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Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip¹

This standard is issued under the fixed designation B 127; 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 reappraisal. A superscript epsilon (ε) indicates an editorial change since the last revision or reappraisal.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This specification² covers rolled nickel-copper alloy (UNS N04400)* plate, sheet, and strip.

1.2 The values stated in inch-pound units are to be regarded as the standard. The other values given are for information only.

1.3 *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 become familiar with all hazards including those identified in the appropriate Material Safety Data Sheet for this product/material as provided by the manufacturer, to establish appropriate safety and health practices, and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:³

- B 906** Specification for General Requirements for Flat-Rolled Nickel and Nickel Alloys Plate, Sheet, and Strip
- E 140** Hardness Conversion Tables for Metals
- F 155** Test Method for Temper of Strip and Sheet Metals for Electronic Devices (Spring-Back Method)⁴

2.2 Federal Standards:⁵

- Fed. Std. No. 102** Preservation, Packaging, and Packing Levels
- Fed. Std. No. 123** Marking for Shipment (Civil Agencies)
- Fed. Std. No. 182** Continuous Identification Marking of Nickel and Nickel-Base Alloys

2.3 Military Standards:⁵

- MIL-STD-129** Marking for Shipment and Storage
- MIL-STD-271** Nondestructive Testing Requirements for Metals

3. Terminology

3.1 *Descriptions of Terms Specific to This Standard*—The terms given in **Table 1** shall apply.

TABLE 1 Product Description

| Product | Thickness, in. (mm) |
|--------------------------------|------------------------------------|
| Hot-rolled plate ^A | 3/16 and over |
| Hot-rolled sheet ^A | 0.018 to 0.250 (0.46 to 6.4), incl |
| Cold-rolled sheet ^B | 0.018 to 0.250 (0.46 to 6.4), incl |
| Cold-rolled strip ^B | 0.005 to 0.250 (0.13 to 6.4), incl |

^A Material 3/16 to 1/4 in. (4.8 to 6.4 mm), incl, in thickness may be furnished as sheet or plate provided the material meets the specification requirements for the condition ordered.

^B Material under 48 in. (1219 mm) in width may be furnished as sheet or strip provided the material meets the specification requirements for the condition ordered.

4. General Requirements

4.1 Material furnished under this specification shall conform to the applicable requirements of Specification **B 906** unless otherwise provided herein.

5. Ordering Information

5.1 It is the responsibility of the purchaser to specify all requirements that are necessary for material ordered under this specification. Examples of such requirements include, but are not limited to the following:

- 5.1.1 *Alloy*—Name or UNS number (see **Table 2**).
- 5.1.2 *ASTM designation*, including year of issue.
- 5.1.3 *Condition*—See **7.1**, **7.2**, and **Appendix X1**.
- 5.1.4 *Finish*—See **Appendix X1**.
- 5.1.5 *Dimensions*—Thickness, width, and length.
- 5.1.6 *Quantity*.
- 5.1.7 *Optional Requirements*:

5.1.7.1 *Sheet and Strip*—Whether to be furnished in coil, in cut straight lengths, or in random straight lengths.

5.1.7.2 *Strip*—Whether to be furnished with commercial slit edge, square edge, or round edge.

¹ This specification is under the jurisdiction of ASTM Committee B02 on Nonferrous Metals and Alloys and is the direct responsibility of Subcommittee B02.07 on Refined Nickel and Cobalt and Their Alloys.

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² For ASME Boiler and Pressure Vessel Code applications, see related Specification SB-127 in Section II of that code.

* New designation established in accordance with ASTM E 527 and SAE J1086, Practice for Numbering Metals and Alloys (UNS).

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 Withdrawn.

⁵ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098

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

TABLE 2 Chemical Requirements

| Element | Composition, % | |
|--------------------------|----------------|--|
| | Alloy N04400 | |
| Nickel, min ^A | 63.0 | |
| Copper | 28.0 to 34.0 | |
| Iron, max | 2.5 | |
| Manganese, max | 2.0 | |
| Carbon, max | 0.3 | |
| Silicon, max | 0.5 | |
| Sulfur, max | 0.024 | |

^A Element shall be determined arithmetically by difference.

5.1.7.3 *Plate*—Whether to be furnished specially flattened (7.2); also how plate is to be cut (8.2.1 and 8.3.2).

5.1.8 *Fabrication Details*—Not mandatory but helpful to the manufacturer.

5.1.8.1 *Welding or Brazing*—Process to be employed.

5.1.8.2 *Plate*—Whether material is to be hot-formed.

5.1.9 *Certification*—State if certification or a report of test results is required (see Specification B 906, section on Material Test Report and Certification).

5.1.10 *Samples for Product (Check) Analysis*—Whether samples for product (check) analysis should be furnished (see Specification B 906, section on Sampling).

5.1.11 *Purchaser Inspection*—If the purchaser wishes to witness the tests or inspection of material at the place of manufacture, the purchase order must so state indicating which tests or inspections are to be witnessed (see Specification B 906, section on Inspection).

6. Chemical Composition

6.1 The material shall conform to the requirements as to chemical composition prescribed in Table 2.

6.2 If a product (check) analysis is performed by the purchaser, the material shall conform to the product (check) analysis variations prescribed in Specification B 906.

7. Mechanical and Other Requirements

7.1 *Mechanical Properties*—The material shall conform to the requirements for mechanical properties prescribed in Table 3.

7.2 *Deep-Drawing and Spinning Quality Sheet and Strip*—The material shall conform to the requirements for grain size and hardness properties prescribed in Table 4.

7.2.1 The mechanical properties of Table 3 do not apply to deep-drawing and spinning quality sheet and strip.

8. Dimensions and Permissible Variations

8.1 *Weight*:

8.1.1 For calculations of mass or weight a density of 0.319 lb/in.³ (8.83 g/cm³) shall be used.

8.2 *Thickness*:

8.2.1 *Plate*—For plate up to 2 in. (50.8 mm) inclusive, in thickness, the permissible variation, under the specified thickness and permissible excess in overweight shall not exceed the amounts prescribed in Specification B 906, see Permissible Variations in Thickness and Overweight of Rectangular Plates Table.

8.2.2 *Plate*—For plate over 2 in. (50.8 mm) in thickness, the permissible variations over the specified thickness shall not

TABLE 3 Mechanical Properties for Plate, Sheet, and Strip (All Thicknesses and Sizes Unless Otherwise Indicated)

| Condition (Temper) | Tensile Strength, min, psi (MPa) | Yield Strength ^A (0.2 % offset), min, psi (MPa) | Elongation in 2 in. or 50 mm, or 4D, min, % | Rockwell Hardness (B Scale) ^{B,C} |
|--------------------------|--|--|---|--|
| Hot-Rolled Plate | | | | |
| Annealed | 70 000 (485) | 28 000 (195) | 35 | ... |
| As-rolled ^{D,E} | 75 000 (515) | 40 000 (275) | 25 | ... |
| Hot-Rolled Sheet | | | | |
| Annealed | 70 000 (485) | 28 000 (195) | 35 | ... |
| Cold-Rolled Sheet | | | | |
| Annealed | 70 000 to 85 000 (485 to 585) | 28 000 (195) | 35 | ... |
| Quarter-hard | ... | ... | ... | 73 to 83 |
| Half-hard | ... | ... | ... | 82 to 90 |
| Hard | 100 000 (690) | 90 000 (620) | 2 | ... |
| Cold-Rolled Strip | | | | |
| Annealed | 70 000 to 85 000 (485 to 585) ^F | 28 000 (195) | 35 ^F | ... |
| Skin hard | ... | ... | ... | 68 to 73 |
| Quarter-hard | ... | ... | ... | 73 to 83 |
| Half-hard | ... | ... | ... | 82 to 90 |
| Three-quarter-hard | ... | ... | ... | 89 to 94 |
| Hard | 100 000 (690) ^F | 90 000 (620) | 2 ^F | ... |
| Spring temper | ... | ... | ... | 98 min |

^A Yield strength requirements do not apply to material under 0.020 in. (0.51 mm) in thickness.

^B For Rockwell or equivalent hardness conversions see Hardness Conversion Tables E 140.

^C Caution should be observed in using the Rockwell test on thin material, as the results may be affected by specimen thickness. For thicknesses under 0.050 in. (1.3 mm), the use of the Rockwell superficial or the Vickers hardness test is suggested.

^D As-rolled plate may be given a stress-relieving heat treatment subsequent to final rolling.

^E As-rolled plate specified “suitable for hot forming” shall be furnished from heats of known good hot-malleability characteristics (see X1.2.2). There are no applicable tensile or hardness requirements for such material.

^F Not applicable for thickness under 0.010 in. (0.25 mm).

TABLE 4 Grain Size and Hardness for Cold-Rolled, Deep-Drawing, and Spinning Quality Sheet and Strip

| Thickness, in. (mm) | Calculated Diameter of Average Grain Section, max | | Corresponding ASTM Micro-Grain Size No. | Rockwell B ^{A,B} Hardness, max |
|---|---|--------|---|---|
| | mm | in. | | |
| Sheet (56 in. (1420 mm) Wide and Under) | | | | |
| 0.050 (1.3) and under | 0.075 | 0.0030 | 4.5 | 76 |
| Over 0.050 to 0.250 (1.3 to 6.4), incl | 0.110 | 0.0043 | 3.5 | 76 |
| Strip (12 in. (305 mm) Wide and Under) ^C | | | | |
| 0.005 ^D to 0.015 (0.13 to 0.38), incl | 0.022 | 0.0009 | 8 ^E | 76 ^E |
| Over 0.015 to 0.024 (0.38 to 0.61), incl | 0.060 | 0.0024 | 5.5 | 76 |
| Over 0.024 to 0.125 (0.61 to 3.2), incl | 0.075 | 0.0030 | 4.5 | 76 |

^A For Rockwell or equivalent hardness conversions see Hardness Conversion Tables E 140.

^B Caution should be observed in using the Rockwell test on thin material as the results may be affected by specimen thickness. For thicknesses under 0.050 in. (1.3 mm), the use of the Rockwell superficial or the Vickers hardness test is suggested.

^C Sheet requirements in Table 4 apply to strip thicknesses over 0.125 in. (3.2 mm), and for all thicknesses of strip over 12 in. (305 mm) in width.

^D For ductility evaluations for strip under 0.005 in. (0.13 mm) in thickness, the spring-back test such as described in Test Method F 155 is often used and the manufacturer should be consulted.

^E Accurate grain size and hardness determinations are difficult to make on strip under 0.005 in. (0.13 mm) in thickness and are not recommended.

exceed the amounts prescribed in Specification B 906, see Permissible Variations in Thickness for Rectangular Plates Over 2 in. (51 mm) in Thickness Table.

8.2.3 *Sheet and Strip*—The permissible variations in thickness of sheet and strip shall be prescribed in Specification B 906, see Permissible Variations in Thickness of Sheet and Strip Table. The thickness of strip and sheet shall be measured with the micrometer spindle $\frac{3}{8}$ in. (9.5 mm) or more from either edge for material 1 in. (25.4 mm) or over in width and at any place on the strip under 1 in. in width.

8.3 Width or Diameter:

8.3.1 *Plate*—The permissible variations in width of rectangular plates and diameter of circular plates shall be as prescribed in Specification B 906, see Permissible Variations in Width of Sheared, Plasma Torch-Cut, and Abrasive-Cut Rectangular Plate Table and Permissible Variations in Diameter for Circular Plates Table.

8.3.2 *Sheet and Strip*—The permissible variations in width for sheet and strip shall be as prescribed in Specification B 906, see Permissible Variations in Width of Sheet and Strip Table.

8.4 Length:

8.4.1 Sheet and strip of all sizes may be ordered to cut lengths in which case, a variation of $\frac{1}{8}$ in. (3.2 mm) over the specified length shall be permitted.

8.4.2 Permissible variations in length of rectangular plate shall be as prescribed in Specification B 906, see Permissible Variations in Length of Sheared, Plasma Torch-Cut, and Abrasive-Cut Rectangular Plate Table.

8.5 Straightness:

8.5.1 The edgewise curvature (depth of chord) of flat sheet, strip, and plate shall not exceed 0.05 in. multiplied by the length in feet (0.04 mm multiplied by the length in centimetres).

8.5.2 Straightness for coiled material is subject to agreement between the manufacturer and the purchaser.

8.6 Edges:

8.6.1 When finished edges of strip are specified in the contract or purchase order, the following descriptions shall apply:

8.6.1.1 Square-edge strip shall be supplied with finished edges, with sharp, square corners, and without bevel or rounding.

8.6.1.2 Round-edge strip shall be supplied with finished edges, semicircular in form, and the diameter of the circle forming the edge being equal to the strip thickness.

8.6.1.3 When no description of any required form of strip edge is given, it shall be understood that edges such as those resulting from slitting or shearing will be acceptable.

8.6.1.4 Sheet shall have sheared or slit edges.

8.6.1.5 Plate shall have sheared or cut (machined, abrasive-cut, powder-cut, or inert-arc-cut) edges, as specified.

8.7 *Squareness (Sheet)*—For sheets of all thicknesses, the angle between adjacent sides shall be $90 \pm 0.15^\circ$ ($\frac{1}{16}$ in. in 24 in.) (1.6 mm in 610 mm).

8.8 Flatness:

8.8.1 There shall be no flatness requirements for “deep drawing quality,” “spinning quality,” or “as-rolled,” sheet and strip (see X1.4).

8.8.2 Standard flatness tolerances for plate shall conform to the requirements prescribed in Table 5. “Specially flattened” plate when so specified, shall have permissible variations in flatness as agreed upon between the manufacturer and the purchaser.

9. Workmanship, Finish, and Appearance

9.1 The material shall be uniform in quality and temper, smooth, commercially straight or flat, and free of injurious imperfections.

9.2 *Sheet, Strip, and Plate*—Sheet, strip, and plate supplied in the conditions and finishes as listed in the appendix may be ground or machined to remove surface imperfections, provided such removal does not reduce the material below the minimum specified dimensions. Surface eliminated depressions shall be faired smoothly into the surrounding material. The removal of a surface imperfection shall be verified by the method originally used to detect the imperfection.

10. Product Marking

10.1 Each plate, sheet, or strip shall be marked on one face with the specification number, alloy, condition (temper), heat number, manufacturer’s identification, and size. The markings shall not have a deleterious effect on the material or its performance and shall be sufficiently stable to withstand normal handling.

TABLE 5 Permissible Variations from Flatness of Rectangular, Circular, and Sketch Plates

NOTE 1—Permissible variations apply to plates up to 12 ft (366 cm) in length, or to any 12 ft or longer plates.

NOTE 2—If the longer dimension is under 36 in. (914 mm), the permissible variation is not greater than ¼ in. (6.4 mm).

NOTE 3—The shorter dimension specified is considered the width, and the permissible variation in flatness across the width does not exceed the tabular amount of that dimension.†

NOTE 4—The maximum deviation from a flat surface does not customarily exceed the tabular tolerance for the longer dimension specified.

| Specified Thickness | Permissible Variations from a Flat Surface for Thickness and Widths Given, in. (mm) | | | | | | | | |
|---------------------|---|--|--|--|--|---|--|--|---------------------------|
| | To 48 (1220), excl | 48 to 60 (1220 to 1520), excl | 60 to 72 (1520 to 1830), excl | 72 to 84 (1830 to 2130), excl | 84 to 96 (2130 to 2440), excl | 96 to 108 (2440 to 2740), excl | 108 to 120 (2740 to 3050), excl | 120 to 144 (3050 to 3660), excl | 144 (3660) and over |
| Inches | | | | | | | | | |
| 3/16 to 1/4 , excl | 3/4 | 1 1/16 | 1 1/4 | 1 3/8 | 1 5/8 | 1 5/8 | ... | ... | ... |
| 1/4 to 3/8 , excl | 1 1/16 | 3/4 | 1 5/16 | 1 1/8 | 1 3/8 | 1 7/16 | 1 9/16 | 1 7/8 | ... |
| 3/8 to 1/2 , excl | 1/2 | 9/16 | 1 1/16 | 3/4 | 1 5/16 | 1 1/4 | 1 1/4 | 1 7/16 | 1 3/4 |
| 1/2 to 3/4 , excl | 1/2 | 9/16 | 5/8 | 1 3/16 | 1 1/8 | 1 1/8 | 1 1/8 | 1 3/8 | ... |
| 3/4 to 1 , excl | 9/16 | 5/8 | 5/8 | 5/8 | 3/4 | 1 3/16 | 1 5/16 | 1 | 1 1/8 |
| 1 to 2 , excl | 1/2 | 9/16 | 9/16 | 9/16 | 1 1/16 | 1 1/16 | 1 1/16 | 3/4 | 1 |
| 2 to 4 , incl | 1/4 | 5/16 | 3/8 | 7/16 | 1/2 | 9/16 | 5/8 | 3/4 | 7/8 |
| Millimetres | | | | | | | | | |
| 4.8 to 6.4, excl | 19.0 | 27.0 | 31.7 | 34.9 | 41.3 | 41.3 | ... | ... | ... |
| 6.4 to 9.5, excl | 17.5 | 19.0 | 23.8 | 28.6 | 35.0 | 36.5 | 39.7 | 47.6 | ... |
| 9.5 to 12.7, excl | 12.7 | 14.3 | 17.5 | 19.0 | 23.8 | 28.6 | 31.7 | 35.0 | 44.4 |
| 12.7 to 19.0, excl | 12.7 | 14.3 | 15.9 | 15.9 | 20.6 | 28.6 | 28.6 | 28.6 | 34.9 |
| 19.0 to 25.4, excl | 12.7 | 14.3 | 15.9 | 15.9 | 19.0 | 20.6 | 23.8 | 25.4 | 28.6 |
| 25.4 to 50.8, excl | 12.7 | 14.3 | 14.3 | 14.3 | 17.5 | 17.5 | 17.5 | 19.0 | 25.4 |
| 50.8 to 101.6, incl | 6.4 | 7.9 | 9.5 | 11.1 | 12.7 | 14.3 | 15.9 | 19.0 | 22.2 |

† Editorially corrected.

10.2 When applicable, each bundle or shipping container shall be marked with the name of the material, condition (temper), this specification number, alloy, size, consignor and consignee address, contract or order number, and such other information as may be defined in the contract or order.

11. Keywords

11.1 N04400; plate; sheet; strip

SUPPLEMENTARY REQUIREMENTS

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.

S1. Referenced Documents

S1.1 The following documents of the issue in effect on date of material purchased form a part of this specification to the extent referenced herein. Federal Standard No. 102, No. 123, No. 182, and Military Standard **MIL-STD-129**.

S2. Chemical Composition

S2.1 The material shall conform to the composition limits specified in **Table 2** except as specified in **Table S2.1**

TABLE S2.1 Chemical Requirements

| Element | Composition Limits, % |
|-------------|-----------------------|
| Carbon | 0.2 max. |
| Sulfur | 0.015 max. |
| Aluminum | 0.5 max. |
| Lead | 0.006 max. |
| Tin | 0.006 max. |
| Zinc | 0.02 max. |
| Phosphorous | 0.02 max. |

S3. Mechanical Properties

S3.1 Mechanical property requirements for quarter hard cold-rolled strip ¼ in. thick and less shall be as specified in **Table S3.1**.

S4. Nondestructive Tests

S4.1 When specified by the purchaser, each piece of each lot shall be inspected. The purchaser shall specify if one or both tests are required.

S4.2 *Ultrasonic Tests:*

S4.2.1 *General Requirements:*

TABLE S3.1 Mechanical Properties for Quarter-Hard Cold Rolled Strip

| | |
|--|-------------------------|
| Tensile Strength, min, psi (Mpa) | 78 000–85 000 (538–586) |
| Yield Strength, min, psi (Mpa) (0.2% offset) | 45,000 (310) |
| Elongation in 2 in., 50 mm, or 4D, min, % | 20 |

S4.2.1.1 Ultrasonic testing shall be performed in accordance with **MIL-STD-271** as modified by the requirements specified herein.

S4.2.1.2 Acoustic compatibility between the production material and the calibration standard material shall be within 75 %. If the acoustic compatibility is within 25 %, no gain compensation is required for the examination. If acoustic compatibility difference is between 25 % and 75 %, a change in the gain or dB controls shall be accomplished to compensate for the differences in acoustic compatibility. This method cannot be used if the ultrasonic noise level exceeds 50 % of the rejection value.

S4.2.2 Calibration:

S4.2.2.1 *Longitudinal Wave*—The longitudinal wave test shall be calibrated on a flat-bottomed reference hole of a given diameter in accordance with **Table S4.1** for specified material thickness drilled either into the piece to be tested or into a separate defect-free specimen of the same size (within $\pm 1/8$ in. (3.18 mm)), shape, material, and condition, or acoustically similar material. Holes are to be drilled to midsection and the bottom of the hole shall be parallel to the entrant surface. The ultrasonic test instrument shall be adjusted so that the response from the reference hole shall not be less than 25 % and not more than 75 % of screen height.

S4.2.2.2 *Recalibration*—During quality conformance inspection, any realignment of the search unit that will cause a decrease in the calibrated sensitivity and resolution, or both, or any change in search unit, couplant, instrument settings, or scanning speed from that used for calibration shall require recalibration. Recalibration shall be performed at least once per 8 h shift.

S4.2.3 *Procedure*—Paragraph S4.2.3.1 describes the requirements for plate. Sheet and strip shall be excluded from these requirements.

S4.2.3.1 *Plate*—Plate shall be inspected by the longitudinal wave technique using the contact or immersion method. For contact, the scanning shall be on a 24 in. grid and one diagonal in each grid. For immersion, the scanning shall be continuous on a 12 in. grid. For either method, the search shall be expanded to determine the full extent of any rejectable indication if the material is to be offered on a waiver basis.

S4.2.4 Acceptance Criteria:

S4.2.4.1 *Longitudinal Wave*—Any material that produces indications equal to or larger than the response from the reference hole, or that produces a complete loss of back reflection shall be rejected. Material shall be tested using a square, rectangular, or circular transducer having an effective area of one square inch or less, but no dimension shall be smaller than the diameter of the reference hole. In the event of

disagreement on the degree of back reflection loss, it shall be determined by the contact method using a 1 to 1- $1/8$ in. (25.4 to 28.6 mm) diameter transducer or one whose area falls within this range.

S4.2.4.2 *Reference Notch Removal*—If reference notches or flat-bottomed holes are made in the material to be tested, they shall be so located that their subsequent removal will not impair the suitability of the material for its intended use.

S4.3 Liquid Penetrant Inspection:

S4.3.1 *Procedure*—Liquid penetrant inspection shall be in accordance with **MIL-STD-271**.

S4.3.2 *Surface Requirements*—The surface produced by hot working is not suitable for liquid penetrant testing. Therefore, liquid penetrant testing will not be applicable to products ordered with a hot finished surface.

S4.3.3 *Acceptance Criteria*—Linear defects revealed by liquid penetrant inspection shall be explored by grinding or other suitable means. Depth of defects shall not exceed the dimensional tolerance of the material.

S5. Quality Assurance

S2.1 *Responsibility for Inspection*—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.

S6. Identification Marking

S3.1 All material shall be properly marked for identification in accordance with **Fed. Std. No. 182** except that the ASTM specification number and the alloy number shall be used.

S7. Preparation for Delivery

S4.1 Preservation, Packaging, Packing:

S4.1.1 *Military Agencies*—The material shall be separated by size, composition, grade, or class and shall be preserved and packaged, Level A or C, or packed, Level A, B, or C as specified in the contract or purchase order.

S4.1.2 *Civil Agencies*—The requirements of **Fed. Std. No. 102** shall be referenced for definitions of the various levels of packaging protection.

S4.2 Marking:

S4.2.1 *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**.

S4.2.2 *Civil 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**.

TABLE S4.1 Ultrasonic Testing Reference Hole for Plate

| Material Thickness, in. (mm) | Hole Diameter, in. (mm) |
|------------------------------|-------------------------|
| Up to and including 4 (102) | 1/4 (6.4) |
| Over 4 (102) | 1/2 (12.7) |

APPENDIX**(Nonmandatory Information)****X1. CONDITIONS AND FINISHES****X1.1 Scope**

X1.1.1 This appendix lists the conditions and finishes in which plate, sheet, and strip are normally supplied. These are subject to change and the manufacturer should be consulted for the latest information available.

X1.2 Plate, Hot-Rolled

X1.2.1 *Annealed*—Soft with an oxide surface and suitable for heavy cold forming. Available with a descaled surface, when so specified.

X1.2.2 *As-Rolled*—With an oxide surface. Available with a descaled surface, when so specified. Suitable for flat work, mild forming, or tube sheets. When intended for tube sheets, specify that plates are to be specially flattened. When intended for hot forming, this should be indicated on the purchase order so that the manufacturer may select appropriate material.

X1.3 Plate, Cold-Rolled

X1.3.1 *Annealed*—Soft with an oxide surface; available with a descaled surface when so specified.

X1.4 Sheet, Hot-Rolled

X1.4.1 *Annealed, and Pickled*—Soft with a pickled matte finish. Properties similar to **X1.5.1** but with broader thickness tolerances. Not suggested for applications where the finish of a cold-rolled sheet is considered essential, or for deep drawing or spinning.

X1.5 Sheet and Strip, Cold-Rolled

X1.5.1 *Annealed*—Soft with a pickled or bright annealed finish.

X1.5.2 *Deep-Drawing or Spinning Quality*—Similar to **X1.5.1**, except furnished to controlled hardness and grain size and lightly leveled.

X1.5.3 *Skin Hard*—Similar to **X1.5.1** but given a light cold reduction to hardness range shown in **Table 3**.

X1.5.4 *Quarter-Hard*—Cold rolled to the hardness range indicated in **Table 3**, bright finish. Out-of-flatness must be expected and will vary with temper and thickness.

X1.5.5 *Half-Hard*—Cold rolled to the hardness range indicated in **Table 3**, bright finish. Out-of-flatness must be expected and will vary with temper and thickness.

X1.5.6 *Three-Quarter Hard*—Cold rolled to the hardness range indicated in **Table 3**, bright finish. Out-of-flatness must be expected and will vary with temper and thickness.

X1.5.7 *Hard*—Cold rolled to the tensile requirements indicated in **Table 3**, bright finish. Out-of-flatness must be expected and will vary with temper and thickness.

X1.5.8 *Spring Temper*—Cold rolled to the minimum hardness indicated in **Table 3**, bright finish. Out-of-flatness must be expected and will vary with temper and thickness.

SUMMARY OF CHANGES

Committee B02 has identified the location of selected changes to this standard since the last issue (B 127 – 98) that may impact the use of this standard.

(1) Added safety caveat to Scope.

(2) General Requirements updated to Specification **B 906**.

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