

DETAIL SPECIFICATION  
SHACKLE: CABLE, AIRCRAFT

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

1. SCOPE

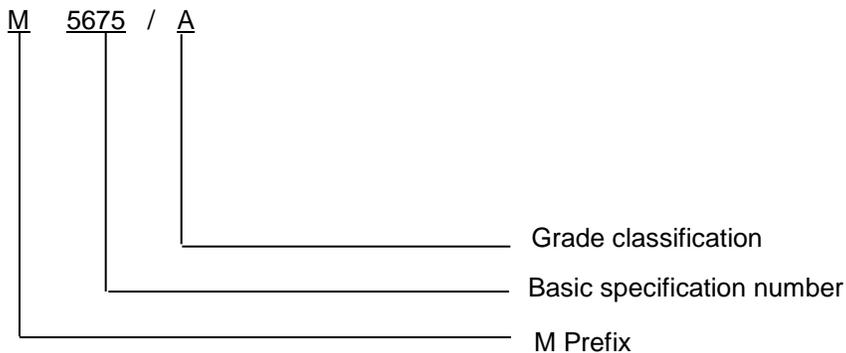
1.1 Scope. This specification establishes the requirements for aircraft cable shackles to be furnished in the grades identified herein.

1.2 Classification. Shackles are of the following grades, as specified by the acquisition requirement document (see 6.2).

1.2.1 Grade. The grades of shackles are as follows:

- Grade A steel - cadmium or zinc plated
- Grade B steel - corrosion resistant
- Grade C nickel - copper - aluminum alloy

1.3 Part or Identifying Number (PIN). The PIN consists of the letter M, the basic specification number, a forward slash, and a letter.



Comments, suggestions, or questions on this document should be addressed to: DLA Land and Maritime, Columbus, Attn: VAI, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to [FluidFlow@dla.mil](mailto: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>.

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2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this standard. 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 of 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-286 - Nickel - Copper - Aluminum Alloy, Wrought (UNS N05500)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-889 - Dissimilar Metals  
MS20115 - Shackle - Wire Rope

(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 these documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM B117 - Salt Spray (Fog) Apparatus, Operating  
ASTM B633 - Zinc on Iron and Steel, Electrodeposited Coatings Of  
ASTM E376 - Standard Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Testing Methods

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

ASME INTERNATIONAL

ASME Y-14.5M - Dimensioning and Tolerancing

(Copies of these documents are available from <http://www.asme.org> or ASME International, Three Park Avenue, New York, NY 10016-5990, Phone: 800-843-2763 (U.S/Canada)

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SAE INTERNATIONAL

SAE-AMS-QQ-P-416	-	Plating: Cadmium (Electrodeposited)
SAE-AMS-S-6758	-	Steel, Chrome-Molybdenum (4130) Bars and Reforging Stock (Aircraft Quality)
SAE-AMS-S-7720	-	Steel, Corrosion-Resistant (18-8) Bars, Wire and Forging Stock (Aircraft Quality)
SAE-AMS-6448	-	Steel Bars, Forgings, And Tubing 0.95cr - 0.22v (0.48 - 0.53c) (SAE 6150)
SAE-AMS2700	-	Passivation of Corrosion Resistant Steels

(Copies of these documents are available on line at [www.sae.org](http://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](mailto:CustomerService@sae.org).)

2.4 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, 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 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.2 Quality.

3.2.1 Dimensioning and tolerancing. Dimensioning and tolerancing shall be in accordance with ASME Y-14.5M.

3.3 Materials. Shackles shall be forged from materials specified herein (see table I).

TABLE I. Materials.

Grade classification	Materials	Required document
Grade A shackles	Steel zinc plated	SAE-AMS-6448 SAE-AMS-S-6758 ASTM B633
	Steel cadmium	SAE-AMS-QQ-P-416
Grade B shackles	Steel - corrosion resistant	SAE-AMS-S-7720
Grade C shackles	Nickel - copper - aluminum alloy	QQ-N-286

3.3.1 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.

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3.3.2 Hazardous substances. The use of hazardous substances, toxic chemicals, or ozone depleting chemicals (ODC's) shall be avoided, whenever feasible.

3.3.3 Other materials. Materials not otherwise specified shall conform to applicable specifications and to the requirements specified herein. All materials that are not specifically described shall be of the highest quality and suitable for the purpose intended.

3.3.4 Grade A shackles. Grade A shackle, shall be made from steel in accordance with SAE-AMS-6448 or SAE-AMS-S-6758.

3.3.5 Grade B shackles. Grade B shackles shall be made from corrosion-resistant steel conforming to SAE-AMS-S-7720.

3.3.6 Grade C shackles. Grade C shackle, shall be made from nickel-copper-aluminum alloy conforming to QQ-N-286.

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

3.4 Form and dimensions. The form and dimensions shall be as specified on MS20115.

3.5 Bend and tension. The shackle shall withstand the applicable load specified on MS20115 without cracks or failure when the shackle is bent as specified herein (see 4.8.3) and then returned to its original shape.

3.6 Finish. Shackles shall be free from cracks, seams, flaws or other imperfections when viewed as specified.

3.6.1 Grade A shackles. Grade A shackles shall be cadmium plated in conformance with SAE-AMS-QQ-P-416, type II, or zinc plated in accordance with ASTM B633, type II. This requirement gives a minimum protection of 96 hours against salt spray in accordance with ASTM B117. Plating thickness verification shall be in accordance with 4.8.4.1.

3.6.2 Grade B and C shackles. Grades B and C shackles shall be polished on all surfaces. Grades B and C shackles shall withstand 200 hours exposure to salt spray as specified in 4.8.4.2 without showing any signs of corrosion. Superficial tarnish removable with a damp cloth shall not be cause for rejection, unless accomplished by pitting.

3.7 Workmanship. The workmanship shall conform to high grade manufacturing practice for aircraft parts. Flashes or fins shall be trimmed off, even with, but not below, the surface. Shackles shall be free from pipes laps, cracks, cold shuts, scale pits, and other injurious defects. Scales shall be removed by sand blasting or tumbling.

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4. VERIFICATION

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

- a. First article inspection (see 4.5).
- b. Conformance inspection (see 4.3).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the applicable test procedures.

4.3 Conformance inspection. All finished shackles shall be carefully examined to determine conformance problems with the specification with respect to workmanship, form, and dimensions.

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

4.4.1 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 shackles. 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.

4.5 First article inspection. First article inspection, if not done by the manufacturer, shall be performed at a laboratory acceptable to the procuring activity on sample units produced with equipment and procedures used in production.

4.6 Samples for first article. Samples for first article shall be representative of the products proposed to be furnished to this specification. Sampling shall be in accordance with 4.8.2.1.

4.7 First article inspection routine. All samples shall be subjected to first article testing in accordance with table II. Sequence is manufacturing's discretion.

TABLE II. First article inspection.

Inspection	Requirement	Test method
Visual and mechanical inspections	3.7	4.9.1
Finish	3.6	4.8.4
Plating (grade A shackles)	3.6.1	4.8.4.1
Salt spray (grade B & C shackles)	3.6.2	4.8.4.2

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4.7.1 Acceptance of first article inspection. Required first article tests may be eliminated if documented approval has been obtained from the procuring activity. A first article test cannot be waived by DLA unless the contractor has delivered the same item within the last three years, has no unfavorable quality history, and has not proposed changes to the processes or changed any subcontractors. DLA will not accept first article test results outside the stated requirements.

4.7.2 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.

4.7.3 First article samples. Samples shall be representative of the construction workmanship, components, and materials to be used during production. When a manufacturer is in continuous production of the shackles from one contract to another, submission of additional first article samples for a new contract may be waived at the discretion of the acquiring activity (see 6.2).

4.7.3.1 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.

4.7.3.2 Disposition of samples. First article samples shall be furnished to the Government as directed by the contracting officer (see 6.2).

4.7.3.3 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, OH 43218-3990, or emailed to [Fluidflow@dla.mil](mailto:Fluidflow@dla.mil).

4.8 Group A inspection. For manufacturers that have successfully passed first article inspections and are continuously producing shackles to this specification, on going inspections shall consist of individual inspections (see table III) and sampling and periodic inspections (see table IV). 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.

TABLE III. Group A inspections.

Inspections	Requirement paragraph	Inspection paragraph	Number of samples
Visual and mechanical	3.7	4.8.5	100%

4.8.1 Group B inspection. Sampling and periodic inspections shall consist of the inspections specified in table IV. Individual inspections shall be implemented on a continual basis throughout the production of thimbles.

TABLE IV. Group B inspections. 1/

Inspections	Requirement paragraph	Inspection paragraph
Plating (grade A shackles)	3.6.1	4.8.4.1
Salt spray (grade B & C shackles)	3.6.2	4.8.4.2
Bend and tension	3.5	4.8.3

1/ If the manufacturer can demonstrate that the periodic tests have been performed for two consecutive years with zero failures, then the frequency of the periodic test, with the approval of the procuring activity, can be performed every fourth year.

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4.8.2 Inspection lot.

4.8.2.1 Lot and sample. The inspection lot shall be product selected at random from the production lot without regard to quality and shall be the sample size specified in table V.

TABLE V. Lot and sample size.

Production lot size	Sample size
1 to 90	8
91 to 150	12
151 to 280	19
281 to 500	21
501 to 1200	27
1201 to 3200	35
3201 to 10,000	38
10,001 to 35,000	46

4.8.3 Bend and tension test. The shackles being tested shall be opened by means of a wedge under gradual pressure, or otherwise, until the minimum opening is at least equal to the specified inside diameter of the shackle, without cracking. The shackle shall then be returned to its original shape and the required load shall be applied through a shackle or a U-bolt similar in shape and size to the thimble normally used with the shackle under test.

4.8.4 Finish. The surface condition of the entire sample shall be examined under a five-time magnification for imperfections as listed in 3.6

4.8.4.1 Plating (grade A shackles). Plating thickness shall be tested in accordance ASTM E376, and shall meet the requirements of 3.6.1.

4.8.4.2 Salt spray (grades B and C shackles). Grades B and C shackles shall be tested for corrosion resistance for a period of 200 hours in accordance with ASTM B117, and shall meet the requirements of 3.6.2.

4.8.5. Visual and mechanical inspection. Shackles shall be examined to ensure conformance with this specification and associated specification sheets. Continuous examination shall be performed to assure compliance with the following requirements:

- a. First article (see 3.1).
- b. Materials (see 3.3, 3.3.1).
- c. Design, construction and physical dimensions (see 3.4).
- d. Workmanship (see 3.7).

## 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 materiel 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 activities 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

6.1 Intended use. Shackles are intended for use with wire thimbles in assembling spliced cable terminals.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. PIN and grade required (see 1.2, 1.3).
- c. First article required (see 3.1).
- d. Packaging requirements (see 5.1).

6.3 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).

6.4 Guidance on use of alternative parts with less hazardous or non-hazardous 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.

6.5 Subject term (key word) listing.

96 Hour corrosion protection  
Copper-aluminum alloy  
Nickel  
Spliced terminals  
Stainless steel  
Wire thimbles

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6.6 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 - AV  
Navy - AS  
Air Force - 99  
DLA - CC

Preparing activity:  
DLA - CC

Review activities:  
Army - MI  
Navy - MC, SA  
Air Force - 50

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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>.