Effective Technical Writing Techniques and a Grammar Refresher for Architects and Engineers

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Timothy D. Blackburn, P.E., M.B.A.

Introduction

While it is possible to convey technical information accurately, our customers may remain less than impressed. If our grammar is poor, our sentence structure flawed, or if our work is generally unorganized, they may view an otherwise *technically* accurate work with scorn. Do you wrestle with when to use *who* or *whom*? Do you agonize over when to use a number or the word equivalent? Do you know the difference between *continual* and *continuous*? Do your modifiers dangle, are your infinitives split, and do your prepositions bring up the rear? Have you ever struggled to know how to begin your Technical writing?   If your answer is yes (or don't know) to any of these questions, perhaps you have forgotten or need a review. This course offers a concise and easy-to-read refresher that you can continue to use as a quick reference. In addition, the course includes practical Technical writing tips to elevate and polish your written work. Unlike most technical writing course, this includes practical tips and principles you can apply for a broad range of technical writing (especially as it applies to engineers and architects.)

Content

Applications of Technical Writing

Technical writing is unavoidable in our business (Engineering and Architecture.) While we all do it with a general degree of success, doing it well will improve our communications and relations with customers. Technical writing expresses itself in many forms in our field, many of which are as follows:

- Reports
- Standard Operating Procedures (SOP)
- Operations and Maintenance (O&M) Manuals
- Specifications
- Studies
- Position Papers
- Technical letters, memos, and emails
- Test data
- Research data

While specific applications and templates of the above are not part of this course's scope, the following are some key steps in beginning and completing your technical writing project.

Steps in Technical Writing

When writing technical documents, a stepped process will facilitate success. The steps include Key Considerations, Outlining the Work, Populate the Outline, Edit, Test the Work, and Publish the Work.

Key Considerations

Before beginning our technical writing, we should pause and reflect on the following key considerations:

- Purpose of the work – Consider the reason for the technical work. What message is it to convey? To whom? What should it conclude?

- Consider the audience – Write so they will understand. Don't write to impress. Don't assume they are as well versed in the subject as you. Consider the educational level of the audience. Consider the positional level (the higher the position, the less detail they will absorb.)

- Include necessary detail – Ask yourself, "Is there anything that the audience could misunderstand, misinterpret, or otherwise result in confusion?" Another question to ask is, "If someone else had to explain the work, could they? Could I read and explain it ten years from now after I forget the detail?"

- Consider the format – What format will most successfully relay the required information? Are you writing a specification, report, or standard operating procedure? Most companies have standard formats for various technical works – don't expend effort recreating the format unless current document formats are insufficient.

Outline the Work

We might choose to avoid outlines for certain forms of creative writing or short pieces.   But generally, effective technical writing efforts begin with an outline. This enables you to see the needs for the work holistically and develop a logical approach to inform the reader. Fortunately, word processors make this task much easier (with easier edits.) Let's consider an example of a failure investigation report. We begin by simply listing all the things needed in the report in an outline format. We might move things around or insert as we develop our ideas.

When outlining, limit the number primary concepts or thoughts to no more than five to nine per category – most people best comprehend and retain information in limited data/information sets. (Limiting to five to nine is termed "chunking.") The outline might look something like the following:

<div align="center">

Title

By (company)

By (person writing the report)

Date of report

</div>

1. Executive Summary
2. Purpose of Report
3. Details of site visit
   a. Personnel
   b. Date, time
   c. Weather
4. Observations
   a. Description
   b. Photos
   c. Illustrations
5. Supporting calculations
6. Conclusions

Populate the Outline

Begin to enter the information for each line item. Don't worry too much about grammar or formatting during the initial draft – you will correct this during editing and rewrites. Depending on the type of technical writing, you can retain or eliminate section numbers (relying on headings instead.)

Edit the Work

We should use smart strategies to proofread our work. One effective strategy is to ask another person to read it. However, we also should check our work. I recommend you allow the work to go stale if time permits. That is, let a few days (or weeks) pass before publishing the work. You will find mistakes you were unable to detect at the first edit.

Use advanced word processor spelling and grammar check tools. Go to the options tabs that allow you to increase the level of checking. However, don't rely solely on the tools – remember GIGO (Garbage In Garbage Out). All final proofs of critical documents should be printed for reading versus on the screen. I suggest proofreading at least four times, each with a different focus as follows:

1. Review the general formatting
2. Next, read with a focus on content and understanding
3. Reread with a focus on poor writing techniques. Read aloud – you'll be surprised what you will discover when you hear it!
4. Reread again for typical and typographic errors

Look for poor writing techniques (many of these will be discussed later in the course.)

1. Active versus Passive Voice
2. Use of two or more clichés in a sentence (minimize or avoid the use of any clichés in technical writing, as well as colloquialisms.)
3. Use of the same noun or verb twice in the same sentence (use the thesaurus)
4. Stilted usage
5. Clarity
6. Long paragraphs or sentences
    a. Limit sentences to 25 words
    b. Limit paragraphs to eight lines

Also, check for other typical errors as follows:

1. Spelling – Even word processor spell checkers can miss words. For example, type the following sentence in your word processor:

   "He is prettier that I." Do you see anything wrong with the sentence? I often transpose "that" and "than" when I type. Spell or grammar check won't catch this!

(Note: Use word processor grammar and spelling tools with good judgment. Strictly accepting recommendations can change meaning or make the wording stilted. Remember, the goal is for the reader to comprehend.)

2. Grammar

3. Punctuation

4. Numbers

5. Spacings

6. Double words

7. Closing brackets

8. Calculation and data errors. Carefully check digits for accuracy (read digit by digit). Double check totals and alignment of columns.

Test the Work

If your technical document directs steps or activities, test the document before publishing it. Often, the typical proofreading steps won't sufficiently substitute for testing. Consider acquiring the assistance of a subject matter expert (SME) to ensure technical accuracy. In addition, consider asking a novice reader with a similar skill level as the intended audience to read the document for comprehension. I often ask my wife (who is an artist) to read my material.

Publish the Work

At this point, you might think your task is complete. However, be ready for questions and be willing to issue revisions or addenda if necessary. Be careful that you have not taken a prideful ownership of the work that will inhibit an otherwise successful completion. As well, learn from your mistakes. Technical writing is an *art* that expresses science and technology – we continue to grow (if we permit ourselves).

Before we proceed, let's pause and refresh our grammar. Perhaps it has been many years since you studied grammar (and now apply it intuitively), or English is a second language. Practically, we need to understand the essential rules and terms of grammar for technical writing to be effective, polished, and professional.

<u>Grammar Term Review</u>

Beyond a verb and a noun, it is easy to forget basic grammatical terms. The following are standard grammatical terms essential to our study:

Term	Meaning	Example
Modifier	A word or phrase (or clause) that defines the meaning of another	Adjectives and adverbs
Verb	Expression of an action, condition, or state of being	Runs, writes, are, am
Adverb	A word (modifier) that describes a verb, adverbs, and adjectives, and answers *how, when, why, how much, to what degree,* or *where.*	Install the pump *properly*.
Participle	Verb acting as an adjective.	The Contractor made an *intriguing* offer.
Gerund	Verb ending in *ing*, acting as a noun	*Designing* is his favorite work activity.
Noun	People, places, or things	Pump, beam, machine, gear, man
Pronoun	Used in the place of nouns	We, he, she, they, them
Adjective	A word (modifier) that describes a noun. Adjectives answer one of the following questions: *What kind, which, what color, how many, what size?*	There are *three* valves. Install the *red* valves. There are *three-red* valves.
Articles	Use of *the* for specific items and *a* for non-specific.	Use *a* qualified method for *the* pipe pressure test.
Preposition	A word that shows relationships between words and sentences	To, for, on, at, etc.
Interjection	Expressions of exclamation	Wow! Run! Help!

Words

Words are important. In technical writing,

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Note: From this point forward in the course, hold a piece of paper over the far right hand columns of the tables, and try to correct the improper or incorrect application before looking at the answer. You must carefully read and practice each example for learning retention. The Quiz includes an honor question as to whether you used this technique. The course often uses *italics* to emphasize words or punctuation, and does not indicate you should use italics to achieve the proper usage.

they are essential for accurately conveying essential design and technical aspects. Proper word usage begins with spelling, which requires memorization and learning common spelling rules (sorry – there's no shortcut for this one.) Fortunately, word processor software enables extensive spell checking. However, we often overlook misused words. The following are some common examples of words that technical writers often misuse and interchange inappropriately:

Words often misused or interchanged

Words and their definition or use	Improper use	Proper use
A – Before a consonant	The inspector discovered *an* gross error.	The inspector discovered *a* gross error.
An – Before a vowel[1]	The inspector discovered *a* error.	The inspector discovered *an* error.
Affect – to change or influence	The steam pressure will *effect* the humidifier operation.	The steam pressure will *affect* the humidifier operation.
Effect – results or to cause	The *affect* of lower steam pressure is lower humidity discharge.	The *effect* of lower steam pressure is lower humidity discharge.
Among – use with more than two	Divide the column spacing equally between the four bays	Divide the column spacing equally *among* the four bays
Between – use with two persons or things	Divide the column spacing *among* the two bays	Divide the column spacing *between* the two bays
Certain – A fact – more preferred where there is no doubt.	I am *sure* I properly calculated the deflection. (Opens questions in the mind of the hearer).	I am *certain* I properly calculated the deflection.
Sure – A fact or belief	I am *certain* I answered your email. (You could be wrong, however)	I am *sure* I answered your email.
Continual - an action that includes pauses and intermissions	The equipment had *continuous* stops.	The equipment had *continual* stops.
Continuous – an action that has no pauses	The equipment will run *continually*.	The equipment will run *continuously*.
Data – plural	We used the *datum* to plot the trend.	We used the *data* to plot the trend
Datum – singular	The surveyor determined the *data*	The surveyor determined the

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[1] Vowels are a, e, i, o, u, and sometimes y. Consonants are all other letters.

Words and their definition or use	Improper use	Proper use
	point.	*datum*.
Farther – physical distance	The beam extended *further* than 10 feet into the room.	The beam extended *farther* than 10 feet into the room.
Further – degree or extent	The testing criteria requires no *farther* explanation.	The testing criteria requires no *further* explanation.
Insure – Insurance	*Ensure* the project against loss by fire.	*Insure* the project against loss by fire.
Ensure – Cause an outcome	*Insure* the bolts are tested.	*Ensure* the bolts are tested.
Its – Possessive (the opposite of what we would think!)	The company has *it's* building under construction.	The company has *its* building is under construction.
It's – Contraction for *it is* or *it has*	Its the first building to be constructed.	It's the first building to be constructed.
Good – Adjective	He is a *well* technical writer.	He is a *good* technical writer.
Well – Adverb	For an engineer, he writes *good.*	For an architect, she writes *well.*
Lay – put or place	The contractor will *lie* the airhandler in the staging area.	The contractor will *lay* the airhandler in the staging area.
Lie – rest, recline, or tell a falsehood	Instruct injured workers to *lay* still until help arrives.	Instruct injured workers to *lie* still until help arrives.
Less – when you *can't* count	There will be *fewer* problems with a robust design.	There will be *less* problems with a robust design.
Fewer – when you *can* count	It will take *less* concrete loads the second phase.	It will take *fewer* concrete loads in the second phase.
Stationary – fixed or still	The pump has a *stationery* pad.	The pump has a *stationary* pad.
Stationery – paper letterhead, envelopes, etc.	We will send the report on our *stationary*.	We will send our report on our *stationery*.

Words and their definition or use	Improper use	Proper use
Were – expresses wishful thinking or idea contrary to fact	The design engineer acts as if he *was* in charge of construction.	The design engineer acts as if he *were* in charge of construction.
Was – indicates statement of fact	The design engineer *were* also in charge of construction.	The design engineer *was* also in charge of construction.

Let us not forget the dreaded *who* and *whom.* Here, we can use a little trick to help us know which one to use. Simply restructure and substitute other pronouns in the sentence. Your ear will tell you the correct answer if you are familiar with English. For example, use *who* when you can substitute *she/he, they, I, or we.* Use *whom* when you can substitute *him/her, me, them, or us*. The same approach applies to *whoever* and *whomever.* When writing questions, simply answer the question with the substituted pronoun.

Sentence – which word should I use?	Substitution Technique
Who or *whom* designed this foundation?	Would you say *he* or *him* designed this foundation? Obviously, *he* designed this foundation; therefore, the proper pronoun usage is *who* designed this foundation.
Who or *whom* did you see violating the hardhat policy?	Would you say you saw *he* or *him* violating the hardhat policy? Obviously, you saw *him* violating the hardhat policy; therefore, the proper pronoun usage is *whom* did you see violating the hardhat policy.
To *who* or *whom* am I writing this course?	Would you say you wrote the course to *he* or *him*? Obviously, you wrote it to *him* ; therefore, the proper pronoun usage is to *whom* am I writing this course.

Another common error in technical writing is the misuse of capitalization. As a rule of thumb, don't capitalize if it isn't required. (Except for drafting, avoid all-caps. People will think you are yelling at them.) The goal should be to minimize capitalization. The following are some practical applications to the rules of capitalization:

Capitalization

When (or not) to capitalize	Improper use	Proper use
Titles of honor/respect when preceding names	We were there when *president* John Sawyer commented on the new project.	We were there when *President* John Sawyer commented on the new project
Do not capitalize when following the name (except for high ranking officers)	We were there when John Sawyer, *President*, commented on the new project. We heard George Bush, *president*, give the speech.	We were there when John Sawyer, *president*, commented on the new project. We heard George Bush, President, give the speech.
Titles of books, plays, and TV programs (capitalize the first, last, and principal words)	The book *principles of foundation design* will be the course text.	The book *Principles of Foundation Design* will be the course text.
Government agencies	Apply for a permit from the *department of buildings.*	Apply for a permit from the *Department of Buildings.*
Academic degrees (abbreviated or written out)	The assigned engineer holds a master of science in engineering.	The assigned engineer holds a *Master of Science in Engineering.*
Academic and religious titles	Ask *doctor* Adams to review the design before issuance.	Ask *Doctor* Adams to review the design before issuance.
Trade Names	Install a data jack for the *zerox* copier.	Install a data jack for the *Zerox* copier. (Actually, it isn't a good idea to use trade names in this manner).
Do not capitalize a.m.,	The meeting began at 2:00 *A.M.*	The meeting began at 2:00

seasons, or compass points		*a.m.*

Use of Numbers versus Words

When should numbers be used, or their word equivalent? The following tables provide examples of proper application of numbers, the first which directs the usage of numbers versus words:

Use numbers when . . .	Improper use	Proper use
Eleven and higher	We installed *twenty* airhandlers in July.	We installed *20* airhandlers in July.
Dimensions	The room dimensions are fifteen by thirty feet.	The room dimensions are 15 x 30 feet.
Weights	The process skid weighs *five thousand* pounds.	The process skid weighs *5,000* pounds.
Times	The plant will shut down at *five p.m.*	The plant will shut down at *5:00 p.m.*
Dates	January *fourteenth*, 2010	January *14*, 2010 (except for diplomas, etc.)
Numbers following nouns (examples include chapter, page, section, etc.)	Go to section *twenty* to find the humidifier maintenance instructions.	Go to section *20* to find the humidifier maintenance instructions.

The following are guidelines for when to use numbers versus words:

Use words for numbers when . . .	Improper use	Proper use
One to ten	Move the skid *8* inches.	Move the skid *eight* inches.
The number starts a sentence	40 airhandlers will arrive on January 14, 2010.	Forty airhandlers will arrive on January 14, 2010.
Fractions	Nearly ¼ of the piping welds are	Nearly *one-fourth* the piping

	deficient.	welds are deficient.
Approximate amounts	About *40* of the weld coupons met specifications.	About *forty* of the weld coupons met specifications.
Running text ordinals	The *12th* pressure test was successful.	The *twelfth* pressure test was successful.
If "o'clock" is understood	We completed the test run at *5*.	We completed the test run at five. (Better: We completed the test run at 5:00 p.m.)

Good Sentences

Words alone aren't enough. We need sentences to make paragraphs, and paragraphs to create written works. This section considers good sentence structure and use. The following are terms that describe aspects of sentences and clauses:

Sentence Terms

Term	**Meaning**	**Example**
Sentence	A complete thought expressed with a minimum of a subject and verb	He (subject) ran (verb)
Dependent Clause	Contains a subject and a predicate, but cannot stand alone as a sentence	When the engineer studied at work for his P.E. exam.
Independent Clause	Also contains a subject and a predicate, but can stand alone as a sentence	The engineer studied at work for his P.E. exam.
Subject	The referenced person, place, or thing	*He* said, "You are responsible for equipment testing." *John* tested the equipment.
Object	A word that follows and receives the verb's action. (Ask *what* or *whom* after the verb to detect the object.)	I took this *course*. (I took what? I took this *course.)*
Conjunction	A word that connects	But, or, and, neither

Term	Meaning	Example
Antecedent	The word (a noun) to which the pronoun refers	*Tim* (antecedent) wrote *his* (pronoun) course carefully.

Subject/Verb Agreement

Subjects and verbs must agree in plurality in sentences. For example, if a verb is singular, the subject must also be singular. If the verb is plural, the subject must be plural.

Incorrect	Correct
I *are* taking this course	I *am* taking this course
They *am* taking this course	They *are* taking this course

It is easy to make typical, common subject/verb agreement errors. Remember to use singular verbs after *many, an, everybody, each, everyone, nobody, every, one, another, someone,* and *much.* Also use a singular verb when referring to the name of a book, company, or article even if the name is plural. Finally, use a singular verb when a noun is considered a single unit. The following illustrate some of the above principles:

Incorrect	Correct
Someone here *are* designing the ductwork.	*Someone* here *is* designing the ductwork.
Johnson & Johnson *are* a large company.	Johnson & Johnson *is* a large company.
Expending $1,500 *are* reasonable to correct the design flaw.	Expending $1,500 *is* reasonable to correct the design flaw.

Use plural verbs after *others, few, many, both,* and *several.*

Incorrect	Correct
Others here *has* designed the ductwork.	*Others* here *have* designed the ductwork.

Other verbs will be singular or plural depending on what they modify – terms which verbs modify in this case include *none, some, all, any, most,* and *fractions.*

Incorrect	Correct
Some of the beams *is* rusty.	*Some* of the beams *are* rusty.
Some of the beam *are* rusty.	*Some* of the beam *is* rusty.

Also, watch for collective nouns, or groups that are the subject of the sentence. When subjects act separately, use plural verbs. When the subjects act collectively, use singular verbs.

Incorrect	Correct
The engineering firm *are* highly specialized.	The engineering firm *is* highly specialized.
The firm's engineers *is* highly specialized.	The firm's engineers *are* highly specialized.

When writing, watch for interrupting phrases that separate verbs and subjects, making it easier to make subjects and verbs disagree.

Incorrect	Correct
I, along with my entire department, *are* taking this course.	*I*, along with my entire department, *am* taking this course.

Sometimes, *or* or *nor* is used to connect a plural and singular subject. When this occurs, ensure the verb agrees with the noun closest to it.

Incorrect	Correct
Neither the engineer nor the *contractors was* responsible for the cost overrun.	Neither the engineer nor the *contractors were* responsible for the cost overrun.
Neither the contractors nor the engineer *were* responsible for the cost overrun.	Neither the contractors nor the engineer *was* responsible for the cost overrun.

Fragments and Run-ons

As noted previously, sentences must contain a subject and verb, and express a complete thought. When a sentence contains a subject and verb but doesn't express a complete thought, it is a *fragment.*

Incorrect	Correct
When I finished taking this course.	I finished taking this course.

When we join multiple ideas, although complete, and miss the proper punctuation, the result is a *run-on* sentence. (Note: We can also write excessively long sentences even with proper punctuation. Comprehension is better when we have less than 20 words per sentence.)

Incorrect	Correct
Tim wrote the course very slowly he finished it today.	Tim wrote the course very slowly. He finished it today.

Proper use of Pronouns

Pronouns can take the place of nouns, and have four case forms as follows:

Pronoun Case	Meaning	Example
Nominative	Subjects or rename subjects	I, he, she, we, they, who, you, or it
Objective	Object	Me, him, her, us, them, whom, you, it
Possessive	Shows ownership	My/mine, his, her/hers, our/ours, their/theirs, whose, your/yours, its
Reflexive	Reemphasizes earlier pronoun	Myself, himself, herself, ourselves, themselves, yourself, itself; (Sentence example: I did it *myself.)*

Like verbs, pronouns must agree. This agreement must be in number and person. For collective nouns like *team* and *committee*, use a singular pronoun.

Incorrect	Correct
After *I* wrote *mine* course, *you* took it on *yourself* own time.	After *I* wrote *my* course, *you* took it on *your* own time.
The committee completed *their* work.	The committee completed *its* work.

Technical writing often uses pronouns with multiple nouns. When two nouns are joined by *and,* the pronoun is usually plural. If nouns are joined by *or, either, nor*, match the pronoun to the closest noun.

Incorrect	Correct
Fred and George stopped *his* work to take this course.	Fred and George stopped *their* work to take this course.
Neither Jack nor the others stopped *his* work.	Neither Jack nor the others stopped *their* work.

Split Infinitives

Although the use of splitting infinitives is not viewed as negatively as it was in years past, avoid it when possible. An infinitive is a basic form of a verb with no additional endings. For example, *begin* is an infinitive in the question, "Can you begin?" Often, we use *to* with an infinitive, such as "I would like for you *to begin*." If you add a modifier between *to* and the verb, you have a split infinitive. The following is an example:

Incorrect	Correct
I would like you *to quickly begin.*	I would like you *to begin quickly.*

Dangling Modifiers

If you begin a sentence with an action, place the person performing the action immediately after it. Otherwise, you will create a *dangling modifier.* Avoid this, even if the reworded sentence sounds like passive voice. Dangling Modifiers can be confusing to the reader. The following is incorrect and correct usage:

Incorrect	Correct
After starting the project, the Steve asked Joe to work longer hours. (Who is working longer hours – Steve or Joe?)	After starting the project, Joe was asked by the Steve to work longer hours. (Place Joe closer to the action).

Prepositions

You might remember your English teacher sternly reminding you, "Don't end a sentence with a preposition!" If you can write a sentence so it isn't stilted, stick with the rule. Otherwise, it is acceptable by many to end a sentence with a preposition where the sentence is more readable (remember, comprehension is the primary purpose of Technical Writing). The following is an example of this:

Less Desired	Preferable
In this project, we have much *for* which to be appreciative.	In this project, we have much to be appreciative *for*. (Here, it sounds better to end with the preposition).
I don't have funds left to work *with*.	I don't have funds *with* which to work.

Passive versus Active Voice

Active voice is much more effective in representing the subject's action. With the active voice, the subject performs the action. With passive voice, the subject is acted upon. Active voice is easier to read, straight to the point, more natural, and clearly illustrates responsibility.

Passive	Active (preferred)

This course was written by Tim Blackburn.	Tim Blackburn wrote this course.
It is recommended that you carefully study before the quiz.	I recommend that you carefully study before the quiz.

However, Passive voice may be better in some circumstances. Use passive when the subject is unknown or important, or better unsaid. Also, passive voice sometimes works better in technical writing when you wish to place focus on the action and not the person. (You will find several applications of passive voice in this course – I chose to leave it in because it *sounds* better in certain applications. Writers have more freedom in this area than many would admit.)

Passive (preferred)	Active
The ancient structure was built in the second century by the Romans.	The Romans built the ancient structure in the second century.
Your check was mailed a week ago.	Fred, the new mailroom guy, mailed your check a week ago.
A mistake was made.	Our firm made a mistake. (In this case, I might have actually preferred the passive voice depending on the circumstances).

Use Similar Grammatical Forms for Multiple Ideas

Incorrect	Correct
Before issuing the drawings, you should check your *spelling, calculations, and dimensioning*.	Before issuing the drawings, you should check your *spelling, calculations, and dimensions*.

Use Concrete Language versus Vague

Incorrect	Correct
The project was extremely difficult throughout its duration.	The project had a challenging schedule, scope, and budget from the beginning.

Avoid Double Negatives

Incorrect	Correct
The engineer is not unwilling to correct his mistakes.	The engineer is willing to correct his mistakes.

Gross Verbosity (Wordiness)

Always look for ways to simplify your sentences. Use as few words as possible to clearly express the thought. Do not write to impress. Do not seek words out of the common vocabulary. Avoid redundancy. Seek single words as alternatives to phrases. The following is an example of an overly complex sentence and an alternative (note how single words replace phrases):

Verbose	Simplified
The project team *held a meeting* and *came to an agreement* with the *end result realizing a savings of $50,000.* This happened after the production department *conducted an experiment* of a *new breakthrough* technology that *makes an examination of* residue remaining in the vessel. They *arrived at the conclusion* and reached a *general consensus* quickly after the equipment *gave an indication* of success. (63 words)	The project team *met* and *agreed* with the *result*, which *saved* $50,000. This happened after production *experimented* with a *breakthrough* technology that *examines* residue in the vessel. They *concluded* this and reached a *consensus* quickly after the experiment *indicated* success. (34 words)

Punctuation

We all know that we should end a sentence with a period. But the use of the other symbols are often less understood. The proper use of commas, colons, semicolons, apostrophes, quotation marks, dashes, and parentheses separate the skilled technical writer from the novice. At the risk of stating the obvious, the following are the common punctuation symbols:

Punctuation	Symbol
Comma	**,**
Colon	**:**
Semicolon	**;**
Apostrophe	**'**
Quotation marks	**"**
Dashes	**– (or --)**
Hyphen	**-**
Parenthesis	**(**
Brackets	**[**
Ellipses	**. . .** (three periods with a space between each)
Period	**.**

Now, let's review proper punctuation usage. First, let's review commas:

Use a comma when	Incorrect Comma Use	Proper Comma Use
Before a conjunction (*and, but, or, for, nor, so, yet)*	The engineer visited the site today and noted several findings.	The engineer visited the site today**,** and noted several findings.
When more than two items are listed in a series.	The contractor shipped the steel rebar and metal studs.	The contractor shipped the steel**,** rebar**,** and metal studs.
<u>Do not use a comma</u> before *because*	We considered a lower dewpoint, because the process is critical.	We considered a lower dewpoint because the process is critical.
When setting off an introductory phrase	Before we start our design we must make a field visit.	Before we start our design**,** we must make a field visit.
For clarity to avoid	Without the contractor Fred can't	Without the contractor, Fred

confusion	enter the project site. (Do you have an employee named "contractor Fred?)	can't enter the project site.
For emphasis	The schedule fortunately is not a factor.	The schedule, fortunately, is not a factor.
Quotations	The worker said "It is not my responsibility."	The worker said, "It is not my responsibility."
For sentences that begin with a statement and end in a question	We do not plan to demobilize early do we?	We do not plan to demobilize early, do we? (I probably would find a better way to structure this sentence to avoid this situation)
For reference material	Refer to the *Concrete Handbook* by ACI page 80.	Refer to the *Concrete Handbook*, by ACI, page 80.
For contrast	The schedule is aggressive but possible.	The schedule is aggressive, but possible.
Around expressions that interrupt the natural flow of the sentence	The engineers will therefore make every effort to visit the site weekly.	The engineers will, therefore, make every effort to visit the site weekly.
When setting off an expression explaining or modifying the preceding word, phrase, or name, or around a phrase that isn't necessary to the meaning of the sentence.	ABC Construction *our general contractor* will begin work today.	ABC Construction**,** our general contractor**,** will begin work today.
Fuse between consecutive adjectives when the comma is substituted for *and*.	The design will include robust maintainable equipment.	The design will include robust**,** maintainable equipment.
For addresses	Our office has moved to 12 South Main Street Richmond VA 23222.	Our office has moved to 12 South Main Street, Richmond,

		VA 23222.
For dates (to set off the year if it follows the month and day)	The project will commence on January 24 2010.	The project will commence on January 24**,** 2010

Next, let's consider the Question mark:

Use a Question Mark when	Incorrect Question Mark Use	Proper Question Mark Use
For a question	Will you complete the project on schedule.	Will you complete the project on schedule?
Items in a series of questions are in the same sentence	Which of the contractors should we shortlist, ABC, XYZ, QRS?	Which of the contractors should we shortlist? ABC? XYZ? QRS?
After a short question following a statement	We discussed this last time didn't we.	We discussed this last time, didn't we?
To express doubt (place question mark in parenthesis)	The original schedule indicated completion by December 10.	The original schedule clearly indicated completion by December 10. (?)

 The following are applications for the Colon:

Use a Colon when	Incorrect Use	Proper Colon Use
After salutations in letters	Dear Mr. Blackburn;	Dear Mr. Blackburn**:**
To separate a title from a subtitle	Project X Report, Findings of Structural Failure	Project X Report: Findings of Structural Failure
After introductions that imply or include *the following* or *as follows*	Please review the shop drawings as follows, rebar, structural steel, and grating.	Please review the shop drawings as follows: rebar, structural steel, and grating.
To introduce long quotations	The superintendent said "After 4:00 p.m., we had our toolbox talk,	The superintendent said: "After 4:00 p.m., we had our

	followed by a short meeting that lasted one hour after which we then adjourned."	toolbox talk, followed by a short meeting that lasted one hour after which we then adjourned." (I would probably try to restructure the sentence to avoid the need for the colon).
In ratios	Ladders should lean no more than a 1-4 ratio.	Ladders should lean no more than a 1**:**4 ratio.
Expression of time (minutes and hours	245	2:45

The following are applications for the Semicolon:

Use a Semicolon when	**Incorrect Use**	**Proper semicolon Use**
In place of a conjunction (when *and, but, or, for, nor, so, yet* are not used)	The architect approved the submittal the engineer did not.	The architect approved the submittal**;** the engineer did not.
For items in a series that have embedded commas	The project had different subcontractors: ABC, phase 1, XYZ, phase 2, and QRS, phase 3.	The project had different subcontractors: ABC, phase 1**;** XYZ, phase 2**;** and QRS, phase 3.
When using transitional expressions (such as *however, accordingly, therefore, consequently, moreover).* Put the semicolon before and a comma after the transitional expression.	The Owner released the project, however, we must wait until summer to mobilize.	The Owner released the project**;** however, we must wait until summer to mobilize.

The following are applications for the Apostrophe

Use an Apostrophe when	Incorrect Use	Proper Apostrophe Use
Possession of a noun (singular)	It is the engineers calculator.	It is the engineer's calculator.
Possession of a noun (plural)	These are the engineers calculators.	These are the engineers' calculators.
Possessive time and measurement	We'll cover this topic on next weeks agenda.	We'll cover this topic on next week's agenda.
When letters are omitted	The equipment cant be installed until the wiring is complete.	The equipment can't be installed until the wiring is complete.
When the omission of an apostrophe would cause confusion.	We are responsible for writing the SOPs. (SOP is *Standard Operating Procedure*)	We are responsible for writing the SOP's.
Contractions (acceptable in technical writing)	We as engineers arent usually responsible for construction means and methods.	We as engineers aren't usually responsible for construction means and methods.
Plural numbers, letters, or symbols	There are three column line Fs on the drawings.	There are three column line F's on the drawings.
When a number, letter, or symbol is used as a word	They pronounce their rs as "ahs."	They pronounce their r's as "ahs."

Next, let's consider Quotation marks. Avoid the tendency to overuse quotation marks to indicate emphasis. Also limit the use of exclamation points (!). Instead, choose *italics* (although use sparingly as well.) Also, there are rules as to where other punctuation should fall when used in conjunction with Quotation marks follows:

Punctuation	Placement

Punctuation	Placement
Period	Inside "."
Comma	Inside ","
Colons	Outside "":
Semicolons	Outside "";
Question marks	Either inside or outside
Exclamation points	Either inside or outside

The following are applications for Quotation marks:

Use Quotation marks when	Incorrect Use	Proper Quotation Mark Use
Making quotations	The Project Manager said we must have the drawings complete this week.	The Project Manager said, "We must have the drawings complete this week."
Use when applying expressions before phrases such as *marked, signed, labeled*	The crate was marked store in the construction laydown area.	The crate was marked "Store in the construction laydown area."
Articles	Our newsletter contained the article Engineering Designs for the 21st Century.	Our newsletter contained the article "Engineering Designs for the 21st Century."
Single quotations – quotations within a quotation	The Project Manager said, "Listen to the Owner's request: Consider our operations."	The Project Manager said, "Listen to the Owner's request: 'Consider our operations.'"

The following are applications for Dashes. (Note: Dashes are longer than hyphens.)

Use Dashes when	Incorrect Use	Proper use of Dashes
Set off expressions for	The contractor shall review before	The contractor shall review –

| emphasis | releasing equipment for shipment all the submittals. | before releasing equipment for shipment – all the submittals. |
| Indicate a strong afterthought | Attached are the submittals, well ahead of schedule, needed to keep the project on-track. | Attached are the submittals – well ahead of schedule – needed to keep the project on-track. |

The following are applications for Hyphens. Note: Hyphens are shorter than dashes.

Use Hyphens when	Incorrect Use	Proper use of Hyphens
Join compound words before nouns	The compressor has a two toned enclosure.	The compressor has a two-toned enclosure.
When using prefixes such as *half, free, self, all, ex, quasi*	Paint the columns orange *half height.*	Paint the columns orange *half-height.*
Prefixes that end with a vowel connected to a word beginning with the same vowel	We have added contingency to cover preexisting conditions.	We have added contingency to cover pre-existing conditions.
Compound numbers and written fractions	We are about two thirds complete.	We are about two-thirds complete.

The following is the proper use of Parentheses:

Use Parentheses when	Incorrect Use or Less Desired	Proper use of Parentheses
At expressions you wish to de-emphasize	The engineer has worked significant overtime – 100 hours this month – to complete the drawings as requested.	The engineer has worked significant overtime (100 hours this month) to complete the drawings as requested.
References to pages, charts,	Reference the specification section	Reference the specification

	on ductwork, 15103.	section on ductwork (15103).
To enclose numbers of items in a series	The steps are to 1 file the permit, 2 mobilize, and 3 install erosion control.	The steps are to (1) file the permit, (2) mobilize, and (3) install erosion control.

Where do you put a period in Parentheses? Use a period outside the parentheses if the wording is not a complete sentence in the bracket. Use a period inside the parentheses if a complete sentence is inside bracket.

Incorrect Period Placement	Correct Period Placement
We will complete the design soon (the first phase.)	We will complete the design soon (the first phase).
We will complete the design soon (the first phase will be completed by month's end).	We will complete the design soon (the first phase will be completed by month's end.)

We might consider Brackets the same as Parentheses, but they have a distinct use as follows:

Use Brackets when	Incorrect Use	Proper use of Brackets
Within parentheses	We will complete the design (the first phase (except for the mechanical) and second phase) by the end of December.	We will complete the design (the first phase [except for the mechanical] and second phase) by the end of December.
Words added to a direct quote	The building reviewer said, "The plan review (indicating the electrical portion) will be complete by August."	The building reviewer said, "The plan review [indicating the electrical portion] will be complete by August."

Use Ellipses as follows:

Use Ellipses when	Example of eliminated portion	Proper use of Ellipses
When omitting a portion of a quotation (beginning, end, or in between)	"~~After the belt failed, we discovered that~~ the drive train runs at twice its design speed."	" . . . The drive train runs at twice its design speed."

Let's conclude with some remaining considerations for the Period, our punctuation stop sign.

Use a Period when	Incorrect Use	Proper use of Period
End of a sentence	We are grateful for your attention to detail	We are grateful for your attention to detail.
After a statement, request, or command	We are grateful for your attention to detail	We are grateful for your attention to detail.
Abbreviations, acronyms, or initials	We only hire PE's.	We only hire P.E.'s.
For words or phrases that logically substitute for a sentence	Thanks	Thanks.
It is acceptable to omit a period in bulleted lists with single sentences or fragments (note that I often avoid periods in these tables)	• Step one is to perform the impact analysis. • Step two is to develop the project report.	• Step one is to perform the impact analysis • Step two is to develop the project report

So this wraps up grammar and sentence structure. To take our study further, let's look at other tips to give our work a competitive edge.

Other Effective Tips for Technical Writers

Consistency and Clarity

To make your work more readable and understandable (and less of a chore for the reader), focus on consistency and clarity. First, use consistent terms throughout. For example, if you use the term *Building Automation System* in one place, don't use *Building Management System* in another (although both are generally assumed to mean the same thing to an understanding reader). When using acronyms, define at the initial use or provide a glossary. Example: *Building Automation System (BAS).*

Also avoid ambiguity, which can occur when using words such as *should* and *would.* When you wish to convey an imperative, use *shall* (especially in legally binding documents and SOP's.)   The following is an example:

Correct (ambiguity)	Correct (accentuate the positive)
The operator *should* react to the alarm first by hitting the emergency stop.	The operator *shall* react to the alarm first by hitting the emergency stop.

Friendly but not Familiar

Technical writing generally necessitates a professional tone, and some works can include a friendly but not familiar tone. Familiarity extends to the personal, and the reader can misinterpret. Also avoid humor. Consider the following example from a transmittal to someone to whom you wish to connect on a more personal level.

Familiar	Friendly
Hey, man. What's up? The wife and kids treating you okay? I've attached a bunch of drawings and specs – don't get picky on me, but let me know if you need me to change anything.	Greetings. Hope you and yours are well. Attached are the drawings and specifications. Let me know if I can be of further assistance.

Colloquial Expressions

Akin to the *familiar* form of writing is *colloquialism*. Avoid the use of colloquialism in most technical writing. The following are examples and alternatives.

Colloquial	Better
The electrician will *hook up* the equipment.	The electrician will *connect* the equipment.
At the *end of the day*, the installation will function as designed.	Upon project *completion*, the equipment will function as designed.
The safety officer will *write up* the violation.	The safety officer will *report (or document)* the violation.

Gender

No longer is *he* considered applicable to either sex. As much as possible, avoid the awkward *him/her* and substitute other words such as person, chair, nonprofessional (versus layman), synthetic (versus man-made), spokesperson, technician (versus repairman), humanity (versus mankind), etc. However, the writer that attempts to be overly politically correct often has awkward writing. Avoid excessive use of *one* when referring to a person.

Bulleted versus Numbered Lists

Use numbered lists when showing items in a priority order, describing procedural steps, or quantifying items. Use bullets when everything on the list is of equal value, and sequence or rank is unimportant. When you have a single sentence or fragment in a bullet, a period is not required. Also, perfect sentence structures are not required for bulleted lists.

Graphics

Use graphics to make the work more interesting and to emphasize key points. With graphics, include a descriptive title and ensure appropriate scales. If the chart isn't self-explanatory, provide a legend. Locate the graphic logically to ensure it links to the text. Also, reference the graphic in the text. Only use a graphic if it assists in transferring information (not just to make the work appealing or attractive.)

Colors

Colors in graphics can enhance your work. However, do not overdo it, especially with font. (Ideally, use the same font style in a piece. See below for more font principles.) Also avoid the desire to print the document on glossy or colored paper. Remember, it's the message you wish to convey primarily, not your artistry. The goal is not to impress the reader with you knowledge or skill.

Tables (Table of Contents, Glossary, Index)

This might sound overly simplistic, but use tables when the reader will need them. Consider a Table of Contents for longer documents (remember to number the pages.) An Index is helpful when the reader might need to find specific information in the document that the Table of Contents won't facilitate. A Glossary is helpful for technical terms not in the common vernacular and for acronyms.

Font and Line Spacing

I'm sure we all have been tempted to use the full range of cool fonts in our word processor. But does that really add value to our technical works? The goal is for the words to transmit a message, and font overuse can impede what we intend to transmit. The following are some recommendations for effective font use:

- Size: Most written works read well with a font size of 11 or 12. Headings and other emphasis can have a larger font size.
- Type: The fundamental difference between font types is whether they are serif or sans serif. Serif refers to shape differentials on letter shapes, or the lack thereof. The most common serif is *Times Roman*, and the most common sans serif is *Ariel*. Serif is often preferred in print form as it allows the reader to better and more quickly comprehend letter differences, and Ariel is better when viewing on a computer screen. Limit other *cool* fonts to short pamphlets and creative works.
- Mixing: Don't mix font types in a piece.
- Spacing: For works that require focused attention, consider double or 1 ½ spacing.

Quizzes

Sometimes, we need to write tests to ensure others comprehend our technical works. Writing Quizzes is an art as well, but there are several principles we can learn to improve their effectiveness. First, understand the goal of a quiz. It is not to punish, or embarrass, or impress the taker with our knowledge. The purpose is to 1) measure learning, and/or 2) force the taker to retrieve certain key elements, thereby enhancing learning retention. When writing a Quiz, consider the following:

- Provide a mixture of question types, not just one. The two most common question types for training technical quizzes are multiple choice and true/false.

- Minimize questions that require exact fill-in the blanks of precise sentences. However, single word fill-in the blank questions are acceptable.

- Avoid essay questions for technical writing quizzes. You should reserve essay questions for college-type courses, not general technical training.

- Ensure the key elements are captured in the quiz questions from the course, lecture, or written work. Again, the quiz will facilitate learning and retention. You do this by first identifying the key learning objectives, then write questions that ensure the students learned the objectives.

- Avoid trick questions. For example, fall *prevention* is required when working on elevated man-lifts. Don't ask the following True/False question: "Fall *protection* is required when working on elevated man-lifts."

- Avoid excessive humor in questions that give away the answer. Generally, limit the use of humor.

- Avoid excessively extreme answers that give away the correct answer.

Person and Tense

First person is *I, me, our, my, we.* Rarely is the *first person* form appropriate for most technical writing. (Some recommend first person for readability, however.) Second person is *you* and *your*, also not common for technical writing except for operating instructions where first person is implied. (An example is *Turn on the equipment* versus *You turn on the equipment.)* The preferred person for technical writing is the third person, or *he, she, their, they, his, hers, him, her.* Often, many technical writers use passive voice

in cases where first or second person would otherwise be required. Note that I (the instructor) often write technical courses using all persons as appropriate for readability and a friendly form of writing.

Most technical writing is best conveyed in the present tense. This is especially true where the facts presented not only remain true now, but also will remain true in the future (when read later). An exception to this – obviously – is for reports (such as daily, trips, meeting minutes, etc.)

Self-Directed Assignment

Select a single page sample from your previous technical writing and use the editing techniques to find grammar and punctuation mistakes, examples of passive writing, verbosity, split infinitives, and other common errors covered in this course. Rewrite and compare to the original. Expend a minimum of 15 minutes on this exercise. Or, you may edit another's work. (The Quiz will ask if you completed this.)

Conclusion

In this course we considered a stepped process for a technical work. Then, we reviewed grammar and effective sentence structure/usage. Next, we considered proper punctuation. We concluded with other tips for effective technical writing.

Perhaps you feel overwhelmed – there is certainly a lot to remember when it comes to grammar. Just start writing. As you write, you will learn. As others critique (sometimes unkindly), you will improve.

As you improve, your customers will be delighted!

Closing comments from the Instructor

Thank you for taking this course. It is my goal to provide you with the highest quality engineering continuing education courses that are practical, straight to the point, and packed with useful takeaways. Please look at the other courses I have authored, all of which I developed with this philosophy in mind. We welcome and request your input to the course, and how we can improve with future revisions. As well, we are interested in the other topics that would interest you.

References and Acknowledgements

1. With gratitude to CareerTrack for their excellent one-day seminar, "The Grammar Game!" which illustrates that grammar can be fun and understandable (plus retainable). I found much of what I learned in the seminar applicable to this course.

2. "Technical Writing for Dummies" is an excellent quick reference if the reader would like more information

3. Strunk and White's "Elements of Style"