and expressions from numerous other languages throughout its history. Rather than evolving in isolation, it has continually absorbed useful words from different cultures, making it one of the world's richest and most adaptable languages. Linguists often describe English as a polyglot language because it incorporates influences from many linguistic traditions. This diversity reflects the complex history of the people who shaped it, including the Celts, Picts, Scots, Jutes, Saxons, Vikings, Normans, and many others.

Although modern English has been influenced by a wide range of languages, its development is largely rooted in two major traditions. The first is the direct and straightforward style of Anglo-Saxon, while the second comes from the more elaborate Romance languages, which originated from Latin. The combination of these influences gives English both simplicity and sophistication, allowing writers to choose between concise, familiar words and more formal or descriptive alternatives.

Understanding these historical influences is particularly valuable for technical writers. Many resources on English concentrate primarily on grammar and sentence structure, which are important aspects of effective communication. However, this document assumes that readers already possess a practical command of the language. Its focus is instead on understanding how the history and vocabulary of English can support clearer, more effective technical writing.

An awareness of the origins of English words helps writers make better choices when communicating technical information. In many situations, simple words with Anglo-Saxon roots are more direct and easier for readers to understand than longer, more complex terms derived from Latin. Choosing straightforward language whenever possible improves readability and makes technical documents more accessible to a wider audience.

The development of English can be compared to the growth of a large, well-established tree. Its deep roots represent the languages from which it evolved, while its strong trunk and expanding branches symbolize centuries of linguistic development. Over time, new expressions, slang, jargon, and specialized terminology continue to emerge as fresh branches. Some of these additions become permanent features of the language, while others are temporary, fading as usage changes. Technical writers should therefore exercise caution when using fashionable expressions or specialized jargon, favoring language that remains clear, accurate, and widely understood over time.

Anglo-Saxon English

Among the many languages that have shaped English, Anglo-Saxon has had the greatest influence on its core vocabulary. Words of Anglo-Saxon origin are generally short, concrete, and easy to understand. Most are single-syllable words that describe everyday objects, actions, and experiences. Their simplicity and directness make them highly effective for communication and contribute significantly to the clarity and accessibility of the English language.

A simple sentence such as "The cat sat on the mat." illustrates this characteristic. Although the sentence contains only a few uncomplicated words, English allows the word order to be rearranged in several ways while preserving the same basic meaning. This flexibility demonstrates one of the language's greatest strengths: ideas can often be expressed clearly without relying on complex vocabulary.

Many of the most common English words—including head, hand, child, earth, day, go, make, break, fight, and small—have Anglo-Saxon origins. These familiar words form the foundation of everyday communication and remain effective because they are immediately understood by most readers. Their straightforward nature gives them a lasting quality that has endured for centuries.

Throughout literary history, accomplished writers have frequently relied on simple vocabulary to create memorable and powerful passages. Rather than using unnecessarily elaborate language, they often begin with short, direct words that immediately capture the reader's attention. The opening lines of works by authors such as William Shakespeare and Charles Dickens demonstrate how uncomplicated language can communicate emotion, establish atmosphere, and leave a lasting impression.

The same principle applies to technical and scientific writing. Authors such as James Leasor, Paul Davies, Albert Einstein, and Carl Sagan are recognized not only for their knowledge but also for their ability to explain complex subjects using clear and accessible language. Their writing shows that sophisticated ideas do not require complicated words. Instead, careful word choice allows difficult concepts to become easier for readers to understand.

For technical writers, this serves as an important lesson. Whenever possible, simple Anglo-Saxon vocabulary should be preferred because it improves readability and reduces ambiguity. Straightforward language enables readers to focus on the information itself rather than on deciphering unfamiliar terminology.

However, English owes much of its expressive power to another important linguistic influence: the Romance languages. While Anglo-Saxon vocabulary provides directness and simplicity, Romance-based words add precision and enable writers to discuss more complex and abstract concepts.

Many words of Latin origin entered English through medieval scholarship and the influence of the Roman Catholic Church. A much larger influx occurred after the Norman Conquest of England in 1066, when French—another language derived largely from Latin—became the language of government, law, education, and administration. As a result, English gradually incorporated thousands of Romance words alongside its Anglo-Saxon foundation.

Unlike Anglo-Saxon vocabulary, Romance-derived words are often longer and contain multiple syllables. They also tend to express abstract ideas rather than tangible objects or everyday actions. This characteristic makes them particularly useful in academic, legal, scientific, and technical communication, where complex concepts must be described with accuracy.

For example, the Latin word meaning true eventually gave rise to English words such as verify and verification. These terms describe the process of confirming or proving that something is correct. Although such words are highly valuable in technical disciplines, they represent abstract ideas rather than physical objects, making them less immediately visual than their Anglo-Saxon counterparts.

Technical documents commonly contain Romance-derived terms such as verification, specification, procedure, implementation, and documentation. These words provide the precision required for professional communication but can also make a document more difficult to read if used excessively or without explanation.

Effective technical writing therefore depends on balancing these two major influences within the English language. Anglo-Saxon words contribute clarity, simplicity, and directness, while Romance vocabulary provides the precision needed to communicate specialized or abstract concepts. Skilled technical writers understand when each style of language is appropriate and combine them to produce documents that are both accurate and easy to understand.

Anglo-Saxon versus Romance

The history of English demonstrates how words evolve over time as new discoveries and technologies emerge. Many scientific and technical terms originate from Greek or Latin because these languages formed the foundation of early scientific study. For example, the word electrical ultimately traces its origins to the Greek word for amber, as the ancient Greeks observed that rubbed amber could produce static electricity. This illustrates how scientific vocabulary often develops from historical observations and gradually becomes standardized within a language.

It is interesting to consider how English might have evolved if it had relied solely on its Anglo-Saxon roots. Many modern technical terms would likely have been expressed using shorter, more descriptive words rather than the longer, classical forms that exist today. Although this is only a hypothetical example, it highlights the contrasting characteristics of the two major influences on the English language.

The evolution of measurement terminology provides another useful illustration. Earlier expressions were often descriptive and closely connected to everyday experience, whereas modern scientific language favors standardized international units. While contemporary terminology offers greater precision and consistency, it can also become less intuitive for readers who are unfamiliar with specialized vocabulary.

These historical differences have an important implication for technical communication. Romance-derived words often provide the precision needed to describe scientific concepts, but excessive reliance on complex terminology can make writing more difficult to understand. In contrast, Anglo-Saxon vocabulary is typically shorter, more concrete, and more direct, allowing ideas to be communicated with greater clarity.

Technical writers should therefore avoid using unnecessarily complicated language simply to appear more knowledgeable. Overly formal expressions, excessive jargon, and inflated vocabulary rarely improve communication. Instead, they often create barriers between the writer and the intended audience.

Specialized terminology certainly has an important place in professional communication. However, writers should use technical terms only when they add precision or are required by the subject matter. Whenever a simpler alternative communicates the same meaning without sacrificing accuracy, the simpler choice is generally more effective.

For example, consider the following statements:

Complex: The student's behavior is inconsistent with expected classroom conduct.
Simple: The student regularly disrupts the class.

Both sentences communicate a similar idea, but the second version is more direct and easier for most readers to understand. This example illustrates how replacing unnecessary abstraction with plain language can significantly improve clarity.

The same principle can be observed in literature and everyday communication. Messages expressed with familiar, straightforward words are generally easier to read, remember, and interpret than those filled with obscure or overly elaborate vocabulary. While sophisticated language may appear impressive, it can reduce comprehension if readers must spend unnecessary effort interpreting the wording rather than understanding the message.

For technical writers, the objective should always be effective communication rather than linguistic complexity. Clear, concise, and purposeful language enables readers to understand information quickly and accurately, making simplicity one of the most valuable tools in technical writing.

Word Diseases

Languages constantly evolve, with new words and expressions replacing older ones. While some additions improve communication, others complicate it without adding meaning. Just as certain species in nature displace others from their environment, unnecessarily complex words can replace simpler, more effective alternatives. This tendency is particularly noticeable in technical and business writing.

One common problem is word inflation—the practice of turning simple, familiar words into longer, more complicated forms. Writers often create terms by adding suffixes such as -ization, -ability, or -izing, producing expressions that sound more sophisticated but communicate no additional information. Instead of improving precision, these constructions frequently make sentences more abstract and more difficult to understand.

For example, a straightforward term such as system may become systematization, while function may be expanded into functionalization. Although these forms are sometimes appropriate in specialized contexts, they are often used where the original, simpler word would communicate the same idea more effectively. As complexity increases, readability decreases.

In some cases, writers invent lengthy expressions that obscure rather than clarify meaning. Business and technical documents occasionally contain unnecessarily elaborate terms that could easily be replaced with a single familiar word. Such language creates the appearance of expertise without improving the quality of communication.

Another common issue is the overuse of fashionable terminology, often referred to as buzzwords. Words such as optimize, facilitate, prioritize, leverage, and utilize are valuable when they convey a specific technical meaning. However, when they replace simpler alternatives without adding precision, they make writing sound inflated and less accessible.

The word impact provides a useful example. In its literal sense, impact describes a forceful collision between two objects. Because of this strong physical meaning, the word creates a vivid mental image. In many business and technical documents, however, impact is frequently used as a substitute for words such as effect or influence. While this usage has become common, it is not always the clearest choice. In many situations, phrases such as adverse effect, positive influence, or result communicate the intended meaning more precisely.

Effective technical writing depends on selecting words carefully rather than choosing those that simply sound impressive. A useful habit for any writer is to pause and consider whether a simpler word would communicate the idea just as accurately. Clear thinking should always be reflected in clear language.

The following examples illustrate how concise vocabulary often improves readability:

Prefer	**Instead of**
Find	Ascertain
Start	Initiate
Try	Endeavour
About	Approximately
Stop	Discontinue
Use	Utilize
Improve	Optimize

These comparisons do not imply that the longer words are incorrect. Many of them have legitimate uses, particularly in scientific, legal, or engineering contexts where precise definitions are required. The key principle is to select the word that best serves the reader. If a shorter, more familiar word conveys the intended meaning with equal accuracy, it is usually the better choice.

Technical subjects are often challenging enough without adding unnecessary linguistic complexity. By choosing clear, direct language whenever possible, writers make technical information easier to understand, reduce the risk of misunderstanding, and communicate more effectively with both specialist and non-specialist audiences.

Initials

Initials and acronyms can make technical documents shorter and more efficient, but excessive use often creates confusion rather than clarity. Readers may struggle to remember the meaning of abbreviated terms, especially in longer documents where the full name may have appeared several pages earlier. As a result, they may be forced to search back through the document, interrupting the flow of reading and reducing comprehension.

This problem becomes even more significant when the audience includes new employees, students, clients, or readers who are unfamiliar with the subject matter. An abbreviation that seems obvious to the writer may be completely unfamiliar to someone encountering the document for the first time.

Writers often use acronyms because they reduce repetitive typing or save space. While this may improve writing efficiency, it does not necessarily improve the reader's experience. The primary objective of technical writing is to communicate information as clearly and effortlessly as possible, even if doing so requires repeating the full name of an organization, process, or system.

A good practice is to use abbreviations only when they are widely recognized by the intended audience or when the abbreviated form appears frequently enough to justify its use. Well-established abbreviations, such as USA, NASA, or ISO, are generally understood without explanation. Less familiar abbreviations, however, should be introduced carefully by writing the full term followed by the abbreviation in parentheses the first time it appears. For example:

Quality Engineering Design Group (QEDG)

After this initial definition, the abbreviation may be used consistently throughout the remainder of the document, provided it does not reduce readability.

If a document contains numerous abbreviations or technical acronyms, it is good practice to include a glossary or list of abbreviations in an appendix or at the beginning of the document. This allows readers to quickly locate unfamiliar terms without interrupting their reading.

Ultimately, abbreviations should simplify communication rather than complicate it. Before introducing an acronym, writers should consider whether it genuinely helps the reader or merely saves a few keystrokes. If the abbreviation is unlikely to be remembered or recognized, repeating the full term is often the clearer and more effective choice.

2.2 Elements of Style

Although it differs significantly from creative writing, technical writing is not without style. Like novels, poetry, and drama, every technical document reflects the writer's approach to organizing ideas and communicating with an audience.

The nineteenth-century writer Thomas De Quincey distinguished between two broad categories of literature: the literature of knowledge, which exists to inform and educate, and the literature of power, which seeks to inspire, persuade, or evoke emotion. Technical writing belongs primarily to the first category because its principal objective is to communicate knowledge clearly and accurately. Nevertheless, effective technical documents often incorporate persuasive elements when encouraging readers to adopt recommendations, approve proposals, or support decisions.

The purpose of a technical document depends on its intended audience and the situation in which it is written. Regardless of the document type, successful technical writing should enable readers to understand information quickly and apply it with confidence.

Common objectives of technical writing include:

- Providing accurate and reliable information.
- Explaining procedures or giving clear instructions.
- Persuading readers to accept recommendations or proposed solutions.
- Requesting feedback, comments, or professional opinions.
- Securing approval, agreement, or support for a project, decision, or course of action.

Understanding the purpose of a document is one of the first steps in producing effective technical writing. When writers clearly identify what they want readers to know, do, or decide, they can organize information more logically, select appropriate language, and communicate their message with greater precision.

Rules Of Good Style

Before discussing specific writing techniques, it is important to understand the concept of house style. Many organizations, government agencies, academic institutions, and publishers establish their own standards for preparing documents. These standards specify formatting requirements such as page layout, heading styles, numbering systems, punctuation, citation formats, and even preferred spelling conventions. For example, an organization may require either British or American English throughout all official documents.

Adhering to an organization's house style promotes consistency across publications, strengthens its professional identity, and ensures that documents present a uniform appearance. When writing for a particular organization or publisher, these standards should always be followed.

Regardless of the required formatting style, the following principles can significantly improve the quality and effectiveness of technical writing:

1. Keep Sentences Clear and Concise

Technical readers often need information quickly. Long, complicated sentences require greater effort to read and increase the likelihood of misunderstanding. Whenever possible, express one main idea per sentence using clear and straightforward language. Shorter sentences generally improve readability without sacrificing accuracy.

2. State the Purpose Early

Readers should understand the objective of a document from the beginning. A clear introduction establishes the topic, explains why the document is important, and prepares the reader for the information that follows. Beginning with a concise statement of purpose encourages readers to continue and provides context for the remainder of the document.

3. Avoid Clichés and Overused Expressions

Common expressions and clichés often weaken technical writing because they add little meaning while reducing precision. Phrases such as at the end of the day, think outside the box, or bottom line may sound familiar but rarely improve clarity. Replacing them with direct, literal language results in more professional and effective communication.

4. Use Active Voice Whenever Appropriate

Active voice usually produces writing that is more direct, engaging, and easier to understand. Compare the following examples:
Passive: It is proposed that corrective actions be implemented.
Active: The team will implement corrective actions.

The second sentence clearly identifies who will perform the action and communicates the message more efficiently.

5. Avoid Euphemisms

Technical documents should communicate facts accurately rather than soften or disguise them. Euphemistic language can obscure meaning and reduce transparency. Instead of replacing straightforward statements with indirect expressions, describe events and outcomes clearly so readers can interpret the information without ambiguity.

6. Choose Words Carefully

Precision is one of the defining characteristics of technical writing. Select words that accurately convey the intended meaning and verify unfamiliar terms before using them. Many English words appear similar but have different meanings—for example, affect and effect, its and it's, or imply and infer. Using the correct word enhances both credibility and clarity.

7. Eliminate Spelling and Typographical Errors

Even minor spelling mistakes can reduce the professionalism of a document and occasionally alter its meaning entirely. Modern spelling and grammar tools are valuable aids, but they cannot identify every error, particularly when an incorrect word is also correctly spelled. Careful proofreading remains essential to ensure accuracy and maintain the writer's credibility.

8. Be Specific Rather Than Vague

Technical writing should communicate measurable facts whenever possible. General modifiers such as very, slightly, approximately, or nearly often lack sufficient precision. Whenever data are available, replace vague descriptions with specific measurements, values, or quantities. Numerical information allows readers to interpret results objectively and reduces the possibility of misunderstanding.

9. Present Numbers Consistently

Numerical information should be expressed using consistent units, symbols, and formatting throughout a document. Writers should never assume that readers will automatically understand which units are being used. Clearly identify measurements, currencies, dates, percentages, and other numerical values so that the information can be interpreted accurately.

10. Write with Knowledge and Confidence

Effective technical writing requires a thorough understanding of the subject matter. Writers who understand their topic can explain it with confidence, organize ideas logically, and answer readers' questions clearly. Confidence, however, should not be confused with unnecessary complexity. The strongest technical documents present expert knowledge using simple, direct language that readers can easily understand.

Active, Passive and Imperative

One of the most important choices a technical writer makes is whether to use active or passive voice. The difference between these two styles can have a significant effect on clarity, directness, and reader understanding. Consider the following examples:

Passive voice: "The management is very supportive of appropriate actions taken by supervisory personnel."

Active voice: "The management supports the actions taken by supervisors."

The second sentence is stronger because it identifies the subject, uses a direct verb, and communicates the message with fewer words. The phrase supports is clearer and more precise than is supportive of. Similarly, the actions refers to specific activities, while appropriate actions is vague, and supervisors is more direct than the broader term supervisory personnel.

Another comparison demonstrates the same principle:

I am listening to the speaker.
The speaker is being listened to by me.

Although both sentences express the same idea, the first is more natural, concise, and easier to understand. Active voice places emphasis on the person or thing performing the action, making communication more efficient.

Active writing is especially valuable in technical procedures and instructions. When people are required to perform specific tasks, they need clear directions that leave little room for interpretation. Workers such as welders, technicians, equipment operators, and tradespeople generally benefit from direct instructions because they explain exactly what action must be taken.

For this reason, technical procedures should often use the imperative mood, which gives direct commands or instructions. In this style, the action verb appears at the beginning of the sentence, immediately telling the reader what must be done.

Examples of imperative verbs include:

- Inspect the equipment.
- Complete the form.
- Attach the component.
- Send the report.
- Record the measurements.

Beginning instructions with strong action verbs creates a direct and practical writing style. Consider the following example of a procedure written using the imperative approach:

Employee property transfer procedure

When employees are transferred to a new work location and their property is purchased by the corporation, follow these steps:

1. *Obtain proof that the property has been offered for sale for at least six months.*
2. *Obtain three independent property evaluations from qualified appraisers.*
3. *Confirm that the Legal Department has approved the transfer of ownership and any related mortgages.*
4. *Reimburse the employee based on the average value of the three appraisals.*

This format clearly identifies the required actions and allows the reader to follow the procedure without confusion.

Another example of a technical procedure demonstrates a more formal style:

"When a design change request is rejected, the designer will provide written reasons for the rejection. The memorandum will be signed by the Section Supervisor and returned with a copy of the design change request to the originator. A copy will also be forwarded to the Record Data Center for retention in the correspondence file."

This example also raises the question of choosing between ‘shall’ and ‘will’. Although ‘shall’ was once commonly used in formal instructions and legal documents, it now often sounds outdated or overly formal. In everyday technical communication, ‘will’ is usually clearer and more natural.

The word ‘will’ communicate a definite expectation or requirement. A statement such as "You will complete the inspection" clearly identifies the required action. In contrast, wording such as "The operator shall complete the inspection" may sound unfamiliar or unnecessarily legalistic to many readers.

For most technical documents, ‘will’ is the preferred choice because it is widely understood. The use of ‘shall’ is best reserved for specific legal, regulatory, or contractual contexts where it has a defined purpose.

Avoiding Unnecessary Pluralization

Small details of language can influence how clearly technical information is communicated. One example is the unnecessary addition of plural forms where they do not improve meaning.

Language often contains patterns in sound and structure that influence how words are perceived. Certain letters can contribute to the character or impression of words. For example, words beginning with h often suggest effort or force (heave, haul, huff), while words containing r may suggest roughness or resistance (rough, rasp, rumble). The sound of s often appears in words associated with movement or sliding (slip, slide, slither).

Although these patterns are interesting, the letter s can sometimes create problems when writers add it unnecessarily to words. Excessive or incorrect pluralization can make technical writing sound artificial and unclear.

For example, phrases such as 'appropriate actions', 'multiple procedures', or 'various information' often reflect unnecessary attempts to make writing sound more formal. Many words already express a complete idea without requiring additional endings.

Some plural forms have naturally become accepted through common usage. For example, procedure and procedures are now standard because the plural form clearly distinguishes between one process and several processes. However, adding unnecessary plural endings can create awkward results. Words such as information and sheep already function correctly without an added s.

In technical writing, writers should avoid unnecessary pluralization and focus on using the simplest accurate form of a word. Similar caution should be applied to excessive prefixes, suffixes, and inflated terminology. Clear writing depends on precision, not complexity.

2.3 Writing and Editing

Words are the bricks with which we build sentences. Sentences are the building blocks of paragraphs. The following three rules must not be overlooked.

1. A sentence should contain a single thought.
2. It must have a subject.
3. It must have a verb.

Consider the following statement written in an engineering procedure:

Initiating the issue of an appropriate design change, such as those listed under Section 5, and obtaining the appropriate level of approval within the organizational unit initiating the change.

This 'non-sentence' has no predicate verb: no one is required to do anything. There is repetitious use of the words 'initiating', 'appropriate' and 'change'. We can guess that Section 5 is a guide to what design changes are appropriate; and that someone in the unit must authorize design changes. Most of the statement is redundant. Perhaps the writer meant to write:

Applications for design changes, such as those listed in Section 5, must be signed by a member of the unit who is authorized to do so.
The revised sentence is shorter and easier to understand. It has a subject in the phrase 'applications for design changes' and it has a verb in 'must be signed'. Through changes to a few words, and deletion of those that do not contribute to meaning, the passage is transformed.

Consider an example from a health care quality assurance guide.

In conducting a quality assurance program, a number of various mechanisms can be used including performance appraisals, documented observation rounds, quality circles, patient surveys, mortality reviews, worksheets for analyzing data from committee meetings, incident reports, and a variety of quality audits.

The statement is wordy and the writing style passive, not active. There is redundancy of phrasing: either 'a number of mechanisms' or 'various mechanisms' may be used, but not both. In the context of the statement, 'mechanisms' is jargon. Only in the broadest sense is a quality assurance program conducted, whereas it is quite accurate to describe an audit as being conducted. 'Quality circles' is the name given to a management practice that encourages employee participation in the quality assurance process. The following revision is more precise.

There are many sources of information for auditing a QA program. These include job performance appraisals, patient surveys, mortality reviews, and incident reports. Also, the data from committee meetings and the observations of the clinical staff during hospital rounds are available for analysis.

The two preceding examples are taken from different industries to show that the form, style and structure of technical writing apply regardless of the discipline: engineering, food processing, real estate operations, personnel management, or business administration.

Sentences do not need to be built of fifty-pound bricks; nor is it necessary to cover every nuance of meaning. Long sentences, even if grammatically correct, can behave like the knight's horse in Lewis Carroll's Through the Looking Glass, and go prancing off in all directions. Express your thoughts in a logical order, making sure that all the pieces fit.

Like a jigsaw puzzle, a document can suffer from the curse of the missing piece. If there is a logical connection between one sentence and the next, or one paragraph and the next, make sure you provide it for the reader to follow. Do not expect the reader to draw conclusions that seem obvious to you from the facts you present: interpret the facts.

Remember that the reader is not the expert, you are. The reader expects to read and understand, in perhaps an hour, the document on which you have spent a great deal more time than that. Break your work into manageable paragraphs and sentences. You can do this by preparing a writing outline.

2.3.1 Writing

Writing is a solitary occupation.

Although others can provide valuable feedback and suggestions, the actual process of organizing ideas and creating a coherent document requires the writer's personal attention. A committee may review, recommend changes, or contribute information, but responsibility for the final document should remain with the writer.

Whether preparing a technical report, operating procedure, instruction manual, or engineering specification, the process begins in the same way. A writer should not begin drafting until the necessary preparation has been completed. Research, planning, organization, and outlining provide the foundation needed to write with confidence. Once these steps are complete, the writer can begin transforming a collection of ideas and information into a structured, readable document.

After the planning stage is complete, the most important step is simple: begin writing.

Maintaining momentum is essential during the first draft. Try to write continuously for as long as possible without unnecessary interruptions. A quiet environment with minimal distractions allows ideas to develop naturally and helps maintain consistency throughout the document. Frequent interruptions from messages, conversations, or unrelated tasks can break concentration and make it more difficult to maintain a logical flow of thought.

When preparing the first draft, focus primarily on capturing ideas rather than achieving perfect wording. If an awkward or overly complex term appears during the writing process, do not stop to correct it immediately. Continue writing and return to refine the language during the editing stage. A realistic schedule should always include sufficient time for reviewing, revising, and improving the draft.

During revision, writers should evaluate their work critically and make changes where necessary. A useful editing approach includes the following:

1. Remove unnecessary words, phrases, and repetition.
2. Replace complicated words with shorter, clearer alternatives whenever possible.
3. Rewrite unclear sentences to improve meaning and readability.
4. Aim for concise sentences, preferably avoiding unnecessary length.
5. Divide long sentences into shorter statements when multiple ideas are involved.

Editing often requires reorganizing information as well as correcting language. If a paragraph does not transition smoothly into the next idea, add explanations or rearrange sections to improve the logical connection. Cutting, moving, and restructuring sections of text is a normal part of the writing process, much like making adjustments in a technical system based on feedback.

Writers should also avoid becoming trapped by the desire for perfection. Continuous improvement is valuable, but excessive revision can prevent completion. A successful document is not one that has been endlessly modified; it is one that clearly communicates the intended message within the available time and resources.

Keeping previous versions of a document can be useful, especially for large projects. When working electronically, save earlier drafts before making major changes. For complex documents such as manuals, reports, or specifications, maintaining a record of revisions allows writers to review previous decisions and recover information if needed.

Proofreading is another essential stage of the process. Writers often overlook mistakes in their own work because they read what they intended to write rather than what actually appears on the page. A fresh reader is more likely to notice unclear explanations, missing information, spelling mistakes, or inconsistencies. Whenever possible, ask a colleague or another knowledgeable person to review the document before finalizing it.

2.3.2 Editing

Large organizations often have formal review and approval procedures for significant documents. Depending on the purpose and audience of the document, the approval process may involve several levels of management and, in some cases, senior executives or a board of directors. Documents intended for external audiences—such as professional publications, conference presentations, regulatory submissions, or public distribution—usually receive careful review because they represent the reputation and credibility of the organization.

Although others may edit, review, or approve a document before release, the writer remains ultimately responsible for the content when their name appears on the work. For this reason, writers should actively seek feedback from knowledgeable reviewers to confirm that the information is accurate, complete, and clearly presented.

It is important to understand the difference between proofreading and editing. Proofreading is the final review stage focused on identifying surface-level errors, such as spelling mistakes, typing errors, incorrect punctuation, or formatting problems. Editing involves a deeper examination of the document, including sentence structure, grammar, organization, consistency, clarity, and overall effectiveness.

Many writers find criticism difficult to accept, especially when they have invested significant time and effort into a document. However, professional writers understand that feedback is not a personal judgment; it is a tool for improvement. Technical writers must work with editors, reviewers, managers, and subject experts, all of whom may identify areas where the document can be strengthened.

A professional writer recognizes that the purpose of review is to improve communication. If a reviewer or proofreader cannot understand a section of writing, the responsibility lies with the writer to revise it. The goal is not to defend the original wording, but to ensure that the final document communicates the intended message effectively.

External review provides many benefits, including:

1. Identifying spelling, punctuation, and formatting errors that the original writer may have overlooked.
2. Encouraging clearer and more effective wording.
3. Revealing weaknesses in reasoning, organization, or logical connections.
4. Providing new perspectives and ideas that can improve the final document.

3.0 Creating Technical Documents

3.1 Getting Started

Every successful task begins with preparation. Before starting a job, skilled professionals make sure they have the necessary tools, resources, and plans in place. A welder verifies that the correct equipment and materials are available before beginning work. A surgeon ensures that the operating environment is properly prepared. A climber inspects ropes, anchors, and safety equipment before attempting a difficult route.

Writing requires the same level of preparation. Before beginning a document, a writer should consider whether the necessary information, resources, and tools are available. A clear writing objective and a structured plan provide direction and help ensure that the final document meets its intended purpose.

Regardless of the type of document being produced, effective preparation requires three essential elements:

1. Answers to the key planning questions that define the purpose, audience, and requirements of the document.
2. A realistic estimate of the amount of work required.
3. A schedule that allocates sufficient time for research, writing, review, and revision.

The 'All-Purpose' Questions

In his poem Serving Men, Rudyard Kipling identified six fundamental questions: What? Why? When? How? Where? and Who? These questions later became essential tools in journalism because answering them provides the basic structure needed to understand any event or situation. The same approach is valuable in technical writing.

Before beginning a document, writers should use these questions to define the purpose, scope, and requirements of the project. By clearly identifying the answers, the writer gains a better understanding of the information needed, the people involved, the resources required, and the steps necessary to complete an effective technical report.

The following planning questions provide a useful starting point. Additional questions may be required depending on the complexity and purpose of the document.

Purpose and Objectives

What is the main objective of the document?
What outcome must the document achieve?
Is the purpose to provide information, persuade readers, obtain approval, or accomplish a combination of these goals?
Why is this document required?

Information Requirements

What information is needed to complete the document?
Where can the required information be obtained?
Who can provide useful information or technical expertise?
Who needs to be consulted during preparation?

Schedule and Resources

When is the document required?
When will sufficient time be available for research, writing, reviewing, and revising?
How much effort will the project require?
How urgent is the assignment?

Audience and Review

Who will read the document?
Who will use the information provided?
Who will review, approve, or verify the completed document?
Who else should contribute to the final version?

The Work Estimate

An important part of planning any technical document is determining how much time and effort will be required to complete it. Whether preparing a report, procedure, or technical specification, writers must develop realistic estimates to ensure that the project can be completed effectively and within the required timeframe.

The accuracy of these estimates improves with experience. Writers become better at predicting the time needed as they become familiar with their own working pace, the complexity of different assignments, and the resources required to complete each task.

A useful approach is to divide the project into smaller, manageable stages. Breaking the work into clearly defined steps makes it easier to estimate the effort involved, track progress, and identify potential delays before they become problems. The following stages are common steps involved in preparing a technical document:

- Writing plan and outline
- Research
- First draft
- Editing and proofreading
- Rewrite
- Approval
- Final production

Given this information, if you know the speed at which you work - and only you know this - you can estimate the time you will need. To give you some idea of the rate at which drafts are written, an exceptional writer can write 4,000 words a day. Some writers can only manage 1,000 words or less in an eight-hour working day. The average output is probably between 2,000 and 2,500 words a day.

Experience, and discussion with many writers, has shown that the ratio of preparatory work, research, and editing to the actual writing is 4:1. Therefore, if you write at a rate of, say, 2,500 words a day, and you estimate that the report will be of that length, the project will take you five days to complete. This is a rule of thumb only; you need to adapt it to your own rate of output.

What is the size of 2,500 words of written text? Here we are on firmer ground. A double-spaced 8.5" × 11" typewritten page carries about 25 lines of text. Each line has an average of ten words. Each page, therefore, contains about 250 words of text, so that a 2,500-word text is ten pages of manuscript copy.

For a 2,500-word report, the breakdown in hours would be something like this:

Tasks	**Hours**
Plan and outline	4
Research	20
First draft	8
Edit and proofread	2
Rewrite draft	2
Approval	Varies
Final production	4
Total hours	40

The Schedule

Once the amount of work required for a document has been estimated, preparing a writing schedule becomes much easier. For small assignments, a formal schedule may not be necessary. However, for larger projects, a written schedule is a valuable planning tool because it provides a way to monitor progress and ensure that the work remains on track.

Major technical documents can require significant time and effort to complete. For example, the preparation of operating manuals, maintenance guides, or comprehensive technical specifications may extend over several months or even a year. Because of this, realistic scheduling must take into account more than just the time required for writing.

Many technical writers are responsible for other duties in addition to document preparation. If writing can only be completed during part of the available working time, the schedule must reflect this limitation. For example, if a project is estimated to require 40 hours of writing effort but only half of each workday can be devoted to it, the actual completion time will extend over approximately two weeks rather than one.

The greatest uncertainty in a writing schedule often occurs during the review and approval stages. Editing, proofreading, technical review, and management approval may depend on the availability and response time of other people. At these stages, progress is no longer controlled entirely by the writer but also depends on colleagues, supervisors, and decision-makers involved in the approval process.

Striking A Balance

After defining the purpose of the document, estimating the required effort, and creating a realistic schedule, one final preparation step remains: developing a writing outline.

The amount of preparation required should depend on the size and complexity of the project. Careful planning is essential, but preparation should not become a substitute for actually writing the document. Excessive planning can delay progress and prevent the writer from moving forward.

This point is illustrated by a story attributed to Somerset Maugham about a banker who dreamed of becoming a writer. He carefully prepared for his future work by collecting extensive notes, building an impressive library, and creating a comfortable study where he could write. After investing significant time and effort into preparing the ideal environment, he finally retired to his carefully arranged workspace—only to die before writing anything.

The lesson is clear: preparation is valuable only when it supports the writing process. A well-developed plan, including an effective outline, provides direction and improves organization, but it must lead to the creation of the final document.

3.2 Research

Research is the foundation of effective technical writing. Without accurate and relevant information, there is no reliable material from which to develop a document. For this reason, successful technical writers must understand not only the importance of research but also the methods used to gather, evaluate, and organize information.

Research is the process of learning as much as possible about the subject being documented. There are four primary methods of gathering information:

Direct observation of the subject or process.
Interviews with individuals who have knowledge or experience in the area.
Reviewing existing sources, including written documents, recordings, videos, and other published materials.
Analyzing information logically to develop conclusions and connections.

In most technical writing projects, effective research involves a combination of all four methods.

Planning the Research Process

The first step in research is determining exactly what information is needed. Before beginning, writers should consider several important questions:

What is the purpose of the document?
Who is the intended audience?
How much detail is required?
What evidence or supporting information will be necessary?
Where is the most reliable source of information likely to be found?

Careful planning prevents wasted effort. Many writers spend excessive time searching for information because they begin researching without first identifying what they need to discover. A successful researcher defines the objectives, creates a plan, and then searches for information in the most efficient way possible.

Research instructor Alden Todd recommended three useful questions for identifying valuable sources:

Who would know?
Who would care?
Who would care enough to publish or document it?

Before beginning research, create a complete list of the information required. Review the list carefully, identify the most important questions, and determine the best sources for obtaining answers. Only then should the research process begin.

Sources of Information

Technical writers can obtain information from many sources. Subject experts, government agencies, professional organizations, and experienced colleagues can provide valuable knowledge, especially when dealing with specialized topics.

Libraries remain important research resources. Public, academic, and corporate libraries provide access to books, journals, reports, and reference materials. Professional librarians are often highly skilled researchers and can help locate information efficiently.

Many libraries also provide access to electronic databases containing large collections of technical publications, research papers, patents, reports, and other specialized information. These databases allow researchers to search large amounts of information quickly and identify relevant sources.

Online research services and technical databases are particularly useful because they often provide summaries or abstracts of published material. An abstract allows the writer to determine whether a document contains information worth further investigation before obtaining the complete source. Full documents may be available through information services, publishers, or interlibrary loan systems.

Although electronic research services may involve costs, they can often save significant time compared with manually searching through large collections of documents. Effective use of these resources requires some knowledge of search methods and careful planning.

Organizing Research Information

Collecting information is only part of the research process. Once sources have been gathered, they must be organized so that they can be used effectively during writing.

Maintain a record of every source consulted, including:

Author's name.
Title of the document.
Publication name and date.
Publisher or organization.
Page numbers or relevant sections.
Location where the information was obtained.

Assigning a simple reference code to each source can make later organization easier. These codes allow writers to quickly connect notes with their original sources without repeatedly searching for information.

During research, record every question, idea, or possible lead that arises. Later, review these notes and remove items that are no longer relevant. Regularly reviewing and organizing research notes prevents important information from being overlooked and keeps the project focused.

Handling Confidential Information

Not all technical information is available for general use. Some projects involve confidential material, proprietary information, or sensitive subjects that require careful handling.

When confidentiality is involved, writers must consider who can provide information, what questions are appropriate to ask, and how the information may be used. Sensitive topics may require discretion when discussing details with others.

Confidentiality can make research more challenging because some information may be unavailable or restricted. However, a writer who has earned trust may receive access to valuable information for background understanding, provided that the information is not disclosed in the final document.

When working with restricted information, clearly identify confidential material in notes and records. Careful organization helps prevent accidental disclosure and protects the confidence placed in the writer.

Conducting Effective Interviews

Interviews are an important research method in technical writing. Speaking with colleagues, specialists, operators, managers, and subject experts often provides information that cannot be obtained from written sources alone.

Successful interviewing requires preparation, good communication skills, and the ability to create a comfortable environment for the person being interviewed. A productive interview depends largely on the researcher's attitude, preparation, and ability to ask appropriate questions.

Before conducting an interview, the writer should:

Clearly define the purpose of the interview.
Understand enough background information to discuss the topic effectively.
Prepare questions in advance.
Use an interview guide or question sheet to ensure important topics are covered.

The purpose of an interview may extend beyond collecting facts. Interviews can also provide opinions, recommendations, explanations, and practical experience. To organize responses effectively, questions can be divided into categories such as:

Background information.
Facts and observations.
Analysis and interpretation.
Recommendations and suggestions.

General questions are often useful at the beginning of an interview because they introduce the subject and encourage discussion. It is also helpful to demonstrate preparation by asking informed questions or confirming information already known. This builds confidence and encourages the interviewee to provide more detailed and useful responses.

3.3 Document Structure

After completing the research process and conducting any necessary interviews, the next step is to determine how the information should be organized. A well-structured technical document guides the reader through the subject in a logical sequence and ensures that important information is presented clearly.

The structure of a technical document depends on the purpose, audience, and complexity of the topic. Simple documents may require only a few sections, while larger reports, manuals, or specifications may contain several distinct parts.

There are many possible elements that can be included in a technical document. Not every document will require every section, but each possible component should be considered carefully during the planning stage. Evaluating these elements helps writers decide which sections will add value and create the most effective structure for the intended audience.
The following sections describe fourteen common elements that may be included in a technical document.

3.3.1 Cover Page

The cover page, sometimes called a title page or front sheet, provides essential identifying information about a technical document. It typically includes the document title, the name of the author or authoring group, and the date of issue. In many organizations, it also includes the names, signatures, or approval records of individuals responsible for reviewing and authorizing the document.

The cover page may also contain document control information, such as an identification number, revision level, or version history. Large organizations, government departments, and regulated industries commonly use alphanumeric codes to identify documents and track revisions. For example, a document may be labeled with a code such as:

Procedure M31700-8, Revision 4 of 4, issued 08/08/89 by John Doe.

These identification systems help organizations manage large numbers of documents and ensure that users are working with the most current version.

3.3.2 Contents

Including a table of contents in a technical document depends largely on the size and complexity of the material. A short document, such as a brief two-page report, usually does not require one. However, longer documents such as manuals, reports, and detailed specifications benefit greatly from a contents page because it allows readers to locate information quickly.

A table of contents should generally provide a straightforward list of the major sections and headings within the document, along with the page number where each section begins. Its purpose is to give readers a clear overview of the document structure without unnecessary detail.
For documents that require more extensive navigation, additional tools such as an index may be more appropriate. An index allows readers to locate specific topics, terms, or subjects throughout the document. A glossary may also be valuable, particularly in technical documents that contain specialized terminology, abbreviations, or industry-specific language.

3.3.3 Summary

A summary, abstract, synopsis, or précis should normally be prepared after the main body of a report has been completed. Writing it at the end allows the writer to accurately capture the purpose, scope, and main findings of the document.

A summary should be brief and focused. Its purpose is not to repeat the report in detail, but to provide a concise explanation of what the document contains. It should give readers enough information to understand the subject and decide whether the full report is relevant to their needs. In this way, a summary serves a similar purpose to the description found on the back cover or inside cover of a published book, where it introduces the content and encourages further reading.

For example, the following abstract summarizes a technical paper titled Development of a Maintenance Program, which was prepared for an international symposium:

"Bruce Nuclear Generating Station 'A' has been operating for ten years. One factor contributing to its successful performance is the implementation of an effective maintenance program. This paper examines an evaluation of the station's maintenance strategy. The evaluation included a review of selected equipment throughout the operating history of the station. The results identified a need to improve maintenance records to support cost analysis, workforce planning, reliability assessment, and radiation dose calculations."

In only a short paragraph, the author communicates the purpose of the paper, the method used, and the main conclusion. An effective technical summary should be concise, accurate, and written in clear language. As a general guideline, aim to keep summaries to approximately 100 words or fewer whenever possible.

3.3.4 Introduction

Every technical document should begin by establishing its subject and purpose. After reading the summary, the reader should understand why the report is important and why the full document is worth reading. The introduction provides the opportunity to explain the reason for the document, define its purpose, and prepare the reader for what follows.

A separate heading titled Introduction is not always necessary. In many cases, readers naturally recognize that the opening section serves this purpose. However, if an organization's document standards require an introduction heading, it should be included.

The length of the introduction should be appropriate for the size and complexity of the document. A short report may require only a brief opening statement, while a larger report may need a more detailed explanation of the background and objectives. There are no fixed rules; the writer should use good judgment. Most importantly, the introduction should capture the reader's interest and encourage continued reading.

Strong introductions can be created for any technical subject. For example, a Transport Canada manual on airport baggage-handling systems begins by explaining the importance of efficient baggage services:

"Airports exist for the convenience of travelers. Over the past 30 years there has been an enormous growth in passenger traffic. More passengers mean larger baggage loads, but travelers expect their baggage to be available for pick-up at their destinations in the same condition it was in when handed into the care of the airline staff and baggage handlers. This manual is an introduction to the design, installation, operation and maintenance of baggage-handling systems in Canadian airports."

This introduction immediately identifies the situation, explains the problem created by increased passenger traffic, and establishes the purpose of the document.

For investigative reports, the introduction may also describe the problem being examined and provide an overview of the approach used to study it. Some writers use the heading Methodology to describe their analytical process. While this may be appropriate for highly technical procedures, such as detailed scientific experiments or chemical analyses, it is often unnecessary in general technical writing. Clear and direct explanations are usually more effective than overly formal terminology.

3.3.5 Facts

The most important thing about setting out the facts on which your report will be based is to stick to a simple recitation of them. Do not embellish and do not discuss them at this point (we deal with discussion separately).

If you attack your fact sheet this way, you will avoid one of the commonest traps writers fall into - getting all snarled up because they try to work explanations or caveats or other complications into the recital of facts. When you have facts to recite, recite them simply. And the order in which you put them is not nearly as important as their accuracy. Put them down in any order that comes to mind; if you see that your report would be improved by changing the order, change it later.

Much depends on the specific of the individual project. If, for example, you are dealing with the site selection and construction of a hospital, it will be important to recite the facts relating to:

- **Site selection:** location, access and subsoil drainage
- **Regulatory controls:** municipal by-laws, government subsidies and building standards
- **Demographic characteristics**
- **Capital costs and amortization**

Whatever the subject, presentation of the facts is the sole purpose of this section of your document. You might wish to include copies of certain source materials in your document, but these should be placed elsewhere (see "Appendices' below). In this section, do not discuss your sources in detail, only the facts themselves: study results, information from interviews, computer data - whatever you have used.

3.3.6 Discussion

After presenting the facts, the discussion section provides the opportunity to explain their meaning. In this part of the report, the writer moves beyond simply stating information and begins interpreting what the facts reveal. The purpose is to explain conclusions, evaluate evidence, and show the reader how the information supports the overall purpose of the document.

The discussion section is where the writer can incorporate relevant opinions from interviews, apply analysis, and use logical reasoning to develop an argument. While technical writing must remain based on evidence, this section requires thoughtful interpretation and judgment. In this respect, technical writers use many of the same skills as creative writers: imagination, organization, and the ability to communicate ideas effectively.

The quality of the discussion often determines the effectiveness of the entire report. A well-presented set of facts alone does not guarantee that readers will understand their significance or accept the writer's conclusions. The discussion is where the writer demonstrates the value of the information and guides the reader toward a clear understanding.

For example, the study Life Cycle Costing by Astute Defence Systems (1986) examines life cycle costs associated with a specific type of missile equipment. Although the report identifies three possible costing systems, it does not explain which option is preferred, provide meaningful analysis, or offer recommendations. The study states:

"A cost study is a means of choosing design characteristics that minimize the life cycle cost. Three systems emerge as the front runners. These are..."

The report provides information but fails to develop the discussion necessary to help readers make a decision. By not analyzing the results or explaining their implications, the writer misses an opportunity to persuade the audience and add value to the research.

A successful discussion section should therefore do more than repeat information. It should interpret the evidence, explain its importance, and present a clear argument supported by accurate and reliable data. The writer achieves the purpose of the report only when the reader is able to understand, trust, and act on the conclusions presented.

3.3.7 Safety

Safety can no longer be treated as a responsibility belonging only to safety specialists or regulatory authorities. In modern organizations, every industry and professional field is expected to consider the safety implications of its activities and decisions. Protecting employees, the public, and the environment is an essential part of responsible technical practice.

When preparing a technical document, writers should always consider whether safety issues are relevant to the subject. If safety concerns affect the information being presented, they should be addressed clearly and given appropriate attention. In some cases, safety considerations may be significant enough to require their own dedicated section within the document.

3.3.8 Cost

There are few subjects that do not involve serious consideration of cost; cost is the main subject of some project reports. In the cost section of the report, discuss only the meaning of the figures. Tables of cost recovery factors, capital expenditure calculations, escalation rates and insurance should be presented elsewhere (see 'Appendices' Page 95).

3.3.9 Conclusions

The conclusions of a technical report should provide a logical outcome of the information and analysis presented earlier. Readers should be able to follow the reasoning from the facts, through the discussion, and arrive naturally at the conclusions drawn by the writer. A conclusion should never introduce unexpected ideas or information that has not been previously supported.

Depending on the length and purpose of the document, recommendations may be included in the same section as the conclusions. However, it is important to recognize that conclusions and recommendations serve different purposes. A conclusion explains what the evidence shows, while a recommendation suggests what action should be taken as a result.

The difference can be illustrated by considering an investigation into problems experienced by a company’s spare parts system. After reviewing the available information, the investigator concluded that the identification and tagging system used for spare parts was inadequate. Based on the facts presented earlier in the report, the investigator determined that poor tagging information could lead to several consequences:

- Reduced production due to increased equipment downtime.
- Higher maintenance expenses.
- Increased costs associated with purchasing replacement parts.
- Longer delays in obtaining required components.

In this example, the conclusion does not propose a solution; instead, it explains the significance of the information collected and shows the impact of the identified problem. Any proposed corrective actions would belong in a separate recommendations section.

3.3.10 Recommendations

A recommendation goes one step beyond the conclusion, to suggest an action. In the report on spare-part tagging described above, the investigator made these recommendations.

- Ensure that selected spare parts are correct and in stock.
- Ensure that tagging information is correct.
- Revise the spare parts restocking procedure.
- Change the procurement procedure.
- Review the spare parts to reduce unwanted stock, and stock additional spares for critical equipment.

3.3.11 References

References are an important part of a technical document because they provide support for the information presented and demonstrate the reliability of the work. By identifying the sources used, writers allow readers to verify facts, review supporting evidence, and better understand the basis for the discussion, conclusions, and recommendations.

Citing references also recognizes the contributions of other authors, researchers, organizations, and experts whose work has contributed to the development of the document. Proper acknowledgment is an essential part of professional and ethical technical writing.

A complete reference list should clearly identify all sources used during research. The format and level of detail required may vary depending on organizational standards or publication requirements.

3.3.12 Tables and Figures

Tables, figures, sketches, drawings, and other visual materials should be organized in a separate section when they are too numerous or detailed to include within the main body of the document. These items should be presented in the same order in which they are referenced throughout the text so that readers can locate them easily.

Each table, figure, or illustration should be clearly identified with an appropriate title or numbering system, particularly when a document contains a large amount of visual information. Clear labels allow readers to connect the supporting material with the related discussion in the report.

For lengthy documents, some writers use divider pages or section markers to help readers quickly locate tables and figures. Regardless of the method used, the main text should always provide clear references to supporting visuals so that readers know where to find the additional information.

3.3.13 Appendices

Appendices are commonly included near the end of a technical document to provide additional information that supports the main content without interrupting the flow of the report. They allow writers to include detailed material that may be useful to some readers but is not essential to understanding the main discussion.

An appendix may contain a variety of supporting materials, such as manufacturers' documentation, complete publications or studies written by other authors, detailed tables, graphs, calculations, drawings, or other reference information.

Any material that is too extensive or detailed to include within the main body of the document can often be placed in an appendix. This approach keeps the primary discussion clear and organized while still providing readers with access to important supporting information when required.

3.3.14 Index

An index is a valuable resource for readers, particularly when they need to locate specific information within a document after its initial use. It allows users to quickly find important topics, terms, or references without having to search through the entire report.

However, preparing an index can require a significant amount of time and effort. For this reason, an index should only be included when it provides a clear benefit to the intended audience and improves the usefulness of the document.

Writing Outline

If you agree that a technical report can contain the parts discussed above, you will see that those parts will form the basis of your outline. Here's the list of possible report elements again.

1. Cover Page
2. Contents
3. Summary
4. Introduction
5. Facts
6. Discussion
7. Safety
8. Cost Evaluation
9. Conclusions
10. Recommendations
11. References
12. Tables and Figures
13. Appendices
14. Index

An outline provides the basic structure for a technical document, much like the framework of a building provides the foundation for construction. Before a builder can install doors, windows, plumbing, heating systems, and finishing materials, a solid framework must first be established. In the same way, a writer needs an organized structure before developing the complete document.

The fourteen document elements described earlier can serve as a starting point when creating an outline. Writers should evaluate each element, decide which sections are appropriate for the specific project, and arrange them in an order that best supports the purpose of the document.

A practical approach is to begin by organizing the information collected during research. Many professional writers use note cards or similar systems to record research findings, references, and ideas. These notes can then be sorted into broad categories such as facts, discussion, conclusions, and recommendations.

Once the information has been organized into major sections, the outline can be expanded by adding subheadings for specific topics and areas of discussion.

Report Layout

The physical appearance of a technical report may seem like a minor issue compared with the importance of its content. However, document design has a significant effect on readability and can influence whether the document is actually used. A report is written to communicate information and, in many cases, to convince readers of the validity of an argument. Even the strongest ideas are ineffective if poor presentation prevents readers from engaging with the document.

Two main factors influence the design of a technical report:

- The organization and numbering of sections and subsections.
- The arrangement and appearance of text on the page.

The guiding principles for both should be simplicity, consistency, and clarity. A well-structured document allows readers to follow information easily and locate specific sections when needed.

Numbering sections and subsections is useful because it allows readers to refer to specific parts of a document accurately. However, writers should avoid creating overly complicated numbering systems with excessive combinations of letters, numbers, sub-sections, indented passages, and quotations. Too much formal structure can distract from the content and make the document more difficult to read.

4.0 Special Writing Tasks

4.1 How to Write Procedures

A simple set of directions can demonstrate the essential qualities of a good procedure. For example:

"Travel south along Main Street, turn right at the next traffic lights, continue for two blocks, and turn right again. You will arrive at the main entrance."

These instructions are clear, direct, and easy to follow. They tell the reader exactly what actions to take and the order in which they should be completed.

The same principles apply to procedures used in business, industry, and technical environments. An effective procedure should provide clear instructions that allow the user to understand what must be done and how to complete the task correctly. Ambiguous language, unnecessary conditions, or unclear explanations can lead to mistakes and inconsistent results.

A procedure is a defined method or sequence of actions used to complete a specific task. In simple terms, it describes how work is to be performed. Procedures are closely connected with quality assurance because they help ensure that activities are carried out consistently and reliably.

The concept of quality assurance (QA) is widely established in industries such as healthcare, nuclear power generation, aerospace, petrochemical processing, and defence. In these fields, documented procedures are essential components of quality management systems.

Why Written Procedures?

In any large organization, changes to processes or methods of work must be communicated clearly to everyone affected. Employees responsible for specific activities should be consulted and informed about changes that influence their duties. While a small operation may rely on verbal agreements and informal communication, larger organizations require a more structured approach to ensure consistency and accountability.

Written procedures provide objective evidence that work has been performed according to established requirements. They create a documented record that can be reviewed, verified, and relied upon long after the activity has been completed.

For example, if someone observed a welder completing a joint and later reported when and how the work was performed, that information would only be second-hand evidence. A more reliable record would include documentation of the weld, confirmation by the welder, verification by a supervisor with a dated signature, and approval by an inspector. This provides clear evidence that the work was completed correctly and by the appropriate personnel.

A properly maintained written record remains valuable years after the task was performed. It identifies who completed the work, who verified it, and who inspected the final result. The record provides confidence that the required steps were followed and that responsibility can be traced.

The same principle applies across many industries. A security officer completing an incident report or a nurse administering medication according to a documented process creates a record of actions taken. These records form part of a quality management system and provide evidence that procedures have been followed.

Principles For Writing a Good Procedure

The following two principles should be followed at all times, but especially in the early stages of writing a procedure. They are of the utmost importance to good procedure writing.

1. Keep the user in mind
2. Keep the QA program in mind

Keeping the User in Mind

In most situations, the person using a procedure is not looking for an engaging or detailed document. Their main objective is to quickly determine exactly what actions must be taken. For this reason, procedures should be written with simplicity, precision, and clarity as the primary goals.

A user should be able to read a procedure quickly and understand the required steps without confusion. Use straightforward language and simple sentence structures whenever possible. Repetition may seem unnecessary to the writer, but in procedures, consistency and clarity are often more important than variety in wording.

Many organizations develop writing standards that encourage concise and direct communication. These standards, often included as part of an organization's house style, may not produce the most entertaining documents, but they help create procedures that are easier to follow and less likely to be misunderstood.

Procedures should be written for a specific group of users with similar responsibilities, working conditions, and equipment. General procedures designed for many different audiences often create confusion because they include unnecessary information for some users while failing to provide enough detail for others. A focused procedure is more effective because it addresses the exact needs of the people who will use it.

Avoid including explanations of information that the intended users already understand, unless the information is critical for safety or operational reliability. To write an effective procedure, the writer must understand the users' existing knowledge as well as the areas where additional guidance may be required.

For example, if a procedure requires users to perform a task at an unfamiliar location, it should include enough information to help them find and understand that location.

Keeping the Whole QA Program in Mind

A procedure writer must have a strong understanding of the overall quality assurance (QA) system and detailed knowledge of any procedures that are connected to or similar to the one being developed. This understanding is essential to prevent conflicts, duplication, or inconsistencies between documents.

Every procedure exists as part of a larger system of instructions and controls. It may interact with other procedures through shared responsibilities, processes, or requirements. The writer must understand these relationships and ensure that the new procedure fits correctly within the overall framework.

At the same time, each procedure must be clearly distinguishable from others. Confusing one procedure with another can lead to errors and improper actions. The title of a procedure should therefore be brief, descriptive, and unique. When a short title does not provide enough information, additional clarification should be provided through a scope statement rather than by creating an unnecessarily long title.

For example, a procedure titled “Paint Shop Fire Precautions” could be followed by a scope statement such as: “Procedures for paint application, waste removal, and the cleaning and maintenance of paint shop facilities and equipment.”

In some situations, it is also useful to include entry conditions that describe the circumstances requiring the procedure to be used. For example, a procedure called “Primary Power Generator Restart” might apply under the following conditions:

1. After a scheduled generator shutdown.
2. After an automatic generator shutdown, provided that no failure warnings are indicated by the primary control system.

All identifying information, including the title, scope, and entry conditions, should appear on the front page of the procedure. This allows users to quickly confirm that they have selected the correct document before beginning the task. Visual identification methods, such as color coding, may also be used to make procedures easier to locate and recognize.

Preparing to write a Procedure

Before writing a procedure, the writer must develop a thorough understanding of the task and become knowledgeable about every aspect of the process. This requires careful research. Begin by identifying any organizational requirements or standards that define how procedures must be developed, and ensure that these requirements are followed along with accepted technical writing practices.

The first step is to gather all relevant supporting information. This may include equipment manuals, manufacturer documentation, technical reports, engineering studies, human performance information, and other existing procedures that may influence or relate to the new procedure.

A major part of the research process involves creating reliable source documentation. Research worksheets are useful for recording observations, notes, and findings gathered during the investigation. For larger projects, it may be helpful to create specific worksheet formats for different types of research activities. These records should identify information sources, including names, job titles, and qualifications of individuals who provide information.

Research worksheets become the technical foundation of the procedure and must be prepared carefully and retained permanently. Without proper documentation, research findings may become unreliable because they cannot be verified or supported with objective evidence.

The writer should personally examine the location where the procedure will be used. This includes identifying the equipment, materials, tools, and environmental conditions involved. Important details such as instruments, gauges, measurement units, and equipment accuracy should be understood and documented.

An essential part of the research process is communication with the people who will use the procedure. Users can provide valuable information about possible difficulties, safety concerns, and opportunities for improving efficiency. The writer should determine how often the procedure will be used, how important it is to daily operations, and observe similar procedures being performed whenever possible to identify potential problems.

A complete understanding of the users' training, experience, and technical knowledge is also necessary. Procedures should be written at a level that matches the abilities of the intended audience. Writers must know which terminology, symbols, abbreviations, and technical concepts users will understand easily and which areas may require additional explanation.

The writer must also investigate the administrative requirements associated with the procedure. This includes determining when inspections are required, who must be notified if problems occur, and what consequences may result from performing the procedure incorrectly.

After collecting and organizing the research information, the next step is to define the actions required by the procedure. Each task should be clearly identified and arranged in a logical sequence. Flowcharts or similar visual tools can be useful for understanding the relationship between steps and ensuring that the process is complete.

Elements of a Procedure

In the same way that certain components are commonly found in technical reports, all well-produced procedures consist of a series of elements.

Cover Page

The cover page of a procedure should provide essential identifying information about the document. This typically includes the procedure title, document number, revision number (when updating an existing procedure), date of issue, issuing authority, distribution details, author, and the signature of the individual responsible for approval.

The revision number and date are particularly important because procedures are regularly reviewed and updated to reflect changes in equipment, processes, regulations, or organizational requirements. Clearly identifying the current revision helps users confirm that they are working with the most recent and accurate version of the procedure.

Some organizations choose not to use a separate cover sheet or front page. Instead, they include all required identification and approval information on the first page of the procedure itself. Regardless of the format used, the document must provide enough information for users to quickly verify its status and validity.

Contents

If the procedure is a long one, such as an operating manual, a contents page is usually justified. If it is a two-or three-page procedure, a contents page is merely a frill.

Introduction

It is always useful to state the purpose of the procedure; the best place for this is the introduction.

Policy

A procedure may be developed within an organization that either has an established policy related to the subject or has no formal policy in place. When a relevant policy exists, it should be clearly identified, described, or referenced within the procedure.

Organizational policies often define requirements such as specific responsibilities, required documentation, approved forms, and levels of authority associated with certain activities. In addition, external regulations or industry standards may influence how a procedure must be performed.

The policy section of a procedure should make users aware of any requirements, restrictions, or governing controls that affect the task. Providing this information ensures that the procedure is followed within the appropriate organizational and regulatory framework.

Responsibilities

Clearly defining responsibilities is an essential part of an effective organization and an important component of any well-written procedure. A procedure should identify who is responsible for each activity and what duties are assigned to each role.

Responsibilities are usually presented in a point-form format because this makes the information easier to read and allows users to quickly identify their specific tasks.

For example, in a procedure for inspecting incoming materials, responsibility for the inspection process may be assigned to Floor Inspectors. Their duties could include:

- Comparing received materials with the purchase order to confirm quantities and descriptions are correct.
- Signing the carrier's delivery receipt only after verifying that the shipment details are accurate and that no visible damage is present.
- Moving received materials or equipment to the designated incoming inspection area.

Work Process

For a procedure to be effective, the writer must first understand the work process in which the procedure will be applied. Without this understanding, the procedure may fail to address important requirements or create difficulties for the people who must use it.

As the writer studies the process, it may become clear that certain activities must be completed before the main task can begin. These preliminary requirements should be identified and included where necessary. Important questions may include:

- Must electrical circuits or equipment be isolated before work begins?
- Is authorization required before accessing or operating certain equipment?
- What tools, materials, or resources are needed?
- What safety precautions or protective measures must be followed?
- Are verification or testing steps required before proceeding?
- What sequence of actions must be completed?
- Will users require drawings, diagrams, or other supporting information?

By following a thorough preparation process before writing, including the research methods described earlier, the writer gains a complete understanding of the factors that influence the procedure. This preparation reduces the time required for writing and results in a document that is more accurate, practical, and effective for the intended users.

Records

What records of the work done are needed? How many copies are required? To whom must they be sent? Summarize the records required and specify what information must be provided.

References

Users of procedures often need to consult additional documents that provide supporting information, requirements, or guidance. These may include regulatory documents, health and safety instructions, organizational policies, technical manuals, or other internal procedures.

An important responsibility of the procedure writer is to ensure that users have access to all information required to complete the task correctly and safely. Providing a clear list of related documents or including cross-references within the procedure helps users quickly locate additional requirements and supporting material.

Appendices

Some procedures require additional information that is too detailed, extensive, or specialized to be included within the main body of the document. This supporting material may include tables, graphs, diagrams, technical drawings, manufacturers' operating instructions, glossaries, or other reference information.

To maintain clarity and keep the main procedure focused on the required steps, these materials should be placed in an appendix section at the end of the document. Organizing supplementary information in this way allows users to access detailed resources when needed without interrupting the flow of the procedure itself.

Writing Style

The most important quality of a good procedure is simplicity and directness. Instructions should tell the user exactly what action is required, using clear and active language. Whenever possible, use imperative verbs that directly describe the required action, such as "turn the valve," "remove the cover," or "start the pump."

Use simple verbs and apply them consistently throughout the procedure. Avoid changing words merely to create variety. For example, if a procedure instructs users to "tighten" a bolt in one section and "secure" it in another, users may wonder whether the actions are different. Different terms should only be used when they represent different actions, and those differences should be clearly explained.

Organizations may have established writing standards that define preferred terminology and restrict the use of certain words. Regardless of these requirements, every noun and verb used in a procedure must have a clear and specific meaning. Descriptive words such as adjectives and adverbs should be avoided unless they provide precise information. Terms such as "dirty surface" or "clean thoroughly" are open to interpretation and may lead to inconsistent results. Instead, describe exactly what condition must be corrected and what standard must be achieved.

Sentence structure should also remain simple and logical. Users must be able to easily understand the relationship between actions and conditions. Particular attention should be given to words such as and, or, if, and when, since incorrect use of these terms can change the meaning of an instruction.

Conditional statements using the "if…then" format are often effective in procedures because they clearly define the relationship between a situation and the required response. Short conditional statements are especially easy for users to follow.

Avoid long paragraphs in sections where users are expected to perform actions. Instructions should be presented as short sentences or clearly separated points. However, sentences should not be shortened to the point where meaning is lost. For example, "Remove the filter" is a clear instruction, while "Filter removed" does not clearly tell the user what action to take.

Step-by-step instructions may require numbering when the order of actions is important. If steps can be completed in any order, this should be clearly stated. Avoid unnecessary numbering, excessive indentation, and complicated sub-sections. These formatting methods are useful when they improve organization, but too much structure can make a procedure harder to understand.

Footnotes should generally be avoided in procedures because they interrupt the user's workflow. The goal of a procedure is to provide all necessary information at the point where it is needed.

Requiring users to move between sections, pages, or separate documents increases the chance of mistakes.

Instead of directing users to repeat instructions found elsewhere, include the required information directly in the procedure. Reducing unnecessary page turning and document searching helps users complete tasks more accurately and efficiently.

Graphic Design

Effective graphic design plays an important role in the readability and usefulness of a procedure. The visual presentation of a document should never be overlooked. For example, selecting an inappropriate font style or text size may make a procedure difficult to read under the lighting and working conditions where it will be used.

Formatting features such as capital letters, underlining, italics, bold text, and other methods of emphasis should be used carefully. When overused, these techniques can make a document appear cluttered and reduce their impact. Emphasis should be reserved for information that is truly important, such as words that change the meaning of an instruction, including "not" or "only if." Words such as "always" and "carefully" are often unnecessary because the importance of following instructions correctly should already be understood. Quotation marks should not be used as a method of emphasizing words in procedures.

Page layout should be designed to support quick reading and easy reference. A single-column format is often preferred because it reduces visual density and allows the reader to follow instructions more naturally. A two-column layout can be useful when each column serves a separate purpose, such as placing instructions in one column and warnings or notes in the other.

Short procedures may benefit from a simple flowchart format, particularly when the sequence of actions depends on decisions or conditions. When procedures frequently use an "if…then" structure, placing these terms on separate lines can help users quickly identify whether a condition applies and locate the appropriate action.

Additional features can be included to improve usability. For example, check boxes beside procedure steps allow users to confirm completed actions. If these pages are intended for repeated use, they should either be replaceable or protected with a laminated surface that allows marks to be erased. When calculations are required, procedures should provide sufficient workspace and include any necessary conversion factors.

Every page should be numbered, and the document title should appear consistently throughout the procedure. Document identification numbers and revision information may also be included, but excessive information should be avoided because it creates unnecessary visual clutter. For revised procedures, updated sections should be clearly marked. A colored vertical line along the page margin is one effective method of identifying recently changed material.

Warnings, cautions, and notes should only be included when they provide necessary information. When multiple warnings or cautions are required, a separate column or clearly defined area may improve organization. These statements can be highlighted using boxes or bold text, but excessive capitalization should be avoided. Notes should be visually distinct while receiving less emphasis than warnings or cautions.

A procedure should also be easy to identify among other documents. Color-coded covers or bindings can help users quickly locate the correct procedure. For larger documents, colored section dividers and tabs can improve navigation and make information easier to find.

4.2 Letters

Written communication, such as letters and memos, has important advantages over spoken communication. Unlike a conversation, a written message creates a lasting record that can be reviewed whenever needed. Because the writer has time to plan, organize, and revise the message, written communication can usually be clearer, more accurate, and more carefully structured. Letters can also be shared widely or kept confidential depending on the purpose.

However, written communication also carries responsibility. Once a letter or memo has been sent, it becomes evidence of what was communicated and is difficult to withdraw or correct compared with something said verbally. This is why written messages must be prepared thoughtfully and reviewed carefully before being issued.

A professional letter requires the same level of preparation as a technical report. The writer should gather accurate information, organize ideas, prepare a draft, and edit the final version before sending it for approval. If a supervisor or manager must review the document, the writer should aim to provide a complete and accurate draft that requires minimal changes.

Some letters require supporting materials such as technical details, reports, drawings, or other documentation. When the amount of supporting information becomes extensive, it is often more effective to prepare a formal report and use the letter only as an introduction or summary of the attached material.

Letters

A letter should be prepared with the same level of attention and care as a technical report. Whether or not it requires research, it should be properly planned, drafted, and reviewed before it is sent. When a letter requires approval from a manager or supervisor, the writer should aim to provide a clear and accurate draft that needs little correction or rewriting. Although some supervisors may revise letters extensively for their own reasons, the responsibility remains with the writer to prepare a well-organized message and ensure that all facts are correct before submitting it for review.

Like technical reports, some letters may need additional supporting material, such as documents, data, or detailed explanations. If the amount of supporting information becomes too large, it may be better to prepare a separate report and use the letter as a brief introduction or summary of the attached report.

Names and Forms of Address

Always make sure that a person's name is spelled correctly. If there is any uncertainty, confirm the spelling directly with the individual. Names are important to people, and a spelling mistake can create a poor first impression.

When addressing someone, include any professional or official title they hold. If the person has earned qualifications or professional designations, such as P.Eng., F.R.C.S., or B.Sc., include these after their name to acknowledge their achievements.

Use courtesy titles such as Mr., Mrs., Miss, or Ms. when you know the recipient's preference. These forms of address demonstrate respect and professionalism. If you are unsure of the recipient's gender, it is better to avoid using a courtesy title and address the person by name instead.

The Postal Address

Make sure that the letter and envelope are addressed accurately using the recipient's current address. In large organizations, employees are often transferred or relocated, and internal directories can become outdated quickly. Incorrect addresses can cause delays, frustration for mail staff, and even result in the letter being returned with incorrect assumptions about its purpose or recipient.

To avoid these problems, always confirm that your contact information is current before sending correspondence. It is also important to include a return address on the envelope so that the letter can be sent back to you if delivery problems occur.

Salutation

The traditional salutation "Dear…" remains the standard opening for most formal letters, and alternatives such as "Hi" or "Greetings" may appear too casual or inappropriate in professional correspondence.

When addressing the recipient, use the appropriate title and surname, such as "Dear Dr. Smith" or "Dear Professor Podkolinski." Avoid using first names unless you have an established relationship with the person, as doing so may seem overly familiar.

If you are unsure about the recipient's gender, do not make assumptions. Use a neutral form of address, such as "Dear P. Barrett" or "Dear Pat Barrett," until the person's preferred form of address is known.

When addressing women, use the title they prefer. Although "Ms." is widely accepted, some individuals may prefer "Miss" or "Mrs." when their marital status is known.

Subject Title

Most letters and memoranda are part of an ongoing exchange of information between individuals or organizations. Since many people handle a large amount of correspondence each day, it is helpful to give every document a clear and noticeable title.

Traditional labels such as “Reference,” “Ref.,” or “Re.” are becoming less common. Instead, a brief descriptive heading, similar to a newspaper headline, can quickly show the reader the purpose of the correspondence. Examples include:

W. Sugdon Account #25448787
Explosion at Garbage Factory
Destruction of Chemical Supplies
Technical Writing Course
Drunk Driving Statistics

A clear title allows the reader to understand the subject immediately and makes the document easier to locate later in a file or record system. The title can be separated from the main text by underlining it, although this is unnecessary when using bold formatting. Place the title directly below the salutation.

Opening Statement

You may not like to use titles. They may seem too abrupt for your letter-writing tastes. In this case your first sentence has to serve the same function. You need to tell your correspondent immediately what your letter is about.

Beating around the bush wastes everyone's time. Get to the point. Do not make your reader wonder what you are writing about. Here are some examples of good letter introductions.

- Dear Mrs. Mackley: At our meeting last week you asked me to report the results of our reader survey. Here they are.
- Dear John Harcourt: Here's the labor breakdown you asked for.
- Dear Joan Walker: I'm sorry to tell you that a rail strike has interrupted our parts delivery schedule. Here is how we propose to overcome the problem.

If Joan Walker is the buyer for a large organization, you need to remind her what parts order you are writing about. If you have given the order number in the title line, there is no need to repeat the reference in your opening statement.

Body of the Letter

Winston Churchill was highly skilled in many areas, including letter writing. During the Second World War, he introduced a rule that correspondence sent to him should be limited to a single page, emphasizing the importance of brevity and focus. Military leaders are often known for writing concise and direct messages.

This approach is equally valuable in business communication. The principles used in military correspondence apply to professional letters as well: remove unnecessary information, focus on the essential points, and communicate decisions clearly. Effective letters are direct, purposeful, and free from unnecessary wording.

Ending the Letter

Writers who take too long to finish a letter often weaken the impact of their message. A closing should be brief and should not repeat unnecessary phrases or polite expressions that add no real meaning.

Statements such as "Please give careful consideration to this matter" or "Please do not hesitate to contact me if you have any questions" are often unnecessary once the main message has been delivered. When the purpose of the letter has been clearly explained, the writer should simply conclude.

However, when a specific response or action is required, the closing should clearly state what is expected. For example:

- Please provide your decision by the end of the month so that I can complete the report.
- Please confirm by return whether this proposal is acceptable.
- We will not begin the program until we receive your decision.

Signing Off

Just as "Dear…" remains a widely accepted and appropriate way to begin a letter, "Yours sincerely" is a reliable and professional way to close one. It is now commonly used in formal correspondence, whether or not the writer has a close relationship with the recipient.

General

Business correspondence can serve many purposes, including requesting information, declining job applications, refusing requests, or following up on overdue payments. Regardless of the reason for writing, the message should always be professional, respectful, and carefully worded.

When preparing business letters, keep the following principles in mind:

- Avoid sarcasm or language that may offend the reader.
- Do not send a letter written in anger; allow time to review and reconsider it before sending.
- Avoid making personal criticisms or diminishing others.
- Show understanding and consideration for the recipient's position.
- Keep communication open by allowing room for further discussion.
- Present your points clearly and logically.
- Be brief and focus on the essential information.

4.3 Technical Specifications

Technical specifications serve three main functions:

1. They ensure that the customer receives the product or service that meets the required standards.
2. They help control costs and keep the project within the approved budget.
3. They provide the contractor with a clear understanding of the required work, materials, or performance expectations.

These objectives are the primary reasons for preparing specifications. Other considerations are secondary. Since technical specifications form the foundation of many engineering and scientific agreements, they must be written accurately and carefully. Poorly prepared specifications can lead to unnecessary delays, increased costs, and wasted resources.

This section examines the purpose, structure, preparation, and different types of technical specifications. For simplicity, the term "specification" will be used throughout to mean "technical specification."

What Specifications Do

Preparing a specification is the first and most critical stage of any contract. It should be completed before negotiations begin. Without a clear specification, it becomes difficult to estimate costs, develop schedules, assign responsibilities, or evaluate proposals. A well-written specification should:

1. Clearly define the standard of acceptable work.
2. Ensure that required performance goals are achieved.
3. Support the project's financial objectives.
4. Reduce the possibility of future maintenance issues.
5. Prevent misunderstandings or disputes during the contract.

A specification is a detailed description of the requirements for a product, system, or service within a scientific or engineering field. It identifies important details such as dimensions, materials, quantities, and performance standards. It also provides the requirements that guide a manufacturer or contractor.

A specification explains what is required, not the method used to complete the work. The instructions for carrying out the work belong in procedures, although a specification may refer to applicable procedures when necessary.

The purpose of a technical specification is to ensure that all parties involved in a contract have the same understanding of expectations and requirements. Poorly written specifications can create costly problems, as shown by the example of a railway company that requested half-pint beer glasses for its dining cars. The supplier produced glasses that met the stated measurements but used curved sides to reduce material costs. Although the dimensions matched the specification, the glasses did not actually hold half a pint because the required volume had not been specified.

To avoid similar problems, specification writers should follow these guidelines:

- Understand the intended purpose, function, and operating requirements of the product, including important factors such as capacity and performance.
- Have a clear understanding of how the product can be manufactured or produced.
- Use precise, simple, and unambiguous language.
- Present requirements in a logical sequence.
- Allow adequate time for preparation, review, and approval of the specification, as this can help prevent cost increases and schedule delays.

Types of Specifications

Specifications fall into a variety of categories and purposes. For example, design specifications, unlike manufacturing specifications, do not necessarily result in the production of hardware. Here, then, is an explanation of the various types of specifications.

Concept Specifications

A concept specification provides a broad description of a proposed product, system, or major project. Its purpose is to establish the basic requirements needed for further investigation, feasibility analysis, and life cycle cost evaluation.

For instance, a concept specification for a new manufacturing facility may outline the overall design requirements and operational needs of the plant. It may include information about transportation requirements, communication systems, market demands, sources of raw materials, security considerations, waste management requirements, and site conditions such as soil characteristics.

Design Specifications

Design specifications establish the required performance, capacity, and design limitations of a system or piece of equipment. They define the boundaries within which designers must work while allowing them to select an appropriate solution.

For example, a design specification may require that a system use electrical or hydraulic power, which would eliminate alternatives such as pneumatic power. In the same way, a building design specification might require the architect to use concrete as the primary construction material, limiting the available design choices.

Construction and Manufacturing Specifications

Construction and manufacturing specifications include both technical drawings and written instructions that define the requirements for a project or product. They may contain information about applicable regulations, national and international standards, and industry requirements.

These specifications can also describe the conditions that contractors or suppliers must meet before submitting bids. In addition, they identify any restrictions or limitations on the products, materials, or services that may be offered as part of a proposal.

Process Specifications

Process specifications define the scientific or engineering methods and techniques required to manufacture a product or construct a building, system, or structure. They describe the processes that must be followed to achieve the required results.

Examples of processes covered by these specifications include heat treatment of metal castings, pre-stressing of concrete beams, torque testing of bridge anchor bolts, and conducting seismographic surveys at construction sites.

Because process specifications often describe specific methods of performing work, they can closely resemble procedures. In many cases, they are considered procedures rather than separate specifications. For example, the ASME Boiler and Pressure Vessel Code includes requirements that combine both specification requirements and detailed process procedures.

Standards

Standards are a special category of specifications. They are developed by national and international organizations, industry groups, and sometimes large corporations to establish consistent requirements for products, materials, processes, and practices. Although some standards originate from specific countries or organizations, many are used worldwide. For example, the ASME Boiler and Pressure Vessel Code is an internationally recognized standard despite being developed by an American organization.

Many commonly used specifications are based on established standards. Examples include U.S. military specifications, the Canadian Federal Department of Works Master Construction Specification, and Ontario Hydro’s welding standards.

Standards are generally divided into three categories:

Type 1 standards define precise requirements, including specific materials, fasteners, and components that must be used. Products from different suppliers that meet these standards are generally interchangeable.

Type 2 standards establish requirements similar to Type 1 standards but allow suppliers some flexibility in how they meet them. As a result, products from different suppliers may not be identical or interchangeable.

Type 3 standards describe general processes, practices, or guidelines rather than requirements for a specific product. They are often identified by terms such as "codes of practice," "general requirements," "guides," "test methods," or "quality assurance."

Specification writers must understand the differences between these types of standards. Using requirements that are unnecessarily restrictive can reduce competition, limit supplier options, and increase costs. Type 1 standards provide the least flexibility, Type 2 standards allow moderate flexibility, and Type 3 standards provide the broadest range of acceptable approaches.

Standards are generally valuable because they improve reliability, support economical production, and allow products to be obtained from multiple suppliers. However, their use can also create challenges. Standards are influenced by regulations and market demands, and they may become outdated as technology advances. The process of revising and gaining agreement on standards can be slow, and implementing new standards can sometimes involve significant costs, such as the transition from imperial measurements to metric units.

Anatomy of a Specification

The content of a specification depends on its purpose, type, and intended application. Different specifications require different levels of detail, so it is not practical to provide a complete description of the contents for every possible type within a general discussion.

However, a broad guideline for the information that should be included can be useful. Similar to the approach used when explaining document structure, the following general framework provides a starting point for preparing effective specifications.

Identification Number

Assign a number to identify the specification, for use in the commercial contract, or other specifications.

Revision Number

Specifications are often revised. Provide a reference code for each revision issued. Use a letter or number designation, and date it so that the user is aware of the version that applies.

Title

Compose a concise and distinctive title. Avoid long titles. They can be confusing.

Introduction

Say what the specification is about. This can include the scope of the specification, its type, form, purpose and application.

Description

Describe the product or service covered: its dimensions, materials, tolerances, finish, required spares, and so on.

Performance

A specification should clearly define the expected performance of the product, system, or service. This includes operating conditions, expected service life, reliability requirements, and any other factors that influence how the item is expected to function.

The specific performance requirements will depend on the nature of the application. For electrical, mechanical, hydraulic, aerospace, computer, and biomedical equipment, important factors may include power requirements, operating speed, pressure ratings, temperature limits, and both primary and backup power sources.

For buildings and engineering structures, performance criteria may include factors such as load-bearing capacity, construction materials, finishes, and structural requirements.

Service conditions should also be identified. These may include environmental factors such as exposure to chemicals, temperature variations, vibration, moisture, humidity, dust, and other conditions that could affect performance or durability.

Construction

Construction, also meaning manufacture, should include requirements relating to processes, chemicals, solvents, product handling, and the use of special tools and devices.

Reliability

The specification should cover information on service and maintenance factors that affect reliability. It should specify acceptable limits on repair and maintenance down-time, and how speedily replacement parts and service specialists should be available.

Quality Assurance

Quality assurance (QA) standards serve a different purpose from general standards. Their role is to establish a structured system for managing and verifying the requirements of a contract. While specifications define the expected quality of a product or service, inspection and testing activities within a QA program do not directly improve quality; instead, they provide documented evidence that the required quality has been achieved.

The level of QA required should be selected based on cost and risk considerations. Comprehensive QA programs can be expensive, but they provide greater confidence that requirements will be met. The cost of implementing QA must be balanced against the potential consequences of poor quality, such as rejected materials, repairs, reconstruction, production delays, and increased project expenses.

In many cases, investing in an effective QA program can prevent much greater costs that may result from defective products or inadequate performance.

Packaging and Storage

The specification should describe the packaging, handling, shipping and storage requirements of the product.

Standards and Specifications

Throughout the specification, other specifications and standards will be cited. A separate listing of all specifications and standards cited should be summarized in this section.

Records

The law requires organizations to retain accounting records, while manufacturing companies and service contractors usually maintain production, inspection, and performance test records to protect themselves and demonstrate compliance. Clients who issue specifications may also be required to keep manufacturing and operating records to meet government or industry regulations.

Records related to equipment manufacturing, installation, operation, and maintenance—often called history dockets—are especially important when problems occur. They also provide valuable information to maintenance personnel and operators who were not involved when the equipment was originally installed and commissioned.

For this reason, specifications should clearly state:

- The construction and project records that the contractor must provide, including required drawings, spare parts information, operating manuals, installation details, and performance test results.
- The records that the contractor must maintain, along with the required retention period for those records.

Specification Writing

The process of developing a specification follows the same general approach used when preparing a technical report or procedure. The essential steps are:

- Plan
- Research
- Prepare an outline
- Write
- Edit
- Review
- Obtain approval

While each step does not require extensive explanation, several principles are especially important when preparing specifications:

1. Write with confidence. Avoid statements that reveal uncertainty or a lack of understanding.
2. Do not include requirements that cannot be measured, verified, or enforced.
3. Provide clear instructions rather than suggestions or recommendations.
4. Use precise numerical information, including defined limits, values, and tolerances wherever possible.
5. Avoid vague expressions such as “good workmanship,” “easily cleaned,” or “readily accessible.” Similarly, avoid unclear descriptive words such as “good,” “smooth,” “high,” “low,” “large,” or “small” unless they are specifically defined.
6. Clearly identify the contractor’s responsibilities regarding subcontractors and other parties.
7. Verify all reference numbers, codes, standards, and specification identifiers to ensure accuracy.
8. Ensure that requirements are realistic and achievable.
9. Use direct, imperative language. For example, “Conduct the following tests” is clearer and more direct than “The following tests shall be conducted.”
10. Avoid strings of descriptive words that may create ambiguity. For example, the phrase “main circuit control switch” could have several different meanings depending on interpretation and should be rewritten for clarity.

Review and Approval

Anyone reviewing a specification should examine it from the contractor's perspective. The reviewer should consider whether the document provides clear, complete, and practical instructions that can be understood and followed without confusion.

The following checklist can be used when reviewing and approving a specification:

- Is the specification clearly organized and properly formatted?
- Is the language grammatically correct and easy to understand?
- Have all necessary requirements been included?
- Have unnecessary or excessive requirements been removed?
- Is the specification concise, precise, and free from ambiguity?
- Does it clearly define what is required, when it must be done, where it applies, who is responsible, how it will be carried out, and why it is necessary?

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