

MIL-P-24691
 23 September 1987
 SUPERSEDING
 (See 6.3)

MILITARY SPECIFICATION

PIPE AND TUBE, CARBON, ALLOY AND STAINLESS STEEL, SEAMLESS AND WELDED, GENERAL SPECIFICATION FOR

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers carbon, alloy, and stainless steel seamless and welded pipe and tube.

1.2 Classification. The carbon, alloy and stainless steel seamless and welded pipe and tube shall be of the grades and types specified in the detail specification (see 6.2.1).

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications 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 the supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

PPP-B-601	- Boxes, Wood, Cleated-Plywood.
PPP-B-621	- Boxes, Wood, Nailed and Lock-Corner.
PPP-B-1055	- Barrier Material, Waterproofed, Flexible.

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 5523, 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 4710

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MILITARY

- MIL-P-116 - Preservation, Methods of.
- MIL-B-121 - Barrier Material, Greaseproofed, Waterproofed, Flexible.
- MIL-P-24691/1 - Pipe and Tube, Carbon Steel, Seamless.
- MIL-P-24691/2 - Pipe and Tube, Chromium-Molybdenum Steel, Seamless.
- MIL-P-24691/3 - Pipe and Tube, Corrosion-Resistant, Stainless Steel, Seamless or Welded.

STANDARDS

FEDERAL

- FED-STD-183 - Continuous Identification Marking of Iron and Steel Products.

MILITARY

- MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
- MIL-STD-129 - Marking for Shipment and Storage.
- MIL-STD-271 - Requirements for Nondestructive Testing Methods.
- MIL-STD-792 - Identification Marking Requirements for Special Purpose Components.

(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 NATIONAL STANDARDS INSTITUTE (ANSI)

B36.10 - Welded and Seamless Wrought Steel Pipe.

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- A 450 - Standard Specification for General Requirements for Carbon, Ferritic Alloy, and Austenitic Alloy Steel Tubes. (DoD adopted)
- A 530 - Standard Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe. (DoD adopted)

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

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NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC., AGENT
National Motor Freight Classification

(Application for copies should be addressed to the National Motor Freight Traffic Association, Inc., ATA TRAFFIC Dept., 2200 Mill Road, Alexandria, VA 22314.)

UNIFORM CLASSIFICATION COMMITTEE AGENT
Uniform Freight Classification Ratings, Rules and Regulations

(Application for copies should be addressed to the Uniform Classification Committee Agent, Tariff Publication Officer, Room 1106, 222 South Riverside Plaza, Chicago, IL 60606.)

STEEL STRUCTURES PAINTING COUNCIL (SSPC)
SP6 - Commercial Blast Cleaning

(Application for copies should be addressed to the Steel Structure Painting Council, 4400 Fifth Avenue, Pittsburgh, PA 15213.)

(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.

3. REQUIREMENTS

3.1 Detail specifications. The individual item requirements shall be as specified herein and in accordance with the applicable detail specification. In the event of any conflict between the requirements of this specification and the detail specifications, the latter shall govern.

3.2 Material. The carbon and alloy steel from which the pipe and tube is formed shall be made by one or more of the following processes: open hearth, basic oxygen or electric furnace. Unless otherwise specified in the contract or order (see 6.2.1), stainless steel pipe or tube shall be made by the electric furnace process.

3.2.1 The primary melting may incorporate separate degassing or refining and may be followed by secondary melting, using electroslog remelting or vacuum-arc remelting. If secondary melting is employed, the heat shall be defined as all of the ingots remelted from a primary melting.

3.2.2 Recovered materials. Unless otherwise specified herein, material covered by this specification shall be 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.

3.3 Dimensions. Whether pipe or tube is required and the dimensions of tubing acquired in accordance with this specification shall be as specified (see 6.2.1). Pipe shall be ordered to nominal pipe size and schedule and tube to outside diameter (od) and wall thickness. Nominal pipe sizes shall be as specified in ANSI B36.10.

3.4 Tolerances. Tolerances for pipe shall be as specified in ASTM A 530. Tolerances for tube shall be in accordance with ASTM A 450. In addition pipe and tube shall be straight to within the tolerances specified in table I.

TABLE I. Tolerances.

Specified od Inches	Specified wall thickness Inch	Maximum curvature in any 3 feet Inch	Maximum curvature in total length, Inch
Up to 5.0, incl	Over 3 percent od to 0.5, incl	0.030	0.010 x length in feet
Over 5.0 to 8.0, incl	Over 4 percent od to 0.75, incl	0.045	0.015 x length in feet
Over 8.0 to 12.75, incl	Over 4 percent od to 1.0, incl	0.060	0.020 x length in feet

3.5 Finish. Pipe and tube furnished to this specification shall be uniform in quality and condition and have a finish conforming to the best practice for standard quality steel tubing. Surface imperfections such as handling marks, straightening marks, light mandrel and die marks, shallow pits, and scale pattern will not be considered injurious if the imperfections are removable within the tolerances specified for wall thickness or 0.005 inch whichever is greater. The bottom of imperfections shall be visible and the profile shall be rounded and faired-in.

3.5.1 Surface imperfections on the outside diameter may be removed by grinding, provided that a smooth curved surfaced is maintained, and the wall thickness is not decreased to less than that permitted by the contract or ordering data. The local od at the point of grinding may be reduced by the amount so removed.

3.6 Cleanliness. Pipe and tube shall be free from heavy oxide or scale. The internal surface of ferritic steel pipe and tube, when used for steam lines or other applications as specified (see 6.2.1), shall be pickled or blast cleaned to a scale free condition in accordance with SSPC - SP6. Cleaning shall be performed in accordance with a written procedure that has been shown to be effective. This procedure shall be available for audit.

3.7 Soundness. The pipe and tube shall be free from repair welds, welded joints, laps, laminations, seams, visible cracks, tears, grooves, laminations, slivers, pits, and other imperfections detrimental to the tubing as determined by 4.5.1 and 4.5.3 or alternate tests, as specified (see 6.2.1).

3.8 Identification marking. Each length of pipe and tube 1/4 inch od and larger shall be marked with the below listed information. Marking shall be in accordance with FED-STD-183 and MIL-STD-792.

- (a) Name or trademark of the manufacturer.
- (b) Specification number.
- (c) Type and grade.
- (d) Od, wall thickness, and length or nominal pipe size and schedule.
- (e) Heat or lot identification number.

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.

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 Quality conformance inspection. Quality conformance inspection shall consist of the examination and tests specified in 4.4 and in the detail specifications.

4.2.1 Certificate of quality conformance. When specified in the contract or order, a certificate of quality conformance shall be prepared for each lot of material offered for acceptance (see 6.2.2).

4.3 Lot definition.

4.3.1 Chemical analysis. For purpose of chemical analysis a lot shall be all material poured from one heat.

4.3.2 Mechanical properties. For purposes of sampling for all tests and inspections except chemical analysis, a lot shall consist of all tube and pipe of the same od and wall thickness or pipe of the same nominal pipe size and schedule, manufactured during an 8-hour shift from the same heat of steel, and heat treated under the same conditions as to temperature and time in a single charge in a batch type furnace, or heat treated under the same conditions in a continuous furnace, and presented for inspection at the same time.

4.4 Sampling for quality conformance inspection.

4.4.1 Chemical analysis. One sample for chemical analysis shall be selected from each of two tubes chosen from each lot. The sampling method shall be in accordance with the detail specification.

4.4.2 Tension and bend test. One sample shall be taken from each lot. Sampling shall be performed in accordance with the detail specification.

4.4.3 Flattening and flaring test and visual and dimensional inspections. A tube shall be selected from each lot in accordance with MIL-STD-105, inspection level II, AQL of 1.5.

4.4.4 Hydrostatic and ultrasonic tests. Each tube shall be tested by the hydrostatic or ultrasonic tests.

4.5 Examination and tests.

4.5.1 Visual and dimensional examinations. Each sample of pipe and tube selected in accordance with 4.4.3 shall be visually and dimensionally examined for conformance with 3.3 through 3.7

4.5.2 Hydrostatic inspection. Pipe and tube shall withstand the internal hydrostatic test pressure specified in ASTM A 530 without showing any leaks, bulges or other detrimental effects. The specified hydrostatic pressure produces in the tube wall a stress not less than 60 percent of the minimum specified yield strength.

4.5.3 Ultrasonic inspection. When specified (see 6.2.1), each pipe and tube shall be ultrasonically inspected in accordance with MIL-STD-271 except as modified below.

4.5.3.1 Shear wave test. The entire volume of every pipe and tube in the lot, when required shall be ultrasonically tested by the shear wave (angle beam technique). When specified (see 6.2.1), this test shall be conducted in two opposite directions; otherwise, this test may be conducted in one circumferential direction only.

4.5.3.2 Calibration. Pipe and tube shall be ultrasonically tested at a frequency and wave angle capable of detecting inside and outside surface discontinuities and subsurface defects. The calibration standard shall be made from ultrasonically defect-free pipe of the same type, wall thickness, and od as the pipe to be tested. This standard shall contain two longitudinal notches, one on the inside surface (except for pipe less than 1/2 inch od) and one on the outside surface sufficiently separated that readily distinguishable individual indications are obtainable from each notch. The notches shall have a depth equal to 5 percent of the wall thickness or 0.005 inch, whichever is greater; the notch lengths shall not exceed 1/2 inch for wall thicknesses 0.065 inch and less, and shall not exceed 1 inch for wall thicknesses greater than 0.065 inch. The notch which produces the smaller indication shall be adopted as the calibration standard. Ultrasonic instrument settings shall be made such that the indication from the calibration standard is at least 50 percent but less than 100 percent of full screen height or of the initial ultrasonic pulse, whichever is closer to the calibration indications. These settings shall be made under identical conditions of scanning speed, couplant, and search unit alignment with respect to the pipe and using the same search unit and the same test fixturing as will be used in quality conformance testing of the pipes.

4.5.3.2.1 Recalibration. During quality conformance testing, any realignment of the search unit with respect to the pipe, or any change in search unit, couplant, instrument settings, or scanning speed from that used for calibration shall require recalibration.

4.5.3.2.2 Test method. The tube, the search unit, or both the tube and the search unit shall be moved uniformly during testing in such a manner that the search unit motion relative to the pipe describes a helix concentric with the tube so that each pass of the scanning crystal overlaps the previous pass by not less than 20 percent of the width of the crystal. This scanning shall be done at the same couplant, search unit alignment and instrument settings as were used during calibration.

4.5.4 Rejection. Any pipe or tube which produces an indication equal to or greater than 100 percent of the indication from the calibration standard shall be rejected.

4.6 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.

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5. PACKAGING

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

5.1 Preservation and packaging. Preservation and packaging, shall be level A or C as specified (see 6.2.1).

5.1.1 Level A. Cleaning, drying and preservation-packaging shall conform to the applicable processes, procedures and methods of MIL-P-116.

- (a) Carbon steel pipe or tube shall be coated inside and out with type P-19 preservative in accordance with method I of MIL-P-116.
- (b) Stainless steel pipe or tube shall be unit protected in accordance with method III of MIL-P-116.

5.1.2 Level C. Preservation-packaging shall afford protection against corrosion, deterioration and physical damage during shipment from the supply source to the first receiving activity for immediate use. The contractor's normal preservation-packaging methods may be utilized when such meets the requirements of this level.

5.2 Packing. Packing shall be level A, B, or C, as specified (see 6.2.1).

5.2.1 General requirements. Pipes shall be segregated by class, size, and lot, and shall be packed in accordance with the level specified using pipe bundle sizes as follows:

- (a) Pipe with a 2-inch od and under shall be bundled in quantities of 30 pipes per bundle.
- (b) Pipe over 2 inches in od shall be bundled in quantities of 11 pipes per bundle.

5.2.2 Level A. Pipe, preserved and packaged as specified (see 6.2.1) and in the quantity required (see 5.2.1), shall be packed in cleated bundles. Prior to fabricating the cleated bundle, the quantity of pipe shall be completely wrapped, including the ends of the load, with an inner wrap of barrier material conforming to type I, grade A, class 1 of MIL-B-121 and an outer wrap of barrier material conforming to class E1, E2, L-2, L-4, or M-1 of PPP-B-1055. As an alternative to the two types of waterproof material required, any two combinations of the listed types of PPP-B-1055 may be used. The wrapped pipe shall be steel strapped over nominal 2- by 6-inch wood cleats positioned approximately 2 feet from each end of the bundle. Unit loads (bundles) exceeding 10 feet in length shall be provided with an additional cleat band located equidistant from the end cleat bands. Two parallel girthwise coated or galvanized flat steel straps 1-1/4 by 0.035 inch or equivalent round steel wire shall be tension tied over each cleat band. Galvanized corner protectors shall be required over end grain of cleats when round wire strapping is used. Cleats may be staggered to permit stacking. The ends of the unit load shall be completely covered with barrier material conforming to type I of MIL-B-121 and overwrapped with burlap (weight basis 7.5 ounces per 40-inch width). The protective end cover shall be secured in place with two parallel bands of steel strapping (see figure 1).

5.2.2.1 As an alternative to cleated bundles, pipe completely wrapped as specified in 5.2.2 may be packed in containers conforming to either of the following specifications at the option of the contractor:

<u>Specification</u>	<u>Type, class or style</u>
PPP-B-601	Overseas type
PPP-B-621	Class 1

Container closure shall be as specified in the applicable container specification or appendix thereto. Boxes shall be modified by the addition of wood skids in accordance with the applicable box specification.

5.2.3 Level B. Pipe or tube, preserved and packaged as specified (see 6.2.1) and in the quantity required (see 5.2.1), shall be packed in cleated bundles (see figure 1) as specified for level A except that the full length inner and outer wraps may be omitted. Ends of the unit load shall be wrapped as specified under level A.

5.2.4 Level C. Pipe or tube, preserved and packaged as specified (see 6.2.1) and in the quantity required (see 5.2.1), shall be packed in containers acceptable to the common carrier which will ensure safe delivery at the destination in a satisfactory condition at the lowest applicable rate. Containers, packing or method of shipment shall conform to Uniform Freight or National Motor Freight Rules or Regulations or other carrier rules applicable to the mode of transportation.

5.3 Marking. In addition to any special marking required (see 6.2.1), shipments shall be marked in accordance with MIL-STD-129.

5.4 Special requirements. A copy of the certificate of quality conformance, when required (see 4.2 and 6.2.2) shall be placed in a waterproof, greaseproof bag or envelope, identified as to contents, and placed in the bundle in such a manner as to prevent loss or damage to the certificate during shipment or storage.

6. NOTES

6.1 Intended use. Steel pipes and tubes are intended for various services such as oil, water, steam and gas.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Title, number and date of the applicable detail specification.
- (c) Type and grade required by the applicable detail specification (see 1.2).
- (d) If stainless steel pipe or tube is to be made by other than the electric furnace process (see 3.2).
- (e) Dimensions of tubing and whether pipe or tube is required (see 3.3).

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- (f) If pipe or tube is to be used for steam lines (see 3.6).
- (g) If an alternate soundness inspection is to be used and the method (see 3.7).
- (h) If pipe or tube is to be ultrasonically inspected (see 4.5.3).
- (i) If shear wave test is to be conducted in two opposite circumferential directions (see 4.5.3.1).
- (j) Level of preservation, packaging and packing (see 5.1, 5.2, 5.2.2, 5.2.3 and 5.2.4).
- (k) Special marking required (see 5.3).

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 paragraph.

<u>Paragraph no.</u>	<u>Data requirement title</u>	<u>Applicable DID no.</u>	<u>Option</u>
4.2.1 and 5.4	Certification data/report	UDI-A-23264	---

(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 Supersession data. This specification supersedes MIL-T-20157, MIL-T-18162 and MIL-P-1144.

6.3.1 Cross reference. The grades and types in this specification are listed in table II.

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TABLE II. Specification cross reference data.

Superseded specification	Replacement specification	Referenced specification
MIL-T-20157 Type A, B, C, D Type E	MIL-P-24691/1 Grade A Grade B	ASTM A 106 Grade A Grade B
MIL-T-18165 Class 1 <u>1/</u> Class 2	MIL-P-24691/2 Grade P5 Grade P11 Grade P22	ASTM A 335 Grade P1 Grade P5 Grade P11 Grade P22
MIL-P-1144 Grade 304 Grade 304L Grade 316 Grade 316L Grade 321 Grade 347 Type I Type II	MIL-P-24691/3 Grade TP 304 Grade TP 304L Grade TP 304N Grade TP 316 Grade TP 316L Grade TP 316N Grade TP 317 Grade TP 317L Grade TP 321 Grade TP 347 Type I Type II	ASTM A 312 Grade TP 304 Grade TP 304L Grade TP 304N Grade TP 316 Grade TP 316L Grade TP 316N Grade TP 317 Grade TP 317L Grade TP 321 Grade TP 347 Seamless Welded

1/ No longer used. Delete from specification.

6.4 Subject term (key word) listing.

Chromium-molybdenum steel
Corrosion resistant
Hydrostatic inspection
Shear wave test
Ultrasonic inspection

Custodians:

Army - ME
Navy - SH

Preparing activity:

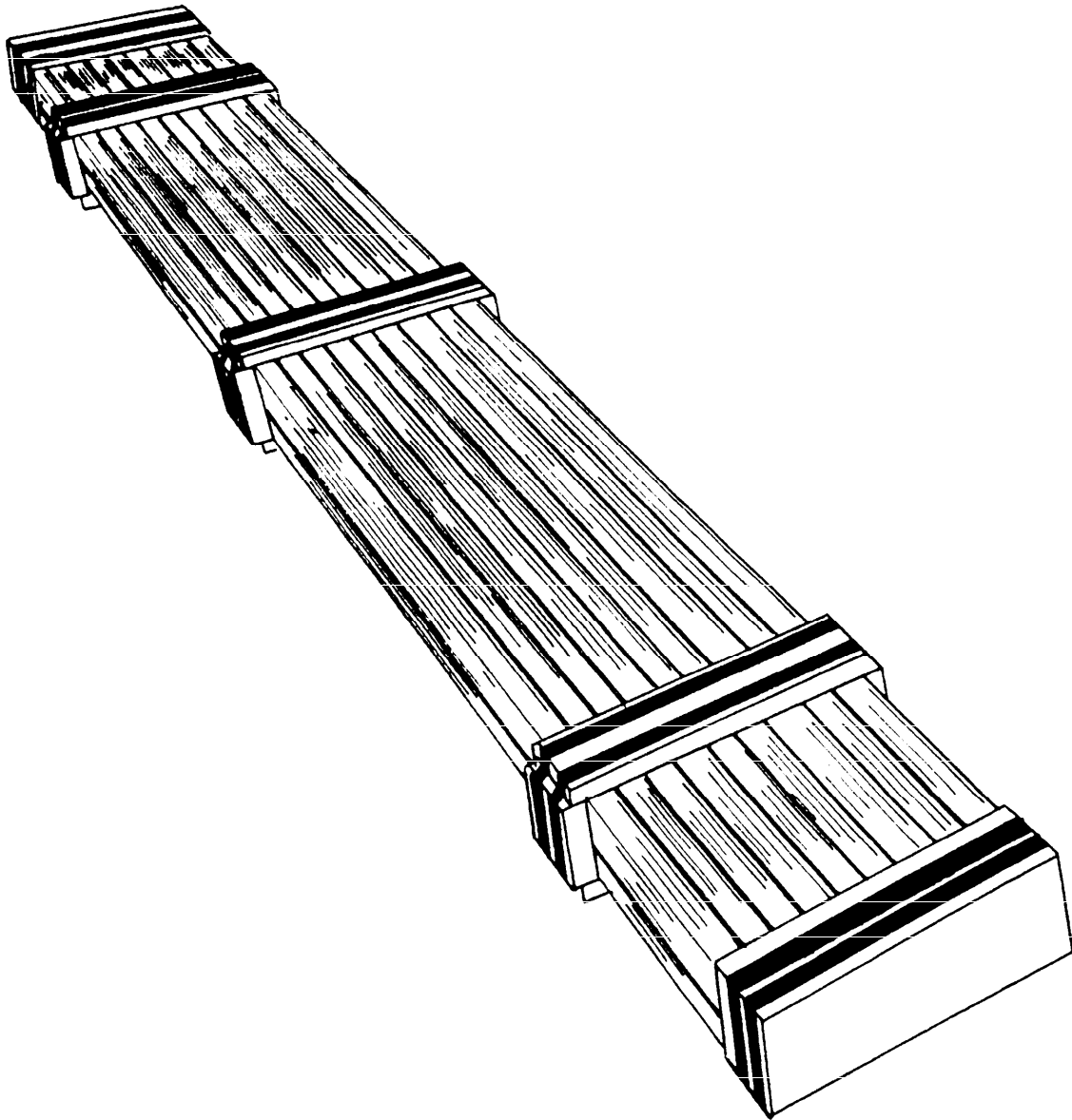
Navy - SH
(Project 4710-0848)

Review activities:

Army - GL, MR, AR, EA, MI
Navy - AS
DLA - CS

User activity:

Navy - MC



SH 89

FIGURE 1. Cleated bundle.

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

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DEPARTMENT OF THE NAVY

COMMANDER
NAVAL SEA SYSTEMS COMMAND (SEA 5523)
DEPARTMENT OF THE NAVY
WASHINGTON, DC 20362-5101



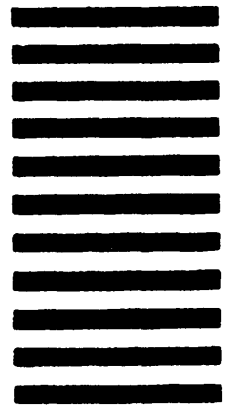
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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER MIL-P-24691	2. DOCUMENT TITLE PIPE AND TUBE, CARBON, ALLOY AND STAINLESS STEEL, SEAMLESS AND WELDED, GENERAL SPECIFICATION FOR
3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION <i>(Mark one)</i> <input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER <i>(Specify)</i> : _____
b. ADDRESS <i>(Street, City, State, ZIP Code)</i>	
5. PROBLEM AREAS a. Paragraph Number and Wording: b. Recommended Wording: c. Reason/Rationale for Recommendation:	
6. REMARKS	
7a. NAME OF SUBMITTER <i>(Last, First, MI) - Optional</i>	b. WORK TELEPHONE NUMBER <i>(Include Area Code) - Optional</i>
c. MAILING ADDRESS <i>(Street, City, State, ZIP Code) - Optional</i>	8. DATE OF SUBMISSION (YYMMDD)