

INCH-POUND

MIL-DTL-781D
15 August 1997
SUPERSEDING
MIL-T-781C
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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. Terminals should be of the following types, as
specified (see 6.1):

Type I - Straight shank terminals

Type II - Ball-end terminals

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specification and standards. The following specifications and
standards form a part of this specification to the extent specified
herein. Unless otherwise specified, the issues of these documents
should be 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).

Beneficial comments (recommendations, additions, deletions) and any pertinent
data which may be of use in improving this document should be addressed to:
Defense Industrial Supply Center, attn.: DISC-EED, 700 Robbins Avenue,
Philadelphia, PA 19111-5096. by using the self-addressed Standardization
Document Improvement Proposal (DD Form 1426) appearing at the end of this
document or by letter.

AMSC N/A

FSC 4030

DISTRIBUTION STATEMENT A. Approved for public release; distribution is
unlimited.

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SPECIFICATIONS

FEDERAL

RR-W-410 Wire Rope and Strand.

MILITARY

MIL-DTL-6117 Terminal Wire Rope Assemblies, Swaged Type.
MIL-DTL-83420 Wire Rope, Flexible, for Aircraft Control.

STANDARDS

FEDERAL

FED-STD-66 Steel, Chemical Composition and Hardenability.
FED-STD-H28/20 Screw Thread Standards for Federal Services
Section 28 Inspection Methods for Acceptability
of UN, UNR, UNJ, M, and MJ Screw Threads.

MILITARY

MS20658 Terminal, Wire Rope, Swaging - Fork End.
MS20663 Terminal, Wire Rope, Swaging - Double Shank.
MS20664 Terminal, Wire Rope, Swaging - Single Shank.
MS20667 Terminal, Wire Rope, Swaging - Fork End.
MS20668 Terminal, Wire Rope, Swaging - Eye End.
MS21259 Terminal, Wire Rope, Stud.
MS21260 Terminal, Wire Rope, Stud.

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

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in 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 NATIONAL STANDARDS INSTITUTE INC.

ANSI B46.1-78 Surface Texture.
ANSI/ASQC Z1.4 Sampling Procedures and Tables for Inspection by
Attributes

(Application for copies should be addressed to the American National Standards Institute Inc., 10 East 40th Street, New York, NY 10016).

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E-140 Metals, Standards Harness Conversion for.
ASTM-A967 Chemical Passivation Treatments for Stainless
Steel Parts

(Application for copies of ASTM publications should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103).

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (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; telephone (412)772-1616.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents may also be available in or through libraries or other informational services).

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

3. REQUIREMENTS

3.1 Qualification. The steel wire rope terminals furnished under this specification shall be a product which has been tested and passed the qualification tests specified herein, and has been listed on or approved for listing on the applicable Qualified Products List.

3.2 Materials. Terminals shall be made of steel which is entirely suitable for swaging onto wire ropes in accordance with the requirements of 3.2.1.

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3.2.1. Corrosion-resistant steel. The maximum tensile strength of corrosion-resistant steel shall not exceed 125,000 pounds per square inch (psi) for sizes under 1/4 inch in thickness and 115,000 psi for sizes 1/4 inch and larger. In all other respects corrosion-resistant steel shall conform to steel number 303Se or 304 of FED-STD-66.

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

3.4 Design and dimensions.

3.4.1 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).

3.4.2 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).

3.5 Protective treatment.

3.5.1 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-A967 may be used) or (b) glass bead blasted per AMS 2431. Unless otherwise specified, either method is acceptable.

3.5.2 Washing. Upon completion of the treatment specified in 3.5.1, the terminals shall be thoroughly rinsed in water and dried.

3.6 Surface Roughness. The surface roughness of the outer surface except in the threaded area, shall not exceed 125 RMS in accordance with ANSI B46.1-78.

3.7 Performance.

3.7.1 Distortion. Elongation shall not exceed 0.001 inch per inch in the direction of application of load per 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 as specified in the related MS on terminal sizes up to 3/8. Sizes 7/16 and larger shall be tested at a proof load of 40 percent minimum breaking strength.

3.7.2 Breaking strength. Terminals shall be capable of withstanding a tension load equal to the minimum breaking strength specified on the applicable MS when tested in accordance with 4.6.2.

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3.7.3 Hardness. Terminals shall be tested for hardness in accordance with ASTM E-140. The measurement of hardness shall be predominantly for uniformity and compressive strength. Hardness readings shall not exceed Rockwell A-scale values of 62.5.

3.8 Identification of product. Terminals shall be marked for identification in accordance with the applicable MS standard.

3.9 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.

3.10 Reclaimed materials. The use of reclaimed materials shall be encouraged to the maximum extent possible.

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.

4.2.1.1 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).

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)

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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. ANSI/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" diameter or to RR-W-410 for 6 X 19 IWRC construction, 7/16" 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 minimum breaking strength (MBS) specified on the applicable MS 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 0.001 inch per inch.

4.6.2 Breaking strength. The wire rope-terminal assembly shall be subjected to the minimum breaking strength specified on the applicable MS 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 for hardness and shall show a hardness reading not to exceed Rockwell A-scale of 62.5. Hardness should be measured on solid portions of terminal to eliminate consideration of cylindrical spring-back.

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

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 Ordering data.

6.2.1 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. The MS or assembly numbers or other drawing numbers required (see 3.5).

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6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Product List 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 contact the activity responsible for the Qualified Products List to determine the specific requirements that must be met for qualification. The activity responsible for the Qualified Products List is Defense Industrial Supply Center, 700 Robbins Avenue, Philadelphia, PA 19111-5096 and information pertaining to qualification of products may be obtained from that activity.

6.4 Subject term (key word) listing.

Ball End
Shank Ball End

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness or the changes.

Custodians:

Army - CR
Navy - AS
Air Force - 99

Preparing activity:

DLA-IS

(Project 4030-0288)

Review activity:

Army - AR, ER, GL, MI
Navy - MC
DLA - CC

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

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

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER
MIL-DTL-781D

2. DOCUMENT DATE (YYMMDD)
970815

3. 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) AUTOVON
(if applicable)

7. DATE SUBMITTED
(YYMMDD)

8. PREPARING ACTIVITY

a. NAME

DEFENSE INDUSTRIAL SUPPLY CENTER

b. TELEPHONE *Include Area Code)*
(1) Commercial

(2) AUTOVON

ATTN: DISC-EED
700 ROBBINS AVENUE
PHILADELPHIA, PA 19111-5096

IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:
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