

INCH-POUND

MIL-DTL-32372B
w/AMENDMENT 1
17 October 2023
SUPERSEDING
MIL-DTL-32372B
26 September 2018

DETAIL SPECIFICATION

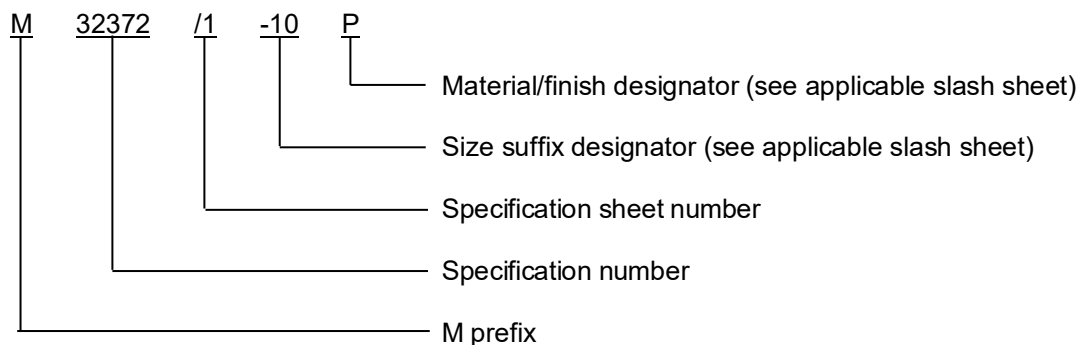
FITTING, ADAPTER, HYDRAULIC AND PNEUMATIC, NPTF TO ORFS CONNECTORS, 1500 TO 3000 PSI AND -65°F TO 250°F

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

1 SCOPE

1.1 Scope. This specification covers fittings, adapter, hydraulic, and pneumatic national pipe thread fuel, (NPTF) dryseal pipe threads to O-ring face seal (ORFS) connectors, 1500 to 3000 psi, -65°F to +250°F temperature range, for use in hydraulic or pneumatic systems. National Pipe Thread connector ends are in accordance with ASME B1.20.3 connector ends; the ORFS end is in accordance with SAE J1453/3 connector ends.

1.2 Part or Identifying Number (PIN). The PIN consists of the letter M, the basic specification number, the specification sheet number, a number for fitting size, and a letter for the material finish designator.



PIN example: M32372/1-10P describes a straight male fitting (NPTF to ORFS) for 5/8 inch tube OD, steel with zinc phosphate finish.

Comments, suggestions, or questions on this document should be addressed to: DLA Land and Maritime, Attn: VAI, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to FluidFlow@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

AMSC N/A

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FSC 4730



2 APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL SPECIFICATIONS

QQ-N-281	Nickel-Copper Alloy Bar, Rod, Plate, Sheet, Strip, Wire, Forgings, and Structural and Special Shaped Sections
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DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-5606	Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance
MIL-PRF-7808	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base
MIL-PRF-8625	Anodic Coatings for Aluminum and Aluminum Alloys
MIL-C-15726	Copper - Nickel Alloy, Sheet, Plate, Strip, Bar, Rod, and Wire
MIL-DTL-16232	Phosphate Coating, Heavy, Manganese or Zinc Base
MIL-DTL-81706	Chemical Conversion Materials for Coating Aluminum and Aluminum Alloys
MIL-PRF-83282	Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Metric, NATO Code Number H-537
MIL-PRF-87257	Hydraulic Fluid, Fire Resistant; Low Temperature, Synthetic Hydrocarbon Base, Aircraft, Missile

(See supplement 1 for list of specification sheets.)

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DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-889	Galvanic compatibility of electrically conductive materials

(Copies of these documents are available online at <https://quicksearch.dla.mil>.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

ASME INTERNATIONAL

ASME B1.20.3	DrySeal Pipe Threads (Inch) - Revision and Redesignation of B2.2-1968
ASME B46.1	Surface Texture (Surface Roughness, Waviness, and Lay)

(Copies of these documents are available online at <https://www.asme.org>.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A276	Standard Specification for Stainless Steel Bars and Shapes
ASTM A564/A564M	Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening

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ASTM A582/A582M	Stainless Steel Bars and Shapes
ASTM B117	Standard Specification for Free-Machining Stainless Steel Bars
ASTM B164	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B166	Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire
	Standard Specification for Nickel-Chromium-Aluminum Alloy, Nickel-Chromium-Iron Alloys, Nickel-Chromium-Cobalt-Molybdenum Alloy, Nickel-Iron-Chromium-Tungsten Alloy, and Nickel-Chromium-Molybdenum-Copper Alloy Rod, Bar, and Wire.
ASTM B487	Standard Test Method for Measurement of Metal and Oxide Coating Thickness by Microscopical Examination of Cross Section
ASTM B499	Standard Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals
ASTM B564	Standard Specification for Nickel Alloy Forgings
ASTM B567	Standard Test Method for Measurement of Coating Thickness by the Beta Backscatter Method
ASTM B568	Standard Test Method for Measurement of Coating Thickness by X-Ray Spectrometry
ASTM B633	Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
ASTM B695	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
ASTM B748	Standard Test Method for Measurement of Thickness of Metallic Coatings by Measurement of Cross Section with a Scanning Electron Microscope
ASTM E18	Standard Test Methods for Rockwell Hardness of Metallic Materials
ASTM E384	Standard Test Method for Microindentation Hardness of Materials
ASTM E60	Standard Practice for Analysis of Metals, Ores, and Related Materials by Spectrophotometry
ASTM F1136/F1136M	Standard Specification for Zinc/Aluminum Corrosion Protective Coatings for Fasteners

(Copies of these documents are available online at <https://www.astm.org>.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO/IEC 17025	General Requirements for the Competence of Testing and Calibration Laboratories
ISO 19879	Metallic Tube Connections for Fluid Power and General Use - Test Methods for Hydraulic Fluid Power Connections

(Copies of these documents are available online at www.ansi.org.)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AMS 2417	Plating, Zinc-Nickel Alloy
SAE-AMS 2486	Conversion Coating of Titanium Alloys Fluoride-Phosphate Type
SAE AMS 2488	Anodic Treatment - Titanium and Titanium Alloys Solution pH 13 or Higher
SAE AMS 2700	Passivation of Corrosion-Resistant Steels
SAE AMS 4124	Aluminum Alloy, Rolled or Cold Finished Bars, Rods, and Wire 5.6Zn - 2.5Mg - 1.6Cu - 0.23Cr (7075-T73, T7351) Solution Heat Treated, Stress Relieved by Stretching, and Overaged - UNS A97075
SAE AMS 4928	Titanium Alloy Bars, Wire, Forgings, Rings, and Drawn Shapes 6Al - 4V Annealed - UNS R56400
SAE AMS 5639	Steel, Corrosion-Resistant, Bars, Wire, Forgings, Mechanical Tubing, Rings and Forging and Ring Stock 19Cr - 10Ni Solution Heat Treated - UNS S30400
SAE AMS 5643	Steel, Corrosion-Resistant, Bars, Wire, Forgings, Mechanical Tubing,

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	and Rings 16Cr- 4.0Ni- 0.30Cb (Nb) - 4.0Cu Solution and Precipitation Heat Treated (H900) - UNS S17400
SAE AMS 5645	Steel, Corrosion and Heat Resistant, Bars, Wire, Forgings, Mechanical Tubing, Rings and Forging Stock 18Cr - 10Ni - 0.40Ti (321) Solution Heat Treated - UNS S32100
SAE AMS 5647	Steel, Corrosion-Resistant, Bars, Wire, Forgings, Mechanical Tubing, Rings, and Forging Stock 19Cr - 9.5Ni Solution Heat Treated - UNS S30403
SAE AMS 5743	Steel, Corrosion and Heat-Resistant, Bars and Forgings 15.5Cr - 4.5Ni - 2.9Mo - 0.10N Consumable Electrode Remelted-Solution Heat Treated, Sub-Zero Cooled, Equalized, and Over-Tempered - UNS S35500
SAE AMS 6370	Steel, Bars, Forgings, and Rings 0.95Cr - 0.20Mo (0.28 - 0.33C) (SAE 4130) - UNS G41300
SAE AMS 6382	Steel, Bars, Forgings, and Rings 0.95Cr - 0.20Mo (0.38 - 0.43C) (SAE 4140) Annealed- UNS G41400
SAE AMS-P-5510	O-Ring, Preformed, Straight Thread Tube Fitting Boss, Type I Hydraulic (-65 Degrees to 160 Degrees F)
SAE AMS-A-22771	Aluminum Alloy Forgings, Heat Treated
SAE AMS-QQ-A-225/9	Aluminum Alloy 7075, Bar, Rod, Wire, and Special Shapes; Rolled, Drawn, or Cold Finished - UNS A97075
SAE AMS-QQ-P-416	Plating, Cadmium (Electrodeposited)
SAE AMS-WW-T-700/4	Tube, Aluminum Alloy, Drawn, Seamless, 5052
SAE AMS-WW-T-700/6	Tube, Aluminum Alloy, Drawn, Seamless, 6061
SAE J403	Chemical Compositions of SAE Carbon Steels
SAE J514	Hydraulic Tube Fittings
SAE J515	Specification for O-Ring Materials Used with Hydraulic Connectors
SAE J1453/1	Specification for O-Ring Face Seal Connectors: Part 1-Tube Connection Details and Common Requirements for Performance and Tests
SAE J1453/3	Specification for O-Ring Face Seal Connectors: Part 3-Requirements, Dimensions, and Tests for Steel Unions, Bulkheads, Swivels, Braze Sleeves, Connectors, Caps, and Connectors with SAE J1926-2 Inch Stud Ends

(Copies of these documents are available online www.sae.org.)

2.3 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, (except for related specification sheets), 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 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between requirements of this specification and the specification sheets, the latter shall govern.

3.2 First article. When specified (see 6.2), samples shall be subjected to first article inspection in accordance with 4.4.

3.3 Materials. Materials shall be as specified herein and shall conform to all applicable specification sheets. When a definite material is not specified, a material shall be used which will enable the adapter to meet the requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guarantee of acceptance of the finished product.

3.3.1 Recycled, recovered, environmentally preferable, or biobased materials. Recycled, recovered,

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environmentally preferable, or biobased materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs.

3.3.1.1 Recovered materials. 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. Unless otherwise specified, none of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification.

3.3.1.2 Used, rebuilt, or remanufactured components. No used, rebuilt, or remanufactured components, pieces, or parts shall be incorporated in the fittings.

3.3.2 Ozone depleting substances (ODS). Class I and II ozone depleting substances (ODS) shall not be used in MIL-DTL-32372 or any referenced procedures.

3.3.3. Dissimilar metals. When dissimilar metals are used in intimate contact with each other, protection against electrolysis and corrosion shall be provided. Dissimilar metals such as brass, copper or steel (except corrosion resisting steel) shall not be used in intimate contact with aluminum or aluminum alloy. Corrosion-resisting steel shall be passivated in accordance with SAE AMS2700. Protective measures for dissimilar metals shall be in accordance with MIL-STD-889.

3.4 Fitting materials. Fitting materials shall be as specified in [Table I](#).

3.4.1 Chemical analysis (see 4.6.4). When requested by the acquiring activity, certification-showing conformance with the applicable material specification shall be made available, see [Table I](#). If certification is not available chemical analysis in accordance with paragraph [4.6.4](#) shall be performed.

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TABLE I. Fitting materials.

Material	Form	Specification	Alloy
Aluminum alloy	Bars	SAE AMS-QQ-A-225/9	7075- T73, T7351
		SAE AMS4124	7075-T7351
	Forgings	SAE AMS-A-22771	7075-T73, T6, T62, or T651
	Seamless tubing	SAE AMS-WW-T-700/4	5052, type I
		SAE AMS-WW-T-700/6	6061-T6, type I
Carbon steel	Bar	SAE J403	1045, 1110, 1120, 1140, 1213, 1215, or 12L14
	Forgings		
Chrome-molybdenum steel	Bars	SAE AMS6370	Alloy 4130
	Forgings	SAE AMS6382	
		SAE AMS6370	
Corrosion resistant steel	Bars and forgings	ASTM A276	304, 316, or 321
		ASTM A564/A564M	XM-12 (15-5 PH) UNS S15500
			or 603 (17-4 PH) UNS S17400
		SAE AMS5639	SAE 30304; UNS S30400
		SAE AMS5645	SAE 30321; UNS S32100
		SAE AMS5647	304L; UNS S30403
		SAE AMS5643	17-4PH
		SAE AMS5743	AM-355
Copper-nickel alloy	Bar	ASTM A582/A582M	UNS S30300
	Bar	MIL-C-15726	C71500
Nickel-copper alloy	Bar	ASTM B164 QQ-N-281	UNS N04400
High-chromium nickel alloy	Bar	ASTM B166	UNS N06690
	Forgings	ASTM B564	
Titanium <u>1/</u>	Bars	SAE AMS4928	6Al-4V annealed
	Forgings		

1/ Titanium shall not be used in oxygen or potable water systems.

3.4.2 Finish.

3.4.2.1 Steel finishes. Not applicable for corrosion resistant steel, see 3.4.2.2. All steel plating's shall meet the 96-hour salt spray test, see 3.4.3.

a. Cadmium plating. Cadmium plating in accordance with SAE-AMS-C-81562, type II, class 3 or SAE-AMS-QQ-P-416, type II, class 2. Fluid passages, other openings and internal threads shall not be subject to the plating thickness requirement and may have bare areas provided they are protected with a light film of oil. Cadmium shall not be used in oxygen or potable water systems. Cadmium is prohibited from use in NAVSEA owned shipboard systems, see 6.6.

b. Zinc plating's. Not for use in aircraft, requires Program Office approval for all applications, see 6.6.2.

- (1) Zinc plating shall be in accordance with ASTM B633; type III or V Fe/Zn 8, or ASTM B695, type II, class 8.
- (2) Zinc-aluminum in accordance with ASTM F1136/F1136M, grade 3, NC.
- (3) Zinc phosphate. Zinc phosphate shall be in accordance with MIL-DTL-16232, type Z.
- (4) Zinc nickel shall be in accordance with SAE-AMS2417, type 2, grade B except the zinc-nickel alloy plate shall contain 12% to 16% nickel. The coating thickness shall be 315μ inches (8μm) minimum coating thickness.

3.4.2.2 Corrosion resistant steel (CRES). CRES shall be passivated in accordance with SAE-AMS2700, method 1, type 6 or 7. Free machining alloy UNS S30300 shall be passivated in accordance with SAE-AMS2700, method 1, type 2 or 4.

3.4.2.3 Titanium. Titanium shall be anodized in accordance with SAE-AMS2488, type 2 or fluoride phosphated in accordance with SAE-AMS2486. Titanium shall not be used in oxygen or potable water systems.

Note: For new design, it is recommended that phosphate coating shall be specified when electrodeposited zinc or mechanically deposited cadmium plating is not required.

3.4.2.4 Aluminum. Aluminum shall be anodized in accordance with MIL-A-8625, type II, class 2.

3.4.2.4.1 Chemical film (aluminum fittings only). NAVAIR trivalent chromate pretreatment (TCP) in accordance with MIL-DTL-81706, type 2, class A, material form (1 through 6), application method A, B, or C. Example of a PIN: M817062A3C.

3.4.2.4.2 Aluminum fittings exposed to heat. Aluminum fittings shall not be exposed to any type of heat, which may alter the temper.

3.4.3 Corrosion resistance. All plating's shall be capable of meeting the 96-hour salt spray test in accordance with 4.6.4. The fittings shall show no evidence of red corrosion after 96 hours of salt spray. Fluid passages, other openings, and internal threads shall not be subject to the plating thickness requirement and may have bare areas provided they are protected with a light film of oil. The following exceptions shall apply:

- a. Phosphate coated fittings shall be subjected to all tests as specified in MIL-DTL-16232, Class 1. The salt spray test is required for first article inspection. A manufacturer that has pass first article inspection salt spray testing additional salt spray testing is required only to verify the phosphating process or changes thereto.
- b. CRES passivated fittings shall be subjected only to the copper sulfate tests as specified in SAE-AMS2700, method 102. Fittings passing this test shall be returned to stock for usage after each fitting is thoroughly rinsed in deionized water and thoroughly dried.

3.4.4 Cadmium is not recommended. Carbon steel material with cadmium plating shall only be used when other materials and finishes specified in this document cannot meet performance requirements (see

6.6).

3.4.5 Plating thickness verification. Applicable to cadmium and zinc plating's only. Plating thickness shall be measured in accordance with 4.6.2 and shall meet the requirements of 3.4.2.1.

3.4.6 Material deterioration prevention and control. The fitting shall be fabricated from compatible corrosion resistant materials or shall be treated to prevent corrosion and deterioration that may be encountered in operating and storage environments.

3.4.7 Identification of materials and finishes. The Contractor shall identify materials, finishes and treatments used and shall make this information available upon request to the contracting officer or designated representative.

3.5 Hardness (steel).

3.5.1 Hardness for finished corrosion-resisting steel parts. Unless otherwise specified in the contract or order (see 6.2), the minimum hardness for finished corrosion-resisting steel parts shall be Rockwell B80 and the maximum hardness shall be Rockwell C32 when tested in accordance with 4.6.3.

3.6 Design.

3.6.1 Design concept. Fittings are designed to connect an ASME B1.20.3 NPTF fitting to a SAE J1453/3 ORFS fitting. When properly assembled shall insure a leak proof full - flow connection. The NPTF connection is an old technology. The ORFS connector-sealing end provides the technology of an elastomeric seal on the connection in line with the fluid flow to account for surface imperfections to give a tight seal.

3.6.2 Working pressures. Fittings, when properly assembled, shall ensure a leak-proof full-flow connection up to 3000 psi (20.7MPa) working pressure or 6000 psi (41 MPa) proof pressure for sizes -2 through -16 (1/8 through 1 inch) and 1500 psi (10 MPa) working pressure or 3000 psi (21 MPa) proof pressure for sizes -20 through -32 (1-1/4 through 2 inch).

3.6.3 Operating temperature. Fittings shall operate in a hydraulic environment of -65°F to +250°F (-54°C to 121°C) and pneumatic environment of -65°F to +160°F (-54°C to 71°C).

3.6.4 Design and dimensions. Fittings shall be in accordance with the applicable slash sheets, see supplement 1. For features not specified on the individual slash sheets design and dimensions shall be in accordance with SAE J514 or SAE J1453/3. The National Pipe Thread end shall be in accordance with ASME B1.20.3.

3.6.4.1 Machined surfaces. Machined surfaces of fittings shall be free of burrs and longitudinal tool marks. Unless a finer finish is specified in the applicable specification sheet, sealing surfaces shall be smooth, except that annular tool marks up to 100µin (2.54µm) roughness-height-rating (Ra) as defined in ASME B46.1, will be acceptable. All other machined surfaces shall not exceed 250µin (6.35µm) Ra. The arithmetical average values shall be interpreted in accordance with ASME B46.1.

3.6.4.2 Forgings. Un-machined surfaces such as forging surfaces and bar stock flats shall be free of cracks, laps, and seams except for forging parting lines.

3.6.4.3 Castings. Casting shall be sound and free from blowholes and other visible defects.

3.6.4.4 NPTF end. The NPTF end shall be in accordance with ASME B1.20.3.

3.6.4.5 ORFS end. The ORFS end shall be in accordance with SAE J1453/3 for both non-bulkheads and bulkheads, and swivel.

3.6.4.6 O-rings. O-rings when required, shall be in accordance with SAE AMS-P-5510 or SAE J515, type 1.

3.6.4.7 Back-up washers. All carbon steel back-up washers shall be steel alloy 1010 or 1015 in accordance with SAE J403. Back-up washers shall be furnished on adjustable fittings that require the use of a locknut. Washers are to be installed on fittings by the manufacturer.

3.6.4.8 Shape and form restrictions. Abrupt reductions of section shall be avoided. Small external sections adjoining relatively heavy body sections shall be shaded into the heavier sections by means of ample fillets. There shall be no sharp corners or inadequate fillets, excessive undercuts, or excessive grooves at the junction of such small sections with large sections of fittings.

3.6.4.9 Drill offset. On straight fittings where the fluid passage is drilled from each end, the offset between the drilled holes at the meeting point of the drills shall not exceed .015 inch (0.38 mm). It shall be possible to pass through the fluid passage a ball whose minimum diameter is .020 inch (0.51mm) less than the minimum diameter specified for the passage. On angle fittings, the cross-sectional area at the junction of the fluid passage shall be not smaller than the cross-sectional area of the smaller passage.

3.6.4.10 Wall thickness. The wall thickness at any point on the fitting shall be not less than the thickness established by the dimensions, tolerances and eccentricities for the inside and outside diameters specified in ASME B1.20.3, SAE J1453/3 or the applicable specification sheet (see 1.2).

3.6.4.11 NPTF end threads. NPTF end threads shall be in accordance with ASME B1.20.3.

3.6.4.12 ORFS end threads. ORFS end threads shall be in accordance with SAE J1453/1.

3.7 Performance.

3.7.1 Lubricant wear (see 4.7.1). The fittings shall be assembled and disassembled, using the torque values listed in Table II when tested in accordance with 4.7.1. The final torque readings shall not exceed the values specified in Table II.

3.7.2 Proof pressure (see 4.7.2). The fittings shall withstand the proof pressure specified in Table III without malfunction or leakage, when tested in accordance with 4.7.2

3.7.3 Leakage (see 4.7.3). The fitting shall show no evidence of leakage from the fitting or other malfunction, when tested in accordance with 4.7.3.

3.7.4 Room temperature burst (see 4.7.4). The fittings shall not leak, rupture, or fail at any pressure below the minimum room temperature burst pressure specified in Table III, when tested in accordance with 4.7.4.

3.7.5 Over-tightening torque (see 4.7.5). The fittings shall withstand over - tightening torque 15 times, when tested in accordance with 4.7.5.

3.7.6 Interchangeability. Parts having the same slash number shall be functionally and dimensionally interchangeable. All parts manufactured to the same military part number shall be functionally interchangeable.

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TABLE II. Torque. 1/ 2/

Fitting dash size	Straight thread SAE J1453/3 Torque foot-pounds (Nm)		Pipe threads ASME B1.20.3 Torque foot-pounds (Nm)	
	Lubricant wear test	Over tightening torque	Lubricant wear test	Over tightening torque
-4	18.4 (25)	23.6 (32)	11.3 (15.3)	12.1 (16.9)
-6	29.5 (40)	39.8 (54)	17.9 (24.3)	20.4 (27.7)
-8	40.6 (55)	59.8 (81)	35.8 (48.6)	39.2 (53.1)
-10	44.3 (60)	100 (136)	51.7 (70)	56.7 (77)
-12	66.4 (90)	133 (180)	71.3 (97)	70.4 (95)
-14	84.4 (115)	170 (230)	87.5 (119)	100 (136)
-16	92.2 (125)	199 (270)	95 (129)	105 (142)
-20	125 (170)	280 (380)	127 (172)	140 (190)
-24	148 (200)	332 (450)	158 (215)	175 (237)
-32	199 (270)	446 (606)	222 (301)	245 (332)

1/ Dimensions are in inches.

2/ Metric equivalents are given for information only.

TABLE III. Performance requirements of high pressure, high temperature fittings. 1/ 2/

Fitting dash size	Max. operating pressure psi (MPa)	Proof pressure psi (MPa)	Min. burst pressure at room temp psi (MPa)	Min. burst pressure at high temp psi (MPa)	Minimum bend radius (inside of bend) inch (mm)
-4	3000 (21)	6000 (41)	16,000 (110)	12,000 (83)	3.00 (76)
-6	3000 (21)	6000 (41)	14,000 (97)	10,500 (72)	5.00 (127)
-8	3000 (21)	6000 (41)	14,000 (97)	10,500 (72)	5.75 (146)
-10	3000 (21)	6000 (41)	12,000 (83)	9,000 (62)	6.50 (165)
-12	3000 (21)	6000 (41)	12,000 (83)	9,000 (62)	7.75 (197)
-16	3000 (21)	6000 (41)	12,000 (83)	9,000 (62)	9.63 (245)
-20	1500 (10.5)	3000 (21)	6000 (41)	4,000 (31)	10.00 (254)
-24	1500 (10.5)	3000 (21)	6000 (41)	4,000 (31)	11.00 (279)
-32	1500 (10.5)	3000 (21)	6000 (41)	4,000 (31)	14.00 (355)

1/ Dimensions are in inches.

2/ Metric equivalents are given for information only.

3.8 Marking.

3.8.1 Identification of product. Fittings shall be marked as specified in 3.8.2 and 3.8.3. Stamped markings shall be applied in a location not detrimental to the function of the fitting prior to the application of the corrosion-protective finish specified in 3.4.2.

3.8.2 Trademark. Unless otherwise specified, all fittings shall be stamped with manufacturer's name or trademark.

3.8.3 PIN marking. Fittings shall be marked for identification in accordance with MIL-STD-130 with the applicable specification sheet PIN (see 3.1).

3.8.4 Additional marking. All fittings made from corrosion-resisting steel, shall be permanently stamped with the composition, designation or type number, as specified in the solicitation or contract.

3.9 Lubrication. During assembly, an anti-friction compound, oil or petroleum lubricant may be used on the sleeves and threads of carbon steel and of corrosion-resisting steel fittings. A dry film lubricant or a lubricous coating may be added to the threads of corrosion-resisting steel nuts.

3.10 Cleanliness. All fittings shall be free of contaminants both internally and externally. Fittings shall be properly cleaned prior to inspection, testing, and shipping.

3.11 Workmanship. Workmanship shall conform to the best commercial practice to produce high quality fittings. Fittings shall be free from all hanging burrs, loose scale and slivers, which might become dislodged in usage and all other defects which might affect their performance. The fittings shall be examined for the following defects as specified in Table IV.

TABLE IV. Workmanship defects.

Examination	Requirement paragraph
Type, size, style, or configuration not in conformance with the applicable individual specification sheet.	3.6.4
Shape and form reduction abrupt: Small external sections not shaded into heavy body section by fillets: fittings have sharp corners; inadequate fillets; excessive undercuts or grooves.	3.6.4.8
Bores drilled from each end exceed specified tolerance at drill meeting point; size of fluid passage of angle fittings, not as specified.	3.6.4.9
Wall thickness of fittings, less than dimensions and tolerances specified.	3.6.4.10
Machined surface finish.	3.6.4.1
Material not as specified.	3.4
Threads not as specified.	3.6.4.4 and 3.6.4.5
Finish not as specified.	3.4.2
Contractor does not have documentation available for identification of material.	3.4.1
Contractor does not have documentation available for identification of finishes or treatment.	3.4.7
Used, rebuilt or remanufactured components, pieces, or parts incorporated in the fittings.	3.3.1.2
Materials, when applicable, are not resistant to corrosion and deterioration or treated to be resistant to corrosion and deterioration for the applicable storage and operating environments.	3.4.6
Locknuts or washers missing, or not as specified.	3.6.4.7
Marking missing, illegible, or not as specified.	3.7
O-ring, missing or not as specified.	3.6.4.6

4. VERIFICATION

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

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

4.2 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained or identified by the Contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with ISO 17025/EC 17025 as applicable.

4.2.1 Inspection conditions. Unless otherwise specified, all testing shall be conducted at atmospheric pressure within the range of 28 to 31 inches of mercury (71.1 to 78.7 centimeters of mercury), a temperature between 60°F and 100°F (15.6°C to 37.8°C), and a relative humidity of not more than 90%. Tolerances of the test conditions shall be as follows:

- a. Temperature: +10°F, -5°F (+5.55°C, -2.8°C)
- b. Pressure (gauge): ±5%

4.2.2 Stabilization of test temperatures. Unless otherwise specified, the test temperature in the chamber shall be stabilized before conducting the test.

4.2.3 Test fluids. Unless otherwise specified, the test fluid shall be hydraulic fluid conforming to MIL-PRF-5606, MIL-PRF-83282, or MIL-PRF-87257, or water. Water if used shall be for proof test, burst test, and leakage test only. When a high temperature test fluid is specified, the test fluid shall be lubricating oil in accordance with MIL-PRF-7808.

4.3 Responsibility for compliance. All items shall meet all requirements of sections 3 and 4. 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 accept defective material.

4.3.1 Lot records. Manufacturers shall keep lot records for 3 years minimum. Manufacturers shall monitor for compliance to the prescribed procedures, and observe that satisfactory manufacturing conditions and records on lots are maintained for these adapters. The records, including as a minimum, an attributes summary of all quality conformance inspections conducted on each lot, shall be available to review by customers at all times.

4.3.2 First article inspection. First article inspection shall be performed at a laboratory acceptable to the procuring activity on sample units produced with equipment and procedures used in production.

4.3.3 Samples for first article. Samples for first article shall be representative of the products proposed to be furnished to this specification. Sampling for adapters shall be in accordance with 4.4.1.

4.4 First article inspection routine. All samples shall be subjected to first article testing in accordance with Table V.

4.4.1 Samples for first article inspection. Samples for first article inspection shall be representative of the products proposed to be furnished to this specification. Test samples for each dash size specified in [Table V](#) shall be examined and tested in accordance with this specification. When required fittings shall be assembled on a tube and the assembly shall be tested. Test results shall be submitted to the acquiring activity. All fittings shall be identified with the manufacturer's name and the slash sheet PIN.

4.4.2 First article test sequence. Adapters shall be tested in accordance with [Table V](#). The following details shall apply:

- a. Individual adapter testing shall consist of Cleanliness, Visual Inspection, Plating Verification, Hardness, Chemical Analysis, Salt Spray Test, Phosphate Coated Tests, Copper Sulfate Tests, and Design Capability Tests as applicable, see [Table V](#).
- b. Tube assemblies shall be tested as specified in [Table V](#) and in the sequence specified in [Table VI](#).

TABLE V. First article inspection.

Inspection	Inspection paragraph	Test paragraph	Number of samples
Cleanliness	3.10	---	All
Visual inspection	3.1 , 3.6.1 , 3.4 , 3.4.1 , 3.8 , and 3.11	4.6.1	All
Plating verification 1/	3.4.5	4.6.2	2 minimum
Hardness 2/	3.5.1	4.6.3	2 minimum
Chemical analysis	3.4.1	4.6.4	2 minimum
Corrosion resistance 3/	3.4.3	4.6.5	2 minimum
Phosphate coated tests 4/	3.4.3.a	---	2 minimum
Copper sulfate tests 5/	3.4.3.b	---	2 minimum
Design capability test	3.6	4.6.6.2	11 fittings
Lubricant wear 6/	3.7.1	4.7.1	14 tube assemblies
Proof pressure	3.7.2	4.7.2	12 tube assemblies
Leakage 6/	3.7.3	4.7.3	4 tube assemblies
Room temperature burst pressure 6/	3.7.4	4.7.4	2 tube assemblies
Over-tightening torque 6/	3.7.5	4.7.5	2 tube assemblies

[1/](#) Applicable to aluminum-nickel, cadmium, or zinc only. May be supplied by the plating manufacturer.

[2/](#) Corrosion resistant steel parts only.

[3/](#) Cadmium or zinc plated parts only.

[4/](#) Phosphate coated fittings only.

[5/](#) CRES passivated fittings shall be subjected only to the copper sulfate tests.

[6/](#) These are destructive tests.

TABLE VI. First article test sequence tube assemblies.

Test assembly	Test paragraph			
1 and 2	4.7.1			
3 and 4 1/	4.7.1	4.7.2	4.7.3	4.7.4
5 and 6	4.7.1	4.7.2	4.7.3	
7 and 8 1/	4.7.1	4.7.2	4.7.5	
9 through 14	4.7.1	4.7.2		
Test sequence	1	2	3	3

[1/](#) These samples shall have a 90°elbow fitting on one end of the assembly.

4.4.3 Failures. All samples must meet all of the contract requirements. Failure of a sample unit to pass

any test shall be cause for rejection of the entire lot and to grant first article approval.

4.4.4 Disposition of samples. First article samples shall be furnished to the Government as directed by the contracting officer (see 6.2). Unless otherwise specified, after award of the contract or order, the manufacturer shall forward, from randomly selected samples, 1 fitting. The sample shall be representative of the construction, workmanship, components, and materials to be used during production.

4.4.5 First article information. Upon completion of first article inspection, the Government activity responsible for conducting the inspection program (see 6.2), shall report the results of the inspection, with appropriate recommendation, to the contracting officer. Approval of the first article samples or the waiving of first article inspection does not preclude the requirements for performing conformance inspection.

4.4.6 Waivers or deviations to specification requirements. All waivers or deviations to specification requirements shall be coordinated through the preparing activity: DLA Land and Maritime, Attn: VAI, P.O. Box 3990, Columbus, Ohio 43218-3990 or e-mailed to FluidFlow@dla.mil.

4.5 Conformance inspection.

4.5.1 Conformance inspection. For manufacturers that have successfully passed first article inspections and are continuously producing adapters to this specification on going inspections shall consist of individual inspections see Table VII. If first article is waived due to prior successful first article inspection, the individual inspections and sampling and periodic inspections shall be the manufactures in house inspection procedures.

4.5.2 Inspection of product for delivery. Inspection of product for delivery shall consist of individual inspections in Table VII.

TABLE VII. Individual inspections.

Inspection	Requirement Paragraph	Test method paragraph
Cleanliness	3.10	---
Dimensional and visual inspection	3.1, 3.6.1, 3.4, 3.4.1, 3.8, and 3.11	4.6.1
Hardness ^{1/}	3.5.1	4.6.3

^{1/} Corrosion resistant steel parts only. 2 samples minimum.

4.5.3 Sampling for individual inspections. Fittings for sampling shall be selected from a production lot (see 4.5.3.1) and shall be subjected to the individual inspections. The sampling size shall be as specified in 4.5.3.2.

4.5.3.1 Production lot. A production lot shall consist of all fittings of the same part number, which have been manufactured under the same conditions and on the same continuous run.

4.5.3.2 Inspection sample. The inspection sample shall be product selected at random from the production lot without regard to quality and shall be the size specified in Table VIII.

TABLE VIII. Inspection sample.

Production lot size	Sample size
1 to 8	All
9 to 90	8
91 to 150	12
151 to 280	19
281 to 500	21
501 to 1,200	27
1,201 to 3,200	35
3,201 to 10,000	38
10,001 to 35,000	46

4.5.3 Nonconformance of sampling tests. If one or more defects are identified, then the entire production lot shall be screened for that defect and all defects shall be removed. A second inspection sample shall then be selected and the sampling tests shall be performed again. If one or more defects are identified from the second inspection lot, then the entire production lot shall be rejected and not supplied to this specification.

4.6 Test methods.

4.6.1 Visual inspection. Fittings shall be examined to ensure conformance with this specification. Continuous examination shall be performed to assure compliance with the following requirements:

- a. Specification sheets (see 3.1).
- b. Design, construction and physical dimensions (see 3.6.1).
- c. Materials (see 3.4) and finishes (see 3.4.2).
- d. Marking (see 3.8).
- e. Workmanship (see 3.11).

4.6.2 Verification of plating thickness. Applicable for cadmium or zinc (see 3.4.7). Verification of under plating and finish plating shall be measured in accordance with ASTM B499, ASTM B567, or ASTM B568. A cross-sectioning method, such as that specified by ASTM B487 or ASTM B748, can also be used as a referee method to confirm the precision when thicknesses of 30μ inches (0.76μm) or above are used. The zinc plating thickness may also be measured in accordance with ASTM B633 or ASTM B695 as applicable. The plating requirements shall meet the requirements of 3.4.5. The following details shall apply:

- a. When applicable a minimum of three points shall be measured on the fitting surface. The fitting may be rotated, but measurement points shall be progressively further from the last point.
- b. Readings shall not be averaged. Measurements shall be as follows:
 - (1) One measurement shall be taken at a point on the front and rear.
 - (2) Three measurements shall be taken in the middle areas.

4.6.3 Hardness test (see 3.5). Two fittings minimum, randomly selected in accordance with 4.5.2 shall be tested for hardness in accordance with ASTM E18 or ASTM E384 and shall meet the requirements of 3.5.

4.6.4 Chemical analysis (see 3.4.1). When specified, spectrochemical analysis shall be in accordance with ASTM E60, see 3.4.1 and 6.2).

4.6.5 Corrosion resistance (cadmium or zinc plated parts only, see 3.4.3). Two fitting samples shall be corrosion resistance tested in accordance with ASTM B117 and shall meet the requirements of 3.4.3.

4.6.6 Design capability testing of fittings.

4.6.6.1 Design certification. In order to provide a basis for certifying to the design requirements of 3.6, fitting manufacturers shall pressure test each of their product designs as outlined in 4.6.6.2.

4.6.6.2 Design capability test. When specified, a minimum of 6 fittings shall be tested on tube assemblies. The fittings of each size, shape and material, after applying lubrication, shall be assembled with mating fittings.

- a. The tube assembly shall be tightened to the fitting with a minimum torque load specified in Table II for the applicable assembly size, fitting end and fitting type.
- b. The straight thread with O-ring end fitting shall be tightened to the point where leakage shall not occur, at a proof pressure of 6000 psi (41 MPa) for size -2 through -16 or a proof pressure of 3000 psi (21 MPa) for size -20 through -32. Under this pressure, there shall be no leakage or distortion of the assembly.
- c. The tube assembly with fitting shall then be pressurized to the point at which leakage or rupture occurs and the results shall be recorded.

4.7 Functional test. The fittings shall be assembled to the tube and subjected to the lubricant wear test as specified in 4.7.1. Any fitting failing to pass this test is counted as a defective unit and is cause for rejection of a lot. Fittings, or parts thereof, subjected to the lubricant wear test shall not be delivered to the acquiring activity.

4.7.1 Lubricant wear (see 3.7.1). Fittings when subjected to the lubricant wear test shall meet the requirements of 3.7.1. The following details shall apply:

- a. The fittings shall be lubricated with hydraulic oil in accordance with MIL-PRF-5606, MIL-PRF-83282, or MIL-PRF-87257 prior to this test.
- b. Tube method:
 - (1) The fitting shall be assembled to the tube and disassembled.
 - (2) A new end or tube assembly shall be used for each assembly.
- c. This sequence shall be repeated 15 times.
- d. During the last assembly, the torque reading shall be recorded.

4.7.2 Proof pressure (see 3.7.2). The fitting when assembled to a tube assembly shall be tested as specified in ISO 19879. When subjected to the rated proof pressure specified in Table III the fitting assembled to the tube assembly shall meet the requirements of 3.7.2

4.7.3 Leakage tests (see 3.7.3). The fittings when installed on tube assemblies shall be tested as specified in ISO 19879 and meet the requirements of 3.7.3.

4.7.4 Burst pressure testing (see 3.7.4). Fittings shall be tested and shall meet the requirements of 3.7.4. The following details shall apply:

- a. Testing shall be in accordance with ISO 19879.
- b. The tube with fittings installed shall be capable of withstanding an internal hydrostatic pressure to a minimum of four times the intended working pressure specified in Table III without failure.

4.7.5 Over-tightening torque (see 3.7.5). Fittings when subjected to over-tightening torque testing shall meet the requirements of 3.7.5. The following details shall apply:

- a. Two tube assemblies with fittings of each size shall be subjected to the following tests.
- b. The threads of the fittings shall be lubricated with oil in accordance with MIL-PRF-5606, MIL-PRF-87257 or MIL-PRF-83282 prior to this test.
- c. All fittings and both ends shall be tightened to the over-tightening torque specified in Table II and then loosened. This sequence shall be repeated 15 times for the NPTF and ORFS ends.
- d. On the 15th over-tightening torque application, the tube assemblies with fitting shall be subjected to the proof pressure test specified in 4.7.2.
- e. After this sequence, there shall be no evidence of failure, leakage, or deformation of the fitting assemblies.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of material is to be performed by DoD or in-house Contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Service or Defense Agency, or within the Military Service's System Commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The fittings covered by this document are intended for fluid flow conveyance systems, for land based and marine applications. The fluids can be hydraulic, fuel, oil, and lubrication. These fitting parts allow the military to upgrade old systems (NPTF) to new systems (ORFS) without dismantling and doing major modifications on bulkheads and vehicle framework. The intended objective is to convert to an elastomeric seal that comes with the ORFS.

6.2 Military unique rationale. The testing is to provide reliability in an environment that is harsh, and of a military nature. Conditions must range from -65° (-54° C) with high blizzard winds to more than 100°F (38°C) in a driving sand storm. Commercial systems and commercial parts are not required to perform in rigorous environments as their military counterparts.

6.3 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Applicable specification sheet number, title, and date.
- c. Applicable specification sheet PIN (see 1.2).
- d. Whether first article inspection is waived (see 4.5.1).
- e. Name and address of the first article inspection test facility to which first article samples are to be forwarded (see 4.4.1) and the name and address of the Government activity responsible for conducting the first article inspection program (see 6.4).
- f. Name and address of the Government activity responsible for receiving a production sample (see 4.4.4).
- g. Hardness requirement, if different (see 3.5.1).
- h. Chemical analysis (see 4.6.4).
- i. Corrosion-resisting steel stamped with the composition, designation or type number (see 3.8.4).
- j. The contracting officer at their discretion may invoke addition testing specified in sections 3 or 4 of this specification.
- k. Increased working pressure, ¼ inch fittings only, see 6.7.1.

I. Packaging requirements (see 5.1).

6.4 First article. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first article samples. Invitations for bids 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.

6.5 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification.

6.6 Guidance on use of alternative parts with less hazardous or nonhazardous materials. This specification provides for a number of alternative plating materials via the PIN. Users should select the PIN with the least hazardous material that meets the form, fit and function requirements of their application.

6.6.1 Cadmium plating replacements. Cadmium is prohibited from use in NAVSEA owned shipboard systems in accordance with the requirements of T9070-AL-DPC-020/077-2.

6.6.2 Zinc coatings. It is recommended that zinc coatings be specified in place of cadmium plating whenever contact with salt atmosphere is not a problem. Not for use in aircraft. Requires approval from the Program Office for all applications. Zinc-plated materials should be avoided in hydraulic systems with water-glycol fluids. Reference ASTM MNL37 - Fuels and Lubricants Handbook, "water glycol fluids are highly alkaline due to the presence of amine based corrosion inhibitors. As a result, these fluids can attack zinc, cadmium, magnesium, and non-anodized aluminum, forming sticky or gummy residues. Consequently, these metals should be avoided when selecting system components.

6.6.3 Phosphate coatings. It is recommended that phosphate coating be specified when electrodeposited zinc or mechanically-deposited cadmium are not required.

6.7 Working pressure. Working pressure is the established recommended pressure based on a safety factor of 4 to 1. However, fittings may have an increased working pressure based on any or all of the following factors: reduced tube size, increased tube wall thickness and reduced safety factor. The sealing of ORFS is made by the contact between two metal surfaces, with no deformation of the single components, plus an elastomeric sealing (O-ring) placed into a groove on the front part of the fitting.

6.7.1 Working pressure 1/4-inch (6.35 mm) fittings. The 1/4-inch (6.35 mm) fittings may have an increased working pressure up to 5000 psi (35 MPa) maximum. Prior to such use, supporting test data will be approved by both the procuring agency and the manufacturer.

6.8 Subject term (key word) listing.

Cadmium
Conveyance fluid
Copper sulfate
Interconnection
Interface
National pipe thread
Nickel
O-ring face seal
Phosphate

6.9 Amendment notations. The margins of this specification are marked with vertical lines to indicate modifications generated by this amendment. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and Contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations.

CONCLUDING MATERIAL

Custodians:

Army - AR
Navy - SH
Air Force 71
DLA - CC

Preparing activity:

DLA - CC

(Project 4730-2023-081)

Review activities:

Army - AT, GL
Navy - AS, MC, SA

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.