This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: B950 – 23

Standard Guide for Editorial Procedures and Form of Product Specifications for Copper and Copper Alloys[1]

This standard is issued under the fixed designation B950; 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 procedures and form and style for product specifications under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys.

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 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 within ASTM Committee B05 on Copper and Copper Alloys. This guide is to be applied in conjunction with the Form and Style Manual. The Appendix contains a copy of the B05 electronic template which includes adopted language for various sections and provides a template for drafting B05 product specifications.

NOTE 2—The contents of this guide were previously maintained as a white paper under the title, "ASTM Committee B05 Outline of Form of Specifications."

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

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, this guide has precedence.

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

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

B153 Test Method for Expansion (Pin Test) of Copper and Copper-Alloy Pipe and Tubing

B154 Test Method for Mercurous Nitrate Test for Copper Alloys

B170 Specification for Oxygen-Free Electrolytic Copper—Refinery Shapes

B193 Test Method for Resistivity of Electrical Conductor Materials

B194 Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar

B216 Specification for Tough-Pitch Fire-Refined Copper—Refinery Shapes

B224 Classification of Coppers

B248 Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar

B248M Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar (Metric)

B249/B249M Specification for General Requirements for Wrought Copper and Copper-Alloy Rod, Bar, Shapes and Forgings

B250/B250M Specification for General Requirements for Wrought Copper Alloy Wire

B251/B251M Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube

B577 Test Methods for Detection of Cuprous Oxide (Hydrogen Embrittlement Susceptibility) in Copper

[1] This guide is under the jurisdiction of ASTM Committee B05 on Copper and Copper Alloys and is the direct responsibility of Subcommittee B05.91 on Editorial and Publications.

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[2] Available from ASTM website at: https://www.astm.org/media/pdf/bluebook_FormStyle.pdf.

[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.

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

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B601 Classification for Temper Designations for Copper and Copper Alloys—Wrought and Cast
B824 Specification for General Requirements for Copper Alloy Castings
B846 Terminology for Copper and Copper Alloys
B858 Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys
B900 Practice for Packaging of Copper and Copper Alloy Mill Products for U.S. Government Agencies
B968/B968M Test Method for Flattening of Copper and Copper-Alloy Pipe and Tube
E6 Terminology Relating to Methods of Mechanical Testing
E8/E8M Test Methods for Tension Testing of Metallic Materials
E18 Test Methods for Rockwell Hardness of Metallic Materials
E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
E44 Definitions for Terms Relating to Heat Treatment of Metals (Withdrawn 1993)[4]
E53 Test Method for Determination of Copper in Unalloyed Copper by Gravimetry (Withdrawn 2022)[4]
E54 Test Methods for Chemical Analysis of Special Brasses and Bronzes (Withdrawn 2002)[4]
E62 Test Methods for Chemical Analysis of Copper and Copper Alloys (Photometric Methods) (Withdrawn 2010)[4]
E75 Test Methods for Chemical Analysis of Copper-Nickel and Copper-Nickel-Zinc Alloys (Withdrawn 2010)[4]
E76 Test Methods for Chemical Analysis of Nickel-Copper Alloys (Withdrawn 2003)[4]
E112 Test Methods for Determining Average Grain Size
E118 Test Methods for Chemical Analysis of Copper-Chromium Alloys (Withdrawn 2010)[4]
E121 Test Methods for Chemical Analysis of Copper-Tellurium Alloys (Withdrawn 2010)[4]
E243 Practice for Electromagnetic (Eddy Current) Examination of Copper and Copper-Alloy Tubes
E478 Test Methods for Chemical Analysis of Copper Alloys
E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)
E581 Test Methods for Chemical Analysis of Manganese-Copper Alloys
E1227 Terminology for Chemical Analysis of Metals (Withdrawn 1991)[4]
E1371 Test Method for Gravimetric Determination of Phosphorus in Phosphorus-Copper Alloys or Phosphorus-Copper-Silver Alloys (Withdrawn 2006)[4]

2.2 *ISO Document:*[5]
ISO 4744 Copper and copper alloys -- Determination of chromium content -- Flame atomic absorption spectrometric method

2.3 *JIS Document:*[6]
JIS H1068 Methods for Determination of Bismuth in Copper and Copper Alloys

3. Terminology

3.1 For definitions of terms used in this guide, refer to the Form and Style Manual and Terminology B846.

4. Significance and Use

4.1 The Form and Style for ASTM Standards 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 B05 recognizes the need to provide a supplementary document pertaining to the types of products and materials covered by specifications under its jurisdiction.

4.2 This guide contains a list of sections to be considered for inclusion in a specification for copper and copper alloys, recommended wording, or both, for such sections. An electronic template including committee adopted language is included in the Appendix.[7]

4.3 Persons drafting new product specifications, or modifying existing ones, under the jurisdiction of Committee B05, should follow this guide and the requirements of the Form and Style Manual to ensure consistency.

5. Subject Headings of Text

5.1 The following is the heading sequence for the specifications text. The headings listed are those most generally used. Other headings may be included for specialized subjects when the information is pertinent to the document under development; in which case, all instructions and guidance for that particular section shall be applied, and these headings should appear in the most appropriate place and sequence depending on their relationship to other sections.

5.2 *Superscripts*—The headings identified as mandatory are required by the Society. The headings identified with an asterisk (*) are a guide for Committee B05 documents, where applicable, either by inclusion or by reference to a general requirements specification.

5.3 Not all of the headings may be required for a particular standard specification. For example, when the specification does not contain reference to any other standard within the text, it is not required to include a section on Referenced Documents. Or, in the case where no physical property requirements are given, the physical property section is not required.

Title[ASTM]	Sampling[B05]
Designation[ASTM]	Number of Tests and Retests[B05]
Scope[ASTM]	Specimen Preparation[B05]
Referenced Documents[B05]	Test Methods[B05*,B]
General Requirements[B05,A]	Significance of Numerical Limits[B05]
Terminology[B05]	Inspection[B05]

[4] The last approved version of this historical standard is referenced on www.astm.org.
[5] Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, http://www.iso.org.
[6] Available from Japanese Standards Association (JSA), Mita MT Bldg., 3-13-12 Mita, Miyoto-Ku, Tokyo 108-0073, Japan, http://www.jsa.or.jp.
[7] For an electronic WORD version of the template, see B05 Main Page on the ASTM website, http://www.astm.org/COMMITTEE/B05.htm.

Classification	Rejection and Rehearing[B05]
Ordering information[B05]	Certification[B05]
Materials and Manufacture[B05]	Test Reports[B05]
Chemical Composition[B05]	Product Marking
Temper[B05]	Packaging and Package Marking[B05]
Grain Size of Annealed Tempers	Keywords[ASTM]
Physical Property Requirements[B05]	Summary of Changes[B05]
Mechanical Property Requirements*	Supplementary Requirements
Performance Requirements	Quality Assurance
Other Requirements	Annexes
Dimensions, Mass, and Permissible Variations[B05]	Appendixes
Workmanship, Finish, and Appearance[B05]	

[ASTM] Mandatory ASTM Society requirement
[B05] Guide for B05 specifications
[A] When reference is made to a general requirements specification, the sequence position of the General Requirements section in the product specification should be prior to the first section referenced, which is usually Terminology.
[B] Test methods that are detailed in specifications shall contain all of the mandatory headings shown in Part A, Section A1, of the Blue Book.

5.4 Subject Headings shall precede each section to orient the reader. Section and text paragraphs shall be numbered in accordance with the Guide for the Use of the Modified Numbering System in Part D of the Form and Style for ASTM Standards manual. The following is an example of how it should appear in a standard:

1. Scope

1.1 This specification establishes the requirements for... etc.

6. Section Contents

NOTE 3—Explanations of section content requirements are detailed in this section. In the Annex, and published separately on the B05 Main Page under Additional Information, is an electronic template containing recommended language for each section. In this guide, the examples were removed to avoid redundancy and inconsistencies.

6.1 *Title*[ASTM]

6.1.1 The title should be as concise as possible, yet complete enough to identify the material, product, system, or services for which the requirements are established by the document.

6.2 *Designation and Year of Issue*[ASTM]

6.2.1 *Designation*—The alphanumeric designation is assigned by ASTM Headquarters.

6.2.2 *Year Date*—After the designation, a hyphen is followed by the last two numbers of the year of acceptance or last revision. Reapprovals are the last date in parentheses. Footnote 1 is not changed with a reapproval.

NOTE 4—The Form and Style Manual includes definitions of date of issue and year date.

6.3 *Scope*[ASTM]

6.3.1 The Scope should be a brief summary of the product and product application.

6.3.2 A statement shall be included in this section as to whether inch-pound or SI units are the standard, if the specification has a companion specification or is a dual designation specification.

6.3.3 Include the prescribed caveat on safety hazards per mandatory blue book language, when one or more test methods are included other than by reference.

NOTE 5—The safety hazard caveat shall also appear in test methods, guides, and practices that involve the use of materials, operations, or equipment.

6.3.4 Related documents not referenced in the text may be included as a footnote, or listed as References at the end of the standard cited by number if more than five are cited.

6.4 *Referenced Documents*[B05]

6.4.1 List in alphanumeric sequence the designation and complete title of all standards and other documents referenced, including standards and codes of other organizations.

6.4.2 Provide footnotes to this section indicating the source of the documents. When referenced later in the text, use only the type of document (specification, test method, practice, guide, etc.) and the designation letter and number (for example, Test Methods B577).

6.4.3 Do not use the year of issue when listing the referenced documents unless there is a technical reason for requiring a specific issue.

6.5 *General Requirements*[B05,A]

6.5.1 This section should be used for requirements that are available in a General Requirements specification and are included in the specification by reference. General Requirements specifications are B248, B248M, B249/B249M, B250/B250M, B251/B251M, and B824. When a product specification refers to a general requirements specification for applicable requirements, the reference shall be made in this section so as to alert the user that the details of the requirement(s) shall be found in another document.

6.5.1.1 The utilization of a general requirements section in the drafting of a new specification or in the revision of a standard is not mandatory; however, it is recommended since considerable repetition within a group of similar documents would be avoided.

6.5.1.2 In the case where a section in the general requirements section has been referenced and the same titled section appears in the product specification with requirements that either supplement or supersede the referenced general requirements section, use the explanatory clause 3.2 in the electronic template.

6.6 *Terminology*[B05]

NOTE 6—For use of terminology in B05 standards, refer also to the Committee B05 Terminology Management Policy.

6.6.1 When applicable, refer to Terminology B846 for definitions of terms relating to copper and copper alloys, or to other existing ASTM terminology standards having general applications. Terms not appearing in other ASTM terminology standards and requiring other than dictionary definitions should be defined.

6.6.1.1 Examples of ASTM terminology standards having general application are: E44, Definitions for Terms Relating to Heat Treatment of Metals; E6, Terminology Relating to Methods of Mechanical Testing; E1227 Terminology for Chemical Analysis of Metals.

6.6.2 *Definitions:*

6.6.2.1 Definitions shall be in dictionary-definition form, following the guidelines of Part E of The Form and Style

Manual and, when appropriate, include in this section definitions from any applicable terminology standard.

6.6.3 *Definitions of Terms Specific to this Standard:*

6.6.3.1 Terms that are specific to the standard under development or revision shall appear in the Terminology section under this heading.

6.7 *Classification*

6.7.1 When more than one material, product or system is specified, each may be separated by type, and designated by Roman numerals. The first subdivision shall be based upon some major property, composition, or application of the product. Designate further subdivisions by grades according to pertinent property or properties and identify by Arabic numbers. When necessary, make additional divisions into classes identified by capital letters.

6.7.1.1 An example of a classification standard is B224.

6.7.1.2 An example of material subdivided by grade is found in the Table of Chemical Composition of Specification B170.

6.8 *Ordering Information*[B05]

6.8.1 This section shall appear in all product specifications as a checklist of items which should be included in an inquiry, contract, or purchase order.

6.8.2 *Choices*—When the specification provides choices for purchase, such as various types, grades, classes, alloys, tempers, dimensions, forms, or quantities, the inquiry, contract, or purchase order should state which choices are required. Choices may have defaults, which should be stated in the specification, if the purchase order does not choose from the standard items offered.

6.8.2.1 A listing of each such choice, together with a reference to the applicable section of the specification, will be of assistance in the wording of the inquiry, contract, or purchase order. This list should include the ASTM specification designation and year of issue to avoid possible misunderstandings between the contracting parties. The purchaser's attention should be directed to what product would be furnished by the manufacturer or supplier when the purchaser fails to specify one or more of the choices. This is typically noted by the phrase "unless otherwise specified".

6.8.3 *Options*—Under a subsection, list optional items to be specified at the time of the order.

6.8.3.1 Options are typically noted with the phrase, "when specified". The purchaser is advised that the option will not be provided if the purchaser fails to specify it in the order, with the explanatory clause of 6.2 in the electronic template.

6.9 *Material(s) and Manufacture*[B05]

6.9.1 *Materials*—This section should contain general statements regarding the material(s) and form(s) from which the product is produced. It is recommended that the alloys involved should be stated.

6.9.2 *Manufacture*—This section should contain general statements regarding the acceptable method(s) of manufacture. It is recommended that the kinds of processes used to achieve the properties should be stated.

6.9.3 The past practice of using the following sentence should be discontinued: "The material shall be of such quality and purity that the finished product shall have the properties and characteristics prescribed in this specification." See 7.1 and 7.2 of the electronic template for recommended wording.

6.10 *Chemical Composition*[B05]

6.10.1 *Limits for Specified Elements:*

6.10.1.1 Detailed chemical composition requirements and other chemical characteristics to which the material, product, or system must conform shall be provided. These requirements are usually presented in tabular form. It is most important that the following information be clearly indicated: *(a)* name of each constituent specified, *(b)* whether the requirement is a maximum or a minimum, *(c)* whether an allowance for measurement error is incorporated in these limits, *(d)* the measurement units applicable, and *(e)* references to notes or footnotes for further clarification.

6.10.1.2 All chemical composition requirements must be in accordance with the UNS Registered Composition or another internationally recognized system for alloy designation ("other designation"). It is permissible for applications to have tighter (more restrictive) limits, but they must be completely within the registered UNS (or other designation) Composition. When different limits outside the registered limits are desired, a new Registered UNS Composition must be obtained.

NOTE 7—Refer to E527 Standard Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS) for information on registering a UNS composition.

6.10.1.3 When presenting chemical limits, it is recommended to use the "—" symbol in the tables (for example, 89.0–91.0), and to use "to" in the text (for example, 89.0 to 91.0).

6.10.1.4 When restricting limit for one of the specified elements, it is given as "remainder" in the chemical composition table. Select the appropriate wording in the electronic template depending on what alloys are specified in the standard.

6.10.2 *Product (Check) Sample:*

6.10.2.1 When it is desirable to state a permissible analytical variance for a specific product, an introductory statement should be used to indicate the requirements. See 8.1.1 in the electronic template for recommended wording.

6.10.2.2 The permitted variances may be incorporated in the chemical composition table or given a separate table.

6.10.3 *Limits for Nonspecified Elements:*

6.10.3.1 Include a disclaimer statement regarding limits for nonspecified elements for all specifications containing chemical composition sections. See 8.2 of the electronic template. See 8.3 for language required for stating the limit for one of the specified elements to be listed as remainder.

6.10.4 An example of a chemical requirements table is shown in the electronic template (see Table A1.1). The use of three periods in a chemical table space rather than a blank space is mandatory, and means those elements are not included in the UNS (or other designation) Registered Composition for the alloy.

6.11 *Temper*[B05]

6.11.1 The standard temper(s) of the products specified shall be stated in this section. Refer to Classification B601 for temper designations for copper and copper alloys.

6.11.2 Use the temper designation codes and names of Classification B601 in both text and tables. Avoid use of former designations. It is recommended to reference Classification B601, as the current codes and names are cross referenced to former codes in the appendix.

6.11.3 If tempers not classified in Classification B601 are used in the specification, details of the temper requirements must be explicitly stated.

6.12 *Grain Size for Annealed Tempers*

6.12.1 Use this section when grain size is the standard requirement for a copper or copper alloy in an annealed (OS) temper.

NOTE 8—In drafting a new document or revising a standard, it is essential to identify in the specification a test procedure for determining conformance to each requirement.

6.12.2 An example of a grain size requirements table is in the electronic template (see Table A1.2).

6.13 *Physical Property Requirements*[B05]

6.13.1 If specified, the requirements for electrical resistivity or conductivity, coefficient of thermal expansion, specific gravity and similar properties are presented in this section; usually in tabular form.

6.13.2 When a requirement is an option, or when the requirement of performance of the test is an option, it should be so stated. It should be noted that such options should be specified in the contract or purchase order. An example is included in 11.1.2 of the electronic template.

6.14 *Mechanical Property Requirements*[B05]

6.14.1 The requirements for tensile strength, yield strength, elongation, and hardness are included in this section. The property requirements are frequently placed in a table.

6.14.1.1 When a requirement is an option, or when the requirement of performance of the test is an option, it should be so stated. It should be noted that such options should be specified in the contract or purchase order. An example is included in 11.1.2 of the electronic template.

6.14.1.2 In the case where the approximate Rockwell hardness values are used as a quick test to indicate general conformance to a specification requirement, see 12.2 of the electronic template for an example of how it should appear. Also see the example Table A1.6 in the electronic template.

6.14.2 *Mechanical Property Requirements Tables:*

6.14.2.1 The use of three periods in a table space rather than to a blank space is mandatory, and means that no requirement has been established.

6.14.2.2 Under "Temper Designation," use Code and Name for tempers to be consistent with Classification B601. (See examples in the electronic template.)

6.14.2.3 Use rounding to the nearest 5 MPa for SI tensile and yield strength requirements.

6.14.2.4 For combined documents—It is preferred to use separate tables for Inch-Pound and SI requirements as in examples in the electronic template. Note cross references from one table to the other (see Tables A1.3 and A1.4).

6.14.2.5 For combined documents where the number of tables or the size of the table is a problem with separate tables, a combined table may be used with the standard requirement followed by the other requirement in brackets (see Table A1.5). In some cases, separate columns for inch-pound and SI requirements in the same table may be used.

6.14.2.6 For other types of documents, where one system is standard and the other is informational, the use of parentheses to enclose mathematical conversions is generally accepted.

6.15 *Performance Requirements*

6.15.1 Include in this section functional, environmental, and similar requirements (for example, Microscopic Examination, Cuprous Oxide [Hydrogen Embrittlement Susceptibility], Expansion Test, Flattening Test, and Residual Stress Tests).

6.15.1.1 When a requirement is an option, or when the requirement of performance of the test is an option, it should be so stated. It should be noted that such options should be specified in the contract or purchase order. An example is included in 11.1.2 of the electronic template.

6.16 *Other Requirements*

6.16.1 Requirements not covered elsewhere, such as Nondestructive Testing (Electromagnetic eddy current Examination, Hydrostatic Test, Pneumatic Test), Cleanness Test, Weld Quality Test, Orders for U.S. Government Agencies, etc., should be located in this part of the specification. These additional requirements should follow the performance requirements and should not be intermixed with the other sections.

6.16.1.1 *Purchases for U.S. Government*—When product is purchased for agencies of the U.S. Government, the specification shall include this section. The section should appear immediately prior to the Dimensions, Mass, and Permissible Variations section of the specification. See the Supplementary Requirements section of the E Template for wording.

6.17 *Dimensions, Mass, and Permissible Variations*[B05]

6.17.1 Only that part of the title which is applicable to the product need be addressed. The section may be self contained or it may reference another document such as a general requirements specification.

6.17.2 This section shall be used for the details as to standard shape, mass, and size ranges which are usually presented in tabular form with a brief reference in the text. Separate sections may be necessary with the individual tables. The tables shall clearly indicate where divisions are made for the dimension ranges. For example ranges from 0 in. to 1 in., 1 in. to 2 in., 2 in. to 3 in. shall be more properly stated as 1 in. and under, over 1 in. to 2 in. inclusive, over 2 in. to 3 in., inclusive, etc.

6.17.3 The permissible variations in dimensions, mass, etc., may be included in the same tables with minimal sizes. It shall be made clear that the tolerances specified are plus and minus or apply only in one direction.

6.17.4 The specific tables in referenced General Requirements should be noted by table number to avoid confusion. As most dimensions are contained in more than one table, be sure to reference the one that is applicable to the product.

6.17.4.1 Should there be more than one section in a table due to grades or applications, the specific section should be noted. (for example the straightness table in Specification B249/B249M.)

6.17.5 For new or revised documents, the Title headers of the appropriate tables in the referenced document should be checked to insure that the product specification, and alloys if applicable, are properly listed. Advise the ASTM Editor of any corrections or additions needed, when finalizing the product specification.

6.18 *Workmanship, Finish, and Appearance*[B05]

6.18.1 Workmanship, finish, and appearance may be addressed separately for better clarity or a general statement may be used. Requirements for workmanship, finish, and appearance include (but are not limited to) the type of finish, the general appearance or color, the temper, and whether the product is clean, sound, and free of scale or defects which would render it unsuitable for the intended application. To avoid misunderstanding, these requirements should be clearly stated. Provisions for removal or repair of minor surface imperfections that are not considered cause for rejection should also be addressed.

6.19 *Sampling*[B05]

6.19.1 This section shall include lot size, portion size, selection of portion pieces, and the manner by which the sample shall be taken from the portion pieces selected.

6.19.2 This subject is too complex to be addressed in this document. However, the Sampling section of Specification B249/B249M, General Requirements for Wrought Copper and Copper Alloy Rod, Bar, and Shapes, is an example of how this section should appear in the standard.

6.20 *Number of Tests and Retests*[B05]

6.20.1 *Tests*—This section shall state the number of test specimens required to determine conformance to specification product property requirements.

6.20.2 *Retests*—If the specification permits retesting, after the product fails to conform to specification requirements when tested by the purchaser, state the conditions and rules under which the retesting is permitted.

6.21 *Specimen Preparation*[B05]

6.21.1 Where special test specimen preparation is required, this section shall be included. Refer to a standard test method when possible and when an acceptable reference is not available, include sufficient information to allow acceptable reproduction of test results.

6.21.2 In the case of tensile strength requirements when tested in accordance with Test Methods E8/E8M for wrought products, the test specimens shall be taken so the longitudinal axis of the specimen is parallel to the direction of rolling for rolled (or flat) products, or final working for drawn or extruded products.

6.21.3 This subject is too complex to be further addressed in this document; however, the Specimen Preparation section of Specification B249/B249M, General Requirements for Wrought Copper and Copper Alloy Rod, Bar, and Shapes, is an example of how this section should appear in a standard.

6.22 *Test Methods*[B05,B]

6.22.1 *General*—In this section identify specific test methods by which conformance with the specification requirements may be determined. In addition to identifying the specific test method, include any additional information necessary for the proper application of the identified test method.

6.22.2 *Chemical Analysis:*

6.22.2.1 There are some copper alloys whose chemical compositions include element(s) with specified limiting values for which no recognized analytical test method is known to be published in the literature. When such a test method can not be obtained from the manufacturer of a product produced from such an alloy, who obviously has the in-house analytical capability, for inclusion in the specification, the following statement should appear immediately after the list of test methods:

X.X.1 Since no viable test method is known to be published, the determination of [specify the element or elements] shall be subject to agreement between the manufacturer or supplier and the purchaser.

6.22.2.2 When such a needed test method has been published by a recognized authority for a particular element, the above statement is no longer valid for that element, and the published test method shall be referenced.

6.22.2.3 Most, if not all, standard specifications permit an agreement between the manufacturer and the purchaser to establish limits and required analysis for unnamed element(s); however, since it cannot be predetermined which element(s) may be subject to this agreement, test method(s) for such element(s) do not have to be identified within the standard.

6.22.2.4 In case of dispute, it is recommended that resolution of dispute shall be subject to agreement between the manufacturer or supplier and purchaser.

1. *General*—Table 1 is a list of published test methods, some of which are considered by ASTM as no longer viable. These and others not listed, may be used subject to agreement. Table 1 is a guide compilation of available chemical analysis methods for coppers and copper alloys listed by elemental alloy constituent or impurity and applicable range (by weight %). The Committee B05 Liaison to Committee E01 on Methods of Analysis may be consulted if there are any questions about the listed methods.

NOTE 9—Commonly accepted methods not included here are frequently used for routine chemical analysis.

2. *Special Cases*—The following special cases exist whereby the reference chemical analysis method for the desired impurities is included in an annex in the standard:

(a) Tough-Pitch Fire-Refined Copper—Refer to the Annex of Specification B216.

(b) Cathode Copper Impurities—Refer to the Annex of Specification B170.

(c) Copper-Beryllium Alloys—Refer to the Annex of Specification B194.

6.23 *Significance of Numerical Limits*

6.23.1 This section provides the rounding procedures for numerical limits associated with specification requirements. See the table included in the electronic template for standard requirements.

6.24 *Inspection*[B05]

6.24.1 This section should contain general information regarding the inspection requirements of the product.

TABLE 1 Compilation of Chemical Analysis Methods for Coppers and Copper Alloys

Element	Range or % max	Test Method(s)	Applicability[A]
Aluminum (Al)	2–12	E478; Titrimetric	General
	>0.10	E54; Gravimetric	General
Antimony (Sb)	0.05–0.70	E62	General
Arsenic (As)	0.0–0.50	E62	General
Bismuth (Bi)	0.1–6	JIS H1068	Bismuth alloys
Cadmium (Cd)	2–25 ppm	E53	Coppers
Carbon (C)	0.0–0.50	E76	Nickel-Copper alloys
Chromium (Cr)	0.003–2.0	ISO 4744	General
	0.30–0.70	E118	General
Cobalt (Co)	0.01–0.5	E75; Photometric	7xxx series alloys
Copper (Cu)	>50	E478; Electrolytic & Photometric	General
	99.75–99.99	E53; Electrolytic	Coppers
Iron (Fe)	0.003-1.25	E478; Photometric	General
	1.0 max	E75; Atomic Absorption	7xxx series alloys
	0.0–5.0	E54	General
Lead (Pb)	0.002–15.0	E478; Atomic Absorption	General
	2.0–30.0	E478; Titrimetric	General
Manganese (Mn)	0.10–12.0	E62	General
	0.10–12.0	E75; Photometric	7xxx series alloys
	28–32	E581 Titrimetric	General
Nickel (Ni) (incl Colbalt (Co))	0.03–5.0	E478; Photometric	General
	4.0–50.0	E478; Gravimetric	General
Phosphorus (P)	0.01–1.2	E62	General
	1–15	E1371; Gravimetric	Phosphor coppers
Silicon (Si)	0.005–5.50	E54; Perchloric Acid Dehydration	General
	0.1–5.0	E62	6xxx series alloys
Silver (Ag)	0.01–5.0	E54	General
	0.01–0.12	E478; Atomic Absorption	Silver Bearing Copper
Sulfur (S)	0.05–0.08	E76; Direct Combustion	Nickel-Copper alloys
	0.001–0.5	E76; Gravimetric	
Tellurium (Te)	0.4–1.0	E121	Copper-Tellurium Alloys
Tin (Sn)	0.01–1.0	E478; Photometric	General
	0.50–20.0	E478; Titrimetric	General
Zinc (Zn)	0.02–2.0	E478; Atomic Absorption	General
	2.0–40.0	E478; Titrimetric	General

[A] Always refer to the test method involved for the scope, specific details and limitations.

6.25 *Rejection and Rehearing*[B05]

6.25.1 This section should describe the conditions under which rejection shall be permitted and the basis for reconsideration when requested by the manufacturer or supplier.

6.26 *Certification*[B05]

6.26.1 This section should be included in all specifications or by reference, as an option, and when included, the electronic template contains the mandatory wording.

6.27 *Test Report*[B05]

6.27.1 This section should be included in all specifications or by reference, as an option. Use the mandatory wording included in the electronic template.

6.27.2 For some products it may be desirable to identify this section as “Mill Test Report,” “Foundry Test Report,” etc.

6.28 *Product Marking*

6.28.1 When this section is used, the wording to be used will be dictated by the product and the circumstances of the application.

6.29 *Packaging and Package Marking*[B05]

6.29.1 This section should be included in all standards, or by reference to a General Requirements specification.

6.30 *Keywords*[ASTM, B05]

6.30.1 Keywords may be added editorially at any time to a standard. Select keywords from title and scope, products involved, etc.

6.30.1.1 It is recommended that the copper or copper alloy UNS designations involved be included in the keywords for the purposes of indexing and electronic searches.

6.31 *Summary of Changes*[B05]

6.31.1 This unnumbered section shall be included in all revised standards when published. The information in this section identifies the principal changes made to the standard since the last publication.

6.31.1.1 The inclusion of this section is identified with an asterisk item in the Scope with the following first page footnote: “A Summary of Change section appears at the end of this standard.”

6.32 *Supplementary Requirements*

6.32.1 For some product specifications, supplementary requirements may be specified. These requirements usually apply only when specified by the purchaser in the inquiry, contract or purchase order. Include an introductory qualifying statement about the requirements.

6.32.2 Instead of including the details of the supplementary requirements in the product specification, the Supplementary Requirements section of a related general requirements specification, when available, may be referenced in the General Requirements section of the product specification.

6.32.3 See the Supplementary Requirements section of the E Template for wording.

6.33 *Quality Assurance*

6.33.1 This requirement, when included, shall be qualified by the statement, "When specified in the contract or purchase order." Reference to a suitable document, such as ASTM, ANSI, MIL, or other, may be made by agreement between the manufacturer or supplier and the purchaser.

6.34 *Annexes and Appendixes*

6.34.1 Additional information may be included in one or more annexes or appendixes to the specification. The words, "Mandatory Information" shall appear directly under the title of the annex, and "Nonmandatory Information" shall appear directly under the title of the appendix.

6.34.2 *Annexes:*

6.34.2.1 Include in annexes any detailed test methods or information such as that on equipment or material that is a *mandatory* part of the specification, but too lengthy for inclusion in the main text. Annexes precede appendixes.

6.34.3 *Appendixes:*

6.34.3.1 There are times when it is desirable to include in a specification additional information for general use and guidance, but does *not* constitute a mandatory part of the specification. It is appropriate to include such material in appendixes. Examples of such materials are tables showing the approximate relationship between tensile strength and hardness, lists of preferred thicknesses of plate, sheet, strip, and strip reproduced from other documents, tables of standard mass and standard sizes, etc.

6.35 *Notes:*

6.35.1 Notes in the text shall not include mandatory requirements. Notes are intended to set explanatory material apart from the text itself, either for emphasis or for offering informative suggestions not properly part of the standard. Clarification of the description of required apparatus or procedure and modifications required or permitted in certain cases belong in the text itself. If inclusion of the contents yields a different result, then that information is considered mandatory for the performance of the standard and shall be located in the text. Notes may be preferable for detailed description of auxiliary procedures (for example, the Rockwell hardness test offers a quick and convenient method of checking for general conformity to the specification requirements for temper, tensile strength, and grain size). Table notes are a part of the table and are mandatory provision.

6.35.2 Notes appearing in a given standard shall be numbered in sequence and should appear at the end of the paragraph to which they pertain. If it is necessary to refer to a text note in connection with a specific word or phrase in the text, that word or phrase should be followed by a reference to the note, "NOTE 1"), etc.

6.35.3 Notes in the text are preferred for the following:

6.35.3.1 To refer to editorial changes made in the text.

6.35.3.2 To refer to similar or companion ASTM standards.

6.35.3.3 Description, if included under "Scope," of experimental means for recognizing cases where the method is not applicable to the material under test.

6.35.3.4 Description of additional (not alternative) apparatus, materials, procedures, or calculations that are not actually required; or description of merely recommended forms of construction of required apparatus.

6.35.3.5 Explanation, if needed, of the reasons for a certain requirement or direction. If brief, include in the text rather than as a note.

7. Keywords

7.1 copper; copper alloys; copper alloy specifications; editorial procedures

ANNEX

(Mandatory Information)

A1. B05 ELECTRONIC TEMPLATE

A1.1 The Committee B05 Electronic Template is published on the B05 committee web page on the astm.org web site. The electronic template includes the language recommended by B05 for standard specifications under its jurisdiction.[7]

A1.2 The user of this template should be aware that not all sections or paragraphs in the template must be used in a new specification. Other paragraphs may be needed and should be added by the user. This is only a guide.

A1.3 A copy of the electronic template attached to this guide follows.

THIS DOCUMENT IS NOT AN ASTM STANDARD; IT IS UNDER CONSIDERATION WITHIN AN ASTM TECHNICAL COMMITTEE BUT HAS NOT RECEIVED ALL APPROVALS REQUIRED TO BECOME AN ASTM STANDARD. IT SHALL NOT BE REPRODUCED OR CIRCULATED OR QUOTED, IN WHOLE OR IN PART, OUTSIDE OF ASTM COMMITTEE ACTIVITIES EXCEPT WITH THE APPROVAL OF THE CHAIRMAN OF THE COMMITTEE HAVING JURISDICTION AND THE PRESIDENT OF THE SOCIETY. COPYRIGHT ASTM, 100 BARR HARBOR DRIVE, WEST CONSHOHOCKEN, PA 19428. ALL RIGHTS RESERVED.

ASTM Committee B05 Electronic Template for Drafting Standard Specifications – 2023

(see footer below for detailed guidelines for use)

ASTM Task Group # XXX
Revision of B0/B000M-XX
Draft # X – Date XX/XX/XX
Page x of y

Note: This electronic template is an Appendix of ASTM B950, which provides guidelines for preparing B05 draft documents.

Guidelines for template use: Editable manuscript text is included in Times New Roman font 12 pt double-spaced. The text includes B05-adopted or example language for some sections. The task group will need to edit this text to suit the needs of the standard under development. ASTM society-mandated (Blue Book) wording appears in italics. Instructions and information not intended to be included in the text appear in royal parentheses in Courier New font. For example: {Instructions and information}. These instructions should be deleted prior to submitting the draft for ballot. ASTM Society-mandated (Blue Book) sections are superscripted as "ASTM." Committee B05-required sections are superscripted "B05." Delete these superscripts and this instructional footer when editing is complete. Note, the auto-numbering feature is activated in this template.

ASTM B0/B0M-XX[ASTM] **Standard Specification for … Xxx Xxx[ASTM]**

This standard is issued under the fixed designation B0/B0M; 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* [ASTM] {The following footnote is to appear at the bottom of the first page when in print:} "*A Summary of Changes appears at the end of this specification."

1.1 This specification establishes the requirements for {include the details of the scope of the standard}.

1.2 {For Inch-Pound Specification with SI Statement} *Units*—The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

{For SI Companion Specification Statement} *Units*—This specification is the companion specification to SI specification B0M; therefore, no SI equivalents are shown in this specification.

{Inch-pound SI Companion Specification Statement} *Units*—This specification is the companion specification to inch-pound specification B0.

{For Combined Specification Standard Statement} *Units*—The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, SI units are shown in brackets. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.3 The following safety hazard caveat pertains only to the test method(s) described in this specification.

1.3.1 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.3.2 (When a standard includes reference to the element mercury or products containing mercury, the following caveat shall appear in the Scope section.)

Warning—Mercury has been designated by many regulatory agencies as a hazardous substance that can cause serious medical issues. Mercury, or its vapor, has been demonstrated to be hazardous to health and corrosive to materials. Use caution when handling mercury and mercury-containing products. See the applicable product Safety Data Sheet (SDS) for additional information. The potential exists that selling mercury or mercury-containing products, or both, is prohibited by local or national law. Users must determine legality of sales in their location.

2. Referenced Documents[B05]

2.1 *ASTM Standards:* {List ASTM standards referenced in the text in alphanumerical order, without the year-date. Include the title.}

2.2 *Other Documents:*

3. General Requirements {Note—When reference is made to a General Requirements specification, the sequence position of the General Requirements section in the product specification should be prior to the first section referenced, which is usually Terminology.}

3.1 The following sections of Specification B0/B0M constitute a part of this specification.

3.1.1 Terminology
3.1.2 Materials and Manufacture
3.1.3 Sampling
3.1.4 Number of Tests and Retests
3.1.5 Specimen Preparation
3.1.6 Certification
3.1.7 Test Reports

3.2 In addition, when a section with a title identical to that referenced in X.1, above, appears in this specification, it contains additional requirements which supplement those appearing in Specification B0/B0M.

4. Terminology[B05]

4.1 For definitions of terms related to copper and copper alloys, refer to Terminology B846.

4.2 *Definitions of Terms Specific to this Standard:*

4.2.1 {List terms in alphabetic order. Example (term, n – a word that identifies a precise meaning or concept.)}

5. Classification

5.1 {Use this section if needed to classify products covered under the specification}

6. Ordering Information[B05]

6.1 Include the following specified choices when placing orders for product under this specification, as applicable:

6.1.1 ASTM designation and year of issue,

6.1.2 Copper [Alloy] UNS No. (or other internationally recognized copper [alloy]) designation,

NOTE A1.1—Refer to 6.10.1.2 for guidance regarding the listing of UNS and other internationally recognized alloy designations. If the standard includes the use of an internationally recognized alloy designation other than UNS, refer to both the international alloy designation and the UNS alloy designation. If the standard only includes UNS alloy designation then only the UNS alloy designation is mentioned.

6.1.3 Temper (Section 8),

6.1.4 Dimensions, diameter, and wall thickness (Section 13) {For tube or pipe: specify either O.D./I.D., O.D./wall, or I.D./wall unless standard sizes such as type K are ordered; for flat products: thickness, width, and edges; for rod, bar, or shapes: by diameter or distance between parallel surfaces},

6.1.5 How furnished: straight lengths or coils,

6.1.6 Quantity—total weight or total length or number of pieces of each size, and

6.1.7 Intended application.

6.2 The following options are available and, when required, shall be specified at the time of placing the order:

6.2.1 Heat identification or traceability details,

6.2.2 Electromagnetic (eddy current) examination,

6.2.3 Embrittlement test,

6.2.4 Expansion test,

6.2.5 Flattening test,

6.2.6 Certification,

6.2.7 Test Report,

6.2.8 If product is purchased for agencies of the U.S. Government (see the Supplementary Requirements section of {this specification or the general requirements section} for additional requirements, if specified), and

6.2.9 If product is ordered for ASME Boiler and Pressure Vessel Code Application (See Certification Section xx).

7. Materials and Manufacture[B05]

7.1 *Materials:*

7.1.1 The material of manufacture shall be a form (cast bar, cake, slab, et cetera) of Copper Alloy UNS No. C00000 or C00001 [or other designation] of such purity and soundness as to be suitable for processing into the products prescribed herein.

7.1.2 When specified in the contract or purchase order, that heat identification or traceability is required, the purchaser shall specify the details desired.

Note X—Due to the discontinuous nature of the processing of castings into wrought products, it is not always practical to identify a specific casting analysis with a specific quantity of finished material.

7.2 *Manufacture:*

7.2.1 The product shall be manufactured by such hot working, cold working, and annealing processes as to produce a uniform wrought structure in the finished product.

7.2.2 The product shall be hot or cold worked to the finished size, and subsequently annealed when required, to meet the temper properties specified.

7.3 *Edges:*

7.3.1 Slit edges shall be furnished unless otherwise specified in the contract or purchase order.

8. Chemical Composition[B05]

8.1 The material shall conform to the chemical composition requirements in Table X for the copper [alloy] UNS No. [or other designation] specified in the ordering information.

8.1.1 Results of analysis on a product (check) sample shall conform to the composition requirements within the permitted analytical variance specified in Table X.

8.2 These composition limits do not preclude the presence of other elements. By agreement between the manufacturer and purchaser, limits may be established and analysis required for unnamed elements.

8.3 For alloys in which copper is listed as "remainder," copper is the difference between the sum of results of all elements determined and 100 %. When all elements in Table X are determined, the sum of results shall be XX.X % min, or as shown in the following table:

8.4 For alloys in which zinc is listed as "remainder," either copper or zinc may be taken as the difference between the sum of results of all other elements determined and 100 %. When all elements in Table X are determined, the sum of the results shall be XX.X % min, or as shown in the following table.

8.5 For standards which have multiple alloys where zinc is specified as remainder in some and copper is specified as remainder in others, both statements (8.3 and 8.4) may be used.

9. Temper[B05]

9.1 The standard tempers for products described in this specification are given in Tables X and Y.

9.1.1 Hot rolled temper M20 {Note—Task Group to assign appropriate temper designations}

9.1.2 Cold rolled tempers H01 to H10

9.1.3 Annealed tempers OS015 to OS120

TABLE A1.1 Chemical Requirements (Example Table)

Element	Composition % Copper Alloy UNS No. (or other designation)		
	C31400	C31600	C32000
Copper	87.5 to 90.5	87.5 to 90.5	83.5 to 86.5
Lead	1.3 to 2.5	1.3 to 2.5	1.5 to 2.2
Iron, max	0.10	0.10	0.10
Nickel	0.7 max	0.7 to 1.2	0.25 max
Zinc	remainder	remainder	remainder
Phosphorus	. . .	0.04 to 0.10	. . .

9.1.4 Annealed-to-temper O80, O81 or O82

10. Grain Size for Annealed Tempers {Note—This section should appear in standards which specify grain size(s) for annealed tempers, which generally applies only to wrought products documents}

10.1 Grain size shall be the standard requirement for all product in the annealed tempers.

10.2 Acceptance or rejection based upon grain size shall depend only on the average grain size of a test specimen taken from each of two sample portions, and each specimen shall be within the limits prescribed in Table X when determined in accordance with Test Methods E112.

11. Physical Property Requirements[B05]

11.1 *Electrical Resistivity Requirement:*

11.1.1 The product furnished shall conform to the electrical mass resistivity requirement prescribed in Table X, when tested in accordance with Test Method B193.

11.1.2 When specified in the contract or purchase order, the product furnished shall conform to the electrical mass resistivity requirement prescribed in Table X, when tested in accordance with Test Method B193.

12. Mechanical Property Requirements[B05]

12.1 *Tensile Strength Requirements:*

12.1.1 Product furnished under this specification shall conform to the tensile requirements prescribed in Table X, when tested in accordance with Test Methods E8/E8M.

12.1.2 Acceptance or rejection based upon mechanical properties shall depend only on tensile strength.

12.2 *Rockwell Hardness Requirement:*

12.2.1 When specified in the contract or purchase order, the product shall conform to the Rockwell hardness requirement prescribed in Table X, when tested in accordance with Test Methods E18.

12.2.2 The approximate Rockwell hardness values given in Table X are for general information and assistance in testing, and shall not be used as a basis for product rejection.

Note X—The Rockwell hardness test offers a quick and convenient method of checking for general conformity to the specification requirements for temper, tensile strength, and grain size.

13. Performance Requirements

13.1 *Expansion Test:*

13.1.1 When specified in the contract or purchase order, tube furnished in the soft-anneal (O60) shall withstand expansion in accordance with Test Method B153 to the following extent: {The following is an example}

TABLE A1.2 Grain Size Requirements for Annealed (OS) Product (Example Table)

Copper Alloy UNS No. (or other designation)	Standard Temper Designation (B601)	Grain Size, mm		
		Nominal	Min	Max
C21000	OS050	0.050	0.035	0.090
	OS035	0.035	0.025	0.050
	OS025	0.025	0.015	0.035
	OS015	0.015	. . .[A]	0.025
C22000	OS050	0.050	0.035	0.090

[A] Although no minimum grain size is required, this material must be fully recrystallized.

Outside Diameter in. (mm)	Expansion of Outside Diameter, %
¾ (19.1) and under	40
Over ¾ (19.1)	30

13.1.2 The expanded tube shall show no cracking or other defects visible to the unaided eye.

13.2 *Flattening Test:*

13.2.1 When specified in the contract or purchase order, the flattening test in accordance with Test Method B968/B968M shall be performed.

13.2.1.1 During inspection, the flattened areas of the test-specimen shall be free of defects, but blemishes of a nature that do not interfere with the intended application are acceptable.

13.3 *Residual Stress Test:*

13.3.1 When specified in the contract or purchase order, product in drawn tempers shall be tested for residual stress according to the requirements of Test Method B154 or Test Method B858, and show no signs of cracking.

Warning—Mercury is a definite health hazard. With the Mercurous Nitrate Test, equipment for the detection and removal of mercury vapor produced in volatilization, and the use of protective gloves is recommended.

13.3.2 When the Ammonia Vapor Test is used, the test pH value appropriate for the intended application shall be 10 unless otherwise specified by the purchaser.

13.3.3 Residual stress test specimens shall be of the full size of the product, and tested without bending, springing, polishing or any other preparation, except as allowed by the test method.

Note—A residual stress test provides information about the adequacy of the stress relief of the material. Bar straightening is a method of mechanical stress relief. Stress relief annealing is a method of thermal stress relief.

14. Other Requirements

14.1 *Nondestructive Testing Requirements;*

14.1.1 Electromagnetic (eddy current) Test:

14.1.2 Hydrostatic Test:

14.1.3 Pneumatic Test:

14.2 *Purchases for U.S. Government:*

15. Dimensions, Mass, and Permissible Variation[B05]

15.1 The dimensions and tolerances for product described by this specification shall be as specified in Specification B0/B0M {Note—Reference is to a General Requirements specification such as Specification B249/B249M, etc.} with particular reference to the following Tables and related paragraphs:

15.2 *Thickness*—Table X.

15.3 *Width:*

15.3.1 *Slit Metal and Slit Metal with Rolled Edges*—Table X.

15.3.2 *Square Sheared Metal*—Table X.

15.4 *Length:*

15.4.1 *Length Tolerance for Straight Lengths*—Table X.

15.4.2 *Schedule for Minimum Lengths and Maximum Weights of Ends for Specific Lengths with Ends, and Stock Lengths with Ends*—Table X.

15.4.3 *Length Tolerance for Square Sheared Metal*—Table X.

15.4.4 *Length Tolerance for Sawed Metal*—Table XX.

TABLE A1.3 Tensile Requirements (Inch-Pound Units) (Example Table)

NOTE 1—SI values are stated in Table A1.4.

Copper Alloy UNS No. (or other designation)	Temper Designation		Diameter or Distance Between Parallel Surfaces, in.		Width, in.	Tensile Strength, min, ksi	Yield Strength at 0.5 % Extension Under Load, min, ksi	Elongation in 4× Diameter or Thickness of Specimen min, %[A]
	Code	Name						
C31400, C31600, C32000	O60	soft anneal	all forms	all sizes	. . .	35	10	25
C31400, C31600, C32000	H02	half hard	rod:	½ and under	. . .	50	30	7
				over ½ to 1	. . .	45	27	10
				over 1	. . .	40	25	12
			bar:	1 and under	2 and under	40	25	12

TABLE A1.4 Tensile Requirements (SI Units) (Example Table)

NOTE 1—Inch-pound values are stated in Table A1.3.

Copper Alloy UNS No. (or other designation)	Temper Designation		Diameter or Distance Between Parallel Surfaces, mm		Width, mm	Tensile Strength, min, MPa	Yield Strength at 0.5 % Extension Under Load, min, MPa	Elongation[A] min, %
	Code	Name						
C31400, C31600, C32000	O60	soft anneal	all forms	all sizes	. . .	240	70	25
C31400, C31600, C32000	H02	half hard	rod:	12 and under	. . .	345	205	7
				over 12 to 25	. . .	310	185	10
				over 25	. . .	275	170	12
			bar:	25 and under	50 and under	275	170	12

TABLE A1.5 Tensile Requirements (Example Table)

Temper Designation		Diameter or Distance Between Parallel Surfaces,[A] in. [mm]	Tensile Strength, min ksi [MPa]	Yield Strength min ksi [MPa], at 0.5 % Extension Under Load	Elongation in 4× Diameter or Thickness of Specimen min, %[B]
Code	Name				
		Copper Alloy UNS No. C61300			
HR50	drawn and stress relieved	rod (round only)			
		½ [12] and under	80 [550]	50 [345]	30
		over ½ [12] to 1 [25], incl	75 [515]	45 [310]	30
		over 1 [25] to 2.0 [50], incl	72 [495]	40 [275]	30
		over 2 [50] to 3 [80], incl	70 [485]	35 [240]	30

TABLE A1.6 Tensile Strength Requirements and Approximate Rockwell Hardness Values for Rolled Temper Product (SI Units) (Example Table)

NOTE 1—Inch-pound values are stated in Table X.

Temper Designation		Tensile Strength, MPa		Approximate Rockwell Hardness							
				B Scale				Superficial 30-T			
				0.50 to 0.90 mm, incl		Over 0.90 mm		0.30 to 0.70 mm, incl		Over 0.70 mm	
Code	Name	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
M20	As hot-rolled	220	290	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
H01	Quarter hard	255	325	20	48	24	52	34	51	37	54
H02	Half-hard	290	355	40	56	44	60	46	57	48	59

15.5 *Straightness:*

15.5.1 *Slit Metal or Slit Metal Either Straightened or Edge Rolled*—Table XX.

15.5.2 *Square Sheared Metal*—Table XX.

15.5.3 *Sawed Metal*—Table XX.

15.6 *Edges Contours:*

15.6.1 *Square Corners*—Section Y.Y.

15.6.2 *Rounded Corners*—Section Y.Y.

15.6.3 *Rounded Edges*—Section Y.Y.

15.6.4 *Full-Rounded Edges*—Table XX.

16. Workmanship, Finish, and Appearance[B05]

16.1 The product shall be free of defects, but blemishes of a nature that do not interfere with the intended application are acceptable.

17. Sampling[B05]

17.1 Refer to sampling section in Specification B248/B248M (or Specification B249/B249M, etc.). {Note—List any sampling requirements different from or in addition to the Sampling section in the applicable General Requirements Specification.}

18. Number of Tests and Retests[B05]

18.1 *Test:*

18.1.1 *Chemical Analysis*—Chemical composition shall be determined in accordance with the element mean of the results from at least two replicate analyses of the sample(s).

18.2 *Other Tests:*

18.2.1 *Electrical Resistivity*—Results shall be reported as the average obtained from at least two test specimens, each taken from a separate test piece where possible.

18.2.2 *Hydrogen Embrittlement Test and Microscopical Examination*—All specimens tested must meet the requirements of the specification.

18.3 *Retest:*

18.3.1 When requested by the manufacturer or supplier, a retest shall be permitted when results of tests obtained by the purchaser fail to conform to the requirements of the product specification.

18.3.2 The retest shall be as directed in the product specification for the initial test, except the number of test specimens shall be twice that normally required for the specified test.

18.3.3 All test specimens shall conform to the product specification requirement(s) in retest. Failure to conform shall be cause for rejection.

19. Specimen Preparation[B05]

19.1 *Flattening Test*—{Note—This is an example of a test that could appear in this section; the flattening test is not a required section.}

19.1.1 A test specimen shall conform to the appropriate requirements of the Sampling and Test Specimen Preparation Section of Test Method B968/B968M.

19.2 *Tensile Strength Test*—{Note—This is an example of the wording for the direction a tensile strength specimen for a wrought copper and copper alloy product that could appear in this section; the tensile strength test is not a required section.}

19.2.1 The test specimens shall be taken so the longitudinal axis of the specimen is parallel to the direction of rolling for rolled (or flat) products, or final working for drawn or extruded products.

20. Test Methods[B05] {Note—Test methods that are detailed in specifications shall contain all of the mandatory headings shown in Part A, Section A1, of the Blue Book.}

20.1 *Chemical Analyses:*

20.1.1 In cases of disagreement, test methods for chemical analysis shall be subject to agreement between the manufacturer or supplier and the purchaser.

Note X—The following table includes published test methods, which may no longer be viable, for reference.

20.1.2 Test method(s) to be followed for the determination of element(s) resulting from contractual or purchase order agreement shall be as agreed upon between the manufacturer or supplier and purchaser.

20.2 *Other Tests:*

20.2.1 The product furnished shall conform to specified requirements when subjected to test in accordance with the following table:

Test	Method
Grain Size	E112
Electrical Resistivity	B193
Tensile Strength	E8/E8M
Expansion	B153
Hardness	E18
Flattening	B968/B968M
Eddy Current	E243

20.2.2 *Grain Size*—In case of dispute, the intercept method of Test Methods E112 shall be followed.

20.2.3 *Electrical Resistivity*—The limit of measurement uncertainty for Test Method B193 shall be ±0.15 % when followed as a referee method.

20.2.4 *Yield Strength*—The yield strength shall be determined by the extension-under-load method of Test Methods E8/E8M. When test results are obtained from both full-size and machined specimens, and they differ, the test results from the full-size specimens shall prevail.

20.2.5 {Note—The following statement should be used when there are no recognized test method(s) available.}

X.X.1 Since no recognized test method is known to be published, the determination of [specify the element or property] shall be subject to agreement between the manufacturer and the purchaser.

21. Significance of Numerical Limits[B05]

21.1 For the purpose of determining compliance with the specified limits for requirements of the properties listed in the following table and for dimensional tolerances, an observed value or a calculated value shall be rounded as indicated in accordance with the rounding method of Practice E29:

Property	Rounded Unit for Observed or Calculated Value
Chemical Composition	Nearest unit in the last right-hand significant digit used in expressing the limiting value
Hardness	
Electrical Resistivity Electrical Conductivity	
Tensile Strength Yield Strength	Nearest ksi [5 MPa]
Elongation	Nearest 1 %
Grain Size	
Under 0.060 mm	Nearest multiple of 0.005 mm
0.060 mm and over	Nearest 0.01 mm

22. Inspection[B05]

22.1 The manufacturer, or supplier, shall inspect and make tests necessary to verify the furnished product conforms to specification requirements.

22.2 Source inspection of the product by the purchaser may be agreed upon between the manufacturer, or supplier, and the purchaser as part of the purchase order. In such case, the nature of the facilities needed to satisfy the inspector, representing the purchaser, that the product is being furnished in accordance with the specification, shall be included in the agreement. All

testing and inspection shall be conducted so as not to interfere unnecessarily with the operation of the works.

22.3 When mutually agreed upon, the manufacturer, or supplier, and the purchaser shall conduct the final inspection simultaneously.

23. Rejection and Rehearing [B05]

23.1 *Rejection:*

23.1.1 Product that fails to conform to the specification requirements when tested by the purchaser or purchaser's agent shall be subject to rejection.

23.1.2 Rejection shall be reported to the manufacturer or supplier promptly. In addition, a written notification of rejection shall follow.

23.1.3 In case of dissatisfaction with results of the test upon which rejection is based, the manufacturer, or supplier, shall have the option to make claim for a rehearing.

23.2 *Rehearing:*

23.2.1 As a result of product rejection, the manufacturer, or supplier, shall have the option to make claim for a retest to be conducted by the manufacturer, or supplier, and the purchaser. Samples of the rejected product shall be taken in accordance with the product specification and subjected to test by both parties using the test method(s) specified in the product specification, or alternately, upon agreement of both parties, an independent laboratory may be selected for the test(s) using the test method(s) specified in the product specification.

24. Certification[B05]

24.1 When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each lot have been tested and inspected as directed in this specification and requirements have been met.

24.2 When specified in the purchase order or contract that product is purchased for ASME Boiler and Pressure Vessel Code applications, certification to this specification is mandatory.

25. Test Report[B05]

25.1 When specified in the contract or purchase order, a report of test results shall be furnished.

26. Product Marking {Note—This is an example of how this section is used.}

26.1 The name or trademark of the manufacturer and the mark indicative of Type G tube shall be permanently marked (incised) on the tube at intervals not greater than 18 in. (460 mm). Straight length tube in H58 (drawn general purpose) temper shall be further identified throughout the length by a continuous yellow colored stripe, symbol, or logo not less than 3⁄16 in. (4.75 mm) in height, including a legend repeated at intervals not greater than 36 in (910 mm). The legend shall include the type of tube, name, or trademark of the manufacturer, or both, and the country of origin. Other information may be included at the option of the manufacturer.

26.1.1 The yellow color marking is not applicable for annealed tube in straight lengths or coils.

27. Packaging and Package Marking[B05]

27.1 *Packaging:*

27.1.1 The product shall be separated by size, composition, and temper, and prepared for shipment by common carrier, in such a manner to afford protection from the normal hazards of transportation.

27.2 *Package Marking:*

27.2.1 Each package shall be legibly marked with the metal or alloy designation, temper, size, shape, gross and net weight, and name of supplier. Upon agreement between the purchaser and supplier, the purchase order number shall be indicated on each package or on the shipping documents.

27.2.2 When specified in the contract or purchase order, the product specification number shall be shown.

28. Keywords[ASTM]

28.1 {Note—It is advisable to include the alloys specified in the standard.}

SUMMARY OF CHANGES[B05]

Committee B05 has identified the principal changes to this specification that have been incorporated since the {identify the year of last issue, i.e. 2006} issue as follows:

(1) Scope section reworded to more clearly state purpose.

(2) Test Methods section revised to identify individual test methods for determination of chemical composition in case of dispute.

SUPPLEMENTARY REQUIREMENTS

S1. Scope

S1.1 The following supplementary requirements shall apply only when specified by the purchaser in the inquiry, contract or order for agencies of the U.S. government.

S2. Referenced Documents

S2.1 The following documents of the issue in effect on date of material purchase form a part of this specification to the extent referenced herein:

S2.1.1 *ASTM Standard:*

B900, Practice for Packaging of Copper and Copper Alloy Mill Products for U.S. Government Agencies

S2.1.2 *Federal Standard:*[8]

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

S2.1.3 *Military Standards:*[8]

MIL-STD-129 Marking for Shipment and Storage

MIL-STD-2073-1E Standard Practice for Military Packaging

S2.1.4 *Civil Agencies:*[9]

AMS-STD-185 Identification Marking of Copper and Copper-Base Alloy Mill Products

S3. Quality Assurance

S3.1 *Responsibility for Inspection:*

S3.1.1 Unless otherwise specified in the contract or purchase order, the manufacturer is responsible for the performance of all inspection and test requirements specified. Except as otherwise specified in the contract or purchase order, the manufacturer may use his own or any other suitable facilities for the performance of the inspection and test requirements unless disapproved by the purchaser at the time the order is placed. The purchaser shall have the right to perform any of the inspections or tests set forth when such inspections and tests are deemed necessary to assure that the material conforms to prescribed requirements.

S4. Identification Marking

S4.1 All material shall be properly marked for identification in accordance with AMS-STD-185 except that the ASTM specification number and the alloy number shall be used.

S5. Preparation for Delivery

S5.1 *Preservation, Packaging, Packing:*

S5.1.1 *Military Agencies*—The material shall be separated by size, composition, grade or class and shall be preserved and packaged, Level A or C, packed Level A, B, or C as specified in the contract or purchase order, in accordance with the requirements of Practice B900.

S5.1.2 *Military Agencies*—The requirements of MIL-STD-2073-1E shall be referenced for definitions of the various levels of packaging protection.

S5.2 *Marking:*

S5.2.1 *Military Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with MIL-STD-129.

S5.2.2 *Federal Agencies*—In addition to any special marking required by the contract or purchase order, marking for shipment shall be in accordance with Fed. Std. No. 123.

[8] Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.

[9] Available from SAE International (SAE), 400 Commonwealth Dr., Warrendale, PA 15096, http://www.sae.org.

ANNEX
(Mandatory Information)
A1.

A1.1

A1.1.1

APPENDIX
(Nonmandatory Information)
X1.

X1.1

X1.1.1

REFERENCES

(1)

(2)

APPENDIX

(Nonmandatory Information)

X1. THE EDITORIAL REVIEW PROCESS

X1.1 The Editorial subcommittee B05.91 is an administrative subcommittee that provides the service of editorial review to Committee B05 task groups in preparing draft documents for ballot. Items subject to editorial review prior to ballot are new documents, major revisions of standards (such as five-year reviews), and standards for reapproval without change.

X1.2 It is highly recommended that the B05 electronic template, available on the committee B05 Main Page under Additional Information, be used as a starting point in preparing drafts of new standards or in major revisions. The template contains the major items of B05 wording and language for many sections.

X1.3 When a new document or a major revision is submitted for editorial review, it is requested that an electronic copy of the draft be submitted to the chairman of the Editorial Subcommittee for distribution and review. The task group will be returned an electronic copy with all the editorial comments. A hard copy will be provided if desired.

X1.4 All documents submitted for editorial review are to be identified by WK number draft number and date so they can be properly tracked. How a draft revision is prepared must be determined on an individual basis since the requirements are unlikely to be the same for any two documents. However, revisions shall always be based upon the most recent issue of the standard, which is available from ASTM in electronic format once a Work Item is registered or upon the request of the task group chairman.

X1.5 In the case of standards to be balloted for reapproval without change, the Editorial Subcommittee Chairman need only be notified of intent and provided a copy of the latest issue of the standard.

X1.6 The editorial review shall consist of, but not limited to, checking for:

Required sections and content,
Clarity of statements,
Redundancy,
Errors in grammar and spelling,
Open-ended statements, and
Misuse of notes in text.

X1.6.1 Recommendations and comments may be offered concerning technical content; however, the technical correctness of the submitted document is the responsibility of the subcommittee with jurisdiction.

X1.7 Subcommittee and Task Group members may call upon ASTM editors at Committee Weeks for editorial help, and throughout the year, they can call upon the B05 Editor for editorial assistance.

SUMMARY OF CHANGES

Committee B05 has identified the location of selected changes to this standard since the last issue (B950 – 22) that may impact the use of this standard. (Approved Oct. 1, 2023.)

(1) The Annex electronic template document was revised to add a note guiding the user to the usage of alloy designations other than UNS Numbers.

Committee B05 has identified the principal changes to this standard guide that have been incorporated since the 2021$^{\varepsilon 1}$ issue as follows:

(1) Revised Sections 6.21, 19.2 and 19.2.1 to include an explanation of the correct direction a tensile specimen is to be made.

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