INCH-POUND

MIL-DTL-6001B
13 February 2013
SUPERSEDING
MIL-F-6001A (ASG)
15 July 1958

DETAIL SPECIFICATION

FITTINGS; AIRCRAFT, SOLDER TYPE, TUBE

Inactive for new design after 24 July 1998.

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

1. SCOPE

1.1 Scope. This specification covers the general requirements for fittings, aircraft, solder type, tube.

1.2 Part or Identifying Number (PIN). The PIN requirements are shown in the specification sheets.

1.2.1 Air Force – Navy Aeronautical Standard. The specification sheets are listed in supplement 1.

1.2.2 Size of fittings. Sizes are shown in the individual specification sheets.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4 or 5 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, 4 or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 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 (Monel and R-Monel) Bars, Plates, Rods, Sheets, Strips, Wire, Forgings, and Structural and Special Shaped Sections

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.

DEPARTMENT OF DEFENSE SPECIFICATIONS

(See supplement 1 for list of specification sheets.)

DEPARTMENT OF DEFENSE STANDARD

MIL-STD-129 Marking for Shipment and Storage

(Copies of these documents are available online at https://assist.dla.mil/quicksearch/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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

ASTM INTERNATIONAL

ASTM B121/B121M	Leaded Brass Plate, Sheet, Strip, and Rolled Bar, Standard Specification for
ASTM B154	Mercurous Nitrate Test for Copper Alloys, Standard Test Method for
ASTM B858	Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys, Standard Test Method for

(Copies of these documents are available online at http://www.astm.org or from the ASTM International, P.O. Box C700, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 6957	Copper Alloys - Ammonia Test for Stress Corrosion Resistance First Edition
ISO 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 - Second Edition

(Copies of these documents are available online at www.ansi.org or from the ANSI Customer Service Department, 25 W. 43rd Street, 4th Floor, New York, NY 10036.)

NCSL INTERNATIONAL

NCSL Z540.3 Requirements for the Calibration of Measuring and Test Equipment

(Copies of these documents are available online at http://www.ncsli.org or from NCSL International 2995 Wilderness Place, Suite 107 Boulder, Colorado 80301-5404)

SAE INTERNATIONAL

SAE AMS-QQ-P-416	Plating, Cadmium (Electrodeposited)
SAE AMS2700	Passivation of Corrosion Resistant Steels
SAE AMS-S-7720	Steel, Corrosion-Resistant (18-8) Bars, Wire and Forging Stock (Aircraft Quality)

(Copies of these documents are available on line at www.sae.org from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, and Tel: 877-606-7323 [inside USA and Canada] or 724-776-4970 [outside USA], email at CustomerService@sae.org.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between 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 the requirements of this specification and the specification sheet, 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 Design and dimensions. The design and dimensions shall meet the requirements specified herein and in the applicable AN or MS standard.

3.4 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. Sharp corners or inadequate fillets, excessive undercuts or grooves, at the junction of such small sections with large sections of fittings shall be considered cause for rejection. Unless otherwise specified, drawing tolerances shall apply to fillet and corner radii.

3.5 Materials. Fittings shall be fabricated of materials listed in table I as specified on the applicable AN or MS standard.

TABLE I. Materials.

Materials	Form	Specification Number
Brass	Bars, Rods, Shapes and Forging	ASTM B121/B121M
Corrosion – Resistant Steel (18Cr – 8Ni)	Bars and Rods	SAE AMS-S-7720
Nickel – Copper - Alloy	Forging, Plates, Rods, Shapes, Sheets, Strips and Wire	QQ-N-281

3.5.1 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable 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 cost.

3.6 Finish.

3.6.1 Brass cadmium plating. Cadmium plating, when required, shall be in accordance with SAE AMS-QQ-P-416.

3.6.2 Corrosion resistant steel. Corrosion resistant steel shall be passivated in accordance with SAE AMS2700, method 2.

3.6.3 Nickel – copper – alloy. No additional finish required.

3.7 Performance.

3.7.1 Examination of product. The fittings shall conform to the requirements of this specification and the applicable AN or MS standard when visually examined as specified in 4.7.1.

3.7.1.1 Cleanliness. Fittings shall be free of all foreign materials, both internally and externally, which could adversely affect performance and reliability when examined as specified in 4.7.1.1.

3.7.1.2 Dimensions. Fittings shall be within the tolerances specified herein and on the applicable AN or MS standard when examined as specified in 4.7.1.2.

3.7.2 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 0.015 inch (see 4.7.2).

3.7.3 Angle fittings. On angle fittings, the cross-sectional area at the junction of the fluid passages shall not be smaller than the cross-sectional area of the smaller passage (see 4.7.3).

3.7.4 Wall thickness. Except as otherwise specified on the applicable AN or MS standard, the wall thickness at any point on the fitting shall be not less than the thickness established by the dimensions and tolerances for the inside and outside diameters and eccentricities specified in the AN or MS standard (see 4.7.4).

3.7.5 Leakage test. The fittings shall withstand the leakage pressure specified in table II without malfunction or leakage, when tested in accordance with 4.7.5.

3.7.6 Proof pressure. The fittings shall withstand the proof pressure specified in table II without malfunction or leakage, when tested in accordance with 4.7.6.

3.7.7 Vibration test. The fittings shall not leak, rupture, or fail at the working pressure specified in table II, when tested in accordance with 4.7.7.

3.7.8 Internal strain of copper base alloys. Fittings made of copper base alloys (ASTM B121/B121M) shall have no internal strains as revealed by the test specified in 4.7.8.

3.8 Identification of product. All fittings shall be marked in accordance with the following instructions. The marking shall be applied in a location not detrimental to the fitting and shall not be detrimental to the corrosion protection of the fitting.

3.8.1 AN or MS symbols and trademarks. Unless otherwise specified, all fittings shall be marked with the letters AN or MS and the manufacturer's name or trademark. The marking shall be permanent, preferably embossed letters or impression stamping. However, ink stamping may be used. The letters AN or MS shall be separated and distinct from the manufacturer's name or trademark.

3.8.2 Identifying number or letter. Wherever practicable, each fitting shall also be identified by the complete AN or MS standard number as shown by the AN or MS standard. The size and material code letter is not to be included with the standard number. The identifying number shall be added to the part by embossing, impressing stamping, ink stamping, or printed on a paper collar supplied with the fitting. The preferable marking shall be in the order mentioned. The identifying number shall not be placed on the union nut specified in AN805. Also the fittings in sizes -6 and under need not be individually marked but shall be packaged in units, with the package carrying the identifying number.

3.9 Workmanship. Fittings shall be free from burrs and longitudinal and spiral tool marks. All sealing surfaces shall be smooth except that annular tool marks up to 100 microinches rms maximum will be acceptable. Workmanship shall conform to the best commercial practice to produce fittings free from all defects which will affect proper functioning in service.

TABLE II. Performance requirements.

Fitting dash size	Maximum working pressure		Minimum leakage pressure		Minimum proof pressure	
	psi	MPa	psi	MPa	psi	MPa
2	100	.689	200	1.38	200	1.38
3	100	.689	200	1.38	200	1.38
4	100	.689	200	1.38	200	1.38
5	100	.689	200	1.38	200	1.38
6	100	.689	200	1.38	200	1.38
8	100	.689	200	1.38	200	1.38
10	100	.689	200	1.38	200	1.38
12	100	.689	200	1.38	200	1.38
16	100	.689	200	1.38	200	1.38

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 used. The establishment and the maintenance of a calibration system to control the accuracy of all test and measuring equipment shall be in accordance with ISO 17025 and NCSL Z540.3, as applicable.

4.3 Inspection conditions. Unless otherwise specified, tests and inspections shall be conducted at local ambient temperature and barometric pressure.

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

4.4.1 Samples for first article. Unless otherwise specified, after award of the contract or order, the manufacturer shall forward three fittings selected at random. The samples shall be representative of the products proposed to be furnished to this specification. When a manufacturer is in continuous production of the fittings from one contract to another or has demonstrated within the past 2 years the capability to meet the requirements of this specification, inspection of additional first article samples for a new contract may be waived at the discretion of the acquiring activity (see 6.3). Approval of the first article samples or the waiving of first article inspection does not preclude the requirements for performing conformance inspection. First article samples shall be furnished to the Government as directed by the contracting officer (see 6.3).

4.4.2 Inspection routine. The sample(s) shall be subjected to the first article inspections specified in table III and in the specified sequence.

4.4.3 Failures. One or more failures shall be cause for refusal to grant first article approval.

TABLE III. First article inspections.

Inspection	Requirement paragraph	Test method paragraph
Examination of product	3.7.1	4.7.1
Cleanliness	3.7.1.1	4.7.1.1
Dimensions	3.7.1.2	4.7.1.2
Drill offset	3.7.2	4.7.2
Angle fittings	3.7.3	4.7.3
Wall thickness	3.7.4	4.7.4
Leakage test	3.7.5	4.7.5
Proof pressure	3.7.6	4.7.6
Vibration test	3.7.7	4.7.7
Internal strain of copper base alloys 1/ 2/	3.7.8	4.7.8

1/ This is a destructive test.
2/ This test shall be performed when specified by the acquiring activity (see 6.3).

4.5 Conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of individual inspections in table IV.

TABLE IV. Individual inspection.

Inspection	Requirement Paragraph	Test method paragraph
Examination of product	3.7.1	4.7.1
Cleanliness	3.7.1.1	4.7.1.1
Dimensions	3.7.1.2	4.7.1.2
Leakage test	3.7.5	4.7.5
Proof pressure	3.7.6	4.7.6

4.5.2 Sampling for individual inspections. Fittings for sampling shall be selected from a production lot (see 4.5.2.1) and shall be subjected to the individual inspections. The sampling size shall be as specified in 4.5.2.2.

4.5.2.1 Production lot. A production lot shall consist of all fittings of the same PIN which have been manufactured under the same conditions and on the same continuous run.

4.5.2.2 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 V.

TABLE V. 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

4.5.2.3 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 conditions.

4.6.1 Temperature and pressure. Unless otherwise specified, tests shall be conducted at local ambient temperature and barometric pressure.

4.6.2 Test fluid. Unless otherwise specified, the test fluid used in testing the fittings shall be hydraulic fluid as specified in ISO 19879.

4.7 Test methods.

4.7.1 Examination of product. The fittings shall be examined for identification markings and workmanship. With documented approval from the acquiring activity, statistical quality control may be used for marking and workmanship examination. Requirements shall be as specified in 3.7.1.

4.7.1.1 Cleanliness. The fittings shall be visually examined without magnification both internally and externally for conformance to the requirements specified in 3.7.1.1.

4.7.1.2 Dimensions. The fittings shall be checked dimensionally to determine conformance to the tolerances specified herein and on the applicable drawings. Conformance shall be as specified in 3.7.1.2.

4.7.2 Drill offset (see 3.7.2). It shall be possible to pass through the fluid passage a ball whose minimum diameter is 0.020 less than the minimum diameter specified for the passage. This does not mean that the drilled passage may be smaller than that required by the detail drawing.

4.7.3 Angle fittings (see 3.7.3). The length of drill depth N as specified in AN791 shall be sufficient to ensure compliance with 3.7.3.

4.7.4 Wall thickness (see 3.7.4). The fitting shall be checked dimensionally to determine conformance to the dimensions specified herein and on the applicable AN or MS standard. Conformance shall be as specified in 3.7.4.

4.7.5 Leakage test (see 3.7.5). The fitting shall be leakage tested in accordance with ISO 19879. When subjected to the rated working pressure specified in table II the fitting shall meet the requirements of 3.7.5. The following details shall apply:

a. Testing shall be in accordance with ISO 19879.
b. The tube fittings with fittings installed shall be capable of withstanding an internal pneumatic pressure to a minimum of two times the intended working pressure specified in table II without failure.

4.7.6 Proof pressure testing (see 3.7.6). The fitting shall be proof pressure tested in accordance with ISO 19879. When subjected to the rated proof pressure specified in table II the fitting shall meet the requirements of 3.7.6. The following details shall apply:

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

4.7.7 Vibration test (see 3.7.7). The fitting shall be vibration tested in accordance with ISO 19879. The fitting shall meet the requirements of 3.7.7.

4.7.8 Internal strain of copper base alloys (see 3.7.8). Fittings fabricated of copper base alloys, shall be tested for internal stresses from manufacturing in accordance with ASTM B154 or ASTM B858 or ISO 6957. The risk level PH for ASTM B858 or ISO 6957, for the ammonia vapor test shall be 10. Any visual evidence of cracks indicates internal strain and is not acceptable.

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 specification are intended for use with all types of aircraft systems, such as hydraulic fluids, oil, fuels, oxygen, air, and water.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.
b. PIN (see 1.2).
c. If first article is required (see 3.2).
d. 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 6.3).

6.3 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.

6.3.1 Defense Logistics Agency (DLA) waiver of first article test. A waiver of first article testing will only be considered by DLA when the contractor has delivered the same item within the last 3 years, has no unfavorable quality history, has not changed processes, or changed any subcontractors. DLA will not accept first article testing results outside the stated requirements.

6.4 Subject term (key word) listing.

Cadmium
Connector delivery fluid
Low pressure
Low temperature

6.5 Cadmium plating. It is recommended that cadmium plating be used only when other materials and finishes cannot meet performance requirements.

6.6 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmental Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals and additional information is available on their website http://www.epa.gov/osw/hazard/wastemin/priority.htm. Included in the EPA list of 31 priority chemicals are cadmium, lead, and mercury. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see Section 3).

6.7 Changes from previous issues. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

CONCLUDING MATERIAL

Custodians:
Army – AR
Navy – SH
Air Force - 99
DLA - CC

Preparing activity:
DLA - CC

(Project 4730-2011-039)

Review activities:
Army – AT, AV, CR4
Navy – AS, CG, MC, SA, YD
Air Force - 71

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.