

METRIC

MIL-S-22664B(SH)

15 March 1988

SUPERSEDING

MIL-S-22664A(SHIPS)

1 October 1963

(See 6.7)

MILITARY SPECIFICATION

STEEL, STRUCTURAL SHAPES ALLOY, HIGH YIELD STRENGTH (HY-80 AND HY-100) (METRIC)

This specification is approved for use within the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers HY-80 and HY-100 alloy steel rolled and extruded shapes for use in applications where good weldability and notch toughness are required.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specification and standards. The following specification and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 9520

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SPECIFICATION

MILITARY

MIL-H-6875 - Heat Treatment of Steel, Process for.

STANDARDS

MILITARY

MIL-STD-163 - Steel Mill Products Preparation for Shipment and Storage.

MIL-STD-271 - Requirements for Nondestructive Testing Methods.

(Copies of specifications and standards required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- A 370 - Standard Test Methods and Definitions For Mechanical Testing of Steel Products. (DoD adopted)
- A 751 - Standard Methods, Practices, and Definitions for Chemical Analysis of Steel Products.
- E 8 - Standard Methods of Tension Testing of Metallic Materials. (DoD adopted)
- E 23 - Standard Methods for Notched Bar Impact Testing of Metallic Materials. (DoD adopted)
- E 381 - Standard Methods of Macroetch Testing, Inspection, and Rating Steel Products, Comprising Bars, Billets, Blooms, and Forgings. (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

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3. REQUIREMENTS

3.1 First article. When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.4 and 6.3).

3.2 Material. Shapes shall consist of one piece, reduced from a billet to the final section in a hot roll or hot-extrusion operation. The billets shall be continuous cast hot rolled from open hearth or electric furnace steel. The steel shall be fully killed using fine grain practice.

3.2.1 Recovered materials. Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and may be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

3.3 Properties of finished shapes.

3.3.1 Chemical composition. The chemical composition shall conform to table I.

TABLE I. Chemical composition (ladle analysis).

| Element | Percent, maximum, unless a range is shown | |
|-------------------------|----------------------------------------------|-------------|
| | HY-80 | HY-100 |
| Carbon | 0.18 | 0.20 |
| Manganese | .10 - 0.40 | .10 - 0.40 |
| Phosphorus ¹ | .015 | .015 |
| Sulphur ¹ | .010 | .010 |
| Silicon | .15 - 0.35 | .15 - 0.35 |
| Nickel | 2.00 - 3.25 | 2.25 - 3.50 |
| Chromium | 1.00 - 1.80 | 1.00 - 1.80 |
| Molybdenum | 0.20 - 0.60 | 0.20 - 0.60 |
| Residual elements | Maximum percent permitted | |
| | HY-80 | HY-100 |
| Titanium | 0.02 | 0.02 |
| Vanadium | .03 | .03 |
| Copper | .25 | .25 |
| Arsenic | .025 | .025 |
| Tin | .030 | .030 |
| Antimony | .025 | .025 |

¹ Phosphorus and sulfur together shall be not more than 0.023 percent.

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3.3.1.1 Check analysis variations. On check analysis, the percentage of the elements shall not be over the upper limits or under the lower limits shown in table I by more than the amounts shown in table II. Where no check analysis variation is shown, the limits for check analysis and ladle analysis are the same.

TABLE II. Check analysis variations.

| Element | Over the upper limit | Under the lower limit |
|------------|----------------------|-----------------------|
| Carbon | 0.02 | --- |
| Manganese | .05 | 0.00 |
| Silicon | .03 | .03 |
| Nickel | .07 | .07 |
| Chromium | .06 | .06 |
| Molybdenum | .03 | .03 |

3.3.2 Mechanical properties. The material shall meet the tensile property requirements specified in table III and the impact property requirements of table IV.

TABLE III. Tensile properties.

| | HY-80 | | HY-100 | |
|---------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
| | Longitudinal | Transverse | Longitudinal | Transverse |
| Yield strength, lb/in ² (MPa) at 0.2 percent offset | 80,000- 100,000 (552-690) ₁ | 80,000- 100,000 (552-690) ₁ | 100,000- 120,000 (690-827) ₁ | 100,000- 120,000 (690-827) ₁ |
| Tensile strength | | | | |
| Elongation, percent in 2 inches (50 mm), minimum | 20.0 | 15.0 | 18.0 | 14.0 |
| Reduction in area percent, minimum (not required for section thicknesses less than 1/2 inch (13 mm)) | 60.0 | 45.0 | 55.0 | 40.0 |

¹ Unless otherwise specified (see 6.2.1), to be recorded for information only.

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TABLE IV. Impact requirements (Charpy V-notch).

| Section thickness, inches (mm) ¹ | Foot-pounds (Joules) minimum average of three tests ² | Specimen size, millimeters | Test (coolant) temperature ³ | Fibrous fracture percent ⁴ |
|---------------------------------------------|------------------------------------------------------------------|----------------------------|-----------------------------------------|---------------------------------------|
| 1/2 to 2 (13-50) incl | 70 (95) | 10 x 10 | °F (°C) -120 (-84) | 50 |
| | 90 | 10 x 10 | 0 (-18) | 90 |
| Over 2 (50) | 60 (81) | 10 x 10 | -120 (-84) | 50 |
| | 80 | 10 x 10 | 0 (-18) | 90 |

- ¹ Tests are not required for shapes less than 1/4-inch (6 millimeter (mm)) thick and only when specified for shapes 1/4 inch (6 mm) up to 1/2 inch (13 mm) in which case acceptance criteria shall be supplied (see 6.2.1).
- ² No individual test result shall be more than 5 foot-pounds (6.8 Joules) below the minimum specified for the average.
- ³ Tolerance for temperature tests shall be plus or minus 3 degrees Fahrenheit (°F) or plus or minus 2 degrees Celsius (°C).
- ⁴ The test values shall verify that the fracture transition curve of the material is on the upper shelf at the lowest operational temperature or at 0°F (-18°C). ASTM A 370 shall be used for the method of determining percent fibrous fracture.

3.4 Heat treatment. Shapes shall meet the requirements of this specification with the following restrictions:

- (a) The shapes shall be quenched and tempered. When necessary, double tempering is permitted and the restrictions for single tempering shall apply to double tempering. The final tempering temperature shall be not less than 1175°F (635°C) for grade HY-80 and not less than 1125°F (607°C) for grade HY-100. After tempering, the shapes shall be removed from the furnace and rapidly cooled by water or forced air.
- (b) If the shapes are stress relieved after final tempering, the stress relief temperature shall be at least 100°F (56°C) below the tempering temperature and shall be not less than 1100°F (593°C) for grade HY-80 and not less than 1050°F (566°C) for grade HY-100.
- (c) The heat treatment given each shape shall produce the minimum mechanical properties throughout the shape.

3.4.1 Heat treatment and equipment and controls. Continuous or automatic heat-treating equipment may be employed, provided such equipment produces heat treated shapes to meet the requirements of this specification. For the particular loading and size range of the pieces being heat treated, the temperature recording equipment shall be proven to correlate with actual temperature of the shapes and shall be maintained and calibrated on a regular basis. The temperature of the furnace charge shall be recorded during the heating and stress relieving

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cycles of the heat treatment. After the charge reaches the selected temperature control setting, furnaces for the heat treatment of grades HY-80 and HY-100 shapes shall maintain the temperature of the heating medium and the shapes at any point in the working zone within plus or minus 25°F (16°C).

3.4.1.1 Furnaces. Furnaces used in the heat treatment of grades HY-80 and HY-100 shapes shall meet the quality assurance provisions of MIL-H-6875 or it shall be demonstrated to the satisfaction of the Commander, Naval Sea Systems Command, Materials and Assurance Engineering Office that the heat treating equipment can produce quality shapes.

3.5 Defects and surface imperfections. The shapes shall be free from flakes, pipes, cracks, internal tears, and harmful imperfections. Harmful imperfections such as surface tears, scores, seams, scabs, blisters, laps, excessive scale, and snakes shall be removed by grinding. The ground areas shall be smooth, well-blended into the surrounding surface, and shall not be below the depth permitted by the specified minimum tolerances or deeper than 1/16 inch (1.5 mm), whichever is less. Deeper defects may be repaired in accordance with 3.5.1.

3.5.1 Weld repairs. Surface imperfections that are over 1/16 inch (1.5 mm) in depth or extend below the minimum specified tolerances may be repaired by chipping or grinding the areas to sound metal and, after the forming operations, but prior to heat treating, depositing weld metal from a heat treatable electrode in accordance with an approved procedure. Weld repair after heat treating is prohibited. The depth of the repaired areas shall not exceed the following:

| <u>Material thickness</u> inches (mm) | <u>Maximum depth of defect</u> inch (mm) |
|------------------------------------------|---------------------------------------------|
| Over 3/8 - 1/2 (10-13), incl | 1/16 (1.5) |
| Over 1/2 - 1 (13-25), incl | 1/8 (3) |
| Over 1 - 1-1/4 (25-32), incl | 3/16 (5) |
| Over 1-1/4 - 2-1/4 (32-57), incl | 1/4 (6) |
| Over 2-1/4 - 3-1/2 (57-89), incl | 3/8 (10) |
| Over 3-1/2 (89), incl | 1/2 (13) |

The total of the chipped or ground areas of any piece shall not exceed 2 percent of the piece. The weld metal shall be ground flush with the surface.

3.5.2 Surface conditioning. Material may be conditioned to remove injurious surface defects provided the depth of the conditioning does not exceed 1/16 inch (1.5 mm) for each 1 inch (25 mm) of dimension concerned up to a maximum of depth of 3/4 inch (19 mm), and provided that the width of the conditioning is at least four times its greatest depth; except that in the case of shapes where the width is at least twice the thickness, the depth of conditioning on the wide surfaces may exceed this allowance by 50 percent up to a maximum width of 3/4 inch (19 mm). The maximum depth of conditioning on two parallel sides at opposite locations shall not exceed one and one-half times the maximum allowed for one side. Conditioned areas shall be flared to result in uniform blending.

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3.5.3 Macrostructure. The macrostructure shall be determined on all shapes. Deep acid etched shapes shall be equal to or better than S-3, R-2 and C-3 plates of ASTM E 381.

3.5.4 Billets. Unless otherwise specified (see 6.2.1), billets shall not be weld repaired before forming.

3.6 Dimensions and tolerances. The dimensions for structural shapes shall be as shown on the applicable drawings. Except for structural tees, the tolerances shall be as specified (see 6.2.1). The tolerances for structural tees shall be as specified on figure 1.

3.7 Surface conditioning. Unless otherwise specified (see 6.2.1), the surfaces of the shapes shall be descaled and coated as specified in the appendix of this specification.

3.8 Internal soundness. Each shape 1/2 inch (13 mm) and over in cross section shall be ultrasonically inspected for freedom from internal defects throughout its entire volume in accordance with 4.7. Causes for rejection shall be as follows:

- (a) Discontinuities resulting in 50 percent or greater loss in back reflection.
- (b) Two or more such discontinuities occurring in the same plane and within 6 inches (152 mm) of each other providing the indicated area of one or more of the discontinuities is 3/4 inch (19 mm) or larger.

3.9 Identification marking. Each shape in the length in which it is shipped shall have indent stamped on one end the following:

- (a) Heat number.
- (b) Slab/extrusion number, if applicable.
- (c) HY-80 or HY-100, as applicable.
- (d) The contractor's name or trademark.

3.10 Workmanship. Shapes shall be uniform in quality and condition and free from visual defects.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

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4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

- (a) First article inspection (see 4.4).
- (b) Quality conformance inspection (see 4.5).

4.3 Sampling for examinations and tests.

4.3.1 Lot size. For purposes of examinations and tests, lot sizes are defined as follows:

- (a) Chemical or spectrographic analysis. Each heat of steel is a lot.
- (b) Mechanical tests. Each shape from one heat, heat-treated in the same furnace and of the same nominal shape, at the same time, shall constitute a lot.
- (c) Visual and dimensional examination and ultrasonic inspection. For purposes of visual and dimensional examination, and for ultrasonic inspection, each shape, as submitted for final inspection, shall constitute a lot.

4.3.2 Sampling for chemical or spectrographic analysis. From each lot two samples shall be taken for chemical analysis. The samples shall be taken at random and shall be of a size sufficient to obtain 2 ounces (each) of clean fine millings, drillings, or chips, in accordance with ASTM A 751. Solid samples shall be taken in lieu of chips when the analysis is made by the spectrographic method.

4.3.3 Sampling for mechanical tests. From each end of each "as heat treated" shape in a lot at least one sample for longitudinal tension test, one sample for transverse tension test and one sample for three longitudinal Charpy V-notch impact tests shall be taken. For structural tee shapes the samples shall be taken from each end in the locations specified on figure 2. For other shapes the samples shall be taken from each end in locations specified on the applicable drawings. The following rules shall be used for specifying the locations of samples for mechanical tests:

- (a) Samples for the longitudinal tension test shall be taken from the thickest section of the shape, preferably that section which has received the least hot work.
- (b) Samples for the transverse tension test shall be taken from the thinnest section of the shape.
- (c) Samples for the longitudinal Charpy V-notch test shall be taken from the thickest section of the shape, preferably that section which has received the least hot work.

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- (d) Charpy V-notch specimens shall be orientated such that the notch is through the thickness of the section (perpendicular to rolled/extruded surfaces) and the bottom of the notch is towards the interior of the shape.
- (e) For all section thicknesses, the samples shall be taken from mid-thickness location.
- (f) For shapes containing wide flanges or webs, the samples shall be taken from within the center third of the width. However, where there is a junction of a thick and thin section, such as occurs in a beam or tee, select the sample at or near the junction and in the thickest section (see figure 2).
- (g) At least 4-inches (102 mm) or largest section width divided by 4, whichever is greater, shall be removed from the "as heat treated" end of each shape prior to mechanical sampling.

4.3.3.1 Form and dimensions of mechanical test specimens. The form and dimensions of all mechanical test specimens for this specification shall be as follows:

- (a) Tension test specimens shall conform to the requirements of ASTM E 8.
- (b) Charpy V-notch specimens shall be in accordance with ASTM E 23 for a 10 x 10 millimeters test.

4.4 First article inspection. Manufacturers who have not previously produced extrusions or rolled shapes under this specification of the strength level specified shall demonstrate to the Command or agency concerned that their facilities are capable of quality production of structural shapes. First article inspection shall consist of the examination and tests specified in 4.4 through 4.8.3, and Charpy V-notch transition curves (longitudinal and transverse) with a minimum of five data points at minus 120°F (minus 84°C), minus 60°F (minus 51°C), 0°F (minus 18°C), 32°F (0°C), and ambient temperature. A minimum of five specimens for each point is required and all individual values shall be reported (see 6.2.2).

4.5 Quality conformance inspection. Quality conformance inspection shall consist of the examination and tests specified in 4.6 through 4.8.4.

4.5.1 Certification of quality conformance. A certificate of quality conformance shall be prepared for each lot of material offered for acceptance (see 6.2.2 and 6.5).

4.6 Visual and dimensional examination. Each shape, as prepared for shipment, shall be examined for conformance to the applicable dimensions and shall be visually examined for conformance to 3.5, 3.7, 3.9, and 3.10, as applicable.

4.7 Ultrasonic inspection. Ultrasonic inspection shall be in accordance with MIL-STD-271, employing a 2-1/4 megahertz (MHz) transducer from 3/4 to 1-1/8 inches (19 to 29 mm) in diameter.

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4.8 Tests.

4.8.1 Chemical or spectrographic analysis. The samples selected in 4.3.2 shall be individually analyzed for conformance to tables I and II, as applicable.

4.8.2 Tension test. Samples selected and prepared in accordance with 4.3.3 shall be tested as specified in ASTM E 8 for conformance to table IV, as applicable. The location of the center of the specimen gauge length shall be at least equal to the section width divided by 2 from any "as heat treated" edge.

4.8.3 Charpy V-notch impact test. The Charpy V-notch impact test shall be performed in accordance with ASTM E 23.

4.8.4 Macroetch test. Each end of each "as heat treated" shapes shall be tested in accordance with macroetch test of ASTM E 381.

4.9 Rejection and retest provisions. Shapes not meeting the requirements of this specification shall be rejected. Retests of additional specimens from the lot will be permitted. If one of the retest specimens fails, the lot shall be rejected with no further retesting permitted. Unless otherwise specified (see 6.2.1), extrusions may not be reheat treated more than twice.

4.10 Test reports. When specified in the contract or order, a record of heat treatment shall be prepared (see 6.2.2 and 6.4).

4.11 Inspection of packaging. Sample packages and packs, and the inspection of the preservation-packaging, packing and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition.)

5.1 Packaging requirements. The requirements for packaging shall be level A or C, as specified (see 6.2.1) in accordance with MIL-STD-163.

5.2 Marking. In addition to any special markings specified (see 6.2.1), marking for shipment shall be in accordance with MIL-STD-163.

6. NOTES

6.1 Intended use. Grade HY-80 and HY-100 alloy steel structural shapes are intended primarily for critical structural applications where a notched tough high strength material is required.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

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- (a) Title, number, and date of this specification.
- (b) When minimum tensile strength is required and, if so, specify acceptance criteria (see table III).
- (c) If impact tests for sub-size specimens are required and, if so, specify acceptance criteria (see table IV).
- (d) If billets can be weld repaired before forming (see 3.5.4).
- (e) Tolerances of other than structural tees (see 3.6).
- (f) If descaling and coating to be other than as specified in appendix (see 3.7).
- (g) The number of times extrusions may be reheat treated (see 4.9).
- (h) Level of packaging and marking (see 5.1 and 5.2).
- (i) Number of pieces required and estimated piece weight.
- (j) Applicable drawing number with specific dimensions and tolerances for shapes, and location of test specimens as appropriate.

6.2.2 Data requirements. When this specification is used in an acquisition and data are required to be delivered, the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (CDRL), incorporated into the contract. When the provisions of DoD FAR Supplement, Part 27, Sub-Part 27.475-1 (DD Form 1423) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification are cited in the following paragraphs.

| <u>Paragraph no.</u> | <u>Data requirement title</u> | <u>Applicable DID no.</u> | <u>Option</u> |
|----------------------|---------------------------------|---------------------------|---------------|
| 4.4 | First article inspection report | DI-T-4902 | ---- |
| 4.5.1 | Certification data/report | UDI-A-23264 | ---- |
| 4.10 | Reports, test | DI-T-2072 | 10.1.b |

(Data item descriptions related to this specification, and identified in section 6 will be approved and listed as such in DoD 5010.12-L., AMSDL. Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

6.2.2.1 The data requirements of 6.2.2 and any task in sections 3, 4, or 5 of this specification required to be performed to meet a data requirement may be waived by the contracting/acquisition activity upon certification by the offeror that identical data were submitted by the offeror and accepted by the Government under a previous contract for identical item acquired to this specification. This does not apply to specific data which may be required for each contract regardless of whether an identical item has been supplied previously (for example, test reports).

6.3 First article inspection. When a first article inspection is required, the item should be a first article sample. The first article should consist of five units. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of first articles. Invitations for bids

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should provide that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

6.4 Heat treatment. The record of heat treatment given each shape including stress relief should include the time and temperature for the final tempering cycle and for the stress relief cycle, if any, and the cooling method used.

6.5 Certification of quality conformance. The certificate should include actual data of specified chemical and mechanical tests. Qualitative results of nondestructive tests and other inspections or tests should be recorded on the certificate. The certificate should also state that each lot has been sampled, tested, and inspected in accordance with the specification and meets all specification requirements. The certificate should be signed by a responsible representative of the contractor.

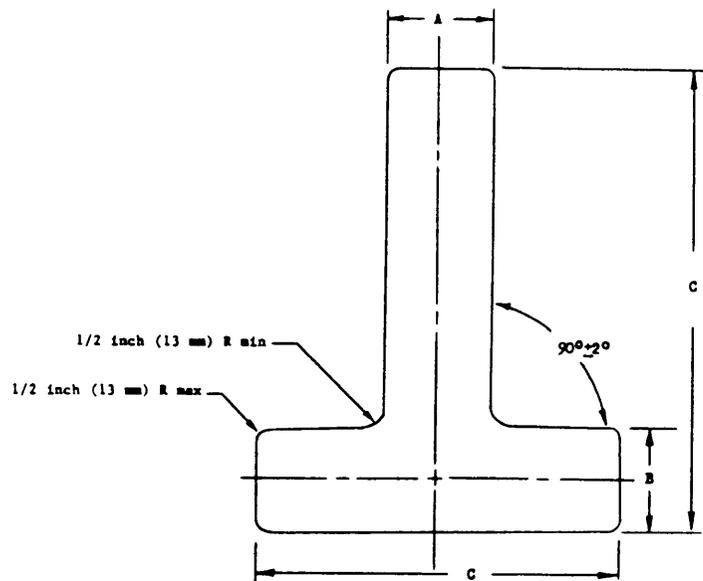
6.6 Subject term (key word) listing.

Charpy V-notch
Coatings
Spectrographic analysis
Ultrasonic inspection
Weld repair

6.7 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Preparing activity:
Navy - SH
(Project 9520-N010)

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Wed offcenter = $\pm 3/32$ inch (2.4 mm)

$$\text{Camber and sweep} = \frac{1}{8} \times \frac{\text{total length of extrusion (inches)}}{5} \text{ or}$$

$$\left(3 \times \frac{\text{total length of extrusion (mm)}}{16.4} \right)$$

Flange to web squareness = 2 degrees maximum

| | A Web thickness ² inches (mm) minimum | | B Flange thickness ² inches (mm) minimum | | | C Flange width or depth of section (total) inches (mm) | | Length inches (mm) |
|---------------------------|-----------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------|-----------------------------------------------|-----------------------------------------------|--------------------------------------------------------------------|------------------------------------------|-------------------------------------------------------------------------------|
| | 0-0.875, (0-22) incl | Over 0.875 to 1.500, (22-38) incl | Over 0.875 to 1.500, (22-38) incl | Over 1.500 to 2.000, (38-51) incl | Over 2.000 to 2.500, (51-63) incl | 0 to 5, (0-127) incl | Over 5 to 15, (127-381) incl | Over 12 inches to 40 ft, (1/3 meter to 12.2 meters) incl |
| Tolerances inches (mm) | .025 (0.6) | .035 (0.9) | .029 (0.8) | .035 (0.9) | .050 (1.3) | 1/16 (1.5) | 1/8 (3) | 1/4 (6) |

¹ Over gauge shall be such that the average weight per linear foot (or meter) of any structural tee shall not exceed the ordered dimensional weight by more than 3 percent.

² The thickness of the web and the flange shall be measured at a point not less than 1 inch (25 mm) in from the edge.

FIGURE 1. Dimensional tolerances¹ and nomenclature for structural tee extrusions.

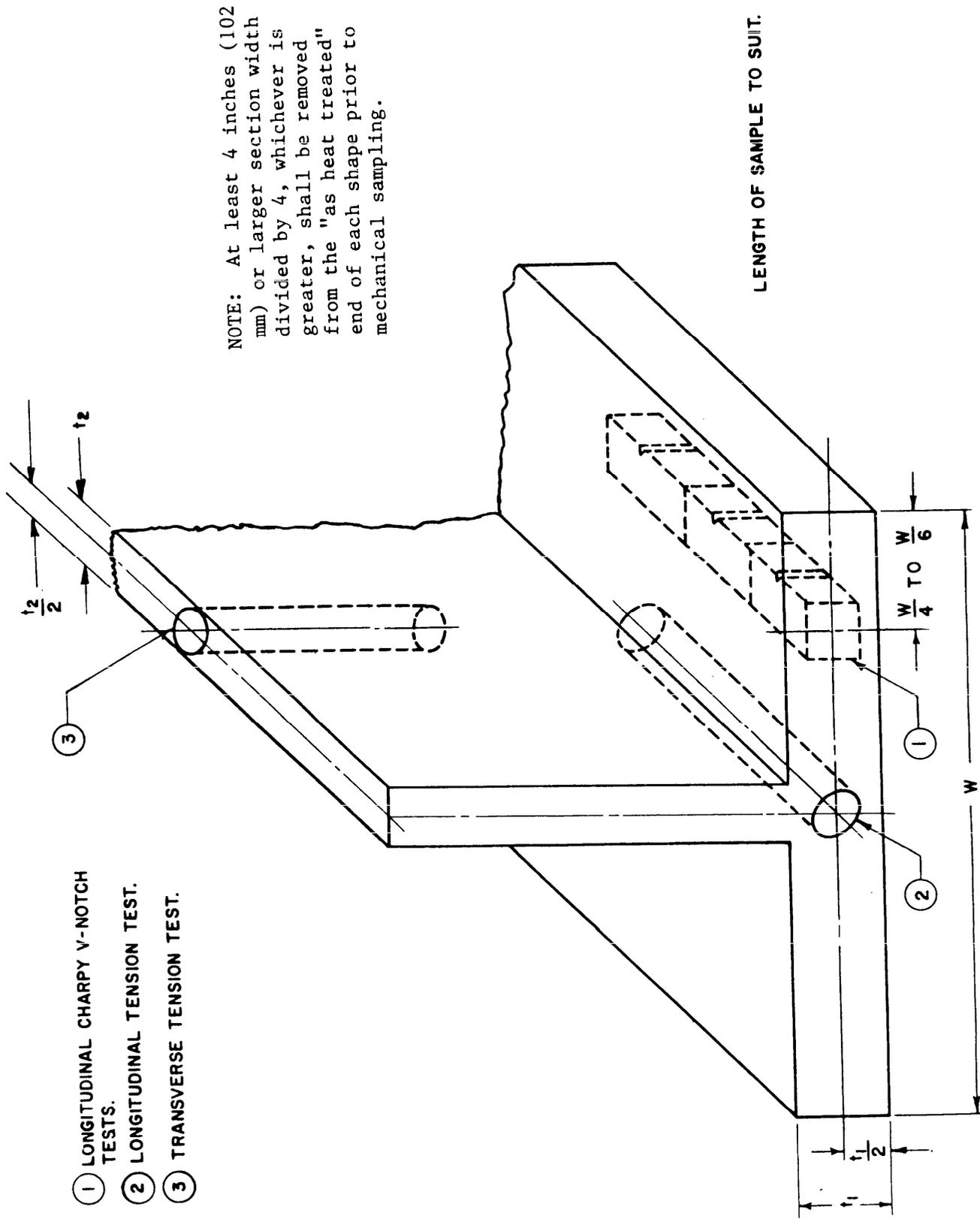


FIGURE 2. Location of mechanical test coupons for structural tee.

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APPENDIX

COATINGS

10. SCOPE

10.1 Scope. This appendix outlines the cleaning and preserving procedures and requirements for ships shapes intended for Naval service.

10.2 This appendix allows the maximum latitude in cleaning and preserving methods and materials commensurate with the intended storage time and conditions prior to their use.

10.3 The coatings specified herein shall be selected in terms of the particular use. Cleaning, followed by one coat of alkyd primer, TT-P-645, TT-P-664, or TT-P-1757 should provide protection for approximately 9 months.

20. APPLICABLE DOCUMENTS

20.1 Government documents.

20.1.1 Specifications and standard. The following specifications and standard form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

- | | |
|-----------|------------------------------------------------------------------|
| TT-P-645 | - Primer, Paint, Zinc Chromate, Alkyd Type. |
| TT-P-664 | - Primer Coating, Synthetic, Rust-Inhibiting, Lacquer Resisting. |
| TT-P-1757 | - Primer Coating, Zinc Chromate, Low-Moisture-Sensitivity. |

STANDARD

FEDERAL

FED-STD-595 - Colors.

(Copies of specifications and standards required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

30. DESCALING AND CLEANING

30.1 Plates shall be descaled and cleaned by abrasive blast cleaning or acid pickling.

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APPENDIX

30.2 Abrasive blast cleaning. Abrasive blast cleaning shall result in a clean metal surface, ready for painting, with mill scale, rust, and other surface contaminants completely removed.

30.3 Acid pickling. The acid pickling process shall be as follows:

- (a) Shapes shall be handled on edge throughout the various steps of the procedure. They shall not be laid flat in the solutions.
- (b) Rust preventives, oils, greases, oil paints, and other foreign matter shall be removed from the shapes prior to immersion in the acid pickling bath. Where alkaline solutions are used for this purpose, the shapes shall be thoroughly rinsed with water prior to pickling.
- (c) The pickling bath shall consist of a sulphuric acid solution to which has been added pickling inhibitor and 1-1/2 percent of sodium chloride. In making the solution initially, 5 gallons of concentrated sulphuric acid are used for each 100 gallons of solution. The acid concentration shall not be allowed to drop below 3.5 percent by volume. The inhibitor shall be used at the concentration recommended by the manufacturer. The bath temperature shall be maintained at 170 to 180°F. When the concentration of iron in the solution reaches 5 percent by weight, the entire bath shall be discarded.
- (d) The water rinse shall consist of fresh circulating water maintained at a temperature of 170 to 180°F. The flow of fresh water shall be maintained so that a complete change of water occurs at least once every 24 hours. The combined concentrations of sulphuric and iron sulphates in the bath, calculated from the acid concentration and the ferrous iron concentration, shall not exceed 2 grams per gallon. This determination shall be made at least once each week.

40. PRESERVATIVE COATINGS

40.1 Coating. The shapes as prepared for coating shall be in the descaled condition and free of visible rust. The paint film shall be sufficient to cover surface roughness peaks. Two random dry film thickness measurements per 100 square feet of painted surface, made with a suitable thickness gauge, shall be considered sufficient for determining conformity of any one shape to the specified coating thicknesses. Other methods of measurement or quality control may be used for paint film thickness, subject to the approval of the Command or agency concerned. The shapes shall be coated as follows:

- (a) One coat of alkyd primer, TT-P-645 modified to color number 30117 of FED-STD-595 for HY-80 and to a color number 22190 of FED-STD-595 for HY-100 to an average dry film thickness of approximately one mil.
- (b) The drying time of the coatings at 73°F shall be 6 hours. Higher plate or ambient temperatures would shorten the drying time.

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APPENDIX

- (c) The following primers are acceptable when modified to meet the color requirements of 40.1(a). These offer the desired reduction in drying time for effective use of automated cleaning and painting. They are subject to the same limitations as specified in 10.3:

| <u>Specification</u> | <u>Drying time maximum</u> |
|----------------------|--------------------------------|
| TT-P-1757 | 30 minutes |
| TT-P-664 | 30 minutes |

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