

Specification writing guide

‘Interpret each rule as if followed by “unless context and common sense dictate otherwise.” Do not follow a rule if clarity is reduced. This is the #1 RULE.’

The excerpts following these introductory pages are presented as general guidance for writing Specifications.

The source documents numbered 1 to 4 are from foreign jurisdictions but the grammatical principles are universally applicable.

Be aware of the jurisdictional specific content – it most likely does not apply to NTG Requests for Tender (RFT).

The source documents, and aspects in each to note, are;

1. *Guide to Writing Specifications*, Masterspec, New Zealand, August 2009

This is a comprehensive guide. The content is appropriate to Australia and NTG in most aspects because New Zealand uses a system similar to Australia’s NATSPEC, and because of the cultural similarities between the two nations. The Classification and Coding section on pages 8 and 9 are slightly different to NATSPEC.

2. *Specification and Writing Style Manual*, Oregon Department of Transportation, USA, October 2009

The USA documents use Imperial measurements, we use Metric. On page 7 the document suggests avoiding use of the word ‘shall’ but then uses it in table in a subsequent paragraph as an appropriate term. Do not use ‘shall’ in NTG RFTs.

3. *Specification Style Guide*, California Department of Transportation, USA

http://ppmoe.dot.ca.gov/hq/esc/oe/construction_contract_standards/Style_Guide_1999-2006.pdf

Minor jurisdictional differences.

4. *A Guide to Writing Specifications*, Los Angeles Unified School District, USA, February 2002

Minor jurisdictional differences. Do not use ‘shall’ in NTG RFTs.

5. *Writing Better Technical Specifications*, G Covey & G Faber, Somerset, Tasmania, March 2002

This document is written as guidance for engineers who are specifying works related to plant and equipment.

The document offers valuable general guidance.

The two documents cited below contain simple checklists which are reproduced here.

Developing Specifications, Queensland Government, v1.4 September 2019

<http://www.hpw.qld.gov.au/SiteCollectionDocuments/ProcurementGuideDevelopingSpecifications.pdf>

'Step 3: Writing the specification

Some writing tips...

- Use simple, clear language without jargon (to minimise misinterpretation).
- Define terms, symbols and acronyms (include a "Glossary of Terms").
- Be concise.
- Do not explain the same requirement in more than one section.
- Define each aspect of the requirement in one or two paragraphs where possible.
- Adopt a user-friendly format.
- Number the sections and paragraphs.
- Seek feedback from someone unfamiliar with the requirement.
- Discuss the draft and refine it.

There are no fixed rules on formats and structures because each specification reflects a different requirement or need. A specification should list the functional, performance and technical characteristics separately.

Specification Writing, Victorian Government - August 2010

'4.2 Vetting Specifications

It is useful to have the specification vetted by someone other than the author.

The person vetting the specification should check that the specification:

- *is easy to read;*
- *is easy to understand;*
- *is clear;*
- *is consistent with specifications for similar or the same goods and/or services;*
- *has a logical structure; and*
- *contains only essential information.'*

masterspec



Guide to Writing Specifications

August 2009

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Writing specifications

This guide will help you when writing specifications, particularly those based on a standard specification system such as Masterspec. It also explains the approach taken in the Masterspec standard text to grammar and style. This will act as a guide to amending existing and writing new, specification clauses.

If not defined, or taken from a listed reference document such as a New Zealand standard, words used in Masterspec have the meaning defined by the Concise Oxford Dictionary. Writing style and punctuation generally follows the New Zealand Style Book (GP Publications 1991).

While texts on construction specifications are not common *Specifying Architecture* by John Gelder (published by NATSPEC, Australia) offers a good grounding in both the history and theory of specification writing.

Writing style

Style is the cornerstone of readability, ensuring text is relevant and capable of being clearly understood by its intended readership. Style includes a good but not pedantic approach to grammar, simple sentence structure and correct punctuation. Style also means following the sometimes neglected rules of specification writing:

clarity accuracy repetition brevity logic

Clarity means using plain English, avoiding legalese and jargon and restricting vocabulary to words in common usage. Avoid using alternatives (like excavate for dig) just to make the text more interesting. Nevertheless words should be selected to ensure that their meaning is clear and unambiguous, while phrasing should be brief and expressed in the imperative mood. Use 'Provide light fittings....' not 'The contractor shall provide light fittings...'

Accuracy Ensure consistency and accuracy by using the same simple terms throughout ('use,' 'supply,' 'submit') and employ accurate and consistent phraseology for repeated clauses. Avoid generalisations, or unclear words or phrasing. Avoid acronyms and abbreviations, unless very well known and incapable of simple error. Blanket clauses implying responsibility for the general or the unknown, must be avoided.

Don't use gender-specific words and phrases. And avoid nominating specific control functions to particular persons (say architect, engineer, surveyor) unless this is intended. In particular avoid words such as 'approve' or 'approved' unless this is an essential requirement of the contract.

Avoid redundant and misleading paragraphs; in particular poorly or loosely worded SCOPE clauses at the start of specification sections. SCOPE clauses are legally dangerous as they could be taken by a contractor or subcontractor as encapsulating everything that is required. They are best avoided altogether. At the most they should be restricted to a simple extension of the section title.

Also avoid clauses such as 'read the General section with this section,' which might imply that the specification can be broken up into individual parts – a dangerous process contractually. And don't repeat general instructions to the contractor in every section unless there is a particular concern (such as the prevalence for some workers to leave debris on site, or a specific risk of damage to adjoining work or finished work).

Avoid listing overly specific, or indefinable requirements such as 'best trade practice,' 'first class work,' or 'acceptable standard.' Only require 'approval' or 'inspection by....' where this fulfils some specific purpose.

Also carefully check secondary consultants' and specialists' specification sections to ensure consistency of meaning. Some consultants can include indefinite phrases like 'builders work,' or include contractual issues, or even monetary amounts in among the technical data.

Repetition Documents are meant to be complimentary. The principles to follow are:

- say everything, but say it only once. Repetition is inadvisable and legally dangerous
- avoid erroneous information (such as listing a standard that is not referenced in the text)
- just in case
- if something applies, include it once, If something does not apply, remove it or leave it out
- if information is on the drawings, don't repeat it in the specification, unless the subject
- requires amplification
- if an issue is covered in the conditions of contract, don't repeat it in the specification. Matters of contract and/or tender must not be included within the technical text.

Brevity You would not include irrelevant details on drawings and similarly there is no justification for including irrelevant clauses or redundant words in the specification.

Logic The Masterspec sections are set in an easily recognisable pattern, with logical and meaningful clause titles and a logical numbering system for all clauses. Cross-referencing within the specification is kept to a minimum, because of possible future changes or project-based modifications. Where unavoidable, clause names rather than numbers are used for cross referencing.

Keep matters of contract, tender and administration separate from the technical sections of the specification, except for specific instructions on quality, or for instructing/informing others (such as a sub-contractor); for example the obtaining of samples, tests and certification, the setting of standards of performance, requirements to provide guarantees, warranties, as-builts, or maintenance information. This approach allows the technical sections to be more readily used with any chosen method of pricing, administration or contract. It also adds certainty for the contractor and/or project manager when attempting to locate all relevant contract, pricing or administrative requirements.

Don't specify for failure, such as specifying repairs following damage. That is for the conditions of contract to resolve.

Don't address individual matters to 'the contractor.' The whole document is addressed to that one person or entity.

Words and meanings

Words whose meanings are unclear, subjective, or even too precise, should be avoided. In the USA design professionals' insurers often issue lists of what are known as 'red flag words.' These are words which are best avoided, or words which should only be used with caution and deliberate intent. Such words include:

Administer	advise	all	any
Approve	assure	best	certify
Complete	control	direct	ensure
Equal	estimate	every	final
Full	guarantee	inspect	maximise
Minimise	none	optimise	oversee
Periodic	safe	shall	sufficient
Suitable	supervise	will	

Specification writing

The process of specification writing, conducted in parallel with design and drawing work, helps create the proper balance between client, statutory, technical and aesthetic requirements. Who should write the specification? Options in larger organisations include specialist specification writers, project managers, or members of the project design group. The principle qualifications needed are:

- familiarity with the project, including the design philosophy
- expertise in editorial, technical and contractual matters
- willingness and availability.

The Masterspec approach

Masterspec provide specification systems not off-the-shelf standard specifications. They require the specifier to vet existing data, to create a project document. All Masterspec systems are formatted to suit electronic on-screen editing. Some specifiers may prefer to prepare a manual draft, but this significantly increases the final checking process. Where a manual approach is used, always print draft sections directly off the current electronic files to ensure that the latest edition is being used as a base.

The GENERAL sections incorporate explanatory clauses on:

- The precedence of figured to scale dimensions
- Trade divisions versus specification sections
- The precedence between specifications, drawings and other documents (Note: precedence between documents is also addressed in some standard conditions of contract)
- Manufacturer's requirements/specifications/instructions/details.
- the use of capital letters as against lower case letters for descriptors (e.g. architect, owner, contractor, acceptable solution, building consent, etc). While some publications capitalise such descriptors to signify that they are a defined term, this is not grammatically correct and the Masterspec text follows the rule of "when in doubt use a lower case initial letter." Title case, where the first letter of each word in the title of a book or other publication, is also avoided.

The updating of New Zealand and overseas standards and other industry references is covered by a clause which states that current versions (at a nominated date) including all amendments, will apply. However the subsequent replacement or withdrawal of a particular standard still requires the removal and replacement of outdated references. The year of publication is not given for referenced documents, other than Acts of Parliament.

Note however that where a standard is updated between edition dates for Masterspec, clause references may also need to be amended to suit the new document as clause numbering in the new standard may have changed.

Purpose

A project specification (along with the project drawings) has at least ten different purposes:

- 1 As a briefing document and a record of decisions made.
- 2 As a design record.
- 3 A demonstration of statutory compliance.
- 4 A cost planning tool.
- 5 A tendering document.
- 6 A contract document.
- 7 A project management aid.
- 8 An on-site manual.
- 9 As evidence in disputes.
- 10 A resource for facilities management and building maintenance.

While all functions are important, the contractual function is the most critical. If your specification is to act as a legal safety-net for both you and your clients.

It must be accurate. It must not contradict itself or other related documents (drawings, schedules, other consultant's documents, standards and codes of practice, the Building Code acceptable solutions). It must avoid factual or technical errors. It also must be project-specific, if it is to be any use in illustrating compliance with the Building Code.

Writing project specifications

It has been said that designers pretend to write specifications and contractors pretend to read them. There is a strong note of truth in this statement; the principal reasons being an undervaluing of the important role of specifications in the design and construction process and the consequently dysfunctional nature of many project specifications.

Consider the physical appearance of your current project specification. It should look professional, have a robust cover, be securely bound together, but open easily at any page. Black type on white paper is preferred, with a typeface of at least 10 point size. Serif lettering is still recognised by many people as being the most legible (check any newspaper, novel, or text book) but you may personally favour another typeface. Masterspec currently favours Arial 10 point, as being one that is common to all popular word processing programmes.

Page formatting is also important, with a clear definition between divisions and clauses, the use of bold and/or upper case titles and a reasonably narrow text width for ease of reading. Double-sided printing can improve the document's professional look and reduce bulk, but production difficulties may preclude this.

Making it easy

A specification that is easy to navigate is more likely to be read, used and understood. The simple, repetitive layout of all Masterspec specification systems makes this as easy and straightforward as possible. The addition of a proper itemised *Table of contents*, not just a list of Contents is readily produced using normal word processing functions – and would assist users to find the information they seek.

The addition of a subject index, which tells the reader where sealants are listed, or information on flashings, would add further value. These subjects are not always logically or consistently located, or they can be located in more than one work section and the inclusion of a subject finder would overcome this.

Make your specification more professional by making it easier to use.

Specifying methods

The introduction of the performance-based New Zealand Building Act in 1992 provided a timely illustration of how a desired end result can be specified rather than the means of achieving it.

Specifying by performance

While in theory a performance based approach should permit greater innovation and competition among tenderers, the nature of most New Zealand building contracts does not allow significant benefits to occur. The cost and time involved in producing the essential performance definitions, methods of verification and confirmation of performance values is generally too high to be either practical or economic on most projects.

Nevertheless performance-based specifying of some elements is already in common use. Products such as aluminium windows, demountable partitions, suspended ceilings, some mechanical services, ready-mixed concrete and precast concrete products, are all specified quite satisfactorily by reference to performance requirements, published technical data, or to certain tested and proven capabilities. This trend is certain to increase.

Specifying by sample

Specifying by reference to a sample offers a relatively simple way to ensure a desired quality standard is met. This is particularly useful in determining the standard of naturally sourced materials such as quarried stone. Alternately a proprietary product of known quality – perhaps a particular window section or balustrade design – can be used as a benchmark for contractors to match or surpass.

The prescriptive approach

The prescriptive (or by prescription) approach is where the means to an end are set out and defined in detail. This detailed information is set out under three main headings: GENERAL, PRODUCTS and EXECUTION; with a fourth SELECTIONS used when appropriate.

Different approaches used when specifying by prescription are:

- **Descriptive** (spelling out in detail what is wanted)
- **Reference** (specifying to a code, standard or other recognised document)
- **Brand name** (nominating a particular brand, range of acceptable brands, or a specific product).

Brand name

While specifying by brand name is the most precise, it can also be restrictive and removes the opportunity for competitive purchasing. In some instances it can be better to have a range of acceptable alternatives nominated by the specifier, or in controlled circumstances, offered by the tenderer or contractor.

One justification for brand specifying is aesthetic; perhaps a certain level of quality or appearance is required by the designer, or a particular piece of hardware, or proprietary window frame is preferred based on past experience. Another justification is that specific manufacturer's requirements for installation or attachment can be built in to the specification text, ensuring that the material or product is used appropriately. Manufacturer's warranties are another potential advantage with brand specifying.

Reference

Specifying by reference to standards or codes of practice can be problematic. The wording of some standards is often not definitive enough for contractors to price accurately. Or the standard's requirements might clash with those of the contract. Standards often recommend rather than require, while levels of quality are generally set at minimum rather than optimum levels. They may also ignore any special aesthetic requirements or specific climatic conditions.

Reference specifying is best used for defining associated requirements (tests, qualifications, etc) and for describing specific material or product selections, rather than for describing the actual construction or installation process.

The Masterspec approach to specifying

The Masterspec systems, along with most current New Zealand construction specification systems, is generally prescriptive, but contains elements of the performance approach. Brand specifying is allowed as an alternative to generic description in most cases.

Specifiers should note that tenderers/contractors are ambivalent on the issue of brand specifying v's generic specifying. On the one hand they prefer the certainty offered by specifying a single brand, but on the other hand demand the freedom to offer alternatives – often from favoured suppliers, or products with which they are familiar.

Special points to note are:

- 1 Avoid including both a generic description and a branded product or material. There could possibly be a clash between the two (i.e. the branded product does not conform precisely with the generic description).
- 2 Where a branded product is specified there is generally no need to also include a requirement to comply with a New Zealand standard or other industry guide. This only leads to potential confusion as to what is required, as a standard can include a range of complying options.
- 3 Define first for the tenderer and later for the contractor, whether they have the option of offering substitute products or materials – either as of right, as tender substitutions, or under specific circumstances like non-availability. Where the specification is not “open” (i.e. the tenderer has no right to nominate alternatives) use the phrase “no substitutions” to reinforce this fact.
- 4 Offer option 3. above only with due caution. A tenderer's or contractor's view of equivalency may be somewhat looser than envisaged by the specifier. Consider instead putting forward a list of acceptable alternatives, or set out precise guidelines for the approval of any proposed alternative products, materials, or systems.

The specification form

A project specification should collect design decisions and allocate them according to the required construction sequence. Information must also be easy to locate and simple to co-ordinate with project drawings and related documents.

Drawings convey information in a graphic form and are usually the preferred means for providing information on “where” and “how.” Qualitative or “what” information is often best described in writing. When this qualitative information is gathered together the document is called a specification.

Lists or schedules of information (hardware or window schedules) are often a combination of graphic and written data. Such schedules may be located either within the specification or on the drawings.

A schedule or bill of quantities is sometimes needed to define how much, in terms of quantity and cost. The schedule of quantities and the specification can be combined, but this seldom if ever occurs today. There is also less use of a schedule of quantity as a contract document, especially on smaller projects, where they are seen more as a pricing tool and are often prepared by or on behalf of the contractor or developer.

Different ways

Historically, a specification contained a preliminaries and general section, which linked matters of tender and contract and defined the various administrative, compliance and quality issues. This was followed by a series of trade sections, set roughly in the sequence work occurred on site. Today your project specification is likely to still generally follow this traditional pattern (with some changes to suit current construction practice) but must also allow for the many different ways a specification can be employed:

- during the design process
- as part of a pricing mechanism
- as a contractual (legal) document:
 - designer to client
 - owner to contractor
 - contractor to subcontractor or supplier
- as a means of compliance document
- as a guide to construction and contract administration
- as a record of what has been built
- for facilities management.

Different forms

At one time designers and their clients did not need to know how the construction contract was divided up. This is no longer the case. The contractor may now be the designer's client, or the form of contract may give the contractor greater power to determine not only how the building is constructed, but also what it will be built of. A specification must also allow for varying methods of:

- documentation
- tendering/pricing procedure
- forms of contract
- trade-related as against element- or material-related building skills
- discrete sections of the material and supply industry
- separate contracts and contractors
- different (and changing) contract strategies
- different methods of working, applying, fixing
- the purchase of off-the shelf building components
- the contractor's (and various subcontractors') influence on design
- changes occurring during construction, due to cost restraints or changing technology.

The future

In the future, further subdivision of specification data may occur, dividing data into smaller and smaller units. This will provide greater flexibility and allow information to be formed and reformed into the most convenient and appropriate packages. Such repackaging may not be static and change may occur at any time during the construction process.

The employment of work sections as the most logical and convenient piece of information is already being re-examined internationally. The future may well see a move towards an element-based and/or object oriented view of construction data. It is also likely that a closer relationship between the graphic data produced using a CAD package and the related specification data will occur at some time in the future.

Classification and coding

Masterspec employs the CBI classification and coding system. CBI is consistent with CAWS (Common Arrangement of Work Sections) the classification system used by the UK National Building Specification. CBI is also compatible with the overarching UK classification system Uniclass (Unified Classification for the Construction Industry) with the CBI headings replacing the CAWS headings used in Table J.

Work section codes

Work sections are identified by a 4-digit numeric code. The first digit signifies the class:

1. **General**
2. **Site**
3. **Structure**
4. **Enclosure**
5. **Interior**
6. **Finish**
7. **Services**
8. **External**

The remaining three digits define each work section within the overall class designation. For example:

1. **2 211 Removing vegetation**
 2. **2 221 Excavation**
 3. **2 222 Backfilling**
 4. **2 223 Removing subsurface constructions**
- etc...

General sections

Associated with but not forming part of CBI is a standard format for General issues. This is presented on two levels, the first comprising:

1. **The project**
2. **Documentation**
3. **Establishment**
4. **Temporary works and services**
5. **Project management**
6. **Construction**

Under each of these numbered headings are a series of sub-headings, designed to place relevant data in the same order and location each time. This initially acts as a check-list for inclusion of all relevant issues and later offers users of the project specification a greater degree of certainty in locating required information. For example:

1. **The project**
 - Description of work
 - Personnel
 - Site description
 - Site features and restrictions

While the first level is individually numbered (1, 2, 3, 4, etc) the second level names are listed as signposts only, with the legal decimal numbering continuing on with only one decimal point.

Section format

A major concern for users of specifications (contractors, territorial authorities, subcontractors and suppliers) is first discovering details of a particular requirement or supply item, and then being confident that all aspects have been found.

Construction managers need to know what tests are required, while subcontractors need to know whether an approved installer is called for. Suppliers need to find information on, for example, fixings and flashings needed to complete a particular building element. The Masterspec format helps this to occur naturally and easily.

The Masterspec format uses the internationally-recognised terms: GENERAL, PRODUCTS and EXECUTION, with a fourth SELECTIONS added when needed. PRODUCTS (a more all-encompassing term) has replaced MATERIALS, with EXECUTION replacing the more gender-specific WORKMANSHIP. The Masterspec format is presented on three levels. The first two levels are:

1.GENERAL	2.PRODUCTS	3.EXECUTION	4.SELECTIONS	<i>Level 1</i>
Scope	Materials	Conditions		<i>Level 2</i>
Documents	Components	Assembly		
Requirements	Accessories	Application		
Guarantees	Finishes	Finishing		
Performance	Equipment	Completion		

The third level lists the wide range of individual items which lie under the Level 2 headings. For example, under COMPONENTS are found JOINTERS, TAPES, FIXINGS, BRACKETS and HARDWARE. Under FINISHING are listed JOINTING, SEALING, SURFACE PREPARATION and COATING.

As with the General sections, while the first level is individually numbered (1, 2, 3, etc) the second level is listed as division headings with the legal decimal numbering continuing on with one decimal point only.

Clause numbering

Numbering within each division follows the legal-decimal system. Clauses in 1. GENERAL are numbered 1.1, 1.2, 1.3, etc; clauses in 2. PRODUCTS are numbered 2.1, 2.2, 2.3, etc.

Additional clauses can be added at the end of each division without upsetting the existing clause numbers. Alternately where clauses are added or deleted, all clauses can be re-numbered once a section has been customised.

Master specification systems

Construction specifications must be:

- technically accurate
- up to date
- simple to use
- easy to coordinate with the project drawings
- and have a logical relationship with other related documents, including schedules of quantities and standard conditions of contract and tender.

Achieving this is not an easy task, especially for the smaller design practice, which may not have access to the wide range of information sources and support structures maintained by larger organisations.

Different ways to specify

Common ways architects use to produce project specifications are:

Using raw data

Creating every project specification from raw data would clearly be unwieldy, unnecessary and expensive. However this approach still applies when specifying a new or unusual product, system, or process.

Adapting a previous specification

Adapting a specification from a previous project is an approach commonly employed by designers. However this is unlikely to provide a specifier with the comprehensive range of selections and options needed for specifying a new project. This approach can also offer a false impression that the content is up to date, when it may not have been independently reviewed for some time.

This approach is inherently flawed and should be avoided, except for projects which closely mirror their predecessor. Even then a better approach is to create an office master as a stable base for each project type.

Using an office master

Most medium-sized and larger design practices maintain some form of office master specification system. This may range from a system based on a series of standard sections, designed to be interleaved with project-specific selections and clauses, through to sophisticated computer-based systems containing a full range of clause and section options, for individual customising by the project specifier.

Using a master specification system

A master specification system takes this structured approach one step further. By maintaining access to a wide range of industry expertise, a master specification system provider can offer greater certainty that the system's database will accurately reflect industry thinking. A further critical ingredient is the ongoing maintenance of the master specification system's reference base and technical content.

Standards, codes, Acts of parliament, industry references and accepted construction practice are all subject to continuing development and change. Keeping abreast of the downstream effect of such changes is difficult if not impossible for a single design practice to achieve successfully and economically.

The additional resources available to a master specification system provider allows them to fulfil this important role. Individual specifiers can then concentrate on the core task of accurately reflecting and recording project requirements.

Master specification systems arrange information in a form which allows project specifications to be compiled in a simple, direct manner. They include only proven construction methods, standards and conditions and provide a range of suitable alternatives for building elements. They also enhance co-ordination, by following generally accepted principles for setting the boundary between specifications and other parts of project documentation.

Master specification systems assist the documentation, pricing and construction processes by offering a default standard for presenting project data. This leads to familiarity with and confidence for all parties to the construction process, in accessing and interpreting specification data.

Having a degree of independence, a master specification system's provider can act as a forum for the exchange and consideration of a wide range of industry views (both local and international) leading to a general consensus on best practice.

Approaches to specifying

Different approaches to specifying can be employed within a single master specification system:

The subtractive approach

Where the specifier deletes what doesn't apply, using a series of standard work sections.

This approach is particularly suited to preparing specifications based on a requirement to comply, or to confirm compliance with, a prescriptive code or universal standard.

Even under New Zealand's performance-based approach to building controls, project specifications will still contain a strong prescriptive element. Most projects will also require the addition of project-specific data and/or instruction, making a purely subtractive approach unworkable.

The additive approach

Where selections are made from a library of standard clauses, with the specifier adding project clauses and selections.

The additive approach allows the specifier to mix and match clauses from the total specification database to accurately reflect the project in hand. Being able to add project-specific selections and project-based descriptive clauses, enhances the ability of a specifier to produce a truly customised specification.

Recommended approach

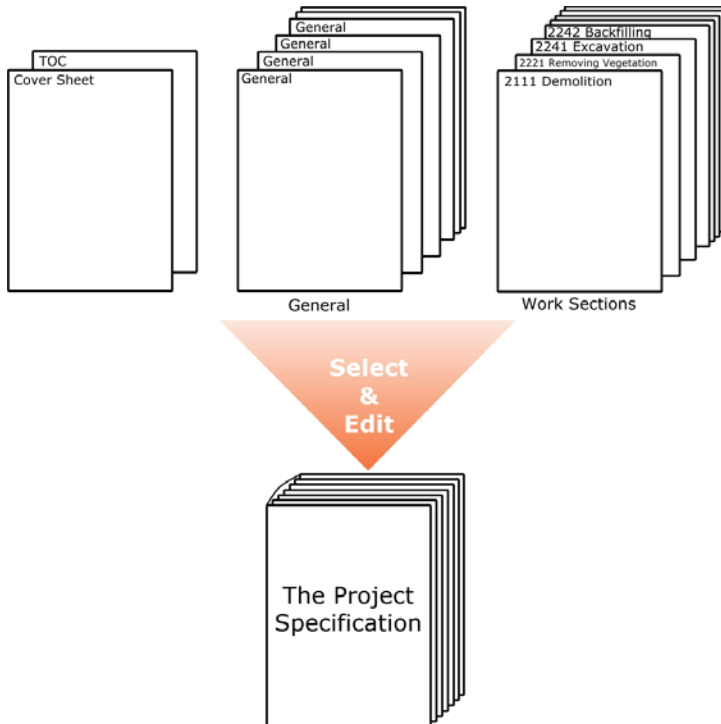
Master specification systems, such as Masterspec - particularly while they are presented as a series of individual word processing files – are generally customised using a mixture of subtractive and additive techniques.

While a truly additive system may seem to offer advantages in terms of producing a truly customised end product with minimum effort, this is unlikely to be practical unless or until a change is made to a database specification system. Currently this change is not favoured by specifiers, due to the perceived need to learn and retain new computer skills.

Why not a standard specification? Even for those designers involved in one type of project, a standard specification will not provide the project-specific document current building control mechanisms demand. Significant differences will also arise from one project to another, due to site constraints, or individual client preferences.

Whatever customising technique is used, the same three elements need to be brought together to make up the final document:

- standard forms
- a General section and
- a series of technical work sections.



Other advantages of a master specification system

A master specification system, particularly a nationally recognised system, provides uniformity in presentation and formulation and by using standardised terminology and definitions, ensures that they are more widely accepted and understood.

Having access to such a system allows specifiers to keep up to date with changes in regulations, codes, standards, work practices, products and technology. The system will also reflect an industry consensus on what comprises current best practice, through the provision of updated text, guidance notes and regular news bulletins on topical issues.

Risk management

The use of a nationally recognised system is an important risk management device. It encourages the production of consistent, concise and easily understood specification clauses, minimises ambiguities (which are generally held against the specifier in a court of law) and offers clients greater certainty that their specification will produce the quality required and expected.

Master specification systems achieve this by maintaining a library of standard clauses, developed using available knowledge and experience (local and overseas) from which project specifications can be created. Such nationally based systems can also be instrumental in bringing about standardised descriptions of the same thing for the same purpose, adding to clarity of interpretation.

Advantages for the construction team

Master specification systems assist all members of the construction team, by providing channels of communication between research and development and day to day practice in the construction industry.

For the designer it allows the logical introduction of technical and product data during appropriate stages of the design and documentation process.

For the specifier it provides the essential standard information, along with clear guidelines on the introduction of project-specific data.

For the quantity surveyor and tenderer it ensures that information is presented in a consistent sequence and pattern.

For territorial authorities and other regulatory bodies it provides a logical structure for discovering and vetting compliance data.

For contractors it provides an unambiguous guide to pricing and construction.

For project supervisors it provides access to data in a logical, co-ordinated sequence.

For the building owner it provides, because of its clear, consistent structure, a transparent statement of project content and quality.

Issues affecting specifying

There are a number of external influences on construction specifications, many of which require decisions to be made by the specifier. Such influences include:

- Codes of practice, regulations and Acts of Parliament
- Technical standards
- Conditions of contract
- Tendering practice
- Product and technical data
- Conformance (the “S” mark)
- Accreditation/certification (by the DBH)
- Appraisal (by BRANZ)
- Quality assurance (to ISO 9000)
- Ongoing reform (energy conservation, government control of resources).

Specifying quality

The specification is both a quantitative and a qualitative document. Quality is tied to the life expectancy of the project and the durability of individual elements and finishes: now subject to a degree of control under the Building Act. Quality also involves the interpretation of a client’s brief by the designer; and the desired level of quality (minimum, median, maximum) should be reflected in the specification text.

Once a contract is signed, the contractor has an obligation (to their owners or shareholders) to complete the contract as economically as possible, within the terms and conditions of the contract. On the other hand the designer (or contract administrator) has a responsibility to ensure that the client’s standards are met in terms of both quantity and quality. This potential dichotomy needs to be understood and likely contentious issues well covered, before the contract is signed.

Current and future issues

A number of current issues should be of concern to specifiers, as both legislation and public attitudes continue to develop and change:

- Is your specification intended to be “open” (i.e. allowing the tenderer/contractor to offer “equal” alternatives to materials or products specified)? Alternately is it “closed” whereby what is specified must be used? In either case, when the matter of substitutions arises, is there a set format for contractors and contract administrators to follow?
- Traditionally designers relied on all contractors being knowledgeable about the materials and

- processes specified and to always provide best trade practice. Specifiers may need to consider whether there should now be greater and more detailed guidance given on how to build as against what to build.
- The use of phrases such as “in accordance with the manufacturer’s requirements” may no longer provide adequate instruction in some cases. Further, is there an implied responsibility for the specifier/contract administrator to ensure the contractor does have and does refer to the relevant manufacturer’s reference data?
- Under the Building Act and underlying New Zealand Building Code, various building elements and finishes must provide stated levels of durability. Many manufacturers provide advice on what steps need to be taken to ensure that their products maintain these standards during the life of a building. Is there a responsibility by the specifier to ensure that the owner is made aware of these on-going responsibilities?
- Some specifiers believe that matters required by law (i.e. Acts of Parliament, Regulations, etc) have no place in a construction contract, as there are other mechanisms available for enforcing and/or overseeing such issues (for example The Health and Safety in Employment Act administered by OSH). While this principle may hold true in general, the need still remains for someone to remind the contracting parties of specific obligations on matters such as public safety, safety in employment, discovery of antiquities and the like.

These and other similar issues provide specifiers with a challenge to ensure that their specifications reflect the building owner’s expectations and their obligations. None of these issues are clear-cut, but it may not be possible to contract out of the responsibilities involved and the matters may need to be addressed. Specifiers are advised to seek legal advice as they see fit.

Changing times, changing roles

Perhaps the most significant trend to have developed in the construction industry over recent years is the decline in the designer’s influence on the construction process. An increasing number of projects now proceed through the construction phase without any involvement by the designer, either as an observer on behalf of the client, or as a technical expert.

The specification is becoming the designer’s only voice in determining what is constructed on site. Designers may need to reconsider both the breadth and depth of what they specify, to ensure that their designs are being accurately interpreted by others, without the benefit of the designer’s direct involvement.

Other traditional roles are also subject to change. The increasing influence of organisations offering management services to building owners (i.e. project managers, cost planners, project planners) is inevitably leading to those same management organisations requiring a greater say in the construction process. The recent introduction of professional managers onto the construction site, effectively replacing or at least reducing the long-held role of head contractor, will lead to significant changes in the way projects are specified in the future.

**Oregon
Department of
Transportation**

Technical Services

**Office of
Project Letting**

**Specification
Unit**

Specification and Writing Style Manual

October 2009

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CHAPTER 2 - WRITING SPECIFICATIONS

2.1 Writing Style and Considerations

A good specification is clear, concise, and easily understood. Simple words and short sentences are used. Duplication is avoided. Specifications need to:

- Provide clear, enforceable requirements that will be easily interpreted the same way by both the Engineer and the Contractor. If more than one meaning can be interpreted, the Contractor will make an interpretation that is most favorable to him.
- Provide clear instructions. If a specification is silent on a point, the Contractor cannot be expected to meet respective requirement without extra compensation.
- Provide specific directions, not suggestions, explanations, or reasons.
- Include only what is needed to obtain the desired end result.

2.2 Grammar and Sentence Structure

2.2.1 Use Imperative Mood Writing Style

The imperative mood gives direction where the subject (contractor) is implied and the verb (provide), (furnish), (construct) expresses command.

Here is an example of the traditional indicative mood style of writing where the subject is expressed:

The Contractor shall FURNISH the following materials:

Here is an example of the same sentence but written in the imperative mood style:

Furnish the following materials:

In this example, the subject is implied and the *VERB EXPRESSES COMMAND*.

Using the imperative mood results in specifications that are shorter, crisper, and easier to understand.

However, when converting indicative mood to imperative mood some mistakes can occur. For example, when selecting appropriate verbs to use in imperative statements, a natural process might be turned into a Contractor action. Here are a couple of examples:

(1) Original: Any resultant rutting of the surface shall not exceed [] inches.

Incorrect Conversion: *Rut the surface a maximum of [] inches.* (The incorrect conversion requires the Contractor to actually place ruts in the roadway.)

Correct Conversion: *Do not rut surfaces more than [] inches deep.*

(2) Original: The material shall be suitably stored and protected before oxidization can occur.

Incorrect Conversion: *Before oxidizing the material, make sure to store and protect it properly.* (The incorrect conversion requires the Contactor to actively work to oxidize the material.)

Correct Conversion: *Store and protect the material to prevent oxidation.*

2.2.2 Be Direct

Talk directly to the readers. In the Agency's specifications, you are talking to the Contractor.

2.2.3 Use the Present Tense

Write so the specification speaks as of the time it is applied, not as of the time it is drafted.

Say	Do Not Say
Name the new directory.	You will need to name the new directory.

2.2.4 Write Positively

Express negative ideas in positive form.

Say	Do Not Say
Changes will be made to the Department of Transportation's regulations only if the administrator reviews them and concludes they are lacking important information.	No changes will be made to the Department of Transportation's regulations unless the administrator reviews them and concludes that they are not lacking any important information.

2.2.5 Use Action Verbs

Say	Do Not Say
applies to	is applicable to
concerns	is concerned with
pay	make payment
recognize	give recognition to

2.2.6 Use Singular Nouns Rather Than the Plural Nouns

Using singular nouns instead of plural nouns avoids confusion of whether the noun applies separately or jointly.

Say	Do Not Say
The guard will issue a security badge to each employee who works in Building D and each employee who works in Building E.	The guard will issue security badges to the employees who work in Building D and Building E.

Exception: Use plural nouns for headings and titles.

2.2.7 Use Elliptical Clauses

An elliptical clause is a clause in which some words have been left out.

Say	Do Not Say
For excusable delays not caused by weather, the Department pays your added costs.	For excusable delays <i>that are</i> not caused by weather, the Department pays your added costs.
If the Engineer determines a claim is without merit, you may pursue the administrative claim procedure...	If the Engineer determines <i>that</i> a claim is without merit, you may pursue the administrative claim procedure ...

2.2.8 Use Parallel Phrases

Parallel phrases balance a sentence when a series of words, thoughts, or ideas appear in one sentence.

Say	Do Not Say
The British Museum is a wonderful place where you can find ancient Egyptian art, explore African artifacts, and discover beautiful textiles from around the world.	The British Museum is a wonderful place to see ancient Egyptian art, you can explore African artifacts, and beautiful fine textiles from around the world.

2.2.9 Avoid Prepositions

Avoid prepositions but do not eliminate them if noun sandwiches or nonparallel phrases are created as a result.

Say	Do Not Say
Engineer's authority	authority <i>of the</i> Engineer
falsework drawings	drawings <i>for</i> falsework

2.2.10 Avoid Noun Sandwiches

Noun sandwiches are strings of nouns grouped together.

Say	Do Not Say
Development of procedures to protect human research subjects...	Human research subjects safety protection procedures development...

2.2.11 Avoid Split Infinitives

An infinitive consists of the word *to* and the base form of a verb. A split infinitive occurs when another word is placed between *to* and the verb.

Say	Do Not Say
Be sure <i>to reply</i> promptly to the invitation. or Be sure <i>to reply</i> to the invitation promptly.	Be sure <i>to</i> promptly <i>reply</i> to the invitation.

2.2.12 Avoid Gender-Specific Terminology

Say	Do Not Say
crew member	crewman
drafter	draftsman
hours worked	manhours
personnel, workforce	manpower
supervisor	foreman

Exception: Use gender-specific terminology if required to match industry-standard terminology or the law.

The word *person* does not make a sentence gender neutral.

2.3 Writing Techniques

2.3.1 Avoid Using the Words "shall", "will", "must", "should", and "may"

Write in the imperative mood to eliminate them.

2.3.2 Avoid Using the Term "and/or"

The use of the combined words *and/or* indicates that items joined by it can be taken either together or as alternatives. It makes the meaning of a document unclear. Select the correct word to fit the meaning.

2.3.3 Avoid Unnecessary Qualifiers

Qualifiers do not add meaning to a sentence and will cause misinterpretations. Do not use them.

EXAMPLES:

actual
all (only use to differentiate between partial and whole quantities)
any (only use to specify a choice)
completely
existing (with remove, reconstruct, salvage, abandon, or obliterate)

Do not use *respective* and *respectively*.

Say	Do Not Say
Forms are listed under the names of their corresponding sections.	Forms are listed under the names of their <i>respective</i> sections.
The hat shall be blue. The scarf shall be green.	The hat and the scarf shall be blue and green, <i>respectively</i> .

2.3.4 Avoid Unnecessary Phrases and Words

EXAMPLES:

Attention is directed to... (Use direct references.)
in this section or specified herein (Be specific and provide the section number.)
in the opinion (Opinions are not used in specifications.)
such as... (Do not give examples.)
immediately (This word can be interpreted differently.)

2.3.5 Avoid Use of Exceptions

State a rule or category directly. Do not describe the rule or category by stating its exceptions.

Say	Do Not Say
Each person under 18 years of age...	All persons except those 18 years or older...

Use an exception only to avoid long and cumbersome lists or elaborate descriptions. State the rule or category first then state its exception.

Say	Do Not Say
Each state except Texas, New Mexico, and Arizona must ration... <i>(In this case the category "each State" is established first and then the exceptions are stated.)</i>	Alabama, Alaska,... <i>(listing 47 states)</i> and Wyoming must ration...

Do not use general phrases such as "except as otherwise specified" or "except as otherwise shown". Be specific and state the particular items to which the specification does not apply.

2.3.6 Avoid Redundancies

Do not use word pairs if the words have the same effect or where the meaning of one includes the other.

Examples of word pairs to avoid:

any and all	full and complete
authorize and direct	order and direct
cease and desist	means and includes
each and every	necessary and desirable

2.3.7 Write Short Sentences

It is difficult to determine the intended meaning of a complex sentence.

Readable sentences are simple, active, affirmative, and declarative. The more a sentence deviates from this structure, the harder the sentence is to understand.

Follow these guides for writing sentences:

- State one thing and only one thing in each sentence.
- Divide long sentences into two or three short sentences.

- Remove all unnecessary words. Strive for a simple sentence with an implied subject and implied verb. Eliminate unnecessary modifiers.

Say	Do Not Say
When the device is not in use during a work shift, turn it off.	When the device is not in use for less than one work shift, turn off the device.

2.3.8 Write Short Paragraphs

Improve clarity of a specification by using short compact paragraphs. Each paragraph should deal with a single, unified topic. Present lengthy, complex, and technical discussions in a series of related paragraphs.

2.3.9 Be Consistent

Use simple specific words. Do not use abstract, vague, or different words to say the same thing.

Say	Do Not Say
Each <i>automobile</i> owner must register their <i>automobile</i> with the Department of Motor Vehicles.	Each <i>motor vehicle</i> owner must register their <i>car</i> with the Department of Motor Vehicles.

2.3.10 Use Parallel Structure

Arrange sentences so that parallel ideas look parallel. When using lists, the lead-in sentence along with each item in the list should read as though it is a stand alone sentence.

Parallel Structure (Yes):

The duties of the Executive Secretary of the Administrative Committee are to:

- Take minutes of all meetings
- Answer all correspondence
- Write monthly reports

Nonparallel Structure (No):

The duties of the Executive Secretary of the Administrative Committee are:

- To take minutes of all the meetings
- The Executive Secretary answers all the correspondence
- Writing of monthly reports

2.3.11 Use Preferred Expressions

Say	Do Not Say
according to	in accordance with conformance with conforming to as determined by
after	subsequent to
Agency	State
allow allowed	permit permitted
at no additional cost to the Agency	at no additional compensation at no expense to the Agency at no cost to the Agency at no additional expense to the Agency at Contractor's expense
at the Agency's expense	at no cost to the Contractor
because	for the reason that
before	prior to
begin	commence
change	alter modify revise
do not...	allow no... perform no... use no...
end	terminate
enough	adequate number of sufficient number of
except	excluding
for	in the interest of with reference to
if (except use <i>when</i> in reference to time and <i>where</i> in reference to location)	when where subject to in case in the event that
indicating that	affirming that
instead of	in lieu of
is	deems
keep	retain

Say	Do Not Say
limits	parameters
meet the requirements of	shall conform to
no separate or additional payment will be made for	will be considered incidental
notify	inform
obtain	get procure secure
on	upon
possible	feasible
produce (except use <i>manufacture</i> to focus on a specific production part)	fabricate
quantity	amount
request	ask
start	begin commence
stop	cease
use	utilize employ
way	manner
when	at the time
while	during such time as

When choosing a word not in this list, balance the following:

- Use the most basic word
- If the most basic word has many definitions and if those definitions can cause confusion, use a more precise word
- Use industry-standard words

When a law is referenced, use the core words of the law. Do not use the legalese.

2.3.12 Omit Needless Words

Say	Do Not Say
about	with regard to
at	located at at the following location
because	because of the fact that
by	by means of
do not	at no time
during	during the course of during the duration of
for	for the period of
how	in a manner that in a manner which
if	in the event of should it appear that
including	including, but not limited to
later	at a later date
monthly	on a monthly basis
near	close proximity
no	there will be no
of	related to
of, about	pertaining to
that	such that
to	so as to in order to
to, for	as a means of for the purpose of
until	until such time

2.4 Formatting and Punctuation

2.4.1 Capitalization

Capitalization of terms is discussed in 00110.05 of the Standard Specifications. Capitalize the words *Agency*, *Contract*, *Contractor*, and *Engineer*.

Capitalize *Section* where used with a number.

Capitalize the terms *Type*, *Class*, and *Grade* when used in reference.

Capitalize each main word in tables.

2.4.2 Punctuation

Use the "outside method" of punctuation for placement of the comma and the period with respect to quotation marks. Only punctuation that is part of the quoted matter is placed within quotation marks.

EXAMPLE: *The accepted quantities of wearing surface drains will be paid for at the Contract unit price per each for the item "Wearing Surface Drains".*

The period is not part of the bid item name, therefore the period is outside of the quotation mark.

2.4.3 Abbreviations and Acronyms

Limit the use of abbreviations and acronyms. Use them when they are:

- Listed in 00110.10 of the Standard Specifications
- Listed in a reference standard
- More familiar to the reader than its spelled-out form
- Used in tables when space is limited

Do not use abbreviations and acronyms:

- With a superscript
- In headings
- When only a few letters are eliminated

If in doubt about the familiarity of the abbreviation to the reader, define the abbreviation.

When introducing new abbreviations and acronyms, define them at their first occurrence.

2.4.4 Definitions

Include defined terms when:

- They are not industry standard
- A term has multiple meanings and could be interpreted multiple ways

Do not define terms that:

- Are defined in 00110.20 of the Standard Specifications
- Use the term being defined in the text of its own definition

When defining terms:

- List them in alphabetical order
- Capitalize the term
- End each definition with a period
- Use bold type for the word being defined
- Use a nonbreaking space, a nonbreaking hyphen, and a nonbreaking space between the word being defined and the definition. (A nonbreaking hyphen is similar to a nonbreaking space. It keeps everything together on the same line. *(MS Word Hot Key: Ctrl/Shift/hyphen key)*)

EXAMPLE:

Calendar Day - Any day shown on the calendar, beginning and ending at midnight.

2.4.5 Lists

Lists convey a series of requirements.

Structure lists of two or more items in vertical bulleted lists. Do not use numerals or alpha characters. Indent each series of bullets.

EXAMPLE:

The duties of the technician include:

- Providing tests
- Preparing the following reports:
 - Morning test results
 - Afternoon test results
- Attending meetings

List items by work sequence or most important to least important. If no logic, list alphabetically.

Capitalize the first word of each item in a list.

Use a period at the end of each item in a list if an item is a complete sentence.

Usually all items in a list apply therefore, avoid using "the following" when introducing inclusive lists.

Say	Do Not Say
Miscellaneous metal consists of:	Miscellaneous metal consists of <u>the following</u> :

When a list is not inclusive, add "one of the following", "either of the following", "any of the following", or other phrase that specifies how the items apply when introducing the list.

Avoid beginning items in a list with articles (*a, an, the*). Lists without the articles are crisp and provide the same information.

Say	Do Not Say
Bring: <ul style="list-style-type: none"> • Pen • Pencil • Calculator 	Bring: or Bring a: <ul style="list-style-type: none"> • A pen • A pencil • A calculator • Pen • Pencil • Calculator

2.4.6 Tables

Create tables as shown in Table 00320-1. Begin table numbers with its corresponding specification section number. When referencing a table, refer to it by its number; for example: ...shown in Table 00320-1.

Table 00320-1

Table Title			
Column Heading	Column Heading	Column Heading	
		Column Subheading	Column Subheading
Row Heading Subheading			

2.4.7 Numbers

Use numerals for quantities, sizes, measurements, and similar entities except:

- Use a word at the beginning of a sentence.
- When numbers are used to define both size and quantity, use a word for the quantity (*three 1/2 inch holes*; not *3 1/2-inch holes*).
- Use the words *million* and *billion*.
- Spell out numbers up to and including nine; use figures for 10 and above.

Use arabic numerals unless roman numerals are used in a referenced document or detail, in which case, match the document or detail.

Use commas in numerals containing 4 or more digits.

Do not use ordinal numerals.

Say	Do Not Say
first, second, tenth	1st, 2nd, 10th

Do not use fraction characters.

Say	Do Not Say
1/2", 1 1/2"	½", 1½"

Use a zero in the unit place of a number less than 1.

Say	Do Not Say
0.1	.1

Do not write out numbers then follow with numerals in parenthesis.

Say	Do Not Say
four 12	four (4) twelve (12)

Add a nonbreaking space between -, +, or ± and its associated numeral when these signs are used to modify the numeral rather than combine 2 numerals. (*MS Word Hot Key: Ctrl/Shift/space bar*)

2.4.8 Dimensions

Do not repeat measurement units.

Say	Do Not Say
2 by 4 inches 5 to 10 feet	2 inches by 4 inches 5 feet to 10 feet

Use the word *by* in dimensions.

Say	Do Not Say
4 by 12 inches	4 x 12 inches

2.4.9 Measurements

Spell out measurement units except when used in tables.

Insert a nonbreaking space between the number and the unit. (MS Word Hot Key: *Ctrl/Shift/space bar*)

For temperatures, use the degree symbol in text and tables. Insert a nonbreaking space between the numeral and the degree symbol. (MS Word Hot Key: *Ctrl/Shift/space bar*)

Say	Do Not Say
72 °F	72° F

Use civilian time with lowercase and periods.

Say	Do Not Say
7:00 a.m. to 8:30 a.m.	7:00 AM to 8:30 AM
midnight	12 p.m.
noon	12 a.m.

Use calendar days or days. Do not use business days.

Do not specify time periods in weeks or months.

2.4.10 Percentages

Do not repeat percent in ranges and tolerances. Do not use the percent symbol except in tables.

Say	Do Not Say
2 to 4 percent	2 percent to 4 percent
3 ± 1 percent	3 percent ± 1 percent
5 percent	5%

2.4.11 Equations

Use the letter *x* for a multiplication sign.

Use the symbol ÷ for a division sign.

Use a nonbreaking space before and a nonbreaking space after a mathematical sign. (MS Word Hot Key: *Ctrl/Shift/space bar*)

Except for complicated equations, avoid using subscript and superscript fonts.

Simple equations may be used within text.

Display complicated equations on a separate line clear of text. If possible, use Microsoft Word's Equation Editor software.

To define the variables, use indent hanging style and introduce them with the word *Where* followed by a colon.

Here is an example of a formula with variables:

Use the following equation to calculate the air-dry weight:

$$W = (A \times 62.3) \div (B - C)$$

Where:

- W = air-dry weight (pound per cubic foot)
- A = 90 day weight of the cylinder as dried (pound)
- B = saturated, surface-dry weight of cylinder (pound)
- C = suspended-immersed weight of cylinder Pound)

2.4.12 Slopes

Show slopes with the vertical unit first followed by the horizontal unit. Include an uppercase V and uppercase H.

Example: 1V:5H

2.4.13 Parentheses

Avoid using parentheses.

Do not enclose in parentheses information that is essential to the specification.

Say	Do Not Say
Provide loaders and trucks to load and haul the material.	Provide equipment (loaders and trucks) to load and haul the material.

2.4.14 Tolerances

For tolerances, add a non-breaking space on each side of ± symbol. (*MS Word Hot Key: Ctrl/Shift/space bar*)

Example: 4.2 ± 0.1 inches

2.4.15 Chemicals

Use chemical names; avoid using chemical formulas.

2.4.16 Phone Numbers

For Oregon phone number do not use parentheses around the area code. For all other states, use the parentheses. Do not use periods.

Examples:

Oregon phone numbers: 503-986-2345

other states: (xxx) 352-4090

2.4.17 References

When referencing other documents or forms use the specified spacing as determined by the referenced organization. For an ASTM or AASHTO reference, add a space between the letter designation and the number. Do not add the number that indicates the year.

Say	Do Not Say
ASTM A 706	ASTM A706
AASHTO M 314	AASHTO M314
AASHTO M 183	AASHTO M 183-04

Refer to forms by form name and number.

2.4.18 Emphasis

Use bold type only for table titles, headings, and definitions.

Do not use bold, caps, underlining, quotation marks, or italics for emphasis.

2.4.19 Commas

Use only technically necessary commas. Do not use a comma just to indicate a pause.

2.4.20 Spaces

Use two nonbreaking spaces after each period and colon. (A nonbreaking space is a space that is used to prevent words from breaking across two lines if it is the intent to keep the words on the same line. It also provides a uniform spacing at the end of each sentence. *(MS Word Hot Key: Ctrl/Shift/space bar)*)

Use two nonbreaking spaces between a heading number and name. *(MS Word Hot Key: Ctrl/Shift/space bar)*

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
OFFICE ENGINEER



Specification Style Guide

for 1999 and 2006 Specifications

June 2007



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3 WRITING STYLE

Interpret each rule as if followed by "unless context and common sense dictate otherwise." Do not follow a rule if clarity is reduced. This is the #1 RULE.

3.1 REFERENCE FOR GRAMMAR, USAGE, CAPITALIZATION, AND PUNCTUATION

Use the guidance provided in CMOS for grammar, usage, capitalization, and punctuation. You can refer to any number of writing guides when writing specifications. Most provide the same basic rules, but a few differences in the rules exist. One guide was chosen to create consistency in Caltrans' specifications. CMOS's Web site has answers to many grammar, usage, capitalization, and punctuation questions. The Specification Style Guide provides rules:

1. From CMOS that are not typically used in everyday writing
2. Not covered in CMOS
3. Contrary to the rules in CMOS (only a few of these). For the contrary rules, follow the rules in this guide.

Where the CMOS allows optional styles, choose the traditional style.

3.2 FEDERAL REGISTER'S WRITING GUIDE

Follow the principles in the Federal Register's "Principles of Clear Writing." For additional explanations, refer to:

<http://www.archives.gov/federal-register/write/legal-docs/clear-writing.html>.

Bracketed text is text not in the Federal Register's guide. The following rule numbers correspond with the rule numbers in the Federal Register's guide.

1. Write in the active voice.

The active voice eliminates confusion by forcing you to name the actor in a sentence. This construction makes clear to the reader who is to perform the duty.

The passive voice makes sentences longer and roundabout. Who is responsible is much less obvious. Passive verbs have a form of the verb to be plus the past participle of a main verb.

Examples of passive verbs:

was received,
is being considered,
has been selected.

The passive voice reverses the natural, active order of English sentences. In the following passive example the receiver of the action comes before the actor.

Passive:

The regulation (receiver) was written (verb) by the drafter (actor).

Active:

The drafter (actor) wrote (verb) the regulation (receiver).

The passive voice is appropriate when the actor is unknown, unimportant, or obvious [such as in conditional clauses; for example, if alternative materials are used].

2. Use action verbs.

Don't Say	Say
is applicable to	applies to
make payment	pay
give recognition to	recognize
is concerned with	concerns

3. Use "must" instead of "shall."

shall	imposes an obligation to act, but may be confused with prediction of future action
will	predicts future action
must	imposes obligation, indicates a necessity to act
should	infers obligation, but not absolute necessity
may	indicates discretion to act

4. Be direct.

Talk directly to your readers. [In Caltrans' specifications, talk to the Contractor.] Use the imperative mood. [Also, use "you" and "your."]

Directness avoids the passive voice:

Sign all copies.
Attach a copy of your W-2 to your return.

This style results in procedures that are shorter, crisper, and easier to understand.

5. Use the present tense.

By [writing] in the present tense, you avoid complicated and awkward verb forms.

Don't Say	Say
The fine for driving without a license shall be \$10.00.	The fine for driving without a license is \$10.00.

6. Write positively.

If you can accurately express an idea either positively or negatively, express it positively.

It's better to express even a negative in positive form.

Don't Say	Say
did not comply with or failed to comply with	violated [only if referring to Contractor's activities]

[Example:

If you violate Pub Cont Code § 4100 et seq., the Department may exercise the remedies provided under Pub Cont Code § 4110.]

7. Avoid use of exceptions.

If possible, state a rule or category directly rather than describing that rule or category by stating its exceptions.

Don't Say	Say
All persons except those 18 years or older must . . .	Each person under 18 years of age must . . .

[Use "Section [Section no.] applies to [x]" or "[Requirement description] applies to [x]" or introduce requirement with "For [x]."]

However, you may use an exception if it avoids a long and cumbersome list or elaborate description.

[Many of our section scopes are broad; therefore, it is often more clear to specify the items to which the scope does not apply than to specify that the section applies only to particular item.]

[If a specification has exceptions, do not use general phrases such as "except as otherwise specified" or "except as otherwise shown." Instead, specify the particular items to which the specification does not apply.]

8. Avoid split infinitives.

The split infinitive offends many readers, so avoid it if you can.

Don't Say	Say
Be sure to promptly reply to the invitation.	Be sure to reply to the invitation promptly . or Be sure to reply promptly to the invitation.

9. Use the singular noun rather than the plural noun.

To the extent your meaning allows, use a singular noun instead of a plural noun. You will avoid the problem of whether the rule applies separately to each member of a class or jointly to the class as a whole.

Don't Say	Say	Unless you mean
The guard will issue security badges to the employees who work in Building D and Building E.	The guard will issue a security badge to each employee who works in Building D and each employee who works in Building E.	The guard will issue a security badge to each employee who works in both Building D and Building E.

[Use plural nouns for headings and titles, but do not change existing titles.

If an existing item description is in the plural, use the plural form. For a new item description, use the singular form.]

10. Be consistent.

Don't use different words to denote the same thing. Don't use the same word to denote different things.

Don't Say	Say
Each motor vehicle owner must register his or her car with the Automobile Division of the Metropolitan Police Department.	Each automobile owner must register his or her automobile with the Automobile Division of the Metropolitan Police Department.
The tank had a 200-gallon tank for fuel.	The tank had a 200-gallon fuel container.

11. Use parallel structure.

Arrange sentences so that parallel ideas look parallel. This is important when you use a list.

Nonparallel construction:

The duties of the Executive Secretary of the Administrative Committee are:
To take minutes of all the meetings; (**phrase**)
The Executive Secretary answers all the correspondence; and (**clause**)
Writing of monthly reports. (**topic**)

Parallel construction:

To take minutes of all the meetings;
To answer all the correspondence; and
To write the monthly reports.

12. Prefer simple words.

[See Preferred Expressions of this guide. Also, refer to Plain Language Web sites such as www.plainlanguage.gov and www.plainlanguagenetwork.org.]

13. Omit needless words.

Don't Say	Say
because of the fact that	because
for the period of	for
[highway right-of-way]	[highway]
[including, but not limited to]	[including]

14. Avoid redundancies.

Don't use word pairs, if the words have the same effect or where the meaning of one included the other.

[Examples of word pairs to avoid are:]

any and all	full and complete
authorize and direct	order and direct
cease and desist	means and includes
each and every	necessary and desirable

15. Use concrete words.

Abstract words can be vague and open to different interpretations. [Use] simple, concrete words. [Be specific.]

Don't Say	If you mean
vehicles	automobiles
firearms	rifles
aircraft	helicopters

16. Don't use words that antagonize.

[Not applicable to specification writing.]

17. Avoid noun sandwiches.

Administrative writing uses too many noun clusters -- groups of nouns "sandwiched" together. Avoid these confusing constructions by using more prepositions.

Don't Say	Say
underground mine worker safety protection procedures development	development of underground procedures for protection of the safety of mine workers

[The meaning becomes clear when the four-word sandwich is broken up.]

18. Don't use gender-specific terminology.

Avoid the gender-specific job title:

Don't Say	Say
crewman	crew member
foreman	supervisor
manpower	personnel, workforce

19. Write short sentences.

Readable sentences are simple, active, affirmative, and declarative.

The more a sentence deviates from this structure, the harder the sentence is to understand. Long, run-on sentences are a basic weakness in legal documents. Legal documents often contain conditions which result in complex sentences with many clauses. The more complex the sentence, the greater the possibility for difficulty in determining the intended meaning of the sentence.

Solutions:

- State one thing and only one thing in each sentence.
- Divide long sentences into two or three short sentences.
- Remove all unnecessary words. Strive for a simple sentence with a subject and verb. Eliminate unnecessary modifiers.
- If only one or two simple conditions must be met before a rule applies, state the conditions first and then state the rule.
- If two or more complex conditions must be met before a rule applies, state the rule first and then state the conditions.
- If several conditions or subordinate provisions must be met before a rule applies, use a list.

20. Make lists clear and logical in structure.

[List by sequence of work or most important to least important. If no logic, list alphabetically. Display lists of ± 3 items in vertical lists.]

21. Use short paragraphs.

A writer may improve the clarity of a [specification] by using short, compact paragraphs. Each paragraph should deal with a single, unified topic. Lengthy, complex, or technical discussions should be presented in a series of related paragraphs.

3.3 BREVITY

Be as brief as possible without reducing clarity.

Avoid prepositions (keeping in mind Federal Register's principle #17). Do not eliminate prepositions if nonparallel clauses and phrases are created as a result.

Examples:

Don't Say	Say
authority of the Engineer	Engineer's authority
working drawings for falsework	falsework working drawings

Use elliptical clauses.

Examples:

Don't Say	Say
For excusable delays that are not caused by weather, the State pays the Contractor's added costs	For excusable delays not caused by weather, the Department pays the Contractor's added costs
Bid submission shows that the bidder has investigated the site and understands the scope of work.	Bid submission shows the bidder has investigated the site and understands the scope of work.

Avoid unnecessary qualifiers.

Examples:

- actual
- all (except to differentiate between partial and whole quantities)
- any (except to specify a choice)
- existing (with remove, reconstruct, salvage, abandon, or obliterate)

Avoid "respective" and "respectively." According to The Elements of Style by William Strunk, Jr., "These words may usually be omitted with advantage."

Examples (from The Elements of Style):

Don't say	Say
Works of fiction are listed under the names of their respective authors.	Works of fiction are listed under the names of their authors.
The one mile and two mile runs were won by Jones and Cummings respectively.	The one mile and two mile runs were won by Jones and by Cummings.

3.4 SECTION 1 DEFINITIONS

Use definitions in Section 1 of the Standard Specifications appropriately.

Example:

traveled way: That portion of the roadway for the movement of vehicles, exclusive of shoulders.

3.5 INDUSTRY STANDARD

Use industry-standard terms.

Use terms in prevalent use by other states and the construction industry. Do not use terms unique to the Department.

An exception to the use of a unique term must be justified and approved by the specification owner and the Construction Division with concurrence by Legal.



A Guide to Writing Specifications

Compiled for:

The Los Angeles Unified School District

Procurement Services Group

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MECHANICS

The need for clarity



The most obvious reason for writing clear specifications is to ensure that you will inform the contractors well enough that they can actually produce or provide the product you need. However, there is another reason why the specifications and statements of work for public contracts must be clear: **fairness to all offerors.**

If one offeror happens to have better access to inside information about the work to be done than the others, then vaguely written specifications will give that offeror an unfair advantage over competitors who may be perfectly capable of doing the work, but lack knowledge about some of the details. The protest that may result from such a situation will take a great deal more time and effort to resolve than you would have to spend sharpening up a vaguely worded document.

Being fair to all vendors is important for three reasons. The most obvious when we are writing specifications for a public contract is that everyone has a right to be treated equally by a public agency spending taxpayer money. Requiring one vendor's product to the exclusion of others would serve to deny the others an opportunity to benefit by receiving the order. The remaining two reasons apply to private business transactions as well as public ones. First, it's good business to encourage competition; without it we pay higher prices. Second, having several independent sources for a

given product ensures a reliable supply of needed goods, and often permits larger quantities to be obtained on short notice.

Sentence Structure

Keep your sentences short and simple. It doesn't matter if specifications read like a grade school textbook. We're not trying for the Pulitzer Prize.

Many times, when sentences are so long and complex, it's because the writer became confused, and ended up saying something different from what was intended, or maybe nothing at all.

There have been specifications for a job where the contractor had submitted a claim. Only one sentence in the lengthy document described the **essential** function of the equipment that was being procured. The sentence was so long and complex that its author couldn't see some of his errors in grammar. The errors made the sentence unenforceable. In that situation it was impractical to do much other than pay the contractor's claim, accept the equipment as built, even though it didn't work right, and the agency staff had to fix it themselves.

References

Four in this guide discuss different types of references.

1. References to other documents in the procurement package
2. Cross references to other paragraphs
3. References to specific specifications and standards

Paragraph cross-references

Paragraph cross-references cite other paragraphs within their own document. Such citations are highly prone to error. It is not unusual for a reader to find a reference either to the wrong paragraph or to a paragraph that doesn't exist. Hold your cross references to a minimum.

Use of acronyms

Acronyms are words that are made from the initial characters of an often-repeated phrase. For example, “RFP” is an acronym for “Request for Proposal.” Usually they are capitalized, but when they are so widely used, they become demoted to the status of ordinary English words. The standard way of defining acronyms is to capitalize the words they represent, and then follow those words by the acronym enclosed in parentheses.

Acronyms make documents hard to read, since the readers often have to stop and refresh their memory of what some of the acronyms mean. When the document is only a page or two long, it’s easy to scan backwards and find the places in the text where the acronyms are defined. In a hundred-paged document, it’s not so easy, and it sometimes takes a reader hours of searching to find just one definition.

The ways to avoid this problem are to avoid using acronyms, especially ones that are project-specific, and to put a glossary of acronyms in your document. Make the glossary easy to find, and make sure each acronym is defined.

How grammatical errors in specifications are handled

There are three categories of grammatical errors:

1. Those that don’t affect the intelligibility of the sentence. An example would be “Joe ate less doughnuts than John.” It should read “fewer doughnuts,” but no one can argue about what the writer intended.
2. Those that make the sentence totally unintelligible. These don’t often get past the review cycle, but when they do, the contractors may legitimately ignore them in providing the bid for equipment. Usually we’re lucky and the contractor will tell us about them and we can fix them in the specification.
3. Those that leave the sentence somewhat intelligible, but change the meaning of the sentence to something different from what was intended. For example, see the section below on restrictive and non-restrictive clauses. In this case, even a contractor who has a policy of

goodwill towards the District is likely to build/provide equipment to meet the erroneous requirement. Eventually, the error will be discovered, and will be fixed through a modification, which results in increased costs to the District.



Essential and nonessential dependent clauses

See also: restrictive and nonrestrictive (below)

The ability to distinguish between essential and nonessential dependent clauses is an extremely important skill for specification writers. When a clause that was intended to be essential is inadvertently written as nonessential or vice versa, the requirement stated by it may be distorted or lost. The visible difference between the two is nothing more than a comma before the introductory word. The nonessential clause gets the comma. Here is a list of introductory words and phrases that may introduce both essential and nonessential clauses, and therefore require the utmost caution:

after	<u>because</u>	since	<u>which</u>
as	before	so that	while
as if	by which	to which	who
as though	for which	unless	whom
as soon as	if	when	whose
at which	in order that	where	

Restrictive and nonrestrictive dependent clauses

When referring to clauses, the terms “essential” and “nonessential” are interchangeable with the more commonly used terms “restrictive” and “nonrestrictive.” We have used the terms “essential” and “nonessential” for most of this text because they seem to express the distinction more simply.

An essential clause is essential to the meaning of the entire sentence. If you take away an essential dependent clause, the main meaning of the sentence is altered. Doing so to a nonessential clause, while removing information, does not change the core meaning of the sentence.

Whenever someone says that a knowledge of grammar is not needed in order to accurately express meaning, the distinction between restrictive and nonrestrictive clauses is sure to be mentioned in the argument that ensues. If you wish to be a credible writer, you must master this distinction.

Multiple conjunctions

When you write sentences with two or more conjunctions, you risk producing an ambiguity. For example:

The flange shall be fastened by gluing and clamping or riveting.

This could mean “**gluing and clamping** or riveting” or it could mean “gluing and **clamping or riveting**,” with the bold characters added for clarity. Unfortunately, English does not provide us with a means of declaring the order of application of its logical operators the way computer languages do. The burden of resolving the confusion of precedence is placed on the writer, who must find a different way of expressing the idea without ambiguity. In the above case try

“The flange shall be fastened either by gluing and clamping or by riveting.”

Specifications in the third person

Normally we write specifications so that they always refer to the third person. Forcing your writing into the third person is difficult, and often makes the sentences difficult to read. It runs contrary to the advice of modern writing teachers who are trying to reform us, but the rest of the world for the most part is expecting to see specifications written in the third person, and writing them otherwise is inviting criticism. Hence, using the words, “I,” “we,” and “you” is frowned upon.

If you **MUST** refer to the first or second person, be sure you define the meaning of the pronouns, and use them only as defined.

Elegant variation

You probably have been taught for aesthetic reasons to avoid repeating the same words and phrases. For specification writers, such practice may be disastrous. Forget what your teacher told you; you’re not competing for a Pulitzer Prize. It is extremely important to clarify, that you refer to things using exactly the same words every time.

Some good examples of synonymous (or nearly so) terms often erroneously used together in training device specifications are:

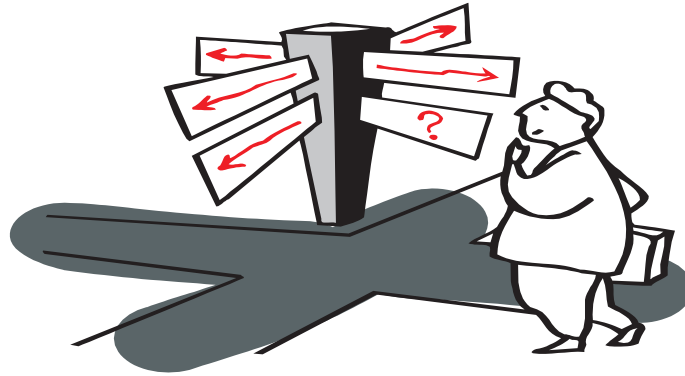
- trainee, student
- trainer, training device, training system, system, device
- Scenario, exercise, training exercise, script, mission, profile

If you intend to distinguish between the meanings of terms like these, you must define each term in the document. If you intend no difference in the meaning of two words, use only one of them.

Types of ambiguities

Ambiguous sentences can be interpreted to have more than one meaning. Three types of ambiguities are found in sentences. These are:

1. Ambiguous words,
2. Syntactic ambiguities, and
3. Contextual ambiguities.



Ambiguous words are words that may have more than one meaning. Most English words have multiple meanings. In normal reading we usually can tell from the context which meaning was intended. We really get in trouble when someone goes looking for ways to misinterpret our words.

An example of an ambiguous word is “run,” which could have any of 67 different meanings. The ambiguous words “any” and “include” are so often misused by people that they deserve special articles of their own, but that discussion shall be for another day.

Adjusting your point of view will help you catch ambiguities.

Contextual ambiguity--Sometimes we find a sentence that has no ambiguous words and can be reasonably diagrammed in only one way, but still leaves its reader confused about its meaning. Consider the sentence:

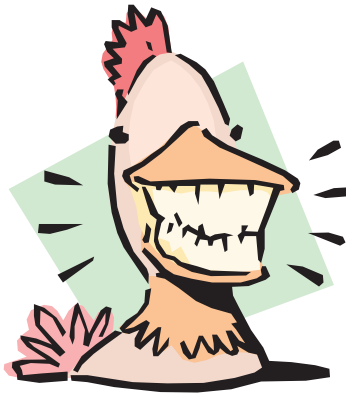
All surfaces...shall be painted white to increase reflectivity.

Does it mean “paint all surfaces white”? Or does it mean “determine which surfaces have lower reflectivity than white paint, and then paint them white” We know from other sources that the writer really wanted all surfaces to be painted.

The infinitive phrase, “to increase reflectivity,” was added to explain the specifier’s general intentions. In addition, it gave the reader two ways to interpret the words.

Generally speaking, it is unwise to make explanatory statements in specifications. They tend to cause results like the example. The example sentence is taken from a real Federal Government case. The Government won partly because the contractor did not have data to prove that some of the surfaces were already more reflective than white paint. Even though the Government won, the dispute caused time and labor to be wasted.

Another example is: “*The chicken is ready to eat.*” Does this mean that it’s time to feed the chicken or that dinner is served? What do you think?



The only way you can avoid making errors of this type is by adjusting your point of view and playing “what-ifs” in your head when you read the text. The ability to catch conceptual errors in specifications and foresee their possible effects comes with many years of experience.

Syntactic ambiguities occur when there are two or more ways to read the structure of a sentence. Take, for example:

Flying aircraft may be hazardous.

This is an often-used example, and is attributed to a famous linguist named Noam Chomsky. Does it mean the act of flying may be hazardous? Perhaps it means that airplanes themselves may be hazardous. Maybe it means they’re hazardous only when in flight. Regardless, it cannot be resolved from the content of the sentence since “flying” may act as a noun, an

adjective, or a verb. Things your English professor called “misplaced and dangling modifiers” also cause syntactic ambiguities. In spoken English, ambiguities are resolved by raising the pitch of a word. The rise in pitch is called intonation. If you need to add intonation to a sentence to make the meaning clear, the sentence most likely has an ambiguity.

Other types of syntactic ambiguities happen when pronouns aren’t clearly tied to a single noun phrase, in strings of prepositional phrases and in sentences with multiple conjunctions. Sometimes syntactic ambiguities can be resolved by punctuating the sentence correctly.

Punctuation to resolve ambiguities

Hyphens tie together chains of words that serve as units, usually adjectival phrases. Most people tend to neglect hyphens when they are needed.

Commas sometimes play a syntactic role in grouping clauses to indicate their effectivity. For example:

“The flange shall be fastened by three round-head screws, three flat-head screws, and three fillister-head screws all of grade eight.”

means you’ve specified that three of the screws must be of grade eight.

If you add a comma before “all,” then you’ve specified nine grade-eight screws.

A comma preceding a dependent clause often indicates whether or not the writer intends the clause to be essential to the meaning of the sentence. In such cases, the presence of a comma may change a firm requirement into a mere statement of fact.

Note well: commas in specifications demand extreme care.

Chains of prepositional phrases

When you write a sentence containing a series of prepositional phrases all in a row, you are running a risk of creating a syntactic ambiguity. The most common textbook example is, “*He saw the man on the hill with the telescope.*”

Another example that hits closer to home: “*The instructional materials shall be prepared for use by District teachers.*” Who is supposed to prepare the materials, the contractor of the teachers?

Granted, sentences with nested modifiers are often necessary in specifications, but when you need to use one, be careful. Pay attention to which word each phrase modifies. By some stretch of your imagination, if it is possible for a reader to attach one of the phrases to a different word than the one you intended, you must restructure the sentence. Remember, your readers (contractors) may be very creative.

Modifiers that apply to two or more nouns

We often get confused when a writer tries to apply a modifier to two or more nouns without writing the modifier twice.

Here’s an example:

The flange shall be fastened by nuts and bolts of stainless steel.

Which is stainless, both the nuts and bolts, or just the bolts?

If you get into a dispute over specification requirements that have this kind of an ambiguity, it will probably be settled by applying the modifier only to the noun that appears nearest to the modifier. Unless the context indicates otherwise, cases of confusion like this one are usually resolved by attaching the modifier only to the nearest word that it may modify. Lawyers call this approach to resolving ambiguities “the doctrine of the last antecedent.” It is a rule that is easy to run afoul of, especially when the sentence in question is long and complicated.

“Front-end” work

Before you specify something, you must know what is really needed, and whether or not building it is commercially practicable. Supposedly, a great deal of front-end work has been done before you were assigned to write the specifications. We know, however, that sometimes requirements are overlooked or misidentified during these early phases of the project, and the errors may impact the project in its later phases. Such is quite likely, since keeping track of numerous requirements can be very difficult. Large projects often collect their requirements in a database to help them cope with the very large number of requirements.

We have ways to protect ourselves from errors in requirements. These are to make sure that the end-user reads, understands, and approves the specifications, and that the specifications are checked by knowledgeable technical staff people before they are released.

Remember, competent professionals know the limits of their own technical knowledge. They are never hesitant to seek help from other professionals with different specialties. Remember, it’s a collaborative effort. **That’s teamwork!**



Ellipsis is another related phenomenon of language mentioned in this context because the notion is similar. When speaking in English, we often leave out a word or short phrase without interfering with the understanding

of cooperative listeners. This practice is also permissible in casual written English. We say the missing words are “understood.”

When reading specifications, however, nothing is understood! Readers are not necessarily cooperative, and may actually be looking for a way to rationalize failure on their part to deliver acceptable goods.

Examine your sentences for cases where words are “understood” and insert the missing words where they belong.

Example:

“The generator shall supply the processor with 10.5 amperes and the batteries 8.5 amperes.”

A “shall supply” has been left out, and it is not clear whether the understood phrase belongs after “and” or after “batteries.” The resulting statement is ambiguous.

None of these phenomena are acceptable in specifications. You should be aware that some contractors employ skilled analysts whose job it is to find ways to interpret your words differently from what you intended. These interpretations may be used as the basis for reducing requirements and for the submissions of claims. The practice is commonly known as “finding money in the contract.”

Totality

Totality is an idea that is easily expressed in words, but very rarely occurs in real life. We use it whether we really mean it or not. When you use words like: “all,” “always,” “never,” “every,” and “none,” you may be creating a logical error. Conflicting requirements often result from totality statements when something else in another sentence makes an exception to the totality.

Now that you’re aware of the totality problem in language, here’s a trick you can play on your friends and co-workers:

Listen for them to use the phrase “all the time” in conversation. When they do, take the statement literally and comment on its illogic. For example



Tom: “I go to the public library all the time.”

You: “Tom, if you were at the public library all the time, then you wouldn’t be here in the office right now.”

Needless to say, your friends will be impressed with the preciseness of your reasoning. After doing this awhile, just a snicker will suffice. Soon you’ll find that you have enriched their vocabularies with uncommon words like “often,” “usually,” and “sometimes.”

Or ,

you will drive them crazy! Nonetheless, in specification writing you need to be **precise**.

The slash mark “/”

Use of “and/or”

Properly called a “virgule,” the slash mark is often found in draft engineering specifications. The purpose of this section is to convince you to never use one in a specification. In fact, it’s not even good form in ordinary writing.

The dictionary says about the virgule: “an oblique stroke (/) used between two words to show that the appropriate one may be chosen to complete the sense of the text.” **Please note that it’s your contractor who gets to decide which word is proper.** Note also that the dictionary tells the contractor to chose just one, not both.

When we write A/B, we usually mean “either A or B” or “either A or B or both” or “both A and B” or “number of A’s divided by number of B’s.” There’s no telling which one.

In many cases, substituting a hyphen for the slash will fix the problem. For example, we see “instructor/operator” in training device specifications where “instructor-operator” would be more clear.

In most cases, you’ll have to write “A or B or both,” or whatever you really mean.



Verb Tenses and auxiliary verb usage

When writing specifications, we always state requirements in the future tense using the emphatic form “shall.” Hence, the finished product **shall** be, **shall** produce, **shall** consume... The weaker auxiliary verbs “will,” “should,” and “may” do not express a requirement. In the case of “will,” the sentence places responsibility on the purchaser/buyer. “May” grants permission, and “should” states a preference. “Must” is ambiguous, since it may express a presumption instead of a requirement.

All work where compliance or performance is binding upon the contractor must be expressed in mandatory language and must be distinguishable from background or general information, which should be kept in the “Background” element of the specification or SOW. So if the contractor must do something, write, “The contractor shall...”

For example:

John must love Deborah; after all, they’ve been happily married for over twenty years.

Correct usage of “shall” and “will” in specifications is **extremely important**, and is a frequent source of errors found in solicitations. Be clear in what you say the requirements are.



Remember:

- **Shall** is used to express a binding requirement—mandatory.
- **Will** is used to express a declaration of purpose on the part of the purchaser/buyer or when futurity is required. (As a rule of thumb, the contractor shall and the District will.)
- **Should or may** are used to express non-mandatory provisions. It is best to avoid them, (Use of “permissive” or “choice” words is appropriate if you intend to give the contractor flexibility.)



More on word choices

- Define and be consistent with terminology. Make sure that you use words and phrases (especially technical ones) in the same way throughout the specification/SOW.
- Pronouns can be ambiguous. It is better to repeat a noun and avoid misinterpretation. The words “it,” “they,” “them,” and “their” are hazardous. When a pronoun is preceded by more than one noun phrase, people may argue over which noun phrase the pronoun refers to.

Consider the following example taken from a SOW:

Prior to accepting software or documentation developed by subcontractors, the contractor shall evaluate them for completeness, technical adequacy, and compliance with District contract requirements.

What is to be evaluated? Is it the products, or is it the subcontractors?

Note that pronouns often refer to nouns in preceding sentences. Check a few sentences to the left of each pronoun that you use for nouns that the pronoun may refer to. Is your meaning clear?

- Avoid, “any”, “either” and “and/or.” These words imply that the contractor has a choice. Use of “permissive” or “choice” words is appropriate only if you intend to give the contractor flexibility.
- Avoid words and phrases which are subject to multiple meanings and broad interpretations. Use active voice not passive. Passive voice promotes ambiguity and leads to needlessly complex sentences.
- Try to use short, descriptive sentences to ensure clarity.
- Avoid using bureaucratic, scientific or complex terms except as necessary. When you must use them, define them within the specification/SOW.

- Whenever possible, use simple words and terms in order to avoid ambiguity.
- Stress that any papers, recommendations, etc., which the contractor submits are drafts, not final copies. If you are procuring professional services, then discuss the process which the District will be used to review the contractor's work.
- Avoid the appearance of "personal services" in the way in which the SOW is written by including as much detail or as many performance requirements as possible. Doing so will underscore that tasks are sufficiently well defined to allow the contractor to perform independently.
- Avoid words such as "support" or "assist", which might imply joint efforts between the District and its contractor unless the contract's assistance or support roles are subsequently described in a manner which makes it clear that the contractor will perform independently.
- Clearly delineate the contractor's performance requirements.
- Avoid open-ended SOWs which contain on-going tasks without defining completion.
- Avoid abbreviation unless they are of common usage or are defined at the first usage.
- Specify or emphasize performance requirements, "what is needed", versus design approach, "how to".

Gender specificity

It pays to make all the things you write gender-neutral. Avoid words like "man," "he," "him," and "his," which might indicate that you haven't considered the person involved might be a woman. Instead, use "person," "they," "them," and "their," and refer to people by their currently correct job

titles like “firefighter” and “server” instead of the obsolete “fireman” and “waiter.”

Lists

Whenever you compose a list in the text of your specifications, you should take pains to make it complete and easy to read, and that its elements all consist of parallel parts of speech.

Completeness of lists

Take the time to think of everything you could possibly want to include in your list. Generally speaking, the best policy for specification writers to follow is “If you don’t mention a thing explicitly, then don’t expect to get it.”

Adding generalized list elements, like “and others,” “and the like,” or the words “not limited to” will not get you something you haven’t mentioned explicitly. Generalized list elements add little meaning to the text, and can often be ignored by readers. If you must use generalized terms, then use them alone and unaccompanied by specific items. By mentioning one thing explicitly, you may be excluding others. So often and for so many years has this method of interpretation been used that lawyers have a Latin name for it: “*Expressio unis est exclusio alterius*,” which means “to say one thing is to exclude the other.”

Sometimes generalized list elements are subject to interpretation according to another legal canon known as “*ejusdem generis*,” which limits the unwritten elements to members of the same family. For example, the list of “resistors, capacitors, inductors and other components” could be interpreted as not applying to transistors, since transistors are active components and all the listed components are passive.

Readability of lists

When the elements of a list become numerous, the visual clutter of the text makes it difficult to read, and readers are therefore likely to miss one or more of the elements. This human-factors problem is easily solved by

listing the elements vertically with bullets or subparagraph labels and separated by blank lines. For example:

Temperature-rise specifications shall apply to:

- a. resistors,
- b. capacitors,
- c. inductors, and
- d. transistors.

As a rule, indented lists are **always** preferred in technical documentation.

Parallelism in lists

The elements of each list should all be the same part of speech. For example, the list:

- a. safety,
- b. rowboats,
- c. resuscitate, and
- d. life preservers

is incorrect because “resuscitate” is a verb and all the other three elements are nouns. This list’s elements should have all be nouns.

Bureaucratic prose

*“You write with ease to show your breeding,
but easy writing’s curst hard reading.”*

Richard B. Sheridan
(1751 – 1816)

Bureaucratic prose is a holdover from the 18th century, and the Federal Government and public agencies have been trying for many years to put an end to it. It is stuffy and impersonal; it uses needlessly difficult language and is often written in the passive voice. These traits are so distracting that readers have a hard time staying focused on important things the writers have to say. Often, people who read a document written in bureaucratic

prose end up knowing very little about the document's content. No wonder, then, that important laws and regulations are sometimes inadvertently violated.

Take the time to go over your drafts, looking for ways to say the same thing in fewer words, simpler words, and shorter sentences. The labor will pay off in terms of fewer misunderstandings and less chance of constructive changes.

The District faces real problems in having contractors increase their profits by exploiting unclear specifications and thereby generating the need for rework. A solution to this problem comes with contractor performance evaluations prepared by District staff and used as determining factors in decisions about future contract awards.

And finally...

The objective of this guide is to provide guidance and assistance to our procurement professionals and our technical and program customers when it is necessary to develop specifications or statements of work for procurements. It is hoped that the guidance provided herein will result not only in better-written procurement documents, but better products and services delivered to the District, as well as realized cost savings.

Good luck with your specification writing!



GRAMMAR REVIEW

For most of us, the word "grammar" evokes painful memories of tedious exercises done many years ago while we were sitting on a hard seat and eagerly awaiting the bell. The subject matter is forgotten, and all we remember is the pain.

Unfortunately, grammar is a foundation for further learning. Without it we would have no terms in which to describe and discuss language, and that's why this section has been included.

We shall try to cover the topic as quickly and painlessly as possible while nonetheless conveying an explanation of all the grammatical terms used elsewhere in this guide. We'll briefly cover only the topics you need right now. Consequently, we've left out a great deal of information that you may wish to review in your pursuit of better writing skills. For that information, you may refer to Web pages posted by some genuine English teachers:

- <http://www.ucl.ac.uk/internet-grammar/intro/intro.htm>
- <http://www.edufind.com/english/grammar/>

In the way of a warning, real grammarians may have fits over some of the things we've said below. That's because we've ruthlessly simplified a topic that properly should consume many megabytes of disk storage, and could take years to master.

To begin, let's review the main parts of speech:

- Nouns and related types of words,
- verbs and their helpers,
- prepositions, and
- conjunctions.
- Then we finish up with a few words about clauses.

If you understand it all, then you've had enough grammar. Go back to learning about specifications. That's **imperative!** If not read on....

The noun family

A **noun** is the name of a person, a place, a thing or an idea. Nouns have properties, like:

case (nominative, objective or possessive),
number (singular or plural),
gender (masculine, feminine, or neuter), and
countability (mass or countable).

Pronouns, like *it*, *she* and *they* take the place of a noun so you don't have to repeat the whole noun or noun phrase. The **relative pronouns**, *which*, *that*, and *who* perform the special function of introducing **relative clauses**.

By the way, words that perform special functions like relative pronouns are often called **function words** by modern grammarians. The function words are the very core of the English language; to them we attribute the fact that Lewis Carroll's famous line:

'Twas brillig and the slithy toves did gyre and gimble in the wabe.

This obviously an English sentence, even though it makes little sense.

Adjectives, like *slow*, modify nouns. Adjectives, in turn, may be modified by **adverbs** like *painfully*. More about adverbs in a few minutes.

Articles, like *the* and *an* alert readers to the fact that that a noun follows. Sometimes they're called **determiners**.

When nouns are grouped with their associated articles, adjectives, and modifying clauses, the combination is sometimes called a **noun phrase**.

Often found in technical English are strings of nouns grouped together, like *software life cycle model*. In technical writing texts they're often called **noun sandwiches**. Thank goodness we don't have to write our specifications in German, because in German the noun sandwiches are more like noun sausages, all strung together into one great big word, like *datenverarbeitungstechnik*.

The verb family

Verbs are action words. Two good examples are *go* and *write*.

This is a good time to mention that a given word in English often may appear in some places performing one function and in other places performing another. An example would be the word *paint*, which can function as either a noun or a verb.

You should paint your house every five years.
Sally sells paint and varnish.

Now back to verbs. Verbs are often made up of a main verb plus one or more adjoining words known as **auxiliary verbs**, or simply **auxiliaries**. They help to convey the author's intended properties of the verb, like:

tense (the time when the action occurs),
mode or **mood** (a very complex property that affects the manner in which the verb is applied), and
voice (the party who performs the act or the one on whom the act is performed).

There are numerous **tenses** in English, but the one we use almost exclusively in specifications is the future tense. Thank goodness we don't have to cover the topic of English tenses: it's a dilly!

Mode in specifications is a slightly more complicated and very relevant topic. The main subdivisions of mode in English are the **indicative** and **imperative**. There's also another, called subjunctive, but it's so rarely used correctly these days that we could safely say it's no longer a part of the language. Here's an example of verbs in the **imperative** mode:

Go to the store and get me a loaf of bread.

Simply stated, imperative verbs are commands. Nearly all other verbs are **indicative**.

The **voice** of a verb is either active or passive. **Active voice** is straightforward:

Deborah bought a loaf of bread at the store.

First the actor, then the verb, and then the object acted upon. **Passive voice** reverses this order:

A loaf of bread was bought at the store by Deborah.

Note that we could very well have left "by Deborah" off the end of the passive-voice sentence.

Writing in passive voice has two effects:

1. It puts the object of the action up front where it gets special attention. We do this often in specifications because the emphasis in specifications belongs on the product we're trying to describe.
2. It subordinates or eliminates the mention of who performs the act. For this reason, bureaucrats often couch their statements in the passive voice in order to downplay their responsibility. In specifications, it permits us to leave off endless repetitions of "by the contractor."

All of the above are accomplished by the addition of auxiliary verbs, which can also serve to shade the meaning of verbs. Preceding a verb with a **modal auxiliary** like *shall*, *will*, *should*, *may*, *might*, *ought*, and so on changes the way in which the verb behaves. For example, correct usage of *shall* and *will* in specifications is crucial: it determines which party, the contractor or the District, is responsible for fulfilling the requirement.

The category "**adverb**" is a catch-all for words that don't fit very well in any other category. Most of them modify verbs or adjectives, and most are formed by adding "ly" to an adjective, but some of them are harder to describe. The word "just" in the next example is such an adverb, and it seems to modify either the verb "works," or the preposition "like," but it is better that you refer to a genuine grammarian for an explanation of exactly how it operates.

Prepositions

Prepositions are function words used in front of noun phrases to express relationships. Most of them are very short words. For example:

John works in a cubicle, just like Dilbert.

Phrases formed by prepositions and their adjacent noun phrase are called **prepositional phrases**, and they act as modifiers. They often appear chained together, as in

He saw the man on the hill with the telescope.

Conjunctions

Conjunctions are words like *and*, *or*, and *but* that tie things together. **Coordinating conjunctions** tie together words or clauses of equal rank. They correspond to the logical operators, and perform a similar function. Therefore they must be used very carefully in specifications. **Subordinating conjunctions** tie dependent clauses to main clauses.

Clauses

Having already said a little bit about sentences written in active and passive voices, the **clause** is the only notion about sentences that's necessary to explain here. Clauses are either independent or dependent. For example, in

John gained weight while he was eating his breakfasts at restaurants.

the independent clause is "*John gained weight,*" because it can stand on its own and expresses a complete thought.

The remainder of the sentence is a dependent clause, since no one would say such a thing unless it were part of another sentence. The **subordinating conjunction** "while" indicates that it's not a complete thought, so even though it contains a complete sentence, it's not an independent clause. In this case, the dependent clause acts as a modifier to the verb "gained."

Subordinate clauses can be either **essential** or **nonessential**. Another pair of terms for the same notion is **restrictive** and **nonrestrictive**. A restrictive dependent clause changes the meaning of the independent clause, while a nonrestrictive clause does not. The difference between the two is often indicated only by the presence of a comma. For example,

David has not seen Mary since she dyed her hair.

means something totally different from

David has not seen Mary, since she dyed her hair.

David's and Mary's problems are trivial in comparison to the havoc that this linguistic phenomenon can play on your specifications.

Writing better technical specifications

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ABSTRACT

Many contractual problems relating to performance can be traced back to inappropriate drafting of the technical specifications. The problems commonly relate to: inclusion of irrelevant or contradictory information, use of ambiguous or undefined terms, or concentrating on the means by which a result is to be achieved rather than on the performance required. Drafting specifications of this sort will maximise the probability of the supplier understanding what was intended and hence of providing what was actually required. It will also minimise the remedies available to the purchaser to resolve problems.

The approach advocated in this paper is to adopt a results oriented specification by which the vendor assumes most of the responsibility for determining the means of achieving these results. This does require greater care by the purchaser in evaluating tenders, but the end result will usually be more efficient and flexible plant and clearer lines of responsibility on the vendor if equipment does not perform as intended

INTRODUCTION

Many contracts run into difficulties because the technical specification has been written without sufficient care or consideration of what is really required. The commercial, administrative and 'standards' aspects of the contract are usually fairly well covered partly because they can be largely built out of standard clauses.

The technical specification is somewhat different. By its nature, it is usually a one-off document and is often written by a person who does not write them very often and mistakenly makes them over detailed. It is often forgotten that the more information that is provided to the supplier about the conditions under which the equipment is to work, i.e. the plant environment, feed conditions etc, the less flexible the piece of equipment supplied has to be. Thus it could be easier for the vendor to meet the letter of the specification while still not providing what the client really wants.

Examples of providing unnecessary or ambiguous information that has led to problems over responsibilities at a later stage include:

- Including background documents such as peripheral research reports and labelling them 'for reference' or 'for information only' or similar wording. The two sides will rarely agree in their interpretation of what this means. If the matter finds its way to arbitration, the vendor will almost certainly be able to establish they reasonably took it to mean that they were to refer to the document or to use it as a source of information or at the very least, it was intended as a guideline. Even changing the words to a form such as 'this document is for information and does not form part of the specification' will not necessarily avoid this problem. At the very least, if the equipment supplied does not work, the supplier will be in a position to say I deviated from my preferred choice because of the information that you supplied. Looked at sensibly, if this information is not part of the specification, it should not be included. If the supplier really does need to see the information, then it must be remembered that its inclusion will have an effect on his contractual responsibilities. In this case carefully spell-out the limited purposes for which the information is relevant and that it is not supplied for any other purpose.
- Including a 'notional' flow sheet of the equipment to be supplied on the drawing which shows the existing surrounding equipment. The purpose of this drawing should be to indicate termination points and where streams come from and go to so that new equipment can be designed accordingly. The inclusion of a notional flow sheet for the new equipment on this drawing gives an (unintended) indication to the supplier of what the purchaser wants and may readily cause him to deviate from supplying the most appropriate equipment.
- Ambiguous use of terms. The use of 'for reference' has already been noted. A more extreme example was the case of a contract for an electrical installation. All the items which were to be installed were listed in the specification, in most cases followed by the words 'to be provided'. The purchaser had intended this to be read as 'to be provided by the supplier'. The supplier however read it as 'to be provided by the purchaser'. In the end the work probably only cost a little more than it should have done (somebody would have had to pay for these items and presumably there were not originally included in the budget of the supplier when tendering for the work). However there were significant delays in completing the contract because no-one had even ordered the hardware until site work was about to start.

- One other extreme, which is possibly an apocryphal story, is of a company which placed an order which simply said 'one paper machine drive system to suit number X machine'. The supplier was very pleased to receive such a contract which was so vague that they thought they could fulfil it easily until the time came when they sought to sign-off and receive payment, when they were told "No, it doesn't suit the machine yet".

STRATEGIES

There are a number of basic rules which may be applied to avoid the type of problems described above and some other problems which will be described later on.

Ends v means

Whenever possible write the specification in terms of the performance that you require not in terms of the means of achieving this. For example, what you really want is a pump that will 'pump slurry for at least 5000 hours before replacing wear parts **not** one with wear parts made of material with a Brinell hardness of not less than 400' and certainly not 'one with wear parts made of UNS-F47003'. If you use the latter approach and the pump wears out too quickly, the problem is yours not the suppliers because he has supplied you with what you asked for, not with what you needed. In such a case a supplier will probably come and ask you what material you want. You can tell him what you have used in the past, but avoid making this part of the specification. Let him make the decision.

Only specify the means of performing a task if it is truly essential. For example, one might say that a spray atemperator is not acceptable because of the fear of damage to a turbine downstream of it, but it might still be better to write the specification in terms of the particle/droplet content of the steam leaving the atemperator. However, it is very unwise to specify a particular type of equipment or a construction method simply because you have used it before or because you have been told it worked well elsewhere. This approach prevents you from benefiting from new technology because it will never be offered. However, there is nothing to prevent you from rejecting offers which you feel will be inadequate (giving the supplier a choice in specifying equipment can give you a better indication of his real understanding of the problem – and sometimes a better indication of your understanding of it).

You should be going to a supplier because you believe that they know their job, therefore it is unwise to try and do the job for them. A technical specification is not the place to show off your knowledge of equipment used for a particular task and to try and impress the supplier that you know more than he does. If things don't work, and matters

come to arbitration, it is going to be very difficult to argue that the responsibility of getting the technology right was with the supplier who is the expert and claim that you are the innocent purchaser when you have specified what he is to supply in such detail.

Avoid the irrelevant

Avoid the inclusion of all irrelevant/marginal information. The supplier is justified in assuming that it has been included to give him instructions on what he is to do. If he follows this information and the plant does not perform, it is not his problem. If you don't like what the supplier offers, reject it and guide him towards what you want. But let it be the supplier who ultimately specifies what he will supply otherwise guarantees become of very limited value.

Ranges of operation

Pay particular attention to giving appropriate operating ranges. People drafting technical specifications usually consider variations in flow, operating temperature and pressure (if appropriate). However, it is very important to ensure that the range given is realistic. If the range over which equipment is required to work is too narrow, it is unlikely to result in a plant that works properly when other equipment is working slightly away from its optimum.

For example, consider a four stage screening system. A change in rejects rate from say 10% to 11% together with a 10% increase in the feed rate has a very big effect - about a 60% increase in the rejects flow from the system. Does your rejects handling system allow for this?

Also it is not sufficient just to put an upper limit, one should also consider lower limits. Turn down can be very limited on some types of equipment. It can also help you notice whether the ranges that you are using look real. Just putting the expected and the maximum value can look reasonable, but if you bring in the bottom range as well, you can be aware that your conditions look either very asymmetrical or improbably broad. Very broad operating ranges lead to a dramatic increase in the cost of the plant or suppliers refusing to quote.

In particular it is important to be particularly careful with temperatures.

There has been at least one case where for purposes of material selection, safety factors have been added to the upper but not lower temperature range for a pipeline. In the end what was given to the piping designer was merely a maximum operating temperature. Unfortunately this was so far removed from the real operating temperature, that what was supplied was a very expensive alloy which was capable of handling the gaseous form of the product flowing through the pipe. Unfortunately in the actual process, the product

was going to be a liquid and could have been adequately handled by a cheap polymer pipe. Sadly however, the alloy specified was quite unsuitable for the product in its liquid form. In this case we not only had an extreme cost blow-out, but the resulting pipe work corroded out within a few months.

It is also important to consider the ranges of compositions and physical forms of the flow streams to be handled by the equipment. We have seen technical specifications written for solids handling equipment with a particle size of a feed of the form shown in Table 1 (except there were actually more size fractions given).

Size range	%
>2.0	9.83
1.4-2.0	27.61
1-1.4	36.08
0.7-1.0	19.07
<0.5	7.41

Table 1 Inappropriate specification of particle size

Even writing ‘typical’ somewhere does not help very much in determining the range of particle size over which the supplied equipment should be expected to work. (It might persuade the arbitrator that instead of the feed being within $\pm 0.01\%$ it should be $\pm 0.02\%$. Even rounding the size distributions off to the nearest whole number would only give you about plus or minus 1% on any size fraction if no other information were given. Anyone who has worked around a solids processing plant knows that when the plant is built it is very unlikely that it will ever actually operate within that range, therefore no guarantees or warranties are going to apply. Going to the other extreme and putting very wide bands on everything, results in suppliers declining to quote or offering equipment at very high prices.

The correct approach is to put realistic bands of what you think the process might work in and specify that the equipment must meet the specified performance criteria whenever the feed is within this range. A good compromise between flexibility and cost is to recognise that when the plant deviates by a moderate amount from design conditions, i.e. some deterioration in performance can be accepted. In such cases two operating bands may be quoted, each with its own performance requirements and the performance requirements for the broader band being less stringent than those for the narrower band.

Retain flexibility

The reality is that process design is not an exact science and it is unlikely to become one within the lifetime of anyone currently practising. Experience suggests that

many plants and particularly those processing natural materials, spend most of their time operating somewhat outside the range anticipated at the design phase. Therefore it is unwise to end up buying equipment which has a very high performance over a very narrow band and which performs very poorly outside this band. Your specifications should reflect this situation. Because most scientific and engineering calculations are less accurate than people think, plants do not operate where they are designed to. So it is essential that the plant that is built should have flexibility.

Adding this flexibility gives some increase in the capital cost. Reducing the flexibility leads to a very substantial reduction in profitability.

Even if the actual process design is very accurate, the raw materials to the plant will vary. This is particularly true in industries such as pulp and paper and mineral processing. The real determinant of profitability of a plant is not how it performs at the exact design conditions, but its efficiency, throughput and control over a moderate range of conditions such as will be encountered in normal operation. Figure 1 represents profit volume chart for a flexible design. Figure 2 represents what project managers and project accountants think they will achieve by taking the flexibility out of the plant and reducing its capital cost. Figure 3 is typical of the real profit volume chart for a plant which has been designed for low capital cost at the expense of operating flexibility.

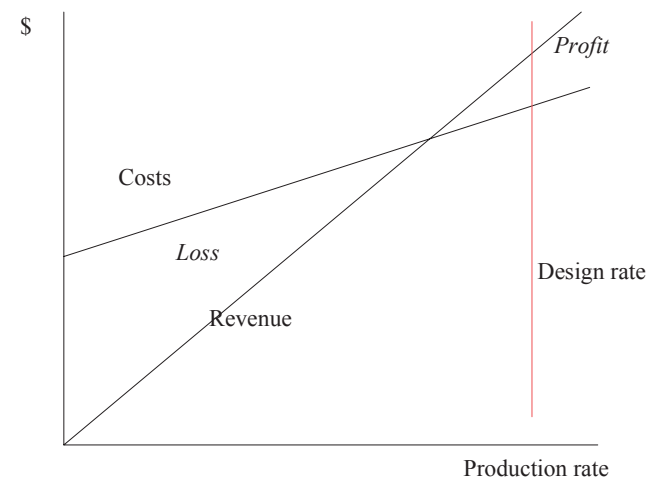


Figure 1. Flexible design

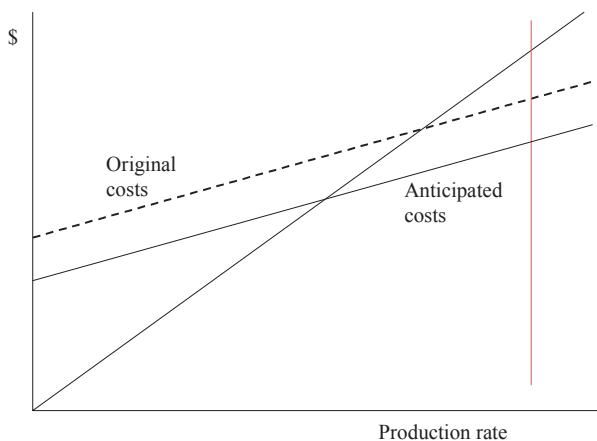


Figure 2. Optimistic specification

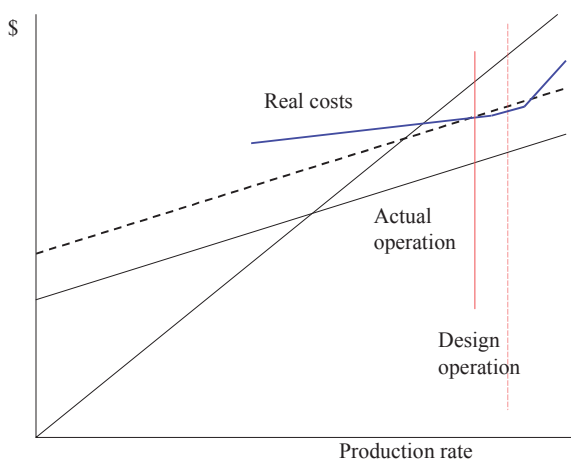


Figure 3. Actual performance of optimistic specification

Precise performance specifications

As has been stated several times already, the critical point of the technical specification is what the plant is to achieve, not the means by which it is to be achieved. Therefore the technical specification should be very precise on the performance criteria. It should give consideration to such matters as how performance is measured, where it is measured and when it is measured.

For example, when specifying the environmental control in the machine room, what part of the room are you referring to? Or is it all of the room? What elevation above floor level?

In this case it is fairly obvious what things should be considered. In other cases it is very easy to write a technical specification in which the supplier can fulfil his contractual requirements without giving you what you really want. Similarly give consideration to the requirements for stability of operation when measuring the performance of the plant. It is very nice to be able to specify the average performance over a period of 24 hours or 7 days of stable operation, but such a requirement may well work against your interests. In practice you may not be able to keep the plant stable for such a long period, and this is most likely to be the case when the equipment is not working well – i.e. in the circumstances in which a performance trial is really important. You will then never be able to establish poor performance as defined in the contract specification. All you will do is get into all sorts of arguments with the supplier over whose fault it is that the plant isn't stable.

Company standards

Avoid invoking company engineering standards except when these are really necessary. This is particularly for things such as painting standards unless these standards exist because of an unusual corrosive environment around the plant. At first instance at least, permit the vendor to offer alternatives (these will often be the standard for the equipment and therefore cheaper and quite likely better than your company standard).

A problem is that company engineering standards do not get updated often enough. They usually describe what was good 5 to 20 years ago and/or seek to save on spare parts inventories. The result is that the quality of what you are supplied is fixed in the past, with expensive, lower quality equipment (the exact opposite of what was intended).

For example, a mill sought a quote for its standard pump which is of mild steel but with a stainless steel shaft. The vendor offered as an alternative another brand of pump which was all stainless steel, more efficient and cost less than one-third of the standard pump price. Despite this it was still difficult for the engineer to obtain approval to buy it.

In another case, a short life pilot plant was to be built. For industrial relations reasons it had been agreed from the start that mill personnel on the site adjacent to the pilot plant site would never have responsibility for the maintenance of the plant. Despite this, the company instrument and electrical departments were able to insist that the plant have all electrical and instrument equipment to the mill standard which was designed for uniformity for spare parts and for a long operating life in a much for adverse environment. This made a considerable increase in the cost of the plant which in fact never was maintained or

otherwise touched by the mill personnel up to the point when it was demolished.

Tender evaluation

One important consequence of writing specifications in terms of results rather than means is that greater care is required at the tender evaluation stage. Permitting the vendor to offer what he thinks will be best for the duty means that at least some of the solutions offered should be better than is the means had been specified by a non-expert. However, tenders will sometimes include unsatisfactory solutions. It is important to evaluate the tenders carefully to ensure that inappropriate offers are rejected.

More often, different suppliers will offer equipment or processes which have different benefits and a very careful evaluation is required.

A process for producing chlorine dioxide was selected on the basis of capital cost and fit with existing plant operations. However, it was recognised that the materials of construction were unlikely to give a long plant life.

An alternative tender offered better materials of construction and hence a longer plant life, but the products of the plant were far less suited to the requirements of the existing plant.

The shorter life plant was selected and functioned well. The material life problem was overcome by replacing corroded PVC components with titanium components.

CONCLUSION

In summary, when writing technical specifications, do not try and use a simple formula approach. Do not be over detailed in the means required. Instead, put the emphasis on what is to be achieved. Be careful in evaluating tenders to ensure that the means proposed by the vendor are consistent with meeting your objectives (but remember, he should know his job better than you do, otherwise why are you using him?). Finally don't stick too closely to these or any other suggestions. Instead think about what is really required in the case you are dealing with.