MIL-R-12221D(ME)
25 February 1985
SUPERSEDING
MIL-R-12221C(ME)
11 December 1975

MILITARY SPECIFICATION

RIVETS, SOLID: ALUMINUM ALLOY 7277

This specification is approved for use by the USA Belvoir Research and Development Center, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers 7277 aluminum alloy rivets for structural use. Rivets of this composition are to be hot driven only at temperatures between 850° F and 975° F.

1.2 Classification. The rivets shall be of the following types, as specified (see 6.2):

Type B-2 - High buttonhead.

Type 3 - Roundhead.

Type 6 - Buttonhead.

Type 7 - Flat-top countersunk head.

Type 8 - Round-top countersunk head.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein:

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: USA Belvoir Research and Development Center, ATTN: STRBE-DS, Fort Belvoir, VA 22060-5606 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 5320

SPECIFICATIONS

FEDERAL

PPP-H-1581 - Hardware (Fasteners and Related items) Packaging of.

STANDARDS

FEDERAL

FED-STD-151 - Metals: Test Methods.

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.

MIL-STD-129 - Marking for Shipment and Storage.

(Copies of specifications, standards, and drawings required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

B 557 - Tension Testing Wrought and Cast Aluminum and Magnesium-Alloy Products.
B 565 - Shear Testing of Aluminum and Aluminum-Alloy Rivets and Cold-Heading Wires and Rods.
D 3951 - Standard Practices for Commercial Packaging.

3. REQUIREMENTS

3.1 Description. Rivets shall conform to the dimensions and types shown in figure 1 and as specified herein.

3.2 Material. Rivets shall be fabricated from 7277-H13 aluminum alloy rod. The rod shall conform to the chemical composition shown in table I and shall have an ultimate tensile strength of 36,000 - 46,000 psi.

TABLE I. Chemical Composition for Aluminum Alloy 1/ (7277)

Element	Percent
Copper	0.8 - 1.7
Magnesium	1.7 - 2.3
Chromium	0.18 - 0.35
Silicon	0.50 (max.)
Titanium	0.10 (max.)
Iron	0.7 (max.)
Zinc	3.7 - 4.3
Other elements, each	0.05 (max.)
Other elements, total 2/	0.15 (max.)
Aluminum	Remainder

1/ Except for "Aluminum" and "Others", analysis normally is made for elements for which specific limits are shown.

2/ The sum of those "Others" metallic elements 0.010 percent or more each, expressed to the second decimal before determining the sum.

3.3 Dimensions.

3.3.1 Diameter of rivet shank. The diameter of the rivet shank shall be as specified (see 6.2) and shall not deviate from the specified diameter by an amount greater than the tolerances shown in table II.

TABLE II. Shank Diameter Tolerances.

Diameter in Inches (inclusive)	Tolerance in Inches (minus)	(plus)
1/2 to 5/8	0.007	0.010
11/16 to 7/8	0.009	0.012
15/16 to 1-1/4	(as specified, see 6.2)	

3.3.2 Diameter of rivet head. The diameter of the rivet head shall not deviate from the nominal diameter shown in figure 1 by an amount greater than ±10 percent in rivet sizes up through 7/8 inch shank diameter. Tolerances for larger size rivets shall be as specified (see 6.2).

3.3.3 Thickness or depth of rivet head. For rivets up through 7/8 inch shank diameter, the tolerances shall be ±8 percent of the nominal head thickness or depth, excluding height of marking, with a minimum tolerance of 0.008 inch. Tolerances for larger size rivets shall be as specified (see 6.2).

3.3.4 Length of rivets. The length of rivets shall be as specified (see 6.2). The length shall be measured from the largest diameter of the bearing surface of the head. The length of rivets shall not deviate from the specified length by more than ±1/64 inch in rivet sizes up through 7/8 inch shank diameter. Length tolerances for larger size rivets shall be as specified (see 6.2).

3.3.5 Roundness and concentricity. Rivet heads shall not deviate from true roundness and concentricity with the shank by an amount greater than the tolerance specified for the corresponding rivet shank diameter shown in table II.

3.4 Mechanical properties.

3.4.1. Tensile strength. When heat treated to the T62 temper (see 6.3 and 6.4), rivets shall have a minimum tensile strength of 60.0 thousand pounds per square inch (ksi).

3.4.2 Shear strength. When heat treated to the T62 temper (see 6.3 and 6.4), rivets shall have a minimum shear strength of 35.0 (ksi).

3.5 Identification marking. The rivets shall be identified by a raised numeral "7" on the end of the rivet shank or on the rivet head.

3.6 Workmanship. The rivets shall be of uniform quality, free from flash, seams, clinch or die marks, cracks, or other injurious defects.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements specified herein. Except as otherwise specified in the contract or order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Classification of inspections. Inspections shall be classified as follows:

a. Quality conformance inspection (see 4.3).
b. Inspection of packaging (see 4.5).

4.3 Quality conformance inspection.

4.3.1 Examination.

4.3.1.1 Sampling. Sampling for examination shall be in accordance with MIL-STD-105, Inspection level S-3.

4.3.1.2 Samples. Samples selected in accordance with 4.3.1.1 shall be examined for the defects specified in 4.4.1. AQL shall be 4.0 percent defective.

4.3.2 Tests.

4.3.2.1 Sampling. Sampling for each test shall consist of one rivet, or a specimen of the full section of material from which the rivets were made, taken from any lot of 500 pounds or less; for larger lots, an additional sample for each test shall be taken for 1000 pounds or fraction thereof, in excess of the first 500 pounds.

4.3.2.2 Samples. Samples selected in accordance with 4.3.2.1 shall be solution heat treated with the rivets it represents. The samples shall be artificially aged to the T62 temper (see 6.3) and tested as specified in 4.4.2. Failure of any test shall be cause for rejection.

4.4 Inspection procedure.

4.4.1 Examination. The rivet shall be examined as specified herein for the following defects.

Major

101. Material not as specified.
102. Dimensions not as specified.
103. Roundness and concentricity of the rivet head not as specified.
104. Identification marking not as specified.
105. Workmanship not as specified.
106. Diameter of rivet shank not as specified.
107. Diameter of rivet head not as specified.
108. Thickness or depth of rivet head not as specified.
109. Length of rivets not as specified.

4.4.2 Tests.

4.4.2.1 Tensile test. The tensile test specimens shall be tested in accordance with ASTM B 557. When practical, the material shall be tested in full section. For material which cannot practically be tested in full section, the standard round type specimen in the largest size applicable shall be used.

4.4.2.1.1 Tensile test specimen. If the tensile test specimen is a section of the material from which the rivets are made, it shall be heat treated to the T42 temper with the rivets it represents (see 6.3). In addition, whether the specimen is a rivet or a section of the material, the final test specimen shall

be heat treated to the T62 temper (see 6.3). If the test jigs are not available to use with a full section of the rivet or material, small size specimens proportional to the standard specimen may be used.

4.4.2.2 Shear test. The shear test specimens shall be tested in accordance with ASTM B 565. The shear test specimen may be turned down to 0.372 inch in diameter to accomodate the test apparatus. The shear strength shall be calculated using the actual measured diameter of the test specimen.

4.5 Material inspection. Materials inspection shall consist of reviewing the mill certification and verifying data that the material used in fabricating the rivets is in accordance with 3.2. Mill certification on all material shall be kept on file and available for inspection by the procuring activity at the producing facility.

4.6 Inspection of packaging. The preservation, packing, and marking of the rivets for level A or B shall be examined and tested in accordance with the quality assurance provisions of PPP-H-1581. Commercial preservation, packing and marking shall be examined to determine compliance with ASTM D 3951.

5. PACKAGING

5.1 Preservation. Preservation shall be level A, level B, or commercial as specified (see 6.2).

5.1.1 Level A. The rivets shall be preserved in accordance with the level A requirements of PPP-H-1581.

5.1.2 Level B. The rivets shall be preserved in accordance with the level B requirements of PPP-H-1581.

5.1.3 Commercial. The rivets shall be preserved in accordance with ASTM D 3951.

5.2 Packing. Packing shall be level A, level B, or commercial as specified (see 6.2).

5.2.1 Level A. Rivets, preserved as specified in 5.1, shall be packed in accordance with the level A requirements of PPP-H-1581.

5.2.2 Level B. Rivets, preserved as specified in 5.1, shall be packed in accordance with the level B requirements of PPP-H-1581.

5.2.3 Commercial. Rivets, preserved as specified in 5.1, shall be packed in accordance with ASTM D 3951.

5.3 Marking.

5.3.1 Military. Marking for military levels of protection (level A or B) shall be in accordance with MIL-STD-129.

5.3.2 Commercial. Marking for commercial packaging shall be in accordance with ASTM D 3951.

6. NOTES

6.1 Intended use. The rivets are intended for use as fasteners in structures.

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number, and date of this specification.
b. Type of rivet required (see 1.2).
c. Diameter of rivet shank required (see 3.3.1).
d. Shank diameter tolerances for rivets of 15/16 to 1-1/4 inch diameter (see table II).
e. Head diameter tolerances for rivets larger than 7/8 inch shank diameter (see 3.3.2).
f. Head thickness tolerances for rivets larger then 7/8 inch shank diameter (see 3.3.3).
g. Length of rivet required (see 3.3.4).
h. Length tolerances for rivets larger than 7/8 inch shank diameter (see 3.3.4).
i. Degree of preservation and degree of packing required (see 5.1 and 5.2).

6.3 Recommended heat-treatment practice. To produce the T42 temper, (for 7277 rivets) the solution heat-treatment temperature should be 860° F to 920° F for approximately 30 minutes. To produce the T62 temper, the solution heat-treated material should be artificially aged for 4 hours at 210° F ±10° F, and then aged for 8 hours at 315° F ±10° F

6.4 Caution to designers. Do not use T62 properties for design purposes. Since 7277 rivets are not used in the artificially aged condition, T62 properties are not applicable. Tensile strength and shear strength will be appreciably lower than stated in 3.4.1 and 3.4.2.

Custodian:
Army - ME

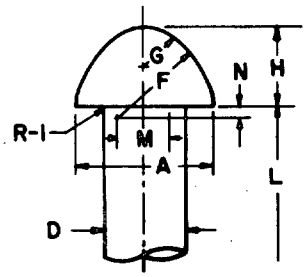
Preparing activity:
Army - ME

Review activity:
DLA - IS

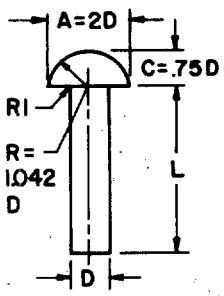
Project 5320-A009

DIMENSIONS - HIGH BUTTONHEAD

D	A	H	F	G	M	N
DIA. OF BODY	DIA. OF HEAD	HEIGHT OF HEAD	RADII OF HEAD		HEAD RADIUS CENTERS	
INCHES	INCHES	INCHES	INCHES	INCHES	INCHES	INCHES
0.500	0.781	0.500	0.656	0.094	0.517	0.093
0.625	0.969	0.594	0.750	0.188	0.519	0.093
0.750	1.156	0.688	0.844	0.281	0.522	0.093
0.875	1.344	0.781	0.937	0.375	0.500	0.093
1.000	1.531	0.875	1.031	0.469	0.500	0.093
1.125	1.719	0.969	1.125	0.563	0.500	0.093
1.250	1.906	1.063	1.219	0.656	0.500	0.093

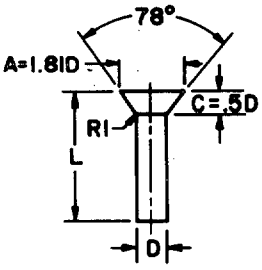


HIGH BUTTONHEAD
TYPE B-2



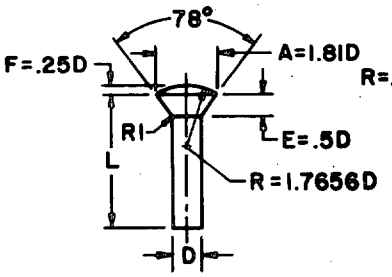
ROUNDHEAD

TYPE 3



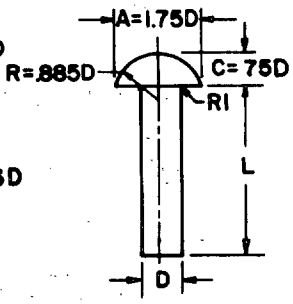
FLAT-TOP COUNTERSUNK HEAD

TYPE 7



ROUND-TOP COUNTERSUNK HEAD

TYPE 8



BUTTONHEAD

TYPE 6

RI MAXIMUM NOT TO INTERFERE WITH PROPER HEADING; MINIMUM, 0.01 INCH

FIGURE I. ALUMINUM RIVETS

X-3044A

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-R-12221D(ME)	Rivets, Solid: Aluminum Alloy 7277

3a. NAME OF SUBMITTING ORGANIZATION

b. ADDRESS *(Street, City, State, ZIP Code)*

4. TYPE OF ORGANIZATION *(Mark one)*

- ☐ VENDOR
- ☐ USER
- ☐ MANUFACTURER
- ☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

DD FORM 82 MAR 1426

PREVIOUS EDITION IS OBSOLETE.