

[ INCH-POUND ]  
MIL-S-63540C  
27 JUNE 1995  
SUPERSEDING  
MIL-S-63540B  
29 June 1990

## MILITARY SPECIFICATION

### \* STUD, SELF-CLINCHING GENERAL SPECIFICATION FOR

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 requirements for self-clinching studs, which are permanently attached to a structure by embedding them into the structure. Push-out, pull-out resistance results from cold flow of the structural material into recesses or grooves provided beneath the head of the stud.

#### 2 APPLICABLE DOCUMENTS

##### 2.1 Government documents

2.1.1 Specifications and standards The following specifications and standards 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 supplements 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 Commander, Defense Industrial Supply Center, ATTN DISC-ECC, 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 5307

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SPECIFICATIONS

\* FEDERAL

QQ-P-35 - Passivation Treatments for Corrosion-Resistant Steel

\* MILITARY

MIL-T-10727 - Tin Plating, Electrodeposited or Hot-Dipped, for Ferrous and Nonferrous Metals

MIL-P-81728 - Plating, Tin-Lead (Electrodeposited)

STANDARDS

FEDERAL

FED-STD-H28/2 - Screw Thread Standards for Federal Services, Section 2, Unified Thread Form and Thread Series for Bolts, Screws, Nuts, Tapped Holes and General Applications

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

MILITARY

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

MIL-STD-1312 - Fastener Test Method 6, Hardness

HANDBOOKS

MILITARY

MIL-HDBK-57 - Listing of Fastener Manufacturer Identification Symbols

(Unless otherwise indicated, copies of Federal and Military Specifications, Standards, and Handbooks are available from the Standardization Documents Order Desk, Building 4D 700 Robbins Avenue, Philadelphia, PA 19111-5094 )

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2.2 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 which 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)

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI/ASME B46.1 - Surface Texture (Surface Roughness, Waviness and Lay)
- ANSI/ASME B1.1 Unified Inch Screw Thread (UN and UNR Thread Form)
- ANSI/ASQC Z1.4 Sampling Procedures and Tables for Inspection by Attributes
- ANSI/SAE J 429 Mechanical and Material Requirements for Externally Threaded Fasteners, Standard

(Applications for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018 )

## \* ASTM

- ASTM A29/A29M - Steel Bars, Carbon and Alloy, Hot-Wrought and Cold-Finished, General Requirements for
- ASTM B633 - Plating, Zinc (Electrodeposited)
- ASTM A493 - Stainless and Heat-Resisting Steel for Cold Heading and Cold Forging-Bar and Wire
- ASTM A510 - General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
- ASTM A582 - Free Machining Stainless and Heat-Resisting Steel Bars, Hot-Rolled or Cold-Finished
- ASTM B159 - Phosphor Bronze Wire
- ASTM E10 - Brinell Hardness of Metallic Materials, Standard Test Method for
- ASTM D3951 - Standard Practice for Commercial Packaging

(Applications for copies should be addressed to ASTM, 1916 Race Street, Philadelphia, PA 19103 )

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(Non-government standards and other publications are normally available from the organizations that prepare or that distribute the documents. These documents also may 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 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 (see 6.2).

\* 3.2 Material Recycled and reclaimed materials shall be used to the maximum extent practicable. Self-clinching studs shall be fabricated of the following materials, as specified (See 3.1).

3.2.1 Carbon steel Carbon steel shall be Grade 1005 (UNS G10050) thru Grade 1018 (UNS G10180) in accordance with ASTM A29 or ASTM A510, or 10B16 and 10B21 in accordance with SAE J429 Grade 8.2.

3.2.2 Alloy steel Alloy steel shall be Grade 4130 (UNS G41300) thru Grade 4140 (UNS G41400) in accordance with ASTM A29.

3.2.3 Corrosion-resistant steel Corrosion-resistant steel shall be Type (UNS S30430) (formerly identified as XM-7) and 302 (UNS 30200) in accordance with the chemical compositions specified in ASTM A493 or Types 303 (UNS 30300) and 303SE (UNS 30323) in accordance with ASTM A582.

3.2.4 Phosphor bronze Phosphor bronze shall be copper alloy UNS C51000 in accordance with ASTM B159, temper H01.

\* 3.3 Hardness When tested in accordance with 4.3.5, self-clinching studs shall have one of the following hardness, as specified (see 3.1).

\* 3.3.1 Carbon steel studs Carbon steel studs, after carburizing and tempering or carbonitriding, shall have a hardness of 75-87 HR15N. The minimum effective depth of case shall be .010 inch. When carbon steel studs are thru hardened, they shall be 31-35 HRC.

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3 3 2 Alloy steel studs Alloy steel studs shall have a hardness of 26-32 HRC

3 3 3 Corrosion-resistant steel studs Corrosion-resistant steel studs shall have a hardness of 171 BHN minimum

3 3 4 Phosphor bronze studs Phosphor bronze studs shall have a hardness of 121 BHN minimum (68 HRB minimum)

3 4 Protective finish or surface treatment The protective finish or surface treatment shall be one of the following, as specified (see 3 1)

\* 3 4 1 Carbon and alloy steel studs Carbon and alloy steel studs shall be plated with Electrodeposited zinc in accordance with ASTM B 633-85, SC 1, Type II, Yellow

3 4 2 Phosphor bronze studs Phosphor bronze studs shall be plated with electrodeposited tin in accordance with MIL-T-10727, Type I or with electrodeposited tin-lead in accordance with MIL-P-81728, as specified (see 3 1)

3 4 3 Corrosion-resistant studs Corrosion-resistant steel studs shall be passivated in accordance with QQ-P-35

### 3 5 Design

3 5 1 Dimensions Dimensions and tolerances shall conform to the dimensional requirements of the applicable specification sheet and shall apply after protective finish

3 5 2 Threads Threads shall be in accordance with the applicable specification sheet and shall be unified form in accordance with FED-STD-H28/2 and ANSI B1.1, 2A.

\* 3 5 3 Self-clinching device The appearance and profile of the self-clinching device may vary but shall meet the dimensional requirements as specified on the applicable specification sheet

\* 3 5 4 Construction Self-clinching studs shall be of one piece construction

\* 3 6 Installation Self-clinching studs shall be capable of being installed in a milled, drilled or punched hole in the sheet material as specified in the applicable specification sheet. The clinching portion of the stud shall provide a positive, permanent attachment to the sheet without damaging or affecting the threads. There shall be no evidence of cocking or loosening of the stud nor splits or cracks in the stud or panel after installation

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### 3.7 Mechanical requirements

- \* 3.7.1 Push-out force The installed self-clinching stud shall be capable of withstanding the push-out loads as specified on the applicable specification sheet. Failure of the stud to withstand the push-out load without loosening, cracking or thread damage shall be cause for rejection.
- \* 3.7.2 Pull-out force The installed self-clinching stud shall be capable of withstanding the pull-out loads as specified on the applicable specification sheet. Failure of the stud to withstand the pull-out load without loosening, cracking or thread damage shall be cause for rejection.
- \* 3.8 Surface roughness The surface roughness of all external surfaces, except knurling, shall not exceed 125 micro-inches as specified in ANSI/ASME B46.1.

3.9 Source identification mark The stud shall be marked with a symbol indicating the source of manufacturer. Location of the marking is optional provided it does not interfere with proper function of the part. The source identification mark shall be legible and permanent.

\* 3.10 Workmanship Self-clinching studs shall be free from burrs, seams, laps, irregular surfaces, corrosion, surface contamination, damaged threads or any other defects which may affect serviceability.

## 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 as specified herein. Except as otherwise specified in the contract or purchase 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.

4.1.1 Responsibility for compliance All items must meet all requirements of section 3 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 assuring that all products or supplies submitted to the government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the government to acceptance of defective material.

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\* 4 2 Quality conformance inspection Quality conformance inspection shall be as specified in Table I Sampling shall be based upon a zero-based acceptance plans outlined in Table II ANSI/ASQCZ1 4 shall be used as a guide in the development of contractors' statistical techniques to assure the self-clinching stud meet all requirements specified herein

TABLE I Quality conformance inspection

Inspection	Level	Requirement paragraph	Test paragraph
Hardness	Major	3 3	4 3 5
Protective finish (as applicable)	Major	3 4	4 3 3
Surface treatment (as applicable)	Major	3 4	4 3 4
Dimensions	Major	3 5 1	4 3 1
Threads	Major	3 5 2	4 3 2
Self-clinching device	Minor	3 5 3	4 3 1
Construction	Minor	3 5 4	4 3 1
Surface roughness	Minor	3 8	4 3 1
Workmanship	Minor	3 10	4 3 1
Installation test	Minor	3 6	4 3 6
Push-out force (as applicable)	Minor	3 7 1	4 3 7
Pull-out force (as applicable)	Minor	3 7 2	4 3 8

\* 4 2 1 Inspection lot An inspection lot shall consist of all self-clinching studs covered by a single specification sheet, of the same material and finish, nominal size and thread series, produced by the same manufacturer under essentially the same conditions, and submitted for acceptance at one time There shall be no evidence of defects in the lot submitted

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TABLE II

"C = O" TABLE

## INDEX VALUES 1/

LOT SIZE	SAMPLE SIZE (Acceptance number in all cases is zero "A" indicates the entire lot must be inspected)		
	Critical	Major	Minor
1-8	A	A	3
9-15	A	13	3
16-25	A	13	3
26-50	A	13	3
51-90	A	13	6
91-150	A	13	7
151-280	A	20	10
281-500	A	29	11
500-1200	A	34	15
1201-3200	1250	42	18
3201-10,000	1250	50	22
10,000-35,000	1250	60	29
35,000-150,000	1250	74	29
150,001-500,000	1250	90	29
500,000 & over	1250	102	29

1/ Index Values to be used on the "C = O" table shall be

Critical Characteristics (where 100% inspection is not specified)	010%
Major Characteristics	1 0%
Minor Characteristics	4 0%

4 2 2 Rejected lots If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmitt for inspection Resubmitted lots shall be in accordance with 4 2 Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots

\* 4 2 3 Sampling for visual and dimensional examination Samples of self-clinching studs shall be taken from each lot in accordance with Table III, and 4 2



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TABLE III Visual and dimension examination

Characteristic	Inspection method
Threads, not as specified (see 3 5 2)	CIE <u>1/</u>
Hardness (see 3 3)	CIE <u>1/</u>
Protective finish or surface treatment missing or incomplete (see 3 4) (as applicable)	Visual
Length of stud (see 3 5 1)	CIE <u>1/</u>
Height of stud head (see 3 5 1)	CIE <u>1/</u>
Diameter of stud head (see 3 5 1)	CIE <u>1/</u>
Surface roughness (see 3 8)	CIE <u>1/</u>
Source identification mark not as specified (see 3 9)	Visual
Workmanship (see 3 10)	Visual

1/ Commercial inspection equipment

\* 4 2 4 Sampling for tests on installation, push-out, pull-out Sampling for tests on installation, push-out, pull-out shall be in accordance with Table I, and 4 2

\* 4 2 5 Inspection of packaging The sampling and inspection of the preservation, packing, and container marking shall be in accordance with the requirements of ASTM D3951

4 3 Method of inspection In lieu of the installation and mechanical properties inspection of 4 3 6, 4 3 7, 4 3 8 and 4 3 9, installation and mechanical properties inspection may consist of certification supporting verifying data that the stud has met the requirements of 3 6 and 3 7

\* 4 3 1 Visual and dimensional examination Samples of self-clinching studs shall be examined to verify conformance with this specification Examination shall be conducted in accordance with Table III, and 4.2 Sampling shall be based upon zero-based acceptance plan

\* 4 3 2 Threads Samples of unified external thread on self-clinching studs shall meet the requirements of 3 5.2 when inspected in accordance with the inspection requirements of FED-STD-H28/20, system 21

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4 3 3 Protective finish Samples of carbon and alloy steel studs, and phosphor bronze studs shall be inspected for adequacy of plating in accordance with the applicable specification of 3 4 1 and 3 4 2

4 3 4 Surface treatment Samples of corrosion-resistant steel studs shall conform to the inspection test specified in QQ-P-35

4 3 5 Hardness

4 3 5 1 Samples of carbon and alloy Samples of carbon and alloy steel studs shall be tested for hardness in accordance with MIL-STD-1312 Test 6

4 3 5 2 Samples of corrosion-resistant steel studs Samples of corrosion-resistant steel and phosphor bronze studs shall be tested for hardness in accordance with ANSI/ASTM E10

\* 4 3 6 Installation test Samples shall be subjected to an installation test as follows With a hardened tool, force the stud into the mounting material in the proper direction as indicated on the applicable specification sheet The sheet shall be supported in the area surrounding the hole by a proper hardened anvil to prevent damage Installation forces will vary with stud size and sheet material composition The installation force shall cause displacement of sheet metal to flow into recesses or grooves provided in the underside of the head of the stud The displacement of this metal shall provide push-out, pull-out resistance Self-clinching studs have a hardness greater than the sheet material to obtain proper material displacement rather than stud deformation The samples shall be visually inspected under 10 power magnification for evidence of the damage specified in 3 6

4 3 7 Push-out force test Samples shall be installed in sheet material as specified in the applicable specification sheet Installation of the studs shall be in accordance with 4 3 6 The sheet material shall be supported on a hollow block to prevent its collapse during testing (see Figure 1) The push-out load shall be steadily applied to the end of the stud, directly in line with the centerline axis of the stud, tending to force the stud away from the sheet material until the value of the push-out load shown on the applicable specification sheet is reached The load shall be released and the samples shall be visually inspected under 10 power magnification for evidence of the damage specified in 3 7 1

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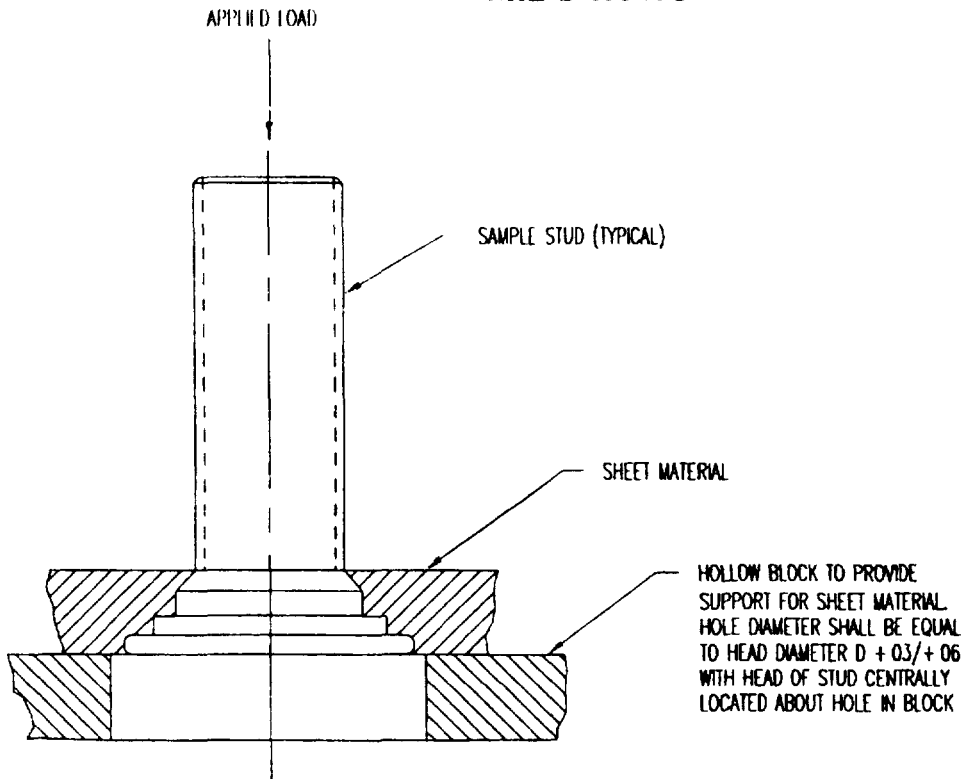
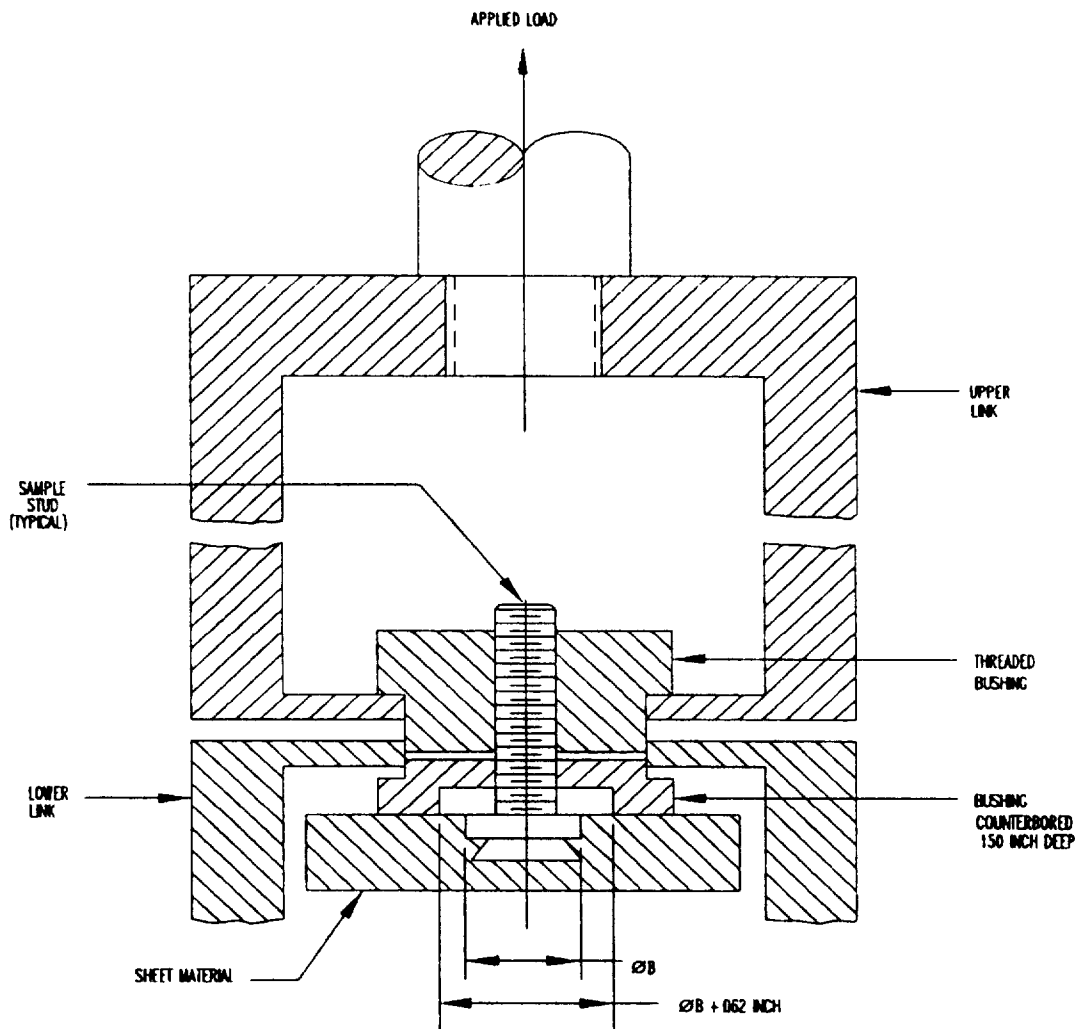


FIGURE 1 PUSH-OUT TEST

4 3 8 Pull-out force test Samples shall be installed in sheet material as specified in the applicable specification sheet. Installation of the studs shall be in accordance with 4 3 6. A hardened counterbored bushing shall be placed over the stud and inserted into the lower link of the test machine (see Figure 2). A threaded bushing shall be inserted into the upper link and turned down on the stud. The axial load shall be gradually increased tending to force the two links apart until the value of the pull-out load shown on the applicable specification sheet is reached. The load shall be released and the samples shall be visually inspected under 10 power magnification for evidence of the damage specified in 3 7 2.

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## NOTES

- 1  $\varnothing B$  IS THE MAJOR DIAMETER OF THE CLINCHING DEVICE

FIGURE 2 PULL-OUT TEST

4.3.9 Material inspection Material inspection shall consist of certification supported by verifying data that the material used in fabricating the studs are in accordance with the applicable paragraphs listed in 3.2 and 3.3 prior to such fabrication.

## 5 PACKAGING

5.1 Packaging requirements The requirements for packaging shall be in accordance with ASTM D3951 (see 6.2).

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6 NOTES

\* 6 1 Intended use Self-clinching studs covered by this specification are intended to provide permanent male threads in thin sheet materials, which can be installed quickly and easily

6 1 1 Caution These studs should not be installed into magnesium or magnesium alloy panels

6 2 Ordering data

6 2 1 Acquisition requirements should specify the following

- a Title, number and date of this specification and applicable specification sheet
- b Applicable specification sheet (see 3 1) part number

6 3 Changes from previous issue The margins of this specification are marked with asterisks to indicate where changes (additions, modifications corrections, deletions) 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 requirement of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue

\* 6 4 Keyword listing

Stud, Captive  
Stud, Self-clinching  
Stud, Retainer

Custodians  
Army - AR  
Navy - MC  
Air Force - 99

Preparing Activity  
DLA - IS  
(Project 5307-0587)

Review Activities  
Air Force - 82  
NSA - NS