

INCH-POUND

MIL-DTL-781G
5 November 2001
 SUPERSEDING
 MIL-DTL-781F
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DETAIL SPECIFICATION

TERMINAL; WIRE ROPE SWAGING

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

1. SCOPE

1.1 Scope. This specification covers wire rope terminals designed for attachment to wire rope by swaging.

* 1.2 Classification. The terminals will be of the following types, as specified (see 6.2).

* 1.2.1 Types. The types of terminals are as follows:

Type I - Straight shank terminals

Type II - Ball-end terminals

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 of the documents cited in sections 3 and 4 of this specification, whether or not they are listed.

Beneficial comments (recommendations, additions, deletions) and any pertinent data that may be of use in improving this document should be addressed to: Defense Supply Center Richmond, ATTN: DSCR-VBD, Richmond, VA 23297-5610, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 1560

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2.2 Government documents.

* 2.2.1 Specifications and standards. The following specifications and standard 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).

SPECIFICATIONS

FEDERAL

RR-W-410 - Wire Rope and Strand.

* DEPARTMENT OF DEFENSE

* MIL-DTL-6117 - Terminal Wire Rope Assemblies, Swaged Type.
 * MS20658 - Terminal, Wire Rope, Swaging, Fork End.
 * MS20663 - Ball End, Wire Rope, Swaging, Double Shank.
 * MS20664 - Ball End, Wire Rope, Swaging, Single Shank.
 MS20667 - Terminal, Wire Rope, Swaging, Fork End.
 MS20668 - Terminal, Wire Rope, Swaging, Eye End.
 * MS21259 - Terminal, Wire Rope, Swaging, Stud, Long Thread.
 * MS21260 - Terminal, Wire Rope, Swaging, Stud.
 MIL-DTL-83420 - Wire Rope, Flexible, for Aircraft Control.

STANDARD

FEDERAL

* FED-STD-H28/20 - Screw Thread Standards for Federal Services Section 20 Inspection Methods for Acceptability of UN, UNR, UNJ, M, and MJ Screw Threads.

(Unless otherwise indicated, copies of the above specifications and standard are available from the Standardization Documents 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 the documents that are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

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* AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

* ASME B46.1 - Surface Texture (Surface Roughness, Waviness, and Lay).

* (Application for copies should be addressed to the American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.)

* AMERICAN SOCIETY FOR QUALITY CONTROL (ASQC)

* ASQC Z1.4 - Sampling Procedures and Tables for Inspection by Attributes (DoD adopted).

* (Application for copies should be addressed to the American Society of Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

* ASTM A 967 - Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts (DoD adopted).

* ASTM E 140 - Standard Hardness Conversion Tables for Metals (DoD adopted).

* (Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)

* SAE AMS 2431 - Peening Media General Requirements.

(Application for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

* 2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications, specification sheets or MS 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 MS sheets. The individual item requirements shall be as specified herein and in accordance with the applicable MS sheet. In the event of any conflict between the requirements of this specification and the MS sheet, the latter shall govern.

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3.2 Qualification. Steel wire rope terminals furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3).

3.3 Material. Terminals shall be made of corrosion resistant steel, 303Se (UNS S30323) or 304 (UNS S30400) and be suitable for swaging onto wire ropes in accordance with the requirements of 3.3.1.

3.3.1 Tensile strength. The maximum tensile strength shall not exceed 125,000 pounds per square inch for sizes under 1/4 inch in thickness and 115,000 pounds per square inch for sizes 1/4 inch and larger in thickness. Tensile strengths for parts that will be subjected to finish annealing may be higher than those specified, but must meet the hardness requirements delineated in 3.8.3, after annealing.

3.4 Threads. Threads shall be in accordance with FED-STD-H28/20.

3.5 Design and dimensions.

3.5.1 Type I shank terminals. The design and dimensions of type I terminals shall be in accordance with MS20658, MS20667, MS20668, MS21259, or MS21260, as specified in the contract or order (see 6.2).

3.5.2 Type II ball-end terminals. The design and dimensions of type II terminals shall be in accordance with MS20663 or MS20664, as specified in the contract or order (see 6.2).

3.6 Protective treatment.

3.6.1 Corrosion-resistant steel terminals. Terminals made of corrosion-resistant steel shall be (a) passivated after the removal of all oil or grease by submerging into a solution containing four parts water to one part commercial nitric acid, specific gravity 1.389 to 1.408, at 125 ° to 135 °F, for 20 to 40 minutes (equivalent method of ASTM A 967 may be used) or (b) glass bead blasted per SAE AMS 2431. Unless otherwise specified, either method is acceptable.

3.6.2 Washing. Upon completion of the treatment (a) specified in 3.6.1, the terminals shall be thoroughly rinsed in water and dried.

3.7 Surface roughness. The surface roughness of the machined surface, except in the threaded area, shall not exceed 125 root mean square (RMS) in accordance with ASME B46.1.

3.8 Performance.

3.8.1 Distortion. Elongation shall not exceed .001 inch per inch in the direction of application of load (see 4.6.1) of any measured dimension resulting from the application, for 5 seconds, of a proof load of 60 percent of the minimum breaking strength (MBS) as specified in

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* the related MS sheet on terminal sizes up to 3/8. Sizes 7/16 and larger shall be tested at a proof
* load of 40 percent MBS.

* 3.8.2 Breaking strength. Terminals shall be capable of withstanding a tension load equal
* to the MBS specified on the applicable MS sheet when tested in accordance with 4.6.2.

3.8.3 Hardness. When tested in accordance with paragraph 4.6.3, terminal hardness
readings shall not exceed a Rockwell A-scale value of 62.5.

* 3.9 Identification of product. Terminals shall be marked for identification in accordance
* with the applicable MS sheet. The maximum depth of marking shall be in accordance with the
* applicable MS sheet, however, on certain curved surfaces, the maximum depth specified may be
* exceeded to assure adequate legibility. Position of the marking is optional.

3.10 Workmanship. Terminals shall be uniform in quality and free from pits, voids,
burrs, sharp edges, rust, laps, cracks, seams and other detrimental defects. Slight burrs in the
thread-locking slot area that do not prevent gauging or interfere with installation of the barrel and
locking clip are acceptable.

4. VERIFICATION

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

- a. Qualification inspection (see 4.2).
- b. Quality conformance inspection (see 4.3).

4.2 Qualification inspections. The qualification inspections shall consist of all the tests
and examinations of this specification.

* 4.2.1 Sampling instructions. Qualification test samples shall consist of a minimum of
* four terminals of the type and size upon which qualification is desired. Either the left-hand or
* right-hand threaded fitting may be submitted for qualification approval, wherein qualification of
* one would automatically mean approval of the other without additional tests

4.2.2 Retention of qualifications. To retain qualification, the manufacturer must be able
to demonstrate that the company still has the capabilities and facilities necessary to produce the
items. The qualifying activity will request appropriate documentation demonstrating this
capability at the time qualification retention is required (at least 2-year intervals).

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4.3 Quality conformance inspection. The quality conformance inspection shall consist of:

- a. Examination of product (see 4.5.1).
- b. Hardness (see 4.6.3).
- c. Breaking strength (see 4.6.2).

4.3.1 Lot. A lot shall consist of finished terminals of the same material, size, and part number produced consecutively by the same machine or series of progressive processing machines submitted for inspection at the same time under one contract or order. Lots shall be segregated and marked to identify them with their respective random samples designated for testing.

* 4.3.2 Sampling. ASQC Z1.4 shall be used as a guide in the development of contractors' statistical techniques to assure the components meet all requirements specified herein.

* 4.4 Test preparations. Sample terminals to be tested for distortion and breaking strength shall be swaged, in accordance with MIL-DTL-6117, to 2-foot lengths (minimum) of the appropriate size wire rope conforming to MIL-DTL-83420 for sizes of wire rope up to and including 3/8-inch diameter or to RR-W-410 for 6 x 19 independent wire rope core (IWRC) construction, 7/16-inch diameter and larger as applicable. The swaged terminals shall be examined for cracks and splits and dimensions accurately measured and noted.

4.5 Examinations.

4.5.1 Examination of product. Each sample terminal shall be examined to determine conformance to dimensions, workmanship, and all other requirements of this specification not covered by tests.

4.6 Tests.

* 4.6.1 Distortion. A proof load of 60 percent of the MBS specified on the applicable MS sheet shall be applied to the terminal-wire rope assembly for sizes up to and including 3/8-inch diameter. The proof load shall be 40 percent of MBS for sizes 7/16-inch diameter and larger. After holding for 5 seconds, the load shall be released and the terminal measured for distortion. Permanent increase of the overall dimensions measured in the direction of application of load shall not exceed .001 inch per inch.

* 4.6.2 Breaking strength. The wire rope-terminal assembly shall be subjected to the MBS specified on the applicable MS sheet on a tension testing machine. The load shall be applied to the fitting end of the terminal in a manner similar to that for which it was designed. Prior to application of the load, the wire rope shall be marked at the point where it enters the swaging end of the terminal. Any slippage of the wire rope in the fitting, or signs of failure in the terminal shall be cause for rejection. The test wire rope must not break below the minimum required breaking strength of the terminal. In order to achieve breaking strength required for terminal, a carbon steel wire rope should be used.

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4.6.3 Hardness. Terminals and ball ends shall be tested in accordance with ASTM E 140 to determine compliance with 3.8.3. Hardness values will be obtained from the area reserved for swaging. Because of variations caused by surface work hardening, sectionalized hardness testing is permitted to ascertain conformance when values exceed the allowable limit. The sectioned hardness test must be performed on a cross-section of the area reserved for swaging.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department 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 that may be helpful, but is not mandatory.)

6.1 Intended use. The corrosion-resistant steel terminals covered by this specification are intended for swaging to corrosion-resistant steel and galvanized wire rope conforming to MIL-DTL-83420 or RR-W-410 as applicable. These terminals can also be used in applications involving corrosive conditions or where non-magnetic properties are essential.

6.1.1 Type I terminals. Type I terminals are the regular terminals in general use on aircraft wire rope assemblies.

6.1.2 Type II terminals. Type II terminals are designed for use in ordnance and glider control installations and in attaching wire ropes to quadrants, drums, etc., in the wire rope control systems of powered aircraft.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type of terminal required (see 1.2).
- c. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of the individual documents referenced (see 2.2.1 and 2.3).
- d. MS sheet or assembly numbers or other drawing numbers required (see 3.5).
- e. Packaging requirements (see 5.1).

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6.3 Qualification. With respect to products requiring qualification, awards will be made only for products that are, at the time of award of contract, qualified for inclusion in QPL-781 whether or not such products have actually been so listed by that date. The attention of contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Richmond, ATTN: DSCR-VBD, 8000 Jefferson Davis Highway, Richmond, VA 23297-5610.

6.4 Subject term (key word) listing.

Ball End

Shank Ball End

6.5 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. 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 and relationship to the previous issue.

Custodians:

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Navy - AS

Air Force - 99

Preparing activity:

DLA - GS5

(Project 1560-0002)

Reviewers:

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Navy - MC

Air Force - 71

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

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1. **DOCUMENT NUMBER**
MIL-DTL-781G

2. **DOCUMENT DATE (YYYYMMDD)**
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DOCUMENT TITLE

TERMINAL; WIRE ROPE SWAGING

4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME *(Last, First, Middle Initial)*

b. ORGANIZATION

c. ADDRESS *(Include Zip Code)*

d. TELEPHONE *(Include Area Code)*
(1) Commercial
(2) DSN
(if applicable)

7. **DATE SUBMITTED**
(YYYYMMDD)

8. PREPARING ACTIVITY

a. NAME

Defense Supply Center Richmond

b. TELEPHONE *Include Area Code)*

(1) Commercial (804) 279-5019 (2) DSN 695-5019

c. ADDRESS *(Include Zip Code)*

ATTN: DSCR-VBD (C. Hammond)
8000 Jefferson Davis Highway
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IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:
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