Designation: A 994 – 05

Standard Guide for Editorial Procedures and Form of Product Specifications for Steel, Stainless Steel, and Related Alloys[1]

This standard is issued under the fixed designation A 994; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This guide covers the editorial form and style for product specifications under the jurisdiction of ASTM Committee A01.

NOTE 1—For standards other than product specifications, such as test methods, practices, and guides, see the appropriate sections of *Form and Style for ASTM Standards* (Blue Book).[2]

1.2 Subcommittees preparing new product specifications or revising existing ones should follow the practices and procedures outlined herein, and be guided by the latest specification covering similar commodities.

1.3 This guide has been prepared as a supplement to the current edition of the Form and Style Manual, and is appropriate for use by the subcommittees to Committee A01. This guide is to be applied in conjunction with the Form and Style Manual.

1.4 If a conflict exists between this guide and the mandatory sections of the current edition of the Form and Style Manual, the Form and Style Manual requirements have precedence. If a conflict exists between this guide and the nonmandatory sections of the current edition of the Form and Style Manual, the guide has precedence.

1.5 When patents are involved, the specifications writer should refer to section F3 of the Form and Style Manual. Also, refer to part F of the Form and Style Manual for trademark information and the safety hazards caveat.

2. Referenced Documents

2.1 *ASTM Standards:* [3]

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products

A 488/A 488M Practice for Steel Castings, Welding, Qualification of Procedures and Personnel

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

A 941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

E 6 Terminology Relating to Methods of Mechanical Testing

E 1282 Guide for Specifying the Chemical Compositions and Selecting Sampling Practices and Quantitative Analysis Methods for Metals, Ores, and Related Materials

2.2 *ASME Boiler and Pressure Vessel Codes:*[4]

Section IX Welding and Brazing Qualifications

2.3 *Military Standard:*

MIL-STD-163 Steel Mill Products, Preparation for Shipment and Storage[5]

2.4 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipments (Civil Agencies)[5]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard*:

3.1.1 For definitions of terms used in this guide, refer to the Form and Style Manual, Terminology A 941, and Terminology E 6.

4. Significance and Use

4.1 The Form and Style Manual provides mandatory requirements and recommended practices for the preparation and content of ASTM specifications. In order to promote consistency in the style and content of product specifications under its jurisdiction, Committee A01 recognizes the need to provide a supplementary document pertaining to the types of products and materials covered by those specifications.

4.2 This guide contains a list of sections to be considered for inclusion in a specification for steel, stainless steel, and related alloy products, and guidance or recommended wording, or both, for such sections.

[1] This guide is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.91 on Editorial.

Current edition approved June 15, 2005. Published June 2005. Originally approved in 1998. Last previous edition approved in 2003 as A 994 – 03.

[2] Available from ASTM International Headquarters, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[4] Available from American Society of Mechanical Engineers (ASME), 345 E. 47th St., New York, NY 10017.

[5] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Phila., PA 19111-5094, Attn: NPODS.

***A Summary of Changes section appears at the end of this standard.**

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4.3 Persons drafting new product specifications, or modifying existing ones, under the jurisdiction of Committee A01, should follow this guide and the requirements of the Form and Style Manual to ensure consistency.

5. Subject Headings of Text

5.1 The various sections of a Committee A01 product specification should be arranged in the following order. Not all of these sections will appear in every specification; however, those used should be listed in the order given. In some cases, a specification may require the addition of a section or sections not listed, in which case they should be inserted in the specification so as to preserve the logical sequence of sections, insofar as possible.

5.2 When only one requirement is used in a section having multiple possible subheadings, that requirement becomes the section heading (for example, Tension Test instead of Mechanical Properties).

- Title
- Designation
- Scope
- Referenced Documents
  - ASTM Standards
  - Other Documents
- Classification
- Terminology
- Ordering Information
- General Requirements
- Materials and Manufacture
  - Melting Practice
  - Mechanical Working Practice
  - Heat Treatment
  - Welding
  - Coatings
- Chemical Composition
  - Heat Analysis
  - Product Analysis
  - Methods of Analysis
- Metallurgical Requirements
  - Grain Size
  - Decarburization
  - Etch Test
  - Micro-cleanliness
  - Hardenability
  - Corrosion Resistance
- Physical Properties
  - Electrical Resistivity
  - Thermal Conductivity
- Mechanical Properties
  - Tension Test
  - Hardness Test
  - Impact Test
  - Bend Test
  - Flattening Test
  - Flange Test
  - Flare Test
  - Proof Load Test
  - Wrap Test
  - Crush Test
  - Coiling Test
- Pressure Test Requirements
  - Hydrostatic Test
  - Air-Under-Water Test
- Nondestructive Test Requirements
  - Magnetic Particle Test
  - Liquid Penetrant Test
  - Radiographic Test
  - Ultrasonic Test
  - Eddy Current Test
  - Flux Leakage Test
- Other Test Requirements
- Dimensions, Mass, and Permissible Variations
  - Flatness
  - Straightness
  - Out-of-roundness
  - Camber
  - Bowing
  - Mating
  - Length
  - Diameter
  - Thickness
- Workmanship, Finish, and Appearance
  - Surface Finish
  - Edges
  - End Finish
- Rework, Retreatment, and Weld Repair
- Sampling
- Number of Tests, Retests, and Resampling
- Specimen Preparation
- Test Methods and Analytical Methods
- Inspection
- Rejection and Rehearing
- Certification
- Product Identification
- Packaging, Marking, and Loading for Shipment
- Keywords
- Supplementary Requirements
- Annexes and Appendixes

6. Section Contents

6.1 *Title*:

6.1.1 The title should be as concise as possible, but complete enough to identify clearly the product covered by the specification. Titles are also used in lists, table of contents, and indexes, and it is most important that they be brief but self-explanatory.

6.1.2 Two methods for establishing wording are considered acceptable and are at the option of the subcommittee.

6.1.3 One is to word as in ordinary conversation with the adjectives first as is normal in the English language. For example, “Standard Specification for Hot-Worked, Hot-Cold-Worked, and Cold-Worked Alloy Steel Plate, Sheet, and Strip for High Strength at Elevated Temperatures.” A general scheme for generating titles with this format is:

6.1.3.1 Type of document: “Standard Specification for,”

6.1.3.2 Special treatment of the material, if any: “quenched and tempered,” “hot-rolled,” “seamless,” “welded,” etc.,

6.1.3.3 Material type based on chemical composition: “carbon,” “high-strength low-alloy,” “austenitic stainless,” etc.,

6.1.3.4 “Steel,”

6.1.3.5 Product form: “bars,” “pressure vessel plate,” “casting,” “sheet and strip,” etc.,

6.1.3.6 Special quality of the product, if any: “with improved toughness,” “with mechanical property requirements,” “of commercial quality,” etc., and

6.1.3.7 Specific application or use of the product, if any: “for machine parts,” “for valves,” “for low temperature,” “for general use,” “for corrosive service,” etc.

6.1.4 The key word in order of importance concept for specification titles is preferred by many subcommittees because it facilitates accurate indexing and provides rapid identification of specification subject matter. For example, “Standard Specification for Steel Plate, Sheet, and Strip, Alloy, Hot-Worked, Hot-Cold-Worked, and Cold-Worked, for High Strength at Elevated Temperatures.” A general scheme for developing a title with this format is:

6.1.4.1 Type of document: “Standard Specification for,”

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6.1.4.2 “Steel,”

6.1.4.3 Product form: “bars,” “pressure vessel plate,” “casting,” “sheet and strip,” etc.,

6.1.4.4 Material type based on chemical composition: “carbon,” “high-strength low-alloy,” “austenitic stainless,” etc.,

6.1.4.5 Special treatment of the material, if any: “quenched and tempered,” “hot-rolled,” “seamless,” “welded,” etc.,

6.1.4.6 Special quality of the product, if any: “with improved toughness,” “with mechanical property requirements,” “commercial quality,” etc., and

6.1.4.7 Specific application or use of the product, if any: “for machine parts,” “for valves,” “for low temperature,” “for general use,” “for corrosive service,” etc.

6.1.5 The use of temperature categories in the titles of specifications should be avoided. When a subcommittee determines that temperature categories must be used in the title of a specific standard, numerical temperature ranges should not be used; the establishment of limits on the use of materials is not the responsibility of Committee A01. When a subcommittee determines that a temperature category must be used in a title, one of the following should be selected: cryogenic, low, ambient, moderate, elevated, or high.

6.2 *Scope*:

6.2.1 When the specification covers multiple grades, classes, types, or combinations thereof, this should be stated in a separate section in the scope. The subdivision grade should be based upon chemical composition, a mechanical property, or application of the product. Further subdivision should be by class, based on some pertinent property or properties, and identified by arabic numbers. The subdivision type should be based on some major property, such as manufacture, product form, or generic classification. The precedence of grade, class, and type is the A01 preferred style, and it should be used in the absence of any established preference.

6.2.2 When a specification has supplementary requirements, the scope should include the following, or similar, statement as a subsection:

> Supplementary requirements of an optional nature are provided for use at the option of the purchaser. The supplementary requirements shall apply only when specified individually by the purchaser in the purchase order or contract.

6.2.3 When a specification is a combined standard, the scope should include the following, or similar, statement as a subsection:

> This specification is expressed in both inch-pound units and in SI units; however, unless the purchase order or contract specifies the applicable *M* specification designation (SI units), the inch-pound units shall apply. The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.

6.2.4 In a general requirements specification, the scope should contain the following, or similar, statement:

> In the case of conflict between a requirement of a product specification and a requirement of this specification, the product specification takes precedence. In the case of conflict between a requirement of the product specification and a requirement of this specification and a more stringent requirement of the purchase order or contract, the purchase order or contract takes precedence. The purchase order or contract requirements shall not take precedence if they, in any way, violate the requirements of the product specification or this specification; for example, by the waiving of a test requirement or by making a test requirement less stringent.

6.2.5 *Temperature Categories*:

6.2.5.1 Temperature categories should not be used in the scopes of specifications, because that use may mislead users of standards by creating an implication that the scope reflects engineering judgment on the temperature suitability of products for specific applications. The establishment of temperature limitations on the use of materials is the responsibility of code committees.

6.2.5.2 When a subcommittee determines that temperature categories must be used in a specific standard, numerical temperature ranges should not be used. The categories should be limited to the following: cryogenic, low, ambient, moderate, elevated, or high.

6.2.5.3 When a temperature category is used in the scope of a standard, the scope should cite the property or properties of the specified material that explain the selection of the temperature category with a statement such as:

> Elevated temperatures are temperatures in the range where creep and stress rupture properties are important for the steels in this specification.
>
> Low (or cryogenic) temperatures are temperatures where fracture toughness is important.

6.2.6 Specifications that reference general requirements may include the following statement in the scope:

> The following referenced general requirements are indispensable for the application of this specification: Specification A XXX.

6.2.7 Definitions of the various product forms should be addressed in the section on Terminology, rather than in the Scope section.

6.3 *Referenced Documents*:

Populate this section last, listing in alphanumeric sequence the designation and complete title of all documents referenced within the standard. (The standards listed below are those included in this document in the suggested wording sections.) See section B6 of the Form and Style Manual for more information and for handling of footnotes, year date, and adjuncts.

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ASTM Standards:
A 370 Test Method and Definitions for Mechanical Testing of Steel Products[6]
A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment[7]
A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products[6]
A 941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys[8]
E 6 Terminology Relating to Methods of Mechanical Testing[9]

6.4 *Terminology*— The standards to which the Terminology section should refer for definitions of terms are as follows:

6.4.1

A 941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

E 6 Terminology Relating to Methods of Mechanical Testing

6.5 *Ordering Information*:

6.5.1 In general, the following statement should appear in the Ordering Information section:

It shall be the responsibility of the purchaser to specify all requirements that are necessary for product under this specification. Such requirements to be considered include, but are not limited to, the following:

6.5.2 This statement should be followed by a list of the appropriate items to be shown in the purchase order or contract to adequately describe the product to be supplied under the specification. Each item should contain a parenthetical reference to the number of the appropriate part of the specification to which the item applies, to the extent possible and practicable. Typically, the list would include:

6.5.2.1 Quantity (mass, length, or number of pieces),

6.5.2.2 Name of material,

6.5.2.3 ASTM specification designation and year date to which the product is to be furnished and be certified as meeting,

6.5.2.4 Condition (hot rolled, cold rolled, cold drawn, annealed, heat treated),

6.5.2.5 Grade, class, and type designations,

6.5.2.6 Dimensions,

6.5.2.7 Shape and finish characteristics,

6.5.2.8 Requirements for certifications and for reporting chemical analyses and test results, and

6.5.2.9 Supplementary or other special requirements.

6.6 *General Requirements*:

6.6.1 When a general requirements specification exists for the product specification under consideration, the product specification should contain a General Requirements section, if the general requirements specification is to apply in whole or in part.

6.6.2 Appropriate wording for a General Requirements section is as follows:

Product furnished to this specification shall conform to the requirements of Specification A xxx/A xxxM, including any supplementary requirements indicated in the purchase order or contract. Failure to comply with the general requirements of Specification A xxx/A xxxM constitutes nonconformance with this specification. In case of conflict between the requirements of this specification and Specification A xxx/A xxxM, this specification shall prevail.

6.7 *Materials and Manufacture*:

6.7.1 This section addresses such issues as melting, refining, and casting practices; mechanical working requirements; fabrication practices; heat treatment; and surface finishing.

6.7.2 Unless technical considerations dictate otherwise, restrictions should not be placed on manufacturing practices.

6.7.3 When lengthy sections are required describing annealing, heat treating, or other processing, they should be specified in a separate major heading; for example: "8. Heat Treatment."

6.7.4 This section should state briefly the general requirements of the starting materials to be used. Reference appropriate ASTM specifications, if available, and, if appropriate, the process to be followed in manufacture.

6.7.5 When welding is involved in the fabrication of the material or product specified, or to bring a product to the specification requirements, it is necessary to define the processes and procedures that are permitted, either in this section or by reference to other codes and standards. The appropriate process and procedure qualifications may be determined by the intended end use of the part. For example, for castings that are not intended for use under the ASME Boiler and Pressure Vessel Code, procedures and welders shall be qualified under Practice A 488/A 488M. For castings that are intended for use under the ASME Boiler and Pressure Vessel Code, procedures and welders shall be qualified under Section IX of that code.

6.8 *Chemical Composition*:

6.8.1 When limits on chemical composition are required, the section should be stated substantially as, "The steel shall conform to the requirements prescribed in Table X."

6.8.2 This section should include detailed requirements of the chemical composition to which the steel should conform. These requirements should be listed in tabular form and include:

6.8.2.1 Name of each element spelled out,

6.8.2.2 Maximum, minimum, or range for each element,

6.8.2.3 The units applicable (percent or ppm),

6.8.2.4 The UNS number (if available) or common name for each grade of steel, or both, and

6.8.2.5 References to explanatory notes, when applicable.

6.8.3 The preferred order for listing elements for carbon and alloy steels is as follows:

Carbon
Manganese
Phosphorus
Sulfur
Silicon
Nickel
Chromium
Molybdenum
Copper
Titanium
Vanadium
Aluminum
Boron
Columbium (Niobium)

[6] *Annual Book of ASTM Standards*, Vol 01.03.
[7] *Annual Book of ASTM Standards*, Vol 01.05.
[8] *Annual Book of ASTM Standards*, Vol 01.01.
[9] *Annual Book of ASTM Standards*, Vol 03.01.

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Columbium + Tantalum
Tantalum
Cobalt
Selenium
Lead
Nitrogen
Others alphabetically

6.8.4 The preferred order for listing elements for stainless steels is as stated in 6.8.3, except list chromium before nickel, nitrogen before copper, and columbium (niobium) before titanium.

6.8.5 *Significant Figures*:

6.8.5.1 It is recommended that Guide E 1282 be consulted as a guide for specifying the chemical compositions for steels.

6.8.5.2 It is recommended that for specifying chemical composition limits the number of figures for each element to the right of the decimal point does not exceed the following:

Chemical Concentration	Composition Limits
Up to 0.010 %	0.XXXX
0.010 to 0.10 %	0.XXX
0.10 to 3.00 %	X.XX
Over 3.00 %	X.X

NOTE 2—This recommendation should be used to reduce the number of significant figures, such as from 18.00 to 18.0 %; however a significant figure should not be added unless there is a technical reason for so doing.

6.8.5.3 For those cases in which the composition range spans 0.010, 0.10, or 3.00 %, the number of figures to the right of the decimal point is to be determined by that indicated by the upper limit of the range.

6.8.5.4 Technical considerations may dictate the employment of less than the maximum number of figures to the right of the decimal point as previously recommended.

6.8.6 A product analysis may be required or be optional in a product specification. When permissible variations for product analysis are included, the following language is recommended:

> The chemical composition determined by product analysis shall conform to the composition limits of Table X, within the permissible variations listed in Table Y.

6.8.7 The section on methods and practices for chemical analysis should be worded as follows:

> Methods and practices relating to chemical analysis shall be in accordance with Test Methods, Practices, and Terminology A 751.

6.9 *Mechanical Properties*:

6.9.1 This section should include separate sections, where applicable, for tests such as tension, hardness, and impact. The heading "Mechanical Properties" shall be used only when two or more properties are specified. When only one property is specified, the section shall be given the heading for the specific test, such as "Tension Test" or "Hardness Test."

6.9.2 Each section should include information on general requirements, including, but not limited to, number of samples, sample location (for example, width, length, thickness), specimen orientation, specimen size and shape (when relevant), and retest provisions.

6.9.3 *Test Methods*:

6.9.3.1 Where appropriate, the test methods described in Test Methods and Definitions A 370 should be used and referenced.

6.9.3.2 When test methods other than those contained in Test Methods and Definitions A 370 are required, such methods shall be referenced or described. It is preferable that test methods that have been standardized by a consensus process be used.

6.9.4 When converting specified yield strength and tensile strength requirement values to SI units, convert to the nearest 5 MPa. When converting from SI units, convert to the nearest 1 ksi.

6.9.5 *Specified Values*— The recommended practice for specifying mechanical test requirements is to specify to the nearest value in accordance with Table 1.

6.9.6 The definitions of terms relating to mechanical testing found in Terminology E 6 should be used to the extent possible.

6.10 *Metallurgical Requirements*:

TABLE 1 Recommended Specification Increments for Specifying Mechanical Test Requirements

Test Quantity	Inch-pound Units		SI Units	
	Test Data Range	Specify to	Test Data Range	Specify to
Yield Point, Yield Strength, and Tensile Strength	Under 100 ksi	1 ksi	Under 1000 MPa	5 MPa
	100 ksi and over	5 ksi	1000 MPa and over	10 MPa
Elongation	All values	1 %	All values	1 %
Reduction of Area	All values	1 %	All values	1 %
Impact Energy	Under 30 ft-lbf	1 ft-lbf	Under 40 J	1 J
	30 to 100 ft-lbf	2 ft-lbf	40 to 140 J	5 J
	100 ft-lbf and over	5 ft-lbf	140 J and over	10 J
Lateral Expansion	All	1 mil	All	25 μm
Percent Shear Area	All	5 %	All	5 %
Brinell Hardness	All	[A]	All	[A]
Rockwell Hardness	All scales	1 Rockwell no.	All scales	1 Rockwell no.

[A] Select values corresponding to 0.002 in. [0.05 mm] indentation diameter increments.

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6.10.1 This section should include separate sections, where applicable, on grain size, decarburization, etch testing, microcleanliness, hardenability, corrosion resistance, or other metallurgical structure requirements.

6.10.2 Each section should include information on the requirements, including the test methods or reference to a General Requirements specification that contains this information. In addition, each section should contain the number of tests and the test locations.

6.11 *Physical Properties*:

6.11.1 This section should include, where applicable, requirements for physical properties, such as electrical resistivity, thermal conductivity, and other specified physical properties.

6.11.2 Each physical property should be covered in a separate section that includes the acceptance criteria.

6.11.3 The requirements for test procedures should be contained within the section addressing the physical property. The test procedure should either be defined completely within the section or by reference to another test procedure specification. All information required by the referenced specification should be provided.

6.12 *Nondestructive Examination Requirements*:

6.12.1 This section should include, where applicable, requirements for nondestructive examinations, such as magnetic particle tests, liquid penetrant tests, radiographic tests, ultrasonic tests, eddy current tests, and flux leakage tests.

6.12.2 Each nondestructive test should be covered in a separate section that includes the acceptance criteria.

6.12.3 The requirements for test procedures should be contained within the section addressing the nondestructive test. The test procedure should either be defined completely within the section or by reference to another test procedure specification. All information required by the referenced specification should be provided.

6.12.4 Many specifications require the individual performing nondestructive examinations to be certified. Wording similar to the following should be used in such cases:

> Individuals conducting the examinations shall be certified in accordance with (state referenced standard) or an equivalent documented standard acceptable to both purchaser and manufacturer.

6.13 *Other Test Requirements*:

6.13.1 This section should include, where applicable, test requirements that are not addressed elsewhere in this guide.

6.13.2 Each test requirement should be covered in a separate section that includes the acceptance criteria.

6.13.3 The requirements for test procedures should be contained within the section addressing the test requirement. The test procedure should either be defined completely within the section or by reference to another test procedure standard.

6.14 *Dimensions, Mass, and Permissible Variations*:

6.14.1 For clarity, details as to standard shape, mass, and size usually are presented in tabular form with a brief reference in the text. Separate sections with individual tables are preferred. Such a reference may be similar to the following:

> The product form referred to (sheet, strip, bar, etc.) shall conform to the permissible variations in dimension and mass prescribed in Table X.

6.14.2 In tables of permissible variations, the following preferred usage should be adhered to as far as possible:

6.14.2.1 In general headings for columns for thickness, etc., the word "specified" is to be used in preference to "nominal"or "ordered." Where size designations are indeed nominal, for example, for some structural shapes, and for pipe, "nominal" is preferred.

6.14.2.2 The tables should clearly indicate where the various size ranges are divided, for example, ranges from 0 to 10 in., 10 to 20 in., 20 to 30 in. should be more properly stated as:

> 10 in. [250 mm] and under
> Over 10 to 20 in. [250 to 510 mm], incl
> Over 20 to 30 in. [510 to 760 mm], incl

6.15 *Workmanship, Finish, and Appearance*:

6.15.1 *Workmanship*— Examples of workmanship requirements that might be used are presented below. Examples 6.15.1.1 and 6.15.1.2 could apply to any product form. Examples 6.15.1.3-6.15.1.6 could also apply, as appropriate for the product form and quality ordered.

6.15.1.1 For all product forms where surface finish is not specified elsewhere in the specification, "The general appearance with respect to soundness and surface finish shall be consistent with good commercial practice, as determined by visual inspection."

6.15.1.2 For all product forms where surface finish is specified elsewhere in the specification, the statement of 6.15.1.1 should be preceded by the phrase, "In addition to the surface finish requirements of . . ."

6.15.1.3 For bars, "Bars shall be commercially straight and free from twist."

6.15.1.4 For castings, "All castings shall be made in a workmanlike manner and shall conform to the dimensions on drawings furnished by the purchaser before manufacture is started. If the pattern is supplied by the purchaser or is produced using a die supplied by the purchaser, the dimensions of the casting shall be as predicated by the pattern or die."

6.15.1.5 For tubular products, "Tubular products shall have smooth ends free from burrs. They shall be free from defects, as determined by visual inspection."

6.15.1.6 For wire, "The wire shall be uniform in diameter and shall be free from splits, scale, and similar imperfections."

6.15.2 *Finish and Appearance*—This section should be used to specify the surface finish requirements, edge requirements, or end finish requirements.

6.15.2.1 Appropriate wording for a section on finish would be, "The types of finish shall be as follows." (This statement is then followed by a list of the finishes and their individual descriptions. For clarity and uniformity, the nomenclature for the finishes and their respective descriptions should be according to recognized industry standards.)

6.15.2.2 When required, a section should be used to specify the type of edge required. Typical wordings for such sections are:

> The type of edge required shall be specified in the purchase order or contract, as follows:
>
> *No. 1 Edge*—An edge of a specified contour (round or square) that is produced when a very accurate width is required or when an edge finish suitable for electroplating is required, or both.

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No. 5 Edge—An approximately square edge produced from slit edge material on which the burr is eliminated by rolling or filing.

Cut Edge—An approximately square edge resulting from the cutting of flat-rolled steel into one or more desired widths by means of rotary knives (slit edge) or blade shears (sheared edge).

6.16 *Rework and Retreatment*:

6.16.1 This section should be used, when appropriate, to provide for rework, such as by grinding or repair welding, or retreatment of product represented by tests or inspections that fail to meet the requirements of the specification. Any limitations on the extent of such rework or the number of retreatments should be addressed in this section.

6.16.2 When welding is permitted to bring a deficient product to the specification requirements, it is necessary to define the processes and procedures that may be used, either in this section or by reference to other codes and standards. The appropriate process and procedure qualifications may be determined by the intended end use of the part. For example, for castings that are not intended for use under the ASME Boiler and Pressure Vessel Code, procedures and welders shall be qualified under Practice A 488/A 488M. For castings that are intended for use under the ASME Boiler and Pressure Vessel Code, procedures and welders shall be qualified under Section IX of that code.

6.17 *Sampling*:

6.17.1 If a sampling section is included, the size, that is, mass, number of pieces, etc., of the lot to be qualified should be described for each required test.

6.17.2 When the qualification of the lot is dependent upon test results from an individual sample or samples, the number of tests necessary to qualify the lot should be defined.

6.17.3 The location of the sample or samples and orientation of the test specimen or specimens should be stated, as well as procedures for acquisition of the sample or samples.

6.17.4 When statistical sampling methods are used to qualify a lot on the basis of an examination of some individual units of the lot, references to appropriate sampling plans and procedures for implementation of such plans should be included in an annex to the standard. The sampling plans should include the lot size, the number of units to be sampled, and the number that must be acceptable for the lot to be qualified.

6.17.5 Specifications may include provisions for the making and testing of new test specimens to provide for occasions when a specimen is damaged by defective machining, or reveals casting imperfections or other imperfections during preparation of the specimens that might cause failure upon testing for reasons not attributable to typical material properties or conditions. For example:

If in the course of preparation, a test specimen is made or found to be defective due to such things as machining errors or the presence of non-typical imperfections in the metal, the specimen may be replaced with another that shall be selected on the same basis as the one discarded.

6.18 *Number of Tests, Retests, and Resampling Procedures*:

6.18.1 This section should address the number of tests for each test required by the specification. It should also cover the allowances for retesting and resampling, if permitted by the specification. For example, retesting might be permitted due to the mechanical failure of a specimen, for example, it broke outside the gage length during a tension test. Resampling is the securing of new samples because the tests failed to meet the limits of the standard but were within prescribed limits that allow resampling. Procedures for dealing with product between the original sample and additional samples should be described.

6.18.2 The number of test units and the number of test specimens necessary to qualify the product should be included, as well as the orientation of such test units or specimens. Following are examples of paragraphs that have been used to define the number, location, and orientation of test specimens:

6.18.2.1 For structural steel plates:

Tension Tests—Orientation—For plates wider than 24 in. [600 mm], test specimens shall be taken such that the longitudinal axis of the specimen is transverse to the final direction of the rolling of the plate. Test specimens for all other products shall be taken such that the longitudinal axis of the specimen is parallel to the final direction of rolling.

Plates Provided from Coils—Two tension test specimens shall be taken from each coil tested. One tension-test specimen shall be taken immediately prior to the first plate produced to the qualifying specification and the second tension test specimen shall be taken from the approximate center lap. . .

6.18.2.2 For high-strength low-alloy sheet and strip:

Location and Orientation—Tension test specimens shall be taken at a point immediately adjacent to the material to be qualified. Tension test specimens shall be taken with the longitudinal axis of the test specimens parallel to the rolling direction (longitudinal test).

6.18.3 If the specification allows retesting, the rules for such retesting and the procedures to be followed should be stated, including the number of additional test specimens required and the limits of acceptance. The following paragraph is an example of a paragraph describing retesting procedures:

If the percentage of elongation of any test specimen is less than specified, and any part of the fracture is more than [nl]P in. [20 mm] from the center of the 2-in. [50-mm] gage length of a specimen, or is outside the middle half of the 8-in. [200-mm] gage length of a specimen, a retest is allowed.

6.18.4 If the specification allows resampling, the rules for such resampling, including disposition of product between the original test and the resample, should be included. The procedures to be followed, including the number of additional test specimens and the acceptance criteria, should be included. The following are examples describing resampling procedures:

If the result for an original tension test specimen is within 2 ksi (14 MPa) of the required tensile strength, resampling is permitted. The new sample shall be taken at random from the lot in question. If the result for this retest specimen meet the specified requirements, the lot shall be accepted.

If the result for an original tension test specimen is more than 2 ksi (14 MPa) from the required tensile strength, resampling is permitted, provided that product produced between the location of the original sample and the new sample is discarded from the lot being qualified. Such discarded product shall not be qualified to meet the specification by the new sample. A total of two resampling efforts shall be permitted. If the lot is resampled, two tests shall be required. The first shall be adjacent to the beginning of the lot to be qualified. If the results of both resampling test specimens meet the specified requirements, the lot shall be accepted.

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6.19 *Specimen Preparation*—Specifications requiring the determination of the mechanical properties of the product should include the appropriate paragraphs to adequately describe the preparation of the required test specimens. Below are some examples:

> The tension test specimens shall conform to the appropriate sections of Test Methods and Definitions A 370.

> Hardness tests may be made on the grip ends of the tension test specimens before they are subjected to the tension test.

> Test coupons, from which tension test specimens are prepared, shall be attached to the castings where practicable. If, in the opinion of the manufacturer, the design of the casting is such that test coupons should not be attached thereon, these coupons shall be cast attached to separately cast blocks. The test coupons from which test specimens are to be prepared shall remain attached to the castings or blocks they represent until submitted for inspection, and shall be heat treated with the castings. Test coupons shall be provided in sufficient numbers to furnish the test specimens required in Section X.

The width of strip for which bend tests can be made is subject to practical limitations on the length of the bend test specimen. For narrow strip, the following widths can be tested:

Strip Thickness, in. [mm] Transverse	Minimum Strip Width and Minimum Specimen Length for Bend Tests, in. [mm][A]
0.100 [2.0] and under	½ [13]
0.101 to 0.140 [2.1 to 3.0], excl.	1 [25]
0.140 [3.0], and over	1 ½ [38]

[A] Bend test specimens for sheet and strip may be of any suitable length over the above minimum length.

6.20 *Inspection*—The following standard wording for this section has been adopted by Committee A01:

> The manufacturer shall afford the purchaser's inspector all reasonable facilities necessary to be satisfied that the product is being produced and furnished in accordance with this specification. Mill inspection by the purchaser shall not interfere unnecessarily with the manufacturer's operations.

6.21 *Rejection and Rehearing*:

6.21.1 *Rejection*—When a rejection section is to be included, the provisions for rejecting the product should be stated. Examples of rejection paragraphs, which may be used, as appropriate, are:

> Product that is found to be defective subsequent to its acceptance at the manufacturer's works may be rejected, and the manufacturer shall be notified.

> Product that is found to be defective following original inspection and acceptance at the manufacturer's works may be rejected, and the manufacturer shall be notified.

6.21.2 *Rehearing*—Provisions should be stated for maintaining samples of product rejected by the purchaser, pending disposition. An example is as follows:

> Samples representing product rejected by the purchaser shall be preserved until disposition of the claim has been agreed to between the supplier and the purchaser.

6.22 *Certification*:

6.22.1 When a specification is to include a certification section, the ordering information section should include 6.5.2.3 and 6.5.2.8 of 6.5.2 of this guide. The following are provided for guidance in preparing a certification section: a given specification could include one or more of the following, as appropriate:

> *Product Marking*—Application of the identification markings, as required under Product Marking, shall constitute certification that the product has been supplied in accordance with the requirements of this specification.

> *Certificate of Compliance*—When specified in the purchase order or contract, the producer or supplier shall furnish a certificate of compliance stating that the product was manufactured, sampled, tested and inspected in accordance with this specification (including year date) and any other requirements designated in the purchase order or contract, and has been found to meet such requirements.

> *Test Reports*—When specified in the purchase order or contract, test reports shall be furnished to the purchaser containing the results of all tests and chemical analyses required by this specification (including year date), and any other requirements designated in the purchase order or contract.

6.22.2 The certification section could also include one or more of the following, as appropriate:

> A signature or notarization is not required; however, the document shall clearly identify the organization submitting it. Notwithstanding the absence of a signature, the organization submitting the document is responsible for its content.

> Copies of the original manufacturer's test report shall be included with any subsequent test report.

> A certificate of compliance (or test report) printed from or used in electronic form from an electronic data interchange (EDI) shall be regarded as having the same validity as a counterpart printed in the certifying organization's facility. The content of the EDI transmitted document must conform to any existing EDI agreement between the purchaser and the supplier.

6.23 *Product Identification*—Where identification of individual pieces is required, the product markings must include sufficient attributes to distinguish one piece from another. Even product from the same specification number, type, grade, and class may vary from one heat to the next with respect to chemistry and mechanical properties; and product with all these particularities the same may vary in properties with respect to their origin in the ingot or mold, or due to differences in heat treatment. Accordingly, product markings may need to contain enough designators to provide unique piece identification. The list of markings may be different for different products and may include the number, code, or symbol for the following, as applicable: heat number; specification designation and, if necessary, year date; type; grade; class; lot; manufacturer's name, brand, or trademark; and any additional codes required by the specification.

6.24 *Packaging, Marking, and Loading for Shipment*:

6.24.1 Where appropriate Practice A 700 should be referenced, as follows:

> Where applicable, the packing, marking, and loading methods described in Practice A 700 shall be used.

6.24.2 For U.S. Government procurement, packaging, packing, and marking should be required to be in accordance with MIL-STD-163, to the level specified in the purchase order or contract. Marking for shipment for civil agencies should be required to be in accordance with Fed. Std. 123.

6.25 *Keywords*—This section lists appropriate terms for indexing.

6.26 *Supplementary Requirements*—The following supplementary requirements shall apply only when specified individually by the purchaser in the contract or purchase order.

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NOTE 3—Supplementary requirements are not permitted to relax the requirements in the body of the standard.

S1 [Title of the First Supplementary Requirement]
S1.1

6.26.1 *Numbering*:

Numbering of supplementary requirements in General or Common Requirements Documents under the jurisdiction of A01 may start with a number other than S1 per agreement with the Committee on Standards (see COS Minutes from 2/27/02).

6.26.2 *Renumbering*:

Supplementary requirements are normally numbered in sequence. When supplementary requirements are deleted or cancelled, the subcommittee may elect to retain the original requirement number. In this case, a note shall be placed after the number indicating the requirement has been cancelled and, where appropriate, indicating a replacement requirement. This minimizes the impact on specification users who may refer to the requirement.

6.27 *Annexes and Appendixes*—Follow the Form and Style Manual.

6.28 *Summary of Changes*:

6.28.1 A Summary of Changes section shall be included in each specification as an unnumbered section at the end of the document. ASTM Committee on Standards has agreed (see COS Minutes from 9/12/02) that entries to this summary of changes section will be retained for a period of eighteen months to ensure availability. An asterisk shall appear after the Scope (**Scope***) with the following wording at the bottom of the first page:

*** A Summary of Changes section appears at the end of this standard.**

6.28.2 Include this statement, filling in the specification number and year date:

This section identifies the principal changes incorporated since A XXX-XX was issued.

6.28.3 Next list, by section or subsection, changes made since the last issue that may impact the use of the standard. Brief descriptions of the changes and reasons for them may be included.

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this guide since the last issue, A 994 – 03, that may impact the use of this guide. (Approved June 15, 2005)

(*1*) Added new paragraph 6.2.6 and renumbered subsequent paragraphs.

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