

**INCH-POUND**

MIL-E-15809D(NAVY)  
19 May 1992  
SUPERSEDING  
MII-E-15809C(NAVY)  
6 July 1987  
(See 6.5)

MILITARY SPECIFICATION

EXPANDER TUBE CONDENSER **AND**  
HEAT EXCHANGERS

This specification is approved for use by 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 tube expanders of the self-feeding type for use in expanding titanium, copper-nickel alloy or other non-ferrous alloy tubes in all types of tubular heat exchangers.

2.1 Government documents.

2.1.1 Specification and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

MILITARY

MIL-L-19140 Lumber and Plywood, Fire Retardant Treated

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 3441

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FEDERAL

- PPP-P-40 Preservation and Packing of Hand Tools; Tools and Tool Accessories for Power Driven, Metal and Woodworking Machinery
- PPP-F-320 Fiberboard Corrugated and Solid Sheet Stock  
(Container Grade) and Cut Shapes

(Unless otherwise indicated, copies of federal and military specifications are available from the Standardization Documents Order Desk Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111 -5094.)

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

### 3. REQUIREMENTS

#### 3.1 Material.

3.1.1 Bodies and collars. Bodies, collars, collar sleeve bearings, and collar sleeves shall be made of heat-treated alloy steel.

3.1.2 Mandrels and rolls. Mandrels and rolls shall be made of tool steel, tempered and hardened to withstand the shocks and wear of regular usage.

3.1.3 Recovered materials. Unless otherwise specified herein, all material and articles incorporated in the products covered by this specification shall be new and may be fabricated using materials produced from removed 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.

3.2 Construction. Expanders shall consist of a mandrel, body, collar, collar sleeve, collar sleeve bearing, and rolls. Unless otherwise specified (see 6.2), expanders shall be righthand feed and have three rolls.

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3.2.1 Mandrel. The portion of the mandrel in contact with the rolls shall have a taper of 0.030 to 0.032 inch per inch of mandrel length. To prevent the expander body from remaining in the tube when the mandrel is withdrawn, the mandrel shall have a threaded end with nut except that mandrels for 3/8 inch and smaller size expanders may use other means for mandrel retention. The mandrels for 1/2 inch and larger size tube expanders shall be provided with either a 1/2-inch square shank or a No. 1 Morse taper shank as specified (see 6.2). The mandrels for less than 3/8 inch size expanders shall be provided with a 1/4-inch (0.240 to 0.245 inch) square machined on the last 1/2 inch of a 5/16 inch round shank for a Jacobs chuck. The tapered length of the mandrel shall be ground to a surface finish of 32 RMS or smoother. Grinding shall remove all decarbonized metal and distortion from the tapered length of the mandrel.

3.2.2 Body. The body shall be slotted to contain three taper rolls, set 120 degrees apart at a lead angle of 1/4 to 2 degrees, and shall have a threaded section on which shall be mounted a collar, collar sleeve bearing, and sleeve, adjustable in position on the body so as to regulate the depth of penetration of the rolls into the tube, and secured by a lock nut or other positive means. The length of the body and threaded section on the body shall be tailored to the location and thickness of the tube sheet for which the expander is intended to be used relative to the end of the tube (see 6.2).

3.2.3 Collar. The collar shall be threaded internally to suit the threads on the body. An antifricition type thrust bearing shall be mounted on the collar with a sleeve mounted on or made integral with the bearing.

3.2.4 Collar sleeve. The collar sleeve for single tube sheets or outer tube sheets on double tube sheet designs shall cover the small ends of the tapered rolls with the collar and locknut adjusted as close to the rolls as possible. The collar sleeve of all expanders over the 1/4-inch tubing size shall be recessed 1/16-inch (plus 1/64 inch minus 0) to fit over the end of the tube. The diameter of the collar sleeve recess shall be not less than 1/32 inch larger than the outside diameter of the tubes for which the expander is intended.

3.2.5 Rolls. The rolls shall have a taper which shall measure 0.015 to 0.016 inch per inch of roll length so as to produce parallel expansion of the tube. The effective length of the rolls shall be such that, together with position adjustment of the collar, the expander will be suitable for rolling the tubes to within 1/8 inch of the inner face of the tube sheet (within 1/8 inch of each face on an inner tube sheet), the thickness of which is specified, or to the maximum depth specified (see 6.2). The rolls shall be ground after heat treatment to remove all decarbonized steel and distortion. Surface finish shall be 32 RMS or smoother. The rolls shall be arranged so that they will not fall out of the body unless the expander is disassembled. When the mandrel is inserted to within 1/4 inch of the shoulder, the rolls shall not be body-bound. Rolls furnished with expanders designed to seat tubes in inner tube sheets or for use in retractive rolling shall be rounded at each end to prevent scoring the tube at the beginning and end of the rolled section. Rolls furnished with expanders designed to seat tubes in outer tube sheets shall be rounded at the entrance end.

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3.2.6 Sizes. Expander shall be sized according to the outside diameter of the tube and tubing wall thickness (see 6.2).

3.3 Spares. A complete set of rolls shall be furnished with each expander.

3.4 Marking. The size and the manufacturer's name shall be indelibly stamped on each expander.

3.5 Workmanship. The workmanship shall be first class in every respect.

#### 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 (examinations and tests) 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 this specification where such inspections are deemed necessary to ensure supplies and service 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 ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this 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 be as follows:

4.2.1 Lot. For purposes of quality conformance inspection, a lot shall consist of all assembled expanders or all spare rolls produced in one facility using the same materials and production processes, and being offered for delivery at one time.

4.2.2 Quality conformance inspection sampling. As a minimum, the contractor shall select a sample quantity of assembled expanders or spare rolls in accordance with table I and inspect them in accordance with paragraph 4.3. Detection of any nonconforming characteristic in any sample shall result in rejection of the entire lot. The contractor has the option of correcting the discrepancy, retesting, and resubmitting a conforming lot or submitting a new lot or submitting a new lot which shall be inspected and tested as specified herein.

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TABLE I. Sampling for quality conformance inspection.

Lot size	Sample Size
2 to 8	All
9 to 90	8
91 to 150	12
51 to 280	19
81 to 500	21
01 to 1200	27
01 to 3200	35
01 to 10,000	38

## 4.3 Examination.

4.3.1 In process examination. Intermediate assemblies which cannot be checked or measured after final assembly shall be examined at various stages of manufacture for conformance to this specification. Whenever a deviation is noted, correction shall be made. Failure to make immediate correction may cause rejection of the affected end items.

4.3.2 Visual and dimensional examination. Each of the assembled expanders shall be examined to determine conformance to this specification regarding dimensions, fits, finishes, security of assembly, and freedom of movement of the parts. Each of the spare rolls shall be examined to determine conformance to this specification regarding dimensions and finishes. Any expander or spare roll which does not conform to this specification shall not be offered for delivery.

4.4 Inspection of packaging. Sample packages and packs, and the inspection of packaging (preservative packing, and marking for shipment, stowage 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 Preservation-packaging, packing, and marking. Tube expanders shall be preserved and packaged level A or C, packed level A, B, or C as specified (see 6.2), and marked including other ordering data options as specified (see 6.2.) in accordance with PPP-P-40. In addition, for Navy acquisitions, the following applies:

- a. Navy fire-retardant requirements.

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(1) Lumber and plywood. Unless otherwise specified (see 6.2), all lumber and plywood including laminated veneer materials used in shipping container and pallet construction, members, blocking, bracking, and reinforcing shall be fire-retardant treated materials conforming to MIL-L-19140 as follows:

Level A and B -                   Type II - weather resistant  
  Category I - general use.

Level C -                            Type I non-weather resistant  
  Category I - general use.

(2) Fiberboard. When specified (see 6.2), fiberboard used in the construction of interior (unit and intermediate) and exterior fiberboard boxes including interior packaging forms shall conform to the class-domestic/fire retardant or class-weather resistant/fire retardant material requirements, as specified (see 6.2), of PPP-P-320 and amendments thereto.

(3) Cushioning and wrapping materials. The use of excelsiar, newspaper, shredded paper (all types), and similar hydroscopic or non-neutral materials and all types of loose fill materials for packaging applications such as cushioning, fill stuffing and dunnage is prohibited. Materials selected for cushioning and wrapping shall have properties (characteristics) for resistance to fire (see 6.4) Cushioning or wrapping materials, as applicable, shall be provided to prevent item and package damage and to prevent free movement of the container contents.

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The tube expanders covered by this specification are intended for use in all types of tubular heat exchangers.

6.2 Acquisition requirements. Acquisition documents must specify the following:

- a. Title, number, and date of this specification
- b. Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1)
- c. Expanders other than righthand feed (see 3.2)
- d. For 1/2 inch size and above tube expanders, whether 3/8-inch square shank or No. 1 Morse taper shank is required (see 3.2.1)
- e. Thickness of tube sheet in which tube is to be expanded or maximum depth of expansion (see 3.2.5)

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- f. Size of tube expanders required and wall thickness of tubing to be expanded (see 3.26)
- g. Levels of preservation-packaging and packing (see 5.1).
- h. When fire retardant lumber and plywood is required. (see 5.1 a(1)).
- i. Class of fire retardant fiberboard required (see 5.1 a(2)).
- j. Number of rolls if more than three are to be required

## 6.3 Subject term (key word) listing.

Collar sleeve  
 Rolled joint  
 Spare rolls

6.4 Cushioning and wrapping materials (see 5.1 A (3)). Materials having properties for resistance to fire and acceptable for use within interior (unit and intermediate) packs and shipping containers for Navy acquisitions are:

<u>Material</u>	<u>Specification</u>
Cushioning Material, Plastic, Open Cell	A-A-440
Paper, Kraft, Treated (Fire Resistant)	A-A-1894
Paper, Kraft, Wrapping	UU-P-268, Type XI, Grade C or D
Fiberboard	PPP-F-320, (see 5.1 a.(2))
Plastic Film, Flexible, Cellular	PPP-C-795, Class 3 - Fire Retardant
Polystyrene Expanded, Resilient	PPP-C-850, Grade SE
Plastic, Open Cell, Cushioning	PPP-C-1842, Type I, Style B
Bound Fiber	PPP-C-1 120, Class A, Grade 1 Type Optional
Rubber, Latex Foam	MIL-R-5001, Grade A
Rubber, Cellular	MIL-R-6130, Grade A
Fibrous Glass	MIL-C-17435
Polystyrene Foam	MIL-P-19644, Type 11
Rubber, Cellular, Synthetic	MIL-R-20092, Class 5
Polyurethane Foam	MIL-P-26514
Cushioning, Resilient Type, General	MIL-C-26861
Polyurethane Foam, Flexible, Open Cell	MIL-F-81334
Foam-In-Place Packaging Materials: General Specification For	MIL-F-83671
Foam, Combustion, Retardant, for Cushioning Supply Items Aboard Navy Ships	MIL-F-87090

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6.5 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.

Review activity  
Navy - SH

Preparing activity  
Navy - SH  
(Project 3441-N144)

User activity  
Navy - YD

# STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

## INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

**NOTE:** This form may not be used to request copies of documents, nor to request waivers, or clarification of 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.

<b>1. DOCUMENT NUMBER</b> MIL-E-15809D (NAVY)	<b>2. DOCUMENT DATE (YYMMDD)</b> 19 MAY 1992
<b>3. DOCUMENT TITLE</b> EXPANDER, TUBE, CONDENSER AND HEAT EXCHANGERS	
<b>4. NATURE OF CHANGE</b> (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)	
<b>5. REASON FOR RECOMMENDATION</b>	
<b>6. SUBMITTER</b>	
<b>a. NAME (Last, First, Middle Initial)</b>	<b>b. ORGANIZATION</b>
<b>c. ADDRESS (include Zip Code)</b>	<b>d. TELEPHONE (include Area Code)</b> (3) Commercial (2) AUTOVON (if applicable)
	<b>7. DATE SUBMITTED (YYMMDD)</b>
<b>8. PREPARING ACTIVITY</b>	
<b>a. NAME</b> COMMANDER NAVAL SEA SYSTEMS COMMAND (SEA 5523)	<b>b. TELEPHONE (include Area Code)</b> (1) Commercial (703) 602-0347 (2) AUTOVON (AV) 332-0347
<b>c. ADDRESS (include Zip Code)</b> WASHINGTON, DC 20362-5101	<b>IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:</b> Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340